



CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
<http://www.azgs.az.gov>
inquiries@azgs.az.gov

The following file is part of the John E. Kinnison 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.

J.E.K.

JUN 20 1968

*John Kimmsay personal file copy of the
only govt witness called to testify.*

Caldwell - Direct

239

MR. RUBLOFF: I call Mr. Caldwell.

TESTIMONY FOR THE DEFENDANT

Whereupon,

DAVID LEE CALDWELL

a witness produced on behalf of the Defendant, having first been duly sworn by said Commissioner, was examined, and in answer to interrogatories testified as follows:

COMMISSIONER FLETCHER: Please be seated.

DIRECT EXAMINATION

BY MR. RUBLOFF

Q Will you state your full name and address for the record?

A David Lee Caldwell. I live at 1312 South Nelson Street, Arlington, Virginia.

Q By whom were you employed in 1956?

A By the Bureau of Indian Affairs.

Q In what capacity?

A As a Mining Engineer.

Q And in what office?

A I was in the Natural Resources Section, the Central Office, Washington Office.

Q National Resources Section?

A Yes.

Q Is that part of a branch?

A It is in the branch of realty - - excuse me. Let me correct that. I was in the Minerals Section of the Branch of Realty.

Q During what period?

A This was from July 1956 until November 1959.

Q Did you occupy the same position throughout the entire period?

A No, I went there as the Mining Engineer in the Section at about the latter part of 1958 I was changed to Minerals Officer in the same Section.

Q What is your educational background?

A I graduated from the Colorado School of Mines in 1950 with the Professional Degree of Engineer of Mines. I received a Bachelor of Laws from American University in 1956 and I received a Master's in Business Administration from American University in 1967.

Q During the period 1956 through 1959, what was the function of the Natural Resources Section?

A If I can correct you, it is the Minerals Section.

Q Excuse me, the Minerals Section?

A Of the Bureau of Indian Affairs. We were charged with the development of minerals on Indian land.

Q Did you receive an assignment in July of 1956?

A Yes, I did.

Q What was that assignment?

A This concerned the application of ASARCO and others in regard to the leasing of minerals on the San Xavier Reservation.

Q What decision was made by the Bureau with respect to the leasing of those lands, and my question is directed to the period 1956?

A Well, it seemed at that time that it was to the best interests of the Indians to explore these lands and to get them under lease, if possible.

Q Was any decision made at that time as to whether the lands would be privately leased or publicly bid on?

A The decision was made that they would be publicly bid on, that they would be offered in a public bidding basis.

Q By whom was that decision made?

A By the Bureau of Indian Affairs.

Q I show you Joint Exhibit 1. What is that?

A This is the Notice of Competitive Sale, exclusive prospecting permit with option to lease and it is dated April 8 , 1957.

Q Who prepared Joint Exhibit 1?

A The Bureau of Indian Affairs.

Q Did you participate in the preparation of Joint Exhibit 1?

A Yes, I did.

Q Who else participated in the preparation of Joint Exhibit 1?

A Well, there are individuals -- there are other individuals in our Central Office -- I believe people from the Geological Survey and also people from the Bureau of Indian Affairs, Phoenix Office.

Q Are these all employees of the United States Government?

A Yes, the ones that I mentioned are all employees of the United States.

Q Did any other individuals participate in the preparation of Joint Exhibit 1?

A Not directly. We did have consultations with employees of ASARCO. We did have contacts, for instance with employees of the Pima Mining Company in regard to gathering data.

Q Who formulated the terms of Joint Exhibit 1?

A The Bureau of Indian Affairs.

Q Who decided which lands would be included within the bid, Joint Exhibit 1?

A This is also by the Bureau of Indian Affairs.

Q Who decided the length of time the prospecting permit would be in force?

A This was by the Bureau of Indian Affairs.

Q Who determined the royalties that would be payable under the mining lease?

A This was by the Bureau of Indian Affairs.

Q Who determined how the monies receivable for the bonuses and under the leases would be distributed?

A This was also - - -

MR. KIPPS: Objection, your Honor. I would like a little bit of clarification as to the time you are talking about. Is this the notice of sale?

BY MR. RUBLOFF:

Q Mr. Caldwell, do you understand that by virtue of the bid, that certain bonuses would be payable?

A Yes, that's correct.

Q And that under the lease certain additional payments would be made?

A Yes, that's correct.

Q Who decided how those monies would be distributed?

MR. KIPPS: Again, your Honor - - are you talking about the notice of sale? The Indians had something to do

about this. This is the reason for my objection. Part of this has to do with what the regulation and the statute say about the Indian's Rights to these monies. He is asking too broad a question.

MR. RUBLOFF: Your Honor, the documents in evidence establish that all of the monies payable under the various contracts and agreements are to be payable to an employee of the United States Government. My question of the witness is, who decided how that money would be distributed?

COMMISSIONER FLETCHER: By that employee?

MR. RUBLOFF: Yes.

MR. KIPPS: That's not in Joint Exhibit 1. That is in Joint Exhibit 2. That was decided when the Indians signed Joint Exhibit 2 - - that and the regulations which were applicable at the time.

MR. RUBLOFF: My question was not restricted to the monies payable under the agreement, designated as Joint Exhibit 1. It pertained to all of the agreement.

COMMISSIONER FLETCHER: Objection overruled.

BY MR. RUBLOFF:

Q Mr. Caldwell, do you understand that by virtue of the various agreements pertaining to the Indian Land which we have been discussing here today, that certain monies were to

be paid to an employee of the United States Government?

A Yes, I understand.

Q My question is, who decided how that money would be distributed?

A The Bureau of Indian Affairs.

Q Was this distribution method referred to in the agreement - - in the various agreements?

A I don't recall if it was precisely referred to in the agreement.

Q With respect to the mineral prospecting permits, who decided how much of the acreage could be preferentially leased?

A Well, this is provided in the agreements.

Q Who was responsible for that provision?

A The Bureau of Indian Affairs, of course, with the consultation of the Geological Survey, and I think possibly there was the acreage limitation in the regulations that required an exception be made by the Secretary of the Interior.. Of course, this was all done before the documents were published.

Q Who decided on what terms the acreage could be leased?

A The Bureau of Indian Affairs.

Q Did any of the individual Indian allottees participate in the formulation of Joint Exhibit 1?

A No, not to my knowledge.

Q Did they participate in the formulation of the mineral prospecting permits?

A Not to my knowledge.

Q Did they participate in the formulation of the leases?

A No, not to my knowledge.

Q Were the individual Indians kept advised as to the decisions made by the Bureau regarding these lands?

A Not on a day to day basis. However, I believe there was a meeting at which the Indians could attend and this was explained to them. This was at the Agency at Sells, Arizona.

Q Do you recall whether, in 1959 ASARCO made any representations to the Indian Bureau regarding their plans for Tracts 1 and 2?

A I of course left the Indian Bureau in November, 1959. But I believe before that, some time, maybe in the Summer, they had presented some brief maps with little details showing where they had done some drilling, and also, I believe they had shown some outlines of mineral deposits.

Q Did they make any statements or representations regarding their ability to profitably mine the area?

A I believe at that time I believe they expressed some doubt that it was economical, at precisely that time.

Q Did they make any other statements?

A I am sure they did - - -

Q Did they make any statements regarding their plans to mine the area?

A I don't recall precisely that they did make statements, although I can only recall my feelings that they were somewhat optimistic.

MR. KIPPS: Objection, your Honor. We are really not interested in the witness's feelings. If he has a statement of fact that is relevant - - but I don't see where his feelings - - he barely remembers the conversation.

COMMISSIONER FLETCHER: I will sustain that objection. Rephrase your question.

BY MR. RUBLOFF:

Q Can you remember in substance what was said?

A I can remember that there were some thoughts that these deposits would be of commercial value. if not at that precise time, perhaps at some time in the not too distant future.

MR. RUBLOFF: No further questions.

MR. KIPPS: We have a few questions, your Honor.

COMMISSIONER FLETCHER: All right.

CROSS EXAMINATION

BY MR. KIPPS:

Q You have Joint Exhibit 1 in front of you?

A No, I do not.

(Whereupon a document was handed to the witness.)

BY MR. KIPPS:

Q Would you tell me, Mr. Caldwell, whether the second full paragraph on page 2 of Joint Exhibit 1, which is the notice of sale states that the bonus shall be paid to the allottees in proportion to their acreage held, which is signed up for prospecting leases?

A Yes, sir, I believe the last sentence says that the allottee will be paid according to the acreage in which he has an interest.

Q Isn't it true that in order for the Bureau of Indian Affairs to combine the allotments in Tracts 1 into one advertised sale, it necessarily concluded that the value of the lands of each allotment was substantially the same?

MR. RUBLOFF: Objection, your Honor. I believe that the question started off asking the witness - - -

MR. KIPPS: Read the question, please.

(Whereupon the pending question was read by the Reporter.)

THE WITNESS: No, I do not think that this is a necessary conclusion.

BY MR. KIPPS:

This is a beautiful question. The witness froze in his chair -- looked like he would fall over.

Q Do you agree that one allottee's rights may not be sacrificed for the benefit of another allottee?

MR. RUBLOFF: Objection, your Honor. I am not certain whether he is asking for the witness's opinion, or whether he is asking the witness if he knows what the policy of the body is, or whether he knows what the law is.

MR. KIPPS: I am asking for his legal opinion in response to this previous question as to whether he knows if one allottee's rights may not be sacrificed for another? He is a lawyer. He apparently has something to do with the drafting of these documents, and I would like to have him answer that question.

MR. RUBLOFF: I will object to the question on the ground that it calls for a legal conclusion.

COMMISSIONER FLETCHER: Objection overruled.

MR. RUBLOFF: Do you want the question reread?

THE WITNESS: No, I recall what it was. I think the Indian Bureau felt that the method here being used, that is

BY MR. KIPPS:

Q Let's answer the question yes or no. Can one Indian

allottee's land be sacrificed for the benefit of another?

Yes or no and then you may explain.

MR. RUBLOFF: Your Honor, I would like to have clarification as to whether the witness is being asked whether, from a standpoint this can be done.

MR. KIPPS: That's right.

MR. RUBLOFF: I object on the ground that it calls for a legal conclusion and the witness is not competent to testify.

COMMISSIONER FLETCHER: Objection overruled, with this advice, Mr. Caldwell. If you find it impossible to answer yes or no, counsel cannot force you to do so.

THE WITNESS: I don't think that I can give you an answer without qualifying it.

BY MR. KIPPS:

Q That's all right. You may qualify it. I would like a yes or no and then your explanation.

A I would say yes, it can be -- this method can be used when the Indian Bureau is able to show that it is in the best interests of the Indians on an overall basis.

Q Let's be a little more specific. Let's look at Tract 2. Let's assume the Bureau of Indian Affairs with advice in counsel of the Geological people had a pretty good

suspicion that the ore body south of the Reservation projected into Tract 2, at least to some extent, let's say, into what is allotment 130 and thus you have the same knowledge that ASARCO had, and let's say you looked up here in allotment 77, and let's assume that you had the same knowledge that ASARCO had, which was virtually nothing about that area.

Now, if we assumed that that was an unknown quantity and this was a known possibility of a good ore body here, or at least a good potential, do you think you could combine this one and this one without doing violence to allottee's 77 right and allottee's 130 right? *beautiful!*

MR. RUBLOFF: I object to the use of the word "violent".

MR. KIPPS: Violates his rights, substitute that.

MR. RUBLOFF: Could I, your Honor, with your indulgence, elaborate on my previous objection to this entire questioning?

COMMISSIONER FLETCHER: Yes.

MR. RUBLOFF: The witness testified that he was hired as an engineer and he also testified that he had a law degree. But there is nothing in his testimony to indicate

that he is acting in a legal capacity in the course of his services rendered for the Indian Bureau and there is nothing to indicate that he was cognizant of either the policy of the Indian Bureau with respect to these matters or the law which pertains to the questions which are being asked, and unless this is first established I think all the witness is doing is giving his curbstome opinion at this point in time, which I think is irrelevant as well as incompetent.

MR. KIPPS: The witness testified as to the meaning of these documents, like Joint Exhibits 1 and 2, and presumably in a capacity as a lawyer. He was qualified through the background of being with the BIA, and it seems to me that these questions are perfectly proper.

MR. RUBLOFF: The witness did not testify as to the meaning of anything contained in the documents. He was simply asked who made certain decisions. He was not asked how these decisions were reached or, on what basis, but just who made them.

COMMISSIONER FLETCHER: What is the relevance of this, Mr. Kipps?

MR. KIPPS: Your Honor, the law is clear, that this allottee's right may not be sacrificed for this right. If the BIA knows that this has particular value, or, has

reasonable grounds, it got to lease it separately. It doesn't have a right to tie it in. It has no right to tie it in with something that has a lesser value. If it does, it has violated the fiduciary duty to the allottee.

COMMISSIONER FLETCHER: You say the law is clear in this effect?

MR. KIPPS: Yes, sir. I am testing what this witness said about some of the things he said earlier in the case. This witness talked about the 2560 acre limitation which he said apparently was in the regulation. I am going to cross examine him on that and that has the same legal connotation as this problem does. If he says he doesn't know, or he says he did it under some circumstances, I wanted to see what the circumstances were.

I would like to see whether he thinks it would under this circumstance here and here.

MR. RUBLOFF: Your Honor, I am at a disadvantage in that I am not acquainted with the laws which counsel refers to, but it seems to me that if it is as well settled as he says, there is no purpose in pursuing it.

In any event, it is a matter of law which should be handled by brief and not through the examination of the witness. There has been no foundation laid for this witness

testifying as to what the law is. He hasn't been asked whether he is acquainted with the law and what his knowledge of the law is. I think the entire line of examination should be ruled objectionable and whatever questions asked and answers to those questions be stricken.

MR. KIPPS: I will withdraw that question and ask him this question.

BY MR. KIPPS:

Q Did you have any basis for valuing one allotment any different from another? Did the BIA, when you selected the lands?

MR. RUBLOFF: Objection. I don't understand what is meant by the word "basis". You mean did he have any reason?

BY MR. KIPPS:

Q Did you have any reason to believe that one allotment was of any different value in Tract 1 than another at the time the BIA put those allotments together in this particular Tract?

A You pointed to Tract 2.

Q Let's take Tract 2. Anyone of the three tracts -- when you combined the allotments say, in Tract 1, together as one Tract and put it up for bid, did you have any reason to

believe that any one allotment had a greater value than another within that Tract?

A Yes, I think it is reasonable to think that one had a greater value than another.

Q You think - - - I am asking you when BIA and you participated in the decision - - whether you had reason to believe at the time they combined these into one Tract, into Tract 1, had reason to believe that one allotment within that tract was of greater value than another?

MR. RUBLOFF: Objection, your Honor. He just answered the question.

MR. KIPPS: I would like a definitive answer to the question. Yes or no?

COMMISSIONER FLETCHER: Objection overruled.

THE WITNESS: Yes.

BY MR. KIPPS:

Q You thought they did?

A Yes.

Q And notwithstanding that fact, they combined all of them into one?

A Yes, they were all combined into one.

Q Mr. Caldwell, was there an acreage limitation set forth in the regulations as to how many acres could be leased

*From here on the cross by
Mr. Caldwell as to whether or not
the BIA had a right to do so.*

These answers helped out BIA

at the time of notice of sale in April of 1957?

A I don't recall specifically, but I believe there was.

Q You don't recall how much?

A No, I don't.

Q Or if there definitely was one?

MR. RUBLOFF: Your Honor, I will object to the question if it is for the purpose of establishing whether there was or was not a regulation, which is a matter of law, but if it is for the purpose of laying a foundation - - -

MR. KIPPS: I was testing his credibility. He said he thought there was a regulation to which Secretary made an exception. Now, I am asking him about the regulation to which the Secretary made an exception. I was working up to it, but I will put it just as plain as that.

COMMISSIONER FLETCHER: Well, what is the question now?

BY MR. KIPPS:

Q What is the regulation to which the Secretary granted an exception on acreage limitation?

A You mean the number on the regulation?

Q What did it say? What was the substance of the regulation?

A I don't remember specifically.

Q But you do recall specifically that the Secretary made an exception?

A I believe that he did make an exception.

Q Would it refresh your recollection if I told you the regulation in existence at the time this notice was sent out did not require the Secretary to make an exception, that it provided for 2560 acres - - a lease or leases not to exceed 2560 acres?

MR. RUBLOFF: Objection. The question is argumentative.

MR. KIPPS: I am asking him if it would refresh his recollection if I told him that the regulation at that time did provide for a lease or leases not to exceed 2560 acres per lease.

MR. RUBLOFF: Objection.

MR. KIPPS: Would that refresh your recollection?

MR. RUBLOFF: Assuming a fact not established.
No foundation laid for the question.

COMMISSIONER FLETCHER: Well, I don't take it as establishing a fact.

MR. RUBLOFF: It is based upon an assumption or presumption which may not or may be accurate.

COMMISSIONER FLETCHER: He is only asking if he remembers that to be so. I will overrule the objection.

THE WITNESS: Could you read the question?

(Whereupon the question referred to was read by the Reporter.)

MR. RUBLOFF: May I ask that the witness be reminded that the question is, whether it refreshes his recollection?

COMMISSIONER FLETCHER: That certainly is the purport of the question.

THE WITNESS: No, it doesn't.

MR. KIPPS: No further questions.

MR. RUBLOFF: No redirect, your Honor.

COMMISSIONER FLETCHER: Thank you, Mr. Caldwell.

You may step down.

Witness excused.

MR. RUBLOFF: That concludes Defendant's proof, your Honor.

MR. KIPPS: No rebuttal, your Honor.

COMMISSIONER FLETCHER: All right, the time for a filing requested findings and brief will start from the time that I file a formal notice of closing of proof which will be

just as soon as Mr. Cohen can furnish us a transcript.

Thanks to both counsel for a very fine presentation of this case. I think you made a fine record.

MR. KIPPS: Thank you, your Honor.

MR. RUBLOFF: Thank you, your Honor.

(Whereupon at 3:10 o'clock p.m., the hearing in the above-captioned matter was adjourned.)

- - -

CERTIFICATE OF REPORTER

I, FREDERICK C. COHEN, reporter, hereby certify that at the time and place aforesaid, after being duly sworn by the Commissioner, I did well and truly take down and transcribe the questions propounded to and the answers given by said witnesses so called by plaintiff and defendant: and that the foregoing record is a correct transcript of the proceedings and testimony so had therein.

In witness whereof I have hereunto set my hand
this _____ day of _____ 1968.

FREDERICK C. COHEN
Reporter
312 Hannes Street
Silver Spring, Maryland
20901

April 12, 1968

DIRECT TESTIMONY BY JOHN E. KINNISON

SULPHIDE

Background Information:

1. Address:

1263 W. La Osa Drive, Tucson, Arizona.

2. Education:

Pre-college, Texas and Arizona public schools.

B.S. Mining Engineering, University of Arizona.

Completed, July 1952.

Degree conferred May 1953.

M.S. Geology, University of Arizona.

Credits completed May 1954.

Degree conferred May 1958.

3. Publications and Professional Associations:

Publications

- a. Bryant, D. L. and Kinnison, J. E., 1954, The Lower Cretaceous age of the Amole Arkose, Tucson Mountains, Ariz.; Abs., Bull., Geol. Soc. Am., Vol. 65, p. 1235.
- b. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 49-57.
- c. Kinnison, John E. and Courtright, J. H., 1959, Chaotic Breccias in the Tucson Mountains, Ariz., Guide Book for Field Trips No. 2, Ariz. Geol. Soc.

- d. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz. Abs., Bull., Geol. Soc. Am., Vol. 70, p. 1727.
- e. Kinnison, John E., 1959, Structure of the Saginaw Area, Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 146-51.
- f. Kinnison, John E., 1963, Probable Origin of Mission Copper Deposit, Ariz.; A.I.M.E. pre-print No. 63133.
- g. Kinnison, John E., 1966, The Mission Copper Deposit, Ariz.; in, the Wilson Volume, Geology of the Porphyry Copper Deposits, Southwestern North America, edited by S. R. Titley and C. L. Hicks, pp. 281-287.

Technical Papers Presented

- 1959 Geol. Soc. Am. Cordilleran Section, Annual meeting:
"Chaotic Breccias in the Tucson Mountains".
- 1961 A.I.M.E., Ariz. section, Mining Geol. Division, Annual meeting: "Geology of the Mission Copper Deposit, Arizona".
- 1963 Soc. of Min. Eng. of A.I.M.E., Annual meeting:
"Probable origin of the Mission Copper Deposit"; Member of panel discussion on "alteration features of porphyry copper deposits".

Professional Associations

Member, Society of Economic Geologists.

Member, Society of Mining Engineers, A.I.M.E.

Member, Arizona Geological Society.

Registered Geologist (4822) State of Arizona

1958, Secretary, Ariz. Geol. Soc.

1962, Chairman, Mining Geol. Division,

Arizona Section A.I.M.E.

4. Present position with ASARCO:

Exploration geologist, Tucson Office,
Southwestern Exploration Department.

