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AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

August 16, 1973

MEMORANDUM FOR: FILE

KALAMAZOO GEOCHEM

In connection with evaluation of the Red Hills prospect, I contacted Dave Lowell regarding the copper anomaly over the Kalamazoo deposit as reported in his paper (Econ. Geol., Vol. 63, 1968).

He provided a xerox copy of the sample location map, stating that the samples were mostly rock chip and that they were taken to avoid inclusion of any of the visible copper vein mineralization. The sample grid spacing is 500' N-S and 1000' E-W.

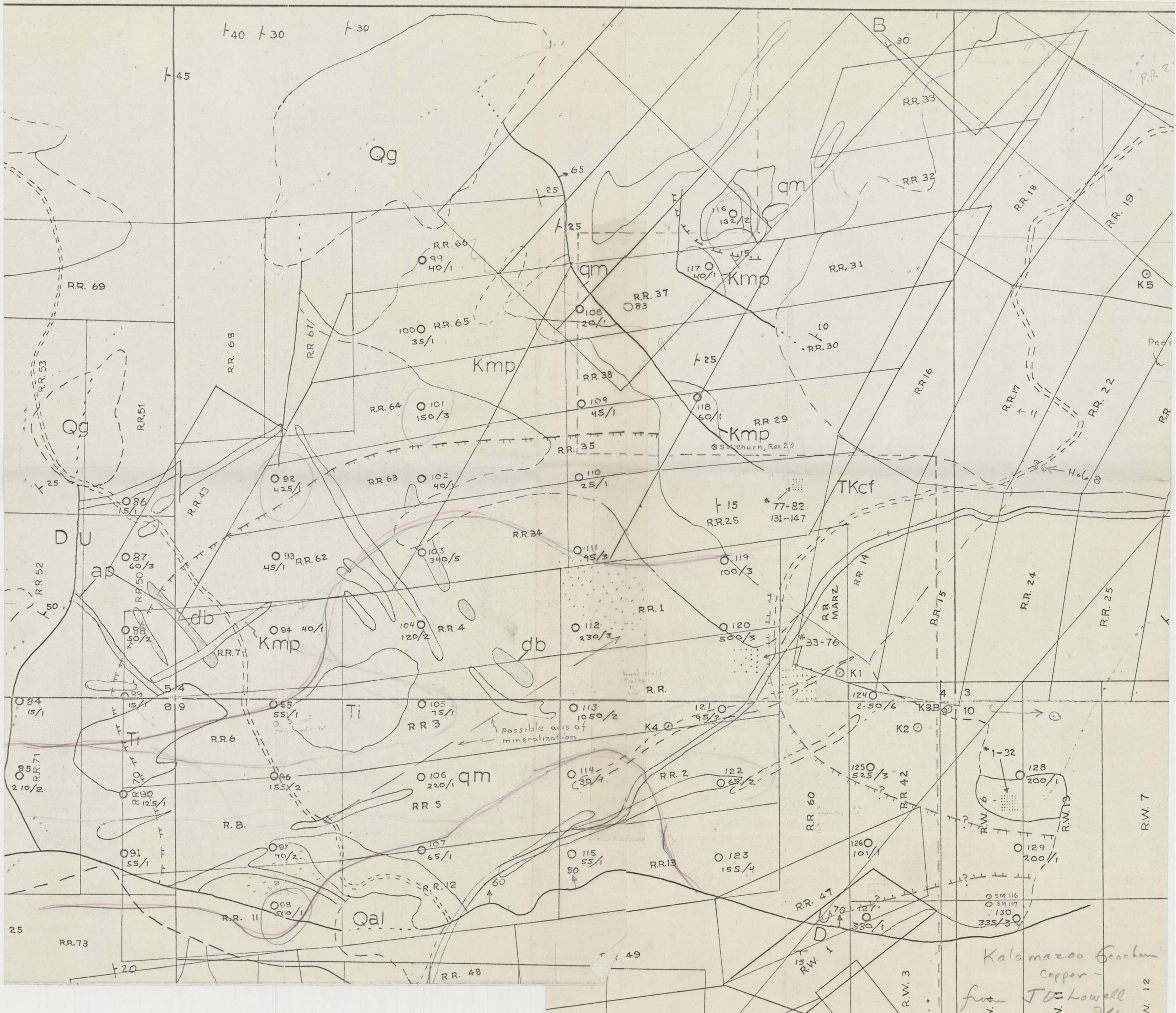
The map showed an anomalous area about 2000' wide extending westerly around 5000' from the edge of post-mineral cover (Gila(?) conglomerate). Within this area values range from around 60 ppm to 1000 ppm Cu with 1 to 3 ppm Mo. The average is around 300 ppm. Drill holes showed a similar range in copper content from the outcrop down to the ore zone 3000' below. Apparently the phyllic zone with increased pyrite was encountered at 1500'-2000' below the outcrop.

