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

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

ASARCO

1150 NORTH 7TH AVENUE
TELEPHONE 602-792-3010

April 11, 1972

Sr. Larry Chandler
Domicilio Conocido
Tubutama, Sonora
MEXICO

Dear Larry:

It was a pleasure to have chatted with you on the phone last week and I hope this letter reaches you at your "well known house."

I have talked with the Southwestern Exploration Manager about your proposal and the following point appears. As I explained over the phone, ASARCO has many areas of interest in the southwest and especially Arizona, and it would be unfortunate if your area and one of ours coincided. You mentioned that some Sate land was involved as well as private and open ground. We believe it would be to the best interest of all concerned if you would pick up some part of the ground for your and Mrs. Ford's peace of mind. Then we could review all of your data and if an interest develops, then we would validate your holdings as well as pick up the surrounding area of interest as you now propose. The agreement as to price would be sufficient on the ground originally held in your names to satisfy both parties. This would allow you to negotiate from the land owners standpoint and you would be fully protected during that period and we would have the opportunity of evaluation as is normal in our outside exploration adventures.

I hope your trip into the wilds of the Sierra Madra was successful and full of good beans and tortillas, along with a good riding mule, and I will be looking forward to seeing you and talking about all the good things.

Sincerely,

Jim

James D. Sell

JDS:sg

cc: WLKurtz

Larry Chandler
Ford Associates
275-7098 Phoenix

Somewhere around Socorro
Cu-Mo in Mesquite
at least 2 sections
two long leads
also sampled over Socorro - got caught (4 years ago) -
Socorro sample lies in consumption

if data is presented & if ASARCO finds something they will keep, then $10,000^{00}$/year for 5 years.

18 Jan 71

Open Memo - Staff

Mr. Bob O'Haire of the Arizona Bureau of Mines called today and is looking for the person who submitted a mineral specimen to them on March 18, 1969, (from Sacaton?).

The mineral is Brochantite and was reported but then he threw away the specimen and now wants to know what rock type the brochantite was in so he can include it in a new Bulletin being prepared.

James W. Sell

verbal by Wolla Vista & Wholey

Laramide granite   44.5 I 1.4 Wemon on SW.

Dr. P E Damon
Telephone Commun Sept 22, 1970.

Whole-rock date on Sacaton

DDH S-9, rock from 754'-767'.
K-Ar 64.5 ± 1.4 Myr.

SACATON DH DATA

USED IN REVISED

PIT DESIGN

12-23-67

Holes: 6, 8, 10, 13, 17, 30, 90, 91, 93, 94, 95, 97, 101, 102, 103, 106, 107, 109, 110, 111, 112, 114, 115, 116, 124, 125, 126.

and Geol-Assay-Cumulative logs of Holes: 12, 30, 35, 102, 112

USED IN REVISED DESIGN 3/

ASSAY LOG

Project ..SACATON... Sheet...1..........of..2.....

Hole No. ..S-6...... Date..............1969.........

✓ Assays Represent 1968-69 Data ✓ 22000.00N 22000.00E 1434 elev.

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
265.0 - 269.0		4.0		R.B.	0.34				
269.0 - 273.0		4.0		R.B.	0.27				
273.0 - 275.0		2.0		100	0.08				
275.0 - 279.0		4.0		98	0.10				
279.0 - 286.6		7.6		92	0.14				
286.6 - 296.6		10.0		96	0.09				
296.6 - 303.3		6.7		100	0.05				
303.3 - 305.0		1.7		100	0.56				40
305.0 - 310.7		5.7		99	1.41				Note:
310.7 - 313.7		3.0		99	0.21				Values in
313.7 - 315.0		1.3		99	8.12				pencil are ...
315.0 - 325.0		10.0		92	2.54				
325.0 - 335.0		10.0		100	0.18				printed are mining
335.0 - 345.0		10.0		99	0.85				dept — upgraded
345.0 - 355.0		10.0		100	0.65				from Geol log
355.0 - 359.0		4.0		99	0.77				
359.0 - 365.0		6.0		99	2.68				circled are geol log.
365.0 - 372.5		7.5		93	0.17	% Cu			
372.5 - 382.5		10.0		99	0.49				* Bottomed into 0.30
382.5 - 392.5		10.0		98	0.58				
392.5 - 402.5		10.0		95	1.15				
402.5 - 406.5		4.0		25	1.69				
406.5 - 417.5		11.0		31	1.30	(8)			10
417.5 - 422.3		4.8		85	0.52				5
422.3 - 432.6		10.3		55	0.45	226.4			
432.6 - 435.0		2.4		33	0.32				
435.0 - 444.7		9.7		97	0.44				
444.7 - 448.8		4.1		80	0.43				
448.8 - 451.7		2.9		90	0.55				
451.7 - 455.0		3.3		76	0.30				
455.0 - 459.8		4.8		96	0.48				
459.8 - 465.5		5.7		88	0.47				
465.5 - 475.0		9.5		93	0.51				
475.0 - 485.0		10.0		99	0.44				
485.0 - 491.0		6.0		93	0.46				
491.0 - 500.5		9.5		95	0.45				
500.5 - 506.0		5.5		91	0.75				
506.0 - 515.0		9.0		96	0.35				
515.0 - 519.9		4.9		84	0.31				
519.9 - 529.7		9.8		94	0.46				
529.7 - 537.4		7.7		97	0.21				
537.4 - 540.7		3.3		100	0.14				
540.7 - 545.0		4.3		88	0.20				
545.0 - 555.3		10.3		95	0.20				
555.3 - 565.0		9.7		100	0.16				
565.0 - 575.0		10.0		98	0.18				
575.0 - 576.8	5286	1.8		83	0.80				
576.8 - 578.9		2.1		100	0.19				
578.9 - 582.9		4.0		90	0.14				
[illegible]		[illegible]		[illegible]	[illegible]				

ASSAY LOG

Project SACATON

Sheet 2 of 2

Hole No. S-6

Date 1969

rom - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
91.1 - 595.4		4.3		81	0.19				
595.4 - 598.8		3.4		88	0.23				
598.8 - 602.6		3.8		84	0.14				
602.6 - 608.8		6.2		94	0.19				
614.4		5.6		93	0.27				
615.0	5287	0.6		67	0.42				
620.6		5.6		91	0.14				
622.6		2.0		70	0.24				
626.7		4.1		73	0.24				
637.2		10.5		92	0.14				
644.6		7.4		99	0.24				
648.9	5288	4.3		77	0.32				
653.9		5.0		44	0.29				
BOTTOM									

ASSAY LOG

Project SACATON .... Sheet... 1........of...1....

Hole No. ..S-8....... Date................1969.......

Assays Represent 1968-69 Data 21994.58N 22539.33E 1435 Elev.