5. Position in 1957-1959:

Exploration Geologist, Southwestern Exploration Division of the Southwestern Mining Department.

6. What were your duties as exploration geologist during 1957-1959?

During the spring of 1957, I was assigned to review all exploration in the Mission area, to maintain first-hand knowledge of new drill data, to clarify rock and ore distribution, and to interpret and synthesize pertinent data. Because of my work in this region, I was familiar with the exploration possibilities of San Xavier lands. When San Xavier drilling began, my assignment was expanded to include a review of all drill hole data and geophysical work on a current basis and to synthesize my interpretations for use by my superiors.

6-1/2. Briefly describe the topography in the San Xavier area.

It is a broad desert plain covered with sand and gravel with a few rock exposures.

7. Briefly describe ASARCO's interest prior to bidding in the acreage included in tracts 1, 2, and 3.

There were several areas of interest to ASARCO:

- (1) Prior to bidding, drilling at Mission had suggested a pattern of mineralization toward the south boundary of tract 2. The Mission copper ore deposit could be projected on a northerly or northwesterly course into tract 2.
- (2) There were two small mineralized outcrops in the west-central part of tract 1. These outcrops had been mineralized and subsequently leached, creating a capping characteristic of the low-grade disseminated copper deposits generally known as the porphyry copper deposits. The mineralized outcrops suggested the presence of iron sulphide with minor copper beneath them. This in turn suggested that an ore deposit did not exist beneath the outcrops but could exist to one side or the other.
- (3) It was possible that the southern area in tract 2 and the outcrop area in tract 1 were connected and might represent a single copper zone, but this could not be predicted prior to bidding. The gap between was regarded as potentially ore bearing.
- (4) In the southwestern corner of tract 1, an outcrop of arkose and igneous rock showed much diffused iron oxide. Some of the characteristics usually

found with copper mineralization were lacking, and the worth of this area could be evaluated only by drilling. Nearby this outcrop, an abandoned water well had penetrated bedrock which, as shown by the drill cuttings, was slightly mineralized with small amounts of pyrite (iron sulphide). ~~¶~~ The known existence of the Mission and other substantial ore bodies to the south and the geological factors relating to the four areas just described created a general interest in exploring all of the acreage in tracts 1 and 2. ~~However,~~ Our information prior to bids in 1957 was too meager and indefinite to really say that tracts 1 and 2 contained any ore deposits. If there were any ore deposits in these lands, their location and size could be determined only by drilling. The northerly or northwesterly trend of mineralization from Mission might not continue its course. The outcrops in tract 1 might lead to nothing. Giving due allowance for deviation in trend and shape, for cross-trends, and for satellitic deposits, all of these two tracts were believed to have exploration potential.

ASARCO's interest in exploration of tract 3 was minimal for the following reasons:

- (1) Tract 3 is offset considerably to the east of the mineralized trend northerly or northwesterly from Mission.

- made in 1956
- (2) An aeromagnetic geophysical survey/, together with one outcrop in tract 3, suggested that post-ore volcanics (lava) would cover a large part of this tract, and thus the host rock which could contain ore might be at great depth.
- (3) As a qualification to these negative features it must be noted that there was a slight prospective value because tract 3 was nearby an area of large and significant copper mineralization (Mission and Pima). Cross-trends from the established copper zone, or separate, satellitic deposits were possible.
8. Briefly describe ASARCO's surveying and mapping of these lands in 1957.

An accurate survey of the lands in the three tracts was made by ASARCO in 1957. Survey was made using transit and chain, and tied in to a triangulation network. The surveying for the basic grid-work was finished prior to drilling in September, and served thereafter for the location of drill holes and for geophysical survey locations. All future survey points were referenced to this basic grid-work. The grid was tied to the Federal coordinate system for this area, so to facilitate ready reference to United States survey markers on the ground. During the course of surveying, section corners and the limits of tracts 1, 2, and 3 were located. All of the acreage in the Indian lands under mineral exploration

permit were surveyed by this evenly distributed grid-work. Mapping was not extensive. The three tracts were walked over and those outcrops found were mapped geologically.

9. Briefly describe ASARCO's geophysical exploration on these lands in 1957-1959.

Three basic types of geophysical surveys were used by ASARCO in conjunction with other exploration on the San Xavier lands. These were as follows:

- (1) Magnetic. The earth has a natural magnetic field. Certain rocks or minerals near the outer surface of the earth cause deviation in the regular lines of magnetic field which would otherwise be present. Interpretations relative to rock type or mineralization can sometimes be made on the basis of magnetic measurements. In practice, a sensitive instrument called a magnetometer, is placed at surveyed stations on the ground, and the magnetic intensity is read. Alternately, the magnetometer may be carried in an airplane and the instrument read at intervals as traverse is made across the ground at a fixed elevation. The airborne magnetic surveys on the San Xavier lands were made prior to placing of bids in 1957, and are not included in the charges against these tracts. Magnetometer surveys on the ground were used to verify the aerial magnetic readings, but ultimately more reliance was placed in the

aerial survey because of the lack of interference due to concentrations of magnetite in the sand and gravel which covers most of the reservation.

- (2) Gravity. The gravitational attraction of the earth is subject to variations because of the proximity of formations with differing degrees of gravitational attraction, or because of the concentration of heavy silicates associated with mineralization. A sensitive instrument, the gravity meter, is placed at surveyed stations and the gravity field recorded.
- (3) Electromagnetic-generally called E.M. E.M. methods of geophysical survey depend upon inducing an electric current into the ground, and receiving this induced electricity at a receiving set. If a highly conductive source occurs between the transmitter and the receiver, the theoretical and uniform lines of electricity will be deflected, and these deflections may be measured at the receiving station. Such concentrated conductor areas are water saturated faults, veins of sulphide minerals of significant size and continuity, or graphite coated faults. The E.M. work on the San Xavier lands was found ineffective.

10. Where were the surveys made?

The ground magnetic surveys were run principally in the southern portion of tracts 1 and 2 adjacent to the south reservation boundary, occupying section 30,

T16S, R13E, and sections 25 and 26, T16S, R12E.

Adjacent to the north of these 3 sections, portions in the south part of sections 23 and 24, T16S, R13E were included. It became apparent that the aerial magnetic survey would be more useful to exploration than the ground magnetic survey, and work was accordingly stopped after the ground just enumerated had been covered.

The gravity surveys were distributed uniformly in all of tracts 1 and 2. In tract 3, a narrow strip along the west margin was included in this detailed survey area. Elsewhere in tract 3, gravity traverse lines, rather far apart, were run easterly for about one and one-half miles.

The E.M. surveys were made in tracts 1 and 2, along traverses extending north from the south line of the reservation for slightly over 2 miles.

//.10. Were any areas of interest developed by ASARCO's geophysics?

Yes, the following four areas of interest, shown on plaintiff's Exh. 1 were developed by geophysics:

- (1) G-2. This gravity high might have been caused by heavy silicates associated with mineralization.
- (2) M-3. This magnetic high could have been interpreted as due to magnetite associated with mineralization, or to volcanic rock.

- (3) M-5. This magnetic low feature, in tract 3, was regarded as a possible area in which the host rock that could have contained ore had been high when the volcanic lava had flowed over the surface, and thus would be an area in which the volcanic cover might be thin.
- (4) M-6. This southeast trending magnetic high had a shape somewhat like the one designated M-1, which was caused by magnetite associated with mineralization. Alternately this magnetic feature could have been caused by volcanic rock.
- (5) A magnetic high, and a gravity high, labeled respectively M-1 and G-1 were thought to represent an area of mineralization with associated magnetite and heavy silicate minerals. Such an occurrence was known elsewhere in the Pima Mining District. This area is directly along the probable extension of known ore previously drilled at Mission, and is consequently not listed here as a separate area of interest.

12. To what extent was ASARCO's geophysics on the lands eventually relinquished in tracts 1, 2, and 3 helpful in discovering or defining the outer limits of the ore bodies on tracts 1 and 2?
They were no help at all.

13. Why not?

The ore bodies on tracts 1 and 2 were discovered and generally delineated by drill holes which would have been drilled in the same general places even if no geophysical work had been done.

14. Briefly describe ASARCO's drilling program on these lands. ASARCO began its drilling program on tract 2 September 14, 1957. Within a few days thereafter four drills were in operation. Additional drills were moved to the property as they became available at a later date. Drilling commenced on tract 1 September 26, 1957, the day following approval of the permit. We were not ^{allowed} permitted to drill on a tract until after approval of the permit.

Early drilling was designed with two objectives in mind.

Namely, to explore by wide spaced holes all of the area in the northerly or northwesterly projection through tracts 1 and 2, and concurrently, to explore the southern part of tract 2 and the general area of the outcrops in tract 1.

These wide-spaced drill holes, termed "scout" holes, were sunk with a rotary bit to bedrock where a length of diamond

drill core would be recovered, varying from a few feet up to perhaps 20 feet in total length of coring. From this core the general nature of bedrock was determined; specifically, areas were separable into post-ore rock, mineralized rock, or unmineralized rock. Information was obtained rapidly over a large area by this method of "scout" hole drilling. When significant mineralization was encountered, the hole was cased and deepened.

Concurrently with the "scout" drilling, ~~conventional~~ drills were placed on the general area of the outcrops in tract 1 and the southern area of tract 2. The drill hole spacing and location near these areas of interest was on a triangular grid, proportional and similar to the basic grid, but with closer spacing.

The exact sequential order of drill holes often depended upon the availability of drill rigs.

15. What were the results of the early drilling operations? Early drilling near what eventually was determined to be the southern ore body, as shown on JE 6, showed an extension of the Mission copper deposit.

Early drilling near what eventually was determined to be the north ore body, as shown on JE 6, disclosed a mineralized zone of significant size, and demonstrated an enriched secondary chalcocite zone, partly oxidized, with ore-grade copper values.

16. Was the lateral extent of the two ore bodies delineated by drill holes situated on lands eventually retained?

Yes, the north ore body was delineated on all sides by drill holes in lands eventually retained in tracts 1 and 2. The north ore body ^{was} is roughly delineated as follows:

- (1) On the north by X-117, X-118, and X-228. Hole X-114 represents the north edge of the secondary chalcocite zone.
- (2) On the east by X-247.
- (3) On the southeast by X-237 and X-243.
- (4) On the south by X-121, X-136, and X-137W, and X-101S, X-134, X-135, and X-240.
- (5) On the west by X-122S and X-125 and X-127.

The south ore body was delineated on three sides on lands eventually retained in tract 2; the delineation on the south side being the south line of the San Xavier Reservation.

The south ore body is roughly delineated as follows:

- (1) On the north by X-221 and X-233.
- (2) On the east by X-201, X-218, and X-259.
- (3) On the northwest by X-231, and X-264.
- (4) On the west by X-219.

17. Were the drilling operations helpful in confirming and eliminating areas of interest?

Yes, prior to placing of bids, there were four areas of interest based on geological evidence, and subsequently four geophysical areas of interest were identified.

Of these combined areas of interest, all but two were eliminated by drilling. The two areas of interest which were shown to be ore bodies, were two of the four pre-bid areas, namely, that area northerly from Mission in southern tract 2 and the area near the mineralized outcrops in the central part of tract 1. Those areas eliminated were done so on the basis of drilling results indicating lack of ore, or on the probable lack of ore coupled with excessive thicknesses of post-mineral cover formations.

In summary, I should note that for all of the eight areas of interest, direct penetration by drill holes was the only positive method to prove or disprove them. In the environment of the San Xavier lands, no amount of speculation based on either geological or geophysical grounds could take the place of a drill penetration into bedrock to indicate either the presence of ore, or lack of it.

18. What information did ASARCO get from the drilling on lands relinquished in 1959?

The principal information obtained by ASARCO from the areas which were eventually relinquished was as follows:

- (1) The thickness of sand, gravel, and other post-ore cover rocks, and their distribution on the lands relinquished.
- (2) The distribution of exceedingly slight mineralization on those lands.
- (3) The distribution of pre-ore rocks which were not mineralized on those lands.

That data, combined with the geophysical surveys, indicated that those lands eventually relinquished did not warrant further exploration or leasing. None of the data obtained from drilling in the areas eventually relinquished had any effect on either the discovery or the definition of extent of those ore deposits on the lands which were eventually retained.

19. Did any of the exploration work on the lands relinquished have any effect on or contribute to discovering or defining the ore bodies on the lands retained?

No.

20. Why not?

The general area of both the ore bodies which were eventually discovered by drilling was believed by us to have good potential prior to bidding in 1957. We intended to and did explore those areas. The early drill holes in September and October 1957 located the ore in what we now call the north and south ore bodies. As I pointed out earlier, the data from the drill holes placed within the lands leased defined the lateral extent of these two ore bodies.

21. Briefly describe the geological data known by ASARCO when it made its decision in 1959 on what acreage to lease.

Both the northern and southern ore bodies were low grade disseminated copper deposits, of the general type known

as the porphyry copper deposits. Individually, they exhibited different shapes and mineralogic characteristics. The essential points were as follows:

- (1) The north deposit is a partly oxidized, enriched secondary chalcocite zone. Beneath alluvium, a capping, leached of copper value, overlies the chalcocite zone, which is a roughly horizontal tabular body. The upper portion of this chalcocite zone has been changed by weathering, largely to copper oxide minerals, while the lower portion is relatively pure chalcocite unaffected by weathering or oxidation. The interface between the oxide area and the pure chalcocite below is gradational, causing the copper oxide and chalcocite to be mixed within the transition zone. The mineralogy of the copper oxides was not known in 1959, nor was the quantity of chalcocite which remained in the oxide zone. Beneath the chalcocite zone, ore grade primary copper sulphides occur irregularly.
- (2) The south deposit was divisible, for analysis, into three parts, two of which are shallow enough for open pit mining and one of which is so deep that it could only be mined by costly underground methods. The main potential for open pit ore was disseminated primary copper sulphides, beneath 200 feet of alluvium.

A thin zone of mixed copper oxides and chalcocite constituted a limited tonnage, to the west of this main zone. The third division was a deep copper zone (generally over 800 feet in depth) 70 to 280 feet thick, cut only by five widely spaced drill holes, so the continuity and quality could only be inferred.

- (3) The drill spacing at the end of 1959, in the south ore body was 288 feet. This spacing was inadequate for a firm ore reserve calculation considering the erratic nature of the copper sulphides which resulted in significant variations in grade from hole to hole, in depth to ore, and in internal waste areas.
- (4) The drill spacing in 1959, for the north ore body, was 577 feet. This was clearly too wide for a firm estimate of ore reserves or for mining plans.

Oxide ore in the north deposit was above the sulphide ore, and would be the first material removed from an open pit. Whereas methods of concentrating sulphide ore are more or less standard, copper oxide requires special treatment and thus introduced an unknown factor into the ore reserve. The best method of treatment for this oxide ore, and of the copper recovery which such treatment would yield was not known in 1959; this problem is still difficult today.

The small zones of mixed oxides and chalcocite in the southern ore body show more irregularity, and more mixture of minerals. The same general statement made with respect to the oxides in the north ore body apply also to this zone. Treatment may be more difficult because of the intimate, and irregular, mixing of oxide and sulphide. In short, the two copper deposits, which were neither large, nor of exceptionally high grade, were clearly marginal ore bodies, compounded with relatively high ratios of stripping waste to mining ore, and in the case of the north ore body, complicated by an oxide zone of questionable value due to metallurgical treatment problems.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 19, 1968
4:45 p.m.

J. E. K.

JUN 20 1968

TO: T.A. Snedden
FROM: J. E. Kinnison

San Xavier Lands

I am nearly through the review of trial testimony,
but it will be too late to send out in this afternoons
mail. It can be sent out early tomorrow morning.

J.E. Kinnison

JEK:ir

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

June 19, 1968
4:45 p.m.

J.E.K.
JUN 20 1968

TO: T.A. Snedden
FROM: J. E. Kinnison

San Xavier Lands

I am nearly through the review of trial testimony,
but it will be too late to send out in this afternoons
mail. It can be sent out early tomorrow morning.

J.E. Kinnison

JEK:ir

9. Open pit copper deposits are mined by drilling, blasting loading and hauling the waste to waste dumps and the ore to milling plant or a concentrator. Pits are designed with benches generally 25 to 50 feet in depth. Equipment varies in size depending on the nature and size of the ore deposit. At present we are using 9 yard shovels, 85 ton trucks and mining with 40 foot benches at Mission Unit.
10. Milling consist of crushing from pit run of blasted material to about 3/4 inch size in two or three stages then grinding to fine mesh making a concentrate of the sulphide copper minerals that contain 25 to 30% copper by floating the sulphide minerals. This concentrate is then shipped to a smelter, to convert the sulphide concentrate to copper.
11. About 50 pounds of concentrate is made out of a ton of copper ore with the grade and character of ore being mined and milled at copper properties today.
12. The cost varies depending on the metallurgical characteristics of the ore but is generally over \$15,000 per ton of capacity that is a 20,000 ton plant would cost about \$30,000,000.
24. The results of the exploration on the acreage relinquished was negative and did not afford data on alteration or copper values that lead to finding any ore.

April 27, 1968

Direct Testimony by T. A. Snedden

1. Please give your name and address.

T. A. Snedden
6861 Mohu Place
Tucson, Arizona

2. What is your present position?

General Manager
United States Mining Department
American Smelting and Refining Co.

3. What was your position in 1959?

Manager
Southwestern Mining Department

4. What was your position in 1957?

The same as in 1959.
Manager, Southwestern Mining Department.

5. Please describe your background in the mining industry.

I graduated from high school in 1928 and from the mining ^{college} school of the University of California at Berkeley in 1933. For the next year I worked at various jobs connected with the mining industry and have been employed continuously by American Smelting and Refining Company since May, 1934. For several months in 1934 I worked as a miner and as a timberman on the underground crew at the Company's Ground Hog mine at Vanadium, New Mexico. In October of 1934 I was sent to Octave, Arizona, as an engineer where I spent the following five years successively as engineer, mine foreman, and acting superintendent. In September of 1939 I was sent to Patagonia, Arizona, as superintendent of their Trench Unit. In December of 1945 I was moved to New Mexico as superintendent of the Ground Hog Unit, and in December of 1951 I was moved back to Arizona to start their Silver Bell property where I again had the title of superintendent. In 1952 I was offered the job as manager of the Southwestern Department, which job I held until 1964, and was then given the job which I now have. I am a registered mining engineer with the State of Arizona, Registration No. 5269.

6. Has ASARCO engaged in extensive mineral exploration programs throughout the Southwest?

Yes

Direct Testimony by T. A. Snedden
Page Two

7. Of the areas of interest that are explored, does ASARCO expect as many as half of those areas explored to result in commercial ore deposits worth retaining and developing?

No. Nothing can be approached in exploration that is anywhere near a fifty-percent figure.

8. Of the acreage that is explored, does ASARCO expect as much as half of this acreage to be retained for development of ore deposits?

No. Nothing can be approached in exploration that is anywhere near a fifty-percent figure.

9. Please describe briefly the way porphyry copper is mined by the open pit method.

10. Please describe briefly the milling process for porphyry copper ore.

11. Approximately how many pounds of concentrate is obtained by milling a ton of porphyry copper ore?

12. What is the cost of constructing a plant for milling porphyry copper ore?

13. Did you participate in the decision by ASARCO to submit bids in 1957 for rights in the Indian lands in tracts 1, 2 and 3?

Yes, I did.

14. Please describe ASARCO's interest in the acreage encompassed in tracts 1 and 2 at the time the bids were submitted in 1957.

A. At that time we had general interest in all the acreage based on known ore bodies south of the Reservation with the possibility that those ore bodies would have northern or northwestern extensions into tract 2, and perhaps continuing to and beyond the outcroppings in tract 1 or that there might be separate ore bodies in the vicinity of these outcrops in tract 1. Also, there was an outcrop in southwestern part of tract 1.

B. Information available was not sufficient to make any significant distinction in one allotment over another in tract 1.

C. The same is true of tract 2 except it looked more interesting to us because of the probability of known ores south of the Reservation projecting into the Reservation.

15. Please describe ASARCO's interest in the acreage encompassed in tract 3 at the time the bids were submitted in 1957.

We had a general interest in this area but considered it to be less attractive than tracts 1 and 2.

16. Are you familiar with the factors that were taken into consideration in deciding the amount of the bids on tracts 1, 2 and 3? What were the main factors?

We were interested in these areas for mineral deposits and we had to guess how much our competitors would bid.

17. I hand you J.E. 2 (Prospecting Permit with option) and direct your attention to paragraph B1 thereof. Did ASARCO have anything to do with the drafting of that paragraph?

No.

18. At the time ASARCO prepared and submitted its bid in 1957, was ASARCO disturbed by the language in paragraph B1 which speaks in terms of a lease not to exceed 2,560 acres plus additional acreage necessary for a successful mining operation?

No.

