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3-1 2 7

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

J. H. C.
OCT 31 1969

October 29, 1969

Mr. T. A. Snedden
Building

W.E.S.
OCT 31 1969

COMPUTERIZED PIT DESIGN
EL TIRO EAST EXTENSION

Dear Sir:

Attached is a copy of a comparison between a computerized pit design and the area of influence design. As has been our experience using the polygon method, the area of influence design tons of ore are reduced and the grade of ore increased.

Another important change is that the pit outline is pushed to the south about 150 feet.

Very truly yours,

R. B. Keen
Manager

RBK:rms
encls.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

October 22, 1969

Memorandum to: R. B. Meen

Subject : A Computerized Pit Design and Ore Reserve Calculation of the El Tiro East Extension #1

This report summarizes a computerized pit design and ore reserve calculation performed on the drill hole assays and geologic data within the area of the El Tiro East Extension Number 1 which adjoins and lies east of the original El Tiro Pit.

The original hand-calculated design and ore reserves were performed at the Silver Bell Engineering office prior to and during the year 1962. The "triangular" area of influence method was used to interpolate assay values between drill holes. No adjustment was made at that time to allow for geological contacts between the igneous and sedimentary rock types. This contact represents a sharp cut-off of values.

The computer method incorporated the "polygonal" area of influence and the polygons were adjusted to conform to the contacts.

The following table summarizes and compares the results of the two methods.

Method	Total Tons + .4% Cu	Average Grade	Total Units	Total Waste	Total Material
	(All Tons & Units x 1,000)				
1962 Calculations	14,676	.69	10,126	43,128	57,804
Computer Calculations UNADJUSTED	13,625	.76	10,314	48,269	61,894
Difference	-1,051	.07	188	5,141	4,090
% Difference	-7.2	10.1	1.8	11.9	7.1
1962 Calculations	14,676	.69	10,126	43,128	57,804
Computer Calculations ADJUSTED	12,479	.76	9,427	49,415	61,894
Difference	-2,179	.07	- 699	6,287	4,090
% Difference	-15.0	10.1	-6.9	14.6	7.1

Since both the 1962 computations and the first computer run were unadjusted for rock types (contact), it is interesting to note that the computized polygonal method was within 2% of the 1962 triangular method when comparing units, but the ore tonnage decreased with the polygonal method by 7% and the grade increased 10%.

By adjusting the polygons to fit the lithography there was a loss of ore tonnage of 1,146,000 tons at a grade of .77% Cu. Therefore, a loss of 15% in ore between the adjusted figures and 1962 computations, but only a loss of 7% in units.

Attached are the computerized results by benches: (1) Unadjusted, (2) the loss due to adjustment, and (3) the adjusted figures. Also attached is a composite map of the computerized pit design.

Carl E. Williams

CEW:rms
attachments
cc: DRJameson

2820

Pol.	3,290,996	.98
Prod.	5,194,500	1.00
Tri.	4,283,520	.84

Silver Bell

Report Mar '57

Prod.	Mar	Total to date Tons	grade
Oxide –	215,000	7,160,000	.98
	strip	22,626,900	
	Leach	6,147,020	.37
El Tiro –		1,115,130	.62
	strip	16,191,180	
	leach	2,821,200	.35

Cost Data	1956 – ¢ per lb Cu
ore breaking –	2.717
Stripping –	7.401
Development –	.281
Milling –	5.695
Indirect –	3.216
Freight - Smelting etc	6.394
	25.704
NY Admin.	.412
Depl & depr	3.397
Other income & expense +	.066
	29.447
Income MOS_2	.404
Total	29.043

Moly — cont. EM & J

market value 1.18 per lb Mo
or .71 " " MoS_2

Equivalent to 10 ¢ per ton ore

Cost — 45 ¢ per lb MoS_2
for year or 36 ¢ in
march — or about
5 ¢ per ton of ore

profit — 5 ¢ per ton

?

AMERICAN SMELTING AND REFINING COMPANY
SILVER BELL UNIT
Silver Bell, Arizona

J. H. C.
SEP 6 1966

August 1, 1966

Mr. R. B. Meen, Manager
Southwestern Mining Department
American Smelting and Refining Company
P. O. Box 5795
Tucson, Arizona 85703

SILVER BELL UNIT
DEEP DRILLING -
NORTH SILVER BELL AREA

Dear Sir:

Attached is a memorandum by James Briscoe proposing to test by diamond drilling for possible deep, underlying sediments in the north El Tiro area.

As I understand it, the primary purpose is to gather geologic information on the dacite porphyry and the underlying sediments which may include mineralized Mescal Limestone. Secondly, if the limestones are there, a test would be made for possible replacement type ore bodies.

Mr. Briscoe is proposing two preliminary deep holes that may involve approximately 3,000 feet of drilling at a cost of not less than $30,000. If it is the opinion of Mr. Courtright and Mr. Saegart that such geologic information is highly desireable, I would be in favor of doing this drilling when we have completed the present program at El Tiro.

Any comments or questions you may have and the comments of Messrs. Courtright and Saegart would be appreciated.

Very truly yours,

Original Signed By
D. R. JAMESON

D. R. JAMESON
Superintendent

DRJ:jca

cc: JHCourtright w/encls.
File " "

AMERICAN SMELTING AND REFINING COMPANY
SILVER BELL UNIT
Silver Bell, Arizona

July 11, 1966

MEMORANDUM TO: Mr. D. R. Jameson, Superintendent

Subject: DEEP DRILLING TO EXPLORE THE POSSIBILITY OF SEDIMENTS UNDERLYING THE DACITE PORPHYRY IN THE NORTH SILVER BELL AREA.

For the past several months I have been doing detailed geologic mapping in the North Silver Bell area in my spare time. The results of this mapping show the following:

1. The quartzite on Quartzite Peak and Jesuit Peak appear to be underlain by hornfelsed sediments that are favorable to sulfide mineralization. The alteration of the beds under the two peaks is slightly different: almost complete alteration to tremolite in the sediments under Jesuit Peak, with non-descript Imperial type hornfelses under Quartzite Peak. The difference could be due to varriance in original composition or possible difference in intensity of the hydrothermal alteration. Since outcrops are so limited no definite conclusion can be drawn. Gossan after strong sulfide mineralization is present in both areas. Sulfides are exposed under Jesuit Peak and assays show 1.06/0.32% copper as chalcocite on pyrite. Gossan from a near by outcrop of metasediments shows 0.44% copper. Drill hole D-181 on Quartzite Peak showed a five foot run of 1.64% copper as chalcopyrite (Section A-A').

2. A block of hornfels and tactite was mapped near the old Prince of Wales workings (Section C-C'). This block is bounded on the north and south by dacite but no vertical limit was exposed. This material assayed 2.49% oxide copper, (Section C-C'). In addition a 4.7 foot run of hornfels running 1.35% copper as chalcopyrite was intersected in drill hole D-183, (Section C-C').

3. Just north of Jesuit Peak, a small block of hornfels with strong sulfide gossan assaying 0.108% copper was mapped (Section B-B'). Further to the north a block of alaskite and three blocks of Pinal Schist were mapped. Northeast of the peak a large block of alaskite bounded by dacite to the east and alluvium to the west was mapped, (Section B-B').

Based on the above information the following can be concluded:

A. There are hornfelsic sediments underlying the quartzite of Quartzite and Jesuit Peaks. Economic bodies of these sediments may underlie the dacite sill.

B. The presence of the alaskite and Precambrian Pinal Schist, north and northwest of Jesuit Peak probably indicate the base of the dacite porphyry sill is at or near the present surface. Rock type beneath the sill is a matter of conjecture as the base of the sill has never been exposed in this area. The presence of the large block of

Pinal Schist hints that the dacite is underlain by Schist and possibly sediments of the Precambrian Apache Group which includes the Mescal Limestone, a favorable rock for Imperial type replacement. There is also the possibility that the dacite porphyry represents the top of a plutonic body which has no bottom. This however is also a matter of conjecture and can not be proven with information at hand.

Dilation of the Cambrian-Precambian
Unconformity by the Dacite Porphyry

The quartzite which caps both Quartzite Peak and Jesuit Peak, is highly altered and silicified, however remnant pebble layers and cross-bedding suggest that it is probably the basal Cambrian Bolsa quartzite. Except for the small fragments of hornfels mentioned above, all outcroppings lying below the quartzite consist of dacite porphyry of Laramide age.

Although no Precambrian Apache Group sediments (this group of rocks contains the Mescal limestone mentioned above) outcrop in the El Tiro area, outcrops of Dripping Springs quartzite (part of the Apache Group) and Precambrian diabase are found just to the north of the Ragged Mountain fault, slightly more than two miles to the northeast. When the sill-like dacite porphyry was implaced the unconformity between the Bolsa quartzite and the Precambrian Apache Group probably provided a weak zone which the dacite dilated. The hornfels at the base of Qaurtzite and Jesuit peaks probably represent small slivers of Mescal limestone, the remainder of which lies below the base of the dacite sill. The limestone could be as much as 240 feet thick and is underlain by 1,300 feet of quartzites, conglomerates and shales.

A test of these theories would be composed of two stages: Geophysical profile lines at right angles to the alaskite dacite porphyry contact to ascertain the dip of the contact and the presence or absence of sediments. 2. Deep drilling to penetrate the dacite and determine the nature of underlying rocks.

1. Geophysical Work:

   The profiles should be run with a ground magnetometer since there is hopefully a much higher susceptibility in the altered sediments than in the surrounding igneous rocks. The first step would be to determine the magnetic susceptibility of fragments of the altered sediments, to ascertain whether the difference between them and the igneous rocks would be enough to cause a magnetic anomoly. Short profile runs over known blocks of sediments should also be run to test the presence or absence of an anomoly. If these preliminary steps are favorable then the main survey could be run along east-west profile lines.

   Mr. Bill Saegart should be consulted as to the feasibility of the above proposals.

2. Drilling:

   Two preliminary holes would compose the program.

   Hole #1. This hole would be placed on the outcrop of alaskite, just south of churn drill hole #515. Capping on this outcrop appears favorable for a chalcocite blanket below. If the hole penetrates

dacite, then the alaskite is probably a large xenolith (foreign fragment) in the dacite, indicating the true alaskite-dacite contact lies somewhere beneath the alluvium to the northwest of the B S & K Mine. If, however, the hole penetrates alaskite a minimum of 500 feet then it can be assumed that the hole is located near the true alaskite-dacite contact.

Depth: If the hole penetrates only alaskite it should be bottomed at 500 feet. If it penetrates alaskite and goes into dacite porphry then an effort should be made to penetrate the sill, the hole being continued to a depth of 1500 feet in dacite porphyry.

Hole #2. The second hole would be located on the road just north of the old Prince of Wales mine shaft, in the block of tactite and hornfels, (a composit sample of the exposed portion of this block gave a 2.49% copper assay). The hole would be expected to penetrate metasediments to an unknown depth. If the drilling penetrates the metasediments and passes into dacite the hole should be continued to a depth of at least 1,500 feet where the projected contact with underlying rocks should be encountered.

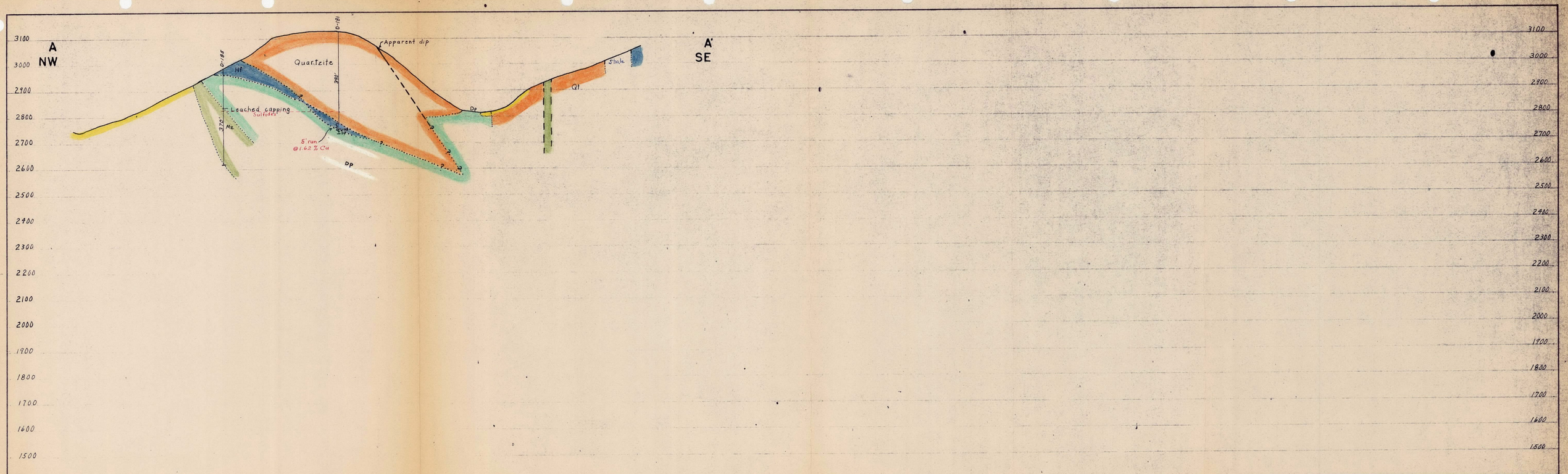
If the dacite sill isn't penetrated by 1,500 to 1,700 feet then the area can be considered of no further interest in relation to deep lying sediments.

James A. Briscoe
Geologist

Explanation regarding Geolgic Plan Map and Cross-Sections:

My recent mapping was done using an air photo base at a scale of one inch equals 500 feet. This geology was transferred to a copy of the 1941, 200 scale, Harrison Schmitt map. The cross-sections were then taken from this map. The geologic plan map included in this report is the 600 scale map prepared in 1954 by O. D. Evans. Up to date geology and the locations of sections A-A', B-B' and C-C' have been added. The essential geologic aspects of this map are correct and it is more readable than the more detailed Schmitt map.

JAB:jca



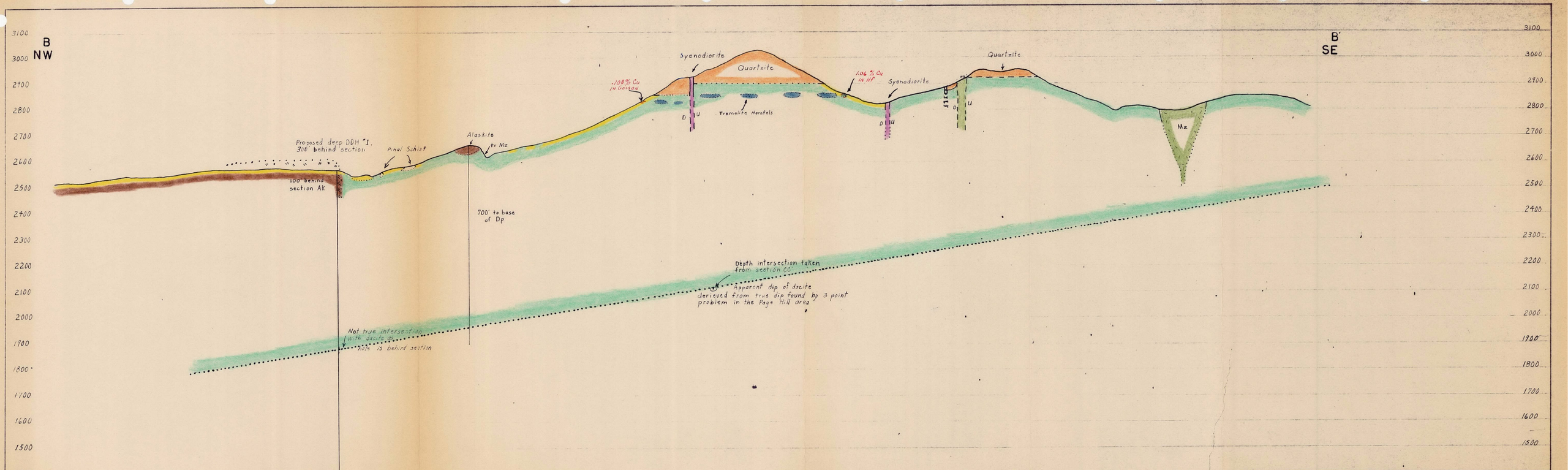
AMERICAN SMELTING & REFINING CO.

SILVER BELL UNIT

NORTH SILVER BELL AREA

CROSS SECTION, A-A'

SCALE	DRAWN	DATE	FILE
1" = 200'	T.B.A.	6-30-66	



AMERICAN SMELTING & REFINING CO.

SILVER BELL UNIT

NORTH SILVER BELL AREA

CROSS SECTION, B-B'

SCALE	DRAWN	DATE	FILE
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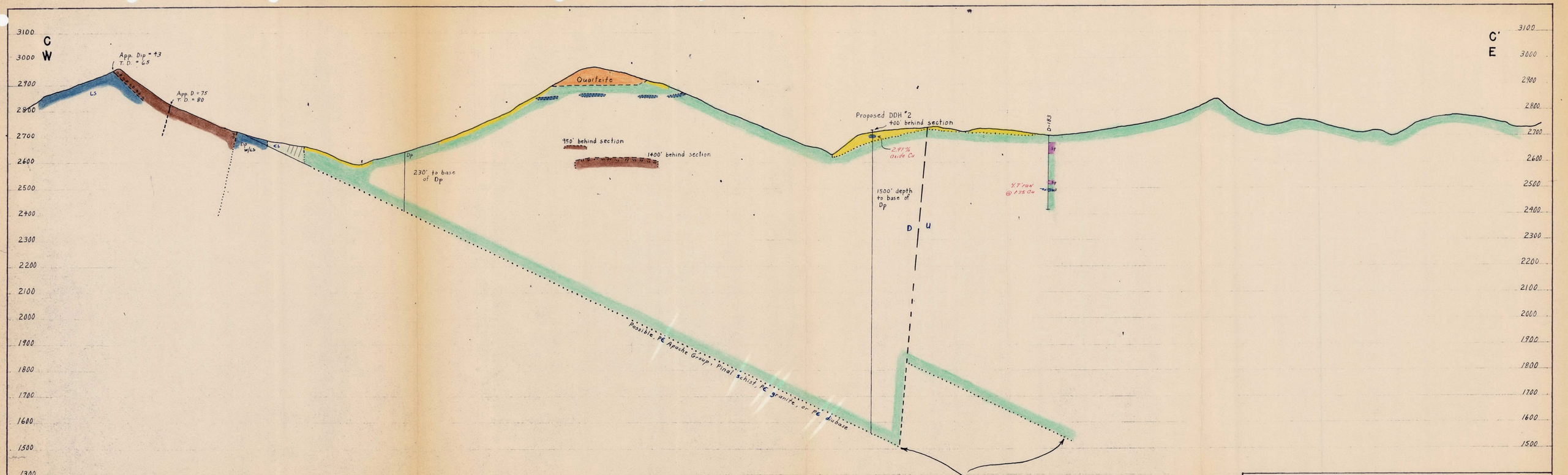


AMERICAN SMELTING & REFINING CO.

