



CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
520-770-3500
<http://www.azgs.az.gov>
inquiries@azgs.az.gov

The following file is part of the

James Doyle Sell Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

July 14, 1992

F.T. Graybeal
New York OfficeLeaching of Copper
Concentrates
Mission Mine

The USBM Reno Metallurgical Research Center has conducted leaching experiments on samples of pure chalcopyrite from a minerals supplier and on samples of Asarco Mission chalcopyrite concentrate (chalcopyrite with minor sphalerite and minor galena, according to USBM).

The typical leaching experiment was conducted on 10 to 20 grams of chalcopyrite. The pure chalcopyrite sample was crushed to minus 400 mesh. Mission chalcopyrite concentrate was run "as is" which, according to Mr. Crowell, is about 60% minus 400 mesh.

Samples of chalcopyrite were placed in an autoclave with given amounts of pure oxygen and sulfuric acid solution. Leaching of the chalcopyrite was done in timed tests (8 hours, 16 hours, and 24 hours) with a fixed pressure of oxygen (set between 150 psi and 400 psi) and a steady temperature (70°C, 90-95°C, and possibly others chosen). Some experiments were conducted on a mixture of chalcopyrite and pyrite. At the end of each timed test the percentage of copper taken into solution was measured.

Over a hundred tests were performed on samples of pure chalcopyrite, and about a half dozen tests were conducted on samples of Mission concentrate. The results of leach tests on Mission concentrate were similar to those for pure chalcopyrite.

The USBM has agreed to run more tests on Mission concentrate under conditions that differ somewhat from above. These additional tests will be conducted with a lower pressure of oxygen (50, 100, and 150 psi) and enough time (to be determined) to get 90-100% of the copper into solution.

Results of a few leach tests were mentioned by the USBM. In one test a 400-mesh sample of chalcopyrite was leached at 150 psi oxygen and 90°C. After 18 to 24 hours, 50% of the copper was leached out of the concentrate.

One of the highest copper recoveries in 24 hours was 93%. In this test chalcopyrite was mixed with 0.6 pound sulfuric acid per pound chalcopyrite and 1.5 pound oxygen per pound chalcopyrite. The test was conducted at 95°C and 450 psi oxygen.

The rate of chalcopyrite leaching is strongly influenced by temperature. For example, reducing the temperature from 90°C to 70°C doubled the time to extract the same percentage copper.

F.T. Graybeal
New York Office

July 14, 1992

Oxygen pressure within the given ranges had little affect on the rate of copper leaching. There was no significant difference in the rate of copper extraction at an oxygen pressure of 150 psi and the rate at an oxygen pressure of 400 psi. The rate of copper extraction does not change as the amount of oxygen is depleted. It does not change until all the oxygen has been consumed. When that happens, the reaction stops completely.

If the concentration of acid in the leaching experiment is maintained above a certain level, sulfur is produced. If the level of acid falls below a certain level, sulfur is converted to sulfate. The formation of a sulfur coating on the chalcopyrite is not a problem. The sulfur is very porous and does not protect the chalcopyrite from chemical reaction.

Leaching experiments similar to those described above are being conducted on samples of chalcopyrite mineralized rocks. It is not known if the samples submitted to the USBM from the Santa Cruz South Deposit are being run at this time.

HGK:mek


H.G. Kreis

CC: W.L. Kurtz
J.D. Sell
A.R. Raihl
D.E. Crowell
S.A. Anzalone

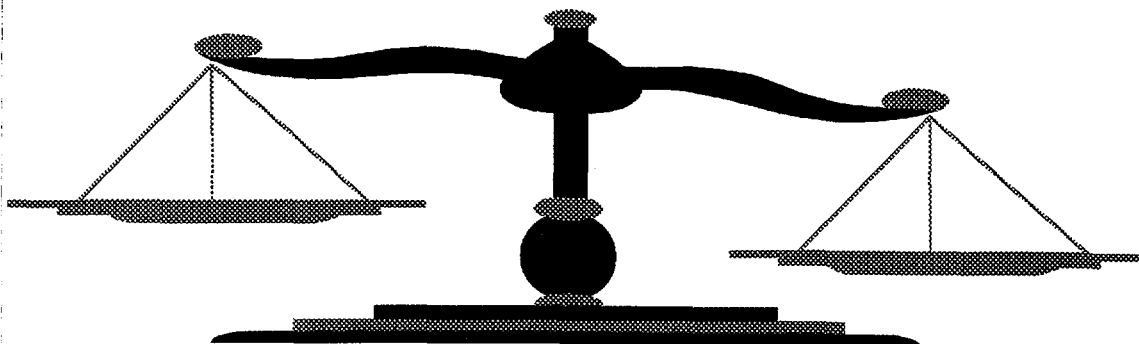
Safety Statistics

Days Since Last Lost Time Injury (Through April 19, 1994)

<u>Work Area</u>	<u>Number of Days</u>
Tire Shop	4,584
Met/Assay	2,564
Warehouse	1,681
Shovel Repair	298
Surface	293
Truck Shop	285
Crusher	262
Lube Center	245
Electric	225
Mine	199
Mill	159
Mill Repair	59
Weld/Mech.	28
South Mill	25

1994 Production Statistics

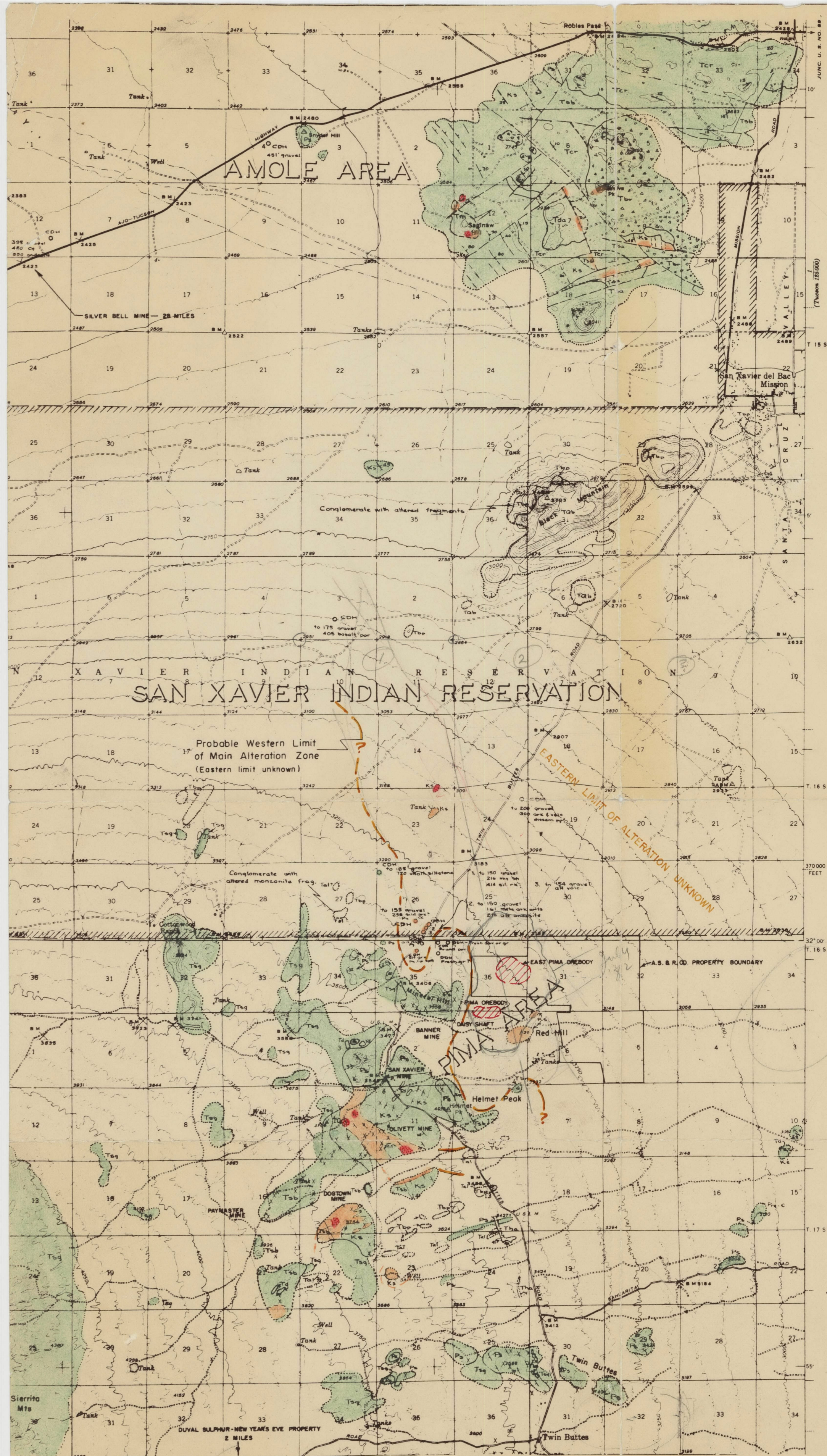
	<u>April</u>	<u>Year to Date</u>	<u>Plan</u>
Tons Mined Per Day	247,972	238,083	233,011
Ore Grade (%Cu)	.633	.640	.630
Cost Per Ton Mined	\$.453	\$.495	\$.480
Mission Mill Tons Per Day	42,380	42,378	43,000
Cost Per Ton Milled	\$ 1.87	\$ 1.99	\$ 1.85
South Mill Tons Per Day	21,727	19,559	20,000
Cost Per Ton Milled	\$ 1.95	\$ 2.22	\$ 2.08



Number 450

P.O. Drawer 48, Bisbee, Arizona 85603

December 27, 1976



EXPLANATION

SEDIMENTARY ROCKS

- POST-MINERAL
- Qal Alluvium and talus
 - Tal San Xavier conglomerate
Angular to subrounded fragments, moderately consolidated.
Beds tilt as much as 70°. In places, contains mineralized rocks from nearby alteration zones.
 - Tsh Silver Bell formation
Includes: andesite porphyry conglomerate, conglomerate of earlier rock types, volcanic rubble and chaos of large boulders.
Overlain by Tcr.
 - Ks Cretaceous sediments
Up to 10,000 feet arkose, quartzite, siltstone, conglomerate
 - Ps Paleozoic sediments
About 4,000 feet of Cambrian thru Permian limestones and quartzites.