Comparing these results with those of Red Hills suggests that if an ore zone does exist there, it is likely at a greater depth than at Kalamazoo.

J.H. Courtright
J.H. COURTRIGHT

JHC:kre

cc: J.J. Collins
W.L. Kurtz


Qg
qm
Kmp
TKcf
db
ap
Ti
Qal
possible axis of mineralization
Kalamazoo Geochem
Copper -
from J D Lowell

Economic Geology
Vol. 63, 1968, pp. 645–654

1968

Geology of the Kalamazoo Orebody, San Manuel District, Arizona

J. David Lowell

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

March 10, 1967

Mr. K. E. Richard, Chief Geologist
American Smelting and Refining Company
120 Broadway
New York, N. Y. 10005

KALAMAZOO COPPER DEPOSIT
QUINTANA MINERALS CORP.
PIMA COUNTY, ARIZONA

Dear Sir:

Since my report of December 21, Quintana completed 5 more holes, making a total of 22 holes through the ore zone. Two holes are in progress.

The northeastern part of the ore zone is now drilled out on a 600 foot grid. This has resulted in no appreciable change in the ore reserve above sea level (depth of 3500'). Drilling to the southwest has not yet delimited the ore zone. A current hole (No. 43) over 5400' from the northeast end of the deposit encountered ore at 4250'.

The total reserve was increased from 500 million to 600 million, but the grade remains approximately the same at .75% Cu.

Considerable difficulty has been encountered in attempting to drill below 3000' with the heaviest diamond drill rigs available. One hole was finally abandoned at 3000' after several unsuccessful attempts to extend the hole. Currently they have only 2 rigs operating which are heavy oil well type rotary rigs adapted to coring.

Rock temperature measurements show 103°F. at a depth of 3500'. From 3000' to a depth of 4500', the temperature gradient was determined to be 1° per 100', or 118°F. at 4500' depth. This gradient is reportedly similar to that encountered in the San Manuel Mine.

Yours very truly,

J. H. Courtright

J. H. COURTRIGHT

JHC/kw
cc: KERichard (1x)
TASnedden
RFWelch
RBMeen

J. H. C.

JAN 10 1967

Inc - Kalamazoo

MR. WES, SVZ, BNW, JRW

READ AND RETURN ✓ to Cus

PREPARE ANSWERS ____ HANDLE ____

FILE ____ INITIALS ____

Chase file San Manuel

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

January 11, 1967

TO: J. H. COURTRIGHT

FROM: J. E. KINNISON

SAN MANUEL FAULT
Direction of Displacement

I studied in the field, during the spring of 1964, the San Manuel fault, and concluded that it was a normal fault with the throw directly downdip. My reason was an "indirect" one.

A similar fault, 11 miles north of San Manuel, and approximately parallel to it, is cleanly exposed near the junction of Putnam and Camp Grant washes. Shear cleavage in the fault zone, and antithetic tension joints indicate the movement, and a second exposure contained beds of "Gila Conglomerate" which could be matched and showed a slight normal slip in these tension joints. Xerox copy of my field sketches is attached.

