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

The following file is part of the

James Doyle Sell Mining Collection

ACCESS STATEMENT

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

CONSTRAINTS STATEMENT

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

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

QUALITY STATEMENT

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

1) May 10, 1979. Drilling Thoughts.
2) June 6, 1979 Thought Reinterpretation
3) July 17, 1979 Future Drilling Thoughts
4) August 6, 1979 Accelerated Exploration Program (by FTG).
5) December 3, 1979 DCFROR, by RB Crist, et al.
6) July 29, 1981 Reevaluation of Vein Structure

ASARCO

Southwestern Exploration Division

May 10, 1979

TO: F. T. Graybeal

FROM: J. D. Sell

Drilling Thoughts
Superior East Project
Pinal County, Arizona

With the partial completion of drill hole A-11, it is strongly confirmed that a northeasterly striking shear zone with a northwesterly dip occurs in the A-8, -9, -10, -11 block of ground and probably extends under hole A-2. This quartz-sulfide vein (qsv) zone contains stringers of bornite with a width of over 400 feet and values above one percent copper.

Figure One is a revision of a map in the May 30, 1978 Interim Report and shows the contours of the hanging wall of the qsv system with the trace of the base of oxidation also shown. Holes penetrating the system south and east of the oxidation line will penetrate oxidized vein material for a variable depth. Thus to fully test the qsv system it is desirable to intercept the zone below the limit of oxidation.

In the forthcoming budget it is recommended that we directional drill (using a Dyna-drill or a Navi-drill) out of the bottom of the NX portion of hole A-11. One orientation would be easterly to check the further extent of the system to the northeast and another oriented southerly toward hole A-9 to secure a full and complete intercept across the qsv zone. The Dyna-drill use will provide up-to-date figures on the cost and use of directional drilling equipment.

In a line north of A-8 and A-10, several drill intercepts should be considered. North of A-8 the hole should be oriented so as to intercept the qsv system between A-8 and A-9, and would cut the system at about the same level as cut in A-8 (i.e., 500 feet above sea level). The hole could be moved somewhat to the north to achieve a deeper level of penetration. The hole north of A-10 is scheduled to fully test the qsv system in this area. As remembered, the qsv system at the intercept level of A-10 was cut out by the basal fault trend as well as being oxidized, thus only the lower portion of the sulfide system was recovered by the drill hole.

The prospective drill holes of this line are shown in Figure One and would require a new drill road from the saddle between A-9 and A-8. The road (and site) could be moved northward for the eastern hole in order to gain a better angle on the qsv structure by means of an oriented wedge near the bottom of the NX portion or in the upper portion of the BX size. The western site will require a road extension continuing from the eastern hole or one coming from the A-10 site across the canyon. Likewise, the western hole could be moved northward somewhat and wedged just above the qsv zone so as to gain a better angle on the system. These holes could be drilled by coring from the surface as in the past holes or perhaps using a rotary to drill down 2500-3000 feet prior to coring.

If favorable cost figures and usage factors are gained from the projected A-11 Dyna-drill tests, then an alternative to the two conventional holes would be the use of a directional drill system out of the old A-2 hole. A-2 has 7" casing from surface to 1863 feet and 4" casing from surface to 4019 feet. The hole is undoubtedly suitable for reentry. (Also lost in the hole are NX rods and corebarrel in open hole from 4122 feet to 4940 feet T.D.)

Figure Two shows several configurations out of A-2 and into the qsv structure around A-8. The initial NC wedge would be placed within the 4" casing and a hole milled through the side of the casing and into the outlying rock unit. A Dyna-drill type directional tool would be used to establish a tangential arc. Spot surveys show A-2 to be drifting to the south and presents an excellent drill base potential. Both examples A and B of Figure Two show 1000 feet of directional drilling followed by 1500-1800 feet of conventional diamond core drilling. The lower hole has less distance to drill, but will penetrate the zone a substantial (1200-1300 feet) distance below the intercept A-8 as shown. A confirmation of the A-10 area could also be made from the A-2 site and if as shown on the plan, the hole would be some 300 feet shorter for the same type intercept levels as in A-8 area. All holes from A-2 site would be in the overall 5500-6000 foot range when completed.

A further alternative is to build a single site on top of the ridge north of A-8 and A-10 as at site "C" of Figure One. As shown on Figure Two, this site "C" would be a large rotary hole to 3000 feet with 4" casing set. From this single hole a series of holes could be drilled: a) the conventional core drill for a deep vertical intercept test, or b) using a combination Dyna-drill (500 feet) and conventional core drilling (1500 feet) to make a higher level intercept. Multiple Dyna-drill orientations could secure penetrations toward A-10, A-8, and easterly toward A-9.

Holes from A-2 site would be more advantageous in penetrating additional disseminated mineralization above the hanging wall of the qsv zone as well as having a good intercept angle across the qsv zone. Only two holes have penetrated the disseminated mineralization; these being hole A-2 where 620 feet of 0.31% copper was cut prior to the hole being lost and hole A-11 where 291 feet of 0.40% copper was cut prior to going into the qsv zone.

The deeper holes with directional controlled turns of significant length will probably be accomplished easier with a Joy 36 or CP-50 class of drill rig for torque-power. (Conversation with Jack Lloyd suggests he is quite pleased with the performance of the heavy duty Joy 22 with NX as used at Red Mountain for Dyna-drill use.)

Revamping of the Devils Canyon access road is badly needed to handle not only the possible larger rotary and diamond drill machines and service units, but is also needed for daily wear and tear on drillers'-supervisors' anxiety during adverse weather.

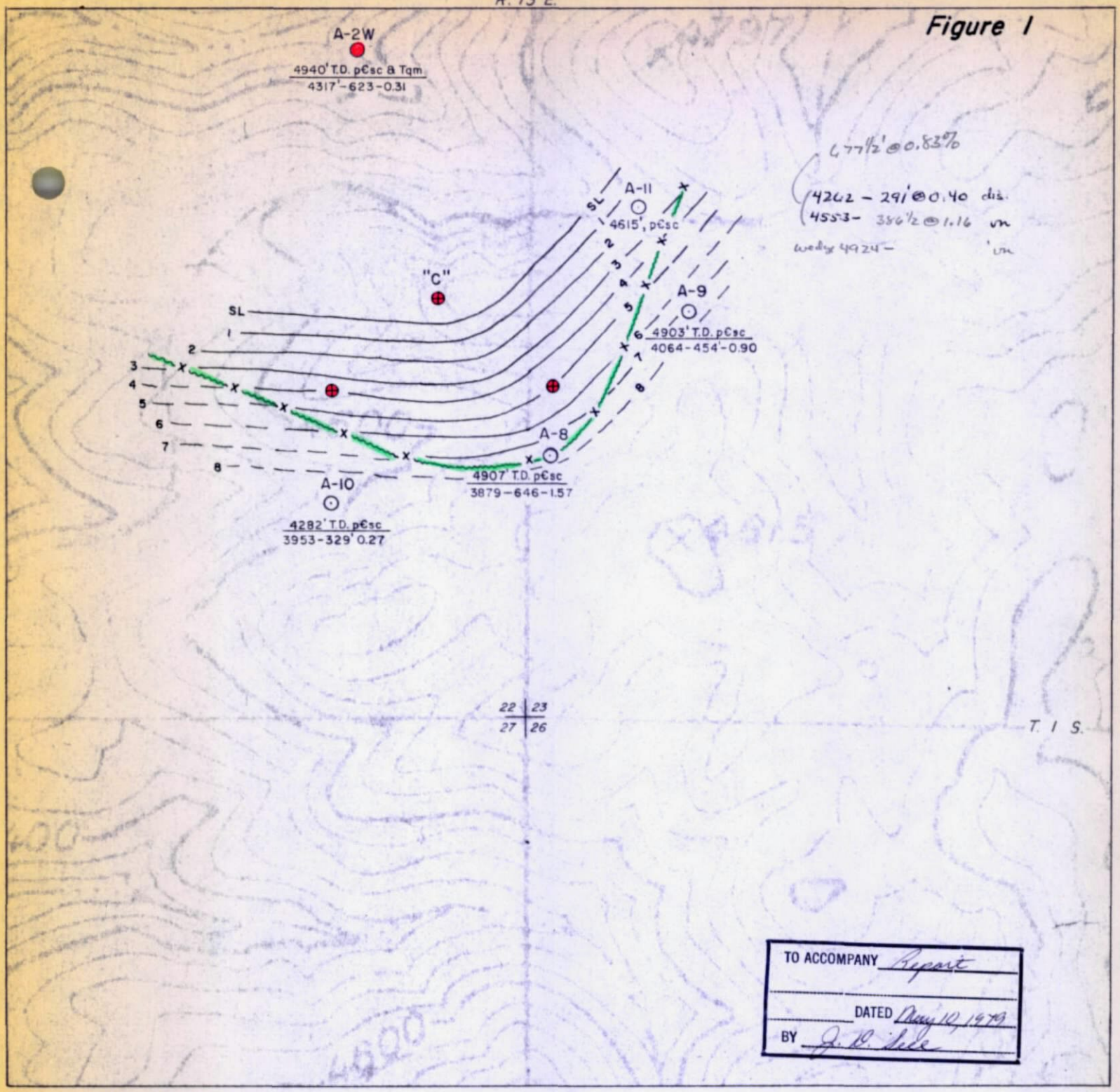
James D. Sell

James D. Sell

JDS:lb
Atts.

R. 13 E.

Figure 1



EXPLANATION

POST-MINERAL ROCK UNIT

Td-Dacite
Tev-Early Volcanics
Tw-Whitetail

PRE-MINERAL ROCK TYPE

Tbx-Breccia
Tqm-Quartz Monzonite
Tgr-Granite
Pe-Supai Formation
fPn-Naco Limestone
Me-Escabrosa Limestone
Dm-Martin Limestone
p€t-Troy Quartz
p€db-Diabase
p€sc-Schist

A-8 — ASARCO Hole & Designation

4907' T.D. p€sc / 3879-646-1.57 — Total Depth-Rock Type / Depth-Length-% Cu

Proposed Drill Site

Trace of oxidation base with hanging wall of qsv system.

2 — Elevation in hundreds of feet above sea level (SL) of hanging wall structure of qsv system

N

DRILLING PROGRESS MAP
For The _____ Quarter, 1978

SUPERIOR EAST PROJECT

PINAL COUNTY, ARIZONA

SCALE: 1" = 500'