19. Why not?

- A. That language is broad, and we thought its application would place no practical restriction on the acreage that we would want to lease. Our primary concern was acquiring rights in individual allotments. We signed up individual owners and paid the bonus so that we would have the right to lease the lands in his allotment. We wanted to be sure that we could lease the specific allotments on which we might discover ore.
- B. The overall general limitation of 2,560 acres did not bother us because the chances were that we would not discover enough ore to warrant a lease on any one tract of as much as 2,560 acres.
- C. On the other hand, we felt that if we did discover a large ore body, the Secretary would exercise his discretion fairly so as to add all the necessary acreage to make it a successful mining operation.

20. What were some of the possibilities that would have required the Secretary to exercise his discretion under the additional acreage provision of B1?

- A. If we had discovered an ore body covering some 2,000 acres, we would have had the right to lease all of it. In such a case we probably would have needed additional surface acreage, perhaps at least as much as 2,000 additional acres for waste disposal and plant construction. We would have asked the Secretary to approve inclusion under the lease of such acres over and above 2,560 acres. Under such circumstances, it would have been unreasonable for the Secretary to refuse to include the acreage necessary to successfully mine the ore.
- B. Another example is if we had discovered an ore body that covered some 4,000 acres of low-grade ore on a tract, and the quantity of ore of the entire 4,000 acres was necessary to make a successful mining operation, the Secretary would have increased the acreage to be covered by lease to include the entire ore body plus acreage for disposal of waste and construction of plant.

C. If we had discovered two separate ore bodies on a tract and neither was sufficient without the other to make a successful mining operation, the Secretary would have increased the acreage to be covered by lease to 3,000, 5,000, or whatever was necessary to successfully mine the ore.

(1) ASARCO's Silver Bell mine is an example of two separate ore bodies that, with a single plant, waste disposal area, and camp site, uses about 6,000 acres. Neither of these ore bodies could have been mined successfully without the other. At the time we started our Silver Bell operation, we had a combined reserve of about 32 million tons, about 20 million in one ore body and 12 million in the other.

D. If ASARCO had discovered an ore body with a large quantity of overburden, it would have required substantial additional acreage for waste disposal, the Secretary would have approved inclusion under lease of more than 2,560 acres to cover the acreage necessary to successfully mine the ore.

21. What factors did ASARCO take into account in deciding what acreage to relinquish?

We considered the cost of retaining acreage and the requirement of justifying the acreage that we retained.

22. What factors did ASARCO take into account in deciding what acreage to retain?

In retaining acreage we only considered the two ore bodies that were found with areas for plant and for disposing of waste from these respective ore bodies and a contiguous area so layed out that we could get from the Mission area through the Reservation to the mineralized ore area drilled on tract 1.

23. In your opinion, did the results of the exploration work on the acreage in each tract that was eventually relinquished assist in the discovery or delineation of the two ore bodies that were retained?

No.

24. Why not?

25. At the time it submitted its bids in 1957, did ASARCO consider the words "construction of improvements" in paragraph B1 of the permit to include or exclude a mill and related facilities?

We considered those words to include a mill and any other related facilities that were necessary for a successful mining operation.

26. Did ASARCO have a mill at its Mission property in 1957?

No.

27. When was a final decision made to build a mill on the Mission property?

July, 1959.

28. When did ASARCO start mining the ore on the Mission property?

Some ore was stockpiled during the preproduction stripping period, but actual mining of ore was not started until August, 1961.

29. Is ASARCO mining any ore on tracts 1 or 2 of the San Xavier properties?

Yes. We started mining ore in May, 1966, in what we call the North San Xavier ore body.

30. Is the ore from the North San Xavier ore body being run through the Mission mill?

No.

31. Why not?

We are mining oxidized, siliceous ore from the North San Xavier area and shipping it to our Hayden, Arizona, plant. Our Mission mill cannot process this type of ore.

32. In 1957 did it appear likely that ASARCO would construct a mill on the San Xavier lands?

No, but we had to have the flexibility of having sufficient acreage to permit the ore to be mined and milled independently of Mission.

33. Why?

A different milling process might be required, or there might be a conflict for time in mining the two properties, or we might even want to sell one of the properties.

34. How much bonus would ASARCO have paid for the right to prospect on each of the three tracts if the permits had contained no rights to lease?

Nothing.

35. Did ASARCO acquire the surface lease on the southern part of tract 3 by reason of having paid a bonus for the permit to lease and explore the lands in tract 3?

36. Did ASARCO have sufficient data by the close of 1959 to work up a design for an open pit operation on either the north ore body or the south ore body?

37. Would the preparation of such designs have been your responsibility?

38. If ASARCO had started developing the north ore body on the San Xavier Reservation in 1959, where would the ore have been milled?
39. What would have been the cost of constructing a suitable milling plant?

IN THE
UNITED STATES COURT OF CLAIMS

No. 443-65

*final (or nearly final)
draft of Stipulation
noncontested facts.*

AMERICAN SMELTING AND REFINING COMPANY--CONSOLIDATED, Plaintiff,

v.

THE UNITED STATES OF AMERICA, Defendant.

STIPULATION OF FACTS
(Filed April , 1968)

*Was Macy's review
ever entered as evidence?*

*att Geol Map of
Tr 1, 2, 3 1000' = 1"
J.E.K Memo Nov 10, 66
entered. Regional
Map not entered.*

The parties hereby stipulate:

1. The plaintiff is a corporation organized and existing under the laws of the State of New Jersey, and has its principal office at 120 Broadway, New York, New York.
2. The plaintiff's principal business is exploring for and mining, smelting, refining, and selling copper, silver, lead, zinc, and other minerals.
3. The plaintiff and its affiliated companies filed a consolidated Federal income tax return on the accrual basis for the calendar year 1959 and timely paid the income tax liability shown thereon (less two credits) in the amount of \$7,626,396.45. Thereafter, the Commissioner of Internal Revenue assessed a deficiency against the plaintiff in the amount of \$1,137,835.44 for 1959.
4. On or about December 2, 1964, the plaintiff paid the \$1,137,835.44 deficiency assessed for 1959, plus \$321,773.63 interest thereon.

5. The plaintiff timely filed a claim for refund in the amount of \$680,513.67 for 1959 and asserted therein that the Commissioner of Internal Revenue erroneously disallowed (a) a loss deduction in the amount of \$843,459.72, (b) a percentage depletion deduction in the amount of \$194,363.69, and (c) a legal expense deduction in the amount of \$6,543.29. The Commissioner of Internal Revenue disallowed the plaintiff's claim for refund for 1959 by statutory notice dated October 26, 1965.

6. The \$194,363.69 percentage depletion deduction issue and \$6,543.29 legal expense deduction issue have been settled administratively since the filing of the petition. The Commissioner of Internal Revenue had disallowed \$843,459.72 of the claimed loss deduction. During this proceeding, the defendant has increased the amount of the disallowed loss deduction to \$888,583.60 and has reduced the amount refunded to plaintiff under the depletion issue settlement by the resulting increase in tax and interest.

7. The plaintiff's claim for the loss deduction presents the question whether the amount deducted, or any part thereof, is deductible in 1959 under Section 165 of the 1954 Internal Revenue Code. The claim arises under the following circumstances.

(a) In April 1957, the United States Department of Interior, Papago Indian Agency, publicly solicited bids for the competitive sale of exclusive prospecting permits with

options to lease lands designated in 142 individually-owned allotments and 160 acres of tribal land located in San Xavier Papago Indian Reservation in Pima County, Arizona. A copy of the Notice of Sale is hereby made J.E. 1. For purposes of bidding and leasing, the Department of Interior divided such land into three "tracts". The lands described as "tracts" 1, 2, and 3 by trust patent had been allotted by the United States to individual Indians under the General Allotment Act of February 8, 1887, 24 Stat. 388 (25 U.S.C. Section 331, et seq.). Under 25 U.S.C., Section 396, the allottee (devisees or heirs) could lease the land designated in his allotment for mining purposes for any term of years as may be advisable by the Secretary of Interior. "Tract" 1 encompassed all the lands designated in 55 allotments plus 40 acres in allotment #176 and 160 acres in allotment #92. "Tract" 2 encompassed all the lands designated in 41 allotments, 160 acres of tribal land, 40 acres in allotment #176, 30 acres in allotment #92, 200 acres in allotment #86, and 40 acres in allotment #41. "Tract" 3 encompassed all the lands designated in 42 allotments plus 80 acres in allotment #86 and 240 acres in allotment #41.

(b) The plaintiff was the successful bidder on "tracts" 1, 2, and 3. The plaintiff paid bonuses totaling \$283,000 (which amounted to \$55.27 per acre) for prospecting and option rights in lands designated in allotments located in "tract" 1, which contained approximately 5,120 acres. The

plaintiff paid bonuses totaling \$757,002.04 (which amounted to \$146.05 per acre) for prospecting and option rights in lands designated in allotments and in the 160 acres of tribal land located in "tract" 2, which contained approximately 5,183 acres. The plaintiff paid bonuses totaling \$26,005 (which amounted to \$5.08 per acre) for prospecting and option rights in lands designated in allotments located in "tract" 3, which contained approximately 5,120 acres. The Prospecting Permits Exclusive with Options for "tracts" 1, 2, and 3 are hereby made Joint Exhibits 2, 3, and 4, respectively. The bonuses were paid by the plaintiff to the Bureau of Indian Affairs and delivered to the Superintendent of the Papago Agency at Sells, Arizona. In accordance with the Notice of Competitive Sale and applicable regulations, the bonuses were deposited and credited to the individual Indian money accounts of the Indian allottees and devisees and heirs of deceased allottees except for the bonus paid with respect to the 160 acres of tribal land which was deposited and credited to the tribal account. The individual Indian money accounts (hereafter referred to as IIM accounts) were internal accounts kept by the Bureau of Indian Affairs. While under the control of the Bureau of Indian Affairs, the IIM accounts belonged to the individual Indians, and they had the right to withdraw the funds from their accounts.

(c) While the Papago Indian Agency did not assume responsibility for obtaining the signatures of the Indian

allottees or devisees or heirs of deceased allottees, it fully cooperated with the plaintiff by supplying the names, and to the extent the Agency had such information, the locations of Indian allottees or devisees or heirs of deceased allottees, whose consent was necessary.

(d) The plaintiff acquired the prospecting and option rights under three contracts dated May 17, 1957, identical in form except for the names of the allottees and devisees and heirs of deceased allottees, the description of the lands, and the amounts payable. Under the terms of the contracts, the allottees and the devisees and heirs of deceased allottees were designated as the Indian owners. In each of the three contracts, the Indian allottees or devisees or heirs of deceased allottees authorized the Commissioner of Indian Affairs or his authorized representative to sign, execute, and deliver on their behalf Modified Form 5-154 mining leases. Under the terms of the leases, the Superintendent, Papago Indian Agency, acted "for and on behalf of the Indian landowners as shown on the ownership schedule".

(e) In order to obtain the prospecting and option rights on lands designated in an allotment, the plaintiff was required to employ attorneys to examine United States and other records to ascertain the name and location of the Indian allottees or devisees or heirs of deceased allottees and to spend months in locating and persuading them to sign the contract covering their land. The Indian Bureau assisted in this

regard. The attorneys' report and opinion letters on the ownership of the allotments are made J.E. 5. No prospecting and option rights could be obtained on the land designated in an allottee's or devisee's or heir's allotment unless he signed the contract granting such rights, except that the Papago Indian Agency signed for minors, incompetents, and undetermined or unlocated devisees or heirs of deceased allottees, and the Tribal Chairman of the San Xavier group of Papago Indians signed for the 160 acres of tribal land. No payments were to be made with respect to lands designated in allotments for which signatures could not be obtained.

(f) In return for granting the plaintiff the prospecting rights and option to lease, each allottee or devisee or heir of a deceased allottee of land designated in "tract" 1 was entitled to have his proportionate share of the bonus money credited to his IIM account in accordance with the Notice of Competitive Sale and the applicable regulations, at the rate of \$55.27 per acre. Similarly, each allottee or devisee or heir of a deceased allottee in "tract" 2 was entitled to have his proportionate share of the bonus money credited to his IIM account in accordance with the Notice of Competitive Sale and applicable regulations, at the rate of \$146.05 per acre. Similarly, each allottee or devisee or heir of a deceased allottee in "tract" 3 was entitled to have his proportionate share of bonus money credited to his IIM account in accordance with the Notice of Competitive Sale and the applicable regulations, at the rate of \$5.08 per acre.

(g) Under the terms of each of the contracts, the plaintiff could prospect on all the acreage designated in an allotment if it could obtain the signature of the Indian allottee or the devisees or the heirs of a deceased allottee. The plaintiff could lease all or any part of the lands designated in an individual allotment. However, under the terms of each of the contracts, the plaintiff could exercise its option to take preference mineral lease on not more than 2,560 acres in each "tract" and such additional acreage in each tract as the Secretary determined as fringe acreage necessary for a successful mining operation. The plaintiff could exercise its options without additional payment for the acreage leased.

(h) The plaintiff surveyed, mapped, and conducted geophysical examinations of the lands designated in the 142 allotments and the 160 acres of tribal land and on September 14, 1957, started its drill holes. Attached as J.E. 6 and made a part hereof is a map of "tracts" 1 and 2 showing the location of the land designated in each allotment and the 160 acres of tribal land, the names of the allottees, or the devisees or heirs of a deceased allottee, for each allotment, the location of the drill holes, and marked in red the location of the two ore bodies. Attached and made a part hereof as J.E. 7 is a map of "tract" 3 showing the location of the land designated in each allotment, the names of the allottees, or the devisees or heirs of a deceased allottee, and the location of the drill holes. The drill hole numbers on each map are in sequence of

the date of the commencement of the holes on each tract. Attached and made a part hereof as J.E. 8 is a schedule showing the number and the start and completion date of each drill hole in "tracts" 1, 2, and 3. Summary Logs of drill holes in "tracts" 1, 2, and 3 dated August 29, 1967, and September 5, 1967, are made J.E. 9. Two ore deposits located on the lands subsequently leased were found but not delineated by the initial drill holes made in September and October 1957. The two ore bodies were subsequently delineated by the plaintiff. These ore bodies are outlined in red on J.E. 6. No holes were drilled on lands designated in 107 allotments. Attached and made a part hereof as J.E. 10 is a schedule listing drill holes and the lands designated in allotments in which they were made. No additional ore bodies were discovered.

(1) In 1959, the plaintiff exercised its option rights under its contract and leased 560 acres of the lands designated in "tract" 1. The mining lease, dated August 31, 1959, covered lands designated in three complete allotments (240 acres) and 160 acres of lands designated in allotment #92, 80 acres of lands designated in allotment #121, and 80 acres of lands designated in allotment #123. Thereafter, all payments under the lease were to the Superintendent, Papago Agency, for credit to the IIM account of each Indian whose allotment covered acreage leased and none was for the account of the Indians whose allotment did not cover acreage leased.

(j) In 1959, the plaintiff exercised its option rights under its contract and leased 1,994.37 acres of the lands designated in "tract" 2. This lease, dated August 31, 1959, covered lands designated in 15 complete allotments (1,435.49 acres), the 160 acres of tribal land, the 80 acre balance of lands designated in allotment #92, 78.88 acres of lands designated in allotment #64, 40 acres of lands designated in allotment #176, and 200 acres of lands designated in allotment #86. Thereafter, all payments under the lease were to the Superintendent, Papago Agency, for credit to the IIM account of each Indian whose allotment covered acreage leased and none was for the account of the Indians whose allotment did not cover acreage leased. The mining leases are hereby made Joint Exhibits 11 and 12, respectively.

(k) In 1959, the plaintiff chose not to take any mineral lease in the land designated in "tract" 3.

(l) By exercising its options to lease, the plaintiff retained its mineral rights in lands designated in 19 complete allotments (1,915.49 acres), the 160 acres of tribal land, 80 acres of land designated in allotment #121, 80 acres of land designated in allotment #123, 40 acres of land designated in allotment #176, 78.88 acres of land designated in allotment #64, and 200 acres of land designated in allotment #86. After September 25, 1959, pursuant to the terms of the contracts, the plaintiff no longer had any right, title, or

interest in or to the lands (or any minerals therein) designated in 118 complete allotments (12,471.29 acres) and 40 acres of land designated in allotment #121, 80 acres of land designated in allotment #123, 40 acres of land designated in allotment #176, 157.34 acres of land designated in allotment #34, and 80 acres of land designated in allotment #36.

(m) As shown by the plaintiff's books and records, the plaintiff expended \$1,658,532.01 with respect to the lands in the three "tracts" prior to taking mining leases on 2,554.37 acres and the termination of its rights in the remaining lands. A schedule showing the bonus and exploration expenses and how they were allocated by the plaintiff is made J.E. 13. Of these costs, \$888,583.60 was allocated by the plaintiff to the lands it did not lease, which lands were designated in 118 allotments and parts of five allotments in which it terminated all of its rights in 1959. The following table sets forth the cost elements comprising the \$1,658,532.01 and the parts thereof allocated by the plaintiff to the acreage not leased.

	<u>Total Costs</u>	<u>Plaintiff's Allocation to Acreage Not Leased</u>
(1) Bonuses	\$1,066,007.04	\$743,766.60
(2) Other costs of acquiring prospecting permits and option rights	28,765.87	24,021.83
(3) Surveying and mapping	38,049.73	29,927.64
(4) Geophysical examination	41,339.10	31,652.85
(5) Miscellaneous costs of acquiring permits	227.25	190.20
(6) Direct drilling expense	353,085.29	42,726.70
(7) Indirect expense of drilling	128,183.36	18,297.78
(8) Mining lease costs	2,874.37	-0-
	<u>\$1,658,532.01</u>	<u>\$888,583.60</u>

(n) The amounts set forth above were reflected on the plaintiff's accounting books by "tracts" and not by individual allotments.

(o) The \$743,766.60 for bonuses (Item 1) was the amount obtained by the plaintiff by multiplying the acreage not leased in each of the "tracts" (4,560 acres in "tract" 1; 3,188.63 acres in "tract" 2; and 5,120 acres in "tract" 3) by a per-acre bonus payment for the prospecting and option rights on the lands in each of these "tracts" (\$55.27 per acre for "tract" 1; \$146.05 per acre for "tract" 2; and \$5.08 per acre for "tract" 3).

(p) The plaintiff's allocation to acreage not leased was determined for items 2, 3, 4, and 5 as follows: The total cost for each item for each "tract" was allocated on a per-acre basis to the acreage in each "tract". The number of acres not leased in each "tract" was then multiplied by the per-acre rate for each "tract".

(q) As shown by the books and records of the plaintiff, the direct drilling expense for the drill holes located on the lands not leased was \$42,726.70. The \$16,297.78 for indirect expense of drilling was determined by allocating the expense between lands leased and lands not leased on the same ratio as direct drilling expense.

(r) The plaintiff leased only part of the lands designated in each of the following allotments: #64, #86, #121, #123, and #176. The part of the bonus allocated by the plaintiff to

acreage not leased in those allotments was \$32,229.11. The direct drilling expense physically incurred on the acreage not leased in those allotments was \$5,625.87. The indirect drilling expense allocated by the plaintiff on the acreage not leased in those allotments was \$2,206.83. The other costs allocated by the plaintiff to the acreage not leased on those allotments was \$3,020.09.

(s) The plaintiff deducted the \$838,583.60 as a loss in 1959 under Section 165 of the Internal Revenue Code of 1954.

(t) The Commissioner of Internal Revenue disallowed \$843,459.72 of the foregoing deductions, and the defendant has, by offset, increased the amount of deductions disallowed to \$838,583.60.

(u) For the tax year 1959, the plaintiff did not make any election under Section 614 of the Internal Revenue Code to aggregate any of the lands in any of the allotments in any of the three "tracts". When it commenced development, the plaintiff, on its 1965 tax return, elected "to aggregate and treat as one property all of the operating mineral interests presently known to exist which comprise San Xavier North" (North ore body) and elected "to aggregate and treat as one property all of the operating mineral interests presently known to exist which comprise San Xavier South" (South ore body).

8. The parties agree that the amount of recovery, if any, is to be determined under Rule 47(c).

9.(a) On March 30, 1956, plaintiff's Chief Geologist, L. H. Hart, wrote the Bureau of Indian Affairs regarding plaintiff's application to lease for mineral purposes certain lands located on the San Xavier Indian Reservation. A copy of that letter is hereby made J.E. 14. A copy of the Bureau's letter in reply to J.E. 14 is hereby made J.E. 15. A copy of Mr. Hart's response to the Bureau's letter (J.E. 15) is hereby made J.E. 16.

(b) On May 23, 1956, Mr. Hart wrote plaintiff's manager regarding plaintiff's bid on the San Xavier Indian Reservation land. A copy of the letter is hereby made J.E. 17.

(c) On May 29, 1956, E. J. Utz, Commissioner, Bureau of Indian Affairs, wrote to plaintiff's T. A. Snedden regarding the San Xavier Indian Reservation. A copy of that letter is hereby made J.E. 18.

(d) On June 5, 1956, plaintiff's attorney transmitted to Harry Gilmore, Superintendent, Papago Indian Agency, its application for a prospecting permit with preference rights to a mining lease on lands located in the San Xavier Indian Reservation. A copy of that letter is hereby made J.E. 19(a), and a copy of the application is hereby made J.E. 19(b).