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
185.3		6.0		R.B.	0.38				
189.3		4.0		R.B.	0.13				
199.3		10.0		R.B.	0.06				
209.3		10.0		R.B.	0.02				
213.5		4.2		100	0.04				
224.4		10.9		87	0.07				
234.6		10.2		96	0.12				
244.4		9.8		100	0.09				
254.3		9.9		99	0.04				
264.3		10.0		100	0.04				
274.3		10.0		97	0.03				
284.6		10.3		92	0.02				
294.4		9.8		97	0.04				
304.3		9.9		99	0.03				
314.3		10.0		97	0.02				
322.7		8.4		92	0.09				
326.5		3.8		76	0.50				
335.0		8.5		00.0	No Sample				
337.5	5419	2.5		24	2.24				OXIDE ZN ASSAY
340.1	5420	2.6		38	0.95				
345.7	5421	5.6		96	0.95				
351.3		5.6		38	0.19				
357.9		6.6		51	0.37				
363.3		5.4		93	0.30				
370.4		7.1		86	0.47				
381.1		10.7		84	0.39				
388.8		7.7		91	0.32				
397.1		8.3		61	0.55				
405.0		7.9		95	0.36	121.5' @ .46% Cu			
415.0		10.0		92	0.49				
418.3		3.3		85	0.41				
427.4		9.1		57	0.42				
434.2		6.8		100	0.31				
441.0		6.8		59	0.39				
445.9		4.9		98	0.32				
453.0		7.1		65	0.34				
459.0		6.0		82	0.28				
BOTTOM					*				

ASSAY LOG

Project SACATON .... Sheet .... of ...3....

Hole No. ...S-10.... Date ....1969......

Assays Represent 1968-69 Data 22534.13N 22013.99E 1438 Elev.

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
230.0		10		Rock Bit	—				
236.0		6.0		78	0.02				
245.9		9.9		79	Tr				
254.0		8.1		74	Tr				
258.1		4.1		100	0.06				
266.2		8.1		95	0.05				
276.2		10.0		100	0.04				
282.3		6.1		98	0.02				
288.9		6.6		92	0.29				
292.0		3.1		100	0.14				
296.2		4.2		100	0.24				
306.0		9.8		97	0.10				
315.1		9.1		93	0.12				
321.0		5.9		90	0.12				
329.9		8.9		91	0.16				
336.2		6.3		100	0.24				
353.0		16.8		100	0.16				
356.2	5371	3.2		100	1.14				
366.2	5372	10.0		100	2.11				
376.2	5205	10.0		100	3.53				
386.2	5373	10.0		100	2.53				
392.6	5374	6.4		95	1.64				
404.5	5375	11.9		51	1.02				
411.1	5206	6.6		91	0.86				
416.5	5376	5.4		81	1.45				
422.4	5377	5.9		37	0.68				
426.2	5378	3.8		63	0.58				
432.6	5207	6.4		92	1.12				
436.1	5379	3.5		94	0.61				
442.3	5380	6.2		95	1.46				
452.3	5381	10.0		100	2.85				
457.5	5208	5.2		96	2.75				
466.0	5382	8.5		99	2.19				
473.1		7.1		70	0.47	% Cu			
480.0	5209	6.9		81	1.76				
486.2		6.2		98	0.70				
493.0		6.8		97	0.46				
495.5		2.5		96	0.63				
499.0		3.5		97	1.03	> @ 544.9'			
501.5		2.5		100	0.50				
506.2		4.7		98	0.47				
512.0		5.8		97	0.52				
521.8		9.8		62	0.78				
530.6		8.8		51	0.38				
534.8		4.2		79	0.60				
541.7		6.9		93	0.38				
548.5		6.8		91	0.52				
557.3		8.8		81	0.45				
566.0		8.7		91	0.49				
571.4		5.4		96	0.40				
576.0		4.6		93	0.22				

ASSAY LOG

Project .SACATON.... Sheet....2........of...3.....

Hole No. .S-10...... Date...............1969.....

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay
585.2		9.2		96	0.25			
593.8		8.6		87	0.43			
604.3		10.5		88	0.36			
611.2		6.9		87	0.35			
620.6		9.4		91	0.55			
630.7		10.1		89	0.31			
641.8		11.1		94	0.33			
646.0		4.2		100	0.25			
657.0		11.0		87	0.34			
660.7		3.7		100	0.36			
665.0		4.3		49	0.34			
675.0		10.0		100	0.25			
678.0		3.0		80	0.37			
678.6		0.6		no sample	0.30			
687.1		8.5		100	0.24			
691.8		4.7		92	0.31			
696.6	5289	4.8		97	0.26			
701.3		4.7		98	0.21			
706.0		4.7		99	0.27			
710.9		4.9		89	0.41			
720.0		9.1		100	0.28			
728.7		8.7		95	0.34			
733.5		4.8		100	0.25			
742.0		8.5		95	0.42			
751.5	5290	9.5		91	0.55			
756.3		4.8		96	0.48			
761.0		4.7		98	0.38			
765.7		4.7		92	0.32			
775.4		9.7		92	0.32			
783.0		7.6		93	0.35			
787.9		4.9		95	0.29			
792.8		4.9		94	0.47			
801.4		8.6		97	0.38			
807.4		6.0		92	0.37			
812.2		4.8		100	0.52			
816.6		4.4		97	0.57			
824.0		7.4		86	0.51			
828.8		4.8		95	0.48			
837.7		8.9		91	0.31			
842.4	5291	4.7		94	0.51			
851.1		8.7		92	0.25			
860.7		9.6		94	0.25			
868.6		7.9		96	0.31			
873.2		4.6		40	0.24			
878.7		5.5		95	0.17			
888.5		9.8		98	0.17			
897.9	5292	9.4		98	0.44			
906.0		8.1		95	0.22			
914.9		8.9		92	0.22			
921.9		7.0		90	0.21			
927.9		6.0		93	0.23			

ASSAY LOG

Project SACATON Sheet....of...3

Hole No. S-10 Date 1969

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
932.7		4.8		95	0.18				
942.0		9.3		86	0.20				
947.3		5.3		92	0.20				
951.3		4.0		88	0.30				
960.7		9.4		96	0.19				
970.0		9.3		95	0.18				
974.3		4.3		97	0.18				
983.3		9.0		94	0.22				
992.4		9.1		89	0.15				
996.9		4.5		86	0.15				
1005.9		9.0		46	0.20				
1013.3		7.4		95	0.33				
1021.5		8.2		96	0.38				
1027.2		5.7		81	0.23				
1029.9		2.7		54	0.39				
1036.9		7.0		99	0.40				
1042.0		5.1		96	0.31				
1052.0		10.0		24	0.20				
1060.0		8.0		96	0.31				
1064.5		4.5		100	0.25	119.2' @ % Cu			
1069.0		4.5		48	0.13				
1078.1		9.1		99	0.30				
1087.9		9.8		99	0.26				
1096.1		8.2		100	0.23				
1105.8		9.7		99	0.25				
1110.7		4.9		100	0.30				
1115.6	5293	4.9		100	0.45				
1120.5		4.9		100	0.34				
1125.1		4.6		98	0.41				
1129.5		4.4		99	0.18				
1139.2		9.7		92	0.23				
1144.1		4.9		100	0.19				
BOTTOM									

