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JHC: ← Does Cummings agree with JEK's conglomerate units? JHC 3-15-77

WXK? → FTG

J.H.C.
JUL 23 1964

RBC has done little with conglomerates outside mine - to my knowledge FTG

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

May 14, 1964

MEMORANDUM TO MR. J. H. COURTRIGHT

Sacaton-Santa Cruz Prospects
Preliminary Geologic Map

The preliminary geologic map (att.) of the subject area shows some formational groups not previously used in Company correspondence; the following comments describe their salient features.

Pre-Ore Rocks

Pre-Cambrian Basement:

Pinal Schist. Partly typical of the quartz-sericite schist defined as Pinal in other areas. Also here includes banded injection gneiss, granite gneiss, and aplite.

Granite. There are two types undivided on the map. One is "typical" coarse-grained granite with biotite similar to the Mineral Butte granite at Blackwater (Report, A. G. Blucher). A second type is coarse-grained, but with less biotite and with large pink feldspar phenocrysts.

Pre-Cambrian and Paleozoic sediments:

The Apache group of shale and quartzite (Younger pre-Cambrian) is mapped undivided.

Paleozoic sediments represent Bolsa quartzite and Devonian-Carboniferous limestone. Not separated during mapping.

Laramide intrusives:

The Laramide intrusive complex contains many more varieties than are shown; these have been grouped into four units, each of which comprises varieties similar in composition and relative age.

Diorite. The earliest intrusive and/or border phase of Laramide granite is rich in biotite and locally contains magnetite.

Coolidge granite. Defined by Blucher (Report, Blackwater and Sacaton). Equigranular biotite granite which is very uniform in character. The granitic rocks along the west edge of the map which extend from Highway 84 north to the Palo Verde mountains may be pre-Cambrian, but they are most similar to Coolidge in appearance. A better correlation of these granites will be made when mapping is complete.

Micro-granite. This rock is like the Coolidge granite but is fine-grained. Included in the category for mapping purposes are pegmatite, aplite, and alaskite--all in small bodies.

Porphyries. A variety of porphyritic rocks ranging from mafic to acid, with and without quartz, occur as dikes in the mountain ranges. The only larger mass occurs beneath cover in the Sacaton Cu deposit, where it is altered to sericite and clay. There, a monzonite and a dacite have been recognized. The monzonite, in the weakly altered fringe area, is seen to contain much biotite.

Post-Ore Rocks

(1) Volcanics.

The volcanic terrain south and west of Casa Grande is divided into three units:

Sediments. Conglomerate and grit derived from granite and apache group. These rocks are tilted as much as 50°.

Older volcanics. Above the sediments (not always present) are flows of basalt, andesite and latite. These rocks are faulted and tilted.

Basalt. The exposed basalt flows are widely scattered erosional remnants resting on the older volcanics.

(2) Valley conglomerates.

The conglomerates which fill the Casa Grande valley are divisible into three units:

Sacaton conglomerate. This unit is known only near the Sacaton Cu deposit. There are no outcrops of similar type. Its character, as determined by drill cores, is that of an unsorted fanglomerate made of granite and schist/gneiss boulders and grit. The Sacaton conglomerate was deposited against steep relief cut on the Sacaton altered zone, and then displaced along the Basement fault to its present position. Induration is significant and the formation is hard and compact.

Burgess Peak conglomerate. A small hill--Burgess Peak--arises just NW of Casa Grande and is composed of a hard granite-boulder fanglomerate with hematite cement. Our three holes on the Gila prospect penetrated similar conglomerates, and water well drillers' logs indicate that this formation probably extends southeast along the ridge which appears to separate the water basins east and west of Casa Grande. The formation is variable in hardness, but is generally well indurated, although less so than the Sacaton conglomerate.

Gas line conglomerate. The Gas line conglomerate is named for a small outcrop of conglomerate along the El Paso gas line east of Sacaton and drill hole penetrations of the formation in the same area. The formation appears to be younger than known faults and is derived from the granitic rocks of the Sacaton mountains. It is poorly consolidated and consists of fanglomerate and sandy stream deposits. A thick clay layer is present east of the Sacaton deposit, which appears to trend south and taper-out across its width of about 2 miles. The Gas line is the aquifer north of Casa Grande. Where it is adjacent to the Sacaton deposit it is dry. The aquifer gravels in the deep basin west of Casa Grande are probably equivalent in age, but they will no doubt contain boulders derived in part from the mountains south and west thereof. The outline of the Gas line basin at Sacaton is shown in green on the map.

(3) Andesite.

Dikes of andesite are post-ore but older than the valley conglomerate.

(4) Quaternary.

Alluvium made of poorly consolidated silt and sand is spread out across the Casa Grande valley, reaching a thickness of about 200 feet near the Santa Cruz River. ?

Dissected alluvial fans flank Table Top mountain, and are made largely of volcanic rubble.

John E. Kinnison
JOHN E. KINNISON

JEK/jk
cc: JRWojcik w/att.
JEKinnison w/att.
File w/att.
3 extras w/att.

FORM SL-1035-A 1 M 2-68

KEEP THIS ON TOP

File No. Aa-16A.3.19B

From 11/7/67 **to**

Subject: SACATON
(JHC's file)

ASARCO

Exploration Department
Western USA

January 14, 1976

J. H C.

JAN 15 1976

Memorandum for Mr. T. E. Scartaccini

Sacaton

As I briefly discussed with you Monday, we would like to have Brian Bailey of our Salt Lake City Exploration Division work at Sacaton as an assistant to Mr. Cummings for a period of two and a half months.

I have discussed this with Mr. Cummings, and he states that he can very effectively use Mr. Bailey at this time to help with the daily mapping, the relogging of east orebody core, and the study of the east orebody.

Unless you direct otherwise, Mr. Bailey will arrive at Sacaton and report to Mr. Cummings no later than 1 February and more likely during the week of 19 January.

W. L. Kurtz

W. L. Kurtz

WLK:lb

cc: TCOsborne
JHCourtright
FTGraybeal
TREdwards
RBCummings
MPBarnes
BBailey

11/12/75

From: J. J. Collins

J. H. C.

To: Messrs. M. P. Barnes
W. L. Kurtz
S. A. Anzalone

NOV 26 1975

Mr. Snedden read this and did not object, only saying he would carry Barnes' report to the Tucson Office.

Mr. MacDonald read this memo and agreed with it.

J. J. Collins

RECEIVED
NOV 17 1975
S. W. U. S. EXPL. DIV.

Lark file - Sacaton

cc for: JHC ✓ RBC FTG

New York, November 7, 1975

MEMORANDUM FOR: Mr. R. L. Hennebach

Sacaton - Ore

The Problem

Copper production has not equalled pre-mine estimates and questions have been raised as to what went wrong. Was the ore reserve calculation incorrect? Are mining operations contributing to the problem?

The Answer

Complete pre-mine drilling records have been recalculated by our Geologic Computer Group for the area that has been mined out prior to May, 1975, and the resulting average grade compares very closely with the average grade from all blast hole assays in the same area, i.e., some 3000 blast holes (both ore and waste) average 0.58% Cu and the reserve estimates by three different methods are 0.60%, 0.62% and 0.59% Cu. Thus, the overall reserve grade figures have been corroborated. Please refer to Table 3 in the attached report by Mr. Barnes entitled "Geostatistical Study."

What we do not know is the degree of sorting that has been practiced within the mined area. All the reserve maps of the ore zone reveal areas of internal waste and sub-profitable rock that should not have gone into the mill, but we do not know how much of this material was actually sent to the mill. All that we do know is that mill heads on a monthly basis, counting backward for a year from May, 1975 were: 0.82, 0.70, 0.76, 0.73, 0.64, 0.66, 0.59, 0.72, 0.66, 0.56, 0.67, 0.61, 0.61% Cu. Apparently waste was not sorted out during some months.

Explanation

The pre-mine ore reserve estimates cover a larger volume than has been mined to date hence they are not directly comparable to production data. Therefore, our Geologic Computer Group in Salt Lake City has reworked the portion of pre-mine drilling data that do coincide with the mined area. To simulate the pre-mine calculations both the polygonal and the Inverse of the Distance Squared methods were repeated, plus statistical analyses of the precision in each method. In addition, a new method, "Kriging" was applied.

All methods show a variance in the overall grade of ore of ±8% at the 95% confidence level. This is an acceptable accuracy for the overall grade of an ore reserve, but statistical analysis shows extreme variation in small volumes. A typical unit area measuring 50 x 50 x 40 feet shows a variance of ±41% for the blast hole assays.

Local variation is evident in the drill logs and is extreme at the irregular boundaries between the oxide zone, the chalcocite enrichment, and the primary sulphides. No reasonable amount of surface drilling can reveal all these irregularities. The only practical method, we think, is mine development with enough exposure of ore and waste prior to completion of a mill so that selectivity in mining can provide the desired grade to the mill. At Sacaton the mill was completed before the mine was fully developed; hence the choice of mill feed was limited and the grade apparently suffered.

Recommendations

Experience at Sacaton leads me to conclude that:

1. A geologist and the geologic computer group should be included in mine planning teams.

2. Two cut-off grades should be used in the mine. Most important is the grade that will generate the desired R.O.I. The second cut-off is the grade that will just pay back mine and mill operating costs. The rock between these two cut-offs should go to a stockpile to remain there until the profitable ore is gone.

Oxidation of Chalcocite would need to be ~~too~~ taken into account

3. Mine and mill production should be reported in pounds of contained copper to balance the too-human tendency simply to put "rock in the box." Sensitivity analysis shows that cost per ton of rock is less critical to profit than is the grade of ore milled, i.e. an extra pound of copper pays for stripping a ton of waste.

John J. Collins

John J. Collins

Attachment

cc: TASnedden - w/att.
NVisnes "

ASARCO Incorporated
Casa Grande Arizona
Sacaton Unit

June 9, 1975

Memorandum To: T. R. Edwards

From: R. B. Cummings

Subject: Exploration Possibilities Northeast of the East Orebody

Summary

Drill hole data from the general area northeast of the east orebody suggests that an attractive underground exploration target is present. Geology in the target area is similar to that from the east orebody. Mineable thicknesses of sulfide mineralization averaging 0.50% copper were intersected in 2 drill holes which are separated by a distance of 2,000'. This and other data suggest that the northeastern end of the Sacaton alteration zone might contain mineralization similar in grade and tonnage to the east orebody. A five hole drilling program costing $ 140,000. is recommended to test this target.

Introduction

Recent examination of drill hole data along the Sacaton alteration trend suggests that a residual exploration target is present northeast of the east (underground) orebody. Drawing SAC-11-G3 is a drill hole location map showing the outline of the east orebody, the open pit, and three sections drawn parallel to the alteration zone. Drawing SAC-11-G2 shows the three sections looking northwesterly through the west orebody, east orebody, and the area of interest.

The drill hole location map shows that the exploration drill spacing northeast of the east orebody is about 2,000' in a direction parellel to the trend, and 500' in a direction at right angles to the trend. The maximum dimension of the east orebody is approximately 1,100' parallel to the alteration trend and 650' at right angles to the trend. Thus, the exploration drilling did not totally eliminate the possibility of finding an underground orebody similar in size to the east orebody. For the purpose of this study the area of interest is considered to be the N 1/2 of Sec. 25 and part of the S 1/2 of Sec. 24 between drill holes S-56 and S-78.

Land Status

The bulk of the area of interest (Sec.25,T5S,R5E) is owned by ASARCO. A property map is included as Figure 1. The land to the north and east of the N 1/2 Sec. 25 is controlled as follows:

1. SW 1/4, Sec. 24, T5S, R5E - unpatented lode claims by James Sullivan of Scottsdale.

2. NE 1/4, SE 1/4, Sec. 24, T5S, R5E by Whitten Thomson of Tucson.

3. S 1/2 + NW 1/4, SE 1/4, Sec. 24, T5S, R5E - by Anthony Pavone of Nogales.

4. SW 1/4, Sec. 19, T5S, R6E - by numerous owners in Desert Vista Unit # 5 sub-division.

5. NW 1/4 Sec. 30, T5S, R6E - by Glendora Megna of Tucson.

Geology and Structure

The geology in the area of interest is similar to the geology from the east and west ore bodies. Bedrock is overlain by about 750' to 1700' of alluvium and conglomerate. The bedrock - conglomerate contact may be a fault in all locations. Mineralized bedrock beneath the conglomerate consists of pre-Cambrian granite, Laramide monzonite porphyry and Laramide dacite porphyry. The rock units mentioned above are terminated at a depth of about 1900' by the Basement Fault.

The main pre-mineral rock type in the area of interest is the granite. Monzonite porphyry and dacite porphyry intrude the granite as irregular dike or sill like bodies and as mixed breccias including the granite. The terms monzonite porphyry and dacite porphyry were adapted from the drill hole logs. The monzonite porphyry may be a phase of this quartz monzonite porphyry. Monzonite porphyry is most abundant in the west orebody and about equally abundant in the east orebody and in the area of interest. Primary rock textures show no major variation from the west orebody through the holes in the area of interest.

Intence fracturing and brecciation are common in the east and west orebodies. Interpretation of drill hole logs suggests similar conditions in the subject area, but the overall intensity may not be as great.

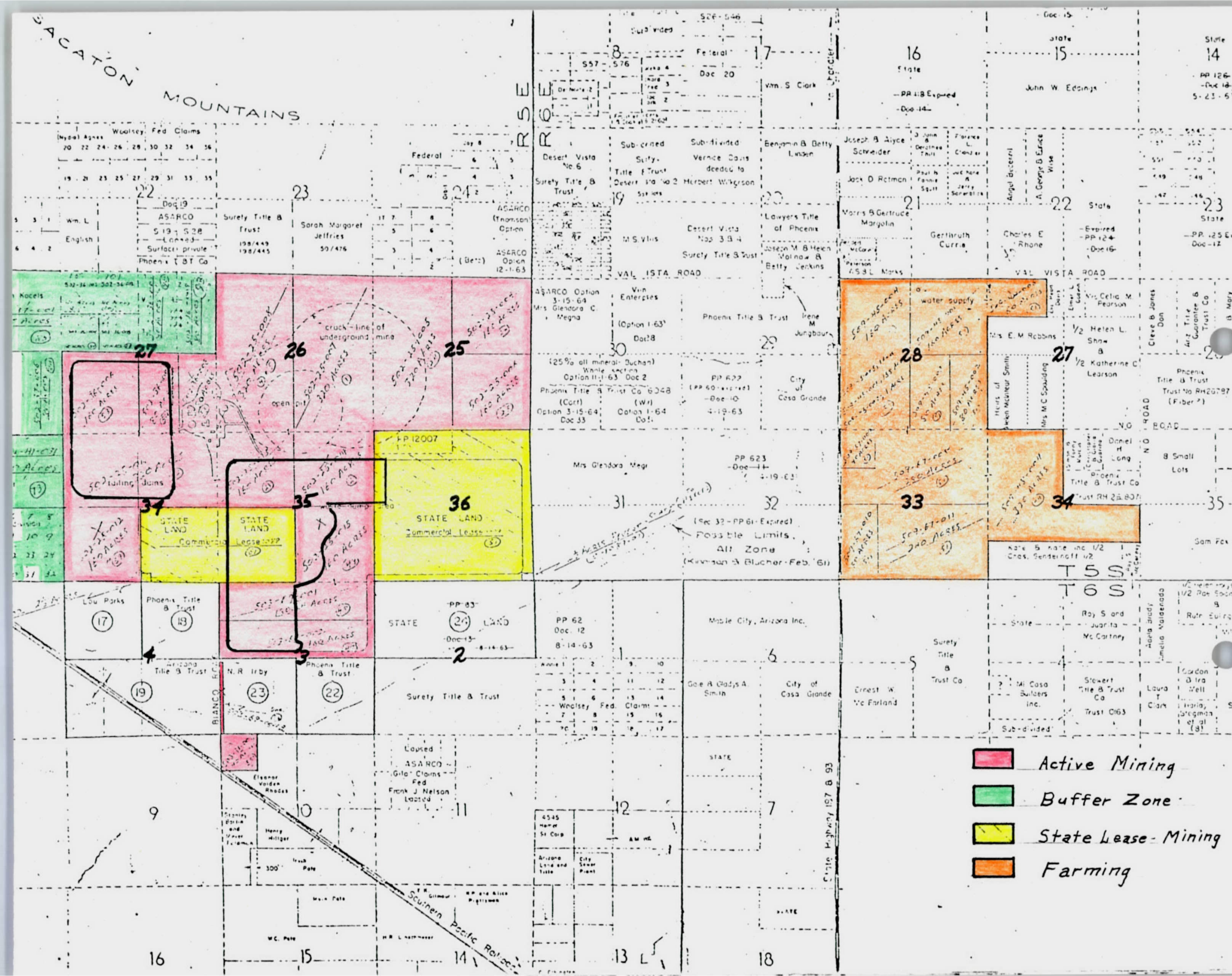

SACATON MOUNTAINS
R 5 E
R 6 E
T 5 S
T 6 S
VAL VISTA ROAD
crack line of underground mine
open pit
STATE LAND
Commercial Lease
Possible Limits, Air Zone (Kinnison & Blucher - Feb. '61)
Southern Pacific Railroad
State Highway 187 & 93
Active Mining
Buffer Zone
State Lease - Mining
Farming

Figure 1

Major faulting is indicated in the subject area by the diverse depths to bedrock encountered in drill holes. It can be seen that a fault must be present between drill holes S-62 and S-77 on Section ABC, S-59 and S-68 on Section DEF, and S-55 and S-64 on Section GHI. Another fault is indicated between holes S-74 and S-78 on Section DEF. The strike, dip, and exact location of the faults are unknown but it is obvious that a structural high is present between holes S-59 and S-78 on Section DEF. In the structural high a thickness of up to 900' of potentially mineralized rock is found between the Basement Fault and the conglomerate-bedrock contact. Southwest of the structural high (between the high and the east orebody) the thickness of potentially mineralized rock reaches a minimum of about 225'. In a like manner the thickness of perimissible rock northeast of the high has been similarly reduced.

Alteration

Hydrothermal alteration of the rocks in the area of interest is similar to that from the east and west orebodies. Since the drill core was not immediately available, alteration assemblages were visually estimated from the core boards. Core boards from the following holes were examined in the study: S-62, S-77, S-76, from section ABC; S-59, S-68, and S-74 from section DEF; S-55, S-64 and S-69 from section GHI. In the subject area the monzonite porphyry usually contains less than 10% (by volume) phyllic and argillic alteration and 10% to 30% secondary biotite as very fine grained dissemenations in the groundmass. The granite contains 10% to 30% phyllic alteration, 10% to 20% argillic alteration, and 4% to 8% silicification. The overall alteration intensity is similar to that seen in the west orebody but somewhat weaker than the well enriched portion of the east orebody. The alteration from the drill holes in section ABC was slightly weaker than average for the area of interest and the alteration for holes S-68 and S-74 (containing the better mineralization) was slightly stronger. Within any given drill hole the better alteration occurs in the enriched portion of the sulfide zone or in randum portions of the leached capping.

The depth of oxidation in the area of interest is quite variable. Elevations to which oxidation is present in the drill holes from the structural high varies from 190 feet above sea level to 220 feet below sea level. The surface of the base of oxidation dips to the northeast parallel to the sections and dips away from section DEF at right angles to the sections.

A thorough leached capping interpretation was not possible from the core boards but the boards were logged for the dominant limonite constituant. In drill holes S-76, S-68, S-55, and S-64 hematite was dominant over goethite throughout the leached capping. In holes S-77, S-79, and S-69 goethite was dominant in portions of the capping but hematite was more abundant overall. In hole S-74 a slightly greater footage of goethite dominant capping was found compared to hematite dominant capping. The overall impression gained from the core boards was that the leached capping represents a spotty zone of weak to strong chalcocite enrichment.

Mineralization

In the study area mineralization occurs as 1. primary chalcopyrite, 2. secondary chalcocite and covellite, and 3. oxidized copper minerals including chrysocolla, brochantite-antlerite, and malachite.

Within the Sacaton alteration zone the grade of primary mineralization shows a well defined zoning pattern which parallels the northeast trending alteration zone. Values of copper as chalcopyrite from drill holes vary from less than .05% to .75% (in the west orebody). Most of the secondary enriched ore from the east and west orebodies is underlain by primary chalcopyrite averaging + .40% copper. The contour of + .40% copper as chalcopyrite is shown on drawing SAC-11-G3. This zone of better primary mineralization trends to the northeast through the structural high in Sec. 25 and appears to be about 500 feet wide in the vicinity of hole S-68, and section DEF.