SILVER BELL UNIT

NORTH SILVER BELL AREA
CROSS SECTION, C-C'

SCALE	DRAWN	DATE	FILE
1"=200'	T.B.A.	6-30-66	

GEOPHYSICAL DIVISION
3422 SOUTH 700 WEST
SALT LAKE CITY, UTAH 84119

J. H. C.
APR 19 1968

April 18, 1968

Mr. N. R. Nuttycombe
Silverbell, Arizona

LUNING REPORT, MARCH 1968
GROUND MAGNETICS, NORTH EL TIRO,
SILVER BELL, ARIZONA

Dear Mr. Nuttycombe:

This is to acknowledge Mr. R. H. Luning's report of March 26, concerning the subject matter. Mr. C. K. Moss reviewed the report and submitted the enclosed memorandum of April 16, to me. I agree with Mr. Moss' analysis.

Very truly yours,

ORIGINAL SIGNED BY
R. J. LACY

R. J. LACY

RJL:ao
Enc.

cc: ✓J. H. Courtright, w/enc.
W. E. Saegart "
W. G. Farley "
R. H. Luning "

GEOPHYSICAL DIVISION
3422 SOUTH 700 WEST
SALT LAKE CITY, UTAH 84119

R. J. L.
APR 17 1968

April 16, 1968

MEMORANDUM TO R. J. LACY:

LUNING REPORT, MARCH 1968
GROUND MAGNETICS, NORTH EL TIRO,
SILVER BELL, ARIZONA

I have made a brief study of Mr. Luning's report. This work appears to be quite thorough and appears to have met the objectives of finding magnetic targets along the projected trend of the sediments. The project seems to be a practical application of magnetics on a local scale which could prove quite effective.

I would have some questions regarding the concept of the magnetite in the igneous rock being derived from sedimentary rock, to which Mr. Luning alludes; but this concept probably would not weigh heavily in the end interpretation of the work.

One additional observation -- Mr. Luning recognizes that there is a displacement of the magnetic high to the southward from the source target for a simple theoretical case assuming inductive magnetization, which is correct; however, in cases in which the associated magnetic low does not lie to the north of the high, and in cases where the area of the magnetic high is much greater than the area of the low then the outline of the high should be considered more significant in relationship to the position of the causative body. As an example, I would suggest that the area between Luning's anomalies 1 and 2 be included with 1 and 2 to make one large anomaly, rather than have two anomalies restricted to the zones of high gradient.

C. K. Moss

CKM:ao

C. K. MOSS

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

Aa 16.19.19F
JHC file

March 8, 1968

Memorandum for Mr. D. R. Jameson

Silver Bell
El Tiro Hill Area

I have read Mr. Nuttycombe's review of the geology and exploration possibilities in the North El Tiro Hill area, dated March 6, 1968. His report is well prepared, bringing together all existing information with acceptable interpretations of stratigraphy and structure.

Although the chances of finding sufficient ore grade mineralization in the deep lying sediments to be mineable by open pit appear somewhat slim because of the limited horizontal extent of the target area, the zone merits some further testing. The drilling proposed should be sufficient to accomplish this objective.

JHC:lml

J. H. Courtright

cc: TASnedden
RBMeen

AMERICA[illegible]SMELTING AND REFINING COM[illegible]Y
Tucson Arizona

February 12, 1968

J.H.C.
FEB 19 1968

TO: W. E. Saegart

FROM: R. H. Luning

Ground Magnetics
North El Tiro Hill-Jesuit Peak Area
Silverbell, Arizona

INTRODUCTION

A ground magnetic survey was initiated in the northwestern part of the El Tiro Pit during the month of February, 1967 in order to find possible tactite copper mineralization beneath the alaskite. During the course of this work it was decided to extend the survey further to the north beyond North El Tiro Hill to Jesuit Peak on an experimental basis. East-west lines were run across the area, each approximately 400' apart with an interval of 100' for each station at which a magnetic reading was taken. The results of this survey showed the occurrence of several anomalous areas in particular in the vicinity of North El Tiro Hill.

Summary and recommendations

The earlier survey has shown that an anomaly can sustain ore grade mineralization and the present work has outlined another six which may indicate possible copper mineralization and which would seem to warrant further investigations by drilling. The anomalies have a general northwesterly trend, but the limits of the anomalous zone have not been delineated. In view of this fact, further magnetometer work is recommended by:

1. Extending the survey 1,000' to the west from 38,000N to 41,000N; the actual distance dependent upon the size and number of anomalies obtained.

2. Extend the survey 1,000' to the north from 14,000E to 16,000E with the same conditions pertaining as in item 1.

Present Survey

Because of encouraging drilling results in the North El Tiro Hill area, the initial survey was expanded in November, 1967 to cover the ground on a more precise and detailed basis. The magnetometer survey was bounded by the following coordinates: 14,000E to 17,500E and 37,800N to 41,000N. The former were surveyed by transit and stadia - rod in order to establish location control points, each marked by a wooden stake, 200' apart. Along the east-west lines magnetometer stations 100' apart were located by brunton and tape and marked by white flagging. In all 700 stations were occupied during the survey. Initially a Varian M - 49 total intensity magnetometer was used, but due to some malfunction of the

instrument, the major part of the survey was ran by using a Barringer GM - 102 total intensity magnetometer which has an accuracy limit of 10 gammas. No serious discrepancies between the two instruments was apparent.

Data

The values for each stations were adjusted for diurnal variations by using the information made available by the Tucson Magnetic Observatory. The total intensity of the earth's magnetic field was calculated from magnetograms which only show the vertical and horizontal intensity components for any 24-hour period. These values were found by taking the square root of the sum of the squares of the vertical and horizontal intensity. Because of the time element involved in calculating these values, a computer at the University of Arizona was used to evaluate the total intensities for each hour of each day during which the survey was made. The diurnal variations were found to be but of minor consequence, ranging from 0 - 20 gammas and the field values were adjusted accordingly. Drift corrections were not necessary. The adjusted values were then plotted on the topographic map of the area and contoured with a 20 gamma interval. In some cases where the gradient was too steep for all the isogams to be shown, only the 100 gamma contour was drawn.

Interpretations

The attached map shows the following:

1. The eastern portion displays a relative low magnetic field as opposed to the western half which features decided magnetic anomalies.

2. The western half shows a general N.N.W. trend of anomalies from the El Tiro pit to the B.S. & K. Mine.

If it is assumed that the anomalous field results solely from the induction in the earth's field and that remanent magnetization, if present, is either negligible or codirectional with the earth's field, then a magnetic low would be found toward the northeast of the magnetic high. The body that causes the anomaly would then lie approximately between its high and low point.

Seven anomalies have been numbered and outlined in red pencil which could be indicative of copper mineralization. Anomaly 1 is principally centered upon North El Tiro Hill with a low occurring on its eastern slope. This low extends to the northeast for a distance of 700'. The geology map shows that this area is mainly monzonite and recent drilling indicates copper mineralization. The high part of the anomaly is centered upon alaskite, but past churn drilling indicates the presence of altered sediments at depth. Deeper drilling in this area as outlined on the map may reveal further mineralized areas.

Anomaly 2 has already been drilled and the existence of copper mineralization with some associated magnetite within sediments at depth has been verified.

Anomaly 3 is smaller but more intense. A higher proportion of magnetite would therefore occur in the rockbody that is the source of the anomaly or alternatively, it lies closer to the surface. Mr. Richard Van Blaricom did a recent "directional" I. P. survey of the drill holes adjacent to the North El Tiro Hill and has indicated in his report a zone of mineralization approximately coincident with the magnetic anomaly.

Anomaly 4 is one of the largest in the area. There is a range of 380 gammas between the high and low point. Characteristically the low lies to the northeast. The geology map shows that the anomalous area consists of limestones and tactites with some copper stain. Monzonite dikes cut the limestone in several places. I. P. surveys of nearby drill holes indicate that mineralization occurs in the vicinity of the anomaly.

Anomaly 5 falls practically in the same category as anomaly 4, but for the fact that it is less well defined. The original high readings on 100' intervals were taken in the wash and were thought to be due to local concentrations of magnetite within the gravel but on further detailed work, the anomaly appears quite broad with a local low (50,600 gammas and less) amidst two subsidiary highs (50,700 gammas and higher) to the north and south of it. The geologic map indicates the existence of at least two faults trending northeasterly which may account for its less well defined outline.

Anomaly 6 is located just off to the northwest. It is large and quite well defined with a low to the northeast. The range between the high and the low points of the anomaly is in the order of 120 gammas which could indicate a greater depth to its source.

Anomaly 7 is located in the extreme northwestern part of the map and borders the B. S. & K. property line. It appears quite small and intense but the 50,700 gamma contour line widens to the north and may indicate that it is a part of a much broader anomaly. Tactites appear on the surface with abundant copper stain.

The relationship of anomalies to subsurface geologic structure and to ore bodies is uncertain. There does, however, seem to be some indications of a lateral offset between anomalies 3 and 4. The geologic map indicates a fault striking almost due east just north of El Tiro Hill. Another fault is suggested between anomalies 4 and 5 with approximately the same strike. The displacement,

however, does not seem as pronounced. The surface geology shows the existence of a well defined fault with a southerly dip and underground evidence from an adit in that area has substantiated this.

R. H. Luning

R. H. Luning

RHL:ir

cc: J. H. Courtright
N. R. Nuttycombe

Legal + dep. $.41 per ton

Silver Bell
Oct 1, '56

OXIDE PIT

	Copper Price	
.40% Cu	29¢ Cu	40¢
~~Milling~~		
Net Smelter	$1.31	$1.95
Milling + Indirect Cost	-1.87	-1.87
	-.56	+.08
.50% Cu	1.64	2.44
Net Smelter	-1.87	1.87
Milling + Indir.	-.23	+.57
.60 Cu	1.96	2.92
	-1.87	-1.87
	.09	+1.05
.70% Cu	2.29	3.41
	-1.87	1.87
	.42	$1.54

Mining Costs (ore or waste) — 30¢/ton

El Tiro (includes 18¢ ore haul)

	29¢	40¢
.40% Cu		
net smelter	1.47	2.16
	-2.05	-2.05
	-.58	+.11
.50% Cu	1.84	2.70
	-2.05	2.05
	-.21	.65
.60% Cu	2.21	3.24
	2.05	2.05
	+.16	+1.19
.70% Cu	2.58	3.78
	2.05 +.53	~~2.05~~ +1.73

El Tiro - 29¢ Cu. 30¢ ton mining
18¢ haul

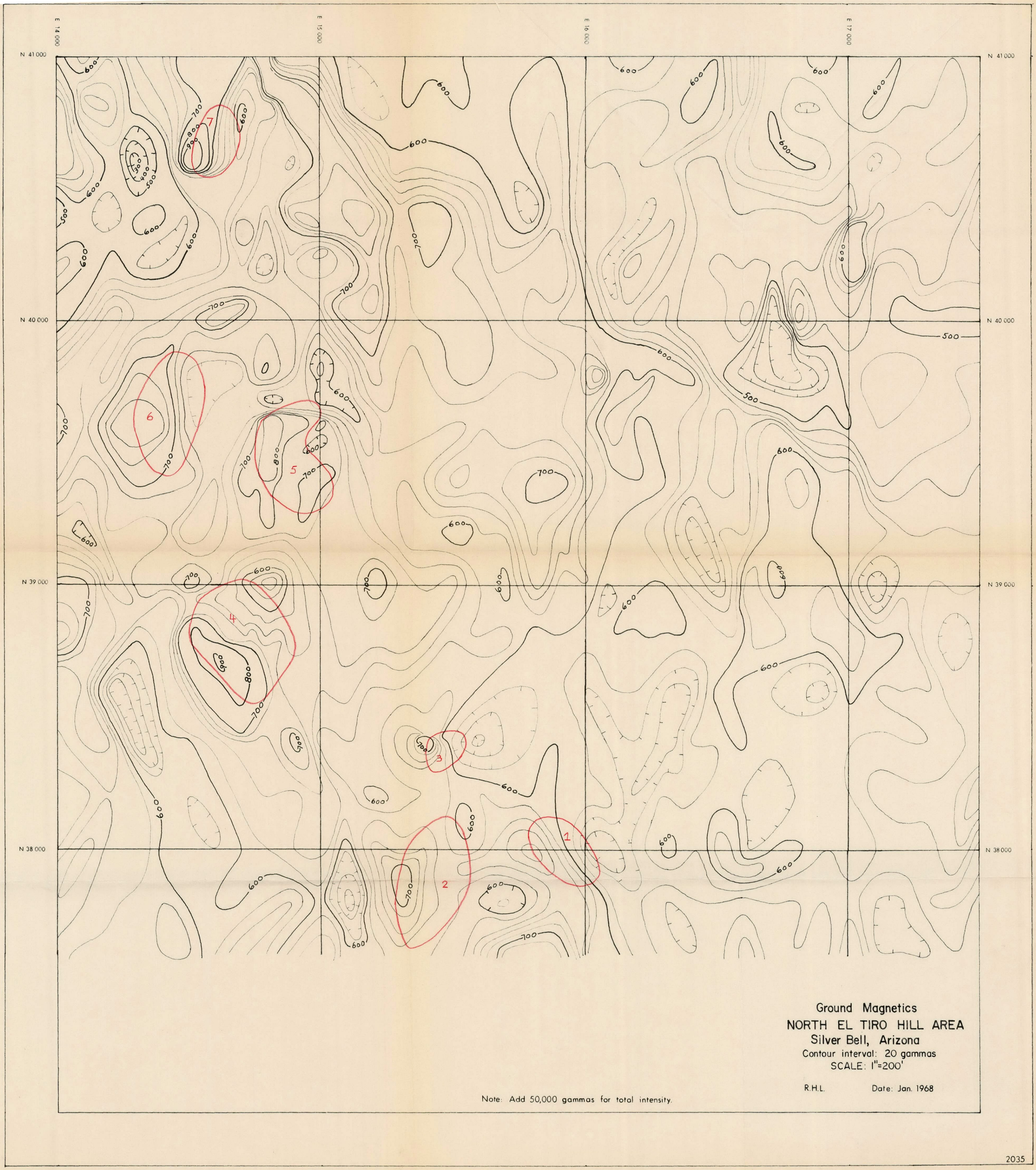
Ore Feet	% Cu and overburden .7	.8	.9	1.0	1.1	1.2
20	8	30	52	73	95	117
40	16	60	104	147	191	235
60	24	90	156	220	286	352
80	32	120	208	293	381	469
100	40	150	260	367	477	587
200	80	300	520	733	953	

Mining - 30¢ (non-contract)

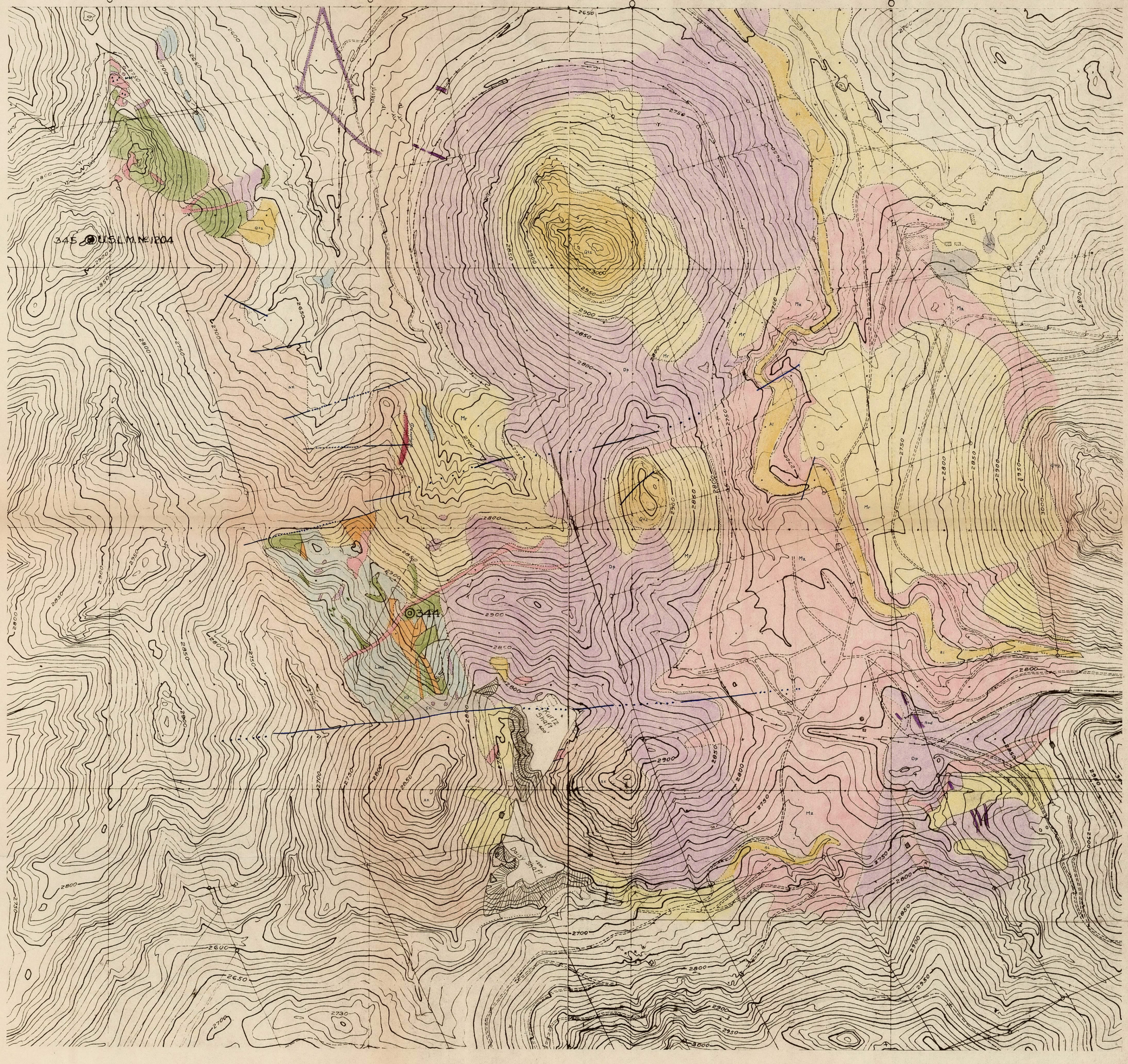
Milling .76
Indirect .44
Depreciation } .61
Depletion }
N.Y. Admin. .06
1.87
70
9.57

S.B. water - require 200 gallons fresh water per ton ore or about 1000 gpm —

Molly - Copper Con - 25.5% Cu .34% MoS_2
moly Con 90.2% MoS_2
Recovery - 65% (cu con)
Rec ~~50%~~ 45% (crude ore)


E 14 000
E 15 000
E 16 000
E 17 000
N 41 000
N 40 000
N 39 000
N 38 000
1
2
3
4
5
6
7
Ground Magnetics
NORTH EL TIRO HILL AREA
Silver Bell, Arizona
Contour interval: 20 gammas
SCALE: 1"=200'
R.H.L.
Date: Jan. 1968
Note: Add 50,000 gammas for total intensity.