ASSAY LOG

Project SACATON

Sheet .... of 3

Hole No. S-13

Date 1969

22544.82N
22558.56E

1440 Elev.

Assays Represent 1968-69 Data

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
130.0		10.0		R.B.	0.15				
140.0		10.0		R.B.	0.06				
150.0		10.0		R.B.	0.21				
160.0		10.0		R.B.	0.33				
170.0		10.0		R.B.	0.07				
180.0		10.0		R.B.	0.21				
190.0		10.0		R.B.	1.10				
200.0		10.0		R.B.	0.88				
210.0		10.0		R.B.	0.45				
220.0		10.0		R.B.	0.25				
230.0		10.0		R.B.	0.10				
240.0		10.0		R.B.	0.10				
250.0		10.0		R.B.	0.09				
260.0		10.0		R.B.	0.08				
270.0		10.0		R.B.	0.46				
275.0		5.0		R.B.	0.82				
280.0		5.0		R.B.	0.14				
290.0		10.0		R.B.	0.08				
297.4		7.4		R.B.	0.06				
301.2		3.8		92	0.05				
312.5		8.7		99	0.29				
321.0		8.5		96	Tr				
330.1		9.1		97	0.02				
337.7		7.6		99	0.11				
346.0		8.3		99	0.56				
356.0		10.0		100	0.14				
363.5		7.5		99	0.17				
369.7		6.2		100	0.08				
378.3		8.6		97	0.04				
384.6		6.3		100	0.04				
393.0		8.4		96	0.32				
395.1		2.1		86	0.08				
399.8		4.7		38	0.25				
407.5		7.7		81	Tr				
409.5		2.0		45	Tr				
414.6		5.1		73	Tr				
419.5		4.9		84	0.02				
428.4		8.9		93	0.02				
434.0		5.6		93	Tr				
442.1		8.1		78	0.10				
445.0	5383	2.9		76	0.94				
449.9	5384	4.9		35	1.08				
455.4	5385	5.5		22	1.11				
459.0	5386	3.6		89	1.33				
462.7	5387	3.7		84	1.24				
464.8	5388	2.1		96	1.31				
469.4	5389	4.6		91	0.97				
474.3	5390	4.9		88	1.30				
480.8	5391	6.5		88	1.27				
487.0	5392	6.2		94	1.65				
496.0	5393	9.0		90	0.82				

ASSAY LOG

Project SACATON Sheet 2 of 3

Hole No. S-13 Date 1969

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay
501.8	5394	5.8		88	0.47			
506.0	5395	4.2		100	1.61			
516.0	5396	10.0		99	0.55			
521.1	5397	5.1		100	0.82			
522.2	5398	1.1		100	0.39			
531.5	5399	9.3		98	3.42			
541.3	5400	9.8		97	5.74			
549.6	5401	8.3		89	1.79			
553.0	5402	3.4		100	1.09			
558.6		5.6		55	0.51			
559.5		0.9		78	0.68			
562.0		2.5		48	0.66			0/5
569.0		7.0		87	0.77			
578.9		9.9		84	0.48			
588.5		9.6		55	0.77			
590.7	5294	2.2		45	1.41			
594.2		3.5		77	0.59			
597.2	5295	3.0		47	1.70	% Cu		
606.0		8.8		81	0.65			
607.8		1.8		72	0.52			
609.7	5296	1.9		57	1.13			
613.7		4.0		85	0.84			
621.2		7.5		81	0.81			
628.2		7.0		94	0.83	407.1' @		
633.2		5.0		98	0.79			
640.0		6.8		91	0.70			
645.3		5.3		98	1.21			
653.9	5297	8.6		99	0.77			
660.4		6.5		97	0.51			
665.3		4.9		98	0.49			
668.8		3.5		100	0.87			
676.0		7.2		100	0.53			
682.1		6.1		100	0.53			
687.6		5.5		100	0.40			
697.1		9.5		100	0.39			
706.0		8.9		82	0.61			
711.0		5.0		96	0.29			
714.0		3.0		60	0.40			
723.5		9.5		96	0.65			
733.0		9.5		86	0.29			
737.7		4.7		94	0.42			
743.2		5.5		100	0.49			
750.5		7.3		99	0.46			
755.0		4.5		89	0.49			
765.9		10.9		95	0.37			
770.6		4.7		100	0.58			
777.8		7.2		96	0.38			
783.9		6.1		98	0.50			
789.3		5.4		93	0.48			
796.2		6.9		100	0.60			
806.0		9.8		97	0.38			

ASSAY LOG

Project SACATON

Sheet 3 of 3

Hole No. S-13

Date 1969

From. - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
816.0		10.0		93	0.42				
819.3		3.3		67	0.48				
823.1		3.8		87	0.36				
825.4		2.3		70	0.73				
836.0		10.6		97	0.52				
841.8		5.8		93	0.45				
844.4		2.6		85	0.28				
849.2		4.8		77	0.34				
BOTTOM					*			pt bottom	890

ASSAY LOG

Project SACATON Sheet 1 of 1

Hole No. S-17 Date 1969

22540.32N
23122.72E

1442 Elev.

Assays Represent 1968-69 Data

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
460		10		RockBit	0.11				
470		10		RockBit	0.74				
480		10		RockBit	1.42				
490		10		RockBit	0.15				
500		10		RockBit	0.09				
510		10		RockBit	0.07				
520		10		RockBit	0.07				
530		10		RockBit	0.13				
540		10		RockBit	0.07				
550		10		RockBit	0.06				
560		10		RockBit	0.06				
570		10		RockBit	0.07				
580		10		RockBit	0.06				
590		10		RockBit	0.05				
600		10		RockBit	0.02				
610		10		RockBit	0.03				
620		10		RockBit	0.02				
630		10		RockBit	0.02				
640		10		RockBit	0.03				
650		10		RockBit	0.04				
660		10		RockBit	0.04				
670		10		RockBit	Tr				
680		10		RockBit	0.04				
690		10		RockBit	0.05				
700		10		RockBit	0.05				
710		10		RockBit	0.49				
715		5		RockBit	0.34				
719.5		4.5		3.5	0.63				
726.0		6.5		42	0.46				
728.2		2.2		99	0.55				
734.0		5.8		21	0.92	52.0' @			
742.0		8.0		80	0.46				
752.0		10.0		93	0.43				
760.0		8.0		91	0.12				
766.0		6.0		79	0.17				
768.9		2.9		66	0.17				
773.5		4.6		100	0.13				
775.5		2.0		100	0.14				
782.6		7.1		18	0.20				
785.1		2.5		64	0.24				
787.4		2.3		38	0.22				
796.6		9.2		100	0.20				
805.1		8.5		99	0.08				
811.0		5.9		100	0.16				
821.1		10.1		52	0.08				
828.0		6.9		75	0.13				
BOTTOM									

ASSAY LOG

Project SACATON ... 15 ... Sheet ... of 3

Hole No. S-30 ... Date ... 1969

23126.95N
22578.54E
1447 Elev.