A number of thin intercepts of enriched chalcocite mineralization were intercepted in the area of interest. The grade of this material varies from .23% Cu to 1.92% Cu. Unfortunately the intercepts which average over .50% Cu are not very thick (60 feet at the most) and are often separated from one another by barren zones of leached capping. As in the east and west orebodies the best enriched ore is found over the better primary mineralization (holes S-64, 68 and 74).

Some oxidized copper mineralization is found in most of the holes drilled in the area of interest. Hole S-68 contains the best such intercepts with 28 feet of 1.38% Cu as chrysocolla and malachite and 130 feet at 1.07% Cu as brochantite-antlerite. Much of this material was problably oxidized and deposited in place from pre-existing chalcocite mineralization. If the above assumption is correct hole S-68 represents an original chalcocite blanket 344 feet thick averaging at least .74% Cu.

Exploration Possibilities

A first order exploration target is present in the area of interest. The target area is a zone 600' wide between holes S-59 and S-78. Primary reasons for considering this area of first order importance are as follows:

1. Existance of known mineralized trend in the target area.

2. Proximity of target area to economic mineralization.

3. Geologic similarity of target area to near-by mineralization.

4. Sparce drilling in the target area indicates the presence of sub-economic mineralization.

Two holes (S-68 and S-74) were drilled near the center of the target area. Hole S-68 contains 272' at 0.51% Cu from the top of the enriched zone to the bottom of the hole (in primary mineralization). The total thickness of bedrock (510') in this hole, including oxidized mineralization above the enriched zone, averages 0.616% Cu. Hole S-74 contains 342' averaging 0.508% Cu from the top of the enriched zone to the base of the better primary mineralization.

Although this mineralization is not underground ore at the present time it may be part of a weakly mineralized halo surrounding higher grade economic mineralization. A real potential does exist for finding a well enriched chalcocite blanket similar, but not limited to, the grade and tonnage found in the east orebody. With a maximum strike length of 1100' the east orebody could easily be hidden between holes S-59 and S-68 or between holes S-68 and S-74. A reasonable potential for this target area is two separate orebodies each containing 10 - 20 million tons of sulfide ore averaging 1.0% to 1.5% copper. In addition substantial tonnage of leachable oxidized mineralization might be developed.

Recommendations

In order to test the potential of the target area a five-hole drilling program is recommended. The bulk of the target area is owned by ASARCO so further land acquisition is not thought to be necessary at the present time. The location of the first three drill holes is shown on SAC-11-G2 & G3. If the results of these holes are negative the fourth and fifth holes would be unnecessary. The holes should be rotary drilled to bedrock and then cored to the Basement Fault.

The total cost of the project is detailed below.

Rotary Drilling

$ 6.50/ft.	Direct Drilling	Mobilization, Hourly Charges and Mud
3.00/ft.	Casing	$ 2,000/hole
$ 9.50/ft.		

Core Drilling

$ 12.00/ft.	Direct Drilling	Mobilization and Hourly Charges
1.00/ft.	Mud	$ 2,000/hole
.50/ft.	Sampling & Assaying	
$ 13.50/ft.		

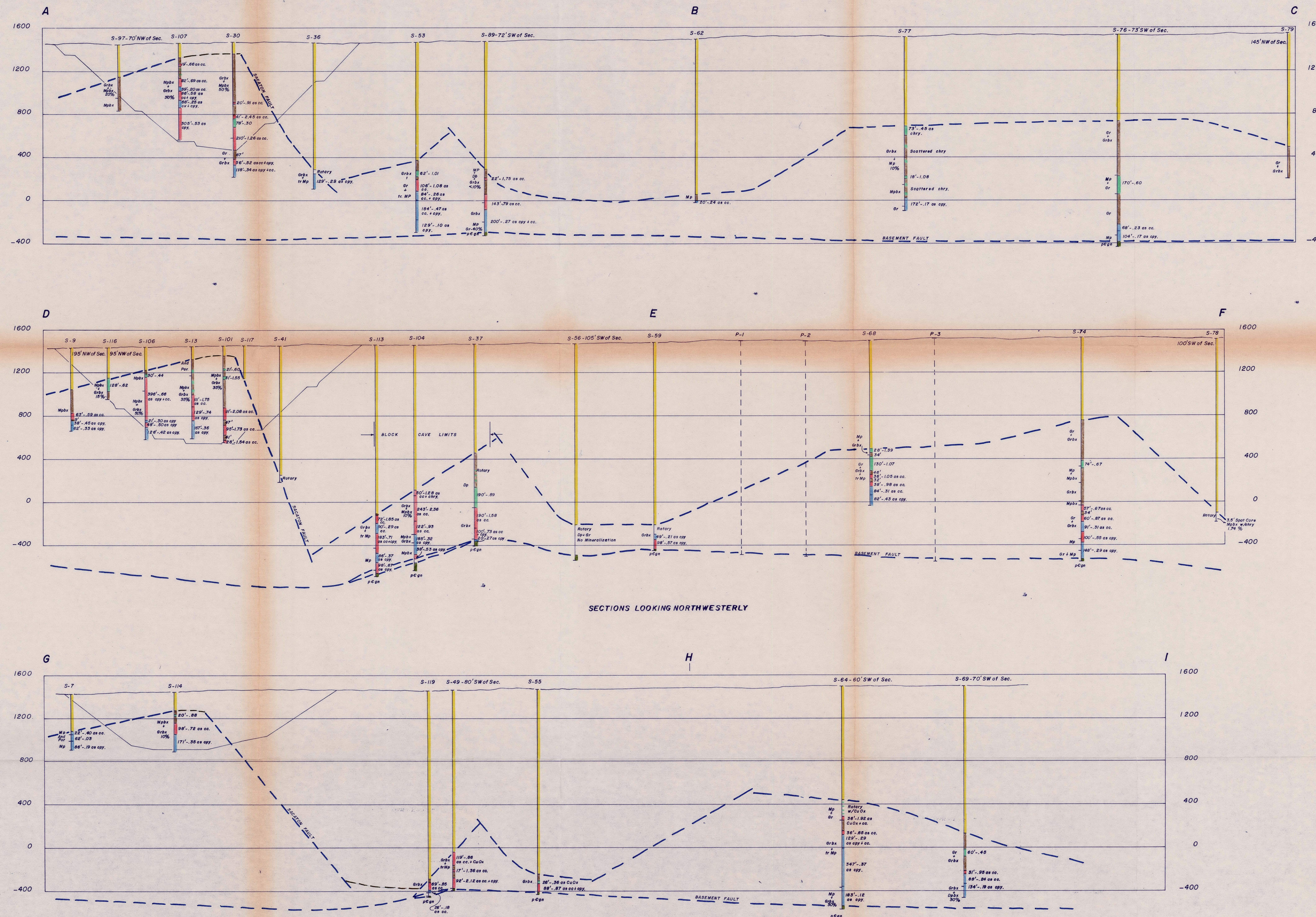
* Note: Core drilling will be with NC bits. Rotary holes assumed to average 1200 in depth and coring assumed to go to an average of 2,000'.

Rotary	5 holes @ 1200'		
	6,000' @ $ 9.50/ft.	=	$ 57,000.00
	5 holes @ $ 2,000/hole	=	10,000.00
			$ 67,000.00
Coring	5 holes @ 800'		
	4,000' @ $ 13.50/ft.	=	$ 54,000.00
	5 holes @ 2,000/hole	=	10,000.00
			$ 64,000.00
Total Drilling			$ 131,000.00
+ Congingencies			9,000.00
Total appropriation necessary			$ 140,000.00

R. B. Cummings

R. B. Cummings
Resident Geologist

RBC;kc
Encl.
cc: WLKurtz
JHCourtright
MAMelcher
File



EXPLANATION

Drill hole showing grade and mineralogy of mineralized intercepts and geology. Geology generalized from drill logs and core boards.

P-1, P-2, & P-3 are proposed holes.

Alluvium and Conglomerate	(yellow)
Leached Capping	(brown)
Significant Oxide Mineralization	(green)
Sulfide Mineralization ≥0.50% Cu.	(red)
Sulfide Mineralization <0.50% Cu.	(blue)
p€ Basement Complex	(olive)

And Por	Andesite Porphyry
Mp	Monzonite Porphyry
Dp	Dacite Porphyry
Db	Diabase
Gr	Granite
p€gn	Basement Complex
bx	Brecciation
— —	Inferred Fault
cc	Chalcocite
cpy	Chalcopyrite
cv	Covellite
chry	Chrysocolla

AMERICAN SMELTING AND REFINING CO.

SACATON UNIT

SECTIONS PARALLEL TO ALTERATION ZONE

Scale 1" = 400'	R.B.C.	4-9-75	SAC-11-G2

Mar 1975

MEMORANDUM REPORT ON SACATON UNIT SHAFT SITE TEST WELL

By

L. C. Halpenny and D. K. Greene

CONCLUSIONS AND RECOMMENDATIONS

1. Jetting tests performed with the test well at depths of 400 and 650 feet indicate that ground-water production above a depth of 650 feet is effectively nil.

2. Maximum pumping water level obtained during the jetting tests with the well at final depth was 733 feet with a discharge of 108 gpm (gallons per minute). Based on an approximate static water level of 250 feet the specific capacity at this discharge rate was 0.22 gpm per foot of drawdown.

3. Straight lining this specific capacity to a depth of 1,700 feet would give a theoretical yield of 319 gpm from this depth.

4. The quality of the water produced from the well during jetting with the hole at total depth is substantially better than the quality of the water presently seeping into the mine pit, indicating that a better circulation pattern exists at depth.

5. Most of the water produced from the final jetting test was probably from the 1,100 to 1,250-foot zone which, based on the quality data, could have reasonably good hydraulic communication with the alluvial basin sediments. The results of the jetting test indicate, however, that the ability of this zone to transmit water is limited.

6. With prolonged pumping and greater drawdowns additional small potential water-bearing fractures will probably open up and contribute water to the bore hole. Thus, it is recommended that a pump capable of producing 500 gpm with a lift in the range of 1,700 to 1,750 feet be installed in the test well if it is desired to dewater the shaft during sinking. The discharge line should be equipped with a gate valve to control the flow and prevent surging in the event the pump capacity exceeds the well capacity. Provision should be made to monitor pumping water levels and the volume of water pumped. A 3/4-inch water-level measuring tube should be installed alongside the pump column in the well.

7. By virtue of its larger diameter the shaft might produce greater quantities of water during initial construction than the test well will produce. In order for the well to be effective as a dewatering point it should be placed in operation ahead of shaft construction and operated at maximum drawdown so as to drain the surrounding rocks. Drainage from these materials will undoubtedly be slow.

JETTING TESTS

Three jetting tests were performed on the well at depths of 400, 650, and 1,798 feet. The tests at 400 and 650 feet were run because this zone was subsequently to be cased with 20-inch casing and cemented off. The drill rig compressor was used for airlifting and discharges were measured with a weir box. Water levels were measured with an electric sounder in the annular space between the drill pipe and the side of the borehole. The depth to static water level was not known at the beginning of the jetting tests because the hole was full of fluid. Recovery data from the final test, however, indicate that the static water level is in the range of 250 feet and this figure has been used in calculating drawdowns.

Hole at 400-Foot Depth

Time spent jetting at this depth amounted to 3 hours and 10 minutes with the jet sub set at a depth of about 380 feet. At the end of this period of jetting the water level was 329.6 feet and the discharge was 7 gpm. Both the discharge and water level were still declining when jetting was stopped. Based on the last set of measurements taken, the drawdown was approximately 80 feet and the specific capacity was 0.09 gpm per foot of drawdown. The data collected during this test are given in Table 1.

Hole at 650-Foot Depth

A total of 4 hours and 36 minutes were spent jetting the hole at a depth of 650 feet with the jet sub approximately 20 feet off the bottom of the hole. At the end of this phase of testing the water level was 518.1 feet and still declining and the discharge was 17 gpm. Based on a static water level of 250 feet the drawdown was about 268 feet and the specific capacity was 0.06 gpm per foot of drawdown at the time jetting was stopped. Data collected during this test are given in Table 2.

Hole at 1,798-Foot Depth

Jetting with the hole at a depth of 1,798 feet was done in three stages and the data are given in Table 3. At the time the casing was

→ 19

TABLE 1

JETTING DATA,
HOLE AT 400-FOOT DEPTH

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-10-75	12:10			Started opening pit to discharge to weir box.
	12:20			Started jetting at 175 psi. Jet sub approximately 20 feet above bottom of hole. Water level prior to start of jetting was at land surface.
	12:24	26		Measuring water levels with sounder from top of rotary table 7 feet above land surface.
	12:25	34		
	12:26	39		
	12:27	47		
	12:29	57		
	12:30	64	284	Measuring flow with 90^{o} V-notch weir. Flow has not stabilized and is still affected by water draining from pit.
	12:32	73		
	12:33		248	
	12:35		248	
	12:36	103		
	12:38		236	
	12:40	117	225	
	12:43		204	
	12:45		193	
	12:48	151	174	100 psi.
	12:50		148	
	12:53		128	
	12:55	174	118	
	12:57	179.7		
	12:58	182.7		

TABLE 1

JETTING DATA,
HOLE AT 400-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-10-75	12:59	185.6		
	13:00	188.8	108	
	13:01	191.4		
	13:02	193.8		
	13:03	196.5	94	
	13:04	199.0		
	13:05	201.8	88	
	13:06	204.5		
	13:07	206.6		90 psi.
	13:08	209.2	82	
	13:09	211.6		
	13:10	214.0	76	
	13:11	216.4		
	13:12	218.5		
	13:13	221.5	70	
	13:14	223.0		
	13:15	225.2	70	
	13:16	227.2		
	13:18	229.6	65	
	13:19	231.5		
	13:20	233.3	60	
	13:21	235.2		
	13:22	237.3		
	13:23	239.0	55	
	13:24	240.7		
	13:25	242.2	50	
	13:28		50	
	13:30	251.8	46	75 psi.
	13:33		46	
	13:35	258.7	42	
	13:40	265.5	42	
	13:45	271.4	34	
	13:50	277.2	34	
	13:55	282.5	28	
	14:00	287.0	22	

TABLE 1

JETTING DATA,
HOLE AT 400-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-10-75	14:05	291.7	22	70 psi.
	14:10	296.3	22	
	14:15		19	
	14:20	303.5	19	
	14:30	310.4		
	14:35		17	
	14:40	315.7	15	
	14:50	320.1	12	
	15:00	323.5	11	65 psi.
	15:10	326.1	11	
	15:20	328.1	9	
	15:30	329.6	7	
	15:31			Stopped jetting.
	15:32	330.5		
	15:33	330.5		
	15:34	330.5		
	15:35	330.2		
	15:36	330.1		
	15:37	330.0		
	15:38	329.9		
	15:39	329.8		
	15:40	329.6		
	15:45	329.1		
	15:50	328.4		
	15:55	327.8		
	16:00	327.3		
	16:10	326.0		
	16:20	324.9		
	16:30	323.7		

TABLE 2

JETTING DATA,
HOLE AT 650-FOOT DEPTH

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-12-75	20:30			Started opening pit to weir box.
	20:37			Started jetting at 200 psi. Jet sub approximately 20 feet above bottom of hole. Water level prior to start of jetting was at land surface.
	20:43			Raising kelly.
	20:45	63.9		Measuring water levels with sounder from top of rotary table 7 feet above land surface.
	20:46	67.4		
	20:47	71.5		
	20:48	75.8		
	20:49	79.2		
	20:50	83.1	193	Measuring flow with 90° V-notch weir. Flow has not stabilized and is still affected by water draining from pit.
	20:51	86.9		
	20:52	90.6		
	20:53	94.3		
	20:54	98.0		
	20:55	101.6		
	20:56	104.3		
	20:57	107.6		
	20:58	110.9		
	20:59	114.0		
	21:00	117.3	156	
	21:01	120.4		
	21:02	123.4		
	21:03	125.3		

TABLE 2

JETTING DATA,
HOLE AT 650-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-12-75	21:04	128.8		
	21:05	131.5		
	21:06	133.9		
	21:07	136.8		
	21:08	139.3		
	21:09	142.0		
	21:10	144.2	82	
	21:15	156.7		190 psi.
	21:20	167.3	70	
	21:25	177.0		200 psi.
	21:30	194.1	60	
	21:35	183.2		Reversed air flow for few minutes.
	21:40	181.0	50	
	21:45			Foam in annulus causing ohm-meter needle to fluctuate.
	21:50	217.0	34	Not jetting right. Losing air. Came out of hole and changed some drill pipe.
	22:00		28	
	22:48			Back in hole. Started jetting.
	22:53	214.3		
	22:55	231.5		
	22:58	240.5		
	23:00	249.1		
	23:05	265.1		160 psi.
	23:10	282.8	42	
	23:15	296.7		
	23:20	311.0	70	143 psi.
	23:25	324.1		
	23:30	335.0	70	
	23:40	354.9	70	130 psi.
	23:50	375.8	60	
	24:00	394.1	60	

TABLE 2

JETTING DATA,
HOLE AT 650-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
01-13-75	00:10	408.4	50	105 psi.
	00:20	422.0	42	
	00:30	434.8	42	93 psi.
	00:40	446.2	34	
	00:50	458.2	34	88 psi.
	01:00	469.3	34	
	01:10	479.7	28	80 psi.
	01:20	489.2	28	
	01:30	497.3	22	
	01:40	503.3	22	70 psi.
	01:50	509.2	17	
	02:00	513.9	17	
	02:10	518.1	17	
	02:11			Stopped jetting.
	02:12	519.6		
	02:13	519.6		
	02:14	519.7		
	02:15	519.6		
	02:16	519.5		
	02:17	519.3		
	02:18	519.2		
	02:19	519.1		
	02:20	519.0		
	02:25	518.3		
	02:30	517.5		
	02:35	516.8		
	02:40	516.0		
	02:45	515.4		
	02:50	514.8		

TABLE 3

JETTING DATA,
HOLE AT 1,798-FOOT DEPTH

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-13-75	09:00			Started jetting at 245 psi. Jet sub at depth of 580 feet. Hole had just been cased to bottom with 14-inch perforated casing.
	09:30			230 psi.
	09:45			190 psi.
	10:00			150 psi.
	10:15			125 psi.
	10:30			110 psi.
	10:45		12	Measuring flow with 90° V-notch weir.
	11:00		34	110 psi.
	11:15		70	100 psi.
	11:20	382.3	34	Measuring water levels with sounder from top of rotary table 7 feet above land surface.
	11:30	385.2		Fairly muddy.
	11:40			T = 66° K = 2,200. Difficult to read. Needle on K-meter drifts due to foam in water.
	11:45	388.7	28	97 psi.
	12:00	391.3	22	97 psi.
	12:15	393.8	22	
	12:30	394.7	22	
	12:45	396.1		
	13:00	399.6		Stopped jetting. Coming out of hole to remove back-off tool and go deeper with jet sub.
	16:10	275.2		Back in hole. Started jetting with jet sub at 1,181 feet.
	16:14	241.0		Air raising water level in annulus. Discharge has not started.

TABLE 3

JETTING DATA,
HOLE AT 1,798-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-13-75	16:19	214.0		Discharge started.
	16:20	236.9		
	16:21	248.5		
	16:22	255.3		
	16:23	264.4		
	16:24	273.6		
	16:25	283.8		
	16:26	293.3		
	16:27	302.1		
	16:28	310.3		
	16:29	318.1		
	16:30	326.1		
	16:35	364.3	50	360 psi.
	16:45	427.7		
	17:00	487.3	94	312 psi.
	17:10	515.3		
	17:15		94	300 psi.
	17:20	532.2		
	17:30	546.1	70	290 psi. T = 72° K = 2,000.
	17:40	557.0		
	17:45		70	
	17:50	562.8		
	18:00	568.3	70	280 psi. Making a lot of foam. Mud much thinner.
	18:15	574.2	70	
	18:30	578.4	60	
	18:35			Reduced compressor speed from 1,450 RPM to 900 RPM (approximately 925 CFM to 425 CFM).
	18:45	585.7	70	271 psi.
	19:00	591.3	70	270 psi.
	19:15	595.8	70	269 psi.
	19:20			Reduced compressor speed from 900 RPM to 800 RPM (approximately 425 CFM to 375 CFM).