J.D. Sell

June 1977
Revised May 1979

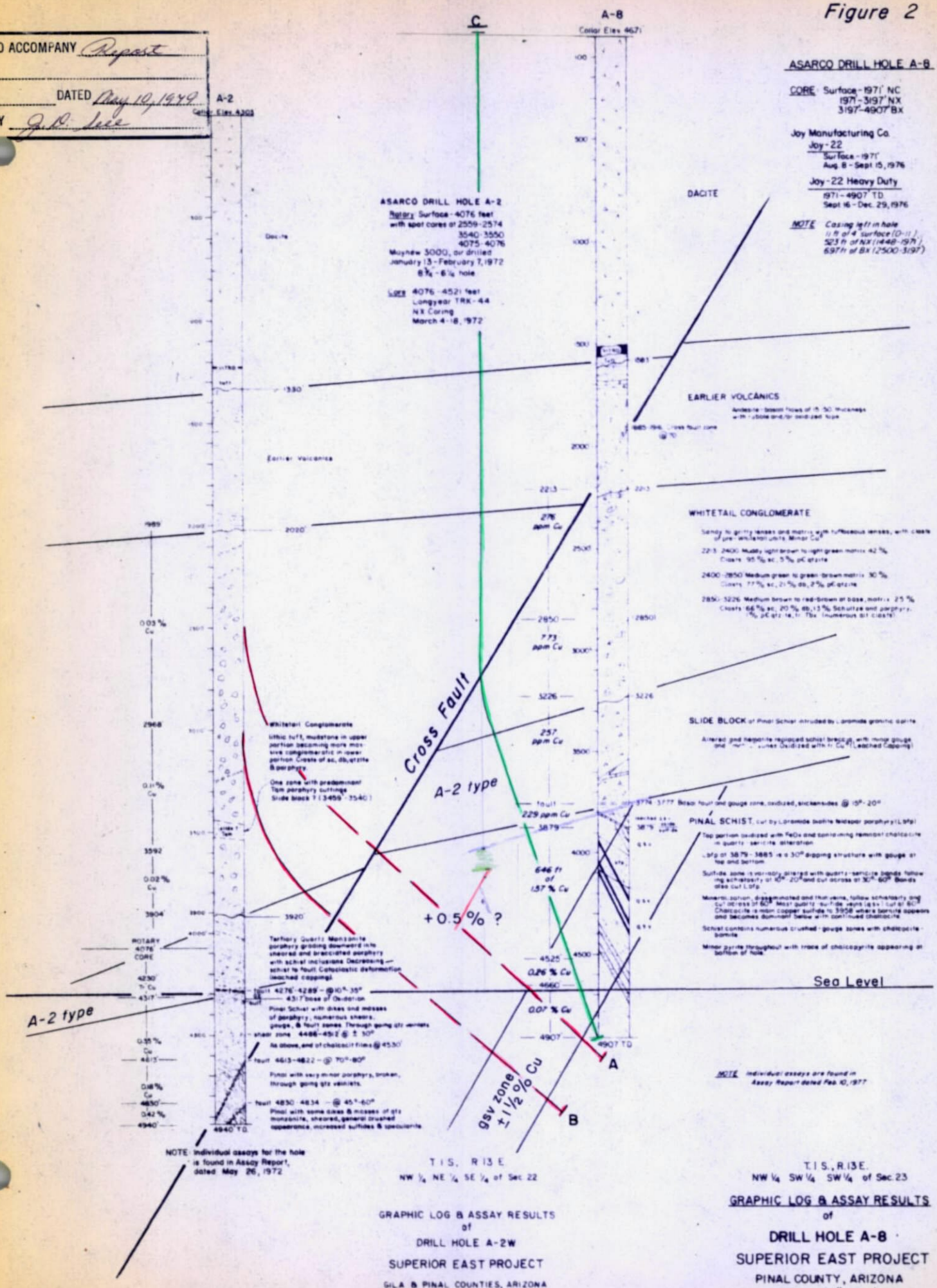
MVK-3041-A

TO ACCOMPANY Report

DATED May 10, 1979

BY J. D. Lee

Figure 2



GRAPHIC LOG & ASSAY RESULTS
of
DRILL HOLE A-2W
SUPERIOR EAST PROJECT
GILA & PINAL COUNTIES, ARIZONA
J.D.S. July 8, 1972

GRAPHIC LOG & ASSAY RESULTS
of
DRILL HOLE A-8
SUPERIOR EAST PROJECT
PINAL COUNTY, ARIZONA
SCALE 1" = 600'
J.D.S. Feb. 1977

MVK-4089

ASARCO

Southwestern Exploration Division

June 6, 1979

TO: F. T. Graybeal

FROM: J. D. Sell

Thought Reinterpretation
Superior East Project
Pinal County, Arizona

During discussions with W. L. Kurtz and F. T. Graybeal on Friday, June 1, the various problems of contouring the qsv system, its apparent curvature opposite to known structures if dipping north, the problems of mineral zoning, timing, fault offsets, etc. were brought forth.

The question of whether the qsv system was the only one was raised and answered that it probably is not the only one based on patterns in the Globe-Miami-Superior region.

Overall alteration-mineralization-porphyry masses suggest an increase from northeast (DCA-3A area) to the southwest (A-4 area). Hole A-8 based on this trend intercepted significant values in a quartz sulfide vein (qsv) system. Subsequent holes have also intercepted a qsv system, but to connect them up into a single structure either leaves one hole out in the cold, which can be rectified by fault gymnastics, or as was stated perhaps several qsv structures have been encountered.

A rough review of the intercepts suggests two alternatives as shown on Attachment A. In example 1 the structures dip to the northwest, and the qsv-1 was intercepted in holes A-8, A-9, and A-11 and would pass under hole A-10. The qsv-2 footwall was cut in hole A-10 and the hanging wall would be to the northwest. The flat fault cut-out would terminate qsv-2 before reaching the site of A-11. The qsv-2 hanging wall would pass several hundred feet below the termination of hole A-2W.

In example 2 of Attachment A, the qsv systems dip to the southeast. The qsv-1 was intercepted in holes A-8, A-9, and A-10 and would be cut out by the flat fault cutoff before reaching A-11. The qsv-2 hanging wall was cut in A-11 and would pass below the three holes to the south and southwest. The footwall of qsv-2 may have just been cut in hole A-2W at or near the oxide-sulfide flat fault contact.

As expressed during the discussion, problems exist between holes A-9 and A-11, some 500 feet apart. One problem is the non-continuation of the flat fault structure, and some sort of fault must be used if one is to match up the flat fault features found in the two holes, as shown on Attachment B-1. This shows, also, example 1 with a northwest-dipping qsv-1 having an overall dip of around 50°, whereas the core holes show closer to a 60° contact. No great problem.

The proposed directional drilling or wedge hole from inside A-11 (see my memos on Drilling Thoughts, May 10, and Directional Drilling - Potential Costs, June 5) is also shown and in this example poses no problem of confirming the northward dip and continuation of the structure between holes A-9 and A-11 as drilled.

Attachment B-2 exhibits example 2 with the qsv structures dipping southeast. Here the qsv-1 as found in hole A-9 would be terminated by flat and other faulting prior to intersecting hole A-11. The qsv found in hole A-11 would be the hanging wall of qsv-2. If this interpretation is valid, then a directional drilled or wedged hole from hole A-11 (shown) has the potential of missing both qsv-1 and qsv-2 and staying in ±0.5% copper values throughout the sulfide intercept.

Under the example 2, both directional drilled holes from A-11, whether to the northeast or southerly, could miss the qsv system. (Present planning would place the intercept point more to the center of the distance between A-9 and A-11 and hence would end up going down structure in example 2 of Attachment B-2.)

No unique solution is possible with the data available, but my present thoughts favor example 1, a northwest-dipping structure, with possible subsidiary subparallel qsv structures in the zone.

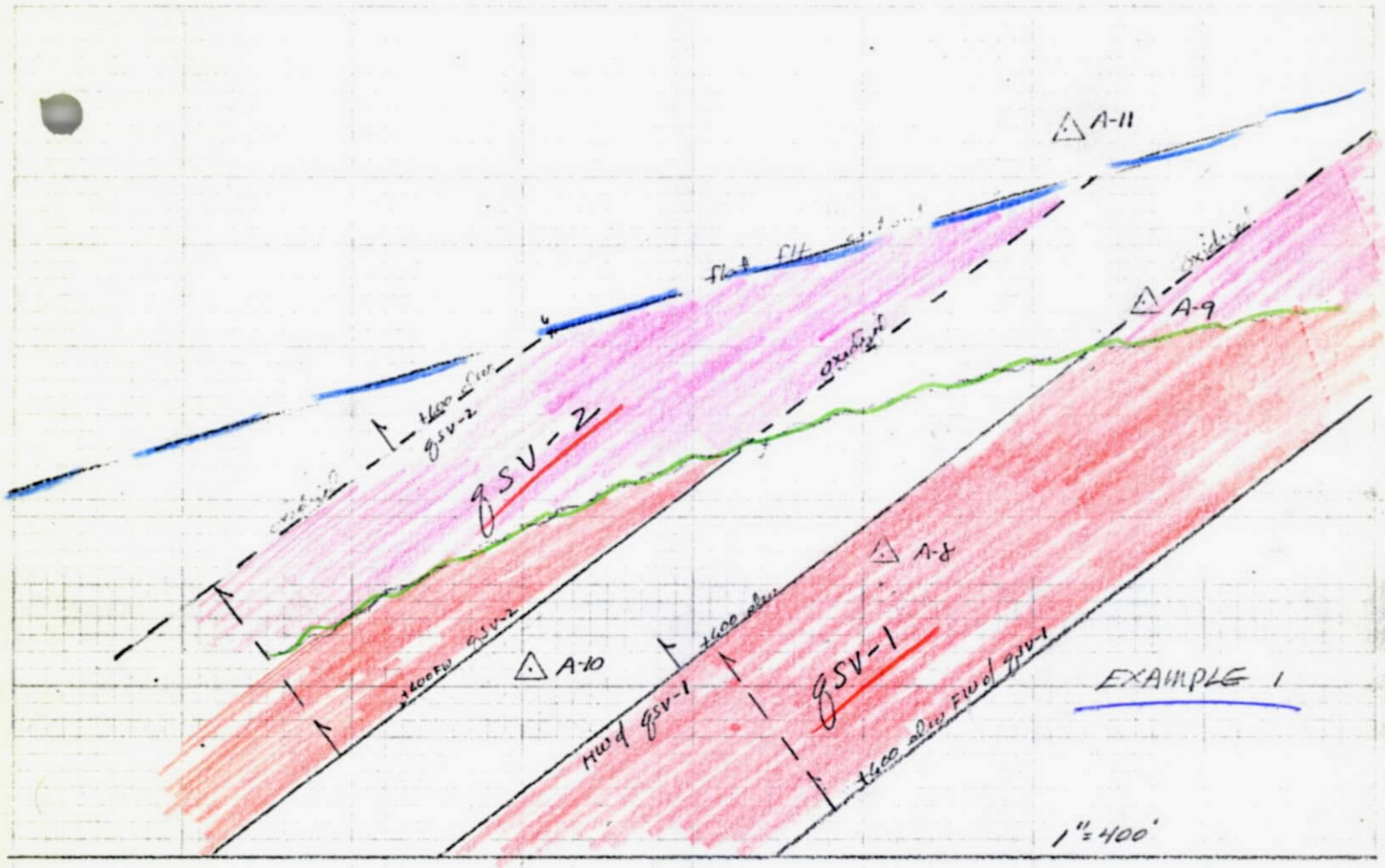
James D. Sell

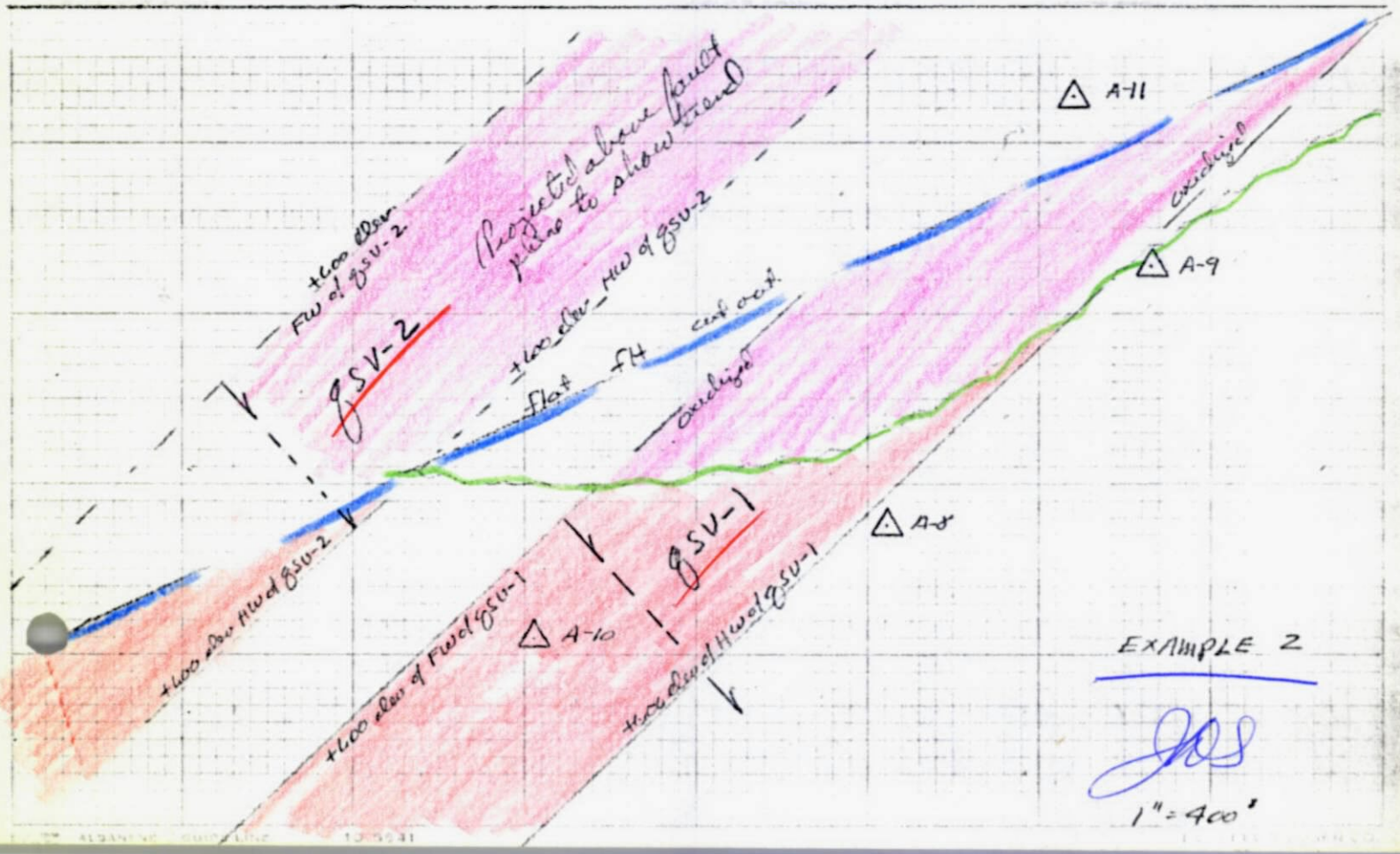
James D. Sell

JDS:lb
Atts.