2035



SEDIMENTARY ROCKS

Al	ALLUVIUM
Mr	MANTLE ROCK
Sh	UNDIFFERENTIATED SHALE
Qtz	UNDIFFERENTIATED QUARTZITE
Lms	UNDIFFERENTIATED LIMESTONE
Ts	TACTITE
Hs	HORNFELS

IGNEOUS ROCKS

And	ANDESITE
Mz	MONZONITE
Dp	DACITE PORPHYRY
AK	ALASKITE

GEOLOGY MAP

NORTH SILVERBELL

GEOLOGY BY
HARRISON SCHMITT ET AL
S VON FAY

SCALE 1"=200' COMPILED BY RHL

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona
March 31, 1966

NORTH EL TIRO AREA
SILVER BELL, ARIZONA

The following consists of a brief resume of Silver Bell geology with special reference to the North Silver Bell area. For more detail refer to the attached paper, Structure and Mineralization at Silver Bell, Arizona, by Richard and Courtright.

ASARCO's two open pit copper mines, the Oxide and El Tiro, lie within a northwest trending zone of alteration-mineralization about 7 miles in length. Copper is everywhere present in this zone, but only certain portions contain deposits of sufficient size and grade to be commercial.

Igneous intrusives and limey sediments make up the principal rock formations within the zone. There are three intrusives: (1) irregular stock-like bodies of alaskite, (2) a large sill-like mass of dacite porphyry, and (3) irregular stocks and dikes of monzonite porphyry and related rock types.

Primary mineralization consists of pyrite and chalcopyrite which occur mainly as discrete grains and narrow seams. Clay and sericite are the dominant products of alteration. This alteration-mineralization pervades the entire zone.

Oxidation and leaching extends 50-150 feet below the surface, forming a layer of "capping" from which both iron and copper sulfides have been removed. Chalcocite enrichment occurs in the sulfides below the capping. Where sufficient chalcopyrite existed prior to leaching, the chalcocite forms a more or less continuous blanket of ore grade copper mineralization, such as at the Oxide and El Tiro.

In recent years geologic studies followed by exploratory drilling determined the existence of a mineable body of copper mineralization in garnetized limestone east of the El Tiro pit. No enrichment is present, primary chalcopyrite mineralization being sufficiently strong to constitute ore.

In 1954 geologic studies were extended into the area north of the El Tiro pit, and the northerly extent of the zone of mineralization-alteration was defined in some detail by geologic mapping. Results of this work are shown on Map No. 1239 by O. D. Evans, August 1954. At this time (1954), ASARCO staked a group of claims which covered the entire north end of the alteration zone and also optioned 3 pre-existing claims (northerly limits of the zone are shown on the attached map of

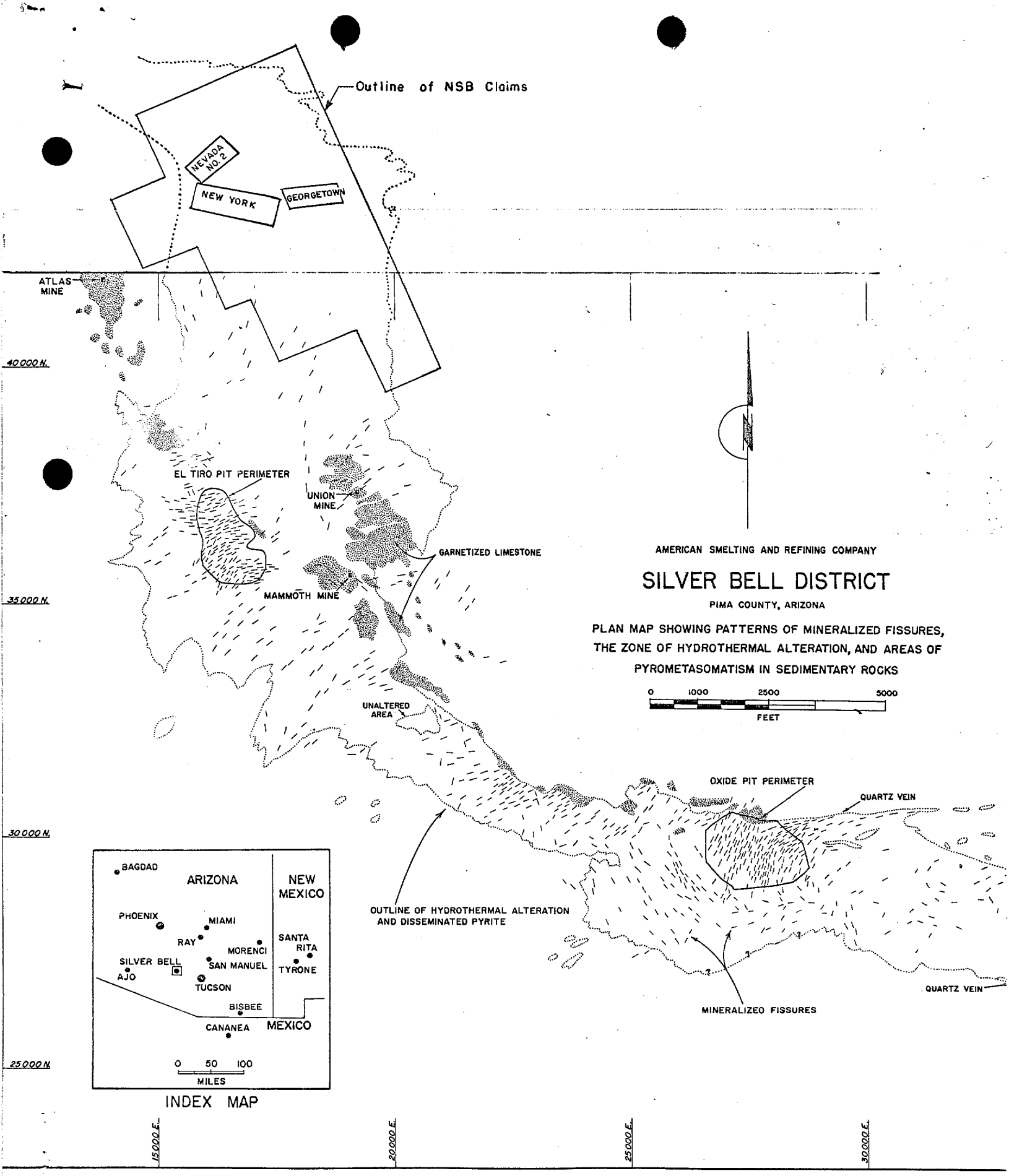
the Silver Bell District). Then, 20 churn drill holes (Nos. 500 to 519) were put down to explore the area. Results in the extreme northern part were quite low, and subsequently certain claims held by location and by option were dropped. Results farther to the south showed some marginal grade chalcocite ore, and accordingly the claims in this area were held for further test drilling at some future date. Claims staked in 1954 and held through location since then are as follows:

NSB 1 through 7
9 through 22
25 through 30

The above listed claims cover a portion of the copper-bearing zone (described in paragraph 2 above) as defined by geologic mapping and drill exploration. Accordingly, work performed within the zone is regarded as beneficial to all mining claims covering the zone.

J. H. Courtright
J. H. COURTRIGHT

Attachments



AMERICAN SMELTING AND REFINING COMPANY

SILVER BELL DISTRICT

PIMA COUNTY, ARIZONA

PLAN MAP SHOWING PATTERNS OF MINERALIZED FISSURES, THE ZONE OF HYDROTHERMAL ALTERATION, AND AREAS OF PYROMETASOMATISM IN SEDIMENTARY ROCKS

W.E.S.
AUG 7 1964

RECEIVED
AUG - 3 1964
J. H. C.
SEP 16 1964

July 31, 1964

AIR MAIL

Mr. Page Morris, President
Duval Corporation
1906 First City National Bank Building
Houston, Texas 77002

North El Tiro Group, Silver Bell Area, Arizona

Dear Mr. Morris:

I have now talked with Mr. Tittmann about your proposal for consolidating the B.K.X. claims you hold under option in the Silver Bell Area with our North El Tiro Group and undertaking an exploration program to further test the mineralized outcrops.

Mr. Tittmann is not interested in disposing of our claims in the area nor does he wish to consider consolidating with the B.K.X. Group.

As I explained, we do not consider the deposit of sufficient magnitude to justify a separate operation. We do feel, however, that the limited tonnage that is indicated can be treated at the Silver Bell plant at some future date and it is our plan to hold this as a reserve for our operations.

Very truly yours,

C. P. Pollock

Bld.CC-TASnedden
RBMeen
JHCourtright

JHC

J. H. C.

OCT 21 1963

xxxxxxxxxxxxxxxxxxxx 3422 South 700 West

October 17, 1963

Mr. C. P. Pollock
American Smelting and Refining Co.
120 Broadway
New York, N. Y. 10005

El Tiro - Imperial

EXPERIMENTAL I.P. DECAY CURVE WORK
NORTH EL TIRO, ARIZONA

Dear Mr. Pollock:

Mr. C. K. Moss' memorandum of October 16, on the subject matter is enclosed. I agree with his interpretations and conclusions. The conclusions are that the decay curve tests at North El Tiro were mildly encouraging for distinction between pyrite mineralization and mixed pyrite-copper sulfide mineralization. This is not definitely proof, however, and Mr. Moss would like to conduct further field tests, particularly over zones containing copper sulfides. Although we do not generally work from the negative standpoint, we feel that the easiest, quickest and most economic procedure in this case is to try to disprove the method in the field. This is a safe procedure and, of course, we shall have further positive developments to make if the results of our preliminary tests continue encouraging.

Very truly yours,

R. J. LACY

RJL:ao
Enc.
Air Mail

cc: J. H. Courtright
C. K. Moss
W. E. Saegart
J. M. Panek
W. G. Farley

GEOPHYSICAL DIVISION
3422 South 700 West
Salt Lake City, Utah

October 16, 1963

MEMORANDUM TO R. J. LACY:

EXPERIMENTAL I.P. DECAY CURVE WORK
NORTH EL TIRO, ARIZONA

INTRODUCTION

During the last part of May, Messrs. Farley and Panek and I conducted experimental work in the Imperial area and at other points north of El Tiro in the Silver Bell district. This work was for the purpose of obtaining recordings of I.P. decay curves to determine whether or not it might be possible to distinguish a difference in an I.P. decay from pyrite alone from an I.P. decay having a source which contained chalcocite and/or chalcopyrite as well. The shape of the curve was to be studied for an indication of any distinctive feature that could be correlated with the presence of either copper mineral.

In earlier decay curve work we had determined that the decay recorded from the clay-type polarizers (as was encountered at the Casa Grande project) showed a faster decay than that from sulfides in general. The hope that we might be able to distinguish characteristic curves for copper minerals hinged mainly on the condition that these minerals would cause an even more prolonged decay than was recorded from pyrite mineralization alone.

We entered this work with the feeling that the odds against success were high, but that the value of the method if it could be developed for exploration would be great enough to justify an initial investigation.

In the process of setting up the present survey, Mr. W. E. Saegart suggested four sites for our work. Two of these sites were over ore-grade sulfides -- chalcocite in one case and chalcopyrite in the other; and the remaining two represented conditions of pyrite mineralization alone.

CONCLUSIONS AND RECOMMENDATIONS

The decay curves for the 200' "a" spacing (used in the horizontal profiling) were surprisingly similar, to me, for all stations.

The decay over the chalcocite site was practically identical with that over the chalcopyrite. (This result was not expected.) And these curves show longer decay times than most of the other stations. (Depth profiles only were made over the chalcocite and chalcopyrite.)

In view of this, there is some evidence in support of the idea that the copper sulfides will produce a longer decay time; and none of the recordings

throughout the project show adverse conditions that would interfere with or strongly complicate curve interpretation. In other words, the results of our initial work have not proven the method unusable.

I still do not feel that the odds favor the existence of a distinctive curve for copper sulfides. However, since our initial work has provided mildly encouraging results I believe that we should conduct additional field work to resolve the question with reasonable certainty.

Future work, I believe, should include a considerable number of stations over known copper mineralization in order to determine the range of decay times for this environment. Since only two locations with known copper sulfides were involved in the present work there is considerable room for the effect of pure chance in our results.

Future work might include more thorough coverage of the Imperial ore zone and perhaps coverage of the San Xavier area near Mission.

For convenience it would probably be best to time this work to correspond with other work in the Southwest which would be done from this office.

I would appreciate any suggestions or comments which might be made by members of Mr. Courtright's department in view of their greater familiarity with the geology concerned.

RESULTS

The problem of comparing the different curves is not such that one can easily assign a figure to a particular curve as a measure of its shape. For the purpose of evaluating the present curves relative to one another, I have simply considered as anomalous those curves which are of the same slope, or nearly the same slope, as the 200' "a" curves over the ore sites.

Admittedly there would be some variance in the interpretation of these curves by different individuals.

The attached plan map shows the location of the traverses and depth profiles. DH-7 is in the area of chalcopyrite mineralization and DH-204 in the area of chalcocite. The depth profiles along traverses 1 and 2 were centered about points for which there was evidence of little or no copper present.

In the case of traverse 1, the most anomalous curves are those taken near DH-501. Inasmuch as this location was chosen as a test area because of the low copper values from the hole, one might argue that the decay results are in contradiction with conditions in the ground. On the other hand, the I.P. and resistivity results in the vicinity of the hole suggest that a rather narrow anomalous body could exist centered slightly southwest of the drill hole; and, in addition one could add that the drill hole was put down on evidence of live limonite in the vicinity.

(The interpretation of a narrow body mentioned in the previous para-

graph is based on the "mirror image" effect and the double peaks shown by the I.P. and resistivity curves. These features have been found in model experiments to correspond to a tabular, conductive I.P. target.)

I do not have as much confidence in the reliability of the results of traverse 2 as for traverse 1. The results of the depth profile show this station to be non-anomalous while a later horizontal profile show an anomalous curve at this point. It is likely that a change occurred in the calibration in the equipment during the work that went unnoticed. (Ordinarily the calibration was checked twice a day.) In any event there is an apparent difference in the curves north from the depth profile as contrasted to those to the south. The northern six stations show curves that are practically identical with each other; while to the south, there is a recognizable difference from station to station. The positive indications for stations on traverse 2 might be due to a calibration change and should not be weighed too heavily, but again there is some reason to attach significance to these results because of the general proximity of the mineralization of the Imperial zone.

One would expect to find a relationship between I.P. amplitude and curve shape, and surely to some extent a correlation would be found in our results if we could analyze them completely enough. The results of the present work do not show a consistent, dominating effect of the I.P. amplitude, however.

Also, one might expect a correlation between curve shape and resistivity but none is obvious from the profiles.

INSTRUMENTATION AND FIELD PROCEDURE

The equipment used in the recordings was greatly improved over the original design utilising an oscilloscope and Polaroid camera. It was constructed for the most part by Mike Panek last winter. This equipment has the advantage of a filter network to reduce high frequency interference, a continuous strip recorder, and most important a logarithmic amplifier which provides a record in which the amplitude of response is proportional to the logarithm of the I.P. voltage. The advantage of the latter feature is that by making transparencies of the records the individual curves can be compared by direct overlaying without concern for differences in amplitude.