TABLE 3

JETTING DATA,
HOLE AT 1,798-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-13-75	19:30	601.8	70	265 psi.
	19:45	606.8	70	260 psi.
	19:50			T = 76° K = 1,700.
	20:00	609.6	70	255 psi.
	20:15	612.1	70	260 psi.
	20:30	613.2	70	258 psi.
	20:45	614.8	70	259 psi.
	21:00	616.0	70	259 psi.
	21:05			Stopped jetting. Adding drill pipe to lower jet sub.
	21:50	451.3		Started jetting. Jet sub at depth of 1,784 feet.
	21:55	409.0		Air raising water level in annulus. Discharge has not started.
	22:10			Discharge started. Kickoff pressure was 560 psi.
	22:13	369.0		
	22:14	380.2		
	22:15	391.2		
	22:16	399.3		
	22:17	407.2		
	22:18	415.6		
	22:19	423.9		515 psi.
	22:20	431.7	15	Small amount of mud in discharge. Lot of foam.
	22:25	473.2		
	22:30	493.2	70	475 psi.
	22:35	520.8		
	22:40	543.2		
	22:45	563.5	123	Lot of foam.
	22:50	581.0		
	23:00	610.0	130	
	23:10	630.0		425 psi.
	23:20	639.0	115	425 psi. Still lot of foam.

TABLE 3

JETTING DATA, HOLE AT 1,798-FOOT DEPTH (continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-13-75	23:30	638.0	123	425 psi.
	23:40	638.7		
	23:50	639.4	123	
	24:00	640.2	123	
02-14-75	00:15	642.6	123	425 psi.
	00:30	643.4	125	425 psi.
	00:35			T = 84° K = 1,100. Water fairly clear but still lot of foam.
	00:45	653.9	123	425 psi.
	01:00	670.6	115	415 psi.
	01:15	678.7	123	415 psi.
	01:30	695.8	123	405 psi.
	01:55	718.3		
	02:05		115	400 psi. T = 85° K = 1,050.
	02:15	726.1		
	02:30	729.1	108	390 psi.
	02:45	730.9		
	03:00	731.7		
	03:30		108	395 psi. Hung probe.
	04:00	733	108	395 psi. Worked probe loose. Hung again at 731 feet.
	04:25			Raised drill string. Got probe loose.
	04:30		108	395 psi. Pulling sounder line to check it.
	05:00		108	395 psi. Replaced probe.
	05:05			T = 86° K = 1,000.
	05:14			Set sounder at 600 feet. Reversing air flow.
	05:25			Water hit 600 feet. Opened discharge line. Little mud.
	05:37			Water dropped below 600 feet.
	05:43	638		
	05:51	643		

TABLE 3

JETTING DATA,
HOLE AT 1,798-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-14-75	06:00		94	420 psi.
	06:15	645		
	06:30	646.2	120	
	06:35			430 psi. Increased compressor speed from 850 RPM to 1,050 RPM.
	06:45	647.7		
	06:50			T = 86° K = 1,000.
	07:00	662.6	120	
	07:30	679.0	120	420 psi.
	07:45	696.8		
	08:00	706.3	120	410 psi.
	08:10			T = 86° K = 1,000.
	08:30	717.2	94	Hung probe. Worked loose.
	08:33			Set sounder at 650 feet. Reversing air flow.
	08:40			Water hit 650 feet. Opened discharge line. Very little mud.
	09:00		65	390 psi.
	09:20	643.6		
	09:45	645.7	70	430 psi.
	09:50	655.2	94	430 psi. T = 87° K = 1,000.
	10:15	664.1		
	10:30	675.1	108	415 psi.
	10:45	688.0		Collected water sample. T = 87° K = 1,000.
	11:00	691.4	94	
	11:03			Stopped jetting.
	11:04	687.4		
	11:05	685.7		
	11:06	681.6		
	11:07	674.9		
	11:08	669.9		
	11:09	663.0		

TABLE 3

JETTING DATA,
HOLE AT 1,789-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-14-75	11:10	657.9		
	11:11	655.7		
	11:12	655.3		
	11:13	654.8		
	11:14	654.3		
	11:15	654.2		
	11:16	653.9		
	11:17	653.7		
	11:18	653.4		
	11:19	653.2		
	11:20	653.0		
	11:21	652.7		
	11:22	652.5		
	11:23	652.4		
	11:24	652.1		
	11:25	651.9		
	11:26	651.7		
	11:27	651.5		
	11:28	651.2		
	11:29	651.0		
	11:30	650.8		
	11:31	650.5		
	11:32	650.4		
	11:33	650.1		
	11:34	649.8		
	11:35	649.5		
	11:36	649.2		
	11:37	648.8		
	11:38	648.4		
	11:39	648.0		
	11:40	647.6		
	11:45	627.1		
	11:50	600.6		
	11:55	575.3		
	12:00	551.8		

TABLE 3

JETTING DATA,
HOLE AT 1,789-FOOT DEPTH
(continued)

Date	Hour	Depth to Water (ft)	Discharge (gpm)	Remarks
02-14-75	12:05	529.5		
	12:10	507.3		
	12:20	473.9		
	12:30	440.3		
	12:40	411.4		
	12:50	388.0		
	13:30 1/	338		
	14:30	293		
	15:30	290		
	16:30	271		
02-15-75	07:30	264		
	15:00	263		

1/ Measurements from 13:30 on taken by B.C. & M. personnel and phoned to WADEVCO office.

installed the jet sub was included in the drill string. After landing the casing the drill string was backed off from the casing and the hole was jetted for 4 hours with the jet sub at a depth of 580 feet. At the end of this phase of jetting the water level was 399.6 feet and the discharge was 22 gpm.

Following this the drill string was pulled to remove the back-off tool and then reinstalled in the hole with the jet sub at a depth of 1,181 feet. To remove and reinstall the drill string took 3 hours and 10 minutes, and during this time the water level recovered to 275.2 feet. A total of 4 hours and 55 minutes were spent jetting the hole with the jet sub at a depth of 1,181 feet. The water level at the end of this period was 616 feet and still declining. The discharge was fairly well stabilized at 70 gpm.

Additional drill pipe was then added so that the jet sub was at a depth of 1,784 feet. Recovery during the time it took to add the additional drill pipe (45 minutes) amounted to 164.7 feet. Jetting time from a depth of 1,784 feet amounted to a total of 13 hours and 13 minutes. Maximum depth to water during this period was 733 feet with a discharge of 108 gpm and the water level was still declining. Based on a static water level of 250 feet, the drawdown to produce 108 gpm amounted to 483 feet and the specific capacity was 0.22 gpm per foot of drawdown.

The drilling mud which was used in drilling the lower portion of the hole was fairly thin within 9 hours after jetting started and within 15 hours after jetting started the water was fairly clear. During the latter stages of jetting from a depth of 1,784 feet the air was reversed two times, forcing water up the annular space between the drill pipe and the casing to see if additional mud could be produced. On the first reversal the water was forced up to a depth of 600 feet and, after opening the discharge line, a little mud was produced. On the second reversal the water was forced up to 650 feet and very little mud was produced. Thus, it was concluded that the hole was reasonably clean. There are undoubtedly some small water-bearing fractures mudded off which will contribute additional water with either prolonged pumping or greater drawdowns. It is concluded, however, that there are not strong highly productive water-bearing horizons in the section penetrated by the well. Following the conversion to drilling mud, excellent mud control was maintained and the mud condition was checked routinely by a Baroid engineer. Filter-cake thickness was generally in the 1/32-inch to 2/32-inch range. Under these conditions and with a 483-foot head differential, any significant water-bearing horizons would not remain sealed off and would contribute water to the bore hole.

Recovery measurements were taken after the final jetting (see

Table 3). Recovery was relatively rapid up to a depth of 655.3 feet and then very slow from 655.3 to 647.6 feet, following which the recovery rate increased again. Drawdown was also slower in this general depth range during jetting. It is concluded that this is the area that contributed the cave material and that the slower drawdown and recovery rates through this section are a result of draining and filling the cavity created by the caving. The recovery measurements are shown graphically on Figure 1.

During the jetting, water-level measurements were taken in the core hole drilled at the shaft site located 60 feet from the test well. Depth to water near the beginning of jetting was 197.10 feet and near the end was 197.01 feet. Thus, there was no decline observed as a result of jetting. The original water level in this area was in the range of 200 feet, and data from the test well indicates that it is now in the range of 250 feet. This 50-foot decline is probably a result of drainage to the mine pit. The fact that the level in the core hole is 197 feet and that the core hole showed no response to jetting the test well indicates that the upper portion of the core hole is probably plugged. If there were hydraulic communication between this zone and the surrounding materials the water level should have responded to jetting the test well. The water level in the core hole should also be reflecting the effect of ground-water drainage to the mine pit.

Using a specific capacity of 0.22 gpm per foot of drawdown, a static water level of 250 feet, and straight lining the specific capacity to a pumping water level of 1,700 feet would give a theoretical yield of 319 gpm from the test well. Normally, specific capacities decrease with an increase in drawdown under non-artesian conditions. However, as mentioned previously, there are probably some additional small water-bearing fractures which will produce additional water with prolonged pumping and additional drawdown. Based on this it is recommended that, as a factor of conservancy, a 500 gpm pump be installed with a setting of 1,700 to 1,750 feet if it is desired to dewater the shaft as it is being sunk. The pump discharge line should be equipped with a gate valve to control the flow and prevent surging in the event the pump capacity is too great. A 3/4-inch water-level measuring tube should be installed alongside the pump column in the well.

AMERICAN SMELTING AND REFINING COMPANY
Casa Grande Arizona
Sacaton Unit

RECEIVED
OCT 4 1974
EXPLORATION DEPT.

October 3, 1974.

J. H. C.
OCT 23 1974

Memorandum To: T. R. Edwards

From: R. B. Cummings

Subject: Placement of Surface Facilities in the Shaft Area

Geologic conditions in the shaft area were studied to find the optimum geologic positions for the shaft de-watering hole, hoist house, and ventilation shaft. Basic geologic relationships in the shaft area are as follows:

1. The Sacaton Fault strikes N45°W and dips approximately 70°NE.
2. The Basement Fault in the shaft dips 20°-40° (most probably to the North).

<u>Shaft De-Watering Hole</u>

The area around the shaft is strongly fractured and shattered. If a substantial amount of water is encountered in the shaft area it will be transmitted through fractures in the rock. The orientation of fractures around the shaft is unknown but it is probable that they would parallel the Sacaton Fault (N45°W). In addition an intensely shattered zone is found above the Basement Fault from a depth of 874' to 1234'. It is probable that this zone parallels the Basement Fault and will be the primary watercourse. The conditions postulated above suggest the following:

1. The hole should be placed northeast or southwest of the shaft since a northwest-southeast elongation of the cone of depression might occur due to a northwest trending fracture set.
2. The hole should be placed south of the shaft on the up-dip side of the Basement Fault. Assuming water will be migrating down the fault surface this position will tend to remove the water before it reaches the shaft. If the hole is placed north of the shaft water will migrate through the shaft before being pumped out.

In order to satisfy both of the above conditions the hole should be placed southeast of the shaft. It is recommended that the shaft de-watering hole is placed at a point 60' S 30°E from the center of the shaft. (21,248N, 23,480E). The location is shown on drawing SAC-11-C12.

Hoist House and Ventilation Shift

Although the planned locations of the hoist house and ventilation shaft are well outside the 45° crack line, (see the attached drawing), their positions on the hanging wall side of the Sacaton Fault are of some concern. The nature of the conglomerate and alluvium over the east ore body suggest that subsidence will not reach the crack line, but it is possible that the subsidence will redistribute stresses sufficiently to trigger rotational movement on the Sacaton Fault. A minor displacement under the hoist house or in the ventilation shaft could be costly.

The present location of the ventilation shaft would intersect at least 400' of conglomerate, most of which would contain water. If this location were moved to the footwall of the fault the conglomerate would be eliminated and the cost would probably be reduced.

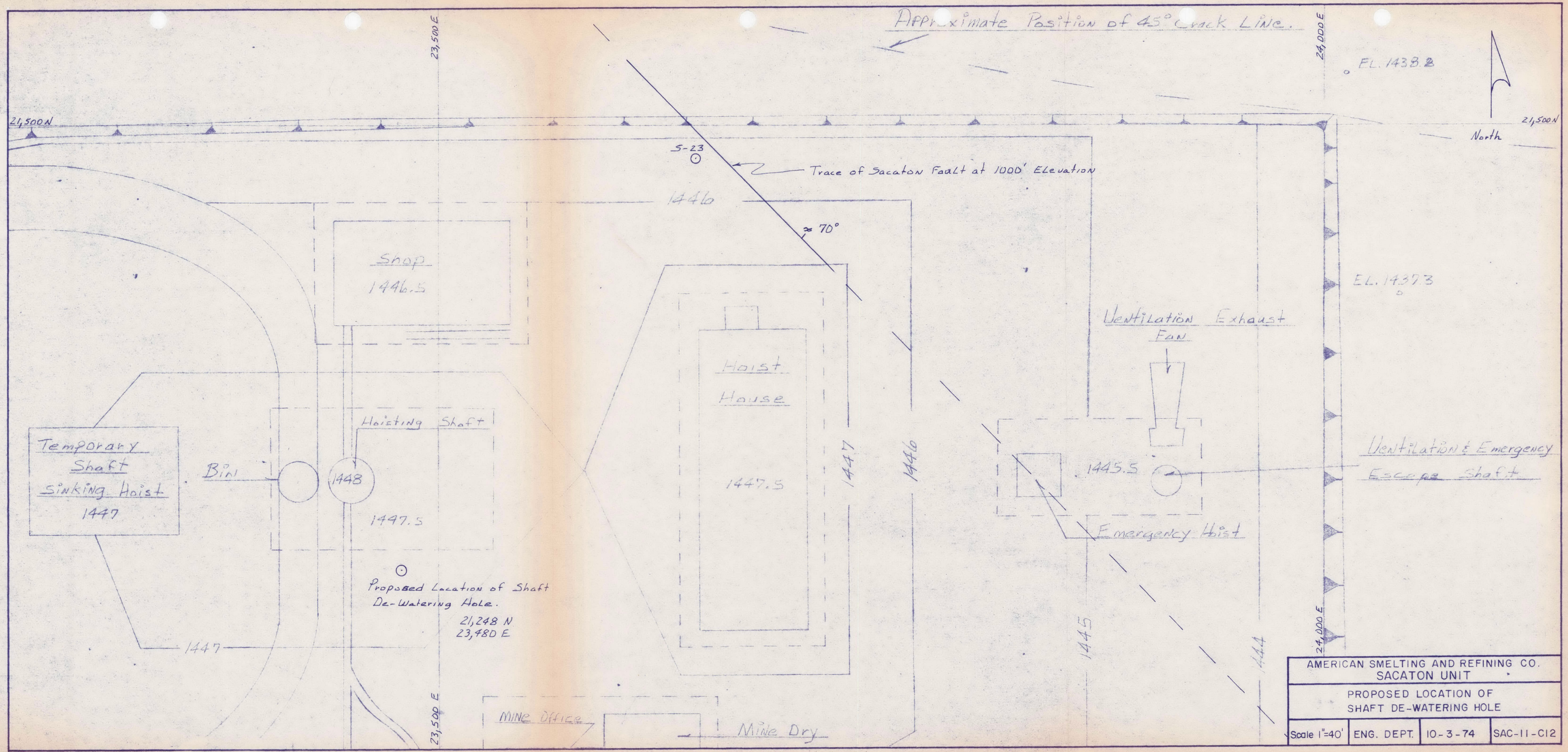
It is recommended that the present locations of the hoist house and ventilation shaft are re-evaluated in light of the above geologic considerations. If either of the structures are relocated they should be placed completely into the footwall of the fault.

R. B. Cummings
Resident Geologist

RBC/gs
cc: File
RBMeen
JLHarasha
JHCourtright

~~0048 09~~

0048 07 W


Approximate Position of 45° Crack Line.
EL. 1438.2
North
21,500 N
21,500 N
23,500 E
24,000 E
S-23
Trace of Sacaton Fault at 1000' Elevation
1446
≈ 70°
Shop
1446.5
EL. 1437.3
Ventilation Exhaust Fan
Hoist House
Hoisting Shaft
Temporary Shaft Sinking Hoist
1447
Bin
1448
1447.5
1447.5
1447
1446
1445.5
Ventilation & Emergency Escape Shaft
Emergency Hoist
Proposed Location of Shaft De-Watering Hole.
21,248 N
23,480 E
1447
1445
1444
24,000 E
23,500 E
Mine Office
Mine Dry
AMERICAN SMELTING AND REFINING CO.
SACATON UNIT
PROPOSED LOCATION OF SHAFT DE-WATERING HOLE
Scale 1"=40'
ENG. DEPT.
10-3-74
SAC-11-C12

SAC-4.1.1

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

J. H. C.
AUG 7 1974

June 28, 1974

Mr. Norman Visnes, General Manager
North American Mining Department
Tucson Office

SACATON UNIT
Appropriation Request No. SAC-4-74
Diamond Drilling

Attached are original and six copies of Sacaton Unit Application for Property Appropriation No. SAC-4-74 in the amount of $186,000 for up to 11,500 feet of drilling in six holes to establish the elevation of the basement fault throughout the entire underground mine. This information is needed to establish the depth location of the shaft station and exploration drift which will later be the haulage drift in this proposed one level mine. Improper location of the drift will cost much more than that of this drilling which will also give six more assay holes in the ore body.

The attached letter of Mr. Harasha dated June 17, 1974, and the two memoranda of Mr. Cummings dated June 6 and June 13 explain in detail the need and value of this drilling program and indicate Mr. Courtright's concurrence.

If you approve of this request, please distribute the copies as designated.

R. B. Meen

R. B. MEEN
Manager

FPK/mc
encls.

cc: TASnedden - w/encls.
JHCourtright - w/o "
TREdwards - w/o "

AMERICAN SMELTING AND REFINING COMPANY
Denver Colorado

June 20, 1974

Memo for R.B. Meen

Sacaton, Arizona

Those present at the meeting with the State Land Department, Phoenix, June 17th, were: Messrs. Little, Kellogg, Sullivan, Allen, Meen, Scartaccini, Fergurson and Courtright.

Mr. Kellogg indicated that in his opinion, insufficient drilling had been done in Section 36 to eliminate the possibility of an ore body and displayed a map showing a hypothetical mineral zone in the western part of the section. He stated that this was based on photo geologic studies and interpretations of structure by Thomas Mitcham, consultant.

When it was pointed out that the hypothetical mineral zone appeared to have been colored in neatly between existing drill holes (none of which cut significant alteration-mineralization), Kellogg contended that Mitcham had not had access to any of Asarco's information. This obviously was not the case.

When questioned, Kellogg stated that one or two holes drilled to a depth of 1500' in the western part would probably determine whether or not the section could be declared non-mineral and utilized for waste dumps.

While the argument for the possible existance of a valuable mineral occurrence in section 36 has no merit whatsoever in my opinion, the drilling, of course, should begin as promptly as possible. However, Sullivan, the prospecting permit holder, may cause further delay by refusing permission for the work to be carried out.

J.H. Courtright
J.H. Courtright

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

AMERICAN SMELTING AND REFINING COMPANY
Casa Grande Arizona
Sacaton Unit

RECEIVED
JUN 17 1974
EXPLORATION DEPT.

June 13, 1974

J. H. C.
JUN 18 1974

R. B. Meen, Manager
Southwestern Mining Department
Tucson Office

SACATON UNIT
Diamond Drilling

Dear Sir:

Attached is a memorandum by R.B. Cummings detailing the cost of diamond drill holes required to further explore the basement fault. His suggested location of the holes are shown on the attached map.

Very truly yours,

T. R. Edwards

T. R. Edwards

cc: JHCourtright
JLHarasha
RBCummings; w/enclosure

AMERICAN SMELTING AND REFINING COMPANY
Casa Grande Arizona
Sacaton Unit

June 13, 1974

Memorandum To: T. R. Edwards

From: R. B. Cummings

Subject: Sacaton Underground Mine Design

In my memorandum of June 6, 1974 six drill holes were recommended in the east orebody to provide additional information on the Basement Fault. On June 7, 1974 this matter was discussed with Mr. J. H. Courtright and Mr. J. L. Harasha. At that time it was decided to change several of the proposed drill hole locations. The new locations are shown on drawing SAC-156-A8.

The northwesterly trending high is still of major concern. One drill hole is proposed on either end of the high (P-1 and P-4). At the present time it is not thought to be necessary to find the maximum elevation reached by the fault within the proposed workings. Hole P-2 is to determine how large an area of influence the fault will have on the workings on the north side of the orebody. Hole P-3 is to test a large area in the center of the orebody where the fault was not penetrated. The locations of the holes P-5 and P-6 are only approximate.