IGNEOUS ROCKS - EXTRUSIVE

- POST-MINERAL
- Tqb Basalt
About 200' thick. Cap rock.
 - Tsa Shorts Ranch andesite
At least 400 feet thick
 - Tcr Cat Mountain rhyolite
At least 300 feet of layered pyroclastic with numerous foreign fragments. Overlies Tsb.

IGNEOUS ROCKS - INTRUSIVE

- POST-MINERAL
- Tha Hornblende andesite
Dikes cutting Tal
 - Tbp Basalt porphyry
Elongate masses, apparently intrusive
 - Tm Monzonite
Small bodies associated with altered and mineralized rocks
 - Td Diabase
Dike-like bodies
 - Tbr Biotite-rhyolite
Contains abundant angular fragments of earlier rocks
 - Tda Diopside-andesite
 - Tsg Sierrita granite
Main mass of Sierrita Mts.
 - Pre-C Pre-Cambrian granite

ALTERATION - MINERALIZATION

- Alluvium and other post-mineral rocks
- Unaltered } pre-mineral rocks
- Altered }
- Areas of stronger copper mineralization as indicated by leached outcrop evidence

TO ACCOMPANY Report
DATED May 14, 1956
BY J.H.C. and O.D.E.

AMERICAN SMELTING AND REFINING COMPANY

GEOLOGIC MAP of PIMA-SAN XAVIER RES.-AMOLE AREA

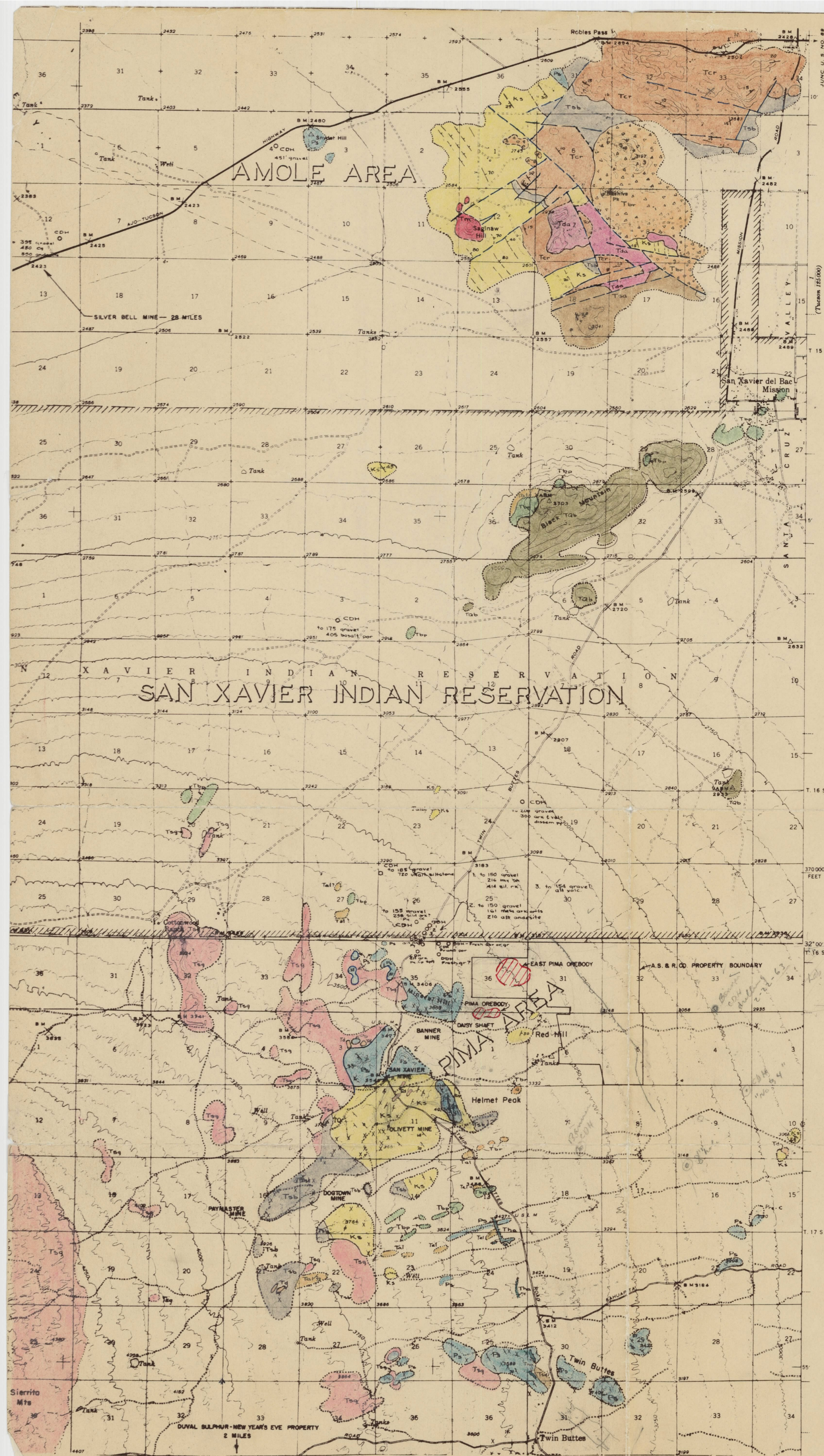
PIMA COUNTY, ARIZONA

BY O.D.E. & J.H.C.

MAY, 1956

SCALE 1:62,500 ATTACHMENT B

0 1 2 3 4 MILES



EXPLANATION

SEDIMENTARY ROCKS

- POST-MINERAL
- Qal** Alluvium and talus
 - Tal** San Xavier conglomerate
Angular to subrounded fragments, moderately consolidated. Beds tilt as much as 70°. In places, contains mineralized rocks from nearby alteration zones.
 - Tsb** Silver Bell formation
Includes: andesite porphyry conglomerate, conglomerate of earlier rock types, volcanic rubble and chaos of large boulders. Overlain by Tcr.
 - Ks** Cretaceous sediments
Up to 10,000 feet arkose, quartzite, siltstone, conglomerate
 - Ps** Paleozoic sediments
About 4,000 feet of Cambrian thru Permian limestones and quartzites.

IGNEOUS ROCKS - EXTRUSIVE

- POST-MINERAL
- Tqb** Basalt
About 200' thick. Cap rock.
 - Tsa** Shorts Ranch andesite
At least 400 feet thick
 - Tcr** Cat Mountain rhyolite
At least 300 feet of layered pyroclastic with numerous foreign fragments. Overlies Tsb.

IGNEOUS ROCKS - INTRUSIVE

- POST-MINERAL
- Tha** Hornblende andesite
Dikes cutting Tal
 - Tbp** Basalt porphyry
Elongate masses, apparently intrusive
 - Tm** Monzonite
Small bodies associated with altered and mineralized rocks
 - Td** Diabase
Dike-like bodies
 - Tbr** Biotite-rhyolite
Contains abundant angular fragments of earlier rocks
 - Tda** Diopside-andesite
 - Tsg** Sierrita granite
Main mass of Sierrita Mts.
 - Pre-C** Pre-Cambrian granite

TO ACCOMPANY Report
DATED May 14, 1956
BY J.H.C. and O.D.E.

AMERICAN SMELTING AND REFINING COMPANY

GEOLOGIC MAP of PIMA-SAN XAVIER RES.-AMOLE AREA PIMA COUNTY, ARIZONA

BY O.D.E. & J.H.C.

MAY, 1956

SCALE 1:62,500 ATTACHMENT A

0 1 2 3 4 MILES

MAP NO. 1297



Hole Numbering System on Reservation
Tract I — X 101, X 102, etc.
Tract II — X 201, X 202, etc.
Tract III — X 301, X 302, etc.
Shallow Holes Designated X 101 S, etc.