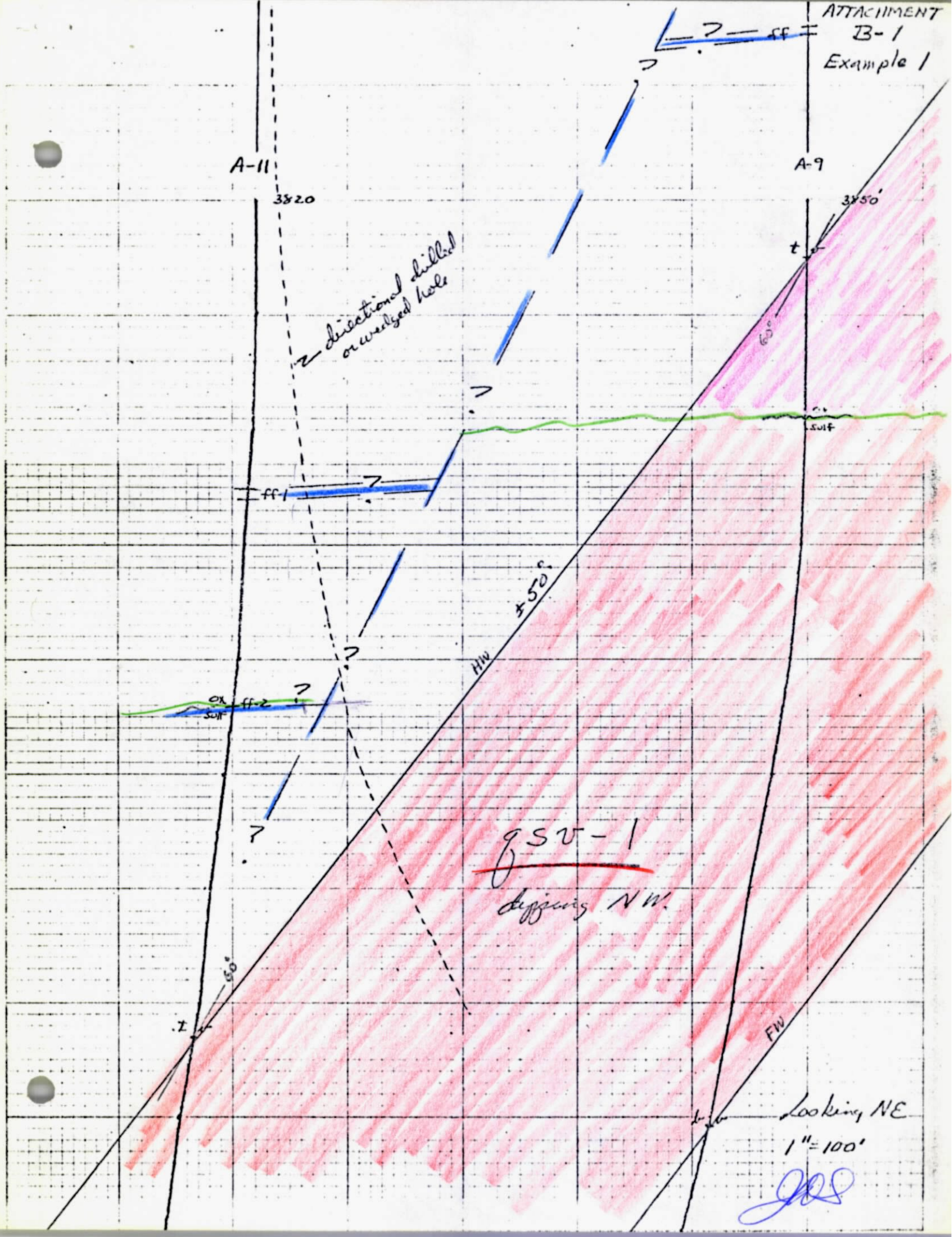
△ A-2W

Attachment A

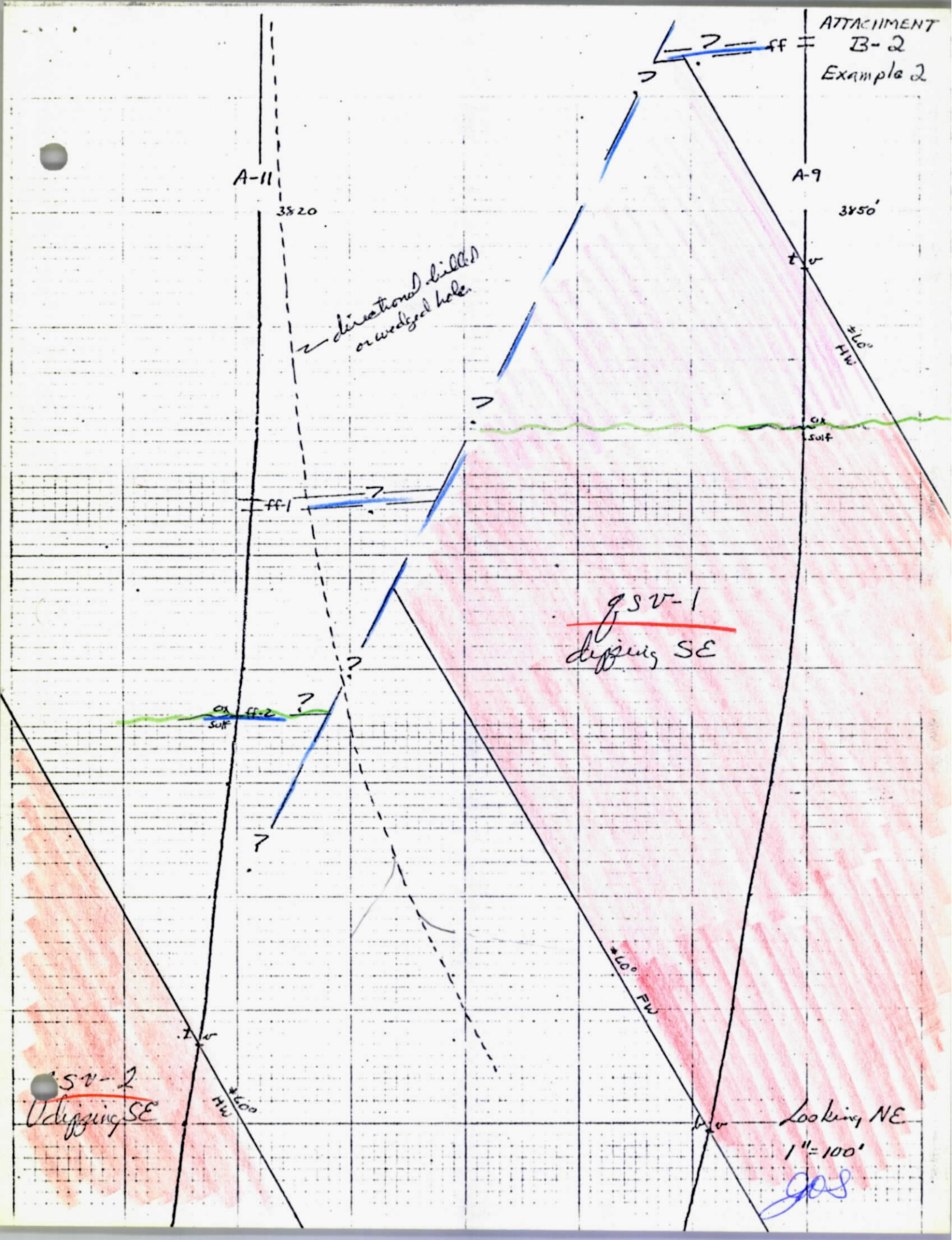




ATTACHMENT
B-1
Example 1



ATTACHMENT
B-2
Example 2



ASARCO

Southwestern Exploration Division

July 17, 1979

TO: F. T. Graybeal

FROM: J. D. Sell

Future Drilling Thoughts
Superior East Project
Pinal County, Arizona

Future drilling thoughts are here expressed using a combination of rotary, directional drilling, and conventional core drilling. One group of holes is designed to further confirm the quartz sulfide vein system (qsv), while the second group is for reconnaissance drilling to probe for additional qsv systems as well as an ore-shell suggested by the overall patterns found in the previous drilling.

QSV System Drilling

Four holes have been drilled into a quartz sulfide vein system containing chalcocite-bornite mineralization within a quartz-filled shear zone. The qsv system is presently estimated to be some 350 feet in thickness with grades in excess of 1% copper. The known portion extends from hole A-9 on the northeast to hole A-10 on the southwest. Hole A-8 is between the two and was the initial hole into the qsv system. Hole A-11 was drilled northerly from A-9 and confirmed the down-dip continuation of a qsv system.

Some question as to whether the A-9 intercept is the same as the A-11 intercept structure has been raised and a memo of June 6, 1979 (Thought Reinterpretation) addresses the problem.

Recommendations for continued defining of the qsv system, its extent, thickness, and grade are given below, and the sites are shown on the Superior 7-1/2' quad attached. Recap of the work and costs are in Table One attached.

Drill hole A-12. A directional drilled hole northeasterly from hole A-11, with the wedge kick-off being placed around the depth of 3000 feet in the NX portion of hole A-11. The BX casing presently set in the NX hole would be removed to permit the continued use of an NX wedge hole.

Drill hole A-13. A directional hole drilled southerly from hole A-11, with the kick-off wedge being placed around 2950 feet in the NX portion of hole A-11.

These two directional drilled holes will confirm and tie-down the strike-dip-and thickness of the qsv zone in this area.

As hole A-10 on the southwest is interpreted to have barely nicked the qsv system, it is recommended that a hole be located north of and between holes A-8 and A-10. [Such as at site "C" in the memo of May 10, 1979 (Drilling Thoughts).]

Drill hole A-14 would be initiated as a rotary hole to a depth of around 3000 feet. It could be continued as a deep test of the down-dip continuation.

Drill hole A-15 would be a directional drilled hole, from the rotary A-14 hole, and drilled to the southwest to define the westerly trend and provide a full thickness intercept.

Drill hole A-16, a directional drilled hole from the A-14 hole, would be southerly to provide a full thickness intercept and provide control on a possible offset of the qsv system.

Conditional upon the completion and confirmation of these five holes, it should be recognized that additional drilling would be considered in extending the qsv zone both to the northeast and to the west-southwest. The cost of these holes would be comparable to the A-14, A-15, A-16 sequence with additional road building and probable deeper intercepts in the westerly sequence.

Based on the depths involved and directional drilling features coupled with the necessity of extended NX core drilling, it is recommended that CP-50 type equipment be used.

Reconnaissance Drilling

Using reconnaissance drilling, concurrently, it is proposed that several holes be drilled to locate and confirm the proposed ring structure containing a primary ore grade shell.

Drill hole A-17 is proposed some 2000 feet southeast of A-9.