Drill holes P-1 thru P-4 should be drilled in numberical order. Holes P-5 and P-6 should not be started until after completion of P-4. At that time analysis of the data will determine whether both P-5 and P-6 will be needed and the exact locations of each.

The total footage for the six holes is 11,450 feet. Below is a tabulation of the drill holes showing the rotary and core footage for each:

	Rotary	Core	Total
P-1	1,400'	400'	1,800'
P-2	900'	975'	1,875'
P-3	1,300'	675'	1,975'
P-4	1,200'	700'	1,900'
P-5	1,175'	800'	1,975'
P-6	1,050'	875'	1,925'
	7,025'	4,425'	11,450'

Note: Rotary footage includes scrapper dump, alluvium, and conglomerate. Average collar elevation was assumed to be 1,510'. Cored footage includes pre-mineral bedrock to a point 20' - 30' below the expected position of the Basement Fault. For all holes the average rotary footage is 1,170', the average cored footage is 738', and the average total depth is 1,908'.

Recent increases in the cost of drilling, drilling materials, and casing necessitate revising the original cost estimate for the project. Cost estimates for both phases of the drilling are tabulated below:

Rotary Drilling

$ 8.00/ft.	Direct drilling	Mobilization &
1.00/ft.	Mud	hourly charges
3.25/ft.	Casing	$1,500/hole
$ 12.25/ft.		

Note: Estimate is for 5 5/8" hole cased with 4" casing.

Core Drilling

$ 12.00/ft.	Direct drilling	Mobilization &
1.00/ft.	Mud	charges & water
.50/ft.	Sampling & Assaying	truck $ 2,000/hole
$ 13.50/ft.		

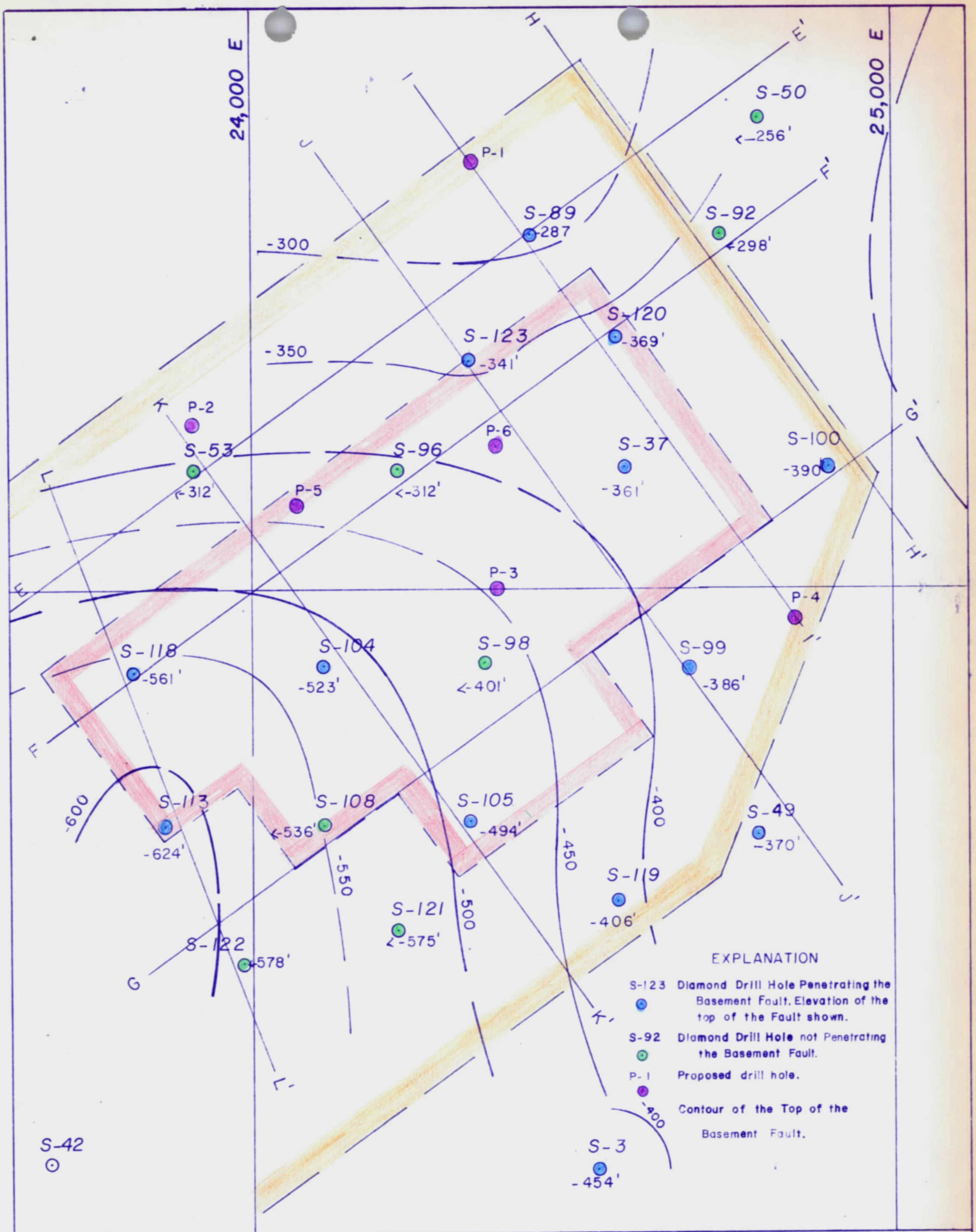
Note: Estimate is for drilling from bottom of rotary hole to T.D. with NC and NX bits.

Rotary	7,025' @ $12.25/ft	=	$ 86,056.25
	6 holes @ $ 1,500/hole	=	9,000.00
			$ 95,056.25
Coring	4,425' @ $13.50/ft.	=	$ 59,737.50
			12,000.00
			$ 71,737.50
Total Drilling			$166,793.75
+ Hole inclination surveys			2,500.00
			$169,293.75
+ 10% for contingencies			16,929.25
Total appropriation necessary			$186,224.00

While the total cost of the project is high the expense is warranted.

R.B. Cummings

R. B. Cummings
Geologist



AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

CONTOUR MAP
OF THE BASEMENT FAULT

1" = 200'	R. B. C.	6-13-74	SAC-156-A8

AMERICAN SMELTING AND REFINING COMPANY
Casa Grande Arizona
Sacaton Unit

J. H. C.
JUN 7 1974

June 6, 1974

Memorandum To: T. R. Edwards

Subject: Sacaton Underground Mine Design

From: R. B. Cummings

The question of how the position of the Basement Fault will effect the underground mine design of the east ore body was raised by Mr. J. L. Harasha in his letter of May 14, 1974 to Mr. R. B. Meen. To facilitate a study of this problem three sections were drawn parallel to the long axis of the ore body and 5 sections transverse to the long axis. The location of the sections and contours of the basement fault are shown on drawing SAC-156-E28 and the sections are shown on drawings SAC-153-B4 thru SAC-153-B11.

Although the diamond drill holes intersecting the fault provide only spotty data for contouring, several important conclusions concerning the fault can be drawn.

1. Under most of the ore body the fault plane dips at shallow angles to the southwest (from S-123 to S-113 the dip averages 18°).

2. On the northeast end of the ore body a north-westerly trending high is found in the fault plane.

3. This high appears to broaden and steepen to the northwest. The highest intersection of the fault within the planned workings is in S-89 (-287')

The present block caving development plan calls for all development workings to be above the Basement Fault. The sections and contour map show that in the north portion of the ore body haulage drifts, slusher drifts and possibly some transfer raises will penetrate the Basement Fault. Additional data on the fault is necessary in order to:

1. Verify the existing data.

2. Determine the position and attitude of the fault with more accuracy.

3. Provide data for alternative planning if necessary.

It is recommended that six diamond drill holes are put down to provide the information described above. The proposed holes are shown on the attached contour map. The holes are numbered in the approximate order in which they should be drilled. This order of drilling may be changed or the locations may be changed as drilling progresses.

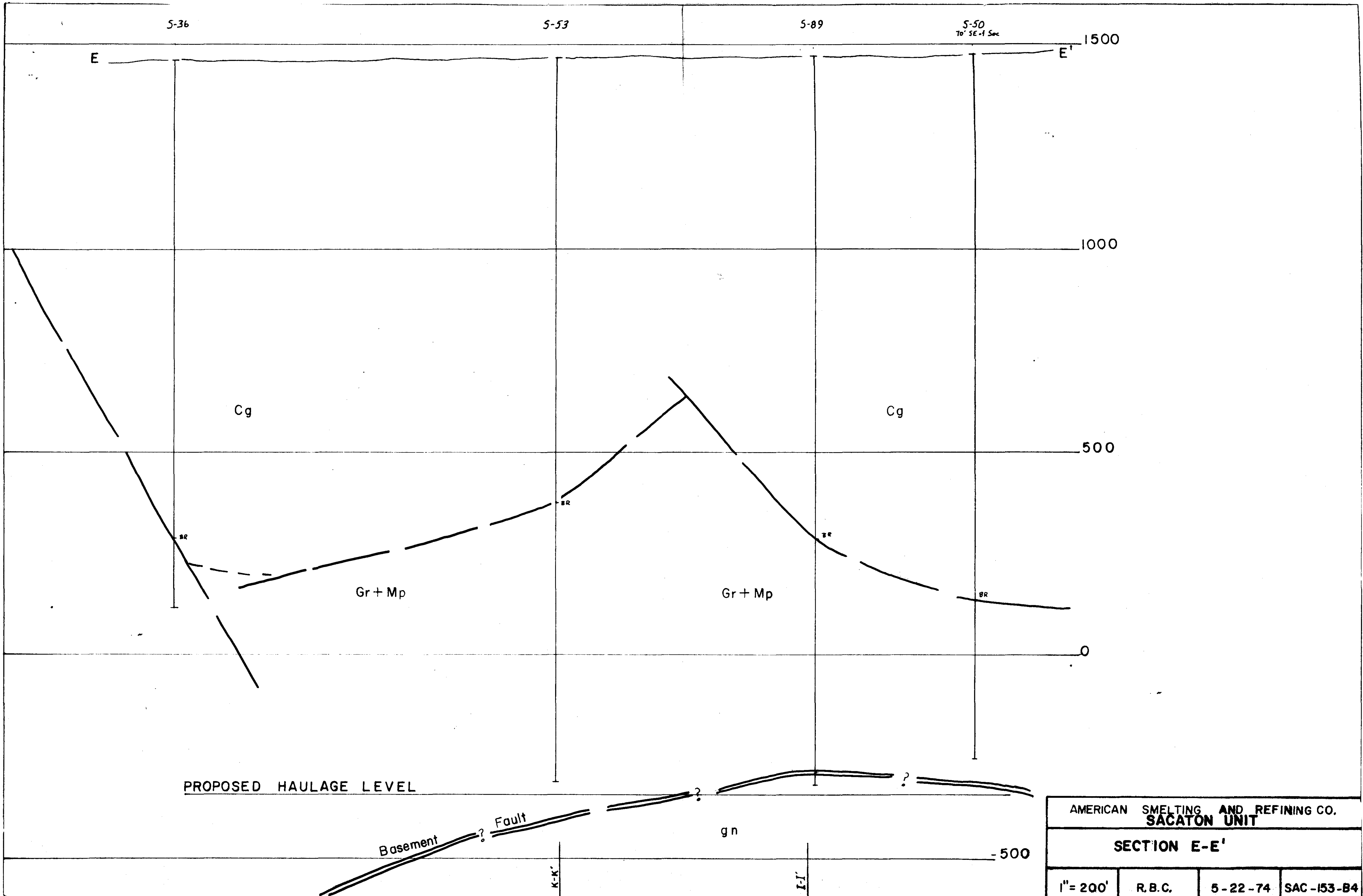
The area of upmost concern is in the vicinity of drill hole S-89 north of the proposed caving blocks. Two drill holes (S-89 and S-123) intersect the fault above the lowest planned workings (the haulage drift at an elevation of -345'). Three drill holes (P-1, P-2 and P-3) are recommended for this area to pin down location of the fault and to find the maximum elevation of the fault within the limits of the proposed workings. On the east end of the ore body one hole (P-5) is recommended to verify that the fault does not rise above -345' on the crest of the northwesterly trending high. On the southwestern flank of the high, drill holes S-53 and S-96 did not penetrate the fault. Two holes (P-4 and P-6) are proposed for this area to verify the projected position of the fault.

The most economical way to accomplish the above program is by rotary drilling to bedrock and then coring through the Basement Fault. For holes P-1 through P-6 this amounts to about 7,050 feet of rotary and 4,300 feet of core drilling. The cost of this program would be approximately $ 150,000.

RB Cummings
R. B. Cummings
Geologist

RBC;ks
Encl.
cc: RBMeen, w/encl.
JLHarasha, w/encl.
JHCourtright, w/encl.
File

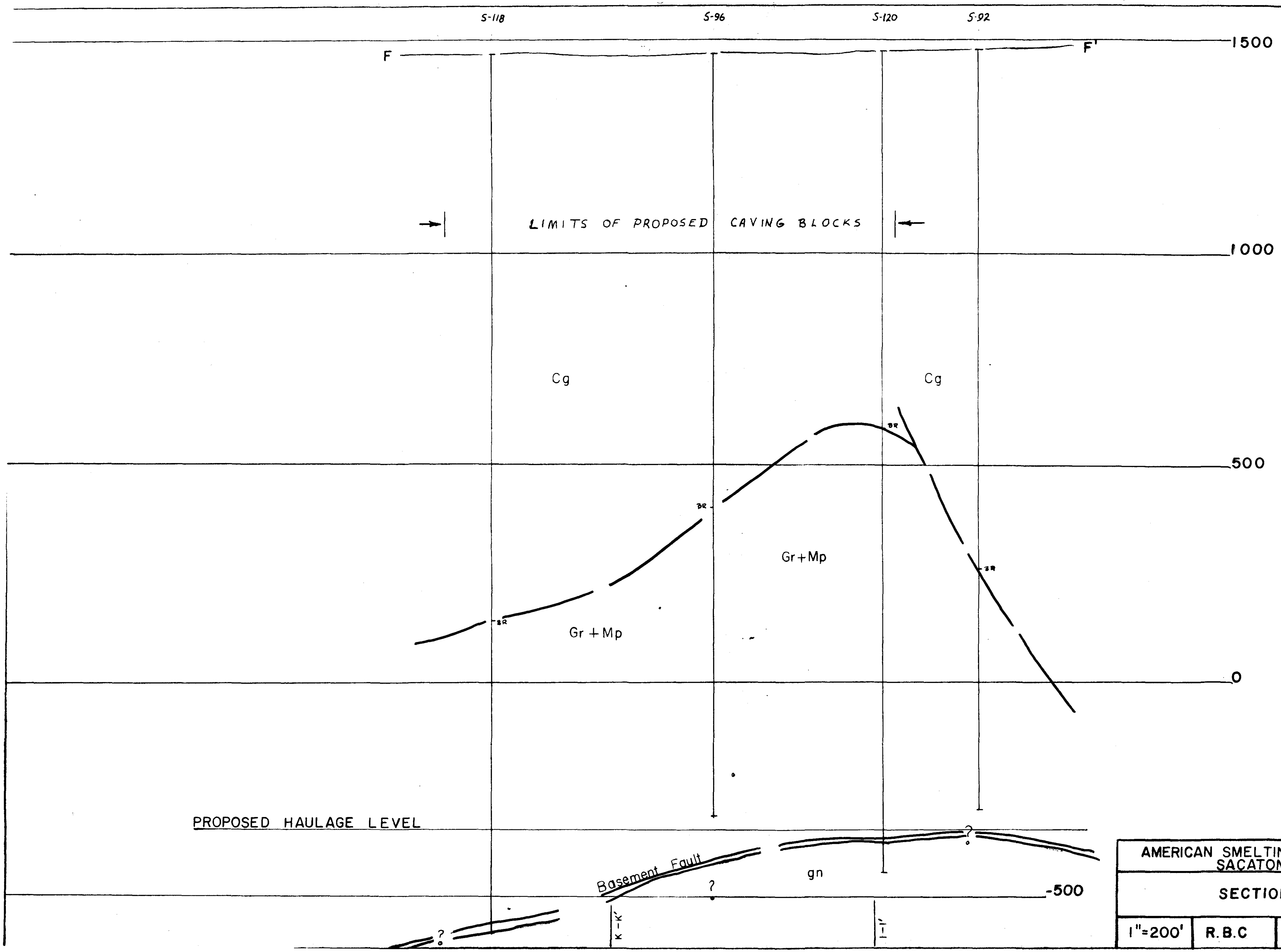

AMERICAN SMELTING AND REFINING CO.
SACATON UNIT
CONTOUR MAP
OF THE BASEMENT FAULT
1" = 200'
R. B. C.
6-6-74
SAC-156-E28
EXPLANATION
S-123 -341 Diamond Drill Hole Penetrating the Basement Fault. Elevation of the top of the Fault shown
S-92 <-298 Diamond Drill Hole not Penetrating the Basement Fault.
P-1 Proposed drill hole.
-400 Contour of the Top of the Basement Fault
Limits of Proposed Developement Workings
Limits of Block Cave
21,000 E
22,000 E
23,000 E
24,000 E
25,000 E
26,000 E
21,000 N
22,000 N
23,000 N
24,000 N



AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

SECTION E-E'