(e) On July 17, 1956, Mr. Hart wrote plaintiff's attorney regarding a meeting which he attended with Indian Bureau representatives. A copy of that letter is hereby made J.E. 20.

geophysicists

(f) In 1956 and 1957, J. W. Erwin and W. E. Saegart, geologists employed by plaintiff, prepared several analyses of the mineral possibilities of lands located in the San Xavier Indian Reservation. Copies of Mr. Erwin's and Mr. Saegart's reports dated October 6, 1956, August 23, 1957, September 11, 1957, October 17, 1957, and December 13, 1957, submitted to their supervisor are hereby made Joint Exhibits 21(a)-(e), respectively. A copy of the supervisor's letter dated December 19, 1957, to Mr. Hart transmitting the December 13, 1957, Erwin report is hereby made J.E. 21(f).

(g) On January 18, 1957, Mr. Hart conferred by telephone with David L. Caldwell of the Indian Bureau. A copy of the memorandum prepared by Mr. Hart for the company files regarding that conversation is hereby made J.E. 22.

(h) On February 25, 1957, Mr. Hart conferred by telephone with the Assistant Commissioner of the Indian Bureau, Mr. E. J. Utz. A copy of the memorandum prepared by Mr. Hart for the company files regarding that conversation is hereby made J.E. 23.

(i) On April 18, 1957, Mr. Hart wrote Mr. Utz regarding the terms of J.E. 1. A copy of that letter is hereby made J.E. 24(a). A copy of Mr. Utz' letter in reply is hereby made J.E. 24(b). A copy of Mr. Hart's response to Mr. Utz' letter is hereby made J.E. 24(c).

(j) On May 2, 1957, plaintiff's general counsel sent a memorandum to Mr. Hart regarding the latter's exchange of

correspondence with Mr. Utz. A copy of that memorandum is hereby made J.E. 25.

(k) On July 9, 1957, plaintiff's general counsel wrote the Bureau of Indian Affairs suggesting that the distribution of bonus payments to the allottees be delayed. A copy of that letter is hereby made J.E. 26.

(l) On September 13, 1957, the Area Director of the Indian Bureau wrote plaintiff and authorized it to enter upon the lands described in the permits. A copy of that letter is hereby made J.E. 27. *Foot 2 also added Sept 20 (tr 3) and Sept 23 (tr 1).*

(m) On January 8, 1958, plaintiff's general counsel wrote Mr. Utz to request confirmation that its exploration program was satisfactory to the Indian Bureau. A copy of that letter is hereby made J.E. 28(a). A copy of the Bureau reply dated February 7, 1958, is hereby made J.E. 28(b).

(n) On June 16, 1958, D. J. Pope, plaintiff's assistant to Vice President, wrote the Commissioner of the Indian Bureau to request a conference regarding its future activities with respect to the San Xavier Indian lands. A copy of that letter is hereby made J.E. 29(a). A copy of a memorandum prepared by plaintiff's general counsel summarizing the discussions had at conference which was held June 20, 1958, is hereby made J.E. 29(b).

(o) On September 3, 1958, the plaintiff's Manager wrote the Superintendent of the San Xavier Indian Reservation regarding a proposed mining lease. A copy of that letter is hereby made J.E. 30(a). A copy of the Superintendent's letter in reply dated October 21, 1958, is hereby made J.E. 30(b).

(p) A copy of the Superintendent's letter dated June 19, 1957, sent to the Indians who had not signed the prospecting permit with option to lease is hereby made J.E. 31.

(q) A copy of a memorandum by John Kinnison dated November 10, 1966, entitled Exploration Review San Xavier Indian Reservation, is hereby made J.E. 32.

/s/ Fred W. Peel
Fred W. Peel

Attorney for Plaintiff

Assistant Attorney General
Tax Division
Department of Justice

Registered Geologist (4822) State of Arizona

1958, Secretary, Ariz. Geol. Soc.

1962, Chairman, Mining Geol. Division,

Arizona Section A.I.M.E.

4. Present position with ASARCO:

Exploration geologist, Tucson Office,
Southwestern Exploration Department.

5. Position in 1957-1959:

Exploration Geologist, Southwestern Exploration Division of the Southwestern Mining Department.

6. *What were your duties as exploration geologist during 1957-1959?*
During the spring of 1957, I was assigned to review all

exploration in the Mission area, to maintain first-hand knowledge of new drill data, to clarify rock and ore distribution, and to interpret and synthesize ~~all~~ pertinent data. Due to proximity of San Xavier lands to Mission, I became familiar with the exploration possibilities there. When San Xavier drilling began, my assignment was expanded to include a review of all drill hole data and geophysical work on a current basis and to synthesize my interpretations for use by my superiors.

7. Briefly describe ASARCO's interest in the acreage included in tracts 1, 2, and 3.

There were several areas of interest to ASARCO:

- First* a. Prior to bidding, drilling at Mission had ~~developed~~ *suggested* a pattern of mineralization ~~to~~ *ward* the south boundary

of tracts ~~1 and~~ 2. The Mission copper ore deposit could be projected on a northerly or northwesterly course into tract 2.

Record

- b. There were two small mineralized outcrops in the west-central part of tract 1, ~~in allotments 121 and 122.~~

These outcrops, ~~of arkose and porphyry~~, had been mineralized and subsequently leached, creating a capping characteristic of the low-grade disseminated copper deposits generally known as the porphyry copper deposits. The ~~extent of this mineralized area was~~ *made*

that area and

the entire surrounding area ~~not known prior to bidding, but looked quite promising.~~

- c. *It was possible that* Whether areas a and b above were connected, *and might* ~~representing~~ *this* a single copper zone, ~~was a possibility, but could~~ not be predicted prior to bidding. The gap between was ~~necessarily~~ regarded as potentially ore bearing. ~~pending drill hole results.~~

- d. In the southwestern corner of tract 1, ~~in allotment 178,~~ an outcrop of arkose and igneous rock showed much diffused iron oxide. Some of the characteristics usually found with copper mineralization were lacking, and the worth of this area could be evaluated only by drilling. Nearby this outcrop, ~~in allotment 184~~ an abandoned water well had penetrated bedrock which, as shown by the drill cuttings, was slightly mineralized with small amounts of pyrite (iron sulphide).

The *the* geological factors relating to ~~these~~ four areas (a through d) created a general interest in exploring all of the

known existence of the Mission could allow substantial ore bodies to the south and the

acres in tracts 1 and 2. ^{However our information} ~~There was reason to~~
~~believe, prior to bids in 1957, that there were~~ ^{was too meager and}
~~indefinite to really say that~~
~~potentially large acreages in tracts 1 and 2 contained any~~
~~ore deposits. Whether there were any~~
~~that would be worth keeping because of their~~
~~mineral content. However, the exact location and size~~
~~and extent of these prospective mineralized~~
~~areas was unknown and could be determined only~~
~~by drilling.~~ ^{northerly of} The northwesterly trend of mineraliza- Sept 17
~~tion from Mission might not continue its course,~~
~~and giving due allowance for devia-~~
~~tion in trend and shape, for cross-trends, and~~
~~for satellitic deposits, all of these two tracts~~
~~were believed to have exploration potential.~~

ASARCO's interest in exploration of tract 3 was minimal for the following reasons:

- (1) Tract 3 is offset considerably to the east of the mineralized trend ^{northerly} ~~northerly~~ from Mission.
- (2) An aeromagnetic geophysical survey, together with one outcrop in tract 3, suggested that post-ore volcanics (lava) would cover a large part of this tract, and thus ^{hot rock} ~~pre-ore~~ rocks might be at great depth. ^{which might contain ore}
- (3) As a qualification ^{these} ~~to the~~ negative features listed in (1) and (2) above, it must be noted that there was a slight prospective value because tract 3 was nearby an area of large

The outcrops in tract 1 might lead to nothing

(Mission and Plan)

and significant copper mineralization.

Cross-trends from the ^{this} established copper zone, or separate, satellitic deposits were possible.

8. Briefly describe ASARCO's surveying and mapping of these lands in 1957.

~~Shortly after the acquisition of the San Xavier exploration permits,~~ An accurate survey of the lands in the three tracts was ^{made} ~~begun~~ ^{in 1957} by ASARCO. Survey was made using transit and chain, and tied in to a triangulation network. The surveying for the basic grid-work was finished prior to drilling in September, and served thereafter for the location of drill holes and for geophysical survey locations. All future survey points were referenced to this basic grid-work. The grid was tied to the Federal coordinate system for this area, so to facilitate ready reference to United States survey markers on the ground. During the course of surveying, section corners and the limits of tracts 1, 2, and 3 were located. All of the acreage in the Indian lands under mineral exploration permit were surveyed by this evenly distributed grid-work.

9. Briefly describe ASARCO's geophysical exploration on these lands in 1957-1958.

Three basic types of geophysical surveys were used by ASARCO in conjunction with other exploration on the San Xavier lands. These were as follows:

a. Magnetic.. The earth has a natural magnetic field, similar to the lines of magnetic field which circle around a magnet. Certain rocks or minerals near the outer surface of the earth cause deviation in the regular lines of magnetic field which would otherwise be present. Interpretations relative to rock type or mineralization can ^{Sometimes} therefore be made on the basis of magnetic measurements, ~~subject to the inherent degree of doubt which may exist in the interpretation thereof.~~ In practice, a sensitive instrument called a magnetometer, is placed at surveyed stations on the ground, and the magnetic intensity is read. Alternately, the magnetometer may be carried in an airplane and the instrument read at intervals as traverse is made across the ground at a fixed elevation. The result of these magnetic readings may be contoured, in a manner similar to that of topographic contours, and the resultant map is then seen as a series of lines denoting equal magnetic intensity, and thus forming either featureless magnetic plateaus, magnetic slopes, or magnetic hills, valleys, or depressions. The airborne magnetic surveys on the San Xavier lands were made prior to placing of bids in 1957, and are not included in the charges against these

*fractured
properties*
project.

Magnetometer surveys on the ground were used to verify the aerial magnetic readings, *by* and ultimately more reliance was placed in this aerial reading because of the lack of interference due to concentrations of magnetite in the sand and gravel which covers most of the reservation.

b. Gravity. The gravitational attraction of the earth

is subject to variation because of the proximity of formations with differing degrees of *gravitational* magnetic attraction, or because of the concentration of *heavy silicates* magnetite associated with mineralization. A sensitive instrument, the gravity meter, is placed at surveyed stations and the gravity field recorded. The individual measurements are then contoured on a similar manner as the magnetic readings.

c. Electromagnetic—generally *called* ~~abbreviated~~ *E.M.* Electro-magnetic methods of geophysical survey depend upon inducing an electric current into the ground, ~~by an electric generator coupled to a coil, and by receiving this induced electricity in the ground from another coil in the receiving set.~~ *at a* If a highly conductive source occurs between the transmitter and the receiver, the theoretical and uniform lines of electricity will be deflected, and these deflections may be measured

at the receiving station. Such concentrated conductor areas are water saturated faults, veins of sulfide minerals of significant size and continuity, or graphite coated faults. The E.M. work on the San Xavier lands was found ineffective in producing positive leads.

The ground magnetic surveys were run principally in the southern portion of tracts 1 and 2 adjacent to the south reservation boundary, occupying section 30, T16S, R13E, and sections 25 and 26, T16S, R12E. Adjacent to the north of these 3 sections, portions in the south part of sections 23 and 24, T16S, R13E were included. It became apparent that the aerial magnetic survey would be more useful to exploration than the ground magnetic survey, and work was accordingly stopped after the ground just enumerated had been covered.

The gravity surveys were distributed uniformly in all of tracts 1 and 2, ~~on a grid coordinated with the basic survey grid for the Indian lands.~~ In tract 3, a narrow strip along the west margin was included in this detailed survey area. Elsewhere in tract 3, gravity traverse lines, rather far apart, were run easterly ^{about} for one and one-half miles.

The E. M. surveys were made in tracts 1 and 2, along traverses extending north from the south line of the reservation for slightly over 2 miles.

10. Were any areas of interest developed by ASARCO's geophysics?

Yes, the following four areas of interest, shown on plaintiff's Exh. 1 ^{prepared by me} ~~attached hereto and made a part hereof~~,
[^] were developed by geophysics:

- a. G-2. This gravity high might have been caused by heavy silicates associated with mineralization.
- b. M-3. This magnetic high could have been interpreted as due to magnetite associated with mineralization, or to volcanic rock.
- c. M-⁵~~3~~. This magnetic low feature, in tract 3, was regarded as ^a possible area in which pre-mineral bedrock had been high when the volcanic lava had flowed over the surface, and thus would be an area in which the ^{volcanic} ~~cover~~ might be thin.
- d. M-6. This southeast trending magnetic high had a shape somewhat like the one designated M-1, ^{which was} ~~caused~~ by magnetite associated with mineralization. ^{Al-}ternately, this magnetic feature could have been caused by volcanic rock.
- e. A magnetic high, and a gravity high, labeled respectively M-1 and G-1 were thought to represent an area of mineralization with associated magnetite ^{and} ~~in~~ heavy silicate minerals. Such an occurrence was known elsewhere in the district. This area is directly along the probable extension of known ore previously drilled at Mission, and is consequently not listed here as a separate area of

interest. ~~It served as a confirming indication of the northwesterly extension of this zone.~~

- f. During the course of gravity surveys, a number of small anomalous highs were located, in the general area of the mineralized outcrops in tract 1. Because these are co-existent with a previously known area of interest due to the proximity of the outcrops, I have not included these as a separate area or areas.

11. Were any areas of interest eliminated by ASARCO's geophysics?

Yes, the following areas of interest were eliminated:

- a. Most of tract 3 appeared, on the basis of the aerial magnetic survey, ^{made in July 1956} to be underlain by an appreciable thickness of volcanic (lava).
- b. A significant thickness of volcanics was interpreted for the magnetic high M-2, based on the aerial magnetic survey.
- c. A considerable thickness of volcanics was predicted for the area designated M-4, a magnetic high, on the basis of ground and aerial magnetic coverage. A gravity low designated G-3, is roughly co-existent with M-4. This indicated the area ^{of G-3 and M-4,} trending through ~~this~~ part of tract 2 and ^{part} ~~portion~~ of tract 1, ^{had} ~~to have~~ steep boundaries and that volcanics and post-ore conglomerate ^{would} ~~to~~ extend to considerable depth.

where was this? →

- d. Interpretation based largely on gravity, and in part on aerial magnetic coverage, indicated that the general area extending north ^{of} ~~from~~ a linear gravity feature, designated G-4, ^{was underlain by} ~~to be made of~~ volcanics and conglomerate totaling 600 feet, and ^{also} further covered by approximately 200 feet of alluvium.

The areas described above were eliminated, ~~with qualification~~ ^{and drilling} on the basis of geophysical work. These areas were tested by deep drilling where the northerly to northwesterly trending zone of copper from Mission projected across them. Elsewhere, as in tract 3, knowledge of the post-ore sequence of conglomerate and lava flows, combined with magnetic results, essentially eliminated that region from consideration following a few wide-spaced drill holes.

12. Briefly describe ASARCO's drilling program on these lands.

ASARCO began its drilling program on the Indian lands in September 1957 with ^{three} ~~two~~ conventional diamond drills, and one ~~small~~ rotary drill. Additional drills were moved to the property as they became available at a later date. Samples of rotary cuttings were collected by ASARCO samplers, and all drill core was received at the site by ASARCO samplers.

Early drilling was designed with two objectives in mind.

Namely, to explore by wide spaced holes all of the area in the ^{northerly or} northwesterly projection through tracts

1 and 2, and concurrently, to explore the southern part of ^{tract 2} ~~allotment 130~~ and the ^{general area of the} ~~outcrops in allotments~~ ^{Tract 1.} ~~121 and 122~~, which, for convenience, I shall call ~~the two prime areas of interest~~.

These wide-spaced drill holes, termed "scout" holes, ^{new} would be sunk with a rotary ^{bit} ~~drill~~ to bedrock where a length of diamond ^{drill} ~~grill~~ core would be recovered, varying from a few feet up to perhaps 20 feet in total length of coring. From ^{this} ~~its~~ core the general nature of bedrock ^{was} ~~could be~~ determined; specifically, areas ^{new} ~~could be~~ separable into post-ore rock, mineralized rock, or unmineralized rock. ~~This~~ ^{deepened} information was obtained rapidly over a large area by this method of "scout" hole drilling. When significant mineralization was encountered, the hole was cased and ^{deepened} ~~a diamond drill, utilizing conventional practices, would~~ ^{was} ~~be placed upon the hole to deepen it~~.

Concurrently with the "scout" drilling, ~~conventional~~ diamond ^{general area of the outcrops} ~~Drills~~ were placed on the ^{two prime areas of} ~~interest~~ ^{in tract 1 and the southern area of tract 2.} The drill hole spacing and location near these ^{new} ~~prime~~ areas of interest ^{was} on a triangular grid, proportional and similar to the basic grid, but with closer spacing.

Drill holes were labeled by tract, and also sequentially in order of the day on which the hole was stated; thus, X-201 was in tract 2, and was the first drill hole commenced in tract 2.

The early "scout" holes generally proceeded in a uniform manner, but as drilling progressed, the location of new drill sites was determined largely by previous drill data. The exact sequential order, however, often depended upon the availability of drill rigs.

Geophysical areas of interest, and other outlying areas, were worked in to the overall exploration program in a manner which best fit the availability of drills.

13. What were the results of the early drilling operations?

Early drilling near what eventually was determined to be the southern ore body, as shown on JE 6, showed a ~~direct~~^{an} extension of the Mission copper deposit.

Early drilling near what eventually was determined to be the north ore body, as shown on JE 6, disclosed a mineralized zone of significant size, and demonstrated an enriched secondary chalcocite zone, partly oxidized, ~~with ore-grade copper values,~~ and streaks of ore-grade primary copper sulfide at greater depth.

14. Were the drilling operations helpful in confirming and eliminating areas of interest?

Yes, prior to placing of bids, there were four areas of interest based on geologic evidence, and subsequently four geophysical areas of interest were identified. Of these combined areas of interest,

John is to expand this to include sufficient drill holes to generally define the horizontal limits of the two ore bodies.

all but two were eliminated by drilling. The two areas of interest which were shown to be ore bodies, were two of the four pre-bid areas, namely, that area northerly from Mission in southern tract 2 and the area near the mineralized outcrops in the ~~east~~ central part of tract 1. ~~Those~~ ^{of} Those areas eliminated were done so on the basis of ~~positive~~ drilling results indicating lack of ore, or on the probable lack of ore coupled with excessive thicknesses of post-mineral cover formations.

In summary, I should note that for all of the eight areas of interest, direct penetration by drill holes was the only positive method to prove or disprove them. The three geological areas of interest northwest of Mission from which two ore bodies eventually were shown, were the strongest and most promising ore prospects. The geologic area of interest in the southwest part of tract 1, and the four geophysical anomalies, were ~~less~~ ^{promising} ~~secondary interest due to the degree of doubt in the interpretation thereof.~~ In the environment of the San Xavier lands, no amount of speculation based on either geological or geophysical grounds could take the place of a drill penetration into bedrock to indicate either the presence of ore, or lack of it.

15. What information did ASARCO get from the drilling on lands relinquished in 1959?

The principal information obtained by ASARCO from the areas which were eventually relinquished was as follows:

- a. The thickness of ^{sand, gravel} ~~alluvium~~ and other post-ore ^{cover} rocks, and ^{their} ~~the~~ distribution of same.
- b. The distribution of exceedingly slight mineralization.
- c. The distribution of pre-ore rocks which were not mineralized.

That data indicated that those areas did not contain sufficient mineral content to warrant further exploration or leasing. None of the data obtained from drilling in the areas eventually relinquished had any effect on either the ~~location and discovery~~, or ~~of~~ the definition of extent of those ^{ore} deposits on the lands which were eventually retained.

16. Did any of the exploration work on the lands relinquished have any effect on or contribute to locating or defining the ore bodies on the lands retained?

No.