Drill hole A-18 is proposed an additional 2000 feet farther southeast from hole A-17. Hole A-18 would be located on Inspiration (Rawhide) ground. These two holes could be initially rotary drilled, then a core rig set up to complete the test, for shorter completion time overall. Both holes would also test for a chalcocite blanket remnant as suggested in the moved slide block containing leached capping with minor chalcocite, as found in hole A-2 and hinted at by the type of capping in holes A-9, A-11, and AI-1.

Reconnaissance drilling to probe the bedrock along the southern Schultze Granite projection for possible weak structural zones hosting qsv systems could be tested by several holes east of old hole A-4. Holes A-19 and A-20 would also test the southern projection of the deeply eroded porphyry system as cut in A-4, as well as slide block transport and capping direction, extent, and value.

Although the holes outlined in the reconnaissance are deep, they can probably be handled by a Joy 22 heavy-duty type.

A further line of holes southerly from A-10 should be considered and would be of the A-17 thru A-20 type.

Auxiliary Drilling and Road Work

With the increased drilling tempo and the more remote sites, it is suggested that a water well(s) be drilled for our account. The hole(s), tabulated as W-1, would be rotary drilled to around 800 feet in dacite and a submersible pump and storage tank installed.

The hole, W-1, could be drilled near the present pond east of A-9 and/or drilled near the site of A-17. In either case it would be adjacent to the existing road and should be drilled early in the use of a rotary rig so as to be available for subsequent hole use. Likewise, to lessen the high climb out of the A-19 and A-20 lower bench sites, a water well should be placed to aid in this drilling as well as being a supplement for cattle watering in this area.

The main Devils Canyon access is badly in need of major revamping and in lieu of doing the revamping it is recommended that a new road be built from the JI-Ranch headquarters area. The road grade would be such that future maintainence should be minimal as well as being controllable as to outside traffic. If the Devils Canyon road is not closed off, but only allowed to deteriorate at its going rate, then we are not in a position of denying access to the public. (I don't believe open-to-public access means providing vehicular traffic right-of-way.)

Projected work and costs are tabulated in Table One attached.

James D. Sell/lb

James D. Sell

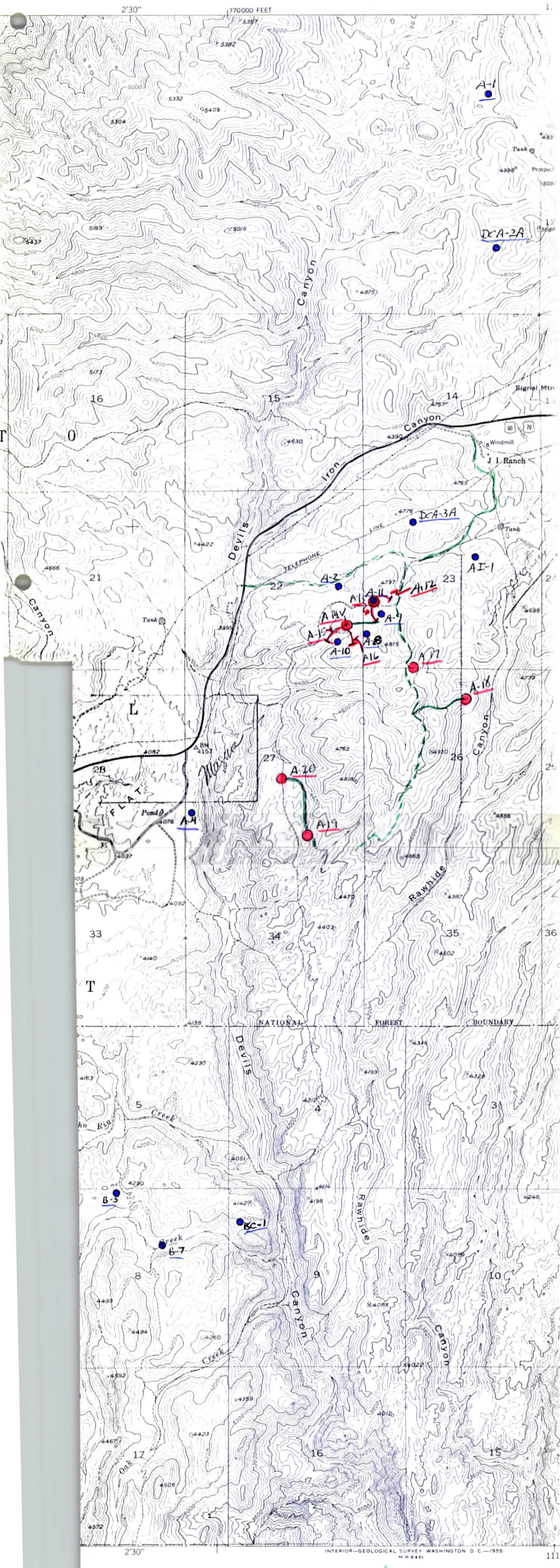
JDS:lb
Atts.

TABLE ONE -- TABULATION OF PROPOSED WORK AND COSTS*

Hole Number	Rotary Footage & Cost (g)	Directional Drill Footage & Cost (a)+(b)	Conventional Core Drill Footage & Cost (d)	Rig Time Cost (e)	Road Work Footage & Cost (h)	Drill Site Cost (i)	Administrative and Assaying Costs (f)	Total Footage Drilled	Total Estimated Cost
A-12	---	250' $15,000	1850' $65,000	$4,000	---	$1,000	$10,000	2100'	$ 95,000
A-13	---	300' $18,000	1050' $37,000	$4,000	---	---	$ 4,000	1350'	$ 63,000
A-14 initial	3000' $60,000	---	---	---	1000' $ 6,000	$2,000	$ 2,000	3000'	$ 70,000
A-14 vertical	---	---	2500' $88,000	$4,000	---	---	$ 6,000	2500'	$ 98,000
A-15	---	300' $18,000	2200' $77,000	$4,000	---	---	$ 6,000	2500'	$105,000
A-16	---	300' $18,000	1600' $56,000	$4,000	---	---	$ 5,000	1900'	$ 83,000
A-17	3000' $60,000	---	1800' $63,000	$8,000	1000' $ 6,000	$2,000	$12,000	4800'	$151,000
A-18	3000' $60,000	---	1300' $46,000	$8,000	2000' $12,000	$2,000	$10,000	4300'	$138,000
A-19	3000' $60,000	---	2500' $88,000	$8,000	4000' $25,000	$2,000	$14,000	5500'	$197,000
A-20	3000' $60,000	---	2500' $88,000	$8,000	2000' $12,000	$2,000	$14,000	5500'	$184,000
W-1	800' $16,000	---	---	$2,000	---	$2,000	$ 1,000	800'	$ 21,000
Revamp or Access Rd.	---	---	---	---	6000' $30,000	---	---	---	$30,000

*Presently assumed costs:
(a) Directional Drill use @ $40.00 per foot.
(b) Core Rig Time during Directional Drill use @ $20.00 per foot.
(c) NX core contract and additives @ $30.00 per foot.
(d) BX core contract and additives @ $35.00 per foot.
(e) Rig Time for setting casing, wedging, retrieval of casing, etc. @ $8,000 per hole.
(f) Administrative and Assaying @ $2.50 per foot.
(g) Rotary Drilling contract and additives @ $20.00 per foot.
(h) Road building costs @ $25,000 to $30,000 per mile; revamp probably more than half that overall.
(i) Drill site preparation and close-down @ $2,000 per site.

SUPERIOR QUADRANGLE
ARIZONA—PINAL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



1 MILE

Road need to be revamped

new access road

A-11 ASARCO Drill Hole

Proposed hole (V-notched) d/or widened

ROAD CLASSIFICATION

HARD-SURFACE ALL WEATHER ROADS		DRY WEATHER ROADS
Heavy-duty	4 LANE 6 LANE	Improved dirt
Medium-duty	4 LANE 16 LANE	Unimproved dirt

Loose-surface, graded, or narrow hard-surface

U. S. Route — State Route

SUPERIOR, ARIZ.
N3315—W11100/7.5

1948

JdS

ASARCO

Southwestern Exploration Division

August 6, 1979

TO: W. L. Kurtz

FROM: F. T. Graybeal

Accelerated Exploration Program
Superior East Project
Pinal County, Arizona

The Superior East Project was initiated in 1970 to explore for high grade supergene enrichment under post-mineral cover. Over the following 10 years we have drilled 68,752 ft. in 17 holes. This relatively slow exploration rate was largely due to the expensive and time-consuming nature of the drilling and to the practice of completing one hole before starting road work to another so that the information gained could be applied to subsequent hole locations. Although a number of copper-bearing zones have been intersected, the first hole to cut mineralization of potential ore length and grade was A-8 (at 3879 ft., 646 ft. averaged 1.57% Cu as bornite-chalcocite) which was completed in 1977. Additional drilling near A-8 has defined a tabular zone of bornite-chalcocite-quartz veins dipping about 70° in severely deformed schist which measures roughly 350 ft. thick and more than 1000 ft. deep and 1500 ft. long. The inferred reserve in this zone at depths of 4000-5000 ft. is roughly 43 million tons averaging 1.27% Cu and the mineralization remains open at depth and along strike.

Within the area of the Superior East Project east of Oak Flat considerable exploration remains to be done. A minimum of 5 additional holes will be required to confirm continuity and geometry of the mineralization adjacent to A-8 and to test continuity of mineralization another 1000 ft. along strike. At the present rate of drilling, at least 3 years will be required to complete these holes. Considerable potential also remains for the discovery of additional bornite vein zones and an enriched chalcocite blanket, particularly south of A-8, and a minimum of 5 holes will be required to test this area assuming all holes are barren. At the present rate of drilling the program outlined above will take 6-7 years to complete. If additional mineralization is discovered, which is likely, this time period could easily be doubled before a decision could be made to proceed with a detailed underground evaluation and production would not likely occur before the year 2000.

The Superior East Project has reached the point where a zone of potentially economic mineralization has been established. It is my view that the extent of this zone should be established as soon as possible so that its potential can be rated against other mining projects which may be available to the Company in the next few years. Our understanding of the area now permits us to abandon the practice of drilling one hole at a time and intensify our exploration. I am therefore recommending an accelerated drilling program at Superior East which will involve continuous operation of two drill rigs with three shifts per day. I estimate that such a program would complete 39,000 ft. in 10 holes in roughly 2 years at a cost of $1,540,000 or $39.50/ft. including road work, geology, and supervision. The locations of the proposed holes, selected by Mr. Sell, are shown on the attached map and the target and cost of each hole on the attached table. If this program is approved I will include roughly one-half this amount in my 1980 budget proposal.