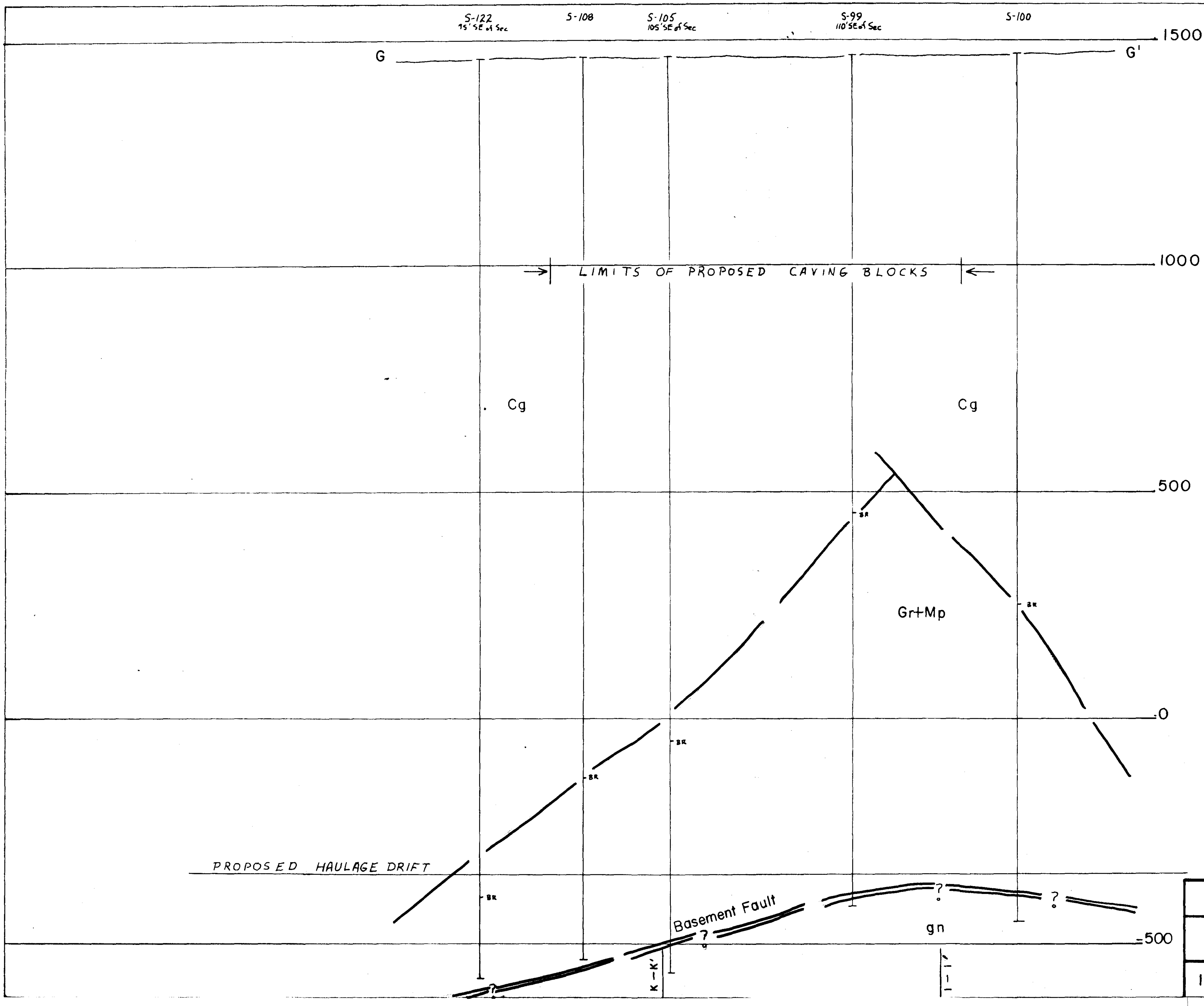
1" = 200'	R.B.C.	5-22-74	SAC-153-B4



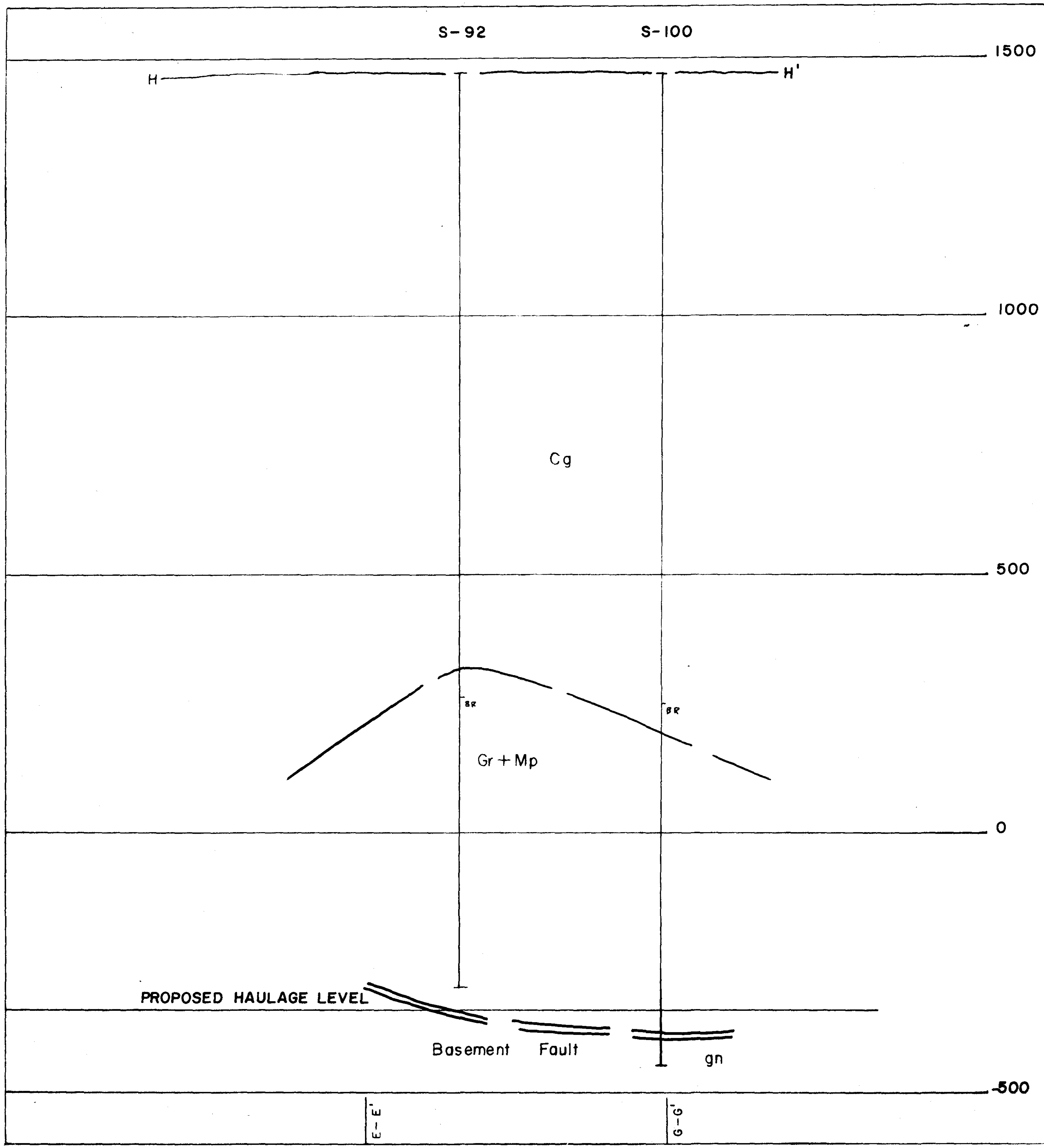
AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

SECTION F - F'

1"=200'	R.B.C	5-23-74	SAC-153-85



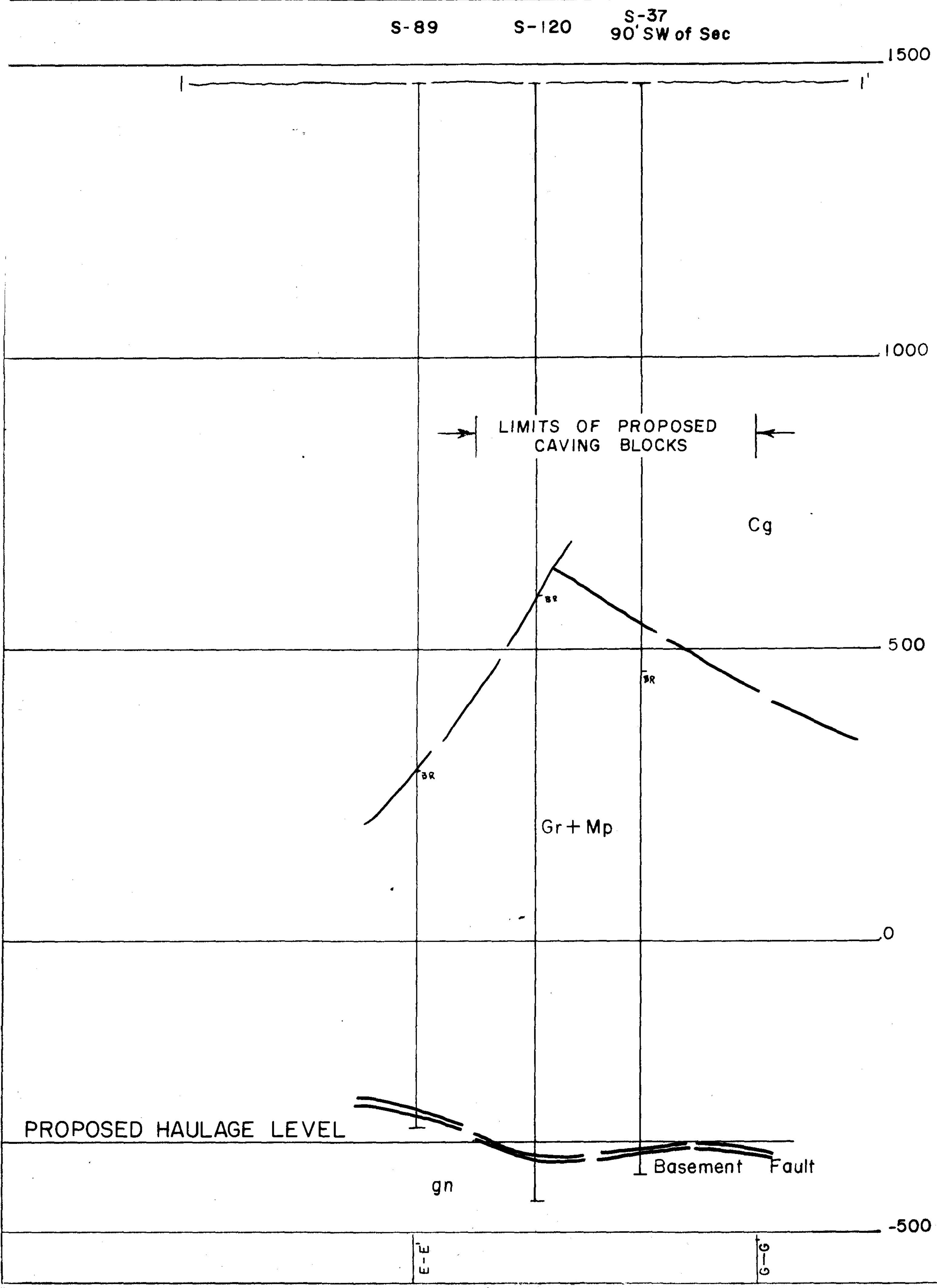
AMERICAN SMELTING AND REFINING CO. SACATON UNIT			
SECTION G—G'			
1"=200'	R. B. C.	5-23-74	SAC-153-B6



AMERICAN SMELTING AND REFINING CO
SACATON UNIT

SECTION H-H'

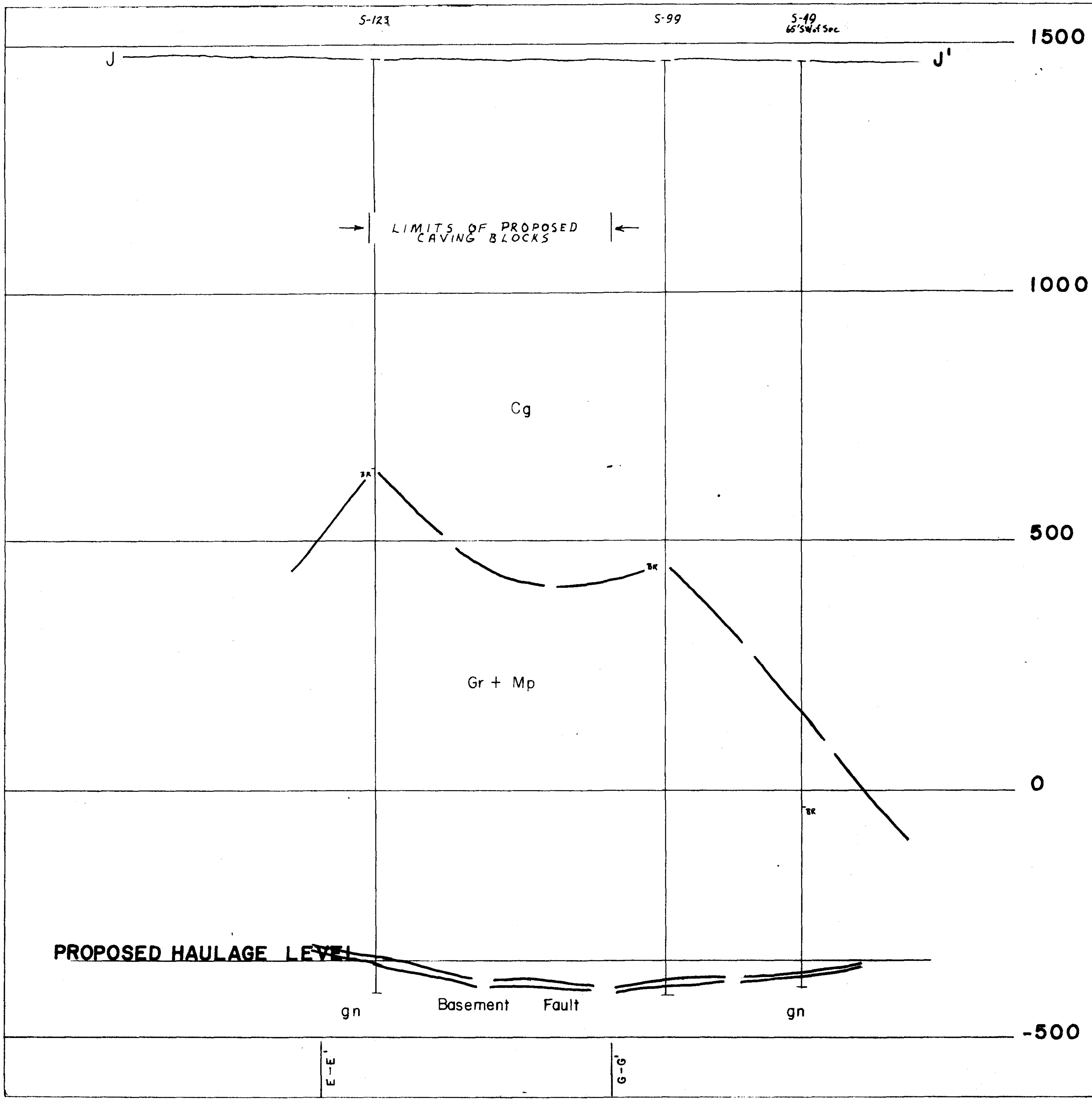
1"= 200'	R. B. C.	5-28-74	SAC-153-B7



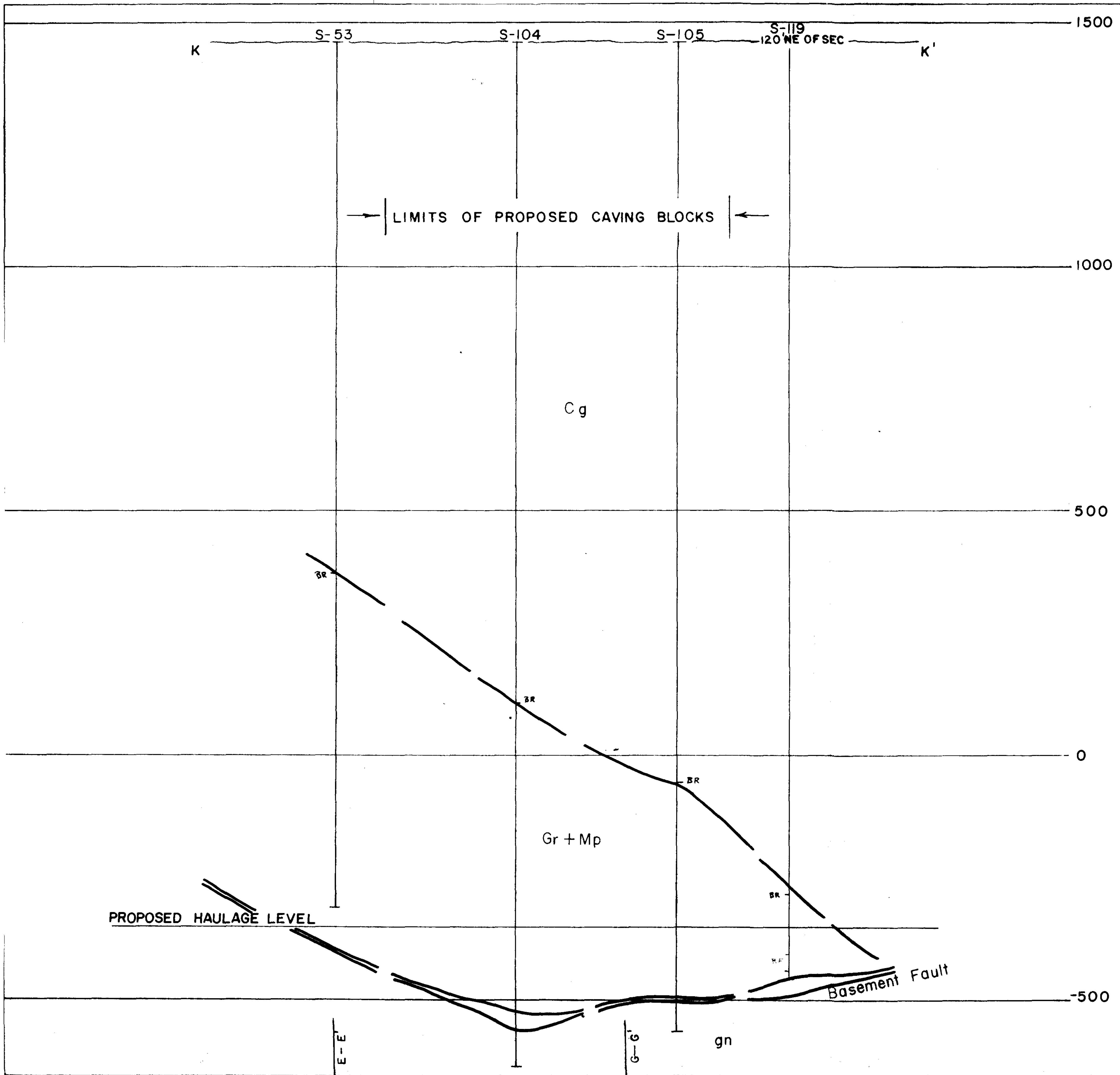
AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

SECTION I - I'

1" = 200'	R.B.C.	5-28-74	SAC-153-B8



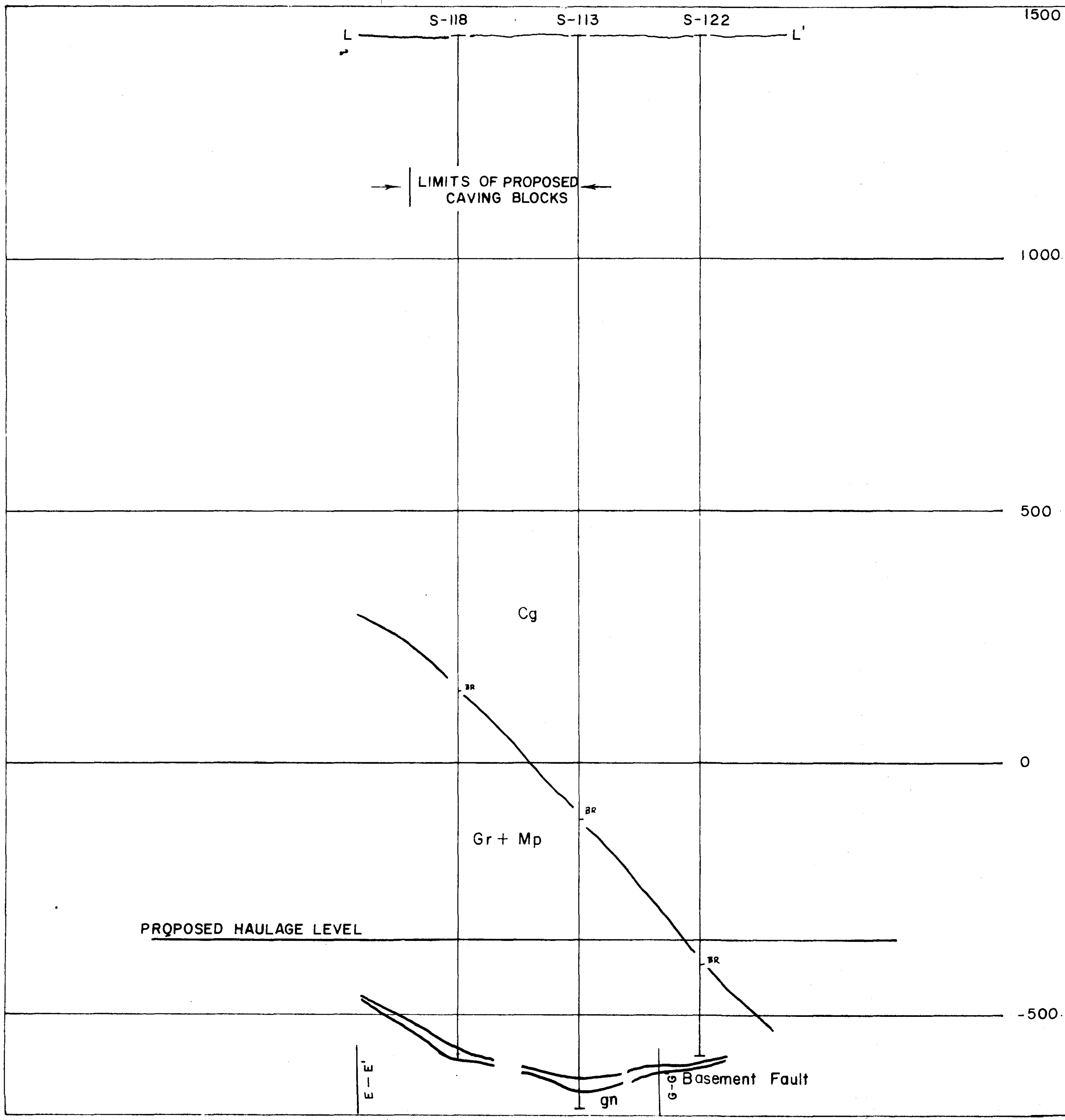
AMERICAN SMELTING AND REFINIG CO. SACATON UNIT			
SECTION J-J'			
1" = 200'	R.B.C	5-28-74	SAC-153-B9



AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

SECTION K – K'

1" = 200'	R. B. C.	5-28-74	SAC-153-B10



AMERICAN SMELTING AND REFINING CO.
SACATON UNIT

SECTION L-L'

1" = 200'	R.B.C.	5-29-74	SAC-153-B11

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

May 30, 1974

MEMORANDUM FOR RECORD:

Arizona's newest copper mine, Sacaton, came into production during March of this year, 13 years after porphyry type mineralization was recognized by ASARCO geologists in a small knoll projecting a few feet above an alluvial plain near the city of Casa Grande. The outcrop was virgin, there having been ~~being~~ no evidence of previous prospecting, although numerous pits had been dug on copper shows in the hills lying two miles to the north.