17. Why not?

The general area of both the ore bodies which were eventually proved by drilling was ^{believed by us} ~~known~~ to have good potential prior to bidding in 1957. We intended to and did explore those areas ~~first~~. The ^{early} ~~initial~~ drill holes in September and October 1957 located ^{the} ore in what we ^{now} call the north and south ore bodies. ^{as 2nd pointed out earlier the data from} The drill holes placed within the lands leased defined the extent of those ^{two} ore bodies. ^{horizontal}

18. Briefly describe the geological data known by ASARCO when it made its decision in 1959 on what acreage to lease.

Both the northern and southern ore bodies were ~~relatively~~ low-grade disseminated copper deposits, of the general type known as the porphyry copper deposits. Individually, they exhibit different shapes and mineralogic characteristics. The essential points ^{were} ~~are~~ as follows:

- a. The north deposit is ^a partly oxidized, enriched secondary chalcocite zone. Beneath alluvium, a capping leached of copper value overlies the chalcocite zone, which is a roughly horizontal ^a tabular ~~body~~ body. The upper portion of this chalcocite zone has been changed by weathering, largely to copper oxide minerals, ^{while} ~~which~~ the lower portion is relatively ^{pure} ~~poor~~ chalcocite unaffected by weather^{ing} or oxidation. The interface between the oxide area ^{and} ~~in~~ the ^{pure} ~~poor~~ chalcocite below is ~~grad~~ ^A ~~itional~~, causing the copper oxide and chalcocite to be mixed within the transition zone. The mineralogy of the copper oxides was not known in 1959, nor was the quantity of chalcocite which remained in the oxide zone. Beneath the chalcocite zone, ore grade primary copper sulf^{ph}ides occur irregularly.
- b. The south deposit was divisible ^{in analysis} into three parts, two of which are shallow enough for open pit

mining and one of which is sufficiently deep that it would be mined if at all by underground methods. The main potential for open pit ore was disseminated primary copper sulfides, ^{PH} beneath 200 feet of alluvium. A thin zone of mixed copper oxides and chalcocite constituted a limited tonnage, to the west of this main zone. The third division was a deep (+800 feet) copper zone, ^{70 280} 50 to 100 feet ^{thick} deep, which appeared to be generally higher grade. The tonnage of this last division ^{probably} ~~no doubt~~ exceeded that of the open pit potential; however, it was cut only by five widely spaced drill holes, and the continuity and quality ^{could} ~~can~~ only be inferred.

c. The drill spacing at the end of 1959, in the south ore body was 288 feet. This spacing was inadequate for a firm ore reserve calculation considering the erratic nature of the copper ^{sulfides} ore which results in significant variations in grade ^{from hole to hole} in depth to ore, and in internal waste areas.

d. The drill spacing in 1959, for the north ore body, was 577 feet. This was clearly too wide for a firm estimate of ore reserves or for mining plans.

~~Drilling was also regarded as incomplete along the margins of the ore body.~~

Oxide ore in the north deposit was above the sulfide ore, ^{PH} and would be the first ore removed from an open pit.

Whereas methods of concentrating ~~the~~ ^{PH} sulfide ore ~~were an~~

more or less standard, and a ~~probable recovery~~ ^{rate?} could be ~~estimated~~, copper oxide ~~ore~~ requires special treatment and thus introduced an unknown factor into the ore reserve. The best method of treatment for ^{this} oxide ore, and of the copper recovery which such treatment would yield was not known in 1959; this problem is still difficult today.

The small zones of mixed oxides and chalcocite in the southern ore body shows more irregularity, and more mixture of minerals. The same general statement made with respect to the oxides in the north ore body apply also to this zone. ^{may} treatment ~~will~~ be more difficult because of the intimate, and irregular, mixing of oxide and sulfide. ^{or} In short, the two copper deposits which were neither large, nor of exceptionally high grade, were clearly marginal ore bodies, compounded with relatively high ratios of stripping waste to mining ore, and in the case of the north ore body, complicated by an oxide zone of questionable value due to metallurgical treatment problems.

exchange conclusions (points)

wait till after this exchange to give in narrative

exchange exhibits and stipulation
look at sudden complete exh.
Report & maps may be exh.

J. E. K.

APR 10 1968

Page 14 - No. 13 - specific on showing ore at early date
and delineating it by holes on the land retained

Note: Thinks Hart's letter will come up
on asking land N and W of Tract I as eventually
defined. Also probably his interest in zone projected
because of limited request of sections on east side
of Tract II.

April 16, 1968

Direct Testimony by T. A. Snedden

1. Please give your name and address.

T. A. Snedden
6861 Mohu Place
Tucson, Arizona

2. What is your present position?

General Manager
United States Mining Department
American Smelting and Refining Co.

3. What was your position in 1959?

Manager
Southwestern Mining Department

4. What was your position in 1957?

The same as in 1959.
Manager, Southwestern Mining Department.

5. Please describe your background in the mining industry.

I graduated from high school in 1928 and from the mining school of the University of California at Berkeley in 1933. For the next year I worked at various jobs connected with the mining industry and have been employed continuously by American Smelting and Refining Company since May, 1934. For several months in 1934 I worked as a miner and as a timberman on the underground crew at the Company's Ground Hog mine at Vanadium, New Mexico. In October of 1934 I was sent to Octave, Arizona, as an engineer where I spent the following five years successively as engineer, mine foreman, and acting superintendent. In September of 1939 I was sent to Patagonia, Arizona, as superintendent of their Trench Unit. In December of 1944 I was moved to New Mexico as superintendent of the Ground Hog Unit, and in December of 1951 I was moved back to Arizona to start their Silver Bell property where I again had the title of superintendent. In 1952 I was offered the job as manager of the Southwestern Department, which job I held until 1964, and was then given the job which I now have. I am a registered mining engineer with the State of Arizona, Registration No. 5269.

6. Has ASARCO engaged in extensive mineral exploration programs throughout the Southwest?

Yes

7. Of the areas of interest that are explored, does ASARCO expect as many as half of those areas explored to result in commercial ore deposits worth retaining and developing?

No. Nothing can be approached in exploration that is anywhere near a fifty-percent figure.

8. Prior to 1966 were expenditures on unsuccessful areas of exploration deducted as a loss by ASARCO or capitalized against the areas of interest which had ore deposits?

They were deducted as a loss.

9. Did you participate in the decision by ASARCO to submit bids in 1957 for rights in the Indian lands in tracts 1, 2 and 3?

Yes, I did.

10. Please describe ASARCO's interest in the acreage encompassed in tracts 1 and 2 at the time the bids were submitted in 1957.

A. At that time we had general interest in all the acreage based on known ore bodies south of the Reservation with the possibility that those ore bodies would have northern or northwestern extensions into tract 2, and perhaps continuing to the outcroppings in tract 1 or that there might be separate ore bodies in the vicinity of these outcrops in tract 1.

B. Information available was not sufficient to make any significant distinction in one allotment over another in either tract 1 or tract 2.

C. The reason for the differences in bids on tracts 1 and 2 was based largely on what we thought we would have to bid in order to outbid our competitors.

D. Tract 2 looked more interesting to us because of the probability of known ores south of the Reservation projecting into the Reservation.

11. Please describe ASARCO's interest in the acreage encompassed in tract 3 at the time the bids were submitted in 1957.

We had a general interest in this area but considered it to be less attractive than tracts 1 and 2.

12. Are you familiar with the factors that were taken into consideration in deciding the amount of the bids on tracts 1, 2 and 3? What were the main factors?

We were interested in these areas for mineral deposits and that we had to guess how much our competitors would bid.

13. I hand you J.E. 2 (Prospecting Permit with option) and direct your attention to paragraph B1 thereof. Did ASARCO have anything to do with the drafting of that paragraph?

No.

14. At the time ASARCO prepared and submitted its bid in 1957, was ASARCO disturbed by the language in paragraph B1 which speaks in terms of a lease not to exceed 2,560 acres plus additional acreage necessary for a successful mining operation?

No.

15. Why not?

- A. That language is broad, and we thought its application would place no practical restriction on the acreage that we would want to lease. Our primary concern was acquiring rights in individual allotments. We paid the bonus and signed up individual owners so that we would have the right to lease the lands in his allotment. We wanted to be sure that we could lease the specific allotments on which we might discover ore.
- B. The overall general limitation of 2,560 acres did not bother us because the chances were that we would not discover enough ore to warrant a lease on any one tract of as much as 2,560 acres.
- C. On the other hand, we felt that if we did discover a large ore body, the Secretary would exercise his discretion fairly so as to add all the necessary acreage to make it a successful mining operation.

16. What were some of the possibilities that would have required the Secretary to exercise his discretion under the additional acreage provision of B1?

- A. If we had discovered an ore body covering some 2,000 acres, we would have had the right to lease all of it. In such a case we probably would have needed additional surface acreage, perhaps at least as much as 2,000 additional acres for waste disposal and plant construction. We would have asked the Secretary to approve inclusion under the lease of such acres over and above 2,560 acres. Under such circumstances, it would have been unreasonable for the Secretary to refuse to include the acreage necessary to successfully mine the ore.
- B. Another example is if we had discovered an ore body that covered some 4,000 acres of low-grade ore on a tract, and the quantity of ore of the entire 4,000 acres was necessary to make a successful mining operation, the Secretary would have increased the acreage to be covered by lease to include the entire ore body plus acreage for disposal of waste and construction of plant.

16. C. If we had discovered two separate ore bodies on a tract and neither was sufficient without the other to make a successful mining operation, the Secretary would have increased the acreage to be covered by lease to 3,000, 5,000, or whatever was necessary to successfully mine the ore.

(1) ASARCO's Silver Bell mine is an example of two separate ore bodies that, with a single plant, waste disposal area, and camp site, uses about 6,000 acres. Neither of these ore bodies could have been mined successfully without the other. At the time we started our Silver Bell operation, we had a combined reserve of about 32 million tons, about 20 million in one ore body and 12 million in the other.

- D. If ASARCO had discovered an ore body with a large quantity of overburden, it would have required substantial additional acreage for waste disposal, the Secretary would have approved inclusion under lease of more than 2,560 acres to cover the acreage necessary to successfully mine the ore.

17. What factors did ASARCO take into account in deciding what acreage to relinquish?

We considered the cost of retaining acreage and the requirement of justifying the acreage that we retained.

18. In your opinion, did the results of the exploration work on the acreage in each tract that was eventually relinquished assist in the location of the two ore bodies that were retained?

No.

19. Why not?

In retaining acreage we only considered the two ore bodies that were found with areas for disposing of waste from these respective ore bodies and a contiguous area so layed out that we could get from the Mission area through the Reservation to the mineralized ore area drilled on tract 1.

20. At the time it submitted its bids in 1957, did ASARCO consider the words "construction of improvements" in paragraph B1 of the permit to include or exclude a mill and related facilities?

We considered those words to include a mill and any other related facilities that were necessary for a successful mining operation.

21. Did ASARCO have a mill at its Mission property in 1957?

No.

22. When was a final decision made to build a mill on the Mission property?

July, 1959.

23. When did ASARCO start mining the ore on the Mission property?

Some ore was stockpiled during the preproduction stripping period, but actual mining of ore was not started until August, 1961.

24. Is ASARCO mining any ore on tracts 1 or 2 of the San Xavier properties?

Yes. We started mining ore in May, 1966, in what we call the North San Xavier ore body.

25. Is the ore from the North San Xavier ore body being run through the Mission mill?

No.

26. Why not?

We are mining oxidized, siliceous ore from the North San Xavier area and shipping it to our Hayden, Arizona, plant. Our Mission mill can not process this type of ore.

27. In 1957 did it appear likely that ASARCO would construct a mill on the San Xavier lands?

No, but we had to have the flexibility of having sufficient acreage to permit the ore to be mined independently of Mission.

28. Why?

A different milling process might be required, or there might be a conflict for time in mining the two properties, or we might even want to sell one of the properties.

April 12, 1968

DIRECT TESTIMONY BY JOHN E. KINNISON

Background Information:

1. Address:

1263 W. La Osa Drive, Tucson, Arizona.

2. Education:

Pre-college, Texas and Arizona public schools.

B.S. Mining Engineering, University of Arizona.

Completed, July 1952.

Degree conferred May 1953.

M.S. Geology, University of Arizona.

Credits completed May 1954.

Degree conferred May 1958.

3. Publications and Professional Associations:

Publications

a. Bryant, D. L. and Kinnison, J. E., 1954, The Lower Cretaceous age of the Amole Arkose, Tucson Mountains, Ariz.; Abs., Bull., Geol. Soc. Am., Vol. 65, p. 1235.

b. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 49-57.

c. Kinnison, John E. and Courtright, J. H., 1959, Chaotic Breccias in the Tucson Mountains, Ariz., Guide Book for Field Trips No. 2, Ariz. Geol. Soc.

- d. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz. Abs., Bull., Geol. Soc. Am., Vol. 70, p. 1727.
- e. Kinnison, John E., 1959, Structure of the Saginaw Area, Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 146-51.
- f. Kinnison, John E., 1963, Probable Origin of Mission Copper Deposit, Ariz.; A.I.M.E. pre-print No. 63133.
- g. Kinnison, John E., 1966, The Mission Copper Deposit, Ariz.; in, the Wilson Volume, Geology of the Porphyry Copper Deposits, Southwestern North America, edited by S. R. Titley and C. L. Hicks, pp. 281-287.

Technical Papers Presented

- 1959 Geol. Soc. Am. Cordilleran Section, Annual meeting:
"Chaotic Breccias in the Tucson Mountains".
- 1961 A.I.M.E., Ariz. section, Mining Geol. Division, Annual meeting: "Geology of the Mission Copper Deposit, Arizona".
- 1963 Soc. of Min. Eng. of A.I.M.E., Annual meeting:
"Probable origin of the Mission Copper Deposit"; Member of panel discussion on "alteration features of porphyry copper deposits".

Professional Associations

- Member, Society of Economic Geologists.
- Member, Society of Mining Engineers, A.I.M.E.
- Member, Arizona Geological Society.

Registered Geologist (4822) State of Arizona

1958, Secretary, Ariz. Geol. Soc.

1962, Chairman, Mining Geol. Division,

Arizona Section A.I.M.E.

4. Present position with ASARCO:

Exploration geologist, Tucson Office,
Southwestern Exploration Department.

5. Position in 1957-1959:

Exploration Geologist, Southwestern Exploration Division of the Southwestern Mining Department.

6. During the spring of 1957, I was assigned to review all exploration in the Mission area, to maintain first-hand knowledge of new drill data, to clarify rock and ore distribution, and to interpret and synthesize all pertinent data. Due to proximity of San Xavier lands to Mission, I became familiar with the exploration possibilities there. When San Xavier drilling began, my assignment was expanded to include a review of all drill hole data and geophysical work on a current basis and to synthesize my interpretations for use by my superiors.

7. Briefly describe ASARCO's interest in the acreage included in tracts 1, 2, and 3.

There were several areas of interest to ASARCO:

a. Prior to bidding, drilling at Mission had developed a pattern of mineralization ^{close to and toward} up to the south boundary

of tracts ~~1 and~~ 2. The Mission copper ore deposit could be projected on a northerly or northwesterly course into tract 2.

- b. There were two small mineralized outcrops in the west-central part of tract 1, in allotments 121 and 122. These outcrops, of arkose and porphyry, had been mineralized and subsequently leached, creating a capping characteristic of the low-grade disseminated copper deposits generally known as the porphyry copper deposits. ~~The extent of this mineralized~~^{outcrop} area was ~~not known prior to bidding~~, but looked quite promising.
- c. ~~Whether areas~~^{It was possible that} a and b above were connected^{and} represented^M ing a single copper zone, ~~was a possibility~~^{this}, but ^{ascertained} could not be ~~predicted~~^{ascertained} prior to bidding. The gap between was necessarily regarded as potentially ore bearing pending drill hole results.
- d. In the southwestern corner of tract 1 in allotment 178, an outcrop of arkose and igneous rock showed much diffused iron oxide. Some of the characteristics usually found with copper mineralization were lacking, and the worth of this area could be evaluated only by drilling. Nearby this outcrop, in allotment 184, an abandoned water well had penetrated bedrock which, as shown by the drill cuttings, was slightly mineralized with small amounts of pyrite (iron sulphide).
- The geological factors relating to those four areas created a general interest in exploring all of the

acreage in tracts 1 and 2. There was reason to believe, prior to bids in 1957, that there were potentially large acreages in tracts 1 and 2 that would be worth keeping because of their mineral content. However, the exact location and extent of these prospective mineralized areas was unknown and could be determined only by drilling. The northwest trend of mineralization from Mission might not continue its course indefinitely, and giving due allowance for deviation in trend and shape, for cross-trends, and for satellitic deposits, all of these two tracts were believed to have exploration potential.

ASARCO's interest in exploration of tract 3 was minimal for the following reasons:

- (1) Tract 3 is offset considerably to the east ^{or northwesterly} of the mineralized trend northerly from Mission.
- (2) An aeromagnetic geophysical survey, together with one outcrop in tract 3, suggested that post-ore volcanics (lava) would cover a large part of this tract, and thus pre-ore rocks might be at great depth.
- (3) As a qualification to the negative features listed in (1) and (2) above, it must be noted that there was a slight prospective value because tract 3 was nearby an area of large

and significant copper mineralization.

Cross-trends from the established copper zone, or separate, satellitic deposits were possible.

8. Briefly describe ASARCO's surveying and mapping of these lands in 1957.

Shortly after the acquisition of the San Xavier exploration permits, an accurate survey of the lands in the three tracts was begun by ASARCO. Survey was made using transit and chain, and tied in to a triangulation network. The surveying for the basic grid-work was finished prior to drilling in September, and served thereafter for the location of drill holes and for geophysical survey locations. All future survey points were referenced to this basic grid-work. The grid was tied to the Federal coordinate system for this area, so to facilitate ready reference to United States survey markers on the ground. During the course of surveying, section corners and the limits of tracts 1, 2, and 3 were located. All of the acreage in the Indian lands under mineral exploration permit were surveyed by this evenly distributed grid-work.

9. Briefly describe ASARCO's geophysical exploration on these lands in 1957-1958.

Three basic types of geophysical surveys were used by ASARCO in conjunction with other exploration on the San Xavier lands. These were as follows:

a. Magnetic. The earth has a natural magnetic field, similar to the lines of magnetic field which circle around a magnet. Certain rocks or minerals near the outer surface of the earth cause deviation in the regular lines of magnetic field which would otherwise be present. Interpretations relative to rock type or mineralization can therefore be made on the basis of magnetic measurements, subject to the inherent degree of doubt which may exist in the interpretation thereof. In practice, a sensitive instrument called a magnetometer, is placed at surveyed stations on the ground, and the magnetic intensity is read. Alternately, the magnetometer may be carried in an airplane and the instrument read at intervals as traverse is made across the ground at a fixed elevation. The result of these magnetic readings may be contoured, in a manner similar to that of topographic contours, and the resultant map is then seen as a series of lines denoting equal magnetic intensity, and thus forming either featureless magnetic plateaus, magnetic slopes, or magnetic hills, valleys, or depressions. The airborne magnetic surveys on the San Xavier lands were made prior to placing of bids in 1957, and are not included in the charges against the

project. Magnetometer surveys on the ground were used to verify the aerial magnetic readings, and ultimately more reliance was placed in this aerial reading because of the lack of interference due to concentrations of magnetite in the sand and gravel which covers most of the reservation.

- b. Gravity. The gravitational attraction of the earth is subject to variation because of the proximity of formations with differing degrees of ^{gravitational} magnetic attraction, or because of the concentration of ^{heavy silicates} ~~magnetite~~ associated with mineralization. A sensitive instrument, the gravity meter, is placed at surveyed stations and the gravity field recorded. The individual measurements are then contoured on a similar manner as the magnetic readings.
- c. Electromagnetic-generally abbreviated E.M. Electromagnetic methods of geophysical survey depend upon inducing an electric current into the ground by an electric generator coupled to a coil, and by receiving this induced electricity in the ground from another coil in the receiving set. If a highly conductive source occurs between the transmitter and the receiver, the theoretical and uniform lines of electricity will be deflected, and these deflections may be measured

at the receiving station. Such concentrated conductor areas are water saturated faults, veins of sulfide minerals of significant size and continuity, or graphite coated faults. The E.M. work on the San Xavier lands was found ineffective in producing positive leads.

The ground magnetic surveys were run principally in the southern portion of tracts 1 and 2 adjacent to the south reservation boundary, occupying section 30, T16S, R13E, and sections 25 and 26, T16S, R12E. Adjacent to the north of these 3 sections, portions in the south part of sections 23 and 24, T16S, R13E were included. It became apparent that the aerial magnetic survey would be more useful to exploration than the ground magnetic survey, and work was accordingly stopped after the ground just enumerated had been covered.

The gravity surveys were distributed uniformly in all of tracts 1 and 2, on a grid coordinated with the basic survey grid for the Indian lands. In tract 3, a narrow strip along the west margin was included in this detailed survey area. Elsewhere in tract 3, gravity traverse lines, rather far apart, were run easterly for one and one-half miles.

The E. M. surveys were made in tracts 1 and 2, along traverses extending north from the south line of the reservation for slightly over 2 miles.

10. Were any areas of interest developed by ASARCO's geophysics?

Yes, the following four areas of interest, shown on plaintiff's Exh. 1 attached hereto and made a part hereof, were developed by geophysics:

- a. G-2. This gravity high might have been caused by heavy silicate associated with mineralization.
- b. M-3. This magnetic high could have been interpreted as due to magnetite associated with mineralization, or to volcanic rock.
- c. M-3. This magnetic low feature, in tract 3, was regarded as ^apossible area in which pre-mineral bed-rock had been high when the volcanic lava had flowed over the surface, and thus would be an area in which the cover might be thin.
- d. M-6. This southeast trending magnetic high had a shape somewhat like the one designated M-1, caused by magnetite associated with mineralization, Alternately, this magnetic feature could have been caused by volcanic rock.
- e. A magnetic high, and a gravity high, labeled respectively M-1 and G-1 were thought to represent an area of mineralization with associated magnetite in heavy silicate minerals. Such an occurrence was known elsewhere in the district. This area is directly along the probable extension of known ore previously drilled at Mission, and is consequently not listed here as a separate area of

interest. It served as a confirming indication of the northwesterly extension of this zone.