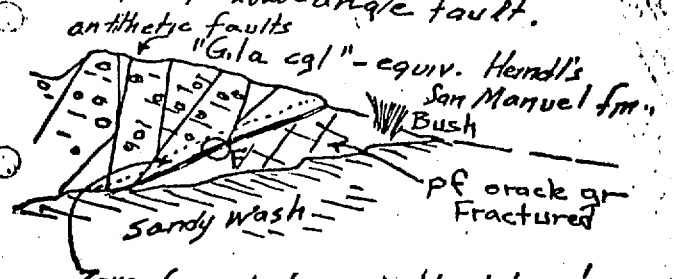
The San Manuel fault is best exposed in Smelter wash, 3 miles southwest of the mine. Joints in the "Gila" are most numerous near the San Manuel fault, and dip in the direction of tension. This, compared to the Putnam wash fault, seemed sufficient to regard the San Manuel as a normal fault. Sulfides (mostly pyrite) in old churn drill holes on the Purcell group, considered also with a few NE fissures with sericitic alteration and a little live limonite, seemed rather conclusive that the faulted segment of San Manuel was on her claims, downdip above the fault.

John E. Kinnison

J. E. KINNISON

JEK/kw
Attachment

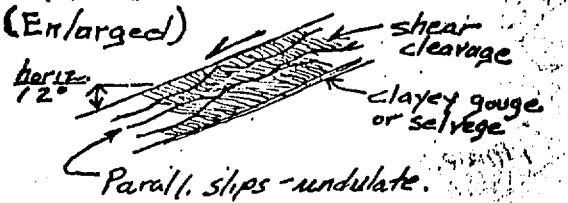
[illegible]ng SW up Putnam wash, aba[illegible] 3 miles SW of RR, is excellent exp. of low-angle fault.



Zone of no distinguishable bd - 3' wide.

F - shown in circle above

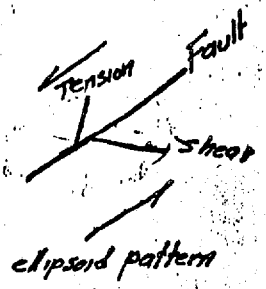
F (Enlarged)



Judged from shear angle, hanging wall moved down.

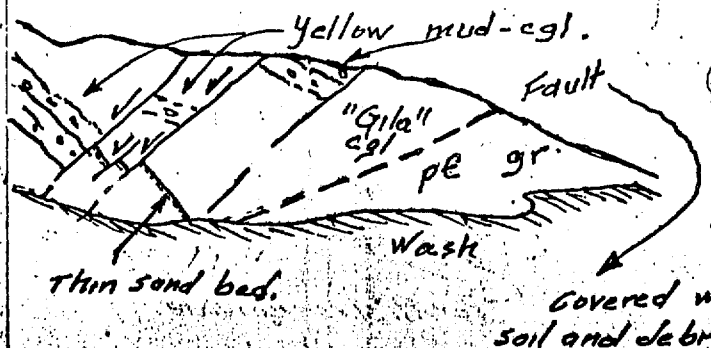
Also - Antithetic faults are tension angle. Appears to be slight offset on these - Not clear - No "marker" beds.

(over)



COPY OF FIELD SKETCHES. Spring of 1964 J. E. K.

About 3/4 miles upstream, a 2nd exposure - fault plane not well exposed, but direction of antithetic fault movement shown by distinguishable beds - is normal fault slip.



2N5-22-140

J. H. C.

JAN 18 1967

January 3, 1967

- air mail -

Kalamazoo

Mr. T. A. Snedden, Gen. Mgr.
Asarco U. S. Mining Dept.
Tucson.

Dear Mr. Snedden:

Attached is copy of Mr. Tittmann's memorandum of December 29th concerning Mr. Courtright's report on the Kalamazoo copper deposit. I have not as yet read Mr. Courtright's report. I would appreciate your thoughts on the subject.

You will note that Mr. Hennebach has suggested a possible joint venture with Newmont because of the facilities they could contribute in regard to water, railroad, etc.

It is Mr. Tittmann's thought that Newmont owns the railroad. If this is the case, please try to determine how we might handle our concentrates and incoming supplies to the main line. Also, what are your thoughts concerning the availability of water for a large milling operation?

Very truly yours,
Original Signed
C. E. NELSON

Att.

J.H.C.
JAN 1 1967

Confidential

NEW YORK OFFICE
December 29, 1966

RECEIVED
DEC 30 1966
C. P. POLLOCK

Mr. C. P. Pollock
B U I L D I N G

Mr. Courtright's report on the Kalamazoo copper deposit is very interesting. As you point out, considerable further drilling will be necessary to delineate sufficient tonnage and to fix the grade before more than preliminary consideration can be given. The fact remains, however, that this is probably one of the few large unexploited porphyry deposits in the United States containing in the neighborhood of fifteen pounds of copper per ton.