The discovery was made during the course of reconnaissance along a porphyry belt extending west-southwest from the Miami-Inspiration-Superior Districts. The area of search was narrowed by an old letter dug out of company files which reported oxide copper found in the bottom of a hole drilled for water in 1919 "Somewhere in the Vicinity of Casa Grande."

Attempts to locate the well were unsuccessful; however, the reported copper was very likely detrital, rather than "in place," as our drilling encountered copper bearing boulders in the alluvium which is several hundred feet deep in the area.

After obtaining options on the fee land and prospecting permits on the State land, an authorization of $30,000 to drill six holes was approved. The first five put down near the outcrop cut only very low values in the sulphide zone underlying the leached capping, but the sixth located one-half mile northerly found the southern edge of the chalcocite ore body that is now being mined open pit. Further prospect drilling through the gravel cover located a richer but smaller deposit at a depth of over 1500 feet, which will be mined underground by block cave. The combined operation is scheduled to produce 315,000 tons of copper metal during its 15-year life.

The initial drill program, which commenced in September 1961, was discontinued late in 1963 with the completion of extensive drill prospecting for several miles along the northeast trend of the mineralized zone. Feasibility studies did not indicate a profitable operation at that time. Four years later a much better copper market encouraged closer spaced drilling of the two "indicated" ore deposits. The total cost of exploration through to the development stage amounted to $1,170,000.

J. H. Courtright

JHC:vmh

	1961	1962	1963	1964	1965	1966	1967	1968					
	26000									26000			
880	49000									49000			
894	1281									1281			
897	24459	5541								30000			
908		45000								45000			
913		83000								83000			
914		64802	7198							72000			
915		23000								23000			
917		93500								93500			
922		220000								220000			
927		142923	102983							245906			
			12094							12094			
931		55301								55301			
932		227276								227276			
934			35300							35300			
944			198975	10587						209562			
			1000							1000			
966				235685						235685			
	51740	508964	301958	10587						871249 ←			871249
	49000	453379	55592	235685						793656			295228
													116477
	100740	960343	357550	246272						1664905	1631431	33474	
	1061083									(523086)			
	1028821		357516	245094						(101472)			
	-32262		-34	-1178	= -33474				(1968)	295228 ←			
										1335575	1302101	33474	

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

RECEIVED
MAY 14 1974
EXPLORATION DEPT.

May 14, 1974

J. H. C.
MAY 14 1974

Mr. R. B. Meen, Manager
Southwest Mining Dept.
Tucson, Office

SACATON UNDERGROUND MINE DESIGN

In designing the Sacaton underground mine, the basement fault presents many problems. The drilling of diamond drill hole S-136 at the proposed hoisting shaft location penetrated the basement fault at a much shallower depth than was anticipated (approx. 1250'). There are nine diamond drill holes in the underground ore reserves, and six of these penetrated the fault. The depth of the fault in these six holes varies from 1800' in S-123 to 2020' in S-113, over a horizontal distance of 870'. Two holes, S-89 and S-121 (both outside the reserves) intersected the basement fault at depths of 1770' and 2000', respectively, over a horizontal distance of 1100'. Other areas indicate a much flatter fault. This indicates that this basement fault is not as flat as originally thought.

A block caving development plan with all haulage and slusher drifts above the basement fault seems the most feasible. Haulage drifts below the fault necessitates transfer raises through the fault, which could prove to be difficult to develop and maintain.

An exploration drift for underground diamond drilling to further delineate the orebody is necessary. This exploration drift from a shaft outside the projected crackline to the orebody should be at a depth to enable it to be utilized as a haulage, supply and/or ventilation drift during production.

In order to locate this drift at the best depth for both diamond drilling and production, more information as to the depth location of this basement fault is required. After discussing this with Mr. J. H. Courtright, it was agreed that more surface diamond drilling is necessary to better locate this basement fault in order to intelligently establish a depth location for the exploration drift. It is estimated that a minimum of five holes would be required and information obtained from these holes would determine if more holes would be necessary. The cost of these five holes is estimated at $150,000.

This expenditure can be justified when compared to the cost of developing a second shaft station and haulage drift if inadequate information about the basement fault results in an improper depth location of a shaft station and haulage level.

Shaft sinking can begin on schedule if the drilling is started as soon as possible. It is estimated that two drills could complete this drilling of about 10,000 ft. within four months.

J. L. Harasha

JLH:clb

cc: Mr. TREdwards
Mr. JHCourtright

10.5
45446

T.E.S.

MAY 2 1974

10.5
(61)

R. S. H.

APR 29 1974

April 16, 1974

CONFIDENTIAL

Mr. John Little
Commercial Leasing Division
State Land Department
1624 West Adams
Phoenix, Arizona 85007

RE: Commercial Lease No. 1089-01

Dear Mr. Little:

Commercial Lease No. 1089-01 was issued to American Smelting and Refining Company for the purpose of piling mine waste and tailings and for other uses incidental to mining and concentrating operations. Our mine operations have now developed to the point that it is necessary for us to initiate the dumping of mine waste upon this leased ground.

We propose a plan similar to that approved by the State Land Department for dumping of mine waste on State land at ASARCO's Mission Unit under Lease No. C-288-03. The toe of the dump would be not less than three hundred (300) feet from the north, east and south section lines of Section 36, and from the west line of the SW 1/4 of Section 35. Each raise would be fifty (50) feet or less in height and would be set back two hundred (200) feet. A plat of the proposed waste dump is attached as Exhibit I.

Inasmuch as the area within the SW 1/4 of Section 35 available for use under this plan is substantially reduced, we anticipate that an adjustment in the annual rental would be made in a manner similar to the adjustment of the Mission Unit lease rental. Less than half of the leased area within Section 36 will be covered by waste under the current plan, and this, too, should be reflected in the rental.

Based upon information derived from our own drilling in the vicinity of Section 36, Township 5 South, Range 5 East, we have concluded there is no possibility that an ore body exists within Section 36, which is susceptible of mining by open pit methods. We are aware that drilling was conducted in Section 36 by American Metals Climax (AMAX) during 1973. The results of that drilling are not available to us, but may be available to the State Land Department through its mineral prospecting permittee. We are confident that the information derived by that drilling will support our conclusion as to the absence of economic mineralization within Section 36. It is our understanding that AMAX has terminated its interest in the Section as a result of its drilling program.

Attached hereto as Exhibits II and III, respectively, are the memorandum of J. H. Courtright, Chief Geologist, dated January 24, 1973, and a plat dated January, 1973, which set forth the factual basis for our conclusions respecting mineralization in Section 36. We request that the information contained in Exhibit II and particularly the information disclosed by Exhibit III be considered confidential, as it is submitted solely for use within the State Land Department.

If additional drilling information directly from Section 36 is desired by the Department, we are prepared to undertake test drilling with the Department's approval. Any such test holes would, of course, be abandoned by ASARCO as soon as the logging thereof were completed.

We respectfully request that the proposed mining plan under Commercial Lease No. 1089-01 be approved promptly in order to avoid interruption of mine operations.

Very truly yours,

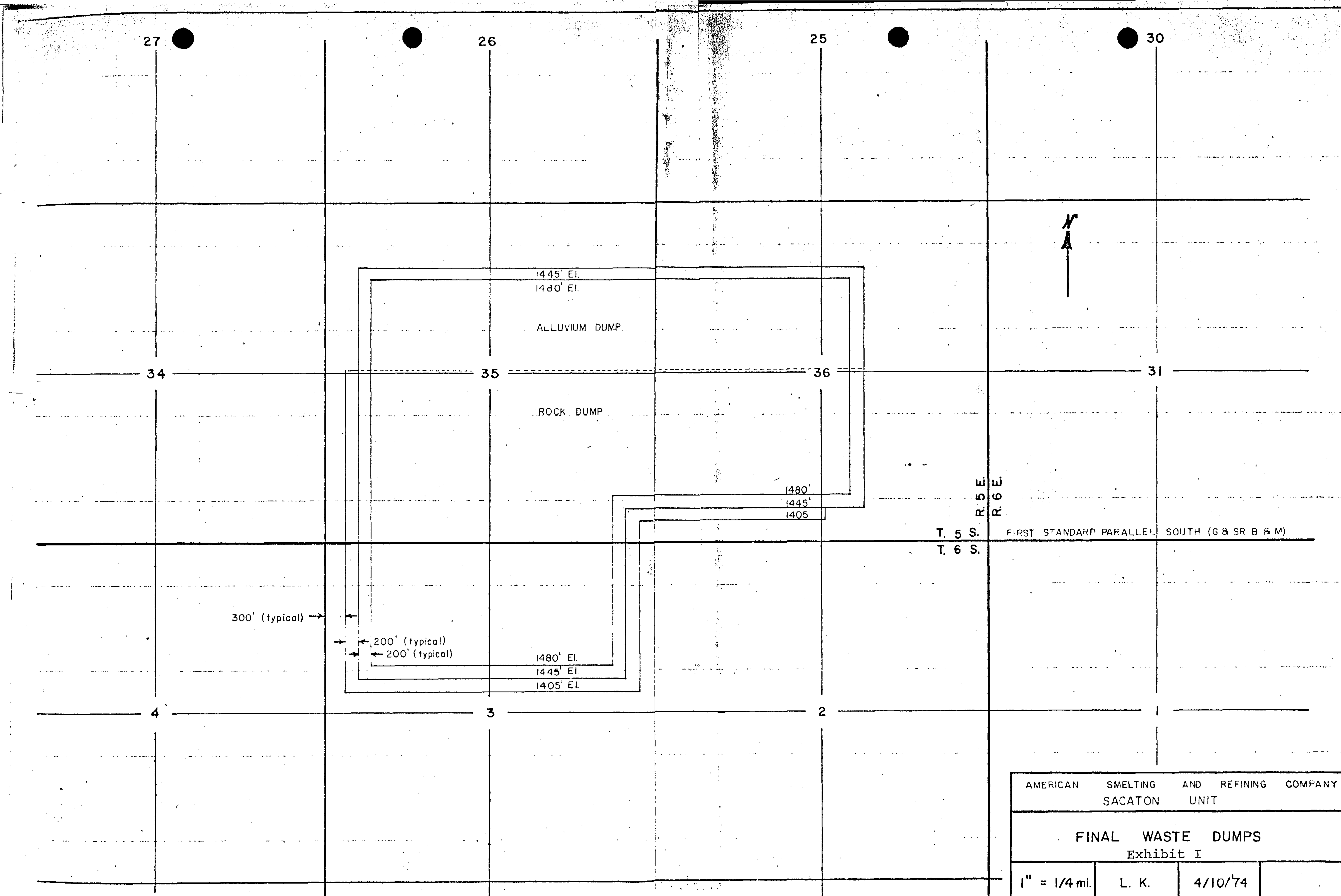
ORIGINAL SIGNED BY
R. B. MEEN

R. B. MEEN
Manager

RBM/mc
attachs.
cc: Mr. Fred E. Ferguson, Jr. - w/o attachs.

bcc: TASnedden - w/o attachs.
NVisnes - " "
TREdwards - " "

BMApker - " "



AMERICAN SMELTING AND REFINING COMPANY
SACATON UNIT

FINAL WASTE DUMPS
Exhibit I

1" = 1/4 mi.	L. K.	4/10/74

April 5, 1974

R.B.M.
APR 5 1974

CONFIDENTIAL

Mr. Fred E. Ferguson, Jr.
Evans, Kitchel & Jenckes, P.C.
363 North First Street
Phoenix, Arizona 85003

Re: Section 36, Sacaton Unit

Dear Fred:

Further to the matter of the possibility of a commercial open pit ore body in Section 36, Mr. Bill Kurtz of our exploration department has been in conversation with Mr. Charles Miller, an exploration geologist for American Metals Climax (AMAX). Mr. Miller informed Mr. Kurtz that the location and depth of the holes are on file with the State Land Department. He also told him that he was under written agreement with Mr. Sullivan not to divulge the information obtained from the drill logs of the holes. Further, that AMAX and Sullivan had terminated all agreements other than the one mentioned above.

This would indicate to me that on the basis of the information obtained, AMAX is satisfied that there is no valuable mineral underlying Section 36. If the State of Arizona is unable to obtain the information contained in the drill hole logs from AMAX, it would seem to me that the mere fact that AMAX walked away from the property would have some weight in the State's consideration as to whether or not ore exists within the confines of Section 36.

If any further information becomes available, I will send it to you without delay.

Very truly yours,

ROY S. HERDE
Assistant Manager

RSH:lal
cc: TREdwards

J. H. Courtright

RECEIVED
FEB 20 1974
EXPLORATION DEPT.

J. H. C.
MAR 15 1974

EXPLORATION SERVICES DIVISION
3422 South 700 West
Salt Lake City, Utah 84119

February 15, 1974

file

MEMORANDUM to W. L. KURTZ:

GEOCHEMISTRY OF ALLUVIUM OVER
THE SACATON WEST OREBODY, ARIZONA.

Introduction:

Secondary geochemical dispersion patterns in alluvium over and around sub-outcropping porphyry copper deposits in the Basin and Range Province of the S. W. United States have received some attention in the past. However, lack of sampling opportunities have commonly hindered such studies. In this context the excavation of the Sacaton Pit offers a unique opportunity of obtaining alluvial samples over and around a sub-outcropping porphyry copper deposit. With this in mind I visited Sacaton last October and collected overburden samples from the pit with the assistance of Mr. Bob Cummings, Mine Geologist. The cooperation and help provided by Mr. Cummings and other members of the Mine staff in this geochemical orientation project is much appreciated.

Conclusions and Recommendations:

1. Apparently anomalous concentrations of copper and molybdenum occur in the indurated post-mineral alluvium for at least 20 - 30 feet above the level of the leached sub-outcrop of the Sacaton orebody. The lateral extent of these anomalous values is as yet uncertain.

2. Chemical evidence suggests that these anomalous metal values are primarily related to detrital dispersion processes.

3. Collection and analysis of additional alluvium samples as the Sacaton pit develops is recommended. The extent and nature of anomalous overburden will be thereby better appreciated. Attention might also be usefully given to any alluvium samples obtained in the Sacaton drilling program.

4. Previous alluvium studies in the region suggest anomalous dispersion patterns in alluvium on pre-mineral bedrock surfaces adjacent to porphyry copper deposits can be fairly extensive (e.g. at least 1.5 miles in the vicinity of the Pima Mine). There would already appear to be sufficient evidence to encourage consideration of basal alluvium geochemistry as an ancillary exploration tool.

Sample Collection:

Samples of alluvium were collected from nineteen locations in the Sacaton pit (Fig. 1). Thirteen of these samples were of unconsolidated material whilst the remainder were of the underlying indurated post-mineral conglomerate. Care was taken to avoid material possibly exposed to contamination from mining activities. The samples were collected along three traverses aligned E. - W. and a fourth N. - S. It is hoped that as the pit is extended additional samples will be taken along these same traverse lines. In this way a three dimensional picture of any secondary dispersion patterns related to the orebody will be developed.

Sample Preparation and Analysis:

The possibility exists that clastic and/or saline ore metal dispersion patterns occur in alluvial overburden. A variety of sample size fractions (i.e. −10 + 35#, −35 + 80#, −80#, −80 + 200# and −200#) were therefore subjected to a variety of chemical attacks, in order that the likely dominant metal dispersion processes might be determined. In dealing with the indurated samples an attempt was made to confine attention to the finer matrix material.

All sample fractions were analyzed for total Mo and Hg. All sample fractions were also analyzed for Cu, Pb and Zn following

1) hot HNO_3 + $HClO_4$ (i.e. "near total") digestion

2) cold 0.5 N HCl leach

3) cold H_2O leach.

The resultant data are shown on the attached tables.

Data:

Examination of the analytical data (see attached data sheets) indicates that all method of analysis used on all the various size fractions produce broadly comparable patterns of metal distribution (although they are at different concentration levels). Only Cu and Mo concentrations display consistent marked geographic variations.

"Total" Cu and Mo concentrations appear to generally increase downward through the alluvium profile (Figs. 2 and 3). Markedly anomalous values occur in the matrix of the indurated conglomerate for at least twenty - thirty feet above the level of the leached cap of the orebody exposed in the pit bottom. More extensive sample data are required to determine whether the general downward moderate increase in Cu and Mo concentrations seen throughout the pit are also related to the presence of the orebody.

Consideration of Cu concentrations extractable by weak leach techniques (Figs. 4 and 5) and more specifically the ratios of partial/total extractable Cu (Figs. 6 and 7) suggests that the observed anomalous metal distribution patterns are primarily related to detrital dispersion processes. Increased ratios of partial/total extractable Cu in the more metal rich areas, which could be indicative of saline dispersion, are not apparent. The general similarity of Cu and Mo distribution patterns in the various size fractions could also be indicative of the dominance of detrital dispersion processes.

Our limited data suggest that fairly extensive detrital dispersion patterns of ore metals likely occur in the indurated conglomerate over and adjacent to the orebody. The full extent of these anomalous dispersion patterns is uncertain.

It is interesting to note that U.S.G.S. studies some years ago in the Pima mining district showed basal indurated (i.e. carbonate cemented) alluvium to contain markedly anomalous Cu concentrations for at least 1.5 miles from the known orebodies. "A Geochemical Study of Alluvium Covered Copper Deposits in Pima County, Arizona" by Lyman C. Huff, U.S.G.S. Bull. 1312-C, 1970). In this case, however, evidence was produced suggesting that the anomalous alluvium resulted from the deposition of Cu from metal rich groundwater.

L. D. James

L. D. JAMES

LDJ:db
Encls.

cc:T.C.Osborne w/encl.
J.H.Courtright w/encl.
R.B.Cummings w/encl.

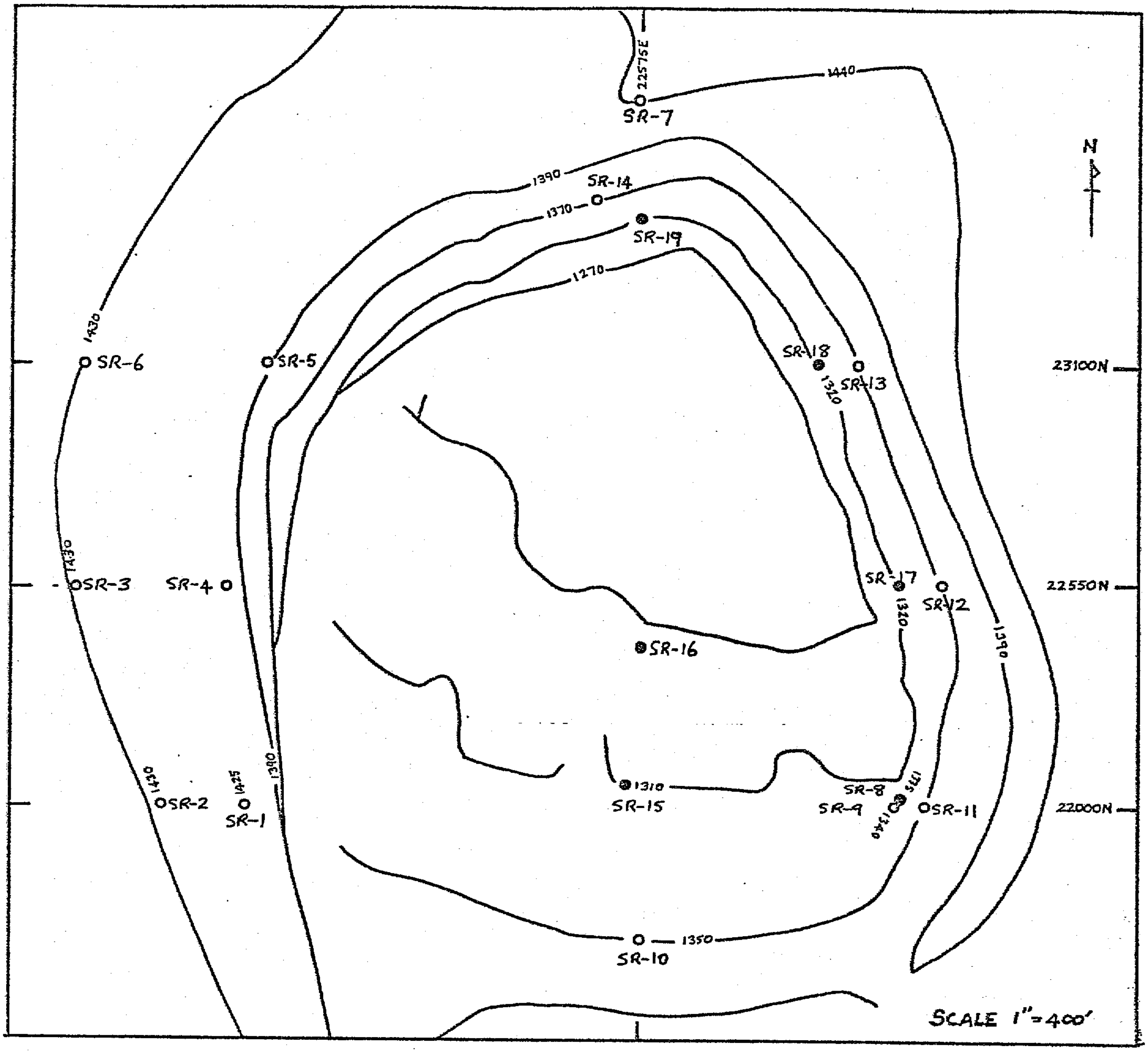


Fig. 1.