- f. During the course of gravity surveys, a number of small anomalous highs were located, in the general area of the mineralized outcrops in tract 1. Because these are co-existent with a previously known area of interest due to the proximity of the outcrops, I have not included these as a separate area or areas.

11. Were any areas of interest eliminated by ASARCO's geophysics?

Yes, the following areas of interest were eliminated:

- a. Most of tract 3 appeared, on the basis of the aerial magnetic survey, to be underlain by an appreciable thickness of volcanic (lava).
- b. A significant thickness of volcanics was interpreted for the magnetic high M-2, based on the aerial magnetic survey.
- c. A considerable thickness of volcanics was predicted for the area designated M-4, a magnetic high, on the basis of ground and aerial magnetic coverage. A gravity low designated G-3, is roughly co-existent with M-4. This indicated the area trending through this part of tract 2 and portion of tract 1 to have steep boundaries and that volcanics and post-ore conglomerate ^{might} extend to considerable depth.

- d. Interpretation based largely on gravity, and in part on aerial magnetic coverage, indicated that the general area extending north from a linear gravity feature, designated G-4, to be made of volcanics and conglomerate totaling 600 feet, and further covered by approximately 200 feet of alluvium.

The areas described above were eliminated, with qualification, on the basis of geophysical work. These areas were tested by deep drilling where the northerly to northwesterly trending zone of copper from Mission projected across them. Elsewhere, as in tract 3, knowledge of the post-ore sequence of conglomerate^t and lava flows, combined with magnetic results, essentially eliminated that region from consideration following a few wide-spaced drill holes.

12. Briefly describe ASARCO's drilling program on these lands.

ASARCO began its drilling program on the Indian lands in September 1957 with two conventional diamond drills and one ~~small~~ rotary drill. Additional drills were moved to the property as they became available at a later date. Samples of rotary cuttings were collected by ASARCO samplers, and all drill core was received at the site by ASARCO samplers.

Early drilling was designed with two objectives in mind. Namely, to explore by wide-spaced holes all of the area in the northwesterly projection through tracts

1 and 2, and concurrently, to explore the southern ^{(area near the) area} ~~part~~ ^{alternate} of allotment 130 and the outcrops[^] in allotments 121 and 122, which, for convenience, I shall call the two prime areas of interest.

These wide-spaced drill holes, termed "scout" holes, would be sunk with a rotary drill to bedrock where a length of diamond ^{drill} ~~grill~~ core would be recovered, varying from a few feet up to perhaps 20 feet in total length of coring. From ^{this} ~~its~~ core the general nature of bedrock could be determined; specifically, areas could be separable into post-ore rock, mineralized rock, or unmineralized rock. This information was obtained rapidly over a large area by this method of "scout" hole drilling. When significant mineralization was encountered, the hole was cased and a diamond drill, utilizing conventional practices, would be placed upon the hole to deepen it.

Concurrently with the "scout" drilling, conventional diamond drills were placed on the two prime areas of interest. The drill hole spacing and location near these prime areas of interest was on a triangular grid, proportional and similar to the basic grid, but with closer spacing.

Drill holes were labeled by tract, and also sequentially in order of the day on which the hole was stated; thus, X-201 was in tract 2, and was the first drill hole commenced in tract 2.

The early "scout" holes generally proceeded in a uniform manner, but as drilling progressed, the location of new drill sites was determined largely by previous drill data. The exact sequential order, however, often depended upon the availability of drill rigs.

Geophysical areas of interest, and other outlying areas, were worked in to the overall exploration program in a manner which best fit the availability of drills.

13. What were the results of the early drilling operations?

Early drilling near what eventually was determined to be the southern ore body, as shown on JE 6, showed a direct extension of the Mission copper deposit.

*specific
elimination*

Early drilling near what eventually was determined to be the north ore body, as shown on JE 6, disclosed a mineralized zone of significant size, and demonstrated an enriched secondary chalcocite zone, partly oxidized, with ore-grade copper values, and streaks of ore-grade primary copper sulfide at greater depth.

14. Were the drilling operations helpful in confirming and eliminating areas of interest?

Yes, prior to placing of bids, there were four areas of interest based on geologic evidence, and subsequently four geophysical areas of interest were identified. Of these combined areas of interest,

all but two were eliminated by drilling. The two areas of interest which were shown to be ore bodies, were two of the four pre-bid areas, namely, that area northerly from Mission in southern tract 2 and the area near the mineralized outcrops in the east-central part of tract 1. Those areas eliminated were done so on the basis of positive drilling results indicating lack of ore, or on the probable lack of ore coupled with excessive thicknesses of post-mineral cover formations.

In summary, I should note that for all of the eight areas of interest, direct penetration by drill holes was the only positive method to prove or disprove them. The three geological areas of interest northwest of Mission from which two ore bodies eventually were shown, were the strongest and most promising ore prospects. The geologic area of interest in the southwest part of tract 1, and the four geophysical anomalies, were of secondary interest due to the degree of doubt in the interpretation thereof. In the environment of the San Xavier lands, no amount of speculation based on either geological or geophysical grounds could take the place of a drill penetration into bedrock to indicate either the presence of ore, or lack of it.

15. What information did ASARCO get from the drilling on lands relinquished in 1959?

The principal information obtained by ASARCO from the areas which were eventually relinquished was as follows:

- a. The thickness of alluvium and other post-ore rocks, and the distribution of same.
- b. The distribution of exceedingly slight mineralization.
- c. The distribution of pre-ore rocks which were not mineralized.

That data indicated that those areas did not contain sufficient mineral content to warrant further exploration or leasing. None of the data obtained from drilling in the areas eventually relinquished had any effect on either the location and discovery, or of the definition of extent of those deposits on the lands which were eventually retained.

16. Did any of the exploration work on the lands relinquished have any effect on or contribute to locating or defining the ore bodies on the lands retained?

No.

17. Why not?

The general area of both the ore bodies which were eventually proved by drilling was known to have good potential prior to bidding in 1957. We intended to and did explore those areas first. The initial drill holes in September and October 1957 located ore in what we call the north and south ore bodies. The drill holes ^{which} placed ^{were placed} within the lands ^{eventually} leased defined the extent of those ore bodies.

18. Briefly describe the geological data known by ASARCO when it made its decision in 1959 on what acreage to lease.

Both the northern and southern ore bodies were relatively low grade disseminated copper deposits, of the general type known as the porphyry copper deposits. Individually, they exhibit different shapes and mineralogic characteristics. The essential points are as follows:

- a. The north deposit is ^apartly oxidized, enriched secondary chalcocite zone. Beneath alluvium, a capping leached of copper value overlies the chalcocite zone, which is a roughly horizontal ^{tabular}~~tubular~~(?) body. The upper portion of this chalcocite zone has been changed by weathering, largely to copper oxide minerals, ^{while} ~~which~~ the lower portion is relatively ^{pure}~~poor~~ chalcocite unaffected by weather ^{ing} or oxidation. The interface between the oxide area ^{and} ~~in~~ the ^{pure}~~poor~~ chalcocite below is ^{gradational}~~traditional~~, causing the copper oxide and chalcocite to be mixed within the transition zone. The mineralogy of the copper oxides was not known in 1959, nor was the quantity of chalcocite which remained in the oxide zone. Beneath the chalcocite zone, ore grade primary copper sulfides occur irregularly.
- b. The south deposit was divisible into three parts, two of which are shallow enough for open pit

mining and one of which is sufficiently deep that it would be mined if at all by underground methods. The main potential for open pit ore was disseminated primary copper sulfides, beneath 200 feet of alluvium. A thin zone of mixed copper oxides and chalcocite constitute a limited tonnage, to the west of this main zone. The third division was a deep (+800 feet) copper zone, ⁷⁰50 to ²⁰⁰100 feet ^{thick.} ~~deep, which appeared to be generally higher grade.~~ The tonnage of this last division ^{probably} ~~no doubt~~ exceeded that of the open pit potential; however, it was cut only by five widely spaced drill holes, and the continuity and quality can only be inferred.

- c. The drill spacing at the end of 1959, in the south ore body was 288 feet. This spacing was inadequate for a firm ore reserve calculation considering the erratic nature of the copper ore which results in significant variations in grade, in depth to ore, and in internal waste areas.
- d. The drill spacing in 1959, for the north ore body, was 577 feet. This was clearly too wide for a firm estimate of ore reserves or for mining plans. ~~drilling was also regarded as incomplete along the margins of the ore body.~~

Oxide ore in the north deposit was above the sulfide ore, and would be the first ore removed from an open pit. Whereas methods of concentrating ~~the~~ sulfide ore ^{are} ~~were~~

more or less standard, and a probable recovery could be estimated, copper oxide ore requires special treatment and thus introduced an unknown factor into the ore reserve. The best method of treatment for ^{this} oxide ore, and of the copper recovery which such treatment would yield was not known in 1959; this problem is still difficult today.

The small zones of mixed oxides and chalcocite in the southern ore body shows more irregularity, and more mixture of minerals. The same general statement made with respect to the oxides in the north ore body apply also to this zone. ^{may} Treatment ~~will~~ be more difficult because of the intimate, and irregular, mixing of oxide and sulfide. In short, the two copper deposits which were neither large, nor of exceptionally high grade, were clearly marginal ore bodies, compounded with relatively high ratios of stripping waste to mining ore, and in the case of the north ore body, complicated by an oxide zone of questionable value due to metallurgical treatment problems.

April 12, 1968

DIRECT TESTIMONY BY JOHN E. KINNISON

Background Information:

1. Address:

1263 W. La Osa Drive, Tucson, Arizona.

2. Education:

Pre-college, Texas and Arizona public schools.

B.S. Mining Engineering, University of Arizona.

Completed, July 1952.

Degree conferred May 1953.

M.S. Geology, University of Arizona.

Credits completed May 1954.

Degree conferred May 1958.

3. Publications and Professional Associations:

Publications

- a. Bryant, D. L. and Kinnison, J. E., 1954, The Lower Cretaceous age of the Amole Arkose, Tucson Mountains, Ariz.; Abs., Bull., Geol. Soc. Am., Vol. 65, p. 1235.
- b. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 49-57.
- c. Kinnison, John E. and Courtright, J. H., 1959, Chaotic Breccias in the Tucson Mountains, Ariz., Guide Book for Field Trips No. 2, Ariz. Geol. Soc.

- d. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz. Abs., Bull., Geol. Soc. Am., Vol. 70, p. 1727.
- e. Kinnison, John E., 1959, Structure of the Saginaw Area, Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 146-51.
- f. Kinnison, John E., 1963, Probable Origin of Mission Copper Deposit, Ariz.; A.I.M.E. pre-print No. 63133.
- g. Kinnison, John E., 1966, The Mission Copper Deposit, Ariz.; in, the Wilson Volume, Geology of the Porphyry Copper Deposits, Southwestern North America, edited by S. R. Titley and C. L. Hicks, pp. 281-287.

Technical Papers Presented

- 1959 Geol. Soc. Am. Cordilleran Section, Annual meeting:
"Chaotic Breccias in the Tucson Mountains".
- 1961 A.I.M.E., Ariz. section, Mining Geol. Division, Annual meeting: "Geology of the Mission Copper Deposit, Arizona".
- 1963 Soc. of Min. Eng. of A.I.M.E., Annual meeting:
"Probable origin of the Mission Copper Deposit"; Member of panel discussion on "alteration features of porphyry copper deposits".

Professional Associations

- Member, Society of Economic Geologists.
- Member, Society of Mining Engineers, A.I.M.E.
- Member, Arizona Geological Society.

Registered Geologist (4822) State of Arizona

1958, Secretary, Ariz. Geol. Soc.

1962, Chairman, Mining Geol. Division,

Arizona Section A.I.M.E.

4. Present position with ASARCO:

Exploration geologist, Tucson Office,
Southwestern Exploration Department.

5. Position in 1957-1959:

Exploration Geologist, Southwestern Exploration Division of the Southwestern Mining Department.

6. During the spring of 1957, I was assigned to review all exploration in the Mission area, to maintain first-hand knowledge of new drill data, to clarify rock and ore distribution, and to interpret and synthesize all pertinent data. Due to proximity of San Xavier lands to Mission, I became familiar with the exploration possibilities there. When San Xavier drilling began, my assignment was expanded to include a review of all drill hole data and geophysical work on a current basis and to synthesize my interpretations for use by my superiors.

7. Briefly describe ASARCO's interest in the acreage included in tracts 1, 2, and 3.

There were several areas of interest to ASARCO:

- a. Prior to bidding, drilling at Mission had developed a pattern of mineralization up to the south boundary

of tracts 1 and 2. The Mission copper ore deposit could be projected on a northerly or northwesterly course into tract 2.

- b. There were two small mineralized outcrops in the west-central part of tract 1, in allotments 121 and 122. These outcrops, of arkose and porphyry, had been mineralized and subsequently leached, creating a capping characteristic of the low-grade disseminated copper deposits generally known as the porphyry copper deposits. The extent of this mineralized area was not known prior to bidding, but looked quite promising.
 - c. Whether areas a and b above were connected, representing a single copper zone, was a possibility, but could not be predicted prior to bidding. The gap between was necessarily regarded as potentially ore bearing pending drill hole results.
 - d. In the southwestern corner of tract 1 in allotment 178, an outcrop of arkose and igneous rock showed much diffused iron oxide. Some of the characteristics usually found with copper mineralization were lacking, and the worth of this area could be evaluated only by drilling. Nearby this outcrop, in allotment 184, an abandoned water well had penetrated bedrock which, as shown by the drill cuttings, was slightly mineralized with small amounts of pyrite (iron sulphide).
- The geological factors relating to those four areas created a general interest in exploring all of the

acreage in tracts 1 and 2. There was reason to believe, prior to bids in 1957, that there were potentially large acreages in tracts 1 and 2 that would be worth keeping because of their mineral content. However, the exact location and extent of these prospective mineralized areas was unknown and could be determined only by drilling. The northwest trend of mineralization from Mission might not continue its course indefinitely, and giving due allowance for deviation in trend and shape, for cross-trends, and for satellitic deposits, all of these two tracts were believed to have exploration potential.

ASARCO's interest in exploration of tract 3 was minimal for the following reasons:

- (1) Tract 3 is offset considerably to the east of the mineralized trend northerly from Mission.
- (2) An aeromagnetic geophysical survey, together with one outcrop in tract 3, suggested that post-ore volcanics (lava) would cover a large part of this tract, and thus pre-ore rocks might be at great depth.
- (3) As a qualification to the negative features listed in (1) and (2) above, it must be noted that there was a slight prospective value because tract 3 was nearby an area of large

and significant copper mineralization.

Cross-trends from the established copper zone, or separate, satellitic deposits were possible.

8. Briefly describe ASARCO's surveying and mapping of these lands in 1957.

Shortly after the acquisition of the San Xavier exploration permits, an accurate survey of the lands in the three tracts was begun by ASARCO. Survey was made using transit and chain, and tied in to a triangulation network. The surveying for the basic grid-work was finished prior to drilling in September, and served thereafter for the location of drill holes and for geophysical survey locations. All future survey points were referenced to this basic grid-work. The grid was tied to the Federal coordinate system for this area, so to facilitate ready reference to United States survey markers on the ground. During the course of surveying, section corners and the limits of tracts 1, 2, and 3 were located. All of the acreage in the Indian lands under mineral exploration permit were surveyed by this evenly distributed grid-work.

9. Briefly describe ASARCO's geophysical exploration on these lands in 1957-1958.

Three basic types of geophysical surveys were used by ASARCO in conjunction with other exploration on the San Xavier lands. These were as follows:

a. Magnetic. The earth has a natural magnetic field, similar to the lines of magnetic field which circle around a magnet. Certain rocks or minerals near the outer surface of the earth cause deviation in the regular lines of magnetic field which would otherwise be present. Interpretations relative to rock type or mineralization can therefore be made on the basis of magnetic measurements, subject to the inherent degree of doubt which may exist in the interpretation thereof. In practice, a sensitive instrument called a magnetometer, is placed at surveyed stations on the ground, and the magnetic intensity is read. Alternately, the magnetometer may be carried in an airplane and the instrument read at intervals as traverse is made across the ground at a fixed elevation. The result of these magnetic readings may be contoured, in a manner similar to that of topographic contours, and the resultant map is then seen as a series of lines denoting equal magnetic intensity, and thus forming either featureless magnetic plateaus, magnetic slopes, or magnetic hills, valleys, or depressions. The airborne magnetic surveys on the San Xavier lands were made prior to placing of bids in 1957, and are not included in the charges against the

project. Magnetometer surveys on the ground were used to verify the aerial magnetic readings, and ultimately more reliance was placed in this aerial reading because of the lack of interference due to concentrations of magnetite in the sand and gravel which covers most of the reservation.

- b. Gravity. The gravitational attraction of the earth is subject to variation because of the proximity of formations with differing degrees of magnetic attraction, or because of the concentration of magnetite associated with mineralization. A sensitive instrument, the gravity meter, is placed at surveyed stations and the gravity field recorded. The individual measurements are then contoured on a similar manner as the magnetic readings.
- c. Electromagnetic—generally abbreviated E.M. Electromagnetic methods of geophysical survey depend upon inducing an electric current into the ground by an electric generator coupled to a coil, and by receiving this induced electricity in the ground from another coil in the receiving set. If a highly conductive source occurs between the transmitter and the receiver, the theoretical and uniform lines of electricity will be deflected, and these deflections may be measured

at the receiving station. Such concentrated conductor areas are water saturated faults, veins of sulfide minerals of significant size continuity, or graphite coated faults. The E.M. work on the San Xavier lands was found ineffective in producing positive leads.

The ground magnetic surveys were run principally in the southern portion of tracts 1 and 2 adjacent to the south reservation boundary, occupying section 30, T16S, R13E, and sections 25 and 26, T16S, R12E. Adjacent to the north of these 3 sections, portions in the southern part of sections 23 and 24, T16S, R13E were included. It became apparent that the aerial magnetic survey would be more useful to exploration than the ground magnetic survey, and work was accordingly stopped after the ground just enumerated had been covered.

The gravity surveys were distributed uniformly in all of tracts 1 and 2, on a grid coordinated with the basic survey grid for the Indian lands. In tract 3, a narrow strip along the west margin was included in this detailed survey area. Elsewhere in tract 3, gravity traverse lines, rather far apart, were run easterly for one and one-half miles.

The E. M. surveys were made in tracts 1 and 2, along traverses extending north from the south line of the reservation for slightly over 2 miles.

10. Were any areas of interest developed by ASARCO's geophysics?

Yes, the following four areas of interest, shown on plaintiff's Exh. 1 attached hereto and made a part hereof, were developed by geophysics:

- a. G-2. This gravity high might have been caused by heavy silicate associated with mineralization.
- b. M-3. This magnetic high could have been interpreted as due to magnetite associated with mineralization, or to volcanic rock.
- c. M-3. This magnetic low feature, in tract 3, was regarded as possible area in which pre-mineral bed-rock had been high when the volcanic lava had flowed over the surface, and thus would be an area in which the cover might be thin.
- d. M-6. This southeast trending magnetic high had a shape somewhat like the one designated M-1, caused by magnetite associated with mineralization, alternately this magnetic feature could have been caused by volcanic rock.
- e. A magnetic high, and a gravity high, labeled respectively M-1 and G-1 were thought to represent an area of mineralization with associated magnetite in heavy silicate minerals. Such an occurrence was known elsewhere in the district. This area is directly along the probable extension of known ore previously drilled at Mission, and is consequently not listed here as a separate area of

interest. It served as a confirming indication of the northwesterly extension of this zone.

- f. During the course of gravity surveys, a number of small anomalous highs were located, in the general area of the mineralized outcrops in tract 1. Because these are co-existent with a previously known area of interest due to the proximity of the outcrops, I have not included these as a separate area or areas.

11. Were any areas of interest eliminated by ASARCO's geophysics?

Yes, the following areas of interest were eliminated:

- a. Most of tract 3 appeared, on the basis of the aerial magnetic survey, to be underlain by an appreciable thickness of volcanic (lava).
- b. A significant thickness of volcanics was interpreted for the magnetic high M-2, based on the aerial magnetic survey.
- c. A considerable thickness of volcanics was predicted for the area designated M-4, a magnetic high, on the basis of ground and aerial magnetic coverage. A gravity low designated G-3, is roughly co-existent with M-4. This indicated the area trending through this part of tract 2 and portion of tract 1 to have steep boundaries and that volcanics and post-ore conglomerate to extend to considerable depth.

- d. Interpretation based largely on gravity, and in part on aerial magnetic coverage, indicated that the general area extending north from a linear gravity feature, designated G-4, to be made of volcanics and conglomerate totaling 600 feet, and further covered by approximately 200 feet of alluvium.

The areas described above were eliminated, with qualification on the basis of geophysical work. These areas were tested by deep drilling where the northerly to northwesterly trending zone of copper from Mission projected across them. Elsewhere, as in tract 3, knowledge of the post-ore sequence of conglomerance and lava flows, combined with magnetic results, essentially eliminated that region from consideration following a few wide-spaced drill holes.