If it should develop into an orebody of 500 to 600 million tons it will have a very significant value over the long pull. Consequently, we must give it consideration and I think we should tell the Quintana people that we are interested in their further exploration work. I presume that there will be other mining companies interested in this. Consequently, we should keep in close touch with the Quintana people so that nobody slips in ahead.

Mr. Hennebach has suggested a possible joint venture with Newmont because of the facilities they could contribute in the way of water, railroad, etc., and the facilities we could contribute in the way of smelting and refining plants. This may be the best way to tackle it. On the other hand, the orebody may develop in size to the point where we would want it alone.

E. McL. TITTMANN

ET:mc

cc: RDBradford
RLHennebach
CENelson

From: KENYON RICHARD, 2/30/86

To: Herold:

Kalamazoo

This confidential cc of Tittmann letter will let you know he has changed his thinking. But do nothing specific about it until you hear from CDP or me.

Ken

W.E.S.
MAR 24 1967

J. H. C.
MAR 23 1967

NEW YORK OFFICE
December 29, 1966

RECEIVED
DEC 30 1966
P. POLLOCK

Mr. C. P. Pollock
B U I L D I N G

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E. McL. TITTMANN

ET:mc

cc: RDBradford
MHennebach
CENelson

Mr. J. H. Courtright

J. H. C.

DEC 13 1966

SOUTHWESTERN ORE PURCHASING OFFICE
Tucson Arizona

December 9, 1966

J. E. K.

DEC 13 1966

FOR: ~~TEK, SWF, WES~~ ~~BWW~~

READ AND RETURN .....

PREPARE ANSWERS ..... HANDLE .....

FILE ✓ INITIALS .....

Kalamazoo ore body
Quintana Minerals Corp

W.E.S.

FEB 14 1967

Mr. A. L. Hatch
Manager Ore Dept.
NEW YORK OFFICE

Dear Sir:

This confirms the conversation Mr. Hennebach and I had with Messrs. Ron Thompson and Marvin H. Morris on Sunday evening, December 4th, in Tucson. Thompson and Morris of Quintana Minerals Corporation have had many conversations with me on their subject of mining in the Southwest and other pertinent interests of Quintana.

During these conversations especially at the time Quintana entered into exploration activity in the Southwest, these newcomers voiced the opinion they were anxious to develop mineral resources but, due to their inexperience and no mining organization at all, were interested in letting operating companies mine for them if their exploration should be successful in making a discovery. I am sure Quintana was frank and honest in making the same statements to other mining interests in the Southwest from whom they had equal cooperation with advice.

For about the last two years Quintana has been concentrating on a drilling project west of San Manuel Mine near Mammoth, Arizona. While it was rumored that the drilling was deep, it was also known that ore had been intercepted at this project.

During the conversation mentioned above I asked Mr. Thompson why we had not been given an opportunity to evaluate the mine as I understood Quintana planned to do. He was very apologetic and gave the thought that we for some reason or other would not be interested in deep mine operation. He readily advised his geologist in charge of the operation, Mr. David Lowell, to give our exploration department complete data on their exploration work.

Quintana is not under obligation with any other company who has had an opportunity to study the drilling results. Without naming companies, he mentioned the firms engaged in block caving had this knowledge. This could be their neighbor, San Manuel; Miami Copper; or Anaconda Company.

According to Thompson the ore ranges in depth from 2500 to 5000 feet. From results of present drill holes (16) it

indicates one-half billion tons of ore which would be similar in nature to the San Manuel ore body.

On December 7th I received a telephone call from Ron Thompson of Houston at which time he reported Quintana had an executive meeting since returning from Tucson and had approved the offer to submit engineering data available on their San Manuel Project to ASARCO. He again apologized for Quintana's failure to supply us with this information at an earlier date and reiterated his company has not made any commitment nor negotiated in any way for someone to operate their property.

I advised Mr. Thompson that his geologist, David Lowell, had been in touch with Harold Courtright and that we were looking forward to the examination of this engineering data. As of today Courtright has reviewed David Lowell's data, and I am sure will have his own comments on this property.

Inasmuch as I feel ASARCO missed obtaining the San Manuel ore deposit by sheer neglect, I am bringing this to the attention of everyone that perhaps here is another San Manuel Mine.