Holes Drilling X 206 S
Hole Location Prepared
Holes To Be Drilled Next Deep Shallow
Holes Complete But All Assays Not Available

Magnetic High (Erwin Letter 9-11-57)
Relative Gravity Contours
CI = 0.5 milligal
(Seegart report 12-10-57)

Hole in post-mineral rocks only
Hole in mineralized bedrock
Hole in possible open pit ore

TO ACCOMPANY letter
DATED May 1, 1958
BY Karpen Richard

ASARCO
SAN XAVIER PROJECT
Pima County, Arizona
DRILLING MAP
CENTRAL TRACT I-II
SCALE 1" = 300'

26

25

30



EXPLANATION

Hole Numbering System On Reservation
Tract I — X 101, X 102, etc.
Tract II — X 201, X 202, etc.
Tract III — X 301, X 302, etc.

Shallow Holes Designated X101S, etc.

Holes Drilling X 206 S, etc.

Hole Location Prepared
Holes To Be Drilled Next Deep Shallow

Holes complete but all assays not available

Magnetic High
(Erwin letter 9-11-57)

Relative Gravity Contours
C1=0.5 milligal

EM "Tandem" effect

EM "Edge" effect

Holes in post-mineral rocks only
Holes in mineralized bedrock
Holes in possible open pit ore

TO ACCOMPANY Letter
DATED May 1, 1968
BY Kenyon Richard

ASARCO
SAN XAVIER PROJECT
Pima County, Arizona

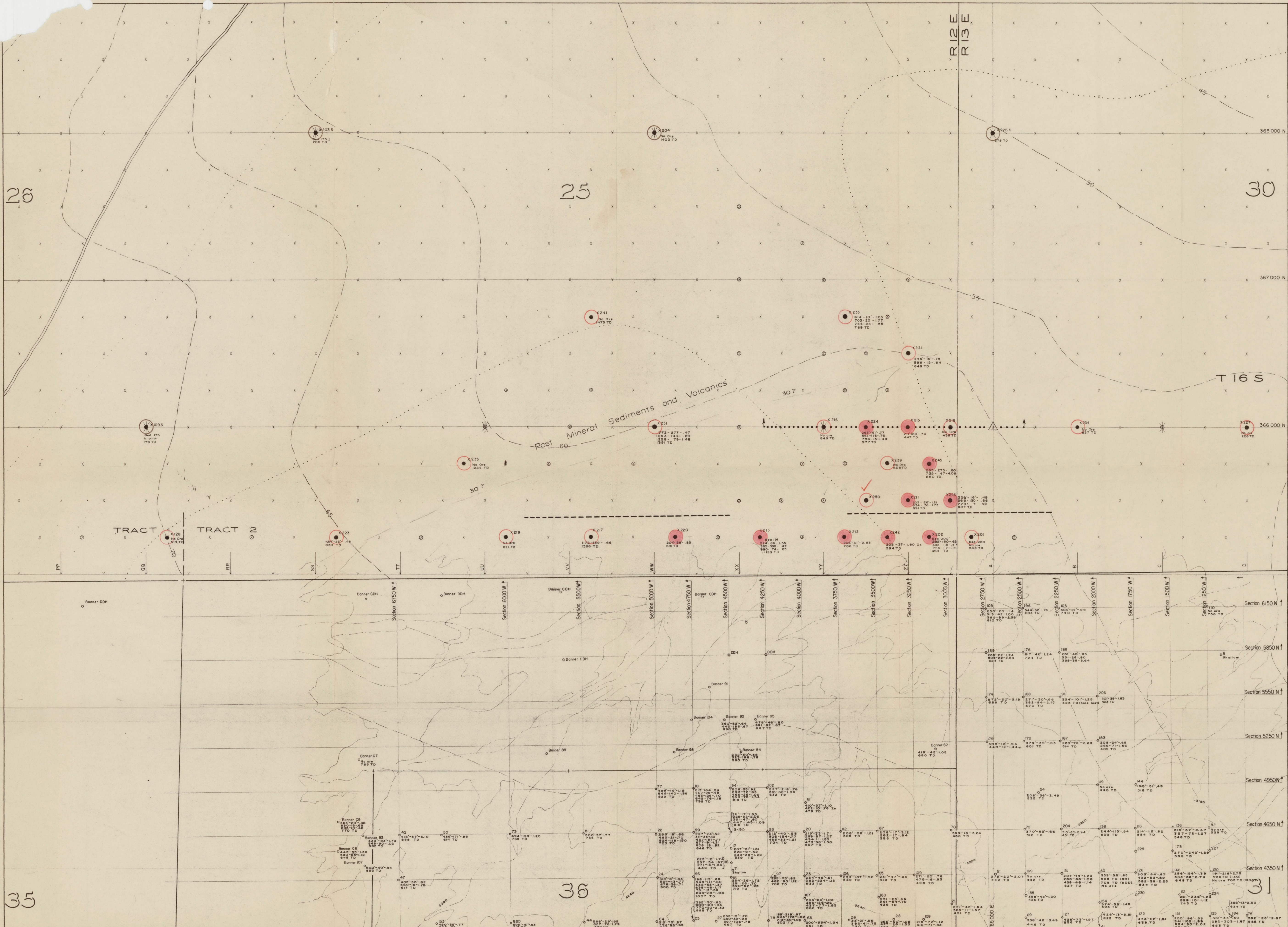
DRILLING MAP
SOUTHERN TRACT II

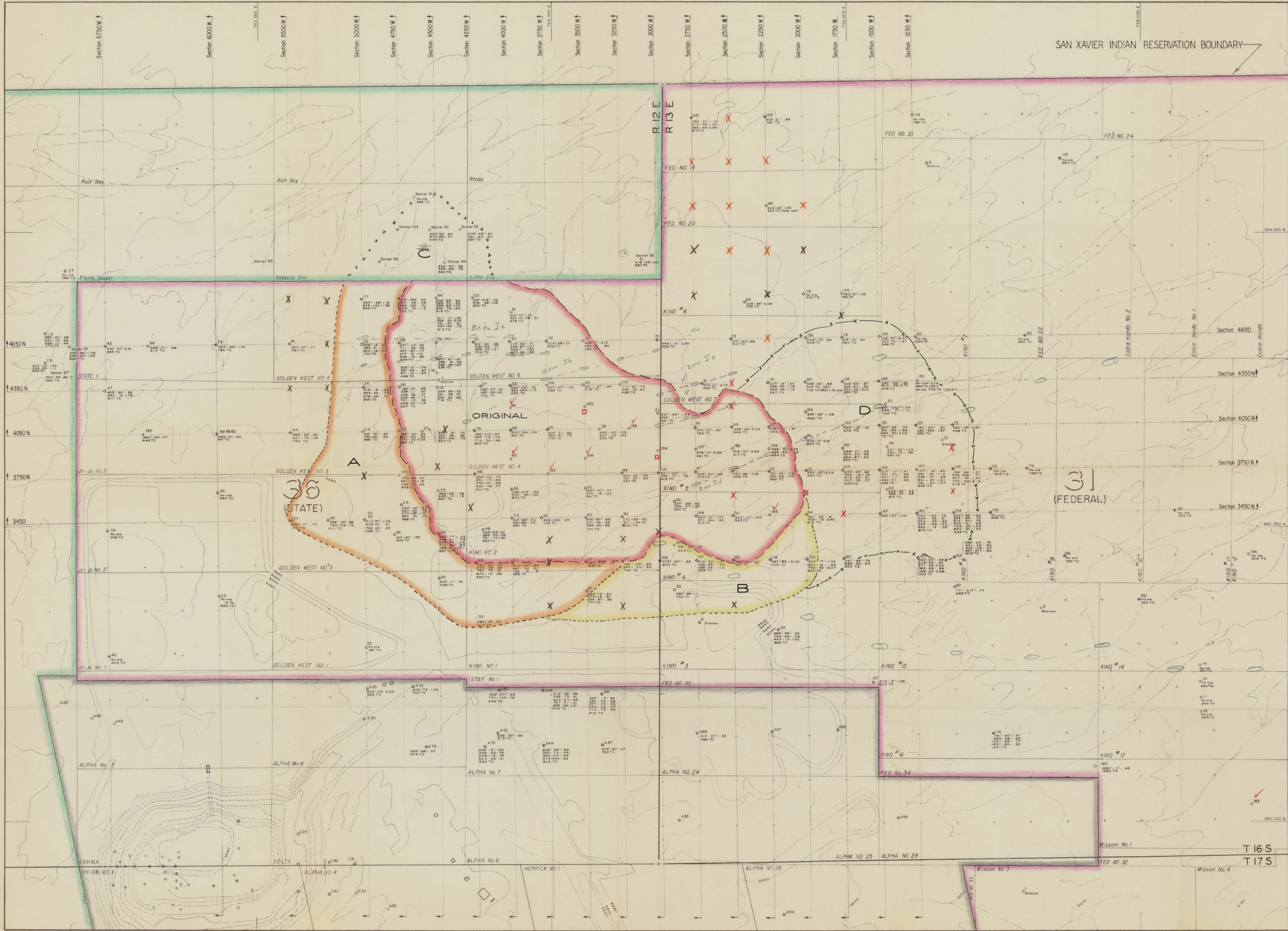
SCALE 1" = 300'
CONTOUR INTERVAL 20'