Assays Represent 1968-69 Data

From. - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
100.0		10.0		RockBit	0.29				
110.0		10.0		RockBit	0.10				
120.0		10.0		RockBit	0.02				
130.0		10.0		RockBit	0.04				
140.0		10.0		RockBit	0.10				
150.0		10.0		RockBit	0.03				
160.0		10.0		RockBit	0.02				
170.0		10.0		RockBit	0.02				
180.0		10.0		RockBit	Tr				
190.0		10.0		RockBit	Tr				
200.0		10.0		RockBit	0.02				
210.0		10.0		RockBit	0.03				
215.0		5.0		RockBit	0.03				
220.0		5.0		RockBit	0.04				
223.0		3.0		RockBit	0.21				
223 W		0.0		RockBit	0.24				
DIAMOND DRILL									
231.1		8.1		97	0.33				
238.0		6.9		95	0.02				
248.0		10.0		98	0.03				
253.8		5.8		100	0.13				
263.8		10.0		98	0.02				
267.1		3.3		92	0.02				
275.0		7.9		91	0.03				
282.5		7.5		89	0.02				
285.7		3.2		83	0.02				
287.8		2.1		95	0.06				
297.6		9.8		83	0.12				
305.0		7.4		100	0.22				
314.4		9.4		97	0.14				
323.1		8.7		94	0.10				
328.8		5.7		98	0.08				
333.9		5.1		92	0.09				
343.9		10.0		96	0.02				
350.3		6.4		98	0.03				
355.1		4.8		100	0.76				
363.1		8.0		100	0.07				
368.9		5.8		94	0.03				
373.8		4.9		92	0.04				
377.7		3.9		90	0.02				
385.0		7.3		97	Tr				
393.0		8.0		100	Tr				
403.0		10.0		98	0.02				
406.8		3.8		98	0.02				
408.0		1.2		70	Tr				
414.0		6.0		95	Tr				
424.0		10.0		100	Tr				
432.8		8.8		98	Tr				
442.5		9.7		96	0.02				
452.5		10.0		100	0.02				
462.4		9.9		96	0.05				

ASSAY LOG

Project SACATON

Hole No. S-30

Sheet 2 of 3

Date 1969

From. - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
470.4		8.0		100	0.02				
480.3		9.9		100	0.03				
488.7		8.4		100	Tr				
495.0		6.3		100	0.33				
502.0		7.0		99	0.05				
512.0		10.0		100	1.00				
517.2		5.2		94	0.09				
523.3		6.1		83	0.05				
528.3		5.0		93	0.02				
535.0		6.7		93	Tr				
545.0		10.0		96	1.06				
555.0		10.0		94	0.74				
564.3		9.3		100	0.08				
572.0		7.7		98	0.35				
579.8		7.8		99	0.02				
583.8		4.0		100	Tr				
593.3		9.5		100	Tr				
603.3		10.0		100	0.02				
613.3		10.0		100	0.03				
623.3		10.0		100	0.02				
633.3		10.0		97	0.11				
635.8		2.5		97	0.02				
645.7		9.9		96	0.03	% Cu			
651.6		5.9		100	0.02				
660.6		9.0		100	3.18				
665.0		4.4		100	3.53				
673.8		8.8		93	0.96	(2)			No Pulp - [illegible] = 0.9[illegible]
679.5		5.7		95	3.63	41.0			
684.1		4.6		96	0.94				
692.6		8.5		100	2.03				
703.7		11.1		99	0.05			OXIDE INTERVAL	
713.7		10.0		97	0.04				
723.5		9.8		101	0.56				
733.6		10.1		98	0.54				
741.5		7.9		98	0.34				
751.5		10.0		89	0.44				
761.5		10.0		100	0.12				
771.4		9.9		99	0.02				
781.8		10.4		83	0.76				
788.1		6.3		87	1.22				
794.5		6.4		99	1.13				
802.5		8.0		91	0.10				
809.9		7.4		81	1.46				
814.9		5.0		95	2.97				
818.6		3.7		96	0.11				
825.0		6.4		94	1.38	% Cu			
829.8		4.8		83	1.22				
835.0		5.2		89	1.10				
841.5		6.5		88	1.33	(3)			
845.8		4.3		89	1.78				

ASSAY LOG

Project SACATON

Sheet 3 of 3

Hole No. S-30

Date 1969

From - To	Sample Code	Int. (ft.)	SpG.	Rec (%)	Total Cu	Wt'd Assay	Ox Cu	Wt'd Assay	
858.3		6.9		100	1.09				
864.8		6.5		95	1.10				
873.5		8.7		90	1.09				
883.2		9.7		100	1.21				
893.2	5215	10.0		94	0.80				
901.8		8.6		95	1.67				
911.8		10.0		100	1.38				
921.8		10.0		100	2.55				
931.6		9.8		100	1.39				
941.5		9.9		100	1.49				
951.5		10.0		100	1.64				
961.4		9.9		97	0.86				
969.5		8.1		97	1.20				
971.3	5216	1.8		97	1.31				
981.3		10.0		93	0.55				
990.6		9.3		93	0.10				
997.6		7.0		79	0.10				
1003.4		5.8		87	0.06				
1011.3	5217	7.9		92	1.15				
1021.2		9.9		98	0.12				
1031.2		10.0		97	0.02				
1037.9		6.7		67	0.05				
1044.5		6.6		96	0.03				
1054.3		9.8		97	0.04				
1057.7		3.4		96	0.02				
1067.7		10.0		99	0.07				
1072.3		4.6		85	0.44				
1080.7	5218	8.4		97	1.34				
1087.6	5219	6.9		94	0.84				
1096.8		9.2		63	0.49				
1104.2		7.4		86	0.30				
1113.1		8.9		51	0.34	% Cu			
1123.3		10.2		96	0.52				
1130.4		7.1		99	0.29				
1138.3		7.9		91	0.26				
1142.2		3.9		99	0.30				
1151.3		9.1		94	0.30	173.8' @			
1160.2		8.9		89	0.25				
1162.9		2.7		84	0.35				
1167.1		4.2		92	0.46				
1173.3		6.2		91	0.40				
1179.4		6.1		90	0.34				
1186.4		7.0		88	0.46				
1196.2		9.8		85	0.24				
1203.0		6.8		97	0.32				
1211.7		8.7		98	0.50				
1216.2		4.5		65	0.20				
1227.3		11.1		84	0.44				
1238.1		10.8		62	1.11				
1241.5		3.4		67	0.72				