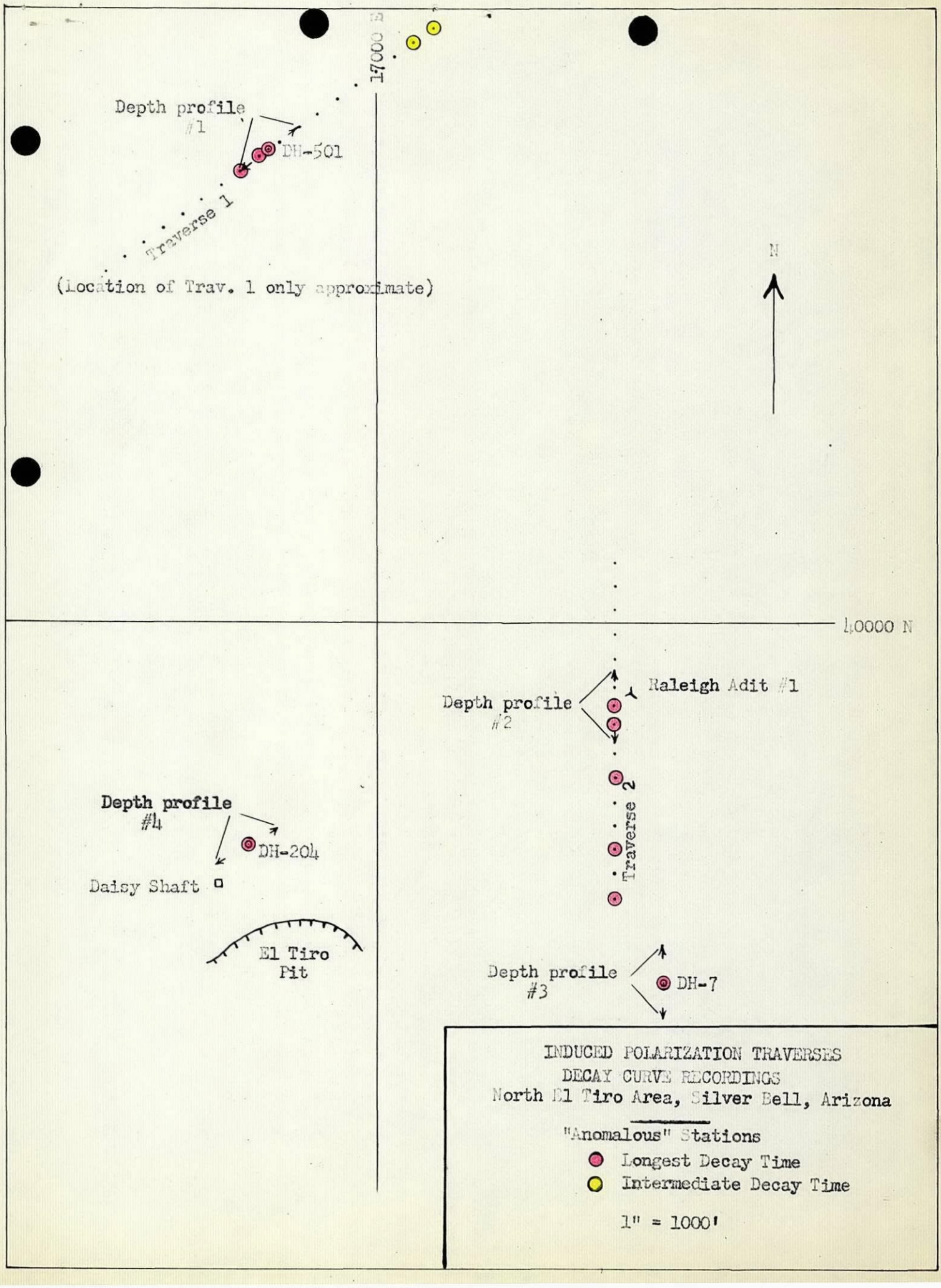
The equipment performed very well and for the large majority of stations the second of two readings which were taken appears virtually identical to the first.

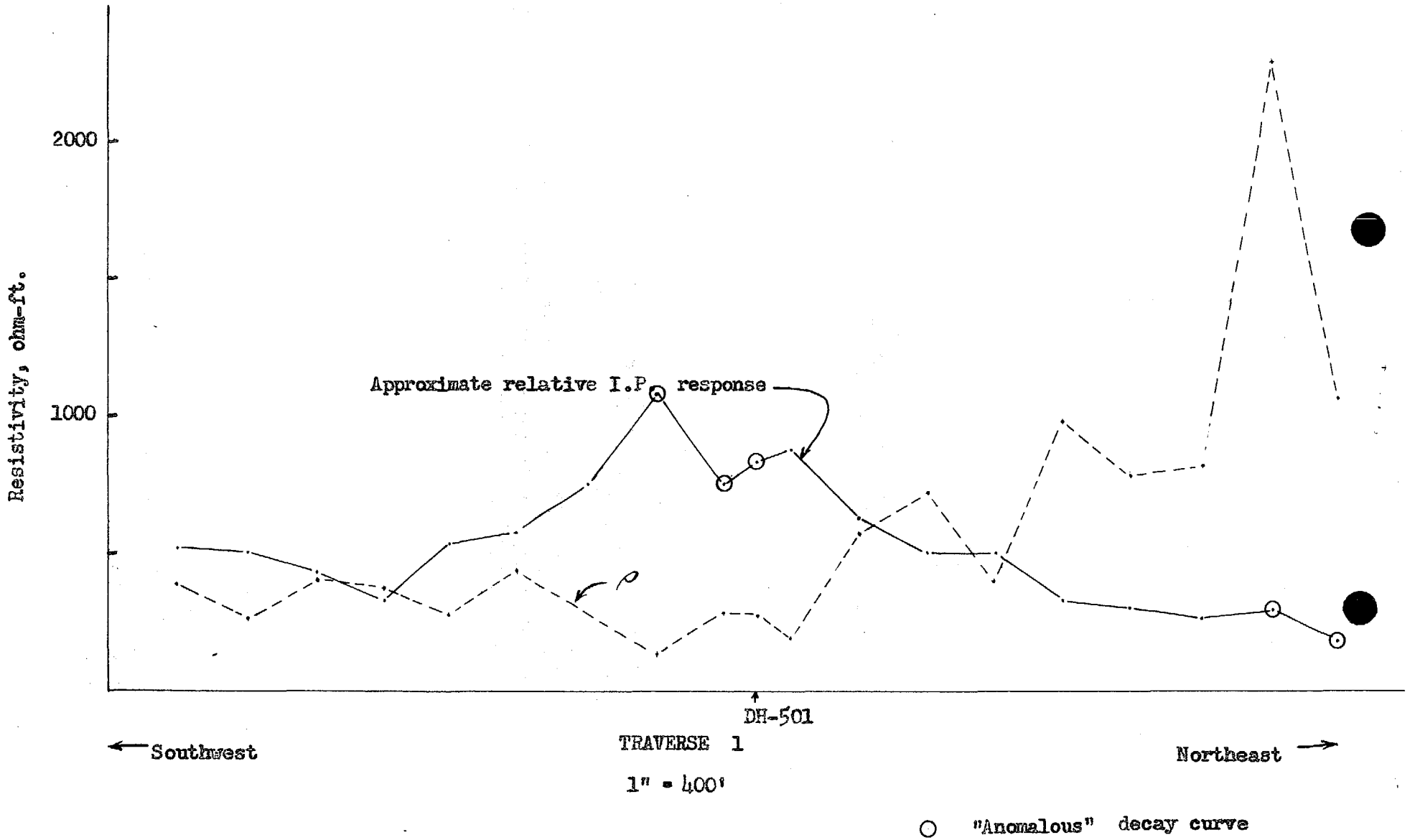
For additional work the equipment would be used with only minor changes. It will be necessary though, in view of the small magnitude in curve anomalies, to maintain more stringent check on calibration.

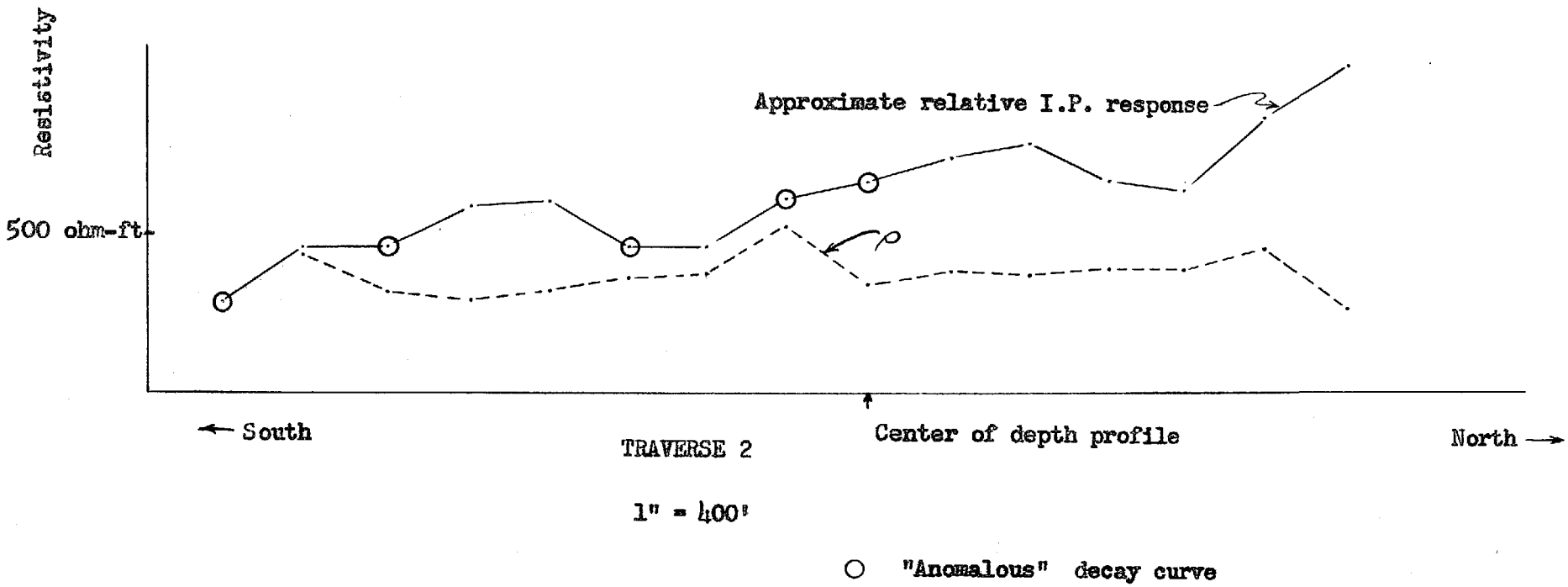
Field work was conducted with reels and a standard Wenner array. Field procedure was the same as for a conventional survey, however, two vehicles were used -- one for the power supply, and the other for the recording equipment.

CKM:ao
Enc.
cc: C. P. Pollock
J. H. Courtright
W. E. Saegart
J. M. Panek
W. G. Farley

C. K. MOSS


17000 E
Depth profile
#1
DH-501
Traverse 1
(Location of Trav. 1 only approximate)
N
40000 N
Depth profile
#2
Raleigh Adit #1
Traverse 2
Depth profile
#4
DH-204
Daisy Shaft
El Tiro
Pit
Depth profile
#3
DH-7
INDUCED POLARIZATION TRAVERSES
DECAY CURVE RECORDINGS
North El Tiro Area, Silver Bell, Arizona
"Anomalous" Stations
Longest Decay Time
Intermediate Decay Time
1" = 1000'


2000
1000
Resistivity, ohm-ft.
Approximate relative I.P. response
ρ
DH-501
Southwest
TRAVERSE 1
Northeast
1" = 400'
"Anomalous" decay curve


Resistivity
500 ohm-ft
Approximate relative I.P. response
ρ
← South
Center of depth profile
North →
TRAVERSE 2
1" = 400'
"Anomalous" decay curve

S-1.1

Mr. Courtright

AMERICAN SMELTING AND REFINING COMPANY
SILVER BELL UNIT
Silver Bell, Arizona

J. H. C.
OCT 15 1963

October 3, 1963

W.E.S.
OCT 17 1963

Mr. T. A. Snedden, Manager
Southwestern Mining Department
American Smelting and Refining Company
813 Valley National Building
Tucson, Arizona 85701

SILVER BELL UNIT
ZINC OCCURRENCE IN EL TIRO AREA

Dear Sir:

Enclosed is a copy of a memorandum by F. T. Graybeal on the occurrence of zinc with the copper sulphide in the El Tiro extensions.

The presence of zinc in the copper ore body has been known since the start of diamond drilling but was thought to be only small, isolated occurrences. With metallurgical testing and examination of the core with the microscope, there is an indication the zinc is widely disseminated and possibly in a ratio of 1 to 1 with the copper.

We will determine at the time we begin mining in this area whether or not the zinc will be a problem in the copper concentrate.

I have enclosed extra copies of the memorandum for your distribution if you so desire.

Very truly yours,

Original Signed By
D. R. JAMESON

D. R. JAMESON
Superintendent

DRJ:dm

Enclosure

cc: TASnedden (3)
WCWaidler
RSalter

1 to JHCourtright
1 to DJPope
1 to NWeiss

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

July 31, 1963

MEMORANDUM FOR MR. T. A. SNEDDEN:

GROUND WATER STUDY
AREA WEST OF SILVER BELL
PIMA COUNTY, ARIZONA

This will transmit Mr. Saegart's comprehensive report on ground water possibilities in the West Silver Bell area. He finds that the potential is restricted to a 2-mile wide, northwest-trending area lying about 3 miles southwest of the El Tiro pit. Although rather narrow, this possible basin appears to be open on the south for several miles and thus could provide a substantial supply of water.

As I understand it, a decision has already been made to rely on the Avra Valley for present and future needs; however, I suggest that the area west of Silver Bell be kept in mind, in case it should become open to mining claims location. In such an event, it would be then possible to make a relatively inexpensive preliminary test for water.

J. H. COURTRIGHT

JHC/kw
Attachment
cc: DRJameson (2), w/att.
WESaegart

J. H. COURTRIGHT

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

July 16, 1963

MEMORANDUM TO MR. KENYON RICHARD:

GROUND WATER STUDY
AREA WEST OF SILVER BELL
PIMA COUNTY, ARIZONA

At your request I made a reconnaissance examination of an area adjacent to our Silver Bell Unit to evaluate the ground water potential. The field work was done during the period June 25 to July 1.

The area studied, as shown on the attached map, is the topographic flat lying southwest of El Tiro pit. This particular area was selected because it is the only possible hydrologic alluvial basin within convenient distance of the El Tiro operations. Most of this topographic flat is within the Papago Indian Reservation (see Reservation boundary plotted on map). The area of interest as a potential water source, then, is restricted to that portion of the flat which lies outside the Reservation.

To estimate the size of a possible basin, most of the field work was devoted to mapping the distribution of bedrock outcrops. From the Silver Bell mountains outcrops continue southwest approximately one mile beyond the El Tiro haulage road and end abruptly along a line which parallels the road. This linear termination of outcrops may be the result of a range front normal fault, down dropped on the southwest side. If such a structure is present, a substantial thickness of gravel probably exists within a few hundred feet of these terminal outcrops.

The alluvial flat immediately southwest of the Silver Bell mountains is not part of the large basin farther west called Aguirre Valley. The two areas are separated by a N-W trending bedrock ridge which outcrops in several places and forms a hydrologic barrier. The area between this barrier and the postulated range front fault is referred to below as "alluvial flat".

To the north, "alluvial flat" is bounded along a line extending WSW from the BS&K mine by the West Silver Bell mountains.

There is no obvious boundary to the south. A few miles south of the map area "alluvial flat" physiographically merges with Aguirre Valley. Several isolated bedrock hills in this area suggest that bedrock may be at a higher elevation to the south preventing ground water escape into Aguirre Valley.

The depth to water in Aguirre Valley varies considerably, increasing from north to south.

Northwest of Silver Bell; T 11S - R 6E and T 11S - R 5E
Opposite the Slate Mountains on the Papago Reservation, the Acme Cattle Co. Ranch and the R. C. Soto Ranch, the water depth in seven wells averages 220 feet.

West of Silver Bell; T 12S - R 6E
The reported water depth in one well on the Reservation in Section 25 is 379 feet.

Southwest of Silver Bell; T 13 and 14S - R 7 and 8E
The water depth in four wells on the Reservation west of the Roskruge mountains averages 477 feet.

I would expect the water depth in "alluvial flat" to be less than in Aguirre Valley because of the intervening hydrologic barrier.

The selection of a well site within "alluvial flat" could be aided by the use of geophysics. The resistivity, gravity and seismic refraction methods are applicable. The cost of using any of these methods, however, might be prohibitive for the purpose of locating one well.

An outcrop of Cretaceous red beds was found in the west central part of Section 6, T 12S - R 8E. The alluvium north of this outcrop may be too thin to constitute a reservoir. That part of "alluvial flat" which is outside the Reservation and south of the above described outcrop occupies 4½ square miles. In my opinion, this area is the best potential source of ground water within practical distance of El Tiro. Without the benefit of geophysical data, I would select a well site at the section corner of Sections 7, 8, 17 and 18 - T 12S, R 8E.

This location is 2.3 miles from El Tiro pit and 3.6 miles from the mill. The elevation at the section corner is 2360 feet. This compares with an average elevation of 2030 at our three wells in Avra Valley. The difference in power consumption in raising water the additional 330 feet is worth considering.

I believe most of the land in "alluvial flat" is public domain. At least 91 Federal lode claims were staked in Sections 7, 8, 17 and 18 in July and November, 1962, by one Lloyd Miller. These claims could complicate acquisition of land for a well, power line, pipe line, etc.

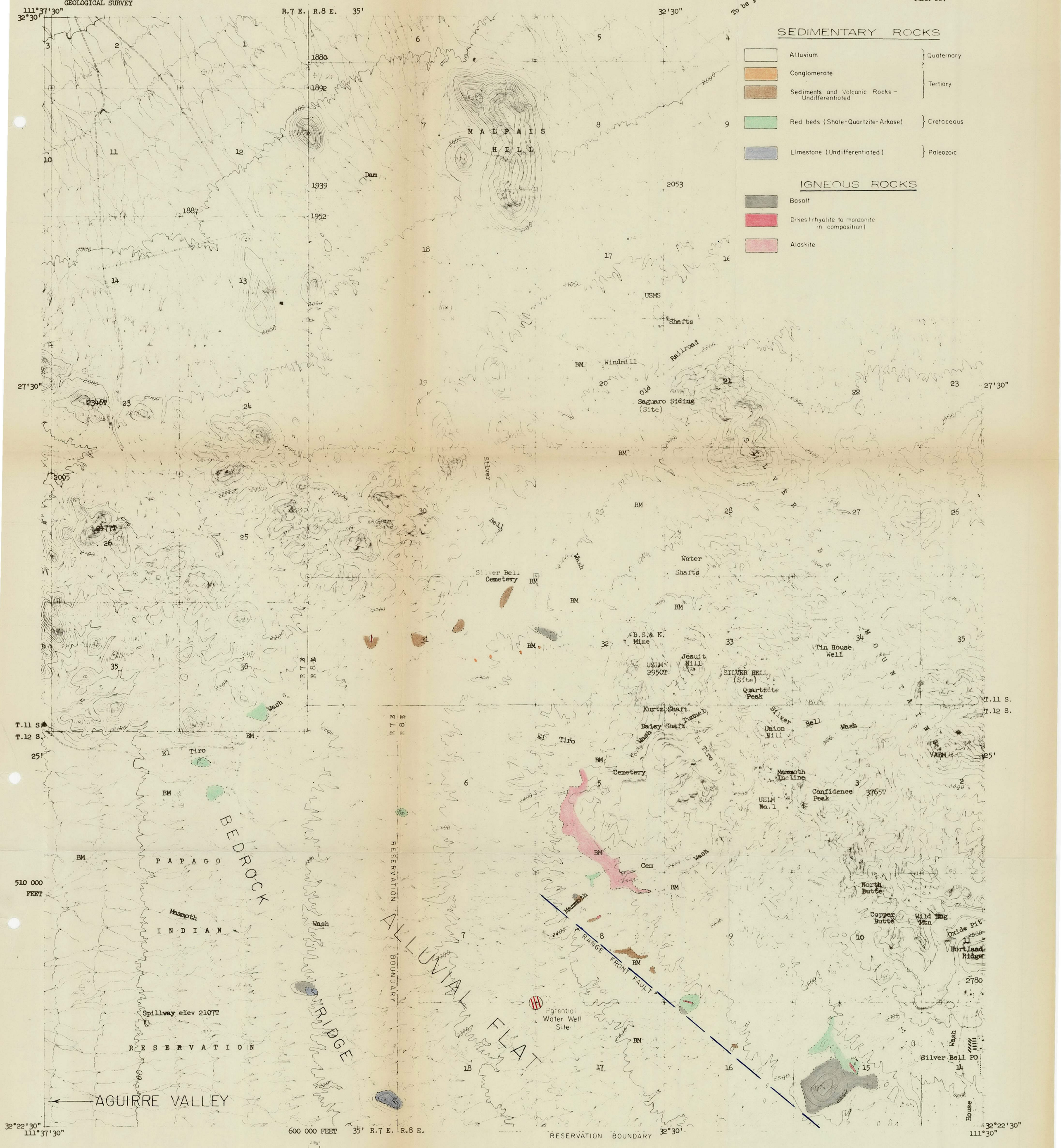
W. E. SAEGART

WES/kw
Attachment
cc: KERichard, 4 w/att.
1 wo/att.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Advance Sheet
Subject to correction
To be published at 1:62500 scale

SILVER BELL 1 NE., ARIZ.
PIMA CO.