35

36

31





EXPLANATION

ORE INTERCEPTS IN DRILL HOLES			
	①	②	③
20	215' - 27' - 1.14	289' - 67' - 1.07	454' - 11' - 1.39
4	473' - 38' - 1.30	597' TD	

- ① Depth to top of ore
- ② Length of ore intercept
- ③ Average % Cu (±.40 cutoff)
- ④ Total depth of hole

Holes drilling
Hole complete but all assays not available

OWNERSHIP MINERAL RIGHTS

- American Smelting and Refining Company
- Pima Mining Company
- Banner Mining Company

PROPOSED DRILL HOLES

- X To be drilled next
- X Measurement holes
- X Fringe holes

ORE BODY

Calculation of August 16, 1956

EXTENSIONS

- A Calculation of January 9, 1957
- B Calculation of April 19, 1957

CONFIDENTIAL

TO ACCOMPANY Letter
DATED May 13, 1957
BY Kenyon Richard
ASARCO

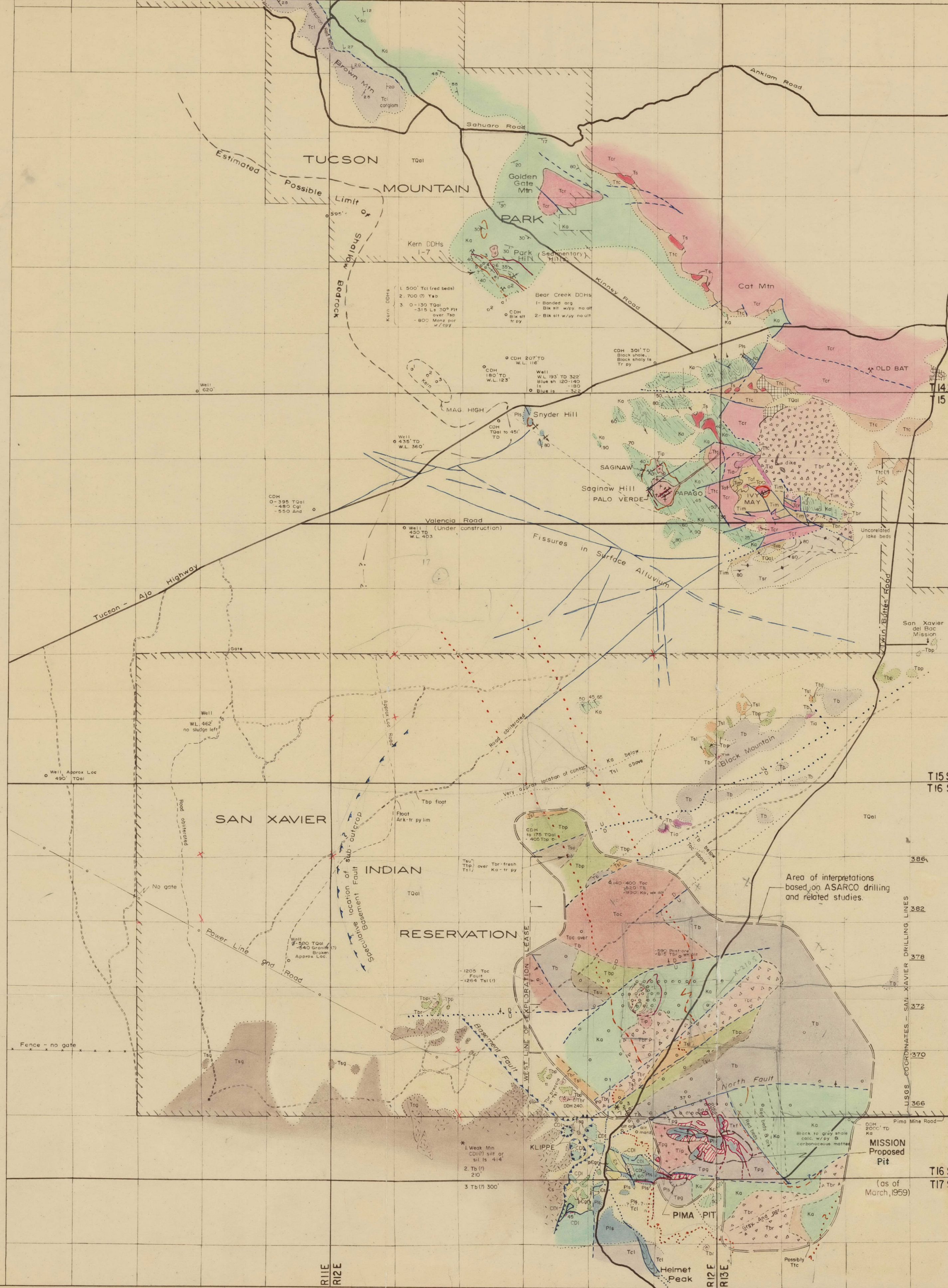
EAST PIMA PROJECT

Pima County, Arizona

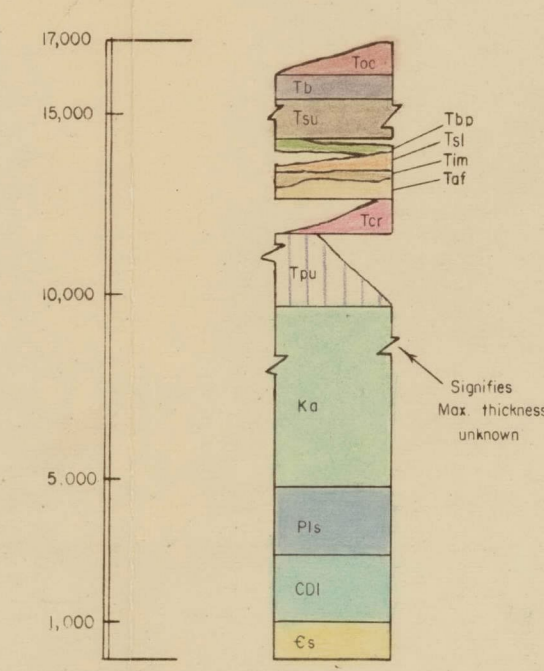
DRILLING MAP

SCALE 1" = 300'
CONTOUR INTERVAL - 20'

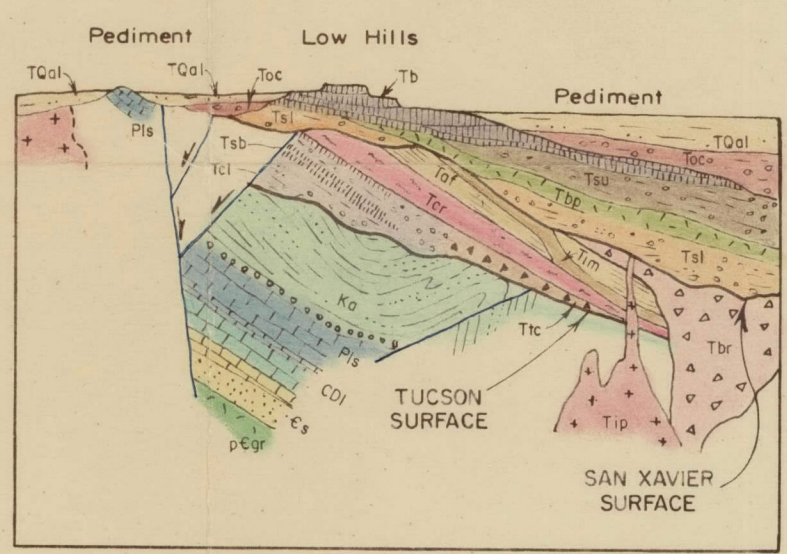
MAY, 1957 MAP NO. 1324



COLUMNAR SECTION
TO SCALE
1 inch = 1 mile



DIAGRAMATIC STRUCTURE
STRATIGRAPHIC COLUMN
NOT TO SCALE



As reference for structural disturbance, note that these strata were approx. horizontal when deposited:
Cs, CDI, Pls, Ka
Tcl, Tcr, Taf
Tbp (?)
Tb

OTHER SYMBOLS

- Maintained road
- Desert auto trail
- Drill hole (not all ASARCO holes shown, within ore zone proper)
- Outline of ASARCO drilling area; geology within, under alluvium, colored as though it were outcrop
- Mine

LAYERED ROCKS
SEDIMENTARY AND EFFUSIVE

- Tqal Valley gravels, surficial alluvium and talus
- Tbc Major Erosion
- Tbc Older conglomerate. Overlies Tb
- Tb Black Mountain basalt
- Tsc San Xavier formation (Upper conglomerate beds, Basalt porphyry flows (locally dikes), Lower conglomerate beds)
- Tbp
- Tsl
- Tim Ivy May andesite (sills)
- Taf Ankiam formation
- Tcr Cat Mountain rhyolite
- Ttc Tucson Mountain chaos
- Tsb Silver Bell formation
- Tcl Clafin Ranch fm. (mapped to include Recreation redbeds)
- Tkf Kina formation
- Tpg Papago fm (below Kina ?)
- Tpu Undifferentiated
- Tu Tucson Mountain chaos
- Ts Silver Bell formation
- Tcl Clafin Ranch fm. (mapped to include Recreation redbeds)
- Tkf Kina formation
- Tpg Papago fm (below Kina ?)
- Tpu Undifferentiated
- Ka Amole group
- Pls Permian limestone. Includes Earp fm., Andorra fm., Scherrer fm., Concha ls
- CDI Carboniferous and Devonian limestone. Includes Martin ls., Escabrosa ls., Horquilla ls
- Cs Cambrian Sediments. Includes Balsa qtz, Cochise fm., Abrigo fm.