Sheet 1 of 1

N   COL ELEV Date / /

Hole No. S-90   22506.5   22239.0   1439.5

Interval FROM	TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
210.0	219.8	2.62	6221	0.04	0.02	START OF CORE
219.8	229.5	2.60	6222	0.05	0.02	
229.5	239.4	2.62	6223	0.05	0.03	
239.4	249.4	2.68	6224	0.07	0.03	
249.4	259.4	2.59	6225	0.19	0.16	
259.4	269.0	2.64-2.56	6226	1.41	1.35	
269.0	278.3	2.67	6227	1.19 29.0' @ 1.53%	1.16	29.0' @ 1.47%
278.3	288.4	2.69	6228	1.96	1.87	
288.4	298.4	2.47	6229	0.09	0.07	
298.4	308.3	2.44	6230	0.07	0.05	
308.3	318.0	2.68	6231	0.05	0.04	
318.0	328.0	2.70	6232	0.35	0.33	
328.0	338.2	2.61	6233	1.39 (10.2'@1.39%)	1.39	(10.2' @ 1.39%)
338.2	348.5	2.51	6234	0.07	0.06	
348.5	358.5	2.60	6235	0.12	0.11	
358.5	368.2	2.58	6236	0.13	0.13	
368.2	379.7	2.50	6237	0.15	0.15	
379.7	389.6	2.53-2.52	6238 Total Cu	0.05	0.05	
389.6	399.6	2.58	6239 0.065	0.03	0.03	
399.6	409.7	2.50	6240 0.438	0.28	0.13	
409.7	420.1	2.50	6241 1.188	0.78	0.33	
420.1	429.6	2.57	6242 2.816	2.63	0.62	
429.6	431.4	2.60	6243	1.36	0.38	
431.4	436.2	2.51	6244	1.22	0.44	
436.2	443.0	2.54	6245 Samples Rerun and screened for NAI Cu	1.48	0.32	
443.0	453.3	2.51	6246	1.46	0.54	
453.3	463.4	2.59-2.58	6247	1.59 104.0' @ 1.03%	0.61	104.0' @ 0.32%
463.4	473.6	2.58	6248	0.46	0.16	
473.6	483.7	2.56	6249	0.33	0.13	
483.7	493.7	2.49	6250	0.74	0.23	
493.7	503.8	2.57-2.52	6251	0.31	0.14	
503.8	513.7	2.60	6252	0.65	0.09	
513.7	524.0	2.78	6253	0.29	0.03	
524.0	534.0	2.53	6254	0.23	0.01	
534.0	542.0	2.60	6255	0.19	0.01	
542.0	552.0	2.50	6256	0.55	0.03	
552.0	562.2	2.56	6257	0.61 29.0' @ 0.53%	0.02	29.0' @ 0.02%
562.2	571.0	2.56	6258	0.42	0.01	
571.0	578.0	2.62	6259	0.27	< 0.01	
578.0	588.2	2.55	6260	0.20	< 0.01	
588.2	595.2	2.74	6261	0.56	< 0.01	
595.2	606.1	2.58	6262	0.37	< 0.01	
606.1	614.1	2.57	6263	0.44	< 0.01	
614.1	624.0	2.54	6264	0.38	< 0.01	
624.0	632.4	2.54	6265	0.11	< 0.01	
632.4	641.4	2.50	6266	0.18	< 0.01	
641.4	649.6	2.54	6267	0.25	< 0.01	
649.6	660.1	2.54	6268	0.27	< 0.01	
660.1	669.5	2.64	6269	0.50	< 0.01	
BOTTOM				*		pit bottom @ 824

Sacaton

Date / /

Hole No. S-91

Interval FROM - TO	Sp. G.	SAMPLE CODE	TOTAL Cu		CuO	COMMENTS
110.0 - 118.4	2.47	6341	0.03		0.02	START OF CORE
118.4 - 128.7	2.42	6342	0.02		0.01	
128.7 - 138.8	2.67	6343	0.03		0.01	
138.8 - 147.2	2.64 - 2.34	6344	0.03		0.01	
147.2 - 157.0	2.66	6345	0.18		0.06	
157.0 - 167.0	2.62 - 2.70	6346	0.14		0.07	
167.0 - 172.0	2.70	6347	0.06		0.02	
172.0 - 182.2	2.54	6348	0.02		0.01	
182.2 - 192.4	2.54	6349	0.02		0.01	
192.4 - 202.2	2.55	6350	0.04		0.01	
202.2 - 212.0	2.65	6351	0.03		0.01	
212.0 - 223.0	2.70	6352	0.80		0.20	
223.0 - 233.3	2.52	6353	0.34		0.11	
233.3 - 243.2	2.46	6354	0.05		0.03	
243.2 - 253.4	2.60	6355	0.15		0.07	
253.4 - 263.4	2.61	6356	0.07		0.03	
263.4 - 273.5	2.36 - 2.65	6357	0.62		0.12	
273.5 - 283.7	2.54	6358	0.03		0.02	O/Ho
283.7 - 293.7	2.72 - 2.47	6359	1.68		0.25	
293.7 - 303.8	2.75	6360	3.70		0.18	
303.8 - 312.0	2.64	6361	1.57		0.14	
312.0 - 322.2	2.74	6362	1.79		0.13	
322.2 - 323.7	2.62	6363	1.34		0.15	
323.7 - 333.8	2.74	6364	1.50		0.27	
333.8 - 338.3	2.60	6365	2.13		0.25	
338.3 - 348.3	2.83	6366	2.37		0.53	
348.3 - 358.4	2.56	6367	1.65	160.1' @ 1.66% Cu	0.29	160.1' @ 0.20% Cu
358.4 - 368.3	2.70	6368	1.35		0.32	
368.3 - 378.3	2.58	6369	1.61		0.35	
378.3 - 387.3	2.70	6370	1.40		0.24	
387.3 - 387.9	2.66	6371	1.34		0.13	
387.9 - 398.3	2.56	6372	1.17		0.05	
398.3 - 408.5	2.56	6373	0.84		0.05	
408.5 - 416.2	2.61	6374	0.83		0.04	
416.2 - 426.4	2.65	6375	1.33		0.07	
426.4 - 433.7	2.72	6376	2.07		0.07	
433.7 - 443.8	2.64 - 2.63	6377	1.50		0.07	
443.8 - 450.7	2.53	6378	0.54		0.03	Ho
450.7 - 457.0	2.60	6379	0.60		0.02	S
457.0 - 463.5	2.69	6380	0.43		0.06	
463.5 - 471.4	2.57	6381	0.73		0.03	
471.4 - 479.9	2.67	6382	0.47		0.04	
479.9 - 487.4	2.53	6383	0.45		0.04	
487.4 - 497.4	2.52	6384	0.44	146.0' @ 0.48% Cu	0.08	146.0' @ 0.04% Cu
497.4 - 507.5	2.62	6385	0.37		0.05	
507.5 - 515.8	2.74	6386	0.44		0.04	
515.8 - 526.0	2.56	6387	0.39		0.07	
526.0 - 536.2	2.66	6388	0.38		0.03	
536.2 - 546.4	2.67	6389	0.53		0.06	
546.4 - 556.4	2.69	6390	0.51		0.05	
556.4 - 564.7	2.70	6391	0.36		0.03	