Mapped by Pacific Area, U.S. Geological Survey

This is an unedited copy of an original manuscript showing field additions made in 1959

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1959

SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

OUTCROP DISTRIBUTION
Area West of Silver Bell
PIMA COUNTY, ARIZONA

SILVER BELL 1 NE., ARIZ.
PIMA CO.

JULY, 1963
W. E. SAEGART

Silver Bell South Project

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

July 31, 1963

MEMORANDUM FOR MR. T. A. SNEDDEN:

SILVER BELL UNIT
IMPERIAL AREA
PROPOSED DRILLING

This will transmit Mr. Von Fay's proposals for extending drill exploration from the east extension and Imperial areas southerly into the Mammoth Mine area. Although much of the copper produced from the Mammoth occurred as sulphide pods in more or less barren marble, Mr. Von Fay believes there is sufficient evidence of disseminated mineralization in silicated limestones and shales to warrant a limited amount of drilling.

I agree in general with his recommendations; however, in view of the existence of numerous barren intrusives and complex structures, ore-grade copper mineralization is apt to be non-uniform and discontinuous in distribution. Since development of mineable ore in the Mammoth would rest largely on the feasibility of extending the Imperial and El Tiro pits southward, the proposed drill exploration should progress from north to south with frequent evaluation of the open pit potential.

J. H. COURTRIGHT

JHC/kw
Attachment
cc: KERichard, w/att.
DRJameson (2), w/att.
SVonFay

JHC

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

July 30, 1963

MEMORANDUM TO MR. J. H. COURTRIGHT:

SILVER BELL UNIT
IMPERIAL AREA
PROPOSED DRILLING

A series of holes is proposed, to test the rather large block of ground in the general Mammoth area. Altered and mineralized sediments project into this area from the northwest, and underground mining in the Mammoth Mine encountered spotty high grade mineralization, with presumably lower grade chalcopyrite-bearing rock still remaining. The area is some 1500 feet long and 1000 feet wide, but contains at least the southeastward projection of the dacite sill, the andesite dike swarm, and irregular monzonite bodies, as barren rocks.

Scout hole 26 was drilled in March and April 1961, early in the initial program. This hole shows 79 feet of .60 Cu at a depth of 301 feet, and a column of altered sediments. This is some distance from other drilling, and no follow up drilling has been done.

Geology in the Mammoth area is particularly intricate, with irregular monzonite intrusions, included sedimentary blocks, and faulting. Because of this complexity, it is hazardous to project either high grade or low grade intercepts any great distance. In this area, I would be reluctant to project even sub ore intercepts very far, and the presence of sub ore intercepts may not indicate the edges of mineralization have been reached, as long as the rocks are strongly altered. Because of the complexity, some interspaced drilling may be required, and a rather large number of holes may be needed if drilling is successful.

Proposed holes (see attachments) are located on the drill grid where possible. Several holes are located off the grid to miss old workings. There is little leeway in the location of these off-grid holes, and they should be drilled where indicated.

The holes are designed to test specific blocks of ground, most of which may bear sulfides of probable ore grade. Holes 14 and 15 test potential ore-bearing horizons above the dacite sill, which have been shown to be ore-bearing to the north. These holes should be drilled at least to the top of the dacite sill. The holes test material which early underground sampling indicates is ore. Current drilling in this general area is testing the southern extent of ore-bearing material located to the north, with hole 160 now being drilled. Proposed holes 14 and 15 should be drilled even if discontinuity in this ore horizon is shown.

Proposed holes 12 and 13 are spotted around D26, and test continuity and extent of underground sampling, and the indicated ore in hole D26. These holes should pass through the dacite sill, and should be drilled to at least the 500 level - elevation 2470. Scanty information indicates ore at greater depths occurred as chalcopyrite lenses in marble. The reliability of this information

is unknown, but the need to probe to greater depths than the 2470 elevation is problematical, and will depend on results of the proposed drilling.

Proposed hole 11 will penetrate about ± 420 feet of igneous rock before sediments are reached, and should also be taken to the 2470 elevation.

Proposed holes 1, 2, and 3 should penetrate to about the 400 level - elevation 2565. For the remainder of the holes, the 2470 elevation is seen as about the bottom limit of drilling. This may vary, depending on what is encountered in the holes.

The copper-bearing sediments in the 400 level area, south of coordinate 35,000 N, are not being tested at this time. Failure of one, or a series of holes, to encounter ore would not remove the need for later holes in the series.

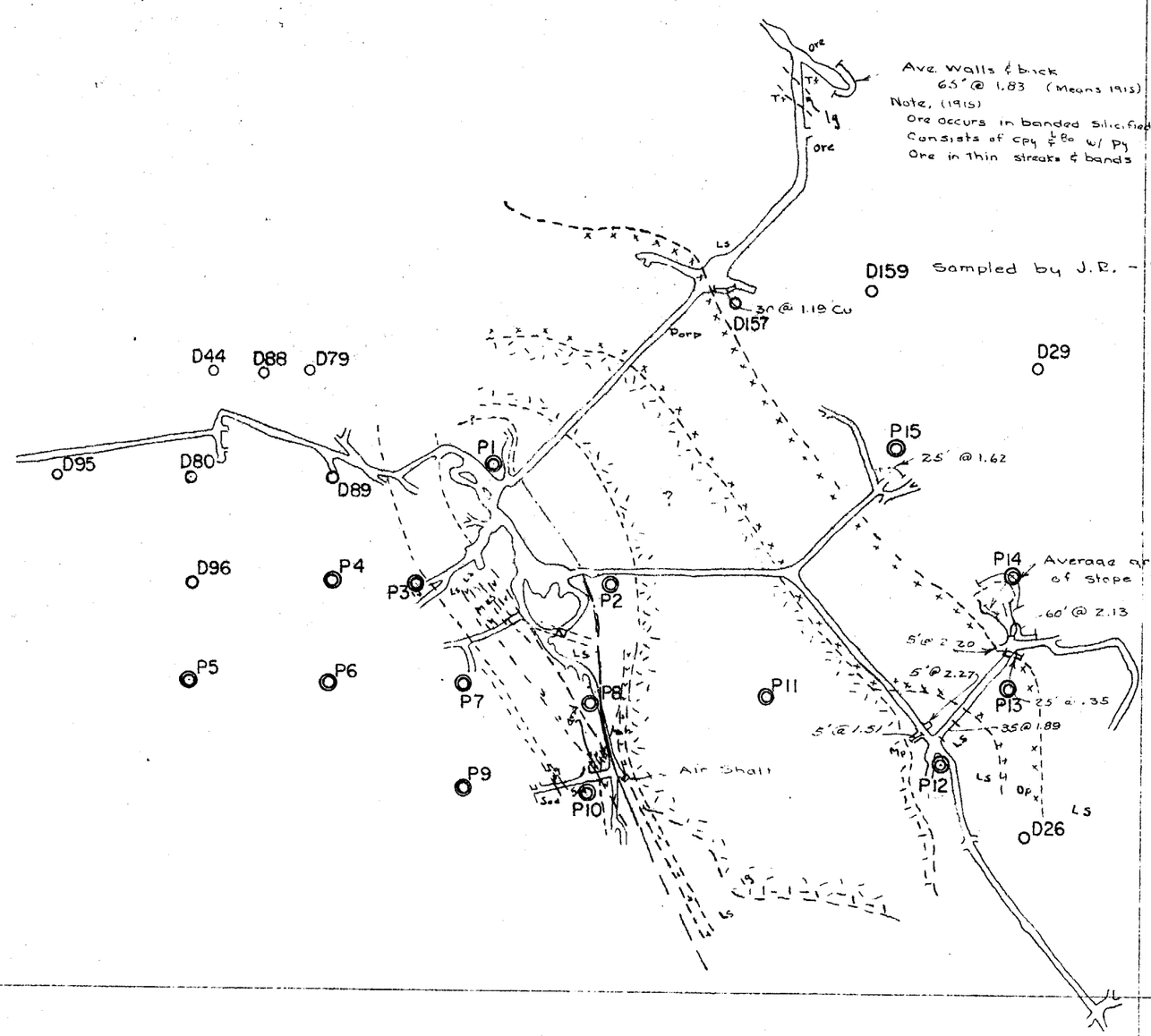
Geophysical work indicates anomalous sulfides in the Mammoth dump area. Geological information indicates sediments beneath the dump. Holes 3, 4, 5, 6, and 7 will test this anomalous condition. Dump material, ranging up to 100 feet in thickness, may result in some drilling difficulties.

Attachments show the holes closest to the proposed drilling, the underground workings, and available assays on the 100 level.

A review of results should be made at the completion of the proposed drilling. It may be desirable to drill out the area on the grid pattern with interspaced holes where required, in the event that satisfactory results have been obtained.

STEPHEN VON FAY

SVF/kw
Attachments
cc: TASnedden, w/atts.
DRJameson (2), w/atts.



TO ACCOMPANY Memo
DATED July 12, 1963
BY S. Von Fay

35 000

0 000 E

IMPERIAL AREA
MAMMOTH MINE
100 LEVEL - ELEV. 2820

Projected Geology by S. Von Fay

SCALE 1" = 200'

December 1958

EXPLANATION
Accessible Workings
Stoped Areas
Workings in Mineralized Sediments
MINE
Yankee Shaft
CDH 32
CDH38
CDH 29
DDH1
No. 3
Hamilton Shaft
300 level
Mammoth Tunnel
Page Tunnel
MAMMOTH MINE
Mammoth Shaft
100 level
200
300 level
500 level
Vincent-Page Tunnel (?)
Mammoth Incline
SAMPSON MINE
Upper Adit
Lower Adit
D95
256-32-47/22
Mz of 345
D80
140-134-70/17
389-57-102
538-46-138
D89
185-40-1.16
292-24-
325-29-
Dp of 417
D36
76-35-64/54
256-41-1.40/1.05
344-98-47/30
deeper lower grade sulphides
D49
151-157-73/43
317-82-52/36
479-19-80/42
D06
308-49-19/51
369-30-70
459-31-86
D47
426-86-69/06
588-55-77/03
662-19-1.09/02
D46
No ore
CDH 83
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
D17
D133
D119
D21
D151
D160
D157
D159
D29
No ore
184-47-
comb.Pb,Zn
D26
301-79-
DDH 4
DDH 2
Morning View Shaft
A
A'
C
C'
Level Approx Rail. Elev.
100 2820
200 2770
300 2680
400 2565
500 2470
600 2375
700 2280
800 2185
3050
3100
3150
3200
3250
3300
3350
3400
36 000 N
18 000 E
19 000 E
20 000 E
TO ACCOMPANY Memo
DATED July 12, 1963
BY S. Von Fay
IMPERIAL MINES
Silver Bell District, Pima County, Arizona
UNDERGROUND WORKINGS
Compiled from Various Sources by S. Von Fay
SCALE 1" = 200'
December, 1959
July, 1963
~~1443~~

OXIDE PIT

September, 1955

Assay	Equivalent in lbs or oz	24.5	30.0	36.0	40.0	43.0
2.0	1.9 @ 90	1.71	1.71	1.71	1.71	1.71
25.3	491 @ .21455	105.34	131.74	155.65	180.84	195.57
		107.05	133.45	157.36	182.55	197.28
Smelter charges		16.29	16.29	16.29	16.29	16.29
		90.76	117.16	141.07	166.26	180.99

NET PROFIT

3. Milling	.8082
4. Indirect Mine & Mill	.3784
	1.1866

Net Smelter Value					
	2% Cu				
	.5094	.6576	.7918	.9332	1.0168
	-1.1866	-1.1866	-1.1866	-1.1866	-1.1866
	-.6772	-.5290	-.3948	-.2534	-.1698
	.3% Cu			Break even .23% Cu	
	.7749		1.2044	1.4194	1.5452
	-1.1866		-1.1866	-1.1866	-1.1866
	- .4117		+ .0178	.2328	.3586
	.4% Cu				
	1.0511	1.3568	1.6337	1.9254	2.0960
	-1.1866	1.1866	1.1866	1.1866	1.1866
	- .1355	+ .1702	.4471	.7388	.9094
	.5% Cu				
	1.3148	1.6972	2.0436	2.4085	2.6219
	-1.1866	1.1866	1.1866	1.1866	1.1866
	.1282	.5106	.8570	1.3219	1.4353
	.6% Cu				
	1.6052	2.0722	2.4950	2.9405	3.2011
	-1.1866	1.1866	1.1866	1.1866	1.1866
	.4186	.8856	1.3084	1.7539	2.0145

Figured at present labor costs
w/o = ± 1/1

.2% Cu @ 48.5 = - $.018

EL TIRO PIT

September, 1955

Assay	Equivalent in lbs or oz	Price of Cu 24.5	30.0	36.0	40.0	43.0
2.5 oz	2.38 @ 90	2.14	2.14	2.14	2.14	2.14
38.0%	745 @	159.84	199.88	244.58	274.38	296.73
		161.98	202.02	246.72	276.52	298.87
Smelter Charge		-18.28	18.28	18.28	18.28	18.28
		143.70	183.74	228.44	258.24	280.59
Milling		.8082				
Indirect Mine & Mill		.3784				
Ore haul		.1650				
		1.3516				

Net Profit

.3% Cu				
			1.4271	1.5506
			-1.3516	-1.3516
			.0755	.1990
.4% Cu				
1.0998	1.4062	1.7484	1.9764	2.1475
-1.3516	-1.3516	1.3516	1.3516	1.3516
- .2518	.0546	.3968	.6248	.7959
.5% Cu				
1.4313	1.8301	2.2753	2.5721	2.7947
-1.3516	1.3516	1.3516	1.3516	1.3516
.0797	.4785	.9237	1.2205	1.4431
.6% Cu				
1.7708	2.2642	2.8150	3.1823	3.4577
-1.3516	1.3516	1.3516	1.3516	1.3516
.4192	.9126	1.4634	1.8307	2.1061

Figured at present labor costs
w/o = 1.4/1

.3% Cu @ 48.5¢ = $.31

Toquepala, Peru.
July 18, 1955.

Mr. K. E. Richard,
American Smelting and Refining Company,
813 Valley National Bldg.,
-Tucson, Arizona,
U. S. A.

SILVER BELL
West Oxide Area

Dear Kenyon,

Reference is made to your letter of June 24 to Mr. F. V. Richard regarding the west oxide area.

As you have noted, one of the four holes (Nº 137) drilled in 1949 entered a post-ore dike near the base of oxidation in the monzonite at a depth of 170 feet, thus the results provided no information on the sulphide mineralization in the monzonite, except for the lowermost 20 feet (370 to 390') which was probably well below the chalcocite zone. Another hole should have been drilled near this location. However, I won't attempt to explain here why this was not done. At any rate the area of copper mineralization mapped in the vicinity of North Butte is much too small by itself to be of interest. Holes 135 and 136 indicated very weak enrichment farther east along the zone. Northeast of Copper Butte, hole 134 cut about 100 ft. of .80% Cu., but the grade here would need to be much higher to make ore in view of the extremely narrow limits shown by the outcrop mapping.

Westerly, beyond North Butte, evidence of copper mineralization diminishes rapidly within a relatively narrow belt of alteration.

Your conclusion regarding the area is the same as mine -- the chances are too small to justify further exploration.

Yours very truly,

J. H. Courtright

J. H. Courtright

JHC/lwa.

cc: F. V. Richard - Salt Lake City.
D. R. Purvis - Silver Bell Unit, Arizona.

S-1.1

J. H. C Personal File

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 24, 1955

AIR MAIL

Mr. F. V. Richard, Manager
Western Mining Department
American Smelting and Refining Co.
600 Crandall Building
Salt Lake City 1, Utah

SILVERBELL
Pima County, Arizona
"West Oxide Area

Dear Sir:

Reference is made to your letter of June 22.

It now appears that I jumped the gun in bringing up this whole matter of drilling in the "West Oxide" area. I have just learned that three holes were drilled in this area in 1949. I presume you have composite logs of these holes in the Salt Lake files but in case you do not, the following are their coordinates:

Hole	North	East
135	30,311	24,283
136	30,509	23,342
137	30,703	22,896

The better values in all three of these holes ranged within .10 and .30%. Hole 137 entered a post-mineral andesite dike at a depth of 170' and the results of this hole below that depth give us no information on the sulphide mineralization in the monzonite.