INTRUSIVE IGNEOUS ROCKS

- Tia Andesite, intrusive as dikes and small bodies. Several ages included together, some of which may be pre-ore.
- Tsg Sierra granite
- Tip Porphyry intrusive qtz-monz, monz
- Tbr Biotite rhyolite
- Ts Spherulitic rhyolite
- Tsr Short's Ranch andesite
- pCgr Mineral Hill granite

STRUCTURE

- Fault
- Contact
- Low-angle fault. Thrust or gravity block
- Strike and dip of sediments
- Strike and dip of igneous flow layering
- Axis of Anticline
- Axis of Syncline
- Generalized bedding structure

NOTE: Structures dashed where obscure, dotted where covered. In the area of ASARCO drilling, structures shown solid where determined by substantial drilling data; dashed where only approx. known.

MINERALIZATION

- Vein, or mineralized fault
- Disseminated Cu bodies, >0.4 % Cu
- Limits of hypogene alteration: Dotted where uncertain.

American Smelting and Refining Company
GEOLOGY
of the
Porphyry Copper Belt
SOUTH AMOLE - SAN XAVIER-MISSION
Pima County, Arizona

Scale 1:62500
(1 inch = 1 mile approx.)

T.A.S.

AUG 4 1975

DARWIN J. POPE

MINING ENGINEER

51 FIFTH AVENUE, NEW YORK, N. Y. 10017

TELEPHONE (212) 244-1665

RESIDENCE

38 HAMILTON ROAD
SCARSDALE, N. Y. 10583
TELEPHONE (914) 725-0797

July 31, 1975

File : Mission 3

Mr. Ira B. Joralemon
168 Southampton Ave.
Berkeley, Calif. 94707

Dear Ira:

I have recently read with great interest your book, "Copper," published by Howell-North Books and copyrighted in 1973. It is a fine and comprehensive book.

However, I have to take exception to statements made on pages 326 and 327. The statements to which I object because they are contrary to the true facts are the following:

"A far more serious loss came from the generosity of Pima in letting engineers of other companies visit their property and even see the drill cores. As the value of the low-grade disseminated deposit east of the richer ore became evident, Pima started to locate a large group of claims out in the desert. But American Smelting and Refining Company engineers had seen the drill cores, and with this knowledge they located for Asarco a great area farther northeast. Much of the low-grade ore extended into Asarco claims, which were called the Mission Mine"

"This loss to Pima of one of the great copper mines makes one wonder whether generosity in welcoming visitors is worth while"

I do not know where you got the above information, but it is incorrect and obviously did not come from any of the principals in the case. During all the period of time involved I was General Manager of the Western Mining Department for American Smelting and Refining Company with offices at Salt Lake City, and I knew and dealt with all of them personally, and there was never any suggestion or intimation that American Smelting and Refining Company (now Asarco, Inc.) had taken any unfair advantage of them for their hospitality.

The Pima property was of course discovered by the United Geophysical Company which was headed by Herbert Hoover, Jr. It is really the extension of the old Mineral Hill Mine which was operated by Julius Kruttschnitt for American Smelting and

Refining Company before he went to Australia. I went to see Mr. Hoover in Pasadena several times to find out if United Geophysical wanted to make a deal with a mining company to explore Pima further and possibly develop it for greater production. We had heard that United Geophysical was interested in finding ore deposits, but not in becoming a mine operating company. Mr. Hoover was very cordial and said that they did wish to sell the property but were not quite ready to do so. The last time I saw Mr. Hoover in Pasadena he said that United Geophysical was being sold to Union Oil, he was leaving and that his chief assistant was taking over.

United Geophysical then did decide to sell the Pima property, but as approved by Union Oil said they would sell to the highest bidder, since several of the large mining companies were interested. We were third or fourth in line for examining the mine. We were promised that if we spent the time and money to examine the mine, we would be given a fair chance to bid on it. When our engineers were about half through their examination and sampling, one of the local Pima officials came into the mine and said: "You might as well come out, the property has been sold." The Union Oil heads had sold it and retained an interest without honoring the commitments to the companies which had examined or were examining it.

Now, when we first decided to enter the game and sample and examine the Pima mine, some of our men thought the property needed more protection. We asked Pima to take this area which was still mostly or entirely unclaimed as to mineral rights. Drex Spaulding, Pima's local manager, wanted to locate it for Pima, but his superiors turned him down. We then asked the Los Angeles people if there was any objection to our taking it. They kept delaying their answer but our Tucson manager finally did get an answer to the effect that they were not interested and that we should take up the area if we wished to. By this time a goodly part of the area of interest had been located by others, so we had to take purchase options on a considerable portion of the ore area, options which we exercised later on. Many of the claims we located actually had no ore and eventually were used for waste disposal, after also obtaining the surface rights.

In all the dealings which I had afterward with Drex Spaulding and other Pima officials, there was never any suggestion that we had sneaked up on them nor were they competitively locating claims in the area as you have stated. I have to admit that when we lost the chance to bid on and purchase the Pima mine itself it would have taken very little pressure to cause us to drop our part of the area as a number of Asarco men wished to. However, Walter Landwehr, Chief Geologist of Asarco in Salt Lake City, recommended strongly that we do some drilling

first before dropping out, and we were actively supported by Clem Pollack, Asarco's Chief Geologist in New York City, and of course there were other enthusiasts. Later, we did our own geophysical work which helped direct the drilling campaign.

Pima, of which control had been purchased by Cyprus Mines, owned the surface rights on an important part of the area. They had purchased this for waste disposal area and had begun actually putting waste on it, which indicates how little they thought of it for mining purposes at that time. This area also included the best location for Asarco's mill. After we began to find ore, a deal was made with Pima-Cyprus to purchase this surface and also an agreement was made for mining the common boundary between Mission and Pima, so that neither company would be burdened by the whole stripping cost. I was involved in all these negotiations and to my knowledge relations between Asarco, Cyprus and Pima have always been on a completely friendly and cordial basis.

I am sorry to have to write you at such length about this, but in view of the facts as covered above, I hope that you will correct and eliminate from your otherwise fine book the remarks which I have quoted and have objected to.

I am sending copies of this letter as noted below because, although I have been retired from Asarco for several years, I feel that this criticism of our activities should not be let stand.

With best personal regards.

Sincerely yours,

Darwin J. Pope
Darwin J. Pope

cc: Henry Mudd
Charles F. Barber
T. A. Snedden ✓
Howell North Books

IRA B. JORALEMON
168 SOUTHAMPTON AVENUE
BERKELEY, CALIFORNIA 94707

May 15, 1974

MAY 20 1974
EXPLORATION DEPT.

American Smelting and Refining Co.
Exploration Department
Box 5747, Tucson, Ariz., 85703.

J. H. C.

MAY 20 1974

Gentlemen:

I am sorry that there has been a misunderstanding as to the propriety of the location of claims that later became your Mission Mine. There was no question as to the legality.

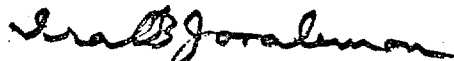
I made several examinations of the Pima Mine, first for United Geophysical and then for Pima Mining Co. Most of my association was with Drex Spaulding and Mr. Pielemer. On one of my earliest trips I told Spaulding that there was a chance of finding a large low grade deposit in addition to the higher ore that was being developed underground. I recommended the location of additional claims and development, mostly drilling, to prove this theory. The memorandum of November 30th, 1953, copy of which you sent me, shows that Pima was acting on this recommendation on that date; that Asarco geologists were told of the results of the work; and that Mr. Spielmeier asked you to get in touch with Spaulding before locating additional claims.

Both Asarco and Anaconda geologists were at the Pima during one or more of my visits. Neither they nor Drex Spaulding told me that there had been any agreement about locating ground. After Asarco had found ore in ground near that located by Pima I remember that Spaulding was much upset.

In my book "Copper," as quoted by you, I stated that when a company gives another results of exploration, there is a chance that the information will result in injury to the first company. In spite of this I was, and am, sure that free interchange is the best policy.