Date / /

Hole No. S-91

22515.1
22495.1
— 20.0

22776.6
22738.3
+38.3

1446.4

Interval FROM - TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
572.7 - 581.8	2.52	6393	0.41	0.03	
581.8 - 589.8	2.68	6394	0.46	0.04	
589.8 - 599.9	2.62	6395	0.61	0.05	
599.9 - 606.6	2.54	6396	0.79	0.04	
606.6 - 616.8	2.60	6397	1.45	0.04	
616.8 - 624.3	2.82	6398	1.59	0.03	
624.3 - 629.8	2.63	6399	0.56	0.02	
629.8 - 636.0	2.70 - 2.74	6400	0.60	0.03	
636.0 - 640.2	2.48	6401	0.63	0.03	
640.2 - 648.7	2.56	6402	0.48	0.04	
648.7 - 659.7	2.64	6403	0.73 152.6'@ 0.80% Cu	0.05	152.8'@ 0.05% Cu
659.7 - 666.0	2.68	6404	1.61	0.05	
666.0 - 675.2	2.54	6405	1.16	0.10	
675.2 - 685.7	2.54	6406	0.66	0.04	
685.7 - 696.3	2.48	6407	0.78	0.05	
696.3 - 706.2	2.52	6408	0.45	0.07	
706.2 - 716.2	2.56	6409	0.50	0.07	
716.2 - 725.0	2.56	6410	0.61	0.04	
725.0 - 734.7	2.54	6411	0.41	0.04	
734.7 - 742.4	2.78	6412	1.02	0.05	
742.4 - 752.8	2.70	6413	0.55	0.03	
752.8 - 763.0	2.70	6414	0.61	0.03	
763.0 - 770.9	2.50	6415	0.50	0.02	
770.9 - 778.5	2.62	6416	0.35	0.02	
778.5 - 786.1	2.68	6417	0.28	0.02	
786.1 - 795.3	2.52	6418	0.42	0.03	
795.3 - 798.2	2.54	6419	0.53 126.2'@ 0.59% Cu	0.02	126.2'@ 0.03% Cu
798.2 - 808.5	2.58	6420	0.54	0.04	
808.5 - 818.1	2.58	6421	0.58	0.03	
818.1 - 826.7	2.54	6422	0.52	0.02	
826.7 - 836.9	2.76	6423	0.60	0.02	
836.9 - 845.2	2.54	6424	0.55	0.02	
845.2 - 855.6	2.64	6425	0.56	0.03	
855.6 - 863.8	2.64	6426	0.74	0.02	
863.8 - 868.6	2.58	6427	0.85	0.03	
BOTTOM			*		pit bottom @ 921'

Sacaton

Date 7/11 /68

Hole No. S-93 22766.3 22269.2

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
180.6-191.0	2.48	A7705	0.10	0.04	START OF CORE
191.0-201.2	2.71-2.68	A7706	0.06	0.02	
201.2-211.2	2.62	A7707	0.03	0.02	
211.2-221.5	2.70	A7708	0.03	0.01	
221.5-232.1	2.58	A7709	0.03	0.02	
232.1-242.1	2.70	A7710	0.07	0.06	
242.1-252.2	2.74	A7711	0.41	0.36	71.5' @ .87% Cu
252.2-262.5	2.70	A7712	0.82	0.78	
262.5-272.8	2.64	A7713	0.65	0.62	
272.8-282.8	2.74	A7714 7.5' @ .92% Cu	0.89	0.67	
282.8-293.1	2.70	A7715	0.88	0.36	
293.1-303.3	2.64	A7716	1.13	0.97	
303.3-313.6	2.66	A7717	1.63	0.21	
313.6-323.8	2.54	A7718	1.68	0.06	
323.8-334.1	2.75	A7719	1.40	0.03	
334.1-343.1	2.66	A7720	0.98	0.03	
343.1-354.6	2.66	A7721	1.63	0.03	144.4' @ .96% Cu
354.6-364.8	2.57	A7722	2.58	0.04	
364.8-375.8	2.56	A7723	0.72	0.10	
375.8-385.3	2.62	A7724	0.74	0.10	
385.3-395.3	2.45	A7725 144' @ .96% Cu	0.73	0.20	
395.3-400.4	2.53	A7726	0.64	0.10	
400.4-411.5	2.58	A7727	0.52	0.03	
411.5-421.5	2.56	A7728	0.30	0.10	
421.5-427.6	2.58	A7729	0.53	0.06	
427.6-437.7	2.48	A7730	0.68	0.08	
437.7-447.8	2.52	A7731	0.44	0.02	
447.8-458.0	2.59	A7732	0.44	0.02	
458.0-468.1	2.57	A7733	0.36	0.01	
468.1-478.1	2.57	A7734	0.26	0.01	
478.1-487.5	2.58	A7735	0.25	0.01	
487.5-495.5	2.58	A7736	0.29	0.01	
495.5-504.0	2.55	A7737	0.30	0.01	
504.0-510.1	2.61	A7738	0.12	Tr	
510.1-518.2	2.61	A7739	0.15	0.01	
518.2-525.2	2.62	A7740 36.8' @ .66% Cu	1.03	0.02	36.8' @ .82% Cu
525.2-534.0	2.65	A7741	0.33	0.02	
534.0-545.3	2.56	A7742	0.87	0.02	
545.3-555.0	2.59	A7743	0.45	0.01	
555.0-565.0	2.57	A7744	0.34	0.01	
565.0-575.0	2.58	A7745	0.37	0.01	
575.0-585.3	2.65	A7746	0.59	0.02	
585.3-593.7	2.52	A7747	0.33	0.01	
593.7-602.4	2.49	A7748	0.32	0.01	
602.4-610.8	2.66	A7749	0.22	0.01	
610.8-620.2	2.61	A7750 27.9' @ .43% Cu	0.45	0.02	27.9' @ .02% Cu
620.2-628.4	2.63	A7751	0.47	0.02	
628.4-638.7	2.65	A7752	0.39	0.01	
638.7-647.0	2.66	A7753	0.33	0.04	
647.0-656.6	2.61	A7754	0.39	0.01	

Date 7/18/68

le No. S-93 22766.3 22269.2 1441.3

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
665.9-672.8	2.66	A7756 45.1' @ .51%	0.75	0.02	45.1' @ 0.02%
672.8-682.5	2.65	A7757	0.39	0.02	
682.5-692.9	2.60	A7758	0.50	0.01	
692.9-701.5	2.57	A7759	0.42	0.01	
701.5-711.0	2.58	A7760	0.58	0.03	
711.0-719.3	2.61	A7761	0.30	0.01	
719.3-728.8	2.57	A7762	0.25	0.02	
728.8-739.6	2.58	A7763	0.20	0.02	
739.6-745.6	2.65	A7764	0.37	0.02	
745.6-747.1	---	-----	-----	-----	No Recovery
747.1-757.8	2.42	A7765	0.37	0.02	
BOTTOM			*		