Yours very truly,

Reed F. Welch

REED F. WELCH

cc: EMcLTittmann
RLHennebach
CPPollock
WGRouillard
TJWoodside
JHCourtright

We sure did! It's all recorded in the expl. files and is a sad story indeed. Missing out hinged over a drawn-out haggling procedure dictated by New York in trying to get the price reduced from $25,000 (as I recall the figure), and other things very trivial. JCR

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 1, 1966

OCT 26 1966

MR. READ AND RETURN
PREPARE ANSWERS HANDLE
FILE INITIALS

Mr. K. E. Richard, Chief Geologist
American Smelting and Refining Company
120 Broadway
New York, N. Y. 10005

QUINTANA MINERALS CORP.

Dear Sir:

Recently Mr. Ron Thompson, Chief Geologist of Quintana, a Texas oil company, came in to discuss their drill exploration in an area immediately west of San Manuel. He advised that they had encountered ore grade copper mineralization between 2000'-3000' below the surface.

Thompson stated that should they develop an orebody they would like to interest a company such as ours in putting it into production.

Subsequently Mr. Kinnison put together some information, and his memorandum with map showing the location of the Quintana drilling is enclosed herewith.

Apparently, the objective of their drilling is the possible southwest continuation of the San Manuel ore zone. As Kinnison notes, the drilling at San Manuel on the southwest did not completely delimit the mineralized zone, but the extent of economic mineralization was determined.

Yours very truly,

J. H. COURTRIGHT

JHC/kw
Enclosure
cc: JEKinnison

~~Aa 16A.13.19B~~
Aa 16A.13.11

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

May 19, 1966

TO: J. H. COURTRIGHT

FROM: J. E. KINNISON

Quintana Minerals Corporation
San Manuel Drilling Program
Pinal County, Arizona

I recently checked, by means of chartered air flight, progress of the Quintana drill program on the old Purcell group (subject area). The two most easterly drills are both large oil well type rotaries, one operated by J. O. Barnes of Casa Grande, and the other operated by a firm from Farmington. The two on the west are operated by Boyles Bros., and consist of a Longyear 44, and a Failing 1500. The Quintana people have consulted with Mr. Wojcik concerning drilling problems which they are having, and from this and other statements to Mr. Welch and you, we know that they are setting casing at about 1500 feet and diamond drilling to about 3000 feet.

It is not clear at this time whether their objective is to find mineralization in the faulted hangingwall block of the San Manuel ore zone, or whether they are attempting to drill beneath the San Manuel fault and delimit the southwest edge of the mineralized zone.

The attachment also shows the gross features of that vicinity. Although I had previously thought the Purcell area should contain the faulted hangingwall portion of San Manuel, this was based on indirect evidence. There are three possible exploration objectives: (1) Quintana may be drilling directly from the tilted conglomerate beds into the foot wall portion, or (2) they may first penetrate unmineralized pre-mineral bedrock before passing through the San Manuel fault and then into mineralization, or (3) they may find mineralization in the faulted hangingwall portion. In either No. 1 or No. 2 above, the question of lateral movement along the fault should be considered. Our present knowledge of their results does not allow a selection of their drilling target.

You will find attached a review of the present state of geologic knowledge as I understand it. Quintana data would add materially to our understanding of the San Manuel District.

Geologic Review

The San Manuel altered zone crops out on Red Hill, where the alteration limits on the northwest may be seen. Elsewhere the deposit is covered by tilted conglomerate and is known principally from drill hole results which have been published in detail, and secondly from publication of data learned from the workings. The ore body consists of two nearly vertical zones,

relatively richer in chalcopyrite, which strike N 60° E. In depth they bend together, and in cross-section form a U-shaped ore zone. The base of the "U" plunges slightly to the southwest. The top of ore has been modified by faults, erosion, and leaching. Very little chalcocite is present, and the copper is largely contained in chalcopyrite.

The main hoisting shafts (3A and 3B) are 2,262 feet deep, and are separated by a 165-foot pillar. The first main haulage level for the block cave stopes is driven from the 1,475-foot level. The second level, now in production, is the 2,075-foot level. Mining began in the southeast ore zone, and at this date the northwest zone is in initial production. Reserves are calculated at about 500 million tons of .8% Cu. Mining is currently at a rate of 40,000 tons per day.