Formal agreements in such cases are seldom practicable, and might not be legal. Everyone must rely on good will, and misunderstandings are likely. This was apparently true in the Mission-Pima case. I am sorry that Drex is not alive to clear up the affair.

Yours very truly



Ira B. Joralemon



AMERICAN SMELTING AND REFINING COMPANY

EXPLORATION DEPARTMENT

P.O. BOX 5747, TUCSON, ARIZONA 85703

J. H. COURTRIGHT
CHIEF GEOLOGIST

May 6, 1974

1150 NORTH 7TH AVENUE
TELEPHONE 602-792-3010

Mr. Ira B. Joralemon
315 Montgomery
San Francisco, California 94104

Dear Sir:

Reference is made to your recently published book entitled "Copper" wherein you comment on acquisition of the Mission property. Excerpts follow (Pages 326, 327):

"A far more serious loss came from the generosity of Pima in letting engineers of other companies visit their property and even see the drill cores. As the value of the low-grade disseminated deposit east of the richer ore became evident, Pima started to locate a large group of claims out in the desert. But American Smelting and Refining Company engineers had seen the Pima drill cores, and with this knowledge they located for Asarco a great area farther northeast. Much of the low-grade ore extended into the Asarco claims, which were called the Mission Mine."

"This loss to Pima of one of the great copper mines makes one wonder whether generosity in welcoming visitors is worthwhile. Sixty years ago, due partly to apex lawsuits, all information was carefully guarded. Dr. James Douglas and Dr. Louis D. Ricketts were largely responsible for a more liberal policy, although they realized that now and then someone would take an unfair advantage of the free information. But they were sure that in the long run an interchange of knowledge would benefit everyone, and in most cases they were right. Pima suffered by the policy, but if Pima had not known of the success in mining very low-grade ores at Morenci, it might not have acquired any part of the Twin Buttes District. As in nearly all our endeavors, we must weigh a gain against a possible loss."

Very briefly the facts are:

Following underground development of the Pima deposit, various companies (Anaconda, ASARCO, Eagle Picher, Cerro, Phelps Dodge, Newmont) were invited and most did examine the workings and drill cores with the

May 6, 1974

understanding that offers to purchase or option would be entertained. Thus, no "generosity" was involved in "allowing" other companies to examine the prospect.

Subsequently, our management advised United Geophysical that ASARCO planned to acquire ground in the vicinity, but would exclude any areas that United Geophysical wished to designate. As evident in the first paragraph of a file memorandum dated 11-30-53 (copy attached) the only area designated was that southeast of Helmet Peak. Shortly thereafter (early December, 1953), we (Richard and Courtright) arranged a meeting with Drex Spaulding, then Pima manager, in his office and informed him personally of our intention to stake claims, but not over any ground that he might select for staking on behalf of his company. He selected an area southeast of Red Hill, and we proceeded to stake elsewhere.

We became aware much later that the fact of our conversation with Spaulding giving him first choice on any of the open ground was never reported by him to his superiors in Los Angeles. Nor, did he ever admit it to any of his local staff.

Furthermore, it was not until after ASARCO had pretty well drilled out the low-grade, large tonnage Mission deposit that Pima began to realize they had a similar very large potential in their own ground. In other words, at the time they did not need any more ground than they already had for what they thought was a small ore body.

Nevertheless, contrary to your statements (quoted above), they (United Geophysical, or Pima Mining Company) were given far more than fair treatment.

Yours very truly,

J. H. Courtright

J. H. Courtright
Then, Assistant Chief Geologist,
Southwestern Department,
ASARCO
Now, Chief Geologist,
ASARCO

Kenyon Richard

Kenyon Richard
Then, Chief Geologist,
Southwestern Department,
ASARCO
Now, Consultant--
Mining Geology

JHC:KR:vmh

Enc. 1

cc: All W/Enc.

J.J. Collins: Exploration Manager, ASARCO

T.A. Snedden: Then, Manager
Southwestern Mining Dept., ASARCO
Now, Vice President,
Mining Dept., ASARCO

81-1
21
T.A.S.
DEC 1 1953
Salt Lake City, Utah
November 30, 1953

FILE MEMORANDUM:

PIMA MINE

Mr. Pielemier of United Geophysical Company called me this afternoon to advise that their company had no objection to our locating claims to the east of their existing claims, also that they were aware of the Nauman and Chilson locations and did not plan to deal with either party and that we were, therefore, free to deal on these claims if we desired. Mr. Pielemier did state, however, that they were running one more electromagnetic line southeast of Helmet Peak, and if we planned on any locations in that direction, he would appreciate if our people would first contact Mr. Spaulding before making any locations as they have not as yet decided whether to locate claims in that area themselves.

Mr. Pielemier stated that they had located 19 additional claims to the east of their previous holdings sometime last month. Judging from the claim map attached to Mr. Kenyon Richard's letter to me of November 25th, this would leave four claims unaccounted for as this map shows only 15 additional locations.

In answer to my request as to the progress that was being made on the exploratory work recommended by Mr. Joralemon, I was advised that one of the two surface holes and one of the two underground holes were completed. The second surface hole which was to go to a depth of 800' has run into trouble at 500'. However, they think there is a chance that the trouble can be corrected and the hole continued. He made no comment on the second underground hole but stated that he thought it would be at least two weeks before any results on this drilling would be available.

ORIGINAL SIGNED BY

F. V. RICHARD

F. V. RICHARD

FVR:bm

cc: C.P. Pollock

D.J. Pope

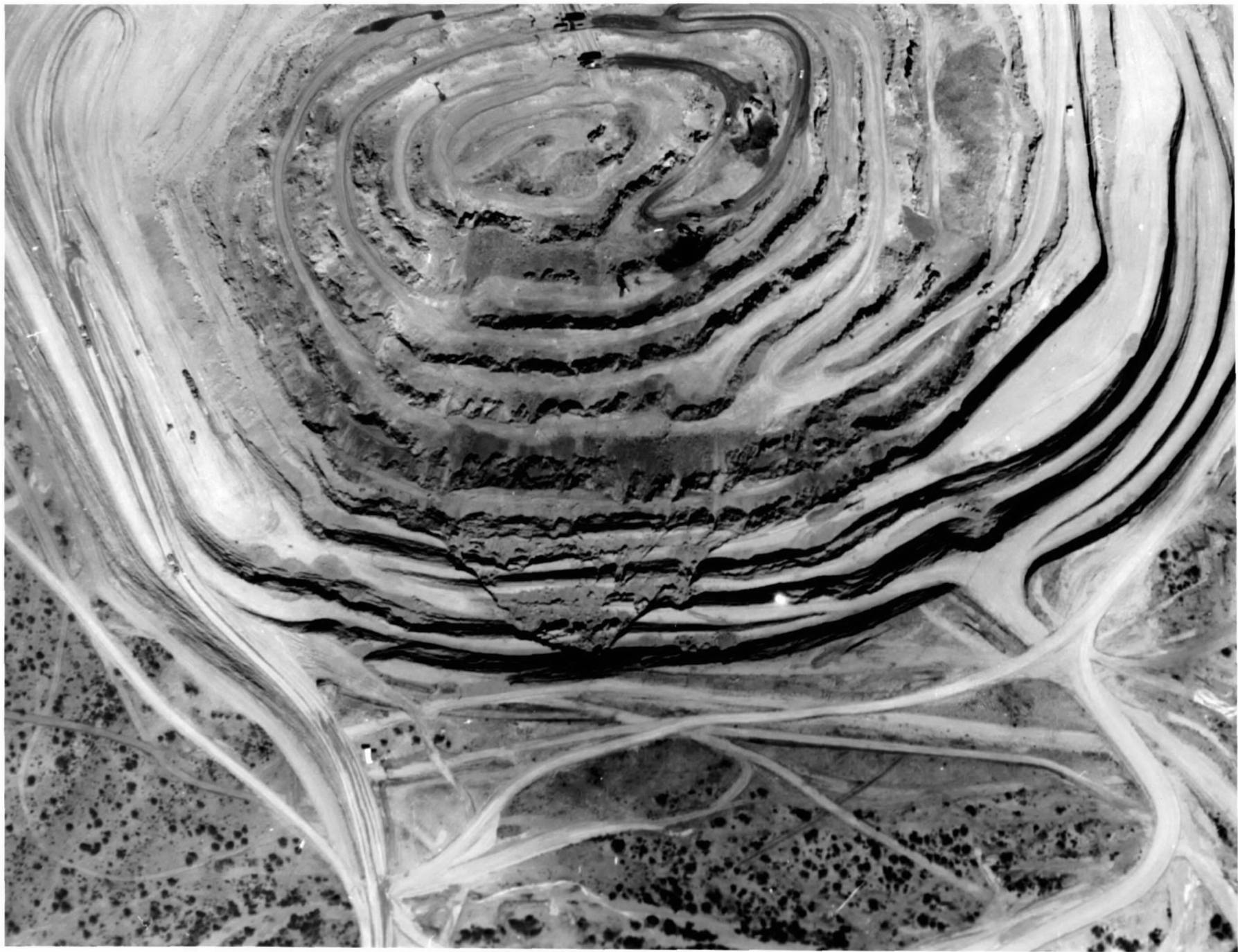
T.A. Snadden (Conf.)