Sacaton

Date 5/14/68

Hole No. S-94 22785.8 22509.6 1443.3

Interval FROM - TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
110.0 - 117.3	2.44	6428	0.09	0.07	START OF CORE
117.3 - 125.2	2.50	6429	0.04	0.03	
125.2 - 135.8	2.68	6430	0.03	0.02	
135.8 - 143.7	2.24	6431	0.05	0.02	
143.7 - 153.5	2.65	6432	0.02	0.02	
153.5 - 163.7	2.62	6433	0.01	0.01	
163.7 - 172.7	2.55	6434	0.02	0.02	
172.7 - 183.6	2.51	6435	0.03	0.02	
183.6 - 193.5	2.47	6436	0.04	0.03	
193.5 - 203.0	2.36	6437	0.05	0.03	
203.0 - 211.6	2.59	6438	0.04	0.03	
211.6 - 221.5	2.62	6439	0.05	0.03	
221.5 - 231.2	2.64	6440	0.05	0.03	
231.2 - 241.5	2.64	6441	0.03	0.03	
241.5 - 251.7	2.51 - 2.60	6442	0.57	0.27	
251.7 - 261.9	2.64	6443	0.05	0.05	
261.9 - 272.3	2.56	6444	0.06	0.06	
272.3 - 282.7	2.68	6445	0.06	0.06	
282.7 - 293.1	2.48	6446	0.12	0.12	
293.1 - 303.2	2.58	6447	0.72	0.64	
303.2 - 313.5	2.56	6448	0.36	0.36	
313.5 - 323.7	2.72	6449	0.43	0.41	
323.7 - 333.9	2.66	6450	0.14	0.13	
333.9 - 344.2	2.70	6451	0.22	0.20	
344.2 - 354.5	2.52	6452	0.15	0.13	
354.5 - 364.7	2.66	6453	0.28	0.25	
364.7 - 375.0	2.62	6454	0.11	0.08	
375.0 - 385.3	2.76	6455	1.57	0.61	
385.3 - 395.5	2.70	6456	1.81	0.22	
395.5 - 402.7	2.66	6457	2.15	0.14	
402.7 - 407.2	2.85	6458	5.74	0.72	
407.2 - 417.3	2.62	6459	1.22	0.15	
417.3 - 422.5	2.67	6460	1.77	0.27	
422.5 - 432.9	2.67	6461	1.89	0.19	
432.9 - 438.1	2.55	6462	1.03	0.10	
438.1 - 448.3	2.54	6463	1.05	0.15	
448.3 - 459.0	2.68	6464	0.61	0.11	
459.0 - 469.3	2.62	6465	0.59	0.07	
469.3 - 479.7	2.59 - 2.62	6466	0.73	0.06	
479.7 - 489.5	2.56	6467	0.39	0.05	
489.5 - 498.7	2.64	6468	0.93	0.05	
498.7 - 509.0	2.58	6469	0.81	0.06	
509.0 - 518.5	2.56	6470	0.83	0.03	
518.5 - 526.5	2.58	6471	0.77	0.05	
526.5 - 531.7	2.52	6472	1.17	0.08	
531.7 - 540.2	2.66	6473	0.74	0.05	
540.2 - 550.2	2.72	6474	1.05	0.06	
550.2 - 562.5	2.60	6475	0.68	0.05	
562.5 - 571.2	2.60	6476	1.13	0.06	
571.2 - 581.2	2.60	6477	1.00	0.06	
581.2 - 591.5	2.58 - 2.62	6478	0.52	0.03	

TOTAL Cu: 73.3' @ 1.82% Cu (375.0 - 448.3); 210.1' @ 0.74% Cu (448.3 - 658.4); 283.4' @ 1.02% Cu

CuO: 73.3' @ 0.27% Cu; 210.1' @ 0.05% Cu; 283.4' @ 0.11% Cu

Hole No. S-94

Date 5/ 7 /68

Interval FROM - TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
591.5 - 601.5	2.66	6479	0.46	0.06	
601.5 - 609.6	2.50	6480	0.60	0.03	
609.6 - 618.7	2.62	6481	0.59	0.04	
618.7 - 628.6	2.50	6482	0.83	0.03	
628.6 - 639.0	2.58	6483	0.34	0.03	
639.0 - 649.4	2.64	6484	0.84	0.06	
649.4 - 658.4	2.66	6485	0.96	0.06	
658.4 - 663.7	2.56	6486	0.49	0.03	
663.7 - 674.1	2.60	6487	0.53	0.02	
674.1 - 679.3	2.50	6488	0.26	0.02	
679.3 - 689.7	2.58	6489	0.49	0.03	
689.7 - 695.0	2.68	6490	0.78	0.03	81.3' @ 0.57% Cu
695.0 - 700.2	2.84	6491	0.29	0.02	81.3' @ 0.02% Cu
700.2 - 709.5	2.64	6492	0.57	0.02	
709.5 - 715.7					
715.7 - 725.2	2.68	6493	0.89	0.02	
725.2 - 729.0	2.58	6494	0.64	0.02	
729.0 - 739.7	2.70	6495	0.45	0.01	
739.7 - 750.0	2.65	6496	0.30	0.01	
750.0 - 760.4	2.70	6497	0.18	0.01	
760.4 - 770.8	2.66	6498	0.04	0.01	
770.8 - 777.5	2.59	6499	0.03	0.01	
777.5 - 787.2	2.62	6500	0.03	0.01	
787.2 - 797.5	2.60	6501	0.48	0.02	
797.5 - 807.8	2.60	6502	0.33	0.02	
807.8 - 818.0	2.55	6503	0.29	0.02	
818.0 - 828.1	2.60	6504	0.40	0.02	
828.1 - 837.3	2.62	6505	0.38	0.05	
837.3 - 847.5	2.58	6506	0.15	0.04	
847.5 - 859.5	2.56	6507	0.05	0.03	
BOTTOM					