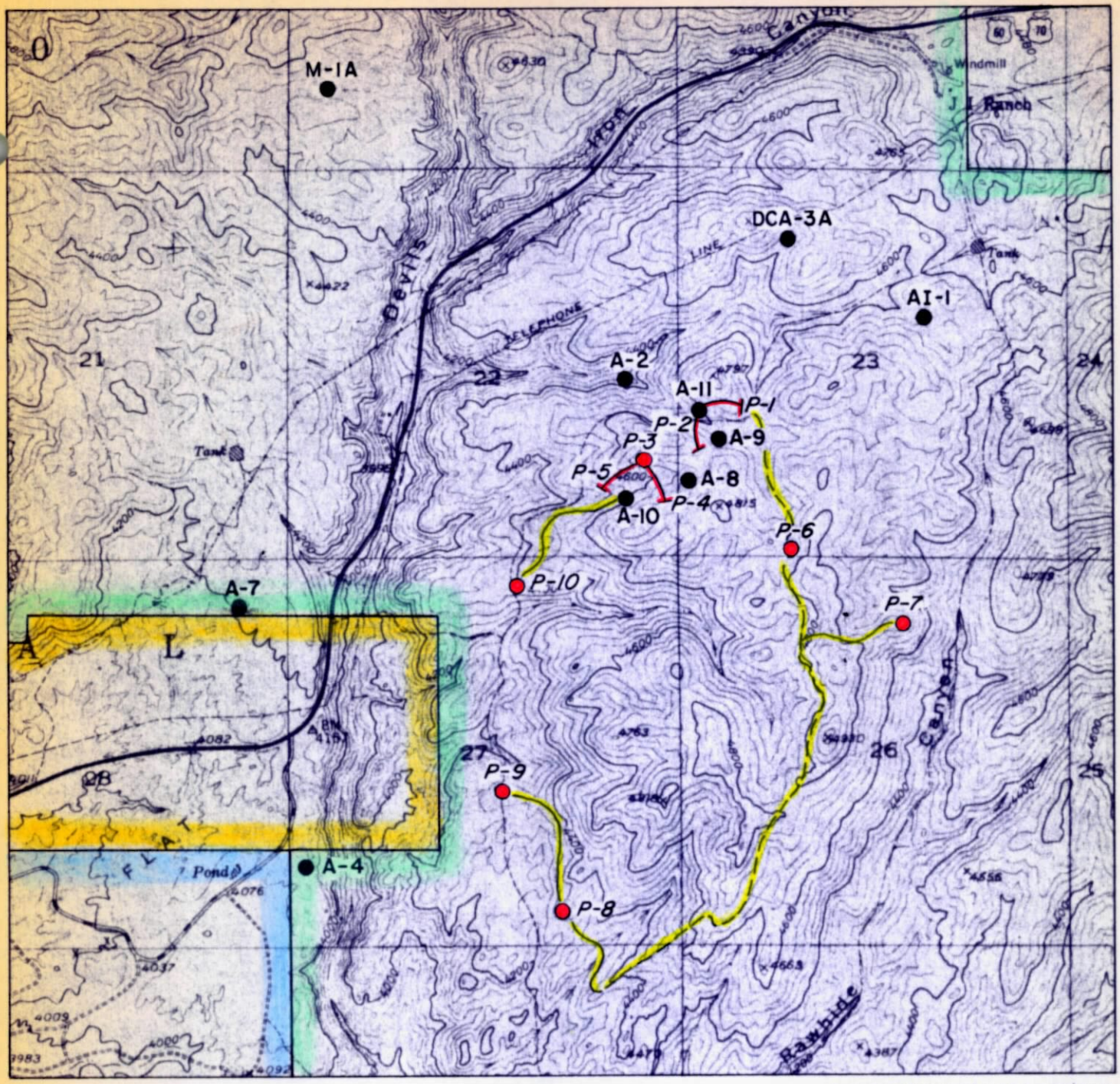
Again I emphasize that the Superior East program has already consumed ten years and the results obtained since 1977 justify an increased rate of exploration. Should additional mineralized zones be discovered, it may be necessary to increase our drilling rate still more to avoid dragging out our exploration into the 21st century. I should also emphasize that this program is not designed to explore either the native copper mineralization or the limestone replacement potential west of the Devils Canyon fault.

F. T. Graybeal

F. T. Graybeal

FTG:lb
Atts.

cc: TCOsborne - w/atts.
JDSell - w/atts.



Base from Superior Az., U.S.G.S. 7.5' Quad.

EXPLANATION

- ASARCO
- Magma
- Oak Flat
- A-2 ● Completed Holes
- P-3 ● Proposed Vertical Holes
- P-4 ⊥ Proposed Inclined Holes
- Road To Be Improved
- Road To Be Built

TO ACCOMPANY Memo

DATED Aug. 6, 1979

BY F.T. Graybeal

Proposed Future Drilling

SUPERIOR EAST PROJECT

PINAL COUNTY, ARIZONA

SCALE: 1" = 2000'

F.T. Graybeal Aug. 1979

MVK-5141

PROPOSED SUPERIOR EAST DRILL HOLES

Hole	Method	Target	Cost
P-1	Wedge out of A-11 with CP-50; drill 2100 ft.	Test NE extension vein zone, determine true thickness	$ 100,000
P-2	Wedge out of A-11 with CP-50; drill 1400 ft.	Test vein continuity between A-8 and A-9; determine true thickness	80,000
P-3	Vertical hole - 2000 ft. air hammer, 3500 ft. CP-50	Test down dip portion A-8 intersection	170,000
P-4[1)]	Wedge out of P-3 with CP-50; drill 2500 ft.	Test continuity of A-8 intersection	120,000
P-5[1)]	Wedge out of P-3 with CP-50; drill 1900 ft.	Contingent on results of P-3 and P-4	90,000
P-6	Vertical hole - 2000 ft. air hammer, 3500 ft. HD-22	Test for chalcocite blanket	140,000
P-7	"	"	140,000
P-8	"	"	140,000
P-9	"	"	140,000
P-10	"	Test for chalcocite blanket and vein zone	140,000
Road work:	rework 10,000 ft. @ $1.00/ft. and build 11,000 ft. @ $10.00/ft.		120,000
Indirect costs on 39,000 ft. @ $4.00/ft.			160,000
		Total	$1,540,000
		Equivalent to	$39.50/ft.

1) If wedging costs in P-1 and P-2 are excessive, holes P-4 and P-5 might be steep angle drilled from surface and holes would each cost $170,000.

TAB

DCFROR (79)

Copy for JDSell ✓
return to FTG

RECEIVED
SEP 1979
S. W. U. S. EXPL. DIV.

F.T.G.

August 30, 1979

Mr. W. L. Kurtz
Tucson Office

Arizona
Superior East Project

Dear Mr. Kurtz:

I'm in agreement with the opinion expressed by Mr. Graybeal's memorandum of August 6 which I know you share, to the effect that exploration of the A-8 discovery has reached the point at which acceleration of drilling is warranted in order to determine tonnage and grade. Although I reserve the right to quibble about details later on, in general you and Mr. Graybeal should plan to include provision for the program in your 1980 budget proposal. I agree two drills should be the minimum during the first year, and we might wish to increase this to three or even four drills during 1981 if the 1980 results are favorable.

We would likely have no difficulty finding a joint venture partner to share cost of the program if we desired, but my initial thought is that the financial commitment is within our capabilities and it will be best to proceed alone.

In considering the proposal, we need a firmer handle on possible economics of the deposit. Therefore, I would like to have from you not later than December 1 a pro forma feasibility outline using horseback figures, for a model of 100 million tons at 1.25% Cu above the 5,000' level. I expect Mr. Skidmore or others in the Mining Department can help you with estimates of development and operating block cave costs derived from Sacaton studies. The scenario should assume that drilling has been completed and Year 1 starts with development shaft sinking. Use 1979 capital and operating costs and work out potential after-tax internal rates of return for various copper prices. The analysis should show returns both for the total project and for Asarco's share after provision for Continental's net proceeds royalty. If any questions arise, please call.

Very truly yours,
Original Signed By
T. C. Osborne
T. C. Osborne

cc: FTGraybeal

Lois - Xerox for RBC/JDS
return original to me.

Oct 2.1979

RBC / JDS

Superior East

See attached letter from TCO concerning a proforma feasibility study. Would you kindly work with Sell and Percival (I've discussed this with Tom Scarticinni who is very negative but finally agreed that George could help you with capital costs, dilution, development costs, operating costs and whatever else you need) to develop the data. This should not take more than 1/2 day of Percival's time. Crowell supply milling costs

Assumptions (Sell / Percival can help fill in missing blanks)

100 million tons 1.25% Cu 95% recovery dilution _____ Percival

recoverable grade _____

Top of ore _____ (Sell)

1979 Costs Bottom ore 5,000

Width ore _____ (from Sell)

Strike length _____ (sufficient to give 100 million tons

Copper Price
~~Now~~
Now 1.00
~~[illegible]~~ 1.30
~~[illegible]~~ 1.60
higher if needed for 15% ROI after tax

Average dip (configuration of ore body) _____ (from Sell)

Temperature in ore zone 140° (check with Sell)

~~Soft~~ Cost water supply in capital costs

Year I starts with development (assume drilled out)

After tax return - 1) project total
2) Shareholder share after Cost Copper - Can Cos.

Need study by Thanksgiving

Please check final figures to be used in calculations before starting with Krug/Crawford.

KURTZ

ASARCO

Exploration Department
T. C. Osborne
Vice President

RECEIVED
SEP 4 - 1979
EXPLORATION DEPARTMENT

August 30, 1979

Mr. W. L. Kurtz
Tucson Office

Arizona
Superior East Project

Dear Mr. Kurtz:

I'm in agreement with the opinion expressed by Mr. Graybeal's memorandum of August 6 which I know you share, to the effect that exploration of the A-8 discovery has reached the point at which acceleration of drilling is warranted in order to determine tonnage and grade. Although I reserve the right to quibble about details later on, in general you and Mr. Graybeal should plan to include provision for the program in your 1980 budget proposal. I agree two drills should be the minimum during the first year, and we might wish to increase this to three or even four drills during 1981 if the 1980 results are favorable.

We would likely have no difficulty finding a joint venture partner to share cost of the program if we desired, but my initial thought is that the financial commitment is within our capabilities and it will be best to proceed alone.

In considering the proposal, we need a firmer handle on possible economics of the deposit. Therefore, I would like to have from you not later than December 1 a pro forma feasibility outline using horseback figures, for a model of 100 million tons at 1.25% Cu above the 5,000' level. I expect Mr. Skidmore or others in the Mining Department can help you with estimates of development and operating block cave — and capital costs derived from Sacaton studies. The scenario should assume that drilling has been completed and Year 1 starts with development shaft sinking. Use 1979 capital and operating costs and work out potential after-tax internal rates of return for various copper prices. The analysis should show returns both for the total project and for Asarco's share after provision for Continental's net proceeds royalty. If any questions arise, please call.

and CanUS Ltd NSR until paid off.

Very truly yours,

T. C. Osborne

cc: FTGraybeal

FOR STARTERS: WLK-FTG-JDS-GP

10/12/79
R.B.Crist

SUPERIOR EAST[1,2,3]

Pro-forma Feasibility Study

(high grade - disseminated - primary orebody)
(& fracture-vein control)

Reserves: 100,000,000 tons @ 1.25% Cu } 90% grade mined
use 110,000,000 " " 1.14% Cu } 110% tons mined

Mining: block cave (need equivalent of ~~5000~~ 4000' strike, ~~600~~ 300' wide (for sublevel cave), ~~400~~ 1000' thick - bottom of ore 5000')
- 20,000 tons per day
- 350 days per year
  (7,000,000 tons per year)
- 16 year life

Top of cave at 4000' depth.

See x-section

Milling: 20,000 tons per day (primary sulfides)
- 95% recovery

Capital Cost:

Predevelopment costs[1]	-	yrs 1 thru 4
Mine development	-	yrs 3 thru 4
Mill	-	yrs 3 thru 4
Water/power	-	
Total	-	

NSR:

Cu price	smelter					Cu + by-prod[4]	NSR
$1.00	.33	1.14 -	20 -	.67 -	95%	= 14.35 + 2.00 =	$16.38
1.30	"	"	"	.97	"	= 20.82 + 2.00 =	22.82
1.60	"	"	"	1.23	"	= 26.41 + 2.00 =	28.41

Operating Costs:

	copper price 1.00	1.30	1.60
Mining direct			
" indirect			
Milling direct			
" indirect			
Management fee	.05	.05	.05
3% royalty	.49	.68	.85
Total -			