As it now stands, the results do not conclusively demonstrate that no ore body exists in this area but the indications of these three holes are so weak that I believe it very unlikely that further drilling here would be worthwhile. At least I would like to have Mr. Courtright's opinion on this matter before any more drilling is planned.

While we are waiting for a letter from Mr. Courtright, I will plan to have a closer look at the outcrops in this area.

Yours very truly,

Original Signed By
K. Richard

KENYON RICHARD

KR:jm
cc: J.H.Courtright
D.R.Purvis

Note to Mr. Courtright: Attached to your copy of this letter is your copy of your report of February 10, 1949 which I extracted from your desk file.

AMERICAN SMELTING AND REFINING COMPANY
Tucson, Arizona

February 10,1949

Mr. A.E.Ring, Manager
Southwestern Division
American Smelting and Refining Company
Tucson, Arizona

SILVER BELL PROJECT
PIMA COUNTY, ARIZONA
"WEST OXIDE" AREA
EXPLORATION

Dear Sir:

Herewith my report on the "West Oxide" area. The purpose of the investigation recently completed was the evaluation of exploration possibilities, with respect to disseminated copper ore, in the principal zone of mineralization extending westerly from the Oxide deposit.

C O N T E N T S

	Page
Summary and Conclusion	2
Geology:	
General Statement	2
Structure	2
Mineralization	3
Leached Outcrops	3
Exploration Possibilities	4
Recommendations	4

Attachments:
Outcrop Map - 200 scale (Plate I).
Areal Geologic Map - 200 scale (Plate II).

SUMMARY AND CONCLUSIONS:

In the area west of the Oxide deposit, significant copper mineralization of the disseminated type is localized in a narrow zone which coincides closely with the northwest trending contact between limestone and igneous rocks, the dominant structural feature of the district. Chances for commercial ore are confined to the western portion, comprising an area 1500 feet long and 400 feet wide. Four churn drill holes are recommended as an adequate preliminary test of this area which is limited(by size) to four or five million tons of possible ore.

GEOLOGICAL FEATURES:

General Statement:

The area covered in this report represents a relatively small segment of the northwest trending zone of mineralization which is exposed for a distance of over four miles. The significant features of this zone have been described in recent reports:

El Tiro - Richard and Playter, July 26, 1948.
The Oxide Deposit - J.H.Courtright, July 17, 1948.

The area under discussion bears a very close resemblance to the El Tiro area in respect to rock types, structure and mineralization. However, it is much smaller in size.

The known disseminated ore occurrences in the Silver Bell district owe their commercial grade entirely to secondary sulphide enrichment of lean primary material. The chief copper mineral, chalcocite, is associated with pyrite and minor amounts of chalcopyrite.

Structure:

A prominent feature of the area, and more or less characteristic of the entire mineralized belt, is the pronounced northwesterly alignment of the igneous and sedimentary rock masses. The intrusion of alaskite, dacite porphyry and monzonite, in the order named, along a major northwest break in the Paleozoic and later rocks, was the process that is mainly responsible for the present pattern. Disturbances along this structure, occurring previous to or during the emplacement of the intrusive rocks, caused an uplift of the Paleozoic limestone mass, the southwest border of which forms prominent outcrops marking the contact with igneous rocks.

Close spaced parallel shears, dipping steeply, and striking mainly at right angles to the northwest trend, occur in the igneous rocks and adjacent to the limestone contact (see Plate I). These sheeted zones do not enter the limestone and extend but a few hundred feet southwest of it.

Post-mineral andesite dikes occur frequently, conforming for the most part to the major structural trend.

Mineralization:

The sheeted zones and minor fissures which break across the extensive northwest trending belt of hydrothermal alteration provided the principal openings in which the iron and copper sulphides were deposited. Subsequent erosion caused the sulphides to be exposed to oxidation, and now, the individual shears occurring in the leached outcrops appear as minute seams of residual limonite. The spacing of these seams varies from an inch or so to several feet. Stronger mineralization is usually evident in areas of relatively close-spaced sheeting; however, the sheeting may be present, either wide or close-spaced, without noticeable mineralization.

Weak mineralization of the "contact" type extends for a few tens of feet into the limestone along the contact with the mineralized igneous rocks. The limestone so affected weathers black, in sharp contrast to the gray color of the unaltered rock. Small concentrations of copper, as sulphide or oxide, occur in the limestone at, or very near, the contact.

The attached outcrop map shows the distribution and relative strength of copper mineralization as interpreted by the character and relative abundance of limonite observed in the leached outcrops. The method is essentially the same as that employed in the Oxide area. An excerpt from an earlier report by the writer, referred to in the foregoing, is here reprinted by way of explanation:

"LEACHED OUTCROPS

A study of the outcrops over the Oxide ore body and adjacent areas disclosed the fact that notable variations in both the color and intensity of residual limonite were present. The attached 200-scale map was prepared to depict the distribution and relative intensity of copper mineralization as evidenced by characteristic limonite visible in the bedrock exposures. This characteristic limonite, derived from pyritic chalcocite, occurs in narrow seams and minute vugs, and possesses a color varying from purple-tinged dark red to chocolate brown. In contrast, the outcrops over essentially pyritic mineralization exhibit yellow and brick red colors.

"Blue-green stains and veinlets, representing chrysocolla for the most part, are prominent in some of the alaskite outcrops of the area. In these outcrops it is considered that the meager amount of copper originally present in the rock was dissolved by acid leaching and precipitated as silicate through the neutralizing effect of a less altered rock. Such areas, classed as weakly mineralized, are not considered to hold potentialities in respect to disseminated copper ore, regardless of their spectacular appearance.

"Several limitations are inherent in the interpretation of leached outcrops: (1) The sparse occurrence of good bedrock exposures is perhaps the foremost. Roadcuts provide the best opportunity for appraisal of the nature and intensity of residual limonite; in the weathered croppings, the limonite has been largely brushed out by the elements, leaving quite often nothing more than an obscure "desert polish". (2) The transition from weak to strong mineralization is of a gradational nature; all shades and intensities are present; thus, divisions between classifications must be arbitrarily applied. (3) The surface expression of a mineralized body is not necessarily a vertical projection."

EXPLORATION POSSIBILITIES:

As indicated on the accompanying maps, the strongest copper mineralization occurs in a rather narrow irregular zone extending for a distance of 3500 feet along the major structural break. The largest portion, the westerly half, is 1500 feet in length and 400 feet in average width. Assuming an average thickness of 100 feet, there is room for a possible 5,000,000 tons of ore. This estimate is considered to be optimistic in view of the spotty nature of even the best areas of mineralization. Also, the outcrops exhibit in general a weaker "tone" than those over the Oxide deposit.

Outside the areas of stronger mineralization noted on the maps, the chances for disseminated copper ore occurrence are considered to be practically nil. Wild Hog and Copper Butte display spectacular green stains, but show very meager amounts of residual limonite -- of any kind. Old hole No. 42, 400 feet in depth, and located in the saddle between the two buttes, cut 95 feet of .94% copper at 55 feet. The presence of copper-bearing shears, accompanying a rather strong vein, in the saddle quite likely accounts for the ore grade material encountered in this hole.

In the area extending (beyond the map) northwesterly to El Tiro, mineralization is extremely weak; no possibilities are apparent here.

RECOMMENDATIONS:

About four churn drill holes are required to test, in a preliminary way, the western portion, which is the only part that even approaches dimensions requisite for commercial ore. These proposed locations are spotted, as shown on the map, on either side of the canyon east of North Butte. The selection of these drill sites was governed by two objectives: To cross-section the long axis of the zone, and to take advantage of the most favorable terrain.

Hole No. 134, located north of Wild Hog Butte, reached the chalcocite zone at 110 feet and is now at a depth of 150 feet. This hole and a location ("P) 500 feet westerly, are two of a series

recommended by Dr. Kerr, which were spaced at 200-foot intervals along a line extending from churn drill hole No. 73 (southeast corner of the map) to North Butte. Some of these locations (based on rock alteration) fall in or near the extremely narrow zone of copper mineralization extending easterly from the saddle north of Copper Butte. As previously stated, in a memorandum of December 22nd to Mr. D.J.Pope, the possibility of finding a commercial tonnage here is definitely remote.

Yours very truly,

J. H. Courtright

J. H. COURTRIGHT

cc: WHLoerpabel
DJPope
WRLandwehr
Silver Bell (2)

COMPOSITE LOG

AMERICAN SMELTING & REFINING CO.

CHURN DRILL HOLE NO. 135

PROPERTY: SILVER BELL W. OXIDE AREA

COLLAR COORDINATES: N. 30,311.28 E. 24,282.59

CLAIM COPPER PRICE & DANUBE ? WILD HOG

COLLAR ELEVATION: 3023.37

DEPTH: 360'

SCALE: 1 INCH=50 FEET

FILE NO.

DATE STARTED: 2/11/49

DATE FINISHED: 2/22/49

NO. 8 HR. SHIFTS: 17

LOG BY: J.H.C.

SURVEY BY: R.E.M.

LEGEND — ROCK CLASSIFICATION: W—WASH; H—MONZONITE; DP—DACITE PORPHYRY; A—ALASKITE; EV—EARLY VOLCANICS (DACITE, ANDESITE FLOWS, INTERCOLATED SEDIMENTS); LS—LIMESTONE; QT—QUARTZITE; SH—SHALE; DR—DIKE ROCKS

ELEVATION	SAMPLE DEPTH	COPPER ASSAYS TOTAL	COPPER ASSAYS NON-SUL	COMPOSITE ASSAYS	ROCK CLASSIFICATION	MINERALIZATION OXIDE: CHRYSOCALLA	OXIDE: NATIVE COPPER	OXIDE: LIMONITE	SULPHIDE: CHALCOCITE	SULPHIDE: CHALCOPYRITE	SULPHIDE: PYRITE	ALTERATION SLIME (CLAY) %	DRY WEIGHT OF SPLIT SAMPLES LBS.	DRY WEIGHT OF SPLIT SAMPLES OZ.	LBS. PER CU. FT. IN BREAK THEORETICAL SAMPLE WEIGHT	HARDNESS	CASING: HOLE DRILLED	CASING: HOLE REAMED	CASING: CASING	REMARKS
	5	0.01			M								12.5		-1.2	M				
	10	0.01			"							17	12.4		-1.1	"				
	15	0.01			"							22	12.4		-1.1	"				BEDROCK
3000	20	0.02			"							28	8.9		-2.4	"				
	25	0.02			"							28	12.6		-1.3	"				
	30	0.03			"							33	12.5		-1.2	"				
	35	0.04			"							39	10.2		-1.1	"				
	40	0.06			"							11	15.8		-4.5	"				
	45	0.07			"							11	10.5		-0.8	"				
	50	0.08			"							11	10.5		-0.8	"				
	55	0.21			"							28	8.4		-2.9	"				
	60	0.26			"							17	9.3		-2.0	H				
	65	0.15			"							22	8.4		-2.9	"				
	70	0.07			"							44	10.1		-1.2	"				
	75	0.04			M&DP							28	11.0		-0.3	"				
	80	0.03			M							33	8.9		-2.4	"		12 7/8"		
	85	0.03			"							28	11.3		0.0	"				
	90	0.05			"							33	13.8		-2.5	"				
	95	0.09			"							33	10.2		-1.1	"				
	100	0.05			"							39	9.9		-1.4	"				
	105	0.01			"							39	15.0		-3.7	"				
	110	0.01			"							44	12.0		-0.7	"				
	115	0.01			"							39	11.8		-0.5	"				
2900	120	0.01			"							39	12.5		-1.1	"				
	125	0.07			"							44	11.8		-0.5	"				
	130	0.13			"							50	10.2		-1.1	"				
	135	0.09			"							50	15.4		-1.8	"				
	140	0.06			"							50	16.8		-3.2	"				
	145	0.04			"							44	13.5		-0.1	VH		10"		
	150	0.04			"							50	15.0		-1.4	"				
	155	0.04			"							50	13.1		-0.5	"				LOST PART OF SAMPLE
	160	0.06			"							33	13.5		-0.1	M				
	165	0.05			"							44	13.0		-0.6	"				
	170	0.06			"							50	10.4		-3.2	H				
	175	0.07			"							39	10.4		-3.2	"				
	180	0.05			"							39	10.2		-1.4	M				
	185	0.02			"							39	8.9		-0.1	"				
	190	0.03			"							22	8.4		-0.4	"				
	195	0.02			"							50	7.3		-1.5	S				
	200	0.02			"							44	7.0		-1.8	"				
	205	0.09			"							50	12.8		-4.0	"				
	210	0.08			"							50	11.5		-2.7	H				
	215	0.06			"							44	10.7		-1.9	"				
2800	220	0.09			"							55	7.0		-1.8	"				
	225	0.06			"							55	9.9		-1.1	"				
	230	0.07			"							44	9.1		-0.3	M				
	235	0.06			"							44	6.4		-2.4	"				
	240	0.05			"							50	7.9		-0.9	"				
	245	0.05			"							44	7.7		-1.1	S				
	250	0.06			"							50	8.5		-0.3	"		8"		
	255	0.04			"							50	12.0		-3.2	VH				SHOT 45 STICKS 80%
	260	0.03			"							60	9.1		-0.3	H				HOLE CAVING
	265	0.05			"							44	10.2		-1.4	S				
	270	0.06			"							33	9.2		-0.4	"				
	275	0.03			"							33	7.4		-1.4	"				
	280	0.04			"							39	6.9		-1.9	"				
	285	0.06			"							50	10.2		-1.4	"				
	290	0.04			"							50	8.0		-0.8	M				
	295	0.04			"							50	9.4		-0.6	"				
	300	0.03			"							44	9.4		-0.6	"				
	305	0.02			"							50	8.9		-0.1	"				
	310	0.02			"							44	9.4		-0.6	S				
	315	0.05			"							60	9.5		-0.7	"				
2700	320	0.05			"							50	7.7		-1.1	"				
	325	0.06			"							44	10.0		-1.2	"				
	330	0.07			"							55	8.1		-0.7	M				
	335	0.10			"							55	10.8		-2.0	"				SHOT 45 STICKS 80%
	340	0.07			"							50	8.6		-0.2	VH				HOLE CAVING
	345	0.05			"							50	10.3		-1.5	H				
	350	0.06			"							33	9.5		-0.7	VH				SHOT 20 STICKS 45%
	355	0.05			"							33	8.0		-0.8	"				
	360	0.06			"							33	10.5		-1.7	"				
	365																			
	370																			
	375																			
	380																			
	385																			
	390																			
	395																			
	400																			
	405																			
	410																			
	415																			
	420																			
	425																			

LEACHED ZONE

NOTE: ASSAYS AND MINERALIZATION AS NOTED ON LOG No. 113

COMPOSITE LOG

AMERICAN SMELTING & REFINING CO

CHURN DRILL HOLE NO 136

PROPERTY SILVER BELL AREA

COLLAR COORDINATES N 30,509.46 E 23,342.26 CLAIM DANUBE

COLLAR ELEVATION 2872.27

DEPTH 310

SCALE 1 INCH = 50 FEET

FILE NO

DATE STARTED 2/23/49

DATE FINISHED 3/10/49

NO 8 HR SHIFTS 25

LOG BY J.H.C.

SURVEY BY R.E.M.

LEGEND — ROCK CLASSIFICATION: W—WASH; M—MONZONITE; DP—DACITE PORPHYRY; R—RHYOLITE; EV—EARLY VOLCANICS (DACITE, ANDESITE FLOWS, INTERCALATED SEDIMENTS); LS—LIMESTONE; QT—QUARTZITE; SH—SHALE; DR—DIKE ROCKS; D—DIORITE

ELEVATION	SAMPLE DEPTH	COPPER ASSAYS TOTAL	COPPER ASSAYS NON SUL	COMPOSITE ASSAYS	ROCK CLASSIFICATION	MINERALIZATION OXIDE: CHRYSOCOLLA	NATIVE COPPER	LIMONITE	MINERALIZATION SULPHIDE: CHALCOCITE	CHALCOPYRITE	PYRITE	ALTERATION SEIMIFICKY, ET	DRY WEIGHT OF SPLIT SAMPLES LBS	OZ	LBS OXIDE OR UNDER THEORETICAL SAMPLE WEIGHT	HARDNESS	CASING: HOLE DRILLED	HOLE REAMED	CASING	REMARKS
	5	0.11			DP															BEDROCK
	10	0.11			"							1.1	6.2		+4.9					
	15	0.10			"							2.8	7.5		+6.0					
	20	0.10			"							2.8	8.2		+6.8					
	25	0.10			"							2.8	2.5		++1.2					
	30	0.11			"							5.0	3.0		++1.8					TRACE CUPRITE
	35	0.10			"							5.0	1.7		+5.7					
	40	0.08			"							3.9	4.5		+3.2					
	45	0.08			"							3.9	5.5		+4.2					
	50	0.10			"							3.9	7.5		+6.2		12 7/8"			
	55	0.10			A							3.9	4.7		+3.4					
	60	0.09			"							4.4	3.0		+1.7					
	65	0.08			"							4.4	1.2		+5.9					
2800	70	0.16			"							3.9	4.0		+2.7					
	75	0.16			"							4.4	2.5		+1.2					
	80	0.15			"							4.4	2.7		+1.4					
	85	0.17			"							4.4	2.2		+0.9					
	90	0.15			"							3.9	3.0		+1.8					
	95	0.20			"							3.9	1.0		-0.6					
	100	0.19			"							3.3	1.0		-0.3					SHOT 60, 20, & 40 STICKS 45%
	105	0.37			"							2.8	1.2		-1.4					LOST WATER
	110	0.09			"							3.9	8.4		+4.8					
	115	0.15			"							3.3	8.5		+4.9					
	120	0.07			"							3.9	1.9		-1.7					
	125	0.08			"							2.2	3.5		-0.1		10"			
	130	0.14			"							5.0	3.5		-0.1					
	135	0.14			"							5.0	4.7		+1.1					
	140	0.11			"							4.4	5.0		+1.4					
	145	0.12			"							5.5	6.0		+2.4					
	150	0.10			"							5.0	5.0		+1.4					
	155	0.03			"							6.1	9.2		+5.6					
	160	0.01			"							4.4	9.2		+5.6					
	165	0.01			"							3.9	6.5		+2.9					
2700	170	0.01			"							3.9	5.2		+1.6					
	175	0.01			"							5.0	6.5		+2.9					
	180	0.02			M							5.0	4.7		+1.1					
	185	0.01			"							3.9	1.5		-2.1					
	190	0.01			"							5.0	6.2		-2.6					
	195	0.02			"							5.0	7.7		-1.1					LOST WATER
	200	0.03			"							3.8	3.0		+4.2					
	205	0.07			"							5.0	8.0		-0.8					
	210	0.08			"							5.0	11.0		+2.2					
	215	0.04			"							5.5	9.5		+0.7					SHOT 16 STICKS 45%
	220	0.05			"							5.0	10.6		+1.8					
	225	0.05			"							5.0	7.2		-1.6					
	230	0.05			"							5.5	7.7		-1.1		8"			
	235	0.04			"							5.5	7.0		-1.8					
	240	0.05			"							4.4	6.2		-2.6					
	245	0.05			"							4.4	6.7		-2.1					
	250	0.06			"							5.5	6.0		-2.8					
	255	0.06			"							6.7	6.0		-2.8					
	260	0.06			"							6.7	7.7		-1.1					WATER IN HOLE
	265	0.07			"							7.8	4.0		-4.8					
2600	270	0.05			"							3.3	6.2		-2.6					WATER LEVEL
	275	0.05			"							5.0	6.2		-2.6					SHOT 51 STICKS 45%
	280	0.05			"							5.0	8.1		-0.7					
	285	0.03			"							6.1	6.6		-2.2					SHOT 40 STICKS 45%
	290	0.02			"							5.5	7.5		-1.3					
	295	0.05			"							1.6	11.0		+2.2					
	300	0.05			"							3.9	12.0		+3.2					
	305	0.08			"							6.7	7.0		-1.8					
	310	0.06			"							5.5	8.8		0.0					BAILING TEST 15 GPM
	315																			
	320																			
	325																			
	330																			
	335																			
	340																			
	345																			
	350																			
	355																			
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	375																			
	380																			
	385																			
	390																			
	395																			
	400																			
	405																			
	410																			
	415																			
	420																			
	425																			

NOTE ASSAYS AND MINERALIZATION AS NOTED ON LOG NO 113

COMPOSITE LOG

AMERICAN SMELTING & REFINING CO

CHURN DRILL HOLE NO 137
PROPERTY SILVER BELL OXIDE AREA
COLLAR COORDINATES N 30,703.04 E 22,895.59 CLAIM DANUBE
COLLAR ELEVATION 2918.79
DEPTH 390
SCALE 1 INCH 50 FEET

FILE NO
DATE STARTED 3/10/49
DATE FINISHED 3/21/49
NO 8 HR SHIFTS 19
LOG BY R.E.M.
SURVEY BY R.E.M.