12. Briefly describe ASARCO's drilling program on these lands.

ASARCO began its drilling program on the Indian lands in September 1957 with two conventional diamond drills and one small rotary drill. Additional drills were moved to the property as they became available at a later date. Samples of rotary cuttings were collected by ASARCO samplers, and all drill core was received at the site by ASARCO samplers.

Early drilling was designed with two objectives in mind. Namely, to explore by wide spaced holes all of the area in the northwesterly projection through tracts

1 and 2, and concurrently, to explore the southern part of allotment 130 and the outcrops in allotments 121 and 122, which, for convenience, I shall call the two prime areas of interest.

These wide-spaced drill holes, termed "scout" holes, would be sunk with a rotary drill to bedrock where a length of diamond grill core would be recovered, varying from a few feet up to perhaps 20 feet in total length of coring. From its core the general nature of bedrock could be determined; specifically, areas could be separable into post-ore rock, mineralized rock, or unmineralized rock. This information was obtained rapidly over a large area by this method of "scout" hole drilling. When significant mineralization was encountered, the hole was cased and a diamond drill, utilizing conventional practices, would be placed upon the hole to deepen it.

Concurrently with the "scout" drilling, conventional diamond drills were placed on the two prime areas of interest. The drill hole spacing and location near these prime areas of interest was on a triangular grid, proportional and similar to the basic grid, but with closer spacing.

Drill holes were labeled by tract, and also sequentially in order of the day on which the hole was stated; thus, X-201 was in tract 2, and was the first drill hole commenced in tract 2.

The early "scout" holes generally proceeded in a uniform manner, but as drilling progressed, the location of new drill sites was determined largely by previous drill data. The exact sequential order, however, often depended upon the availability of drill rigs.

Geophysical areas of interest, and other outlying areas, were worked in to the overall exploration program in a manner which best fit the availability of drills.

13. What were the results of the early drilling operations?

Early drilling near what eventually was determined to be the southern ore body, as shown on JE 6, showed a direct extension of the Mission copper deposit.

Early drilling near what eventually was determined to be the north ore body, as shown on JE 6, disclosed a mineralized zone of significant size, and demonstrated an enriched secondary chalcocite zone, partly oxidized, with ore-grade copper values, and streaks of ore-grade primary copper sulfide at greater depth.

14. Were the drilling operations helpful in confirming and eliminating areas of interest?

Yes, prior to placing of bids, there were four areas of interest based on geologic evidence, and subsequently four geophysical areas of interest were identified. Of these combined areas of interest,

all but two were eliminated by drilling. The two areas of interest which were shown to be ore bodies, were two of the four pre-bid areas, namely, that area northerly from Mission in southern tract 2 and the area near the mineralized outcrops in the east-central part of tract 1. Those areas eliminated were done so on the basis of positive drilling results indicating lack of ore, or on the probable lack of ore coupled with excessive thicknesses of post-mineral cover formations.

In summary, I should note that for all of the eight areas of interest, direct penetration by drill holes was the only positive method to prove or disprove them. The three geological areas of interest northwest of Mission from which two ore bodies eventually were shown, were the strongest and most promising ore prospects. The geologic area of interest in the southwest part of tract 1, and the four geophysical anomalies, were secondary interest due to the degree of doubt in the interpretation thereof. In the environment of the San Xavier lands, no amount of speculation based on either geological or geophysical grounds could take the place of a drill penetration into bedrock to indicate either the presence of ore, or lack of it.

15. What information did ASARCO get from the drilling on lands relinquished in 1959?

The principal information obtained by ASARCO from the areas which were eventually relinquished was as follows:

- a. The thickness of alluvium and other post-ore rocks, and the distribution of same.
- b. The distribution of exceedingly slight mineralization.
- c. The distribution of pre-ore rocks which were not mineralized.

That data indicated that those areas did not contain sufficient mineral content to warrant further exploration or leasing. None of the data obtained from drilling in the areas eventually relinquished had any effect on either the location and discovery, or of the definition of extent of those deposits on the lands which were eventually retained.

16. Did any of the exploration work on the lands relinquished have any effect on or contribute to locating or defining the ore bodies on the lands retained?

No.

17. Why not?

The general area of both the ore bodies which were eventually proved by drilling was known to have good potential prior to bidding in 1957. We intended to and did explore those areas first. The initial drill holes in September and October 1957 located ore in what we call the north and south ore bodies. The drill holes placed within the lands leased defined the extent of those ore bodies.

18. Briefly describe the geological data known by ASARCO when it made its decision in 1959 on what acreage to lease.

Both the northern and southern ore bodies were relatively low grade disseminate copper deposits, of the general type known as the porphyry copper deposits. Individually, they exhibit different shapes and mineralogic characteristics. The essential points are as follows:

- a. The north deposit is partly oxidized, enriched secondary chalcocite zone. Beneath alluvium, a capping leached of copper value overlies the chalcocite zone, which is a roughly horizontal tubular(?) body. The upper portion of this chalcocite zone has been changed by weathering, largely to copper oxide minerals, which the lower portion is relatively poor chalcocite unaffected by weather or oxidation. The interface between the oxide area in the poor chalcocite below is transitional, causing the copper oxide and chalcocite to be mixed within the transition zone. The mineralogy of the copper oxides was not known in 1959, nor was the quantity of chalcocite which remained in the oxide zone. Beneath the chalcocite zone, ore grade primary copper sulfides occur irregularly.
- b. The south deposit was divisible into three parts, two of which are shallow enough for open pit

mining and one of which is sufficiently deep that it would be mined if at all by underground methods. The main potential for open pit ore was disseminated primary copper sulfides, beneath 200 feet of alluvium. A thin zone of mixed copper oxides and chalcocite constitute a limited tonnage, to the west of this main zone. The third division was a deep (+800 feet) copper zone, 50 to 100 feet deep, which appeared to be generally higher grade. The tonnage of this last division no doubt exceeded that of the open pit potential; however, it was cut only by five widely spaced drill holes, and the continuity and quality can only be inferred.

- c. The drill spacing at the end of 1959, in the south ore body was 288 feet. This spacing was inadequate for a firm ore reserve calculation considering the erratic nature of the copper ore which results in significant variations in grade in depth to ore, and in internal waste areas.
- d. The drill spacing in 1959, for the north ore body, was 577 feet. This was clearly too wide for a firm estimate of ore reserves or for mining plans; drilling was also regarded as incomplete along the margins of the ore body.

Oxide ore in the north deposit was above the sulfide ore, and would be the first ore removed from an open pit.

Whereas methods of concentrating the sulfide ore were

more or less standard, and a probable recovery could be estimated, copper oxide ore requires special treatment and thus introduced an unknown factor into the ore reserve. The best method of treatment for oxide ore, and of the copper recovery which such treatment would yield was not known in 1959; this problem is still difficult today.

The small zones of mixed oxides and chalcocite in the southern ore body shows more irregularity, and more mixture of minerals. The same general statement made with respect to the oxides in the north ore body apply also to this zone. A treatment will be more difficult because of the intimate, and irregular, mixing of oxide and sulfide. In short, the two copper deposits which were neither large, nor of exceptionally high grade, were clearly marginal ore bodies, compounded with relatively high ratios of stripping waste to mining ore, and in the case of the north ore body, complicated by an oxide zone of questionable value due to metallurgical treatment problems.

DIRECT TESTIMONY BY JOHN E. KINNISON

April 3, 1968

1. Background information:

1. Address:

1263 W. La Osa Drive, Tucson, Arizona

2. Education:

Pre-college, Texas and Arizona public schools

B. S. Mining Engineering, University of Arizona

Completed, July 1952

Degree conferred May 1953

M. S. Geology, University of Arizona

Credits completed May 1954

Degree conferred May 1958

3. Publications and Professional Associations:

Publications

- a. Bryant, D. L. and Kinnison, J. E., 1954, The Lower Cretaceous age of the Amole Arkose, Tucson Mountains, Ariz.; Abs., Bull., Geol. Soc. Am., Vol. 65, p. 1235.
- b. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 49-57.
- c. Kinnison, John E. and Courtright, J. H., 1959, Chaotic Breccias in the Tucson Mountains, Ariz.; Guide Book for Field Trips No. 2, Ariz. Geol. Soc.
- d. Kinnison, John E., 1959, Chaotic Breccias in the Tucson Mountains, Ariz. Abs., Bull., Geol. Soc. Am., Vol. 70 p. 1727.
- e. Kinnison, John E., 1959, Structure of the Saginaw Area, Tucson Mountains, Ariz.; Ariz. Geol. Soc. Digest No. 2, pp. 146-51.
- f. Kinnison, John E., 1963, Probable Origin of Mission Copper Deposit, Ariz.; A.I.M.E. pre-print No. 63133.

April 3, 1968

- g. Kinnison, John E., 1966, The Mission Copper Deposit, Ariz.; in, the Wilson Volume, Geology of the Porphyry Copper Deposits, Southwestern North America, edited by S. R. Titley and C. L. Hicks, pp. 281-287.

Technical Papers Presented

- 1959 Geol Soc. Am. Cordilleran Section, Annual meeting:
"Chaotic Breccias in the Tucson Mountains".
- 1961 A.I.M.E., Ariz. section, Mining Geol. Division,
Annual meeting: "Geology of the Mission Copper
Deposit, Arizona".
- 1963 Soc. of Min. Eng. of A.I.M.E., Annual meeting:
"Probable origin of the Mission Copper Deposit";
Member of panel discussion on "alteration features
of porphyry copper deposits".

Professional Associations

Member, Society of Economic Geologists

Member, Society of Mining Engineers, A.I.M.E.

Member, Arizona Geological Society

Registered Geologist (4822) State of Arizona

1958, Secretary, Ariz. Geol. Soc.

1962, Chairman, Mining Geol. Division,

Arizona Section A.I.M.E.

4. Present position with Asarco:

Exploration geologist, Tucson Office,
Southwestern Exploration Department.

5. Position in 1957:

Exploration Geologist, Southwestern Exploration division of the
Southwestern Mining Department.

April 3, 1968

6. Position in 1959:

Exploration Geologist, Southwestern Exploration Division
of the Southwestern Mining Department.

7. During the spring of 1957 I was assigned to review all exploration in the Mission area, to maintain first hand knowledge of new drill data, to clarify rock and ore distribution, and to interpret and synthesize all pertinent data. Due to proximity of San Xavier lands to Mission, I became familiar with the exploration possibilities there. When San Xavier drilling began, my assignment was expanded to include a review of all drill hole data and geophysical work on a current basis and to synthesize my interpretations for use by my superiors in charge of San Xavier exploration. During the course of drilling I incorporated regional geologic studies, where applicable, into the correlation of rock formations on the San Xavier lands as they effected exploration.

8. My synthesis of geologic and geophysical work formed a background for my superiors in charge of San Xavier exploration. I was familiar with those elements which determined the lands to retain and the lands to relinquish in 1959, by means of direct discussion with my superiors, whose opinions on this subject were taken into consideration by Asarco management.

11-1 Prior to bidding, drilling at Mission had developed a pattern of mineralization up to the south boundary of tracts 1 and 2. Copper ore was known immediately south of tract 2. The general trend was northwesterly, and could be reasonably projected into the southern part of tract 2. Mineralized outcrops in the east-central part of tract 1 lie on this northwest projection from Mission.

April 3, 1968

11-2 There was good reason to believe, prior to bids in 1957, that there were potentially large acreages in tracts 1 and 2 that would be worth exploring and keeping. The exact location and extent of these prospective mineralized areas was unknown, however, and could be determined only by drilling.

11-3 Areas of interest:

1. The Mission copper ore deposit could reasonably be projected on a northerly or northwesterly course directly into the southern part of tract 2. Ore values were almost a certainty.
2. There are two small mineralized outcrops in the west-central part of tract 1, in allotments 121 and 122. These outcrops, of arkose and porphyry, have been mineralized and subsequently leached, creating a capping characteristic of the low-grade disseminated copper deposits generally known as the porphyry copper deposits. The extent of this mineralized area was not known prior to bidding, but it had a good prospective chance of containing a large copper ore deposit.
3. Whether areas 1 and 2 above were connected, representing a single copper zone, could not be predicted prior to bidding. The gap between was necessarily regarded as potentially ore bearing pending drill hole results.
4. In the southwestern corner of tract 1 in allotment 178, an outcrop of arkose and igneous rock showed much diffused iron oxide. Some of the characteristics usually found with copper mineralization are lacking, and the worth of this area could be evaluated only by drilling. Nearby this outcrop, in allotment 184, an abandoned water well had penetrated bedrock which, as shown by the drill cuttings, was slightly mineralized with

April 3, 1968

small amounts of pyrite (iron sulphide).

11-4 There was general interest in exploring all of the acreage in tracts 1 and 2. The northwest trend of mineralization from Mission might not continue its course indefinitely, and giving due allowance for deviation in trend and shape, for cross-trends, and for satellitic deposits, all of these two tracts were believed to have exploration potential.

11-5 Interest in exploration of tract 3 was minimal for the following reasons:

1. Tract 3 is offset considerably to the east of the mineralized trend northerly from Mission.
2. An aeromagnetic geophysical survey, together with one outcrop in tract 3, suggested that post-ore volcanics (lava) would cover a large part of this tract, and thus pre-ore rocks might be at great depth.
3. As a qualification to the negative features listed in 1, and 2 above, it must be noted that there was a slight prospective value because tract 3 was nearby an area of large and significant copper mineralization. Cross-trends from the established copper zone, or separate, satellitic deposits were possible.

April 3, 1968

III-1 Shortly after the acquisition of the San Xavier exploration permits, an accurate survey of tracts 1, 2 and 3 was begun. Survey was made using transit and chain, and tied in to a triangulation network. The surveying for the basic grid-work was finished prior to drilling in September, and served thereafter for the location of drill holes and for geophysical survey locations. All future survey points were referenced to this basic grid-work. The grid was tied to the Federal coordinate system for this area, so to facilitate ready reference to United States survey markers on the ground. During the course of surveying, section corners and the limits of tracts 1, 2 and 3 were located.

III-2 All of the acreage in the Indian lands under mineral exploration permit were surveyed by this evenly distributed grid-work.

IV-1 Three basic types of geophysical surveys were used in conjunction with exploration on the San Xavier lands. These are as follows:

- a. Magnetic. The earth has a natural magnetic field, similar to the lines of magnetic field which circle around a magnet. Certain rocks or minerals near the outer surface of the earth cause deviation in the regular lines of magnetic field which would otherwise be present. Interpretations relative to rock type or mineralization, can therefore be made on the basis of magnetic measurements, subject to the inherent degree of doubt which may exist in the interpretation thereof. In practice, a sensitive instrument, called a magnetometer, is placed at surveyed stations on the ground, and the magnetic intensity is read. Alternately, the magnetometer may be carried in an airplane and the instrument read at intervals as traverse is made across the ground at a fixed elevation. The result of these

April 3, 1968

magnetic readings may be contoured, in a manner similar to that of topographic countours, and the resultant map is then seen as a series of lines denoting equal magnetic intensity, and thus forming either featureless magnetic plateaus, magnetic slopes, or magnetic hills, valleys, or depressions. The airborne magnetic surveys on the San Xavier lands were made prior to placing of bids in 1957, and are not included in the charges against the project. Magnetometer surveys on the ground were used to verify the aerial magnetic readings, and ultimately more reliance was placed in this aerial reading because of the lack of interference due to concentrations of magnetite in the sand and gravel which covers most of the reservation. The ground magnetic survey was tied to the general survey grid.

- b. Gravity. The gravitational attraction of the earth is subject to variation because of the proximity of formations with differing degrees of magnetic attraction, or because of the concentration of magnetite associated with mineralization. A sensitive instrument, the gravity meter, is placed at surveyed stations and the gravity field recorded. The individual measurements are then contoured ⁱⁿ on a similar manner as the magnetic readings. The gravity survey was tied to the general survey grid.
- c. Electromagnetic-generally abbreviated E.M. Electromagnetic methods of geophysical survey depend upon inducing an electric current into the ground by an electric generator coupled to a coil, and by receiving this induced electricity in the ground from another coil in the receiving set. If a highly conductive source occurs between the transmitter and the receiver, the theoretical and uniform lines of electricity will be deflected, and ^{this} these deflection may be measured at the receiving station.

April 3, 1968

Such concentrated conductor areas are water saturated faults, veins of sulfide minerals of significant size and continuity, or graphite coated faults. The E.M. work on the San Xavier lands was found ineffective in producing positive leads, and on the other hand, did not lend itself to liming areas of less favorability for ore deposits. E.M. work was tied to the basic survey grid.

- IV-2. a. Ground magnetic surveys were run principally in the southern portion of tracts 1 and 2 adjacent to the south reservation boundary, occupying section 30, T16S, R13E, and section 25 and 26, T16S, R12E. Adjacent to the north of these 3 sections, portions in the south part of sections 23 and 24, T16S, R13E were included. It became apparent that the aerial magnetic survey would be more useful to exploration than the ground magnetic survey, and work was accordingly stopped after the ground just enumerated had been covered.
- b. Gravity surveys were distributed uniformly in all of tracts 1 and 2, on a grid coordinated with the basic survey grid for the Indian lands. In tract 3 a narrow strip along the west margin was included in this detailed survey area. Elsewhere in tract 3, gravity traverse lines, rather far apart, were run easterly for one and one-half miles.
- c. E.M. surveys were made in tracts 1 and 2, along traverses extending north from the south line of the reservation for slightly over 2 miles.

IV-3 The following four areas of interest were developed by geophysics, shown on EXH._____.

- a. G-2. This gravity high might have been caused by heavy silicate minerals ^

April 3, 1968

associated with mineralization.

- b. M-3. This magnetic high could have been interpreted as due to magnetite associated with mineralization, or to volcanic rock.
 - c. M-3. This magnetic low feature, in tract 3, was regarded as possible area in which pre-mineral bedrock had been high when the volcanic lava had flowed over the surface, and thus would be an area in which the cover might be thin.
 - d. M-6. This southeast trending magnetic high had a shape somewhat like the one designated M-1, caused by magnetite associated with mineralization. Alternately, this magnetic feature could have been caused by volcanic rock.
 - e. A magnetic high, and a gravity high, labeled respectively M-1 and G-1 were thought to represent an area of mineralization with associated magnetite in heavy silicate minerals. Such an occurrence was known elsewhere in the district. This area is directly along the probable extension of known ore previously drilled at Mission, and is consequently not listed here as a separate area of interest. It served as a confirming indication of the northwesterly extension of this zone.
 - f. During the course of gravity surveys, a number of small anomalous highs were located, in the general area of the mineralized outcrops in tract 1. Because these are co-existent with a previously known area of interest due to the proximity of the outcrops, I have not included these as a separate area or areas.
- IV-4 a. Most of tract 3 appeared, on the basis of the aerial magnetic survey, to be underlain by an appreciable thickness of volcanic (lava).

April 3, 1968

- b. A significant thickness of volcanics was interpreted for the magnetic high M-2, based on the aerial magnetic survey.
- c. A considerable thickness of volcanics was predicted for the area designated M-4, a magnetic high, on the basis of ground and aerial magnetic coverage. A gravity low designated G-3, is roughly co-existent with M-4. This indicated the area trending through this part of tract 2 and portion of tract 1 to have steep boundaries, and that volcanics and post-ore conglomerate ^{would} ~~to~~ extend to considerable depth.
- d. Interpretation based largely on gravity, and in part on aerial magnetic coverage, indicated that the general area extending north from a linear gravity feature, designated G-4, to be made of volcanics and conglomerate totaling 600 feet, and further covered by approximately 200 feet of alluvium.

The areas described above were eliminated, with qualification, on the basis of geophysical work. Where the northerly to northwesterly trending zone of copper from Mission projected across these areas ~~because~~, they were tested by deep drilling. Elsewhere, as in tract 3, knowledge of the post-ore sequence of conglomerate^{*} and lava flows, combined with magnetic results, essentially eliminated that region from consideration, following a few wide-spaced drill holes.

April 3, 1968

- V-1 1. a. Asarco began its drilling program on the Indian lands in September, 1957, with two conventional diamond drills and one small rotary drill. Additional drills were moved to the property as they became available at a later date.
- b. Samples of rotary cuttings were collected by Asarco samplers, and all drill core was received at the site by Asarco samplers.
- 2 a. To gain an adequate understanding of the general procedures used on the San Xavier exploration program, it is necessary to understand the basic concepts of exploration as applied to the San Xavier lands.
- b. Early drilling was designed with two objectives in mind. Namely, to explore by wide spaced holes all of the area ^{that} ~~as~~ ^{northwest} ~~is~~ was projected through tracts 1 and 2, and concurrently, to explore the two prime areas of interest as described in section ~~LL~~-3, this testimony, pre-bid areas 1 and 2.
- c. The basic drill grid for San Xavier was ~~in~~ an equilateral triangle, 2,000 feet high, with sides measuring 2309.8 feet. It was conceived that the northwesterly prolongation of the copper zone at Mission could be initially explored by drill holes on lines running westerly, spaced 2,000 feet apart in a northerly direction, and with ^dgrills placed uniformly ~~to~~ 2309 feet apart on the westerly lines. The initial survey of San Xavier land furnished the location points for this drill sites.
- d. These wide spaced drill holes, termed "scout" holes, would be sunk with a rotary drill to bedrock where a length of diamond ^dgrill core would be recovered, varying from a few feet up to perhaps 20 feet in total length of coring. From ^{this} ~~its~~

April 3, 1968

core the general nature of bedrock could be determined; specifically, areas could be separable into post-ore rock, mineralized rock, or unmineralized rock. This information was obtained rapidly over a large area by this method of "scout" hole drilling. When significant mineralization was encountered, the hole was cased and a diamond drill utilizing conventional practices, would be placed upon the hole to deepen it.