---

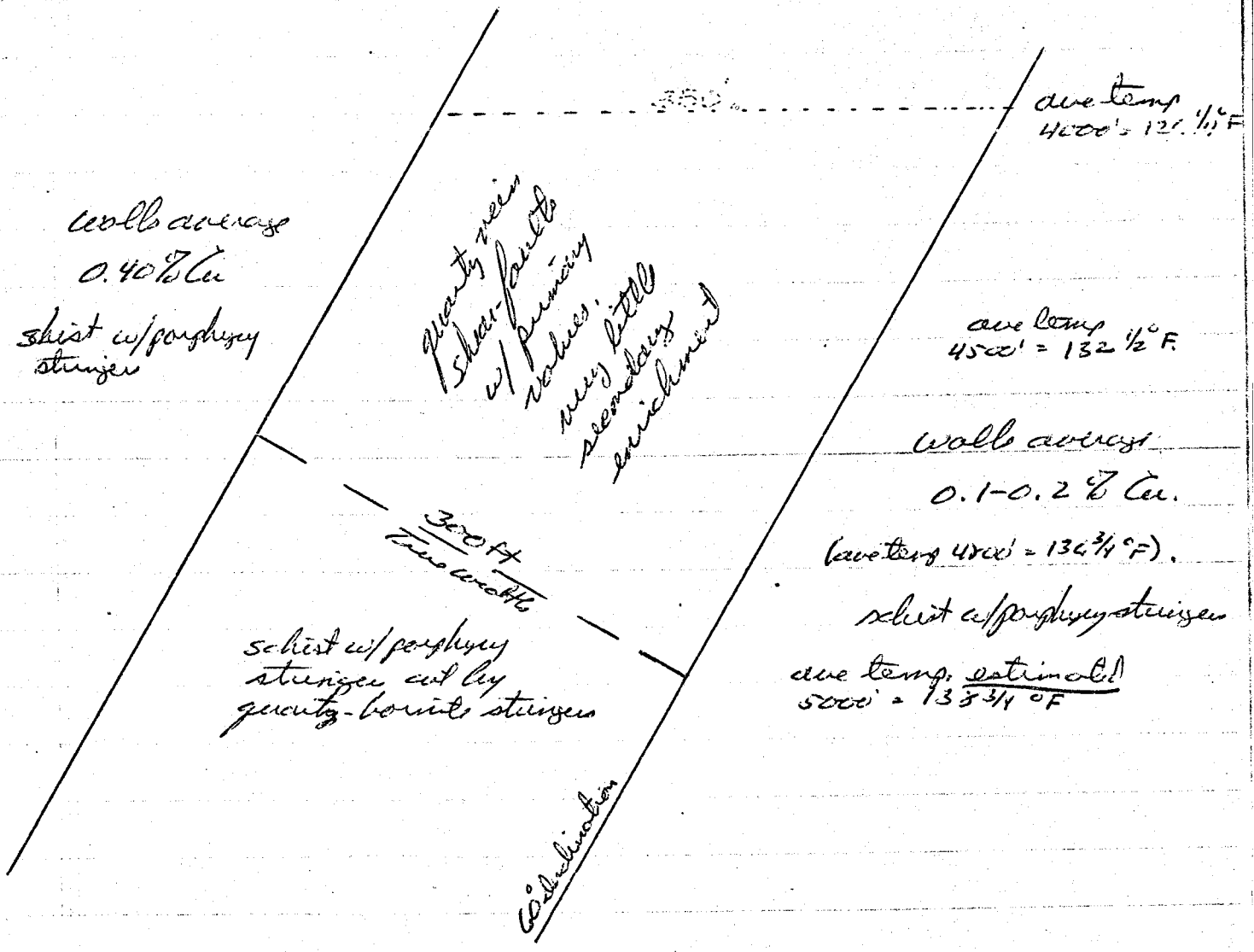
1 Reserves mined under terms of net profits lease. Net profits shared 80-20% after payback of all premining (including exploration) expenses ($500,000 deductible), plus 1% int. over prime rate and after payback of post-mining operation and capital costs.

2 .05 per ton expensed as Asarco management fee.

3 3% NSR to CanUS Ltd. to $20,000,000.

4 Average value year-to-date Mission by-products per ton $3.00.

Top of ore below surface ranges from 3879' to 4262' use 4000' depth as average.



(3 holes) (1 hole)

Ag ranges: 0.41 oz/ton, upper areas; to 0.78 oz/ton deeper

Au ranges: 0.009 oz/ton, " " ; to 0.015 oz/ton " ".

Nov. 28, 1979

JDS

FROM: W. L. KURTZ

TO: T C Osborne

Attached is Bob Crist's pro-forma feasibility on Superior East as requested by your letter of August 30, 1979.

This shows what +1% copper can do for you and certainly justifies an accelerated drill program at Superior East.

ASARCO

Southwestern Exploration Division

November 27, 1979

Superior East Project
Pinal County, Arizona

A pro-forma feasibility study has been made which shows the following after tax internal rates of return:

	Total Project			Project with Property Obligations		
Cu price	$1.00	1.30	1.60	$1.00	1.30	1.60
DCFROR	16.12%	24.33%	30.74%	15.27%	22.96%	27.95%

Feasibility was based on the following criteria:

Reserves: Primary orebody - high grade disseminated and fracture vein controlled.

100,000,000 tons @ 1.25% Cu } 90% mined grade,
110,000,000 tons @ 1.14% Cu } 110% mined tons.

Mining: See attached sketch for configuation of orebody (J.D.Sell) with a presumed strike of 4,000', 300' wide and 1,000' thick. Block caving used for a mining system rated at 20,000 tpd with a 16-year life.

Milling: Standard flotation flow sheet for 20,000 tpd producing high grade concentrates.

Capital Costs: See attached estimate by George Percival.

Mine preproduction	$140,300,000
Mill	100,000,000
Engineering	4,000,000
Working Capital	8,700,000
	$253,000,000

NSR: See A.J.Kroha's estimate to adjust for George Percival's comment (chalcopyrite concentrates estimated at 0.33/lb smelting).

Cu price	smelter	Grade	tpd	NSR/lb	Rec'y	NSR/ton
$1.00	.26	1.14 -	200 -	.74 -	.95	= 16.03
1.30	"	"	"	1.04	"	= 22.53
1.60	"	"	"	1.34	"	= 29.02

>>>

Operating Costs: See attached estimate by George Percival.

	Total Project per ton	Project with with property obligations Cu $1.00	$1.30	$1.60
Direct mining	$3.71	3.71	3.71	3.71
Indirect "	1.48	1.48	1.48	1.48
Direct milling	1.49	1.49	1.49	1.49
Indirect "	0.59	0.59	0.59	0.59
Management fee	--	0.05	0.05	0.05
3% royalty	--	0.48	0.68	0.87
	$7.27	7.80	8.00	8.19

Also attached are print-outs and work sheets for the above six rates of return and a copy of the initial request.

Property obligations include:

1) 3% NSR to CanUS Ltd upon production until $20,000,000 paid;

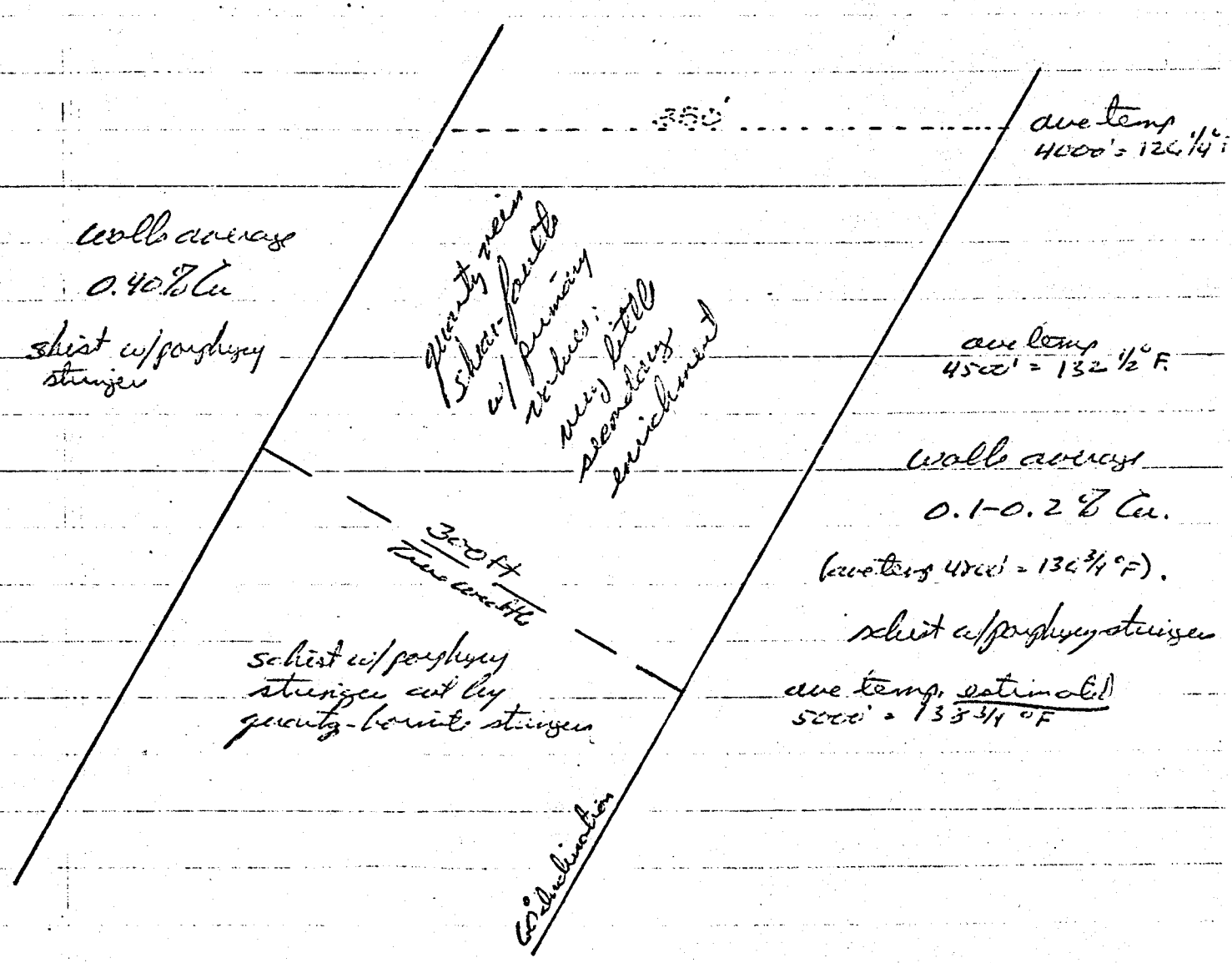
2) 0.05 per ton management fee;

3) Mining agreement with Continental Materials based on net profit lease. Net profits shared 80-20% after payback of all pre-mining expenses (including exploration), plus 1% over the prime rate, less $500,000 deductible. This also covers post-mining operation captial costs.

R.B.C.
R. B. Crist.

RBC:jlh
attachment
c.c. W.L.Kurtz
F.T.Graybeal
J.D.Sell
G.Percival

Top of ore below surface ranges from 3879' to 4262' use 4000' depth as average.



(3 holes) (1 hole)

Ag ranges: 0.41 oz/ton, upper areas; to 0.75 oz/ton deeper

Au ranges: 0.009 oz/ton, " " ; to 0.015 oz/ton " ".

ASARCO

Southwestern Mining Department

November 20, 1979

Mr. R. B. Crist
Tucson Office

SUPERIOR EAST

This study is a quick analysis of the Superior East prospect based on meager information and must not be considered as final. Ore reserves are not fully defined. Under these circumstances opinions can vary considerably but an attempt has been made to establish some cost parameters.

The ore consists of bornite in a quartz vein complex in a schistose rock. The vein does have gougy areas but it is not certain that this material will cave readily but an assumption has been made that block caving will be the mining system as at this time it is doubtful that a more costly system will be feasible.

In general, two production shafts will be sunk to ±5,000 feet with operating levels at the 4,000 and 5,000 elevations. Levels will be interconnected with ramps within the mine to establish a stoping level at 4,500' elevation initially. By preliminary calculations the orebody dips at 60° and this necessitates the shorter caving lift of ±500 feet. Trackless electric equipment will be used throughout the operation wherever possible to alleviate the ventilation problems caused by 140°F temperatures. Electric rail haulage is contemplated on the 5,000' level to the production shafts.

Drainage is considered to be minimal.

The extreme temperatures will necessitate refrigeration and adequate ventilation which will require detailed study.

The Net Smelter Return as listed on the guide sheet should be reviewed with the Smelting Department. The deduction shown is applicable to a chalcopyrite concentrate but not a bornite concentrate which will be much higher grade in copper.

Pre-development costs are not estimated and will include exploration costs, roads, permits, etc.