ELEVATION	SAMPLE DEPTH	COPPER ASSAYS TOTAL	COPPER ASSAYS NON SUL	COMPOSITE ASSAYS	ROCK CLASSIFICATION	MINERALIZATION OXIDE: CHRYSOCOLLA	NATIVE COPPER	LIMONITE	MINERALIZATION SULPHIDE: CHALCOCITE	CHALCOPYRITE	PYRITE	ALTERATION SILICIFICATION CLAY	DRY WEIGHT OF SPLIT SAMPLES LBS	OZ	LBS OVEN DRYING PER THEORETICAL SAMPLE WEIGHT	HARDNESS	CASING: HOLE DRILLED	HOLE REAMED	CASING	REMARKS
	5	0.07			FILL											M				BEDROCK
	10	0.07			M															
	15	0.02											2.8	15.2	+3.9	"				
2300	20	0.03											2.8	13.8	+2.5	"				
	25	0.00											2.8	13.8	+2.5	"				
	30	0.01										MODERATE	4.4	11.0	-0.3	"				
	35	0.01											2.8	10.1	-1.2	"				
	40	0.01											3.9	9.8	-1.5	"				
	45	0.01											4.4	8.3	-3.0	"				
	50	0.01											3.3	13.6	+2.3	"				
	55	0.01											4.4	15.6	+4.3	"				
	60	0.01											3.9	14.0	+2.7	"				
	65	0.01											5.0	14.0	+2.7	"				
	70	0.04											3.9	13.0	+1.7	H				
	75	0.04											3.3	10.7	-0.6	"				
	80	0.05											3.3	11.5	+0.2	"				
	85	0.04											2.8	12.0	+0.7	"		12 7/8"		
	90	0.02											3.9	14.0	+2.7	M				
	95	0.05											3.9	13.2	+1.9	"				
	100	0.10											3.9	10.0	-1.3	"				
	105	0.05											2.9	12.2	+0.9	"				
	110	0.11											4.4	14.5	+3.2	"				
	115	0.17											3.3	12.5	+1.2	"				
2800	120	0.13											2.8	17.7	+6.4	"				
	125	0.12											3.9	15.2	+3.9	VH				
	130	0.01										SPARSE	3.9	15.5	+4.2	H				
	135	0.14											4.4	8.2	-3.1	"				
	140	0.20											4.4	8.0	-3.3	"				
	145	0.23											3.9	6.7	-4.6	"				
	150	0.29											5.5	9.6	-1.7	VH				
	155	0.42											4.4	10.0	-1.3	"				
	160	0.36											7.2	11.5	+0.2	H				
	165	0.44											5.0	9.0	-2.3	"				
	170	0.40											4.4	9.6	-1.7	"				CLAY - GOUGE IN SAMPLE
	175	0.40			ANDESITE								6.1	11.5	+0.2	VH				
	180	0.05			"								4.4	15.1	+3.8	"				
	185	0.01			"								5.5	17.2	+5.9	H				
	190	0.05			"								3.3	13.5	+2.2	"				
	195	0.05			"								2.2	12.5	+1.2	"				
	200	0.06			"								3.3	10.2	-1.1	"				
	205	0.06			"								4.4	10.7	-0.6	"				
	210	0.05			"								3.3	15.5	+4.2	"				
	215	0.05			"								5.0	11.0	-2.6	VH				
2700	220	0.01			"								3.9	10.5	-2.1	"				
	225	0.01			"								4.4	10.5	-2.1	H				
	230	0.01			"								5.5	10.2	-2.4	"		10"		
	235	0.01			"								4.4	9.5	-4.1	"				
	240	0.01			"								5.5	12.0	-1.6	"				
	245	0.01			"								5.0	10.0	-3.6	"				
	250	0.005			"								5.5	11.0	+2.2	"				
	255	0.01			"								5.0	9.0	+0.2	"				
	260	0.01			"								6.1	12.2	+3.4	"				
	265	0.01			"								6.1	9.0	+0.2	M				
	270	0.01			"								7.9	9.2	+0.4	"				
	275	0.01			"								5.5	9.0	+0.2	"		8"		
	280	0.01			"								5.5	9.0	+0.2	"				
	285	0.01			"								6.1	11.5	+2.7	H				
	290	0.01			"							SPARSE + MODERATE	5.5	12.5	+3.7	"				
	295	0.01			"								5.0	11.5	+2.7	"				
	300	0.01			"								5.5	8.0	-0.8	"				
	305	0.01			"								5.0	6.0	-2.8	"				WATER LEVEL
	310	0.01			"								6.1	7.0	-1.8	"				WATER IN HOLE 10 GPM
	315	0.01			"								5.0	2.0	-6.8	VH				"
2600	320	0.01			"								5.5	4.0	-4.8	"				"
	325	0.01			"								6.1	4.0	-4.8	"				"
	330	0.01			"								3.9	10.5	-1.7	H				"
	335	0.04			"								5.0	10.5	+1.7	"				"
	340	0.05			"								4.4	9.7	+0.9	"				"
	345	0.08			"								5.0	6.0	-2.8	"				"
	350	0.08			"								4.4	6.7	-2.1	"				"
	355	0.03			"								4.4	10.0	+1.2	"				"
	360	0.03			"								5.5	5.7	-3.1	M				"
	365	0.06			"								5.0	5.7	-3.1	"				"
	370	0.04			"								5.5	5.2	-3.6	"				"
	375	0.04			M								5.0	4.7	-4.1	"				"
	380	0.05			"							SP	3.3	8.5	-0.3	"				"
	385	0.04			"								4.4	7.2	-1.6	"				"
	390	0.10			"								4.4	7.2	-1.6	"				"
	395												3.9	7.5	-1.3	"				"
	400																			USED 16 STICKS 45%
	405																			
	410																			
	415																			
	420																			

NOTE ASSAYS AND MINERALIZATION AS NOTED ON LOG NO. 113

LEGEND
ROCK CLASSIFICATION
W WASH — LS LIMESTONE
M MONZONITE — QT QUARTZITE
P PORPHYRY — SH SHALE
K KLASKITE — DR DIKE ROCKS
EV EARLY VOLCANICS — DACITE ANDESITE FLOWS — INTERCALATED SEDIMENTS — D DIORITE

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 21, 1955

Mr. F. V. Richard, Manager
Western Mining Department
American Smelting and Refining Co.
600 Crandall Building
Salt Lake City 1, Utah

SILVER BELL PROJECT
PIMA COUNTY, ARIZONA
"WEST OXIDE" AREA
EXPLORATION

Dear Sir:

In regard to our telephone conversation this morning, the above is the subject heading of a report dated February 10, 1949 by Mr. Courtright. The report contains two attachments: An outcrop map and an areal geologic map. Messrs. Loerpabel, Pope and Landwehr are marked for copies so presumably there are two copies in the Salt Lake files. However, if a copy cannot be found we can prepare one for you.

Several years ago, I casually looked over some of the outcrops in this "West Oxide" area but I do not remember them well enough to make a comparison with the outcrops in North El Tiro area where we are presently drilling.

I know of no information acquired in recent years which would alter any of the opinions expressed in this 1949 report by Mr. Courtright except that he limited the number of proposed holes to four, partly because of the difficulty of building access roads. This matter of road building is not as important as it was at the time of Mr. Courtright's report; therefore, I believe at least two additional holes should be drilled: One on the southwesterly slope of North Butte at coordinate 30,700N-22,550E and the other near the Danube Adit at coordinate 30,525N-23,675E.

As I explained to you, the men at Silver Bell have planned at least four more holes to delimit the immediate westerly extension of the Oxide Pit ore body. The locations of these four holes seem appropriate to me. If any of them penetrate significant columns of ore, additional holes may be needed. After this program is completed, the rig could be moved to the area designated by Courtright as "West Oxide".

Although it is not important that we know promptly whether or not this "West Oxide" is an ore body, it would seem more convenient to drill these holes now rather than at a later date.

Yours very truly,

Original Signed By
K. Richard

KENYON RICHARD

KR:jm

cc: J.H.Courtright
D.R.Purvis

C O P Y

WESTERN MINING DEPARTMENT
Salt Lake City, Utah

May 19, 1955

AIR MAIL

Mr. T. A. Snedden, Manager
Southwestern Mining Division
American Smelting and Refining Company
813 Valley National Building
Tucson, Arizona

SILVER BELL UNIT
SILICIOUS SMELTER FLUX

Dear Sir:

I am enclosing copy of Mr. Tittmann's letter to me of May 18th relative to the possibility of developing at Silver Bell a supply of oxidized ore which could be used for converter flux at El Paso. You advised me yesterday by telephone that during the stripping stage consideration was given to this problem and at that time nothing could be found that would be suitable. Nevertheless, I think we should give this matter further consideration as time permits.

I am attaching for your confidential use copy of Mr. Kuzell's letter to Mr. Page of May 13th relative to the possibility of developing silicious flux at the Toquepala deposit. This letter has reference to their so-called "minal analysis." No doubt there will be some experimental work as a result of Mr. Kuzell's idea, and if this is successful, then possibly it would give us some ideas to use for consideration of possibilities at Silver Bell.

Very truly yours,

/s/ F. V. Richard

F. V. RICHARD

FVR:bm
Encls. (2)
cc: E.McL.Tittmann

C O P Y

Salt Lake City, Utah, May 18, 1955

Mr. F. V. Richard,
Salt Lake City.

Dear Sir:

Confirming our conversation, there may be a possibility of supplying some oxidized ore from the Silver Bell area which would prove more profitable at El Paso than the present converter flux. Assuming that the rock was highly altered so that all of the alumina would be present as sericite, flux containing 70% silica or better and 14% alumina or less should prove satisfactory. Assuming a hauling cost of $1.25 and freight of $2.75, the flux would have to contain nine pounds of copper per ton to break even with the present flux. There would have to be additional copper present at a price of 32 cents a pound to cover the mining cost.

If you are able to devdop anything that contains sufficient copper to look attractive on the above basis, we should have samples in order to determine the mineral constituents before making any arrangements for shipment.

Yours truly,

/s/ E. McL. Tittmann

E. McL. TITTMANN

cc BRoberts

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

December 20, 1954

MEMORANDUM FOR MR. T. A. SNEDDEN

NORTH EL TIRO
Silver Bell
Drilling Program

In accordance with the request in Mr. F. V. Richard's letter of November 19 to Mr. Pope, the following are my recommendations for a minimum program of preliminary exploration in the North El Tiro area.

In his report of August 20, Mr. Evans outlined two areas as being favorable for exploration. It is my understanding that he did not intend that the limits of these two areas necessarily would also represent limits of possible ore. Rather, he considered these two areas to be the most favorable for the occurrence of material of ore grade and tonnage. If ore is not found in either of these two areas, exploration would not be worthwhile elsewhere in the surrounding alteration-mineralization zone. If ore is found in either area, it may have extent outside of the outlines shown on Evans' map.

There are a number of old churn drill holes in this area, some of which show intercepts of commercial grade and thickness. The earliest holes in the El Tiro ore body proper were part of this same early drilling program. Presumably the same drilling and sampling procedures were used in both the El Tiro and North El Tiro areas. The recent "measurement" drilling of the El Tiro ore body has shown that the assay results of the early holes were as much as 40% too high. It is not possible to derive an accurate correction factor for the drill hole assays in the North El Tiro area; but, if the old assays are substantially on the high side, we will probably find that the mineralization actually will be commercially marginal.

Regardless of whether the assays are too high or not, they indicate that the chalcocite has erratic distribution. The outcrops also show that the chalcocite has a spotty occurrence. These two indicated conditions — marginal grade and erratic distribution of chalcocite — are the principal factors controlling the extent of preliminary drilling. Four or five wide-spaced holes alone would not provide a satisfactory indication of ore possibilities. Mr. Courtright agrees with me that 10 holes would represent a minimum requirement. If as few as half of these holes penetrate material of near-commercial grade and thickness — say, 50' at 0.75% Cu — a more extensive drilling program then would be in order.

The positions of these 10 holes are shown on the attached sepia print. This print is intended as an overlay on Mr. Evans' map.

A rather extensive amount of road building probably will be required; but no contour map is available for the area, and the probable positions and lengths of roads cannot be estimated by using Mr. Evans' drainage map. The 10 proposed locations shown on the sepia overlay can be adjusted here and there if this will

serve to reduce the expense of roadbuilding. However, this moving of locations should not be done haphazardly because in some cases the position of holes is determined by the strike of structures. It is suggested that the 10 locations first be surveyed and marked in the field. Then Mr. Courtright or I can meet in the field with Mr. Meen, or whoever on the Silver Bell staff will be in charge of building the roads and drill platforms, and determine what changes should be made in the locations.

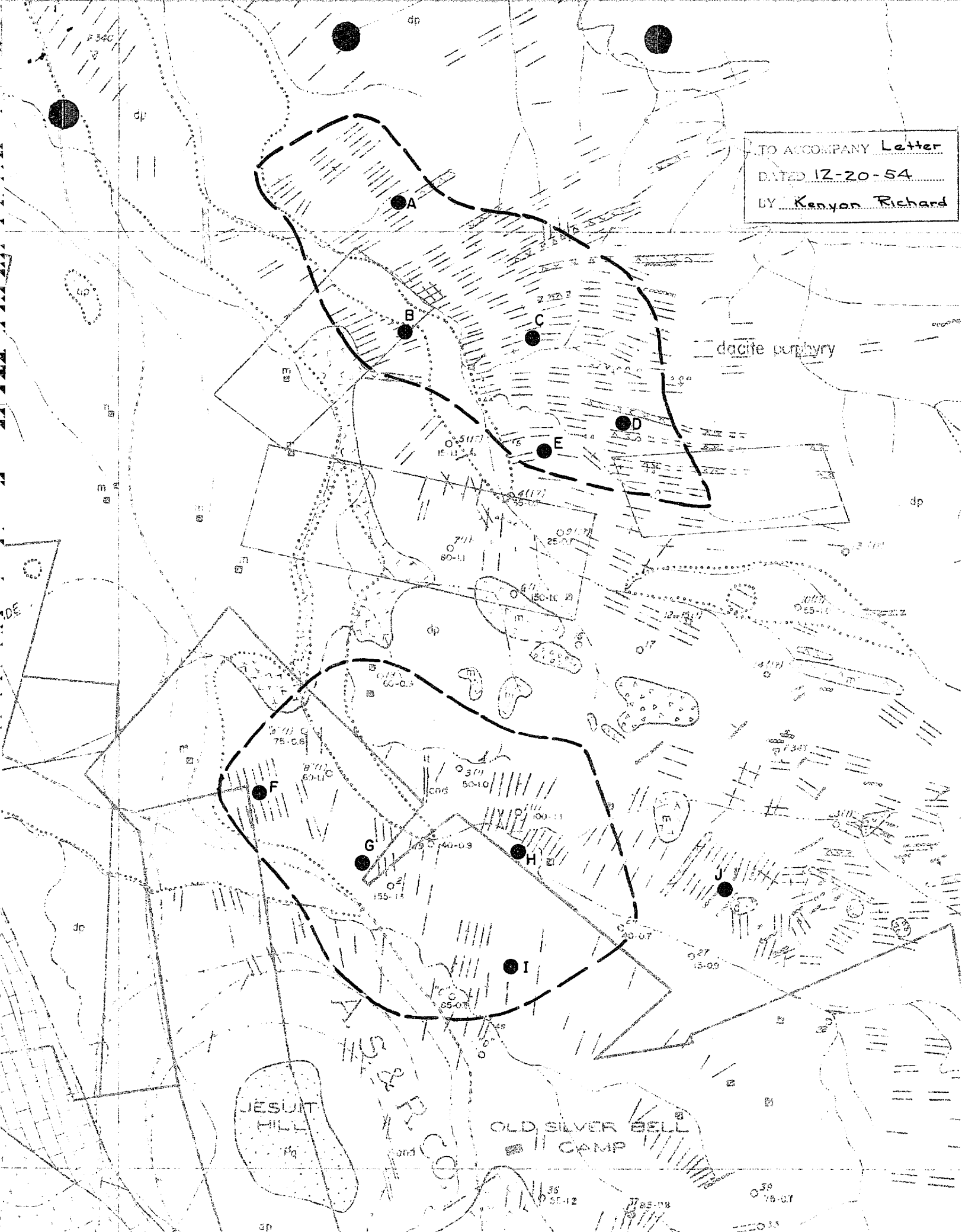
There is a further suggestion in regard to surveying these locations. Evans mapped on aerial photographs, the only control then available in the area. Therefore, his geology is tied to features such as drainage, shafts, and dumps. Due to distortions in the photographs, the geology in some places may be plotted somewhat out of its true coordinate position. Consequently, the surveying to locate these holes in the field should not be done strictly on a coordinate basis. Instead, the locations should be tied in (probably by stadia) to nearby points such as shafts, roads, drainage confluences, etc. which appear on Evans' map.