It has long been known that the San Manuel fault, which dips about 30°, cuts across the altered zone of the San Manuel Mine. From data presented by Schwartz (Professional Paper 256) in 1952, it was known the fault also cuts off part of the San Manuel ore zone--which is defined by a cut-off grade of 0.5% copper. Drilling had not defined the limits of mineralization to the southwest beneath the San Manuel fault at the time Schwartz published his professional paper, and as far as I know, little additional drilling has been done. From the widely scattered holes in that area it appears that "ore" values as chalcopyrite are more limited and also deeper.

During the spring of 1964 I did a limited amount of field work to determine the direction of movement along the San Manuel fault. The exploration problem was simply this: is the San Manuel fault a thrust, or is it a normal fault? If it was a normal fault, the movement down dip, then the upper plate which originally contained the upper portion of the San Manuel orebody, might lie buried beneath alluvium or older conglomerates. I found that the San Pedro Valley, both to the northwest and also to the southeast of San Manuel is the locus of a complex system of post-ore sedimentation and faulting. On the basis of indirect evidence, I concluded that the movement had been directly down dip along the San Manuel fault plane. The most prospective location for the hangingwall was within a conglomerate--covered location about three-quarter miles long and adjacent to the main hoisting shafts at San Manuel. I estimated that to confirm this opinion by careful field mapping would require not less than 6 months--and perhaps it could never be supported directly. In any event, the location of the prospective area was so close to San Manuel and their principle facilities that the decision was made to stop further field work.

The attached map indicates the location of some of the holes sunk by Quintana Minerals Corporation now drilling in that area. Also, the map indicates the very gross geologic features in the San Manuel vicinity.

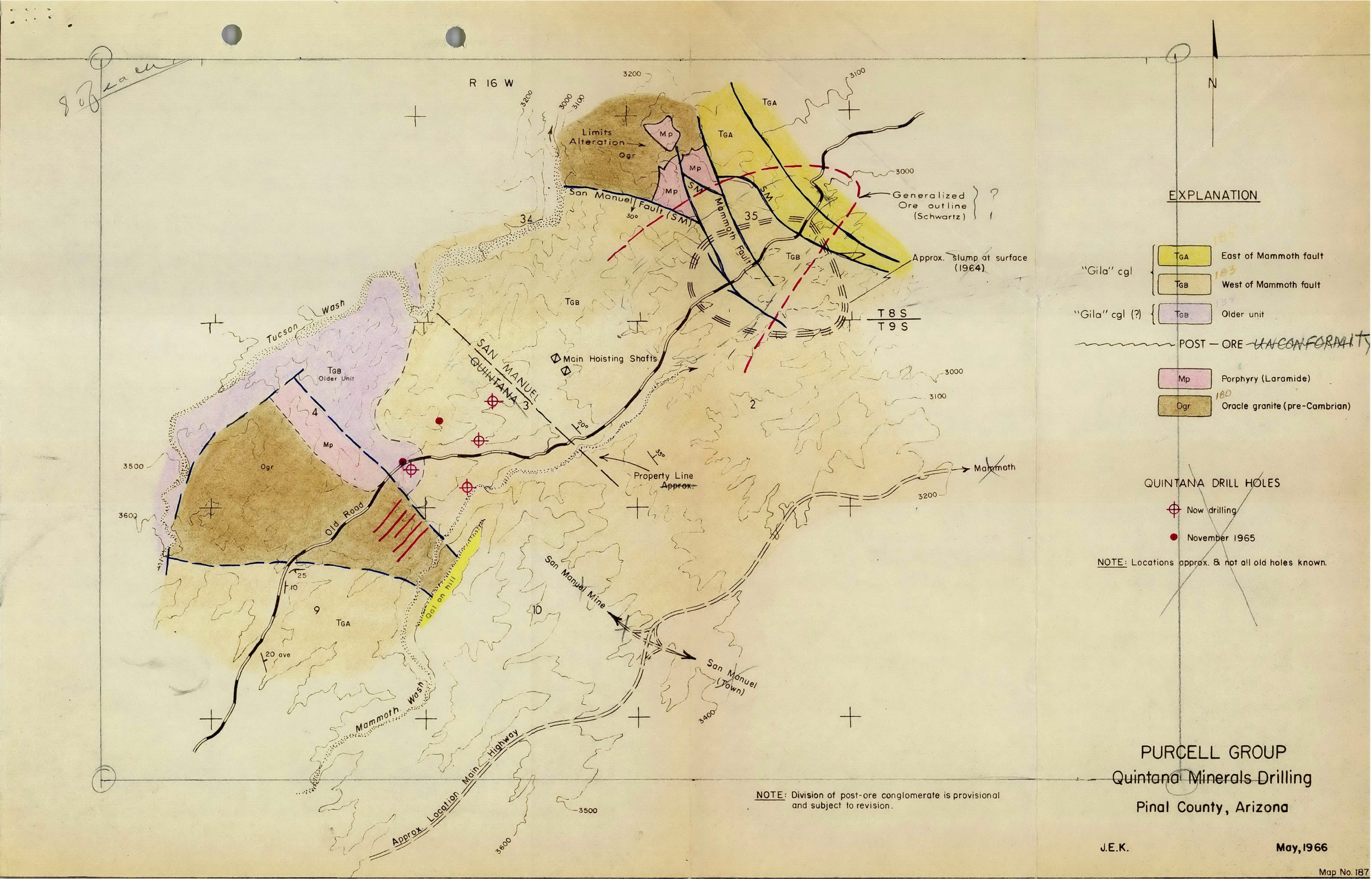
Both Leo Heindl and S. C. Creasey have published recently, in both cases they have attempted to separate the various terrestrial sediments and volcanics into formations, and in neither case have results been produced that would substitute for the type of mapping which we would need to do for exploration purposes. The work by Heindl and Creasey is useful in that it provides a place to start, but I believe that both pre-ore and post-ore conglomerates and volcanics have, in different ways by each author, not been differentiated correctly. The cloudburst formation as now mapped is a particular offender in this respect. There is no doubt that the task of providing a good separation of units would be both tedious and lengthy.