SACATON MINE, ARIZONA.

Location and Numbers of alluvium samples.

o sample unconsolidated alluvium

● sample consolidated alluvium.

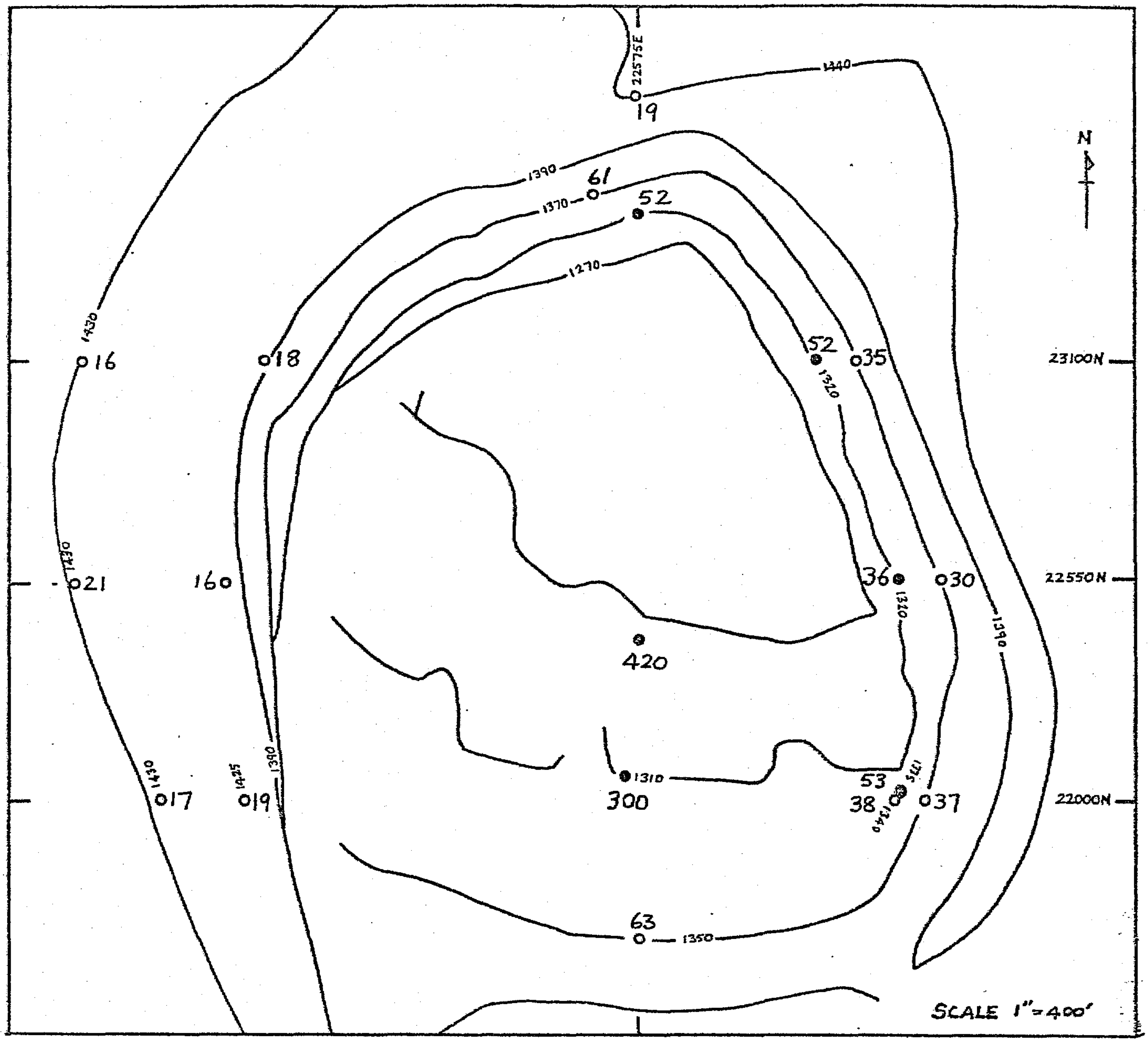


Fig. 2.

SACATON MINE, ARIZONA.

Copper (ppm) in – 80# fraction alluvium samples.

(analysis following HNO_3 + $HClO_4$ digestion)

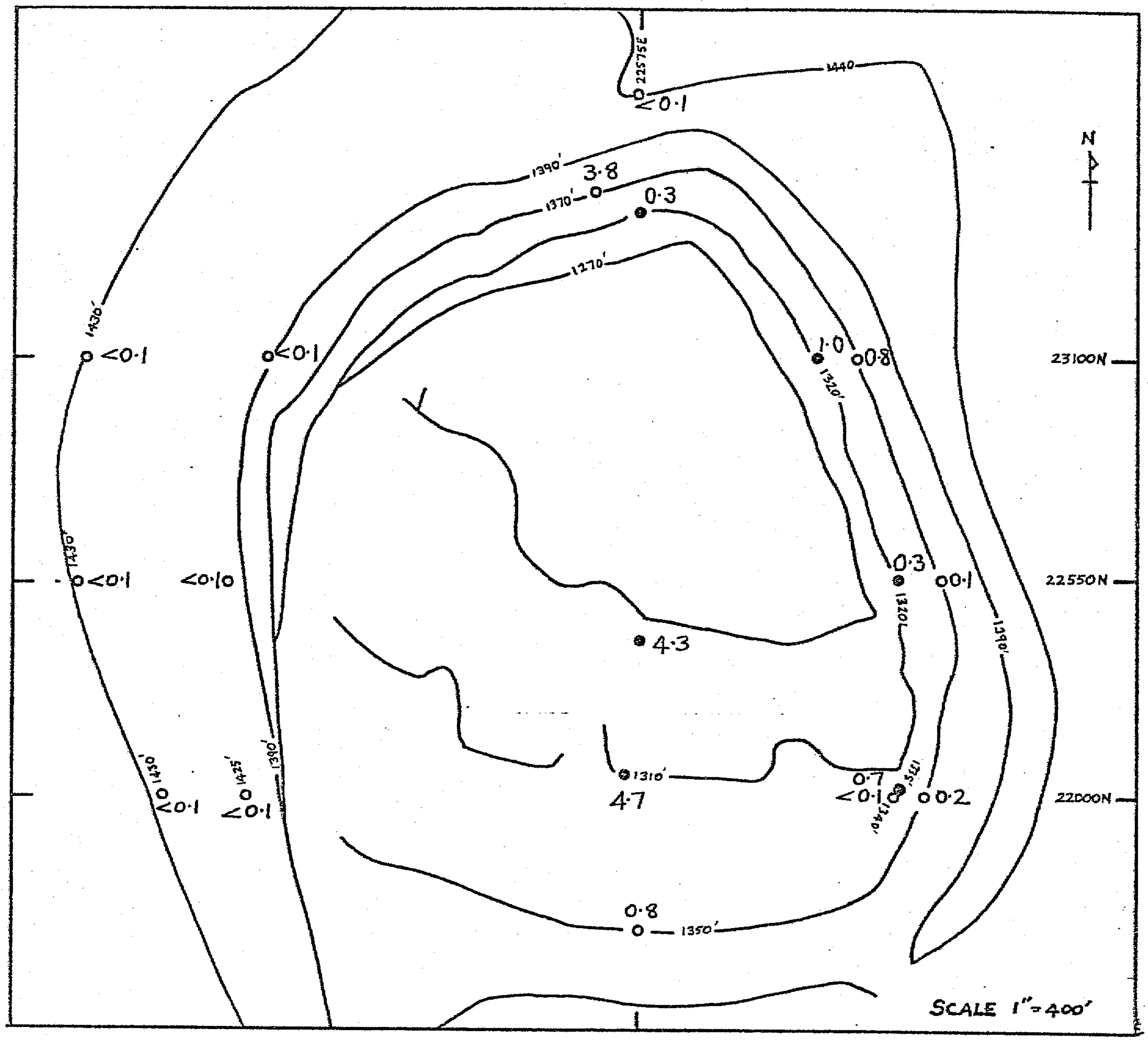


Fig. 3.

SACATON MINE, ARIZONA.

Mo (ppm) in − 80# fraction alluvium samples.

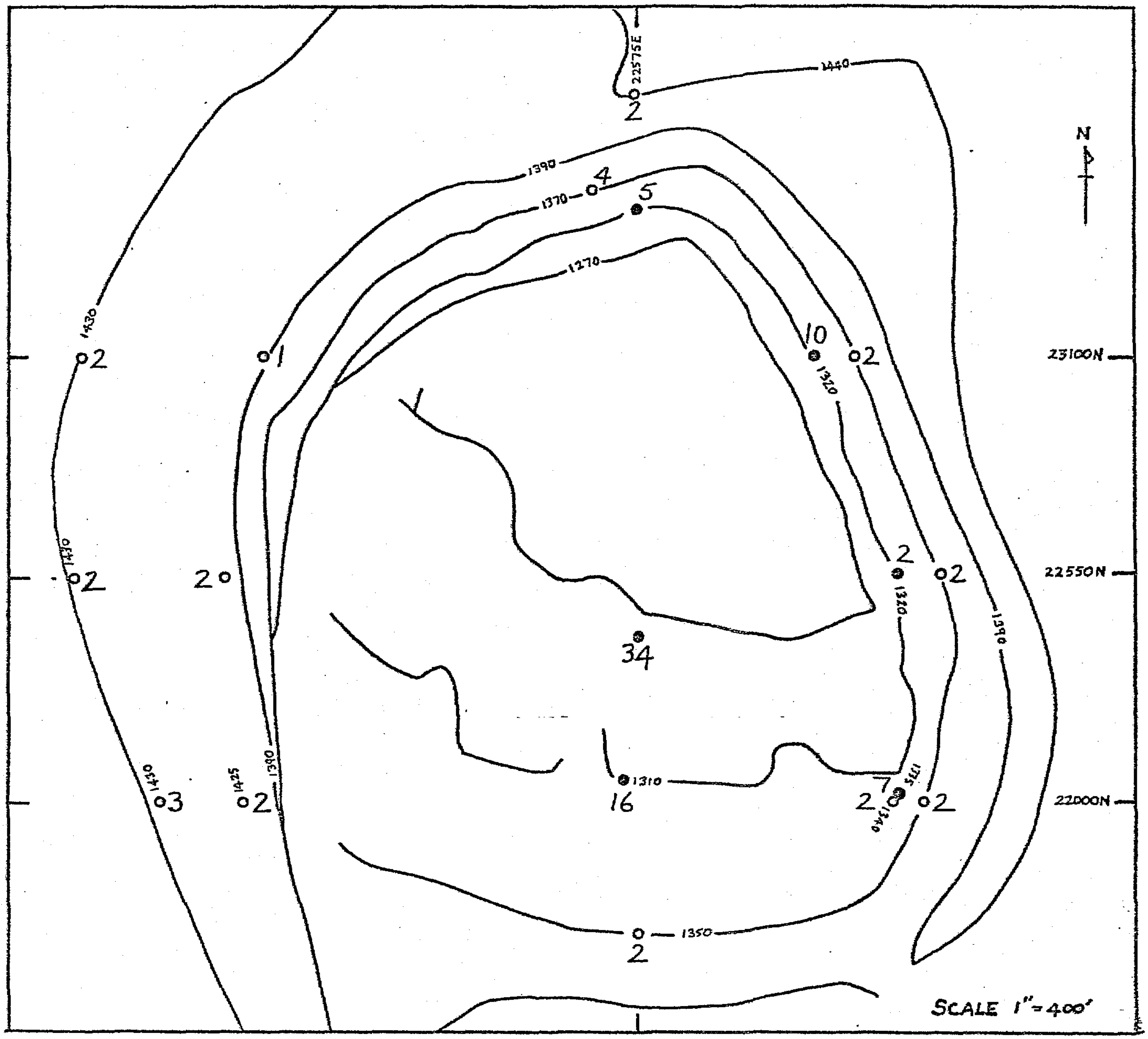


Fig. 4.

SACATON MINE, ARIZONA.

cxCu (ppm) in – 80# fraction alluvium samples.

(analysis following cold 0.5N HCl leach)

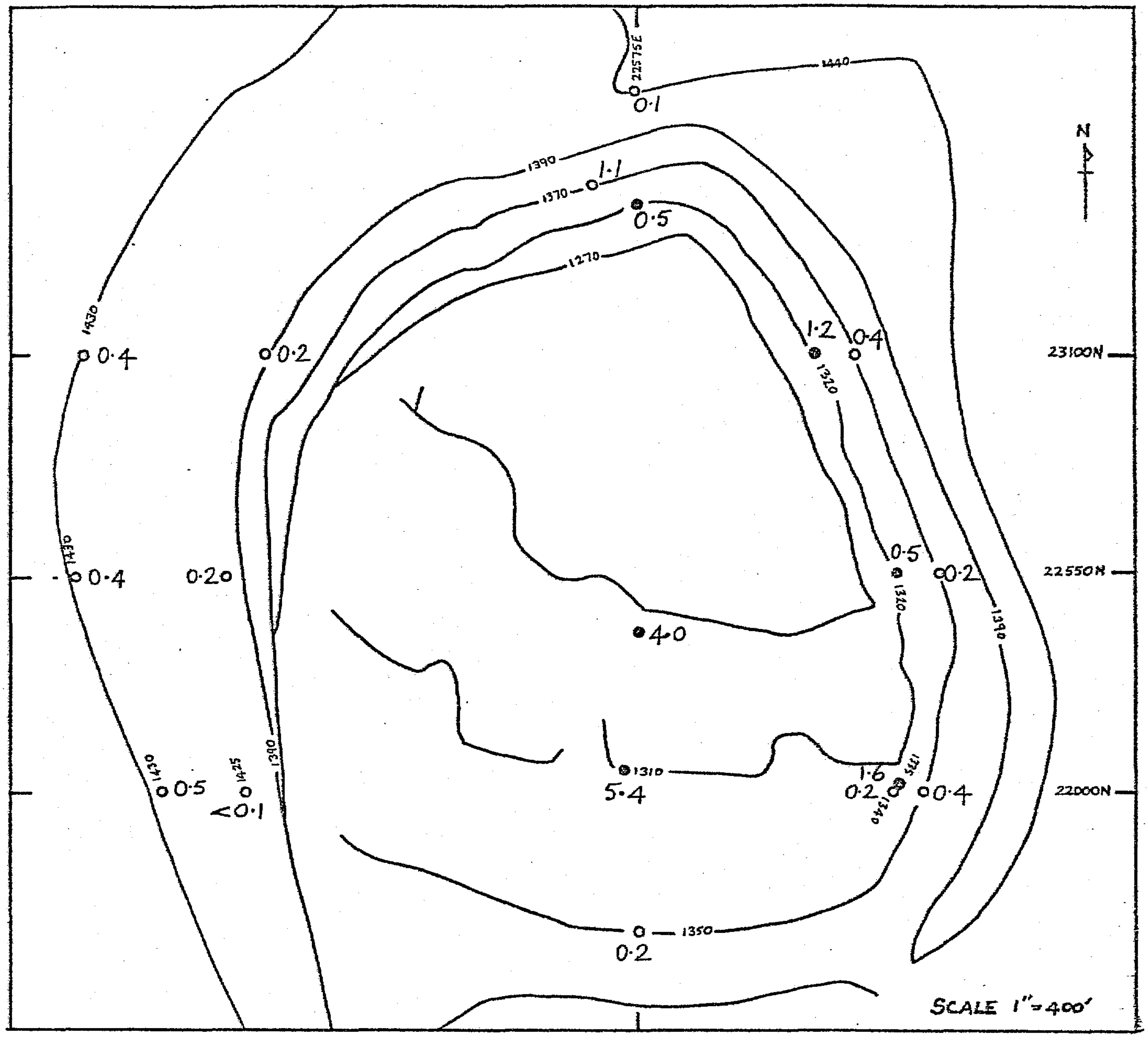


Fig. 5.

SACATON MINE, ARIZONA.

cxCu (ppm) in −80# fraction alluvium samples.

(analysis following cold H_2O leach)

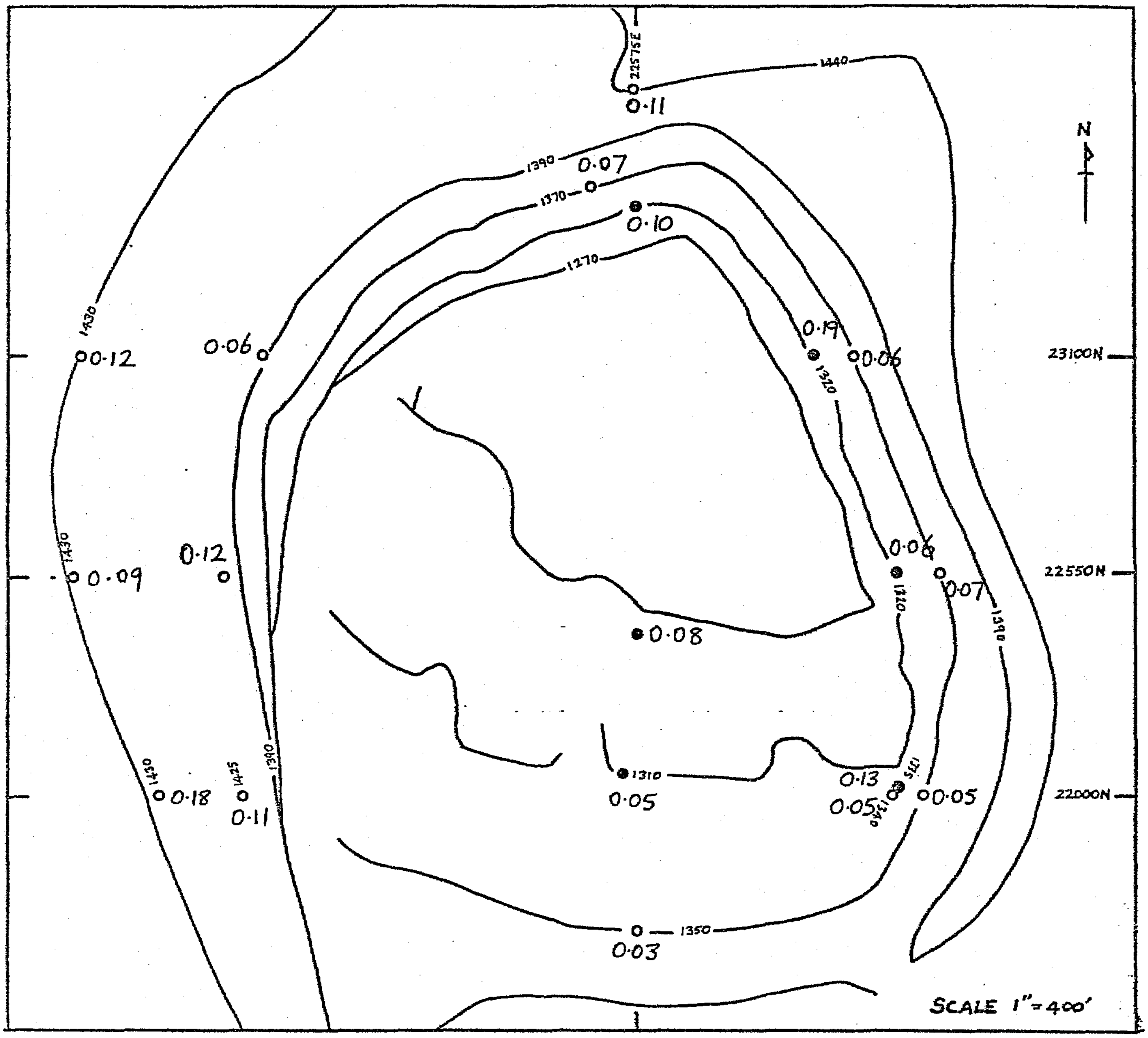


Fig. 6.