MINE PRE-PRODUCTION DEVELOPMENT COSTS

Two (2) production shafts 5,000' @ $5,000 (completed with sets, etc.)	=	$ 50,000,000
One (1) service shaft with waste hoisting 5,000 x $4,000	=	20,000,000
Two (2) ventilation raises 4,000' @ $800	=	6,400,000
4,000' level development 12,000' @ $400	=	4,800,000
5,000' level development 18,000' @ $400	=	7,200,000
Inter-level ramps (4,000' level to 5,000' level)	=	1,000,000
Stope preparation (raises, drawpoints, undercutting, etc.)	=	8,000,000
Core drilling 20,000' @ $30	=	600,000
Mine equipment	=	12,000,000
Surface facilities (buildings, headframe, hoists, etc.)	=	19,900,000
Ventilation & refrigeration	=	2,000,000 (?)
Water Supply (wells, delivery, power, distribution, etc.)	=	1,800,000
Tailings disposal	=	2,500,000
Power supply	=	4,100,000
Sub Total		$140,300,000
MILL		
Capital Cost (20,000 tons @ $5,000)	=	$100,000,000
Sub Total	=	$240,300,000
Engineering & Construction Fees	=	$ 4,000,000
Grand Total	=	$244,300,000
WORKING CAPITAL	=	$ 8,700,000
TOTAL	=	$253,000,000

By interpolating information from various sources, the 1979 operating costs for this block caving system are estimated as follows:

Direct Mining	-	$3.71/ton
Indirect "	-	1.48/ton
Direct Milling	-	1.49/ton
Indirect "	-	0.59/ton
Total	-	$7.27/ton

George Percival

GP/mc
attach.

cc: TEScartaccini - w/attach.

35-37% Cu – concentrate grade

Cu 700-20, 97.5% = 663# ($1.00) 663.00

TC = 79.86

RC 633 (.12391) = 78.44 158.30

504.70

$$\frac{700 - 663 + 158.30}{700} = 27.90 ¢/lb$$

E. SUPERIOR TOTAL PROJECT PROFORMA FEASIBILITY CU 1.00 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-30141.242
3	-45000.000	-33373.270
4	-60000.000	-38320.449
5	-98000.000	-53901.215
6	63936.000	30283.848
7	63936.000	26079.793
8	62996.000	22129.148
9	52345.000	15835.074
10	51127.000	13319.508
11	50061.000	11231.309
12	49129.000	9492.094
13	48313.000	8038.609
14	47599.000	6820.371
15	47599.000	5873.555
16	47599.000	5058.176
17	47599.000	4355.992
18	47599.000	3751.287
19	47599.000	3230.525
20	47599.000	2782.058
21	47599.000	2395.848
TOTAL	569635.000	-58.789

RETURN ON INVESTMENT = 16.120 PCT.

(000 omitted) 11/26/79

Suponica East - Total Project
Proforma Feasibility
Cu 1.00 Grade 1.25%

YR	CAP. INV NSK	OPR. COST	CASH FLOW BEFORE TAX	DEPREC.	DEPLET.	TAXABLE INCOME	INC TAX	CASH FLOW AFTER TAX
1	-15,000							
2	-35,000							
3	-45,000							
4	-60,000							
5	-98,000							
6	+ 117,107	53,071	63,936	31,625	16,161	16,150	7,429	63,936 ①
7				27,672	17,551	18,731	8,616	63,936 ①
8				24,213		22,170	10,198	62,996 ①
9				21,186		25,197	11,591	52,345
10				18,538		27,845	12,809	51,127
11				16,221		30,162	13,875	50,061
12				14,193		32,190	14,807	49,129
13				12,419		33,964	15,623	48,313
14				10,867		35,516	16,337	47,599
15								
16								
17								
18								
19								
20								
21								

① INV. Tax Credit 10% 25,300 — 2 yr carryforward: 17871 — 9255 — 63,936 — Return of Cap 4.2 yrs

7,429
.8616
17,871

9255 − 943

943

63,996

E. SUPERIOR TOTAL PROJECT PROFORMA FEASIBILITY CU 1.30 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-28150.898
3	-45000.000	-29111.254
4	-60000.000	-31219.352
5	-98000.000	-41013.133
6	111333.000	37475.289
7	84214.000	22799.723
8	82623.000	17991.625
9	81231.000	14227.070
10	80013.000	11271.414
11	78947.000	8944.945
12	78014.000	7109.496
13	77198.000	5658.434
14	76484.000	4509.047
15	76484.000	3626.680
16	76484.000	2916.980
17	76484.000	2346.160
18	76484.000	1887.043
19	76484.000	1517.771
20	76484.000	1220.760
21	76484.000	981.871
TOTAL	1032445.00	-10.196

RETURN ON INVESTMENT = 24.330 PCT.

Superior East – Total Project
Proforma Feasibility
Cu 1.30 Grade 1.25%

Yr	OPR Cost	Cash Flow Before Tax	Deprec.	Deplet.	Taxable Income	Inc Tax	Cash Flow After Tax
- 15,000							
- 35,000							
- 45,000							
- 60,000							
- 98,000							
+ 164,442	53,071	111,371	31,625	24,663	55,083	25,338	111,333
			27,672		59,036	27,167	84,214
			24,213		62,495	28,748	82,623
			21,186		65,522	30,140	81,231
			18,538		68,170	31,358	80,013
			16,221		70,487	32,424	78,947
			14,193		72,515	33,357	78,014
			12,417		74,291	34,173	77,198
			10,867		75,841	34,887	76,484

Inv. Tax Credit 25,300

Return of Capital
2.25 yrs.

E. SUPERIOR TOTAL PROJECT PROFORMA FEASIBILITY CU 1.60 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-26770.691
3	-45000.000	-26326.652
4	-60000.000	-26848.867
5	-98000.000	-33542.262
6	140223.000	36709.383
7	113105.000	22648.070
8	111513.000	17079.152
9	110121.000	12900.379
10	108903.000	9758.059
11	107837.000	7390.656
12	106904.000	5604.031
13	106088.000	4253.676
14	105374.000	3231.644
15	105374.000	2471.810
16	105374.000	1890.630
17	105374.000	1446.100
18	105374.000	1106.088
19	105374.000	846.021
20	105374.000	647.102
21	105374.000	494.953
TOTAL	1494686.00	-10.507

RETURN ON INVESTMENT = 30.740 PCT.

11/26/79

Superior EAST - Total Project
Proforma Feasibility
CO 1.66 Grade 1.25%

AP INV.	NSR	OPR COST	CASH FLOW Before TAX	DEPREC.	DEPLET.	TAXABLE INCOME	INC. TAX	CASH FLOW After TAX
	-15,000							
	-35,000							
	-45,000							
	-60,000							
	-98,000							
+211,878		53,071	158,807	31,625	31,782	95,400	43,884	140,223
				27,672		99,353	45,702	113,105
				24,213		102,812	47,294	111,513
				21,186		105,839	48,686	110,121
				18,538		108,487	49,904	108,903
				16,221		110,804	50,970	107,837
				14,193		112,832	51,903	106,904
				12,419		114,605	52,719	106,088
				10,867		116,158	53,433	105,374

INV. TAX Cred 25,300

Return of Capital
2 yrs.

E. SUPERIOR (WITH OBLIGATIONS) PROFORMA FEAS. CU 1.00 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-30363.508
3	-45000.000	-33867.277
4	-60000.000	-39174.449
5	-98000.000	-55508.773
6	60067.000	29515.855
7	60067.000	25605.855
8	60067.000	22213.816
9	51285.000	16453.617
10	48795.000	13580.953
11	48372.000	11679.730
12	48917.000	10246.660
13	46932.000	8528.555
14	44604.000	7031.762
15	44604.000	6100.254
16	44604.000	5292.145
17	44604.000	4591.086
18	44604.000	3982.899
19	44604.000	3455.278
20	44604.000	2997.551
21	44604.000	2600.462
TOTAL	528334.000	-37.300

RETURN ON INVESTMENT = 15.270 PCT.

11/26/79

Superior East - with Property obligations
Proforma Feasibility
Cu $1.00 Grade 1.25%

CAP INV

NSR

YR	CAP INV	OPR. COST	CASH FLOW Before TAX	ASARCO 80% of Net Profits after Payback of ALL Revenue including Explor. plus 1% int. over Prime Rate $500,000 deductible DEPREC. ALL	Depletion 97%-100%	TAXable INC. 80% N.P.	CANUS 3% NSR 3% Deplet $20,000,000 Limit	Cont. Mnta 20% N.P $500,000 deductible		ASARCO INC. TAX	ASARCO CASH FLOW After TAX	PAYBACK ACCUM.
1	-15,000											
2	-35,000											
3	-45,000											
4	-60,000											
5	-98,000											
6	+117,007	56,940	60,067	31,625	13,374	14,548	(426) 3,510	500		6,692	60,067	
7				27,672	15,711	16,684	(486) 3,510	—		7,675	60,067	
8				24,213	17,024	18,830	(527) 3,510	—		8,661	60,067	180,201
9				21,186	"	21,857	3,510	—		8,782	51,285	231,486
10				18,538	"	24,505	3,510 (369.0)	—		11,272	48,795	280,281
11		55,884	61,123	16,221	17,182	27,720	2,450	—		12,757	48,372	328,650
12		53,436	63,571	14,193	17,557	31,857	—	—		14,654	48,917	377,567 (32,433)
13				12,419		31,410	—	21,190		14449	46,932	410,005
14				10,867		28,122	—	7031		13,936	44,604	
15							—					
16							—					
17							—					
18							—					
19							—					
20							—					
21							—					
							20,006	58,938				

PAYBACK 100% of Net Profits,
Less $500,000 for 253,000 CAP.
6,000 Expl.
151,000 Int.
410,000

INV. TAX Credit 25,300.

6692	25,300	10,054
7675	23,028	1,272
8661	1,272	8,782

E. SUPERIOR (WITH OBLIGATIONS) PROFORMA FEAS. CU 1.30 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-28464.562
3	-45000.000	-29763.602
4	-60000.000	-32274.586
5	-98000.000	-42871.828
6	104532.000	37190.469
7	81713.000	23643.402
8	78612.000	18498.828
9	77220.000	14778.203
10	77857.000	12117.855
11	71178.000	9009.699
12	70027.000	7208.859
13	69019.000	5778.379
14	68137.000	4639.344
15	68137.000	3773.054
16	68137.000	3068.524
17	68137.000	2495.549
18	68137.000	2029.563
19	68137.000	1650.589
20	68137.000	1342.380
21	68137.000	1091.722
TOTAL	922254.000	-57.958

RETURN ON INVESTMENT = 22.960 PCT.

Superior East - with Property Obligations

Proforma Feasibility

Cu $1.30 Grade 1.25%

Yr	Cap. Inv. NSR	Opr. Cost	Cash Flow Before Taxes	ASARCO 80% of Net Profits after Payback of All Preproduction Costs plus 1% over Permanent $500,000 deductible. ALL DEPREC.	(97-100%) DEPLETION	80% N.P. Taxable Inc.	Canus 3% NSR 3% Depl.	Cont. Mtn. 20% N.P. 500,000-Ded.	ASARCO Inc. Tax	ASARCO Cash Flow After Tax	Payback Accum.
1	-15,000										
2	-35,000										
3	-45,000										
4	-63,000										
5	-98,000										
6	-164,44[illegible]	58,400	106,042	31,625	22,197	51,718	4,633 2466	500	23,791	104,532	
7		"	"	27,612	"	56,171	4,633 "	—	25,839	81,713	
8		"	"	24,213	"	59,690	4,633 "	—	27,430	78,612	264,857
9		"	"	21,186	"	62,657	4,633 "	—	28,822	77,220	342,077
10		55,007	109,435	18,538	24,433	64,664	1,468 238	1,860	29,718	77,857	410,000
11		53,436	111,006	16,221	24,66[illegible]	56,095	—	14,024	25,804	71,178	
12				14,193		57,718	—	14,429	26,550	70,027	
13				12,419		59,136	—	14,784	27,203	69,019	
14				10,867		60,378	—	15,095	27,774	68,137	
15							—				
16							—				
17							—				
18							—				
19							—				
20							—				
21							—				
							20,000	60,872			

Inv. Tax credit 25,300

Payback 410,000

E. SUPERIOR (WITH OBLIGATIONS) PROFORMA FEAS. CU 1.60 GRADE 1.25 11-26-79

YEAR	CASH FLOW	D.C.F.
1	-15000.000	-15000.000
2	-35000.000	-27354.430
3	-45000.000	-27487.285
4	-60000.000	-28643.773
5	-98000.000	-36564.930
6	110588.000	32248.262
7	109040.000	24850.996
8	107448.000	19138.855
9	103645.000	14428.645
10	96033.000	10448.582
11	95172.000	8092.930
12	94019.000	6248.441
13	93012.000	4831.195
14	92130.000	3740.043
15	92130.000	2923.050
16	92130.000	2284.525
17	92130.000	1785.482
18	92130.000	1395.453
19	92130.000	1090.624
20	92130.000	852.382
21	92130.000	666.184
TOTAL	1292997.00	-24.605

RETURN ON INVESTMENT = 27.950 PCT.