The data presented by G. M. Schwartz, and supplemented by Creasey in Professional Paper 471, would allow much of the detail of the San Manuel deposit, including distribution of copper values, to be understood if their data is compiled in such a way that it is comprehensible.[1] As now presented, both writers have attempted to treat this large disseminated copper deposit as though it were a large vein with assay walls. Because there are two parallel ore zones, the "foot wall" of the one becomes, in writing, the "hangingwall" of the other, and the terms are used interchangeably. They further confuse the reader with problems of direction: example, "North end" may mean specifically a NW end, but elsewhere "North" may mean either a non-specific northerly direction, or a true north. All directions are treated with this same ambiguity. The data to reconstruct most of the ore deposit, however, are present and need only to be sorted out and redrafted into a more legible presentation. If this is desired for any reason, it can be done.

John E. Kinnison
JOHN E. KINNISON

JEK/pjc
Attach.
cc: JHCourtright, 1 Extra

[1] Schwartz states, p. 46, "The shape of the ore body as it is now understood is difficult to describe, . . .". The person who reads this manuscript only once will surely agree.


R 16 W
N
Limits Alteration
Ogr
Mp
TGA
TGB
San Manuel Fault (SM)
Mammoth Fault
SM
Generalized Ore outline (Schwartz)
Approx. slump at surface (1964)
T 8 S
T 9 S
Tucson Wash
TGB Older Unit
Main Hoisting Shafts
SAN MANUEL
QUINTANA
Property Line ~~Approx.~~
Mammoth
Old Road
Qal on hill
San Manuel Mine
San Manuel (Town)
Mammoth Wash
Approx. Location Main Highway
EXPLANATION
"Gila" cgl
TGA East of Mammoth fault
TGB West of Mammoth fault
"Gila" cgl (?)
TGB Older unit
POST — ORE ~~UNCONFORMITY~~
Mp Porphyry (Laramide)
Ogr Oracle granite (pre-Cambrian)
QUINTANA DRILL HOLES
Now drilling
November 1965
NOTE: Locations approx. & not all old holes known.
NOTE: Division of post-ore conglomerate is provisional and subject to revision.
PURCELL GROUP
~~Quintana Minerals Drilling~~
Pinal County, Arizona
J.E.K.
May, 1966
Map No. 187