K.E. Richard (")

Blind note to Messrs. Snadden and Richard: I obtained the above information too late in the afternoon to call New York. However, please do not start locating any claims until I give you clearance as location of claims and dealing with Chilson will depend upon our Company's willingness to do any speculative exploration in this direction.

F.V.R.

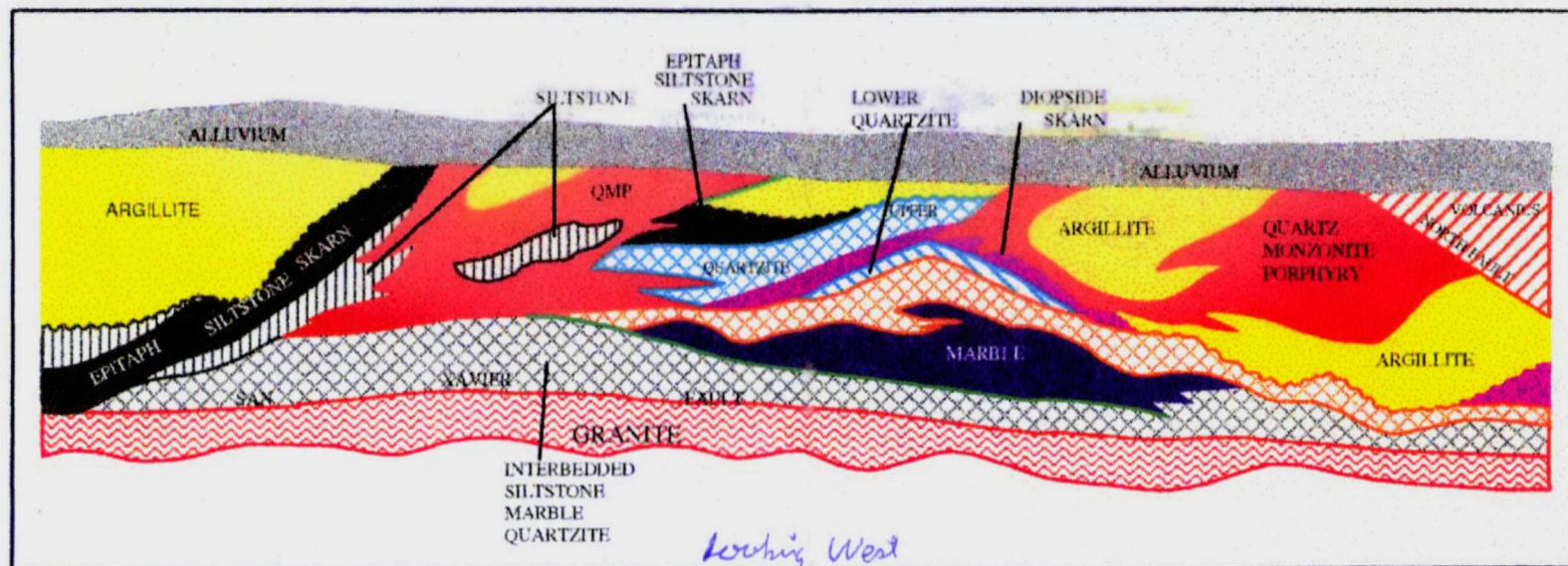




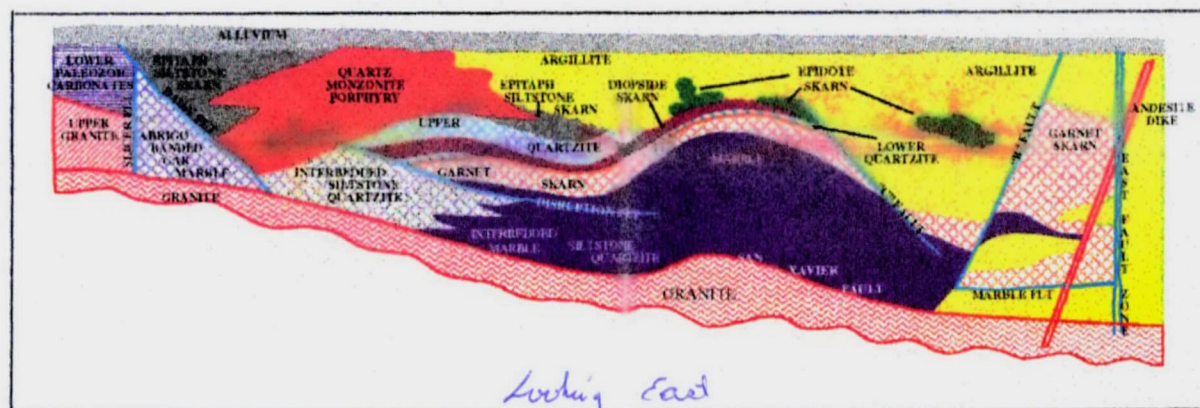
MISSION

July 1997

SCHEMATIC NORTH-SOUTH SECTION



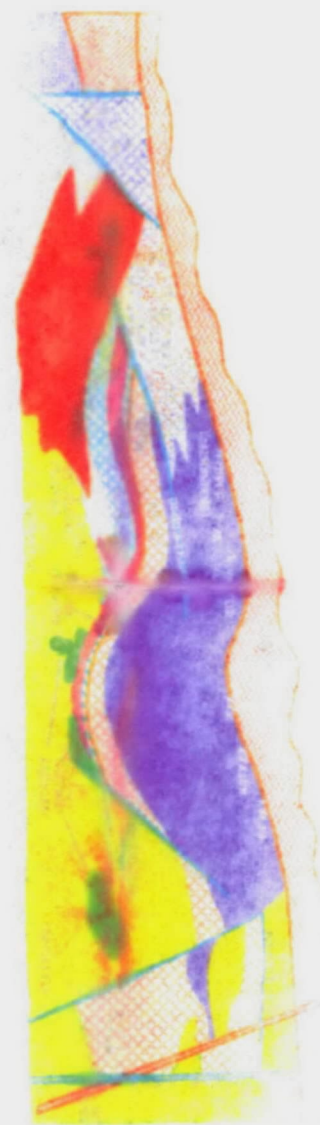
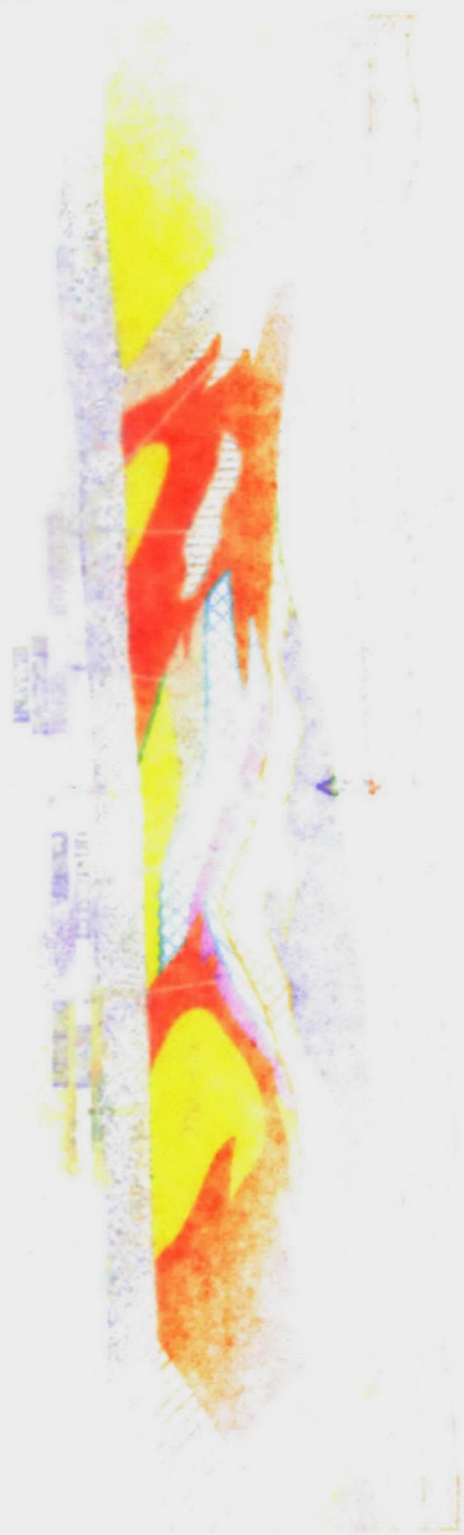
SCHEMATIC EAST-WEST SECTION



Permian Units exposed in pit

26 May 1950, Mission moved from
Horn Butte to Mission area

MISSION AREA
MONTANA



WHD Consulting*Copper - Markets, Metallurgical, Environmental*1201 E. Placita Ardilla
Tucson, Arizona 85718Phone (01) (520) 742-8957, FAX: (01) (520) 742-8950
E-mail: wdresher@compuserve.com**FACSIMILE FORM****DATE:** March 30, 1998**TO:** Jim Sell**FAX:** 578 7196**FR:** William H. Dresher, Ph.D., P.E. (AZ)**PAGE NO.** 1 of 4 pages**MESSAGE**

Dear Jim:

It was good to see you at the Minerals Discovery Center last week. You do an excellent job as a tour guide!