A depth of 250' will be sufficient for most of the holes, but a few should be drilled deeper. Total footage is estimated at 3300. There are no particular geological questions that require diamond drill core for answer, so churn drilling would be adequate.

Mr. Richard has asked for a cost estimate. This can be more appropriately made up by the Silver Bell staff after the road network has been planned in the field.

Original Signed By
K. Richard
KENYON RICHARD

KR:ar
Attachment: Sepia overlay
cc: WRLandwehr with attachment.
DRPurvis with attachment and a copy of Evans' report with maps


TO ACCOMPANY Letter
DATED 12-20-54
BY Kenyon Richard
A
B
C
D
E
F
G
H
I
J
dacite porphyry
JESUIT HILL
OLD SILVER BELL CAMP

OLD SILVER BELL
II CAMP
JESUIT
HILL
pd
dacite porphyry
dp
dnd
m
F340
F343

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

August 23, 1954

Mr. W. R. Landwehr, Chief Geologist
Western Mining Department
Salt Lake City Office

NORTH EL TIRO AREA
SILVER BELL

Dear Sir:

Herewith are Mr. Evans' report and maps of the North El Tiro area.

In the past, some reconnaissance work was done in this area, but detailed mapping was not carried out because the potentialities appeared to be relatively poor as compared to the Oxide and El Tiro areas. A review of the area was made early this year. Mineralization and structure were found to be more favorable than was originally thought to be the case. Consequently, detailed study appeared warranted. Mr. Evans has now completed this work. He was careful and thorough, and his report represents a sound evaluation of exploration possibilities.

He concludes that the occurrence of ore grade material is indicated in this area, and he directs attention to two areas where exploration drilling should be initiated. He expects that the ore will be spotty and low grade. This imposes two factors which will have a bearing on a drilling program: (1) Since it can have no effect on the present mining program, the total data on grade and tonnage of any ore probably will not be needed until mining at Oxide and El Tiro is about finished. (2) Because mineralization is spotty, holes ultimately must be close-spaced.

As fulfillment of annual assessment work requirements on the group of 33 claims now being staked to cover the favorable area, about one churn drill hole per year can be drilled. The cost of this can probably be carried by the Silver Bell operation without special appropriation. Unless the assay results of these preliminary holes are quite low, which is unlikely, a substantial drilling program eventually will be required.

Yours very truly,
Original Signed By
K. Richard
KENYON RICHARD

KR:ar

cc: WRLandwehr, with 1 extra.
JMCourtright √
CDEvans

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

August 20, 1954

Mr. Kenyon Richard, Chief Geologist
Southwestern Mining Department
Tucson Office

NORTH EL TIRO AREA
SILVER BELL

Dear Sir:

Herewith is the report on a geological study of the area north of El Tiro as requested by you in June, 1954. You asked that I weigh the significance of the copper mineralization in the area not only under present economic conditions, but also consider that future developments may permit mining of lower grade ore than is now possible.

Eighteen days, between June 28 and August 7, were spent in field mapping. This includes two days with Mr. J. H. Courtright on a reconnaissance of the group of low hills west-north-west of the zone of alteration. The remaining time was spent mapping within and adjacent to the zone of alteration and mineralization. The region south and southeast of the Atlas camp has been described in previous reports, and the geology has been taken from them to complete the picture within the boundaries of the map.

INTRODUCTION

In addition to describing the geology of the region north of El Tiro, it is undertaken in this report (1) to measure the strength of copper mineralization within the zone of alteration; (2) to determine to what extent the zone is concealed by post-mineral alluvial and volcanic formations, and what is the likelihood of the existence of a buried deposit beneath this cover, and (3) to make recommendations relative to favorable areas.

The region covered by the report includes the northern end of the Silver Bell zone of alteration and environs. (Please refer to Index Map.) It can be divided topographically into the east and west hills separated by a band of shallow alluvium.

APPENDIX

1. List of previous reports most often referred to.
2. Index Map 1" = 5000'.
3. Geologic Map of North El Tiro Area 1" = 600'.
4. Churn drill hole assay record.

SUMMARY AND RECOMMENDATIONS

The North El Tiro zone of alteration is a continuation of the main Silver Bell zone. It is similar to the rest of the zone in that hypogene sulfide mineralization consists of pyrite with minor amounts of chalcopyrite, and deposition of these minerals is controlled by systems of close-spaced joints. On the whole, copper sulfide mineralization is of lower intensity than to the south.

Two zones favorable for exploration have been outlined. One, 2000' by 1500' in size, is based largely on the assay records of old churn drill holes which indicate a blanket of enrichment 72 feet thick averaging 1.0% Cu. The assay records are of

questionable reliability. The other, 3000 feet by 1110 feet in size, is based entirely on the evidence in leached outcrops, which indicates a low grade enriched zone of possible future interest.

The northern end of the zone of alteration turns sharply westward and disappears beneath alluvium and post mineral volcanic flows. It is narrowing rapidly and is only weakly mineralized so the possibility of an important-sized continuation under cover is considered slight.

ASARCO mining claims cover only the southern postion of the North El Tiro alteration zone. Claims are now being staked over most of the remaining ground. The two favorable localities will require drilling to test their possibilities. Inasmuch as any mineralization encountered is expected to be marginal in grade, there is nothing urgent in the accumulation of exploration data. One drill could gradually provide the required information, and the work used to meet the annual assessment requirement of the new claims.

In drilling the northernmost deposit especially, it should be taken into account that under such conditions of extreme irregularity in mineralization, the area of influence of any one hole is small. Therefore a considerable number of holes may be needed.

GEOLOGICAL FEATURES

District geology has been described in several previous reports and need not be reviewed here. * All of the rocks identified in the area occur elsewhere in the district, and no anomalous age relationships were noted. The many references made to the zone of alteration and mineralization has made it advisable to refer to it simply as the "zone of alteration."

ROCK UNITS

Sedimentary

Large blocks of Paleozoic quartzites and limestones occur as pendants in igneous rocks. Due to their relative resistance to erosion they form ridges and hills. Roughly, they mark the southern limits of the present study.

Gently northeast-dipping beds of indurated siltstones, shales and grits form low knolls surrounded by alluvium northwest of the zone of alteration. Similar rocks south of the Oxide pit are of Cretaceous age.

Pre-sulfide igneous

The northern tip of a large exposure of alaskite, the oldest of the Laramide intrusive, borders the Paleozoic sediments on the southwest. It is of minor importance here, but is the host to much of the El Tiro ore to the south.

In contact with the alaskite on the northeast is a large mass of dacite porphyry of consequence in that it is the main host for mineralization. It is continuously and extensively exposed to the southeast.

*Those reports used most extensively as references are listed in the Appendix.

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Andesite porphyry borders dacite porphyry on the northeast, and crops out of the alluvium to the northwest of the zone of alteration and also in the west hills.

Gently north-to-northeast dipping dacite agglomerate (flows and pyroclastics) overlies unconformably the andesite porphyry. It forms the steep hills north of the zone of alteration, and the central part of the west hills.

Monzonite is the youngest of the pre-mineral intrusives and is the second most abundant rock in the zone of alteration north of El Tiro. In many places it contains euhedral crystals of quartz and can properly be called a quartz monzonite. It forms roughly circular, stock-like bodies of various sizes, and narrow, steep-dipping to vertical dikes. Being less resistant to erosion than surrounging rocks, the larger bodies form topographic lows. The stock north of Jesuit Hill is largely covered by alluvium, its extent being indicated by numerous prospect shafts.

Post-sulfide igneous

A few narrow north-northwest trending andesite dikes cut alaskite, dacite porphyry and monzonite. One large dike of rhyolite porphyry cuts dacite porphyry. The andesite is soft and therefore easily eroded, and only exposed in cuts and stream channels. The rhyolite porphyry is hard and forms a low but sharp, prominent ridge.

Red vesicular lava crops out in the alluvium just beyond the northwesternmost exposures of the zone of alteration, and in numerous other places in the central band of alluvium. Gently northeast-to-east dipping beds of vesicular lava, dense gray lava and interbedded coarse volcanic rubble form the northeastern part of the west hills.

The central area is covered by shallow, unconsolidated alluvium of recent age.

STRUCTURE

General

Mapping this area north of El Tiro has completed the delineation of the Silver Bell zone of alteration. This roughly "L" shaped zone, over seven miles in length, trends westerly from the Oxide orebody and completes a northward swing south of El Tiro. It maintains this northerly direction for approximately two miles, at which place it bends abruptly west and pinches rapidly. It crosses diagonally the northwest trending alaskite-dacite porphyry contact, and to the north lies wholly within dacite porphyry.

Sheeting or jointing

Systems of close-spaced parallel joints have attained a remarkable degree of development throughout the Silver Bell district. They are considered to be the most important single structural element within the zone of alteration. They have localized the deposition of the sulfide mineralization, and also appear to have controlled the emplacement of the monzonite and pebble dikes. Their initial development probably is pre-monzonite. Yet the monzonite itself is jointed, indicating a continuing action or rejuvenation of the joint producing forces.

In the North El Tiro area individual joints are commonly 1/8" thick. They exhibit considerable divergence in strike, and are, with but minor exceptions, steep-dipping to vertical. in a broad sense they can be divided into two main systems which appear to radiate outward from the two largest monzonite bodies. Divergence in

strike is more pronounced and intersections are more common in a northwest trending band crossing the center of the zone of alteration. The most extensive development of closely spaced (2-4 inch intervals) joints is in the northern system just east of the monzonite. To the south these zones are smaller and sporadic.

Monzonite

Monzonite was intruded into the dacite porphyry and formed two large and several small, rudely circular bodies, and numerous narrow dikes. The marked parallelism of the dikes and joint planes strongly suggests that the joints controlled the emplacement of the dikes.

Pebble Dikes

These are generally narrow, and composed of rounded pebbles of dacite porphyry in a ground mass of the same material. In the vicinity of sedimentary rocks, quartzite pebbles are present. They are widely scattered throughout the zone of alteration, and occur in the same manner as the monzonite dikes - that is, parallel to the joint planes. Previous workers consider them of intrusive origin.

Breccia

Breccia Pipes

One pipe is located in the center of the zone of alteration. It is irregular in outline and composed of coarse, angular rotated blocks of dacite porphyry. Sericite alteration is notably stronger within and adjacent to the pipe than in the surrounding rocks, indicating it served as a channelway for hypogene solution. Chalcocite after limonite is present in moderate amounts. Another pipe is located just northeast of the Union Mine in dacite porphyry. It is composed of coarse angular blocks of dacite porphyry and minor quartzite. This breccia forms irregular masses in and bordering a roughly circular body of quartz monzonite. The pipe apparently served as a channelway for the later intrusive. The pipe is moderately altered and contains some limonite after chalcocite.

Fault breccia

This consists of narrow, linear, moderate to steep-dipping zones of finely crushed country rock. Occasionally such breccia is formed adjacent and parallel to monzonite dikes. Weathered surfaces with scattered rounded fragments frequently resemble pebble dikes.

MINERALIZATION

Sulfide mineralization and accompanying hydrothermal alteration products are widespread in a zone averaging 5000 feet wide and narrowing to 1400 feet wide at the northern end. This is a continuation of the main Silver Bell zone of alteration. The eastern boundary is normal to jointing and ragged in outline. The western boundary is largely concealed by alluvium but its position is indicated by scattered crops and shallow workings.

Direct observation of sulfides is limited to a few surface exposures and dump material from several shafts. Most of the knowledge about sulfide distribution comes from the assay records of the 42 churn drill holes located in the area, and by interpretation of leached outcrops. The latter consists of mapping the distribution and quantity of reddish-brown to maroon colored limonite as a means of indicating the former strength and distribution of copper bearing sulfides. Reddish-orange to yellow limonite reflects the distribution of pyrite. Mapping of this kind was useful in delineating the Oxide and El Tiro ore zones. Previous reports on those areas thoroughly discuss the theories involved, and the application and limitations of the method.

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Pyrite is easily the most abundant sulfide. It is widespread throughout the zone of alteration, and was found beyond the borders of the zone in fresh dacite porphyry and monzonite. It occurs principally on the joint planes as scattered, minute crystals or as narrow veinlets typically 1/8" in thickness. A rare case of banded quartz and coarsely crystalline pyrite forming veins up to three inches thick in apparently fresh monzonite, was found in dump material from a shallow shaft west of the zone of alteration. A relatively small amount occurs as disseminated grains of the igneous rocks.

Interpretation of leached outcrops indicates the former distribution and quantity of chalcocite in the enriched zone. It is assumed that the distribution of chalcopyrite in the primary zone is essentially the same. Chalcopyrite accompanied the deposition of pyrite, but in very minor amounts. Most of it was deposited on the joint planes. A minor amount occurs in true disseminated form, mainly in monzonite. Perhaps the less dense, granular nature of the rock as compared to dacite porphyry facilitated the dispersal of the solutions.

Molybdenite, as small specks, occurs with pyrite and chalcopyrite in extremely minor amount.

Sericite, a product of hydrothermal alteration accompanying hypogene sulfide mineralization, replaces the wall rock of the mineralized joint planes forming narrow (typically 1/2-inch thick) zones enclosing the sulfide-quartz veinlets. Dikes and smaller irregular bodies of monzonite are often pervasively sericitized in areas of stronger mineralization.

Strong-to-moderate copper mineralization occurs typically in narrow (1 to 15 feet wide) tabular or lenticular shaped zones separated by lower grade pyritic rock. These lenses are characteristically in areas of close-spaced parallel jointing. Minor groupings of the lenses occur in scattered instances throughout the zone of alteration.

Favorable areas

At the north end of the zone of alteration, systems of close-spaced, parallel joints are especially well developed, and lenses of moderate-to-strong copper mineralization are relatively numerous within an ovel-shaped area 3000 feet long and 1100 feet wide. The long axis is parallel to the trend of the zone of alteration but normal to the close-spaced steep-dipping joint planes.

It is estimated that the enriched zone may average 0.4 to 0.6% Cu. Thus it is considered favorable only in the event that future developments permit the mining of lower grade ore than is now considered economic.

The extreme irregularity of copper mineralization as evidenced in the leached outcrops is probably reflected in the enriched zone, for it seems unlikely that in the estimated 100 feet to the base of oxidation much "leveling out" could have been accomplished.

A second favorable zone is indicated by the assay results of old churn drill holes. The Imperial Copper Company and the Oxide Copper Company drilled a total

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of 42 holes in the area in 1909 and 1910. The assay information for all holes is available (please refer to complete record in appendix), and the location of all but 17 is known. While mapping, 14 of the 17 were located in the field. It is possible by various means to identify seven of the 14 with a fair degree of accuracy, and seven were assigned numbers on questionable grounds.

The favorable zone is indicated by a group of nine holes (A, B, C, 1, 2, 3, 18, 19, and 24) in an area 2000 by 1500 feet in size. They show an enriched blanket of ore 72 feet thick, averaging 1.0% Cu. Leached cap rock averages 72 feet thick and contains 0.3% Cu. (Based on spotty assays). The grade of the primary zone is 0.4% Cu. Results of early drilling by these same companies in the Oxide and El Tiro ore bodies were found to be unreliable. Such may be the case here, but until this is proven to be true, they must be accepted as indicating an enriched zone of possible economic size and grade.

Drill holes Nos. 6 and 7 (inferred location) are between the two favorable zones and contain 150 feet of 1.03% Cu and 80 feet of 1.07% Cu respectively.

The boundaries of the favorable zones, especially the northernmost one in which no holes have been drilled, are not rigid boundaries, but serve to indicate focal points from which exploration should start, rather than limits within which it is to be conducted.

POSSIBILITY OF EXTENSION UNDER COVER

Northeast of the Atlas Group is a small exposure of dacite porphyry surrounded by alluvium, in which weak alteration on the south grades into fresh rock to the north. Mineralization is indicated to be weakly pyritic. A few specks of molybdenite were seen, as well as small amounts of copper oxides. This may be a branch of the main zone or an isolated occurrence. In either case it is considered of no importance.

The northernmost exposures of the main zone of alteration show it to be approximately 1400 feet wide and narrowing to the west as it disappears beneath alluvium and post-mineral volcanic cover. The last crops, consisting of small islands in the alluvium, show poorly developed joints and weak pyritic mineralization. A reconnaissance of the hills to the west showed no alteration in the basement rocks except for two small, very weak spots of no consequence. From this evidence it is concluded that the covered section of the zone of alteration probably contains no deposits of commercial value.

Yours very truly,

O. D. Evans

O. D. Evans

ODEsar

Attachments: Selected References.
Appendixes - see p.1

cc: WKLandwehr 2, with attachments.

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Hole No	2	3	4	5	6	7	8	9	10	12	13	4	5	16	17	18
Started	2-25-09	2-2-09	10-12-08	10-9-09	9-25-09	10-31-09	11-7-09	11-9-09	11-5-09	11-22-09	11-27-09	12-4-09	12-3-09	12-20-09	12-26-09	12-3-09
Elevation	243	2363	234	2386	2409	2408	2375	2372	2403	2390	2447	2502	2464	2496	2461	2499	2389

20 0.0
30 0.0
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
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350
360
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380
390
400
410
420
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440
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9-25-09
10-19-09
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12-13-09
12-27-09
12-9-09
12-31-09