11/20/79 Superior Exp - with Property Considerations

Proforma Feasibility

Cu 1.60 Grade 1.25 %

ASARCO

80% of N.P. After Payback

Yr	Capital Exp.	NSR	OPR. COST	CASH FLOW Before Taxes	DEPREC	Depletion	80% N.P. TAXABLE INC.	CANUS 3% NSR 3% DEPL	CONT. MTR 20% N.P. (500,000 def)	ASARCO DUE TAX	ASARCO CASH FLOW After TAX	Payback ACCUM
1	-12000											3
2	-35000											
3	-45000											
4	-60 000											
5	-98 000											
6	+211,878		59 787	152 091	31 625	30,829	89,137	6,356 1043	500	41,003	110,588	
7			"	"	27 672		93,590	6,356 "		43,051	109,[illegible]	245,192
8			"	"	24 213		97,049	6,356 "		44,643	107,458	352,646
9			54 367	157 511	21 186		95,611	932	9,885	43,981	103,645	+10,[illegible] (63,350)
10			53 436	158 442	18538		87,900		21,975	40,424	96,[illegible]	
11					16 221		89,114		22,278	40,972	95,172	
12					14 193		90,736		22,684	41,739	94,[illegible]	
13					12 419		92,155		23,039	42,391	93,012	
14					10 869		93,397		23,349	42,963	92,130	
15												
16												
17												
18												
19												
20												
21								20,000	123,912			

Invest Tax credit 29300

Need 27,754

ASARCO

RECEIVED

SEP 4 - 1979

EXPLORATION DEPARTMENT

Exploration Department
T. C. Osborne
Vice President

August 30, 1979

Mr. W. L. Kurtz
Tucson Office

Arizona
Superior East Project

Dear Mr. Kurtz:

I'm in agreement with the opinion expressed by Mr. Graybeal's memorandum of August 6 which I know you share, to the effect that exploration of the A-8 discovery has reached the point at which acceleration of drilling is warranted in order to determine tonnage and grade. Although I reserve the right to quibble about details later on, in general you and Mr. Graybeal should plan to include provision for the program in your 1980 budget proposal. I agree two drills should be the minimum during the first year, and we might wish to increase this to three or even four drills during 1981 if the 1980 results are favorable.

We would likely have no difficulty finding a joint venture partner to share cost of the program if we desired, but my initial thought is that the financial commitment is within our capabilities and it will be best to proceed alone.

In considering the proposal, we need a firmer handle on possible economics of the deposit. Therefore, I would like to have from you not later than December 1 a pro forma feasibility outline using horseback figures, for a model of 100 million tons at 1.25% Cu above the 5,000' level. I expect Mr. Skidmore or others in the Mining Department can help you with estimates of development and operating block cave — and capital costs derived from Sacaton studies. The scenario should assume that drilling has been completed and Year 1 starts with development shaft sinking. Use 1979 capital and operating costs and work out potential after-tax internal rates of return for various copper prices. The analysis should show returns both for the total project and for Asarco's share after provision for Continental's net proceeds royalty. If any questions arise, please call.

Very truly yours,

T. C. Osborne

cc: FTGraybeal

ASARCO

Southwestern Exploration Division

JDS

Replaces Nov. 27 memo

December 3, 1979

SUPERIOR EAST PROJECT
Pinal County, Arizona

A pro-forma feasibility study has been made which shows the following after tax internal rates of return:

	Project With Property Obligations		
Cu price	$1.00	1.30	1.60
DCFROR	19.29%	27.33%	33.74%

Feasibility was based on the following criteria:

Reserves: Primary orebody - high grade disseminated and fracture vein controlled.

100,000,000 tons @ 1.50% Cu } 90% mined grade,
110,000,000 tons @ 1.36% Cu } 110% mined tons.

Mining: See attached sketch for configuration of orebody (J.D.Sell) with a presumed strike of 4,000', 300' wide and 1,000' thick. Block caving used for a mining system rated at 20,000 tpd with a 16-year life.

Milling: Standard flotation flow sheet for 20,000 tpd producing high grade concentrates.

Capital Costs: See attached estimate by George Percival.

Mine preproduction	$140,300,000
Mill	100,000,000
Engineering	4,000,000
Working Capital	8,700,000
	$253,000,000

NSR: Smelter costs based on predominate bornite concentrates.

Cu price	smelter	grade	tpd	NSR/lb	rec'y	NSR/ton
$1.00	.26	1.36 -	20 -	.74 -	.95	= 19.12
1.30	"	"	"	1.04	"	= 26.87
1.60	"	"	"	1.34	"	= 34.63

>>>

Operating Costs: See attached estimate by George Percival.

	Project with with property obligations		
	Cu $1.00	$1.30	$1.60
Direct mining	3.71	3.71	3.71
Indirect mining	1.48	1.48	1.48
Direct milling	1.49	1.49	1.49
Indirect milling	0.59	0.59	0.59
Management fee	0.05	0.05	0.05
3% royalty	0.57	0.81	1.04
	7.89	8.13	8.36
Without royalty	7.32	7.32	7.32

Also attached are print-outs and work sheets for the above three rates of return.

Property obligations include:

1) 3% NSR to CanUS Ltd upon production until $20,000,000 paid;

2) 0.05 per ton management fee;

3) Mining agreement with Continental Materials based on net profit lease. Net profits shared 80-20% after payback of all pre-mining expenses (including exploration), plus 1% over the prime rate, less $500,000 deductible. This also covers post-mining operation capital costs.

RBC
R. B. Crist.

RBC:jlh
attachments
c.c. W.L.Kurtz
F.T.Graybeal
J.D.Sell
G.Percival

RBCrist - JD Sell → FVG
Sles.

RECEIVED
JAN 4 1980
S. W. U. S. EXPL. DIV.

New York, January 2, 1980

MEMORANDUM FOR: Mr. R. L. Hennebach

Arizona
Superior East Project

Attached for general interest is a summary by Mr. Crist which hypothesizes with respect to possible feasibility of the type of copper deposit we are hoping to confirm by further exploration drilling at Superior East. Using very rough assumptions, it would appear that such a deposit might produce a 15% ROI at $1.00 copper, and a considerably better return at higher prices.

It should be clearly understood that the only conclusion which can be drawn from this purely speculative exercise is that further exploration drilling is warranted. Definitive feasibility studies, even of a preliminary nature, would of course require a great deal more engineering work and input, and in any case could not be made until a mineral reserve has been proven and delineated. We hope that the planned drilling for 1980 and 1981 will accomplish this.

Original Signed By
T. C. Osborne
T. C. Osborne

Attachments

(Crist memo and attachments)

cc: CFBarber)
RdeJOsborne) w/copy of Crist memo.
NVisnes)

bcc: WLKurtz)
FTGraybeal)
CWCampbell) w/o att.
TEScartaccini)

ASARCO

Southwestern Exploration Division

July 29, 1981

TO: W. D. Payne

FROM: J. D. Sell

Reevaluation of Vein Structures
Superior East Project
Pinal County, Arizona

Evaluation of drill data intercepts of the quartz-sulfide vein (qsv) system(s) found in the A-8, A-9, A-10, A-11, A-12, and A-14 holes, based on the oriented core studies which suggested a southerly dip component to a north-northeasterly striking system, now suggest the following:

A. Using the drill holes A-8 and A-10, the best fit is a strike direction of N70°E.

B. Holes A-8 and A-10 intercepted the same qsv system. Unfortunately the hole A-10 was located north of the best fit and hence cored only the footwall portion of the qsv under the oxidized surface.

C. Using the N70°E strike and hole A-14 as a control point, it would be necessary to change the strike direction to more N65°E for the best fit to be the same structure as hole A-12 presently being drilled. As reported, hole A-14 cut only 173 feet of 0.45% and is interpreted to be the basal portion of a qsv system. Thus to fully test this qsv in hole A-14 it will be necessary to move out some 400 to 500 feet south of A-14. Wedging is probably not warranted for that distance of a move-out and a new surface hole is recommended.

D. Using A-14 and A-12 as the same structure, the hole A-9 would be a separate qsv structure and would project to lie between A-8 and A-14.

E. Using the N65-70°E strike, the intercept in hole A-11 is thus a separate qsv structure.

F. Using the above, it is more likely that hole A-12 will need to go to around 5700 foot depth to intercept the A-11 structure dipping south. (Note: The A-12 intercept is not accurately plotted as I have failed to catch up with and reduce a survey plot of the hole. Thus the above may be changed by a factor when all is plotted correctly.)

G. As it presently appears, four qsv zones have been cut in the drilling around A-8:

1) The A-8 to A-10 zone
2) The A-9 zone
3) The A-12 to A-14 zone
4) The A-11 zone

(Note: Checking of the various intercepts and their plots has not been made. The above suggestions should be considered preliminary until all data points are verified.)

James D. Sell

James D. Sell

JDS:lb
Att: Preliminary map

	Subsea
A-8 Collar 4671'	
top of bedrock p€pi& minor bfp 3226'	+1445
A-2 Type SB	
basal flt zone @ 15-20°; 3775'	+ 896
leached qsv in oxidized zone	
oxide/sulfide 3879'	+ 792
646' @ 1.57%	
base of qsv system 4525'	+ 146
4907 TD	- 236

- -

A-9 Collar 4640'	
top of bedrock p€pi, minor bfp 3275'	+1365
M-1A SB type to 3337'; A-2 SB type below	
basal fault zone @ 10°; 3687'	+ 953
leached qsv in oxidized zone	
oxide/sulfide 4044'	+ 596
626' @ 0.81%	
base of qsv system 4670'	- 30
4903 TD	- 263

- -

A-10 Collar 4585'	
top of bedrock p€pi & Lbfp-Lsg 3375'	+1210
M1A Type SB to 3406	
A-2 Type SB to 3859	
basal fault zone @ 20°; 3859'	+ 726
leached qsv in oxidized zone	
oxide/sulfide 3953'	+ 632
296' @ 0.29% (tail end of qsv)	
base of qsv system 4249'	+ 336
low grade	
4282 TD	+ 303

- -

A-11 Collar 4608'	
top of bedrock p€pi & Lbfp 3492'	+1116
A-2 Type SB, leached capping	
basal fault @ 15-20°; 4072'	+ 536
oxide/sulfide 4261	+ 347
291' @ 0.40%	
4553 top of qsv system	+ 55
533' @ 1.12%	
5086 bottom of qsv system	- 478
89' @ 0.26%	
5175 TD	- 567

- -

	Subsea
A-12 (Navi-drill hole from A-11, collar 4608')	
top of bedrock p€pi & Lbfp 3500	+1108
A-2 Type SB	
basal fault ±4060	+ 548
leached qsv in oxidized zone	
oxide/sulfide ±4170	+ 438
down to 4705 have weighted average	
of 456' @ 0.95 (535' actual, some not sampled)	
have mixed hi & low, overall low? down to 5085	
Still drilling (7/27/81)	

complete

- -

A-13 Collar 4728'	
top of bedrock 3071' p€pi & Lbfp	+1657
A-2 type SB, leached capping	
Basal fault zone, flattish; 3251	+1477
prob. low grade	
oxide/sulfide 3499	+1229
138' @ 0.32	
Top of qsv system? 3637	+1091
392' @ 0.67	
base of qsv system 4029	+ 699
low grade	
4663' TD	+ 65

- -

A-14 Collar 4694'	
top of bedrock p€pi & Lbfp 3841	+ 853
A-2 Type SB	
basal fault 10-15°; 4010	+ 684
qsv in oxide zone	
oxide/sulfide 4096	+ 598
173' @ 0.45 (53' @ 0.53)	
(4149)	
(99' @ 0.25) lower part of qsv system	
(4248)	
(21' @ 1.20)	
base of qsv system 4269	+ 425
low grade below	
5738 TD	-1044

- -

AI-2	
Collar 4715'	
top of bedrock 2616 = subsea	+2099
basal fault zone = 2771 = subsea	+1944
Entire hole partially oxidized	
(2850 subsea =	+1865
best intercept (310' @ 0.37%	
(3160 subsea =	+1555
3612 TD	+1103

- -