- e. Concurrently with the "scout" drilling, conventional diamond drills were placed on the two prime areas of interest. The drill hole spacing and location near these prime areas of interest was on a triangular grid, proportional and similar to the basic grid, but with closer spacing.
- f. Drill holes were labeled by tract, and also sequentially in order of the day on which the hole was started; thus, X-201 was in tract 2, and was the first hole to begin drilling.
- g. The early "scout" holes generally proceeded in a uniform manner, but as drilling progressed the location of new drill sites was determined largely by previous drill data. The exact sequential order, however, often depended upon the availability of drill rigs.
- h. Geophysical areas of interest, and other outlying areas, were worked in to the overall exploration program in a manner which best fit the availability of drills.

V-2 The two areas eventually determined to contain ore bodies, are described under Section II-3 this testimony, pre-bid areas 1 and 2. Refer to drill logs EXH___, for description of drill holes listed in the following.

April 3, 1968

Area 1. Early drilling near the southern ore body area showed a direct extension of the Mission copper deposit, with open pit mining depths.

- a. X-201 and X-202, started September 14, 1957, established continuity of the Mission mineralized zone. X-201 drilled mineralized arkose with traces of copper, on the east side of a fault projected from Mission; X-202 cut a significant intercept of ore-grade primary copper sulfide, on the west side of the projected fault. Additional early holes in altered limestone with primary copper sulfide ore sections: X-211, October 11, 1957; X-215, November 9, 1957.
- b. X-212 and X-213, October, drilled a thin secondary chalcocite zone partly oxidized, with ore-grade copper values. X-213 penetrated streaks of ore-grade primary copper sulfide intermittently to the total depth.
- c. "Scout" holes X-203, and X-204 established post-ore rock cover to the north, and "scout" hole X-109 established post-ore rock cover on the west.

Area 2. Early drilling near the north ore body disclosed a mineralized zone of significant size, and demonstrated an enriched secondary chalcocite zone, partly oxidized, with ore-grade copper values, and streaks of ore-grade primary copper sulfide at greater depth. Represents possible open pit ore.

- a. X-104 (October) demonstrated continuity of mineralization in depth and slight secondary chalcocite enrichment. X-113 (November) penetrated a secondary enrichment zone, and showed an increase in copper values, with depth in the primary sulfide zone. X-114 (November) penetrated an

April 3, 1968

ore-grade section of a secondary chalcocite zone. (Note X-114 is on the "Scout" hole grid. After finding mineralization, it was cased and deepened.)

Continuity in depth of strong mineralization was shown by the above 3 holes. The chalcocite zone was indicated in X-104 and X-113; a substantial secondary ore section was shown by X-114.

- b. "Scout" holes: X-206, X-208, X-209, east of (a) above, and X-101, on the south, are mineralized principally with iron sulfide, peripheral to the intensely mineralized holes of (a) above.
- c. "Scout" holes: X-102 (September) on the SW penetrated unmineralized rock. X-105 (October) to the NW found post-ore volcanic cover, probably thick.

V-3 a. Information obtained from the areas which were eventually relinquished was as follows:

- 1. The thickness of alluvium and other post-ore rocks, and the distribution of same.
- 2. The distribution of exceedingly slight mineralization.
- 3. The distribution of pre-ore rocks which were not mineralized.

In summation, the data that were obtained served to determine that exploration had been sufficiently complete in those areas which were eventually relinquished.

- b. Drilling in the areas eventually relinquished had no effect on either the location and discovery, or of the subsequent definition of extent of those ore deposits on the lands which were eventually retained.

V-4 a. Prior to placing of bids, there were four areas of interest based on geologic evidence, and subsequently during the

April 3, 1968

course of drilling, four geophysical areas of interest were identified.

- b. Of these combined areas of interest all but two were eliminated by drilling. The two areas of interest which were shown to be ore bodies, were two of the four pre-bid areas, namely, that area northerly from Mission in southern tract 2 and the area near the mineralized outcrops in the east-central part of tract 1.
- c. Those areas eliminated were done so on the basis of positive drilling results indicating lack of ore, or on the probable lack of ore coupled with excessive thicknesses of post-mineral cover formations.

In summary, I should note that for all of the eight areas of interest, direct penetration by drill holes was the only positive method to prove or disprove them. The three geological areas of interest northwest of Mission from which two ore bodies eventually were shown, were the strongest and most promising ore prospects. The geologic area of interest in the southwest part of tract 1, and the four geophysical anomalies, were ^{of} secondary interest due to the degree of doubt in the interpretation thereof. In the environment of the San Xavier lands, no amount of speculation based on either geological or geophysical grounds could take the place of a drill penetration into bedrock to indicate either the presence of ore, or lack of it.

April 3, 1968

VI The exploration work on the lands relinquished had no effect on, and did contribute to, locating and defining the ore bodies on the lands retained.

The following reasons apply:

1. The general area of both the ore bodies which were eventually proved by drilling was known in advance of bidding in 1957.
2. The south ore body was shown as an extension of the Mission deposit by holes X-202, X-211, and X-212 (refer drill logs, EXH__.) in September and October, 1957, and further measured and defined by drill holes placed with respect to those holes.
3. The north ore body was indicated by the mineralized outcrops in tract 1, was shown by hole X-104 (refer drill logs, EXH__.) in October 1957, and further demonstrated by X-113 which cut primary ore-grades, in November, 1957, and by X-114, in November 1957, which cut an ore-grade enriched zone of secondary sulfides. Drill holes which further measured and defined this ore body were located with respect to the outcrops and drill holes X-104, X-113, and X-114.
4. The early "scout" holes were located on a uniform spacing in a manner such as to straddle a northwest projection of mineralization as known at Mission. These holes, (see drill logs, EXH__.) which showed the general distribution of post-ore rock, unmineralized rock, or mineralized rock, did not proceed one after the other, leading into the ore bodies, but instead furnished information applicable to their individual area of influence.

April 3, 1968

VII 1. Both the northern and southern ore bodies are relatively low grade disseminated copper deposits, of the general type known as the porphyry copper deposits. Individually, they exhibit different shapes and mineralogic characteristics. The essential points are as follows:

- a. The north deposit is ^apartly oxidized, enriched secondary chalcocite zone. Beneath alluvium, a capping leached of copper value overlies the chalcocite zone, which is a roughly horizontal tabular body. The upper portion of this chalcocite zone has been changed by weathering, largely to copper oxide minerals, ^{while} ~~which~~ the lower portion is relatively ^{pure} ~~poor~~ chalcocite unaffected by weather or oxidation. The interface between the oxide area ^{and} ~~in~~ the ^{pure} ~~poor~~ chalcocite below is ^{gradational} ~~traditional~~, causing the copper oxide and chalcocite to be mixed within the transition zone. The mineralogy of the copper oxides was not known in 1959, nor was the quantity of chalcocite which remained in the oxide zone. Beneath the chalcocite zone, ore grade primary copper sulfides occur irregularly.
- b. The south deposit is divisible into three parts, two of which are shallow enough for open pit mining and one of which is sufficiently deep that it would be mined if at all by underground methods. The main potential for open pit ore is disseminated primary copper sulfides, beneath 200 feet of alluvium. A thin zone of mixed copper oxides and chalcocite constitute a limited tonnage, to the west of this main zone. The third division is a deep (+800 feet) copper zone, 50 to 100 feet ^{thick} ~~deep~~, which appears to be generally higher grade. The tonnage of this last division no doubt exceeds that of the open pit potential; however, it is cut only by five widely spaced

April 3, 1968

drill holes, and the continuity and quality can only be inferred.

- c. The drill spacing at the end of 1959, in the south ore body was 288 feet. This spacing is inadequate for a firm ore reserve calculation considering the erratic nature of the copper ore, which results in significant variations in grade in depth to ore, and in internal waste areas.
 - d. The drill spacing in 1959, for the north ore body was 577 feet. This is clearly too wide for a firm estimate of ore reserves or for mining plans; drilling is also regarded as incomplete along the margins of the ore body.
- 2-a. Oxide ore in the north deposit lies above the sulfide ore, and will be the first ore removed from an open pit. Whereas methods of concentrating the sulfide ore are more or less standard, and a probable recovery may be estimated, copper oxide ore requires special treatment and thus introduces an unknown factor into the ore reserve. The best method of treatment for ^{this} oxide ore, and of the copper recovery which such treatment would yield was not known in 1959; this problem is still questionable today and some of the oxide is planned for shipment as a ^{silica flux} ~~silic~~ of flocks to the smelter in Hayden, Arizona as an experiment in treatment.
- b. The small zones of mixed oxides and chalcocite in the southern ore body shows more irregularity, and more mixture of minerals. The same general statement made with respect to the oxides in the north ore body apply also to this zone. ^{The} ~~A~~ treatment will be more difficult because of the intimate, and irregular, mixing of oxide and sulfide.

April 3, 1968

3. Prior to placing bids in 1957, expectations based on geologic indications were ^{that} at least 1, and conceivably 2, ore bodies of sufficient size and grade to form individual economic units, if necessary, would be found. The prime areas of interest were good prospects, with every reason to believe that an equally good ore body would materialize. The result is ~~then~~ two copper deposits which are neither large, nor ~~of~~ exceptionally high grade. ^{marginal} They are clearly ~~large~~ ore bodies, compounded with relatively high ratios of stripping waste to mining ore, and in the case of the north ore body, complicated by an oxide zone of questionable value due to metallurgical treatment problems.

Outenay May 56
Dec 55

J. E. K.

MAR 25 1968

March 20, 1968

OUTLINE OF SUBJECTS FOR
TESTIMONY BY JOHN E. KINNISON

I. Background information.

1. Address.
2. Educational background.
3. Publications.
4. Present position with ASARCO.
5. Position in 1957.
6. Position in 1959.
- ~~7. Role in preliminary assessment of the Indian lands prior to submission of the bids in 1957.~~
7. Role in the exploration program 1957-1959.
8. Role in the choice of lands to retain and lands to relinquish in 1959.

II. Brief description of ASARCO's interest in the general San Xavier area in 1957 prior to submission of bids, including sections North and West of the "tracts" put up for bids.

Final out
about Feb means
here!

1. Had only minimal interest in "tract" 3.
2. Believed there was a general ^{extension} thrust of ore to Northwest of Mission.
3. Believed there were potentially large acreages in "tracts" 1 and 2 that would be worth ^{exploring &} keeping.
4. Briefly describe the different areas of interest known at that time (the more the better). ^{pre-bid}
5. Had general interest in all the acreage in "tracts" 1 and 2.

6. With respect to allotment #4, 86, 121, 123 and 176, it appeared in 1957 on the date of bid that the part of each of those allotments retained was no more valuable than the part abandoned.

III. Brief description of surveying and mapping.

1. Procedures followed. *Transit survey - ~~handwritten~~ ^{data from 1957}*
2. Acreage covered. *all evenly distributed grid*
3. Organization of the project by "tract". *Boundaries I, II, III ^{Surveyed} work charged accordingly*
4. Distribution of expenditures between acreage eventually retained and acreage eventually relinquished. *kept by Tracts ^{pro rated by acres}*
5. Relationship of work with respect to acreage eventually relinquished to the acreage eventually retained.

IV. Brief description of geophysical exploration in 1957.

1. Types of geophysical surveys.
11. Procedures followed. *Summary from book 10/11/66*
12. Acreage covered. *state facts - consider general? - how even*
13. Areas of interest. *Sag and oct "types"*

- a. identified. ① Total by method ② Location w/ numerical designation
- b. confirmed. ① All ② Direct drilling ③ reasonable drill project
- c. eliminated. hist by number *Leave till drilling sect*

1. Organization of the project by "tract". *Work segregated by tract ^{by tract} charged accordingly*
2. Distribution of expenditures between acreage eventually retained and acreage eventually relinquished.

6. At the time of the bids in 1957, ASARCO did not consider the part of allotment #4, 86, 121, 123 and 127 retained in 1959 to be more valuable than the part relinquished.

V. Brief description of the drilling program.

1. Procedures followed. *① Description of extent of explorative ^a _b ^{seam drilling} _{mining} ② availability of drills ③ ^{expenses} _{expenses} ^{trunk} _{trunk} ^{separately} _{separately}*
2. Organization of the drilling by "tract". *Expense, direct and indirect ^{according to tract}*

check on indirect exp. distribution ^{segregated by field supervisor acc to tract}

basis for conclusions in IV

How accurate - ?

Include w/ drilling Discuss

④ Areas of Eliminated

5. Oct [→] meeting procedure

none to 3.
check capital
costs w/ Van.

3. Description of drilling expenditures.

- a. direct. ^{Drill} Contractors cost plus 5% for samples, tools, Auster, insurance, etc.
- b. indirect. ^{Salaries, payroll labor - processing, Auster, insurance, etc.} ^{Geol., eng. supplies} ^{Drill hole data chart}

4. Summary of results of early drilling in areas eventually determined to have mineral deposits of ~~potential~~ ore grade. ^{Refer to logs}

check logs

5. Summary of results of drilling in areas eventually relinquished.

- a. information obtained. —
- b. effect on location of mineral deposits in areas retained.

separate sheet

6. Areas of interest.

- a. identified.
- b. confirmed.
- c. eliminated.

24 no-bid + geophysical (drill hole in needed in this case. Summary to be)

Discuss

Strong indirect through some ref to drive logs.

VI. Exploration work on the lands relinquished did not contribute to the location or definition of the ~~potential~~ ore bodies on the lands retained. Why?

VII. Brief description of geological information known in 1959 when decision was made between retaining and relinquishing acreage.

1. Description of ~~potential~~ ore bodies. ^{1959 summer}
2. Extent and effect of oxidized ores. ^{non spec. for treatment but special treatment (going to Hayden?)}
3. Overall results compared with expectations when the bids were placed in 1957. ^{marginal aspect of both ore bodies compared to expected ore bodies as size & grade to be an individual economic unit, & necessary.}

all VIII out

VIII. Miscellaneous.

1. We could minimize the significance of the 2,560 acre "limitation" contained in B.1 of the permit (p. 2) if substantially more acreage might have been "necessary for a successful mining operation". Is it feasible to prepare a simple computation to illustrate that as much as 5,000 acres (of low grade copper) would have been necessary for a successful mining operation? If so, please prepare one with a brief explanation.

V.P. Swallen

*T.P. Snodden**Discuss?*

2. On the basis of the information available when the bids were made in 1957, was a per acre basis the best basis for allocating the bonuses paid among the allotments in each "tract"?

T.P. Snodden

3. Was it conceivable that more than 2,560 acres might have been required under lease to make an open pit operation "commercial"? *yes*

no

4. In defining "ore" or "commercial ore", are royalties payable deducted? *yes*

- Value Minimal - 1, 2. Qualification 3.
- II-1
1. offset to east of mineral trend N to NW from Mission
 2. Aeronay ~~Basalt~~ cover & ~~Bas~~ volcanic outcrops
 3. Still had ~~slight~~ ^{slight} prospective value - general area of large Cu zone. Cross-trends or satellite zones possible.

II-1 Drilling at Mission developed pattern up to Tr 1 & 2 So line.

- II-2
- A. Project of Mission Cu deposit
- B. Mineralized outcrops ^{Central} Tr I
- A. Repeat statement
- B. Specific interests in II-4³
- C. Size of interests unknown but may be large

II-43

- C. S.W. Cor Tr I - outcrop mineralized?
- Water well ~~with~~ mineralized bedrock.

Question II-4 - OK - dimensions, trends, extent of mineralization unknown before drilling.

Value Allotment SW Corner (SW 1/2 sec 27) Tr I - granite etc.

out II-6

① Allotments same ^{OK} value - ② all essentially on N-NW trends, ④ Giving allowance for deviation in size, trend or cross trend.

③ Check on ^{extent} Tr 3 allot - possible exception

Allot 86 - south 1/2 - exception

- ① Mission Cu zone sharply limited on E side
 - ② Project NW thru SW Cor Allot 118
 - ③ Not reasonable to forecast almost swing or offset ~~along~~ ^{along} ~~satellite~~ through So line
- Allot 86

out

Allot 86 - cross trend or satellite deposit or possible either position.

- 5-(a) ① Depth of gravel ~~cover~~ & other post-ore cover. & distribution of same
② 2. distribution of fringe mineralization
③ 3. distribution of pre-ore rocks without mineralization.
- Summary that no more is needed

5-(b) No effect x-ray intense theoretical - but didn't happen

6 - Discuss - possible duplication of previous
II-4 & IV-3

March 27, 1968

T. A. SNEDDEN

Questions for Direct Examination

J. E. K.

MAR 27 1968

1. Please give your name and address.
2. What is your present position?
3. What was your position in 1957?
4. What was your position in 1959?
5. Please describe your background in the mining industry.

(Graduation to 1957)

6. Does ASARCO engage in extensive mineral exploration programs throughout the United States and many parts of the world? (Yes)
7. Of the areas of interest that are explored, can ASARCO expect as many as half of those areas explored to result in commercial ore deposits worth retaining and developing?

(No, nothing even approaching half)

8. Prior to 1966 were expenditures on unsuccessful areas of exploration deducted as a loss or capitalized against the areas of interest which have ore deposits?

(Deducted as a loss)

9. Did you participate in the decision by ASARCO to submit bids for the right to contract with the owners of the allotments on tracts 1, 2, and 3 for the right to prospect and lease for mining?
10. Please describe ASARCO's interest in the acreage encompassed in tracts 1 and 2 at the time the bids were submitted in 1957.

(General interest in all the acreage based on known ore bodies south of the Reservation, possibility of northern extension through tract 2 and perhaps tract 1, and out-croppings in tract 1. Information available was not sufficient to make any significant distinction in one allotment over another in either tracts 1 or 2. The reason for the differences in bids on tracts 1 and 2 was based largely on what ASARCO thought was necessary to outbid its competitors. Tract 2 also looked a little more attractive because of the probability that the known Mission ore body extended at ____ into tract 2.)

11. Please describe ASARCO's interest in the acreage encompassed in tract 3 at the time the bids were submitted in 1957.

(Slight general interest but not as attractive as tracts 1 and 2)

12. Are you familiar with the factors that were taken into consideration in deciding to submit bids and in deciding the amounts of those bids on tracts 1, 2 and 3?

13. Had ASARCO discussed with the Indian Bureau people the contents of paragraph B1 of the permit or have anything to do with the drafting of that paragraph?

(No)

14. At the time ASARCO prepared and submitted its bid in 1957, was ASARCO disturbed by the language in paragraph B1 of the permit which speaks in terms of a lease not to exceed 2,560 acres plus additional acreage necessary for a successful mining operation?

(No)

15. Why not?

- (1) Chances were that ASARCO would not discover enough ore to warrant a lease of as much as 2,560 acres on any one of the tracts.
- (2) On the other hand, if more ore were discovered than expected, it was believed that the Secretary would exercise his discretion fairly so as to add all the acreage necessary to make a successful mining operation.

For example, if 4,000 acres of low-grade ore were discovered on tract 1 and the quantity in the entire 4,000 acres was necessary to make a successful mining operation, the Secretary would have permitted a lease on 4,000 acres.

OR, if two separate ore bodies were discovered on a tract and neither was sufficient without the other to make a successful mining operation, the Secretary would have leased acreage in excess of 2,560 acres.

ASARCO's Silver Bell Mine is an example of two ore bodies using about 5,000 acres, neither of which could have been successfully mined without the other (tonnages).

Also, ASARCO could have discovered an ore body with substantial overburden which would have required substantially more than 2,560 acres because of the large waste disposal area that would have been necessary. In 1957, we did not know whether any deposits found on the Reservation would be mined as a separate operation, or in conjunction with the Mission Mine that we then had under consideration. The decision had not finally been made in 1957 to put the Mission Mine into production. The ore now being removed from the North ore

15. (continued)

body on the Reservation is not being run through the Mission mill but is being shipped to Hayden for use as fluxing ore.)

16. What factors did ASARCO take into account in deciding what acreage to relinquish?
17. How were the expenditures for bonuses and for exploration handled on the accounting records of ASARCO?
18. In your opinion, did the results of the exploration work on the acreage in each tract that was eventually relinquished assist in the location of the two ore bodies that were retained?
19. Was there a mill or other production facilities on the Mission property in 1959?
20. Did ASARCO finally obtain any surface rights to dump on the acreage in tract 3 as a result of the rights acquired through payment of the bonus bid on the acreage in tract 3?