SACATON MINE, ARIZONA.

Ratio cxCu (o.5N HCl)/Total Cu in —80# fraction alluvium samples.

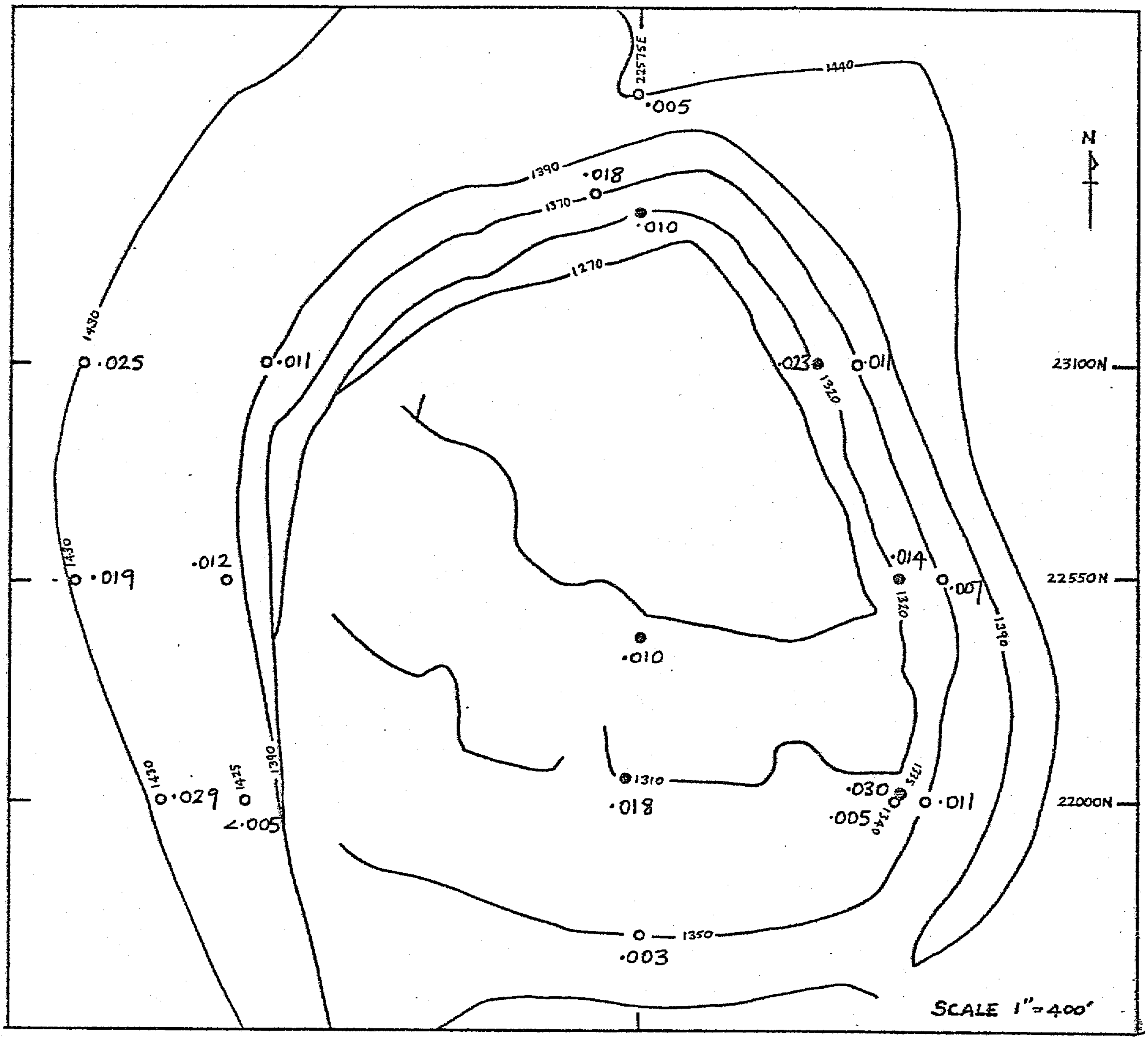


Fig. 7.

SACATON MINE, ARIZONA.

Ratio cxCu (H_2O)/Total Cu in − 80# fraction alluvium samples.

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 12/31/73

Requested By L. D. JAMES

No. Samples

SAMPLE NUMBER		– 80# Cu ppm	Pb ppm	$(HNO_3 + HClO_4)$ Zn ppm	Mo ppm	(1/8/74) Hg ppb
Group #1						
SR - 1		19	19	52	N.D.	4
2		17	17	53	"	4
3		21	18	63	"	N.D.
4		16	16	50	"	"
5		18	14	60	"	"
6		16	14	57	"	"
7		19	16	49	"	4
9		38	17	68	"	4
10		63	17	70	.8	N.D.
11		37	17	63	.2	"
12		30	18	63	.1	"
13		35	13	63	.8	"
14		61	18	64	3.8	"
Group II						
SR - 8		53	19	52	.7	N.D.
15		300	22	61	4.7	"
16		420	20	126	4.3	"
17		36	15	43	.3	"
18		52	26	58	1.0	"
19		52	26	68	.3	"

ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 12/31/73

Requested By L. D. JAMES

~~No. Samples~~ – 10 + 35# ($HNO_3 + HClO_4$)

(1/8/74)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Mo ppm	Hg ppb				
Group I										
SR - 1		12	9	25	N.D.	18				
2		11	12	27	"	5				
3		11	10	25	"	9				
4		15	12	27	"	5				
5		10	10	30	"	9				
6		10	11	33	"	18				
7		12	11	25	"	5				
9		30	16	52	.7	9				
10		31	9	32	.7	9				
11		29	15	47	.2	18				
12		21	11	28	.1	13				
13		21	8	27	.8	13				
14		68	19	49	10.0	23				
Group II										
SR - 8		45	16	37	.2	N.D.				
15		190	19	42	1.6	9				
16		360	16	108	2.5	5				
17		23	16	34	.2	5				
18		38	34	64	N.D.	9				
19		33	20	42	"	13				

ASARCO GEOCHEMICAL DATA

Project 665.

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Area SACATON OVERBURDEN ORIENTATION

Date 12/31/73

Requested By L. D. JAMES

~~No. Samples~~ –35 + 80# ($HNO_3 + HClO_4$)

(1/8/74)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Mo ppm	Hg ppb				
Group I										
SR - 1		15	13	35	N.D.	9				
2		11	12	30	"	5				
3		17	15	37	"	18				
4		11	13	28	"	13				
5		15	13	42	"	13				
6		12	13	37	"	13				
7		15	13	34	"	13				
9		38	19	64	.7	5				
10		51	13	53	1.5	13				
11		40	18	61	.4	7				
12		28	13	40	.7	5				
13		25	8	40	.2	18				
14		68	18	57		N.D.				
Group II										
SR - 8		43	18	41	.4	5				
15		250	20	48	3.0	23				
16		330	15	103	2.5	9				
17		27	14	31	.1	13				
18		38	22	51	N.D.	9				
19		42	22	50	"	23				

ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 12/31/73

Requested By L. D. JAMES

~~No. Samples~~ —80 + 200# (HNO_3 + $HClO_4$)

(1/8/74)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Mo ppm	Hg ppb				
Group I										
SR - 1		18	15	46	N.D.	N.D.				
2		15	14	44	"	"				
3		20	16	52	"	5				
4		14	15	42	"	5				
5		16	11	54	"	5				
6		15	12	48	"	5				
7		19	12	45	"	N.D.				
9		39	15	67	1.0	"				
10		60	13	70	1.0	5				
11		39	16	67	.5	4				
12		31	14	55	.2	N.D.				
13		34	11	59	.5	"				
14		60	15	63	3.9	"				
Group II										
SR - 8		38	15	42	.3	N.D.				
15		310	20	53	3.5	"				
16		290	12	89	2.8	"				
17		30	8	32		"				
18		41	20	50	.1	"				
19		48	15	61	N.D.	"				

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 12/31/73

Requested By L. D. JAMES

~~No. Samples~~ − 200# (HNO3 + HClO4)

(1/8/74)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm	Mo ppm	Hg ppb				
Group I										
SR - 1		20	23	52	N.D.	8				
2		20	21	54	"	N.D.				
3		24	24	64	"	"				
4		18	20	49	"	8				
5		19	14	57	"	4				
6		19	17	55	"	4				
7		22	21	54	"	N.D.				
9		41	18	67	.7	"				
10		52	14	64	.8	"				
11		34	16	57	.2	"				
12		29	16	53	.2	"				
13		31	11	58	.5	4				
14		55	15	58	3.0	N.D.				
Group II										
SR - 8		53	20	55	.8	12				
15		350	22	60	5.4	4				
16		440	15	123	4.8	4				
17		45	15	48	.3	8				
18		58	32	51	1.9	4				
19		54	23	63	.3	16				

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

~~No. Samples~~ -80# (.5n HCl - Shake 30 minutes)

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm						
Group I									
SR - 1	2	10	5						
2	3	11	5						
3	2	10	7						
4	2	6	5						
5	1	9	6						
6	2	8	7						
7	2	5	4						
9	2	4	5						
10	2	6	5						
11	2	5	7						
12	2	7	6						
13	2	3	5						
14	4	5	5						
Group II									
SR - 8	7	3	8						
15	16	2	5						
16	34	3	16						
17	2	N.D.	10						
18	10	5	7						
19	5	7	5						

ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date

Requested By L. D. JAMES

No. Samples — 10 + 35# (.5n HCl - Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm
Group I				
SR - 1		12	11	7
2		12	10	7
3		7	10	10
4		5	10	10
5		5	6	7
6		4	7	8
7		3	8	6
9	Insuf.Sample	-	-	-
10		4	4	6
11		4	5	6
12		6	7	6
13		10	4	10
14		8	9	9
Group II				
SR - 8		7	4	7
15		18	5	9
16		33	5	16
17		3	3	4
18		8	8	6
19		5	8	4

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

No. Samples −35 + 80# (.5n HCl - Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm
Group I				
SR - 1		3	13	9
2		3	12	6
3		9	15	8
4		2	13	5
5		3	7	7
6		3	9	6
7		3	12	8
9		3	7	6
10		3	7	6
11		3	7	8
12		3	8	6
13		2	4	5
14		5	8	9
Group II				
SR - 8	Insuf.Sample			
15		22	3	7
16		38	5	18
17		3	3	10
18	Insuf.Sample			
19		8	4	7

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

~~No. Samples~~ - 80 + 200# (.5n HCl - Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm						
Group I										
SR - 1		3	4	5						
2		2	7	6						
3		3	5	6						
4		2	7	6						
5		2	5	6						
6		2	6	6						
7		2	6	5						
9		4	7	6						
10		4	3	5						
11		5	7	9						
12		4	4	6						
13		3	4	6						
14		7	8	5						
Group II										
SR - 8		20	8	9						
15		21	4	7						
16		46	5	20						
17		4	8	8						
18		6	7	7						
19		6	7	6						

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

No. Samples -200# (.5n HCl - Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm						
Group I										
SR - 1		3	8	5						
2		3	8	12						
3		4	6	12						
4		2	6	7						
5		3	5	10						
6		3	6	11						
7		3	6	10						
9		5	7	12						
10		6	4	10						
11		7	8	14						
12		4	5	8						
13		4	2	9						
14		12	9	13						
Group II										
SR - 8		10	6	11						
15		48	6	13						
16		52	7	26						
17		5	3	11						
18		7	5	8						
19		8	8	10						

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

No. Samples —80# (Cold H_2O Ext., Shake 30 minutes)

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm
Group I			
SR - 1	< .1	< 1.	< .1
2	.5	2.	< .1
3	.4	1.	< .1
4	.2	< 1.	< .1
5	.2	1.	.4
6	.4	1.	.4
7	.1	< 1.	< .1
9	.2	< 1.	< .1
10	.2	< 1.	< .1
11	.4	1.	.8
12	.2	1.	< .1
13	.4	1.	.2
14	1.1	1.	.5
Group II			
SR - 8	1.6	1.	.4
15	5.4	< 1.	.8
16	4.0	< 1.	1.8
17	.5	< 1.	.7
18	1.2	< 1.	.5
19	.5	< 1.	.6

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

No. Samples — -10 + 35# (Cold H_2O Ext. 30 minute shake)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm
Group I				
SR - 1		< .1	< 1.	< .1
2		.3	1.	2.0
3		.4	1.	1.0
4		.1	< 1.	< .1
5		.1	< 1.	< .1
6		.1	< 1.	.4
7		.1	< 1.	.2
9	Insuf.Sample	-	-	-
10		.1	< 1.	< .1
11		.1	< 1.	< .1
12		.2	< 1.	.6
13		.1	< 1.	< .1
14		.2	< 1.	.4
Group II				
SR - 8		1.4	< 1.	.3
15		4.8	< 1.	2.0
16		3.2	< 1.	2.0
17		.3	< 1.	.2
18		.8	2.	.8
19		.7	< 1.	< .1

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GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

~~No. Samples~~ — 35 + 80# (Cold H_2O Ext., Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm
Group I				
SR - 1		.1	< 1.	< .1
2		< .1	< 1.	< .1
3		.1	< 1.	< .1
4		< .1	< 1.	< .1
5		.1	< 1.	.5
6		.1	< 1.	< .1
7		.1	< 1.	< .1
9		< .1	< 1.	< .1
10		< .1	< 1.	< .1
11		.1	< 1.	.2
12		.1	< 1.	< .1
13		< .1	< 1.	< .1
14		.3	< 1.	.2
Group II				
SR - 8	Insuf.Sample	-	-	-
15		5.7	1.	1.0
16		3.2	< 1.	2.0
17		.2	1.	.3
18	Insuf.Sample	-	-	-
19		.7	< 1.	.4

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ASARCO GEOCHEMICAL DATA

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Area SACATON OVERBURDEN ORIENTATION

Date 1/8/74

Requested By L. D. JAMES

~~No. Samples~~ — 80 + 200# (Cold H_2O Ext. Shake 30 minutes)

SAMPLE NUMBER		Cu ppm	Pb ppm	Zn ppm						
Group I										
SR - 1		.1	< 1.	.5						
2		.2	< 1.	.7						
3		.1	< 1.	.5						
4		.1	< 1.	.2						
5		.1	1.	.5						
6		.2	1.	.7						
7		.1	< 1.	.3						
9		.5	1.	.8						
10		.1	< 1.	.2						
11		.2	< 1.	.6						
12		.2	< 1.	.4						
13		.2	1.	.5						
14		.8	< 1.	1.0						
Group II										
SR - 8		1.0	1.	.8						
15		6.0	1.	.3						
16		5.6	1.	1.8						
17		.3	1.	.7						
18		2.4	4.2	2.0						
19		1.0	1.0	.2						

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ASARCO GEOCHEMICAL DATA

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Area: SACATON OVERBURDEN ORIENTATION

Date: 1/8/74

Requested By: L. D. JAMES

~~No. Samples~~ — 200# (Cold H_2O Ext. - Shake 30 minutes)

SAMPLE NUMBER	Cu ppm	Pb ppm	Zn ppm
Group I			
SR - 1	.1	1.	< .1
2	.2	1.	1.0
3	.2	2.	.4
4	.1	< 1.	.5
5	.1	1.	.7
6	.1	< 1.	.4
7	.1	< 1.	.3
9	.1	< 1.	.7
10	.1	< 1.	< .1
11	.1	1.	.5
12	.1	< 1.	.2
13	.1	< 1.	.6
14	.4	2.	.8
Group II			
SR - 8	.8	< 1.	.7
15	7.4	< 1.	.9
16	4.8	< 1.	2.0
17	.2	< 1.	.5
18	2.6	4.	2.0
19	1.0	< 1.	.9

J. H. C.
FEB 5 1973

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

February 2, 1973

FILE MEMORANDUM

SACATON

Mr. Charles Miller telephoned today to inform me of AMAX's activities in the Sacaton area. They have an agreement with Sullivan to explore his ground (secs. 36 and 34 were mentioned specifically). Mr. Miller wants it understood that AMAX is exploring this area strictly based upon their exploration viewpoint and not for any harassment to Asarco. They will, of course, exercise their right to explore the area and hope to remain on good terms with Asarco. I would have to agree that sitting in their position and with their penchant for deep drilling, sections 36 and 34 look like a ripe exploration target.

I asked Mr. Miller if their plans called for rapidly determining the ore potential of Sullivan's ground and he said yes because of the terms of their agreement with Sullivan. He also pointed out that even if they terminate Sullivan's lease continues for another couple of years. I would guess AMAX will hold the ground for at least another six months.

I suggest we offer Miller our drill logs (secs. 36, 34) in return for AMAX's drill logs should they terminate their agreement with Sullivan. I request people receiving copies to reply to this suggestion.

W. L. Kurtz
W. L. Kurtz

WLK:lb

cc: RBMeen
TREdwards
NVisnes
JHCourtright

AMERICAN SMELTING AND REFINING COMPANY
EXPLORATION DEPARTMENT
P. O. BOX 5747, TUCSON, ARIZONA 85703

J. H. COURTRIGHT
CHIEF GEOLOGIST

1150 NORTH 7TH AVENUE
TELEPHONE 602-792-3010

January 24, 1973

MEMORANDUM FOR: R.B. MEEN

SACATON PROJECT
PINAL COUNTY, ARIZONA

An assessment of the mineral potential of lands adjacent to ASARCO's Sacaton copper deposits, in particular Section 36 and the southeast quarter of Section 34, T5S, R6E, is presented in the following.

The Sacaton ore bodies, aggregating around 47 million tons of .95% copper, are porphyry copper occurrences, a type well known in the southwest U.S. and elsewhere. Through intensive study and investigation by many exploration geologists over the past 60 years, certain characteristics have been quite firmly established. One of these involves the zonal arrangement of alteration-mineralization features. In its simplest concept, a body of relatively strong copper mineralization is enveloped by layers, or haloes, successively weaker in copper, with barren rock encompassing the entire mass.

As in other porphyry deposits, the copper at Sacaton is present primarily as small grains and stringers of chalcopyrite, dispersed more or less uniformly through intrusive porphyry masses and various wall rocks. Weathering processes have resulted in secondary enrichment --- concentration of the copper as chalcocite --- converting the low-grade primary chalcopyrite mineralization to ore grade. These concentrations lie within a relatively large zone of disseminated copper-iron sulphide mineralization characterized by pervasive alteration; i.e., mainly clay formed by the decomposition of rock minerals. The accompanying plan map shows the positions of the two ore bodies within the zone of strong alteration-mineralization which is approximately 13,000 feet long and 4,000 feet wide. Also shown are drill hole locations and the only outcrop of bedrock in the area which is otherwise covered by alluvial material (soil, gravel, conglomerate) to depths ranging from a few feet to 1,000 feet, or more. Depth in feet to bedrock, copper assays and rock type are noted for the holes exterior to the zone of alteration-mineralization which is indicated on the attached map as an orange colored area outlined by heavy dots. Of the 142 exploratory holes drilled, 41 lie outside and 101 inside the zone limits.

Drill holes put down outside the zone encountered either very weakly altered rock with sparse sulphides containing a few hundredths of one percent copper, or barren rock. The SE 1/4 of Section 34 falls entirely within the halo of relatively weak alteration-mineralization, as does the northwestern corner of Section 36. The balance of Section 36 is underlain by essentially barren bedrock. Although the holes are wide-spaced for the most part in this outer fringe zone, the information obtained is sufficient to firmly establish its presence peripheral to the ore-bearing zone and to preclude the existence, within the outer limits of the drilling, of another alteration-mineralization zone of sufficient size to contain a commercial deposit.

J. H. Courtright

J.H. COURTRIGHT

JHC:kre
Encl: plan map
cc: J.J. Collins w/encl.

bc: W.L. Kurtz w/encl.