As I told you last week, I am writing the text for a brochure for Rob Vugteveen to distribute at Center on the discovery of the present Mission Mine as part of my volunteer work. Enclosed is a draft of what I have written thus far. The story of the Pima and Mission Mines was largely obtained from Walt Heinrichs and Dave Lowell and the history of the Pima Mining District from the Arizona Geological Survey. The brochure is meant to appeal to the general public and will be presented with appropriate illustrations and in an attractive design. Rob is working on the latter.

I would appreciate it if you would look over the draft and give me your comments on it as to any additions or subtractions based on your knowledge of the situation at the time. I have asked Tom Scarticini to provide me with the two dates that are circled. Maybe you have them as well.

Note: I am aware of a number of controversies involved in both the location of the original Pima Mine and the role that ASARCO played in the staking of the Mission Mine. I have tried to treat these fairly in the text and have tried to avoid unnecessary detail.

Thanks for your help.

Best regards,



2 Sept 1998
Bill paid this
was cleared up
& sent to Rob
a while back.
No word back
from Rob.

How do You Find a Mine? (You Sniff for the Peanuts on its Breath)

DRAFT

The Story of the ASARCO Mission Mine

Sniff for the peanuts on its breath? Well, hardly so! However, this answer to the children's riddle, "How do you tell if there is an elephant in the refrigerator," comes close to the truth - you use remote geophysical sensing techniques to find massive ore bodies located deep within the surface of the earth. (Such ore bodies are known as "elephants" in geologists' jargon.) It is said that the present Mission Mine, is the first mine of any significance in the United States to have been discovered strictly by the use of geophysical techniques. However, it should be noted that some geologists feel that geological interpretive work was more important than the geophysical work. In any case, the story of the location of the present ASARCO Mission Mine is a fascinating one where modern technology, and a good deal of geologic detective work were brought into play. To begin the story, we must go back to the beginning in order to fully appreciate the full meaning of the ASARCO Mission Mine and its nearby neighbors in the Pima Mining District - the Twin Buttes Mine, the Esperanza Mine, the Sierrita Mine and the Eisenhower Mine.

Situated on the west side of the valley of the Santa Cruz River, the Pima Mining District lies within a region, then called the "Primería Alta," that was initially extensively explored by the first Europeans who came north from Mexico in the seventeenth century. It is among the oldest known mineral-bearing regions in North America. The Jesuit Fathers, beginning with Father Kino,

were the pioneer miners of Arizona in the late 1600s and early 1700s. However, their efforts were largely focused on gold and silver. The first account of copper in southern Arizona was in 1870 when the deposits at Silver Bell, Helvetia, Rosemont, and Twin Buttes were opened. Of these, the Twin Buttes is the only one in the Pima Mining District.

In those days mining was not as we know it today. There were no open pit mines. Only very high grade ores could be exploited and this was done by following a surface expressed vein down into the earth in what was called a "glory hole." Some of these consisted of just a shaft, others, a shaft and side tunnels that followed the ore mineralization as it traced its way through the rock. While long since abandoned, a number of these still exist in the District. One of them, a lead-zinc-silver mine established in the early 1700's, the San Xavier Mine, is currently being operated by the University of Arizona as a practice and experimental mine. The metals recovered in those days were copper, gold, lead, silver, and zinc. However, while there were some thirty-eight mines worked at one time or another in the Pima Mining District, the extent of production from these mines was so sparse that in 1922 the General Land Office of the U. S. Department of the Interior declared the District as being "non-mineral in character."

While mining was conducted in this region during World War I and World

War II in order to meet the needs of the war effort, it was not until after World War II that the large open pit mines that we see today were established. The encouragement for opening these mines came as a result of President Truman's determination, based on the recommendations of the Paley Commission, that the United States was running out of copper resources. Thus, the Pima Mine was opened in 1955, the Esperanza Mine was reopened in 1959, the Mission Mine, in 1961, the Twin Buttes Mine, in 1965 and the Sierrita Mine in 1972. The Eisenhower Mine, to the northwest of the Mission Mine, was established much later, in 1984. In total these mines have now produced an amount of copper sufficient to supply the world's entire requirement for copper for more than one year - all from a District once described by the Federal government as being "non-mineral in character!"

What made the difference in converting a "non-mineralized" region into a leading copper producing region? It was the application of technology! The invention of the froth flotation process in 1901 and the invention of the open pit method of mining in 1907 laid the groundwork for the ability to economically process ore grades of 1 percent or less. No longer did mines have to follow veins of mineralization in order to produce high grade ore. The whole area could be mined by large earth-moving equipment providing a safer and cheaper mining method. First applied in Arizona in 1920, and in the Pima Mining District at the Esperanza mine in 1936, both of these technologies, albeit, greatly improved upon over the original, can be seen at the Mission Mine today.

The present ASARCO Mission Mine started life as two separate mines - the Pima Mine and the Mission Mine; albeit, as neighbors exploiting the same ore body. The Pima Mine was in the area immediately below the visitor's overlook in today's mine.

Geophysical exploration work at in the Pima Mining District began in early 1950 by a free-lance group retained by United Geophysical Company - a company owned by Herbert Hoover, Jr., the son of the former president. Lead and zinc were the initial target minerals; however, copper was quickly added to the list. Because of the magnetite (magnetic iron oxide) association with tailings of the previously mined ore (the "peanuts on the breath") magnetics was chosen as the geophysical method most likely to succeed. A magnetic profile of an eight mile long area on the north side of the mining district was run. This profile correlated well with previous production sites so the survey was extended eastward. Magnetic anomalies were discovered in the Twin Buttes area and the Mineral Hill area - what is now the Mission Mine area. Because the Twin Buttes area was already controlled by the Twin Buttes Mining and Smelting Company of Milwaukee, Wisconsin, a prospecting permit was obtained from the State of Arizona, the owner of the land, for more extensive geophysical measurements in the Mineral Hill area. Surveys were run using additional geophysical methods - electromagnetics, self potential, resistivity and gravity. Based on these measurements a site was selected for the first drill hole to be made - the geologic "proof in the eating." Drilling was initiated in February, 1951. The first sixteen holes encountered potential ore - copper mineralization associated with magnetite. The first production mine was a 600-ft deep shaft

with four underground levels. Shipping of copper ore to ASARCO's smelter in El Paso, Texas, commenced in May, 1952. By June, 1955, 69,000 tons of ore, averaging 6 percent copper had been shipped.

For the operation of the mine, Union Geophysical Exploration formed a wholly owned subsidiary, Pima Mining Company, in November, 1951. However, in 1954 Union Geophysical Exploration was purchased by the Union Oil Company of California for the purpose of supplementing UCAL's oil exploration program. Since neither Union nor UCAL had experience operating a mine, Pima Mining Company was offered for sale. ASARCO, who at that time was mainly a custom smelting and refining company rather than a mining company, placed a bid on the company; however, the sale went to Cyprus Mining Company who, in turn, sold 25% of its ownership to Utah Construction and Mining Company in 1955. The company, now Cyprus Pima Mining Company, using Utah Construction's mining expertise, began stripping for open pit operation in the latter part of 1955.

Not having won the bid for the Pima Mining Company, ASARCO decided to seek their own position in the District. After a review of the interpretation of the geology of the newly found Pima mine, ASARCO geologists reasoned that the ore deposit was ~~not a disseminated deposit, as~~ *less than more extensive than* the Pima geologists had interpreted, ^{and} but was a porphyry deposit and therefore a much larger elephant than had been first suspected! As a result, ASARCO mounted its own geophysical exploration and drilling program east of and immediately adjacent to the Pima mine. By 1958 sufficient ore reserves were proven and

the Mission Mine was established as a neighbor of the Pima Mine. Thus, two mines were established essentially mining different areas of the same ore body. As mining progressed by both companies, the pit began to look more and more like a single hole in the ground but with a partition of ~~unmined ore~~ down the middle. In 1984 when ASARCO purchased the Cyprus Pima Mining Company holdings the Pima Mine and the Mission Mine became one and assumed the name that it holds today - the Mission Mine. ?

Tribute should be paid to the geologists and geophysicists who discovered the ore body -

Pima Mine - Walter E. Heinrichs, Jr.
and Robert E. Thurmond
Mission Mine - J. Harold Courtright and
Kenyon Richards

Aknowledgements -

Dr. Larry D. Fellows, State of Arizona,
Geological Survey
Mr. Walter E. Heinrichs, Jr.,
GEOEXploration Co.
Mr. J. David Lowell, Lowell Mineral
Exploration, Ltda.