Date 6 / 26 / 58

Hole No. S-95   22237.2 22512.4 1442.6

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
190.0-193.2	------	Congl. Not Split	------	------	START OF CORE
193.2-195.3	2.56	A7631	0.07	0.02	
195.3-206.3	2.58	A7632	0.02	0.01	
206.3-216.4	2.68	A7633	0.03	0.02	
216.4-225.9	2.68	A7634	0.04	0.03	
225.9-235.5	2.67	A7635	0.08	0.02	
235.5-243.2	2.68	A7636	0.26	0.14	MO=0.018
243.2-253.3	2.68	A7637	0.08	0.04	
253.3-264.0	2.70	A7638	0.07	0.01	
264.0-274.4	2.69	A7639	0.05	0.02	
274.4-284.4	2.62	A7640	0.08	0.01	
284.4-292.2	2.57	A7641	0.07	0.01	
292.2-302.4	2.72	A7642	0.33	0.21	
302.4-312.4	2.60	A7643	0.20	0.10	
312.4-322.7	2.65	A7644	0.09	0.02	
322.7-333.0	2.48	A7645	0.07	0.01	
333.0-343.7	2.48	A7646	0.48	0.04	
343.7-354.1	2.56	A7647	0.05	0.01	
354.1-364.5	2.56	A7648	0.06	0.01	
364.5-375.5	2.45	A7649	0.10	0.01	
375.5-385.7	2.57	A7650	0.13	0.01	
385.7-395.9	2.64	A7651	3.70	0.18	
395.9-405.9	2.60	A7652	3.94	0.23	
405.9-416.1	2.70	A7653	0.88	0.04	
416.1-425.6	2.65	A7654	1.13	0.03	
425.6-436.1	No Gravity	A7655	0.51	0.03	
436.1-445.1	2.45	A7656	1.65	0.02	
445.1-454.0	2.61	A7657	1.05	0.01	
454.0-462.9	2.61	A7658	0.79	Tr	
462.9-473.1	2.45	A7659	0.67	Tr	
473.1-478.1	2.57	A7660	0.60	Tr	
478.1-488.0	No Gravity	A7661	0.72	Tr	
488.0-496.2	2.61	A7662	0.65	Tr	
496.2-507.4	2.67	A7663 337.5' @ 0.92% Cu	1.06	Tr	37.5' @ 2.44% Cu
507.4-517.2	2.67	A7664	0.85	Tr	
517.2-527.7	2.63	A7665	0.84	Tr	
527.7-538.3	2.56	A7666	0.71	Tr	
538.3-548.5	2.64	A7667	0.80	Tr	
548.5-558.7	2.72	A7668	0.55	Tr	
558.7-568.5	2.80	A7669	1.05	Tr	
568.5-576.4	2.61	A7670	0.79	0.32	
576.4-584.1	2.80	A7671	0.62	Tr	
584.1-592.8	2.72	A7672	0.32	0.02	
592.8-602.6	2.55	A7673	0.45	0.03	
602.6-611.7	2.49	A7674	0.45	0.08	
611.7-621.4	2.46	A7675	0.55	0.02	
621.4-631.7	2.51	A7676	0.64	0.02	
631.7-641.8	2.51	A7677	0.59	0.07	
641.8-652.1	2.58	A7678	0.50	0.02	
652.1-662.0	2.55	A7679	0.77	0.02	
662.0-672.2	2.64	A7680	0.78	0.02	

Date 7/1/58

Hole No. S-95

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
672.2-682.3	2.65	A7681	0.67	0.04	
682.3-691.7	2.60	A7682	0.62	0.01	
691.7-701.8	2.62	A7683	0.63	0.23	
701.8-711.8	2.52	A7684	0.44	0.05	
711.8-723.2	2.53	A7685	0.69	0.02	
723.2-731.7	2.49	A7686	0.30	0.20	
731.7-741.0	2.53	A7687	0.31	0.02	
741.0-751.2	2.66	A7688	0.38	0.02	
751.2-761.3	2.53	A7689	0.33	0.10	
761.3-771.4	2.55	A7690	0.31	0.02	
771.4-781.8	2.56	A7691	0.52	0.02	
781.8-791.4	2.65	A7692	0.51	0.06	
791.4-800.1	2.57	A7693	0.34	0.01	
800.1-810.0	2.60	A7694	0.33	0.02	
810.0-820.4	2.62	A7645 90.5' @ 0.45% Cu	0.54	Tr	90.5' @ .41% Cu
820.4-828.4	2.52	A7696	0.42	0.01	
828.4-837.7	2.60	A7697	0.53	Tr	
837.7-847.6	2.61	A7698	0.38	Tr	
847.6-854.8	2.68-2.60	A7699	0.42	Tr	
854.8-861.9	2.60	A7700	0.46	Tr	
861.9-871.5	2.62	A7701	0.31	Nil	
871.5-880.3	2.61	A7702	0.27	Nil	
880.3-888.8	2.63	A7703	0.38	Nil	
888.8-901.5	2.55	A7704	0.31	Nil	
BOTTOM					

Date 5 /10 /68

Hole No. S-97   21747.5   22510.2   1440.0

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
305.2-315.7	2.58	6508	0.13	0.05	START OF CORE
315.7-326.4	2.54	6509	0.08	0.04	
326.4-331.7	2.50	6510	0.15	0.09	
331.7-342.0	2.46	6511	0.13	0.09	
342.0-351.2	2.54	6512	0.07	0.04	
351.2-361.2	2.54-2.70	6513	0.53	0.48	
361.2-371.3	2.60	6514	0.10	0.08	
371.3-379.8	2.60	6515	0.15	0.10	
379.8-390.0	2.53	6516	0.10	0.07	
390.0-400.5	2.56	6517	0.06	0.04	
400.5-410.7	2.52	6518	0.08	0.06	
410.7-421.0	2.50	6519	0.06	0.05	
421.0-431.0	2.52	6520	0.04	0.03	
431.0-441.0	2.67	6521	0.06	0.05	
441.0-451.1	2.72	6522	0.04	0.03	
451.1-461.1	2.50	6523	0.04	0.03	
461.1-469.0	2.58	6524	0.07	0.05	
469.0-479.3	2.50	6525	0.08	0.07	
479.3-489.6	2.52	6526	0.11	0.08	
489.6-499.9	2.74	6527	0.33	0.26	
499.9-509.0	2.46	6528	0.22	0.21	
509.0-520.0	2.54	6529	0.55	0.53	
520.0-530.2	2.62-2.48	6530	0.14	0.13	
530.2-540.5	2.42-2.58	6531	0.09	0.07	
540.5-550.7	2.52	6532	0.11	0.09	
550.7-559.7	2.48	6533	0.08	0.05	
559.7-570.0	2.48	6534	0.17	0.15	
570.0-580.0	2.52	6535	0.18	0.17	
580.0-590.3	2.58	6536	0.25	0.23	
590.3-600.5	2.50	6537	0.06	0.05	
600.5-610.5	2.64	6538	0.11	0.09	

BOTTOM OF HOLE

Date 7/23/68

Hole No. S-101 22793.3 22773.8 14461.1

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
107.5-117.2	2.51	A 7822	0.11	0.05	START OF CORE
117.2-127.8	2.41	A 7823	0.15	0.01	
127.8-138.3	2.48	A 7824	0.03	0.01	
138.3-149.2	2.51	A 7825	0.04	0.01	
149.2-158.9	2.49	A 7826	0.11	0.05	
158.9-168.0	2.52	A 7827	0.09	0.04	
168.0-176.7	2.53	A 7828	0.05	0.01	
176.7-187.4	2.54	A 7829	0.06	0.01	
187.4-197.5	2.49	A 7830	0.45	0.40	
197.5-204.1	2.60	A 7831	0.07	0.02	
204.1-214.5	2.52	A 7832 21.8' @ 0.60%	0.40	0.34	21.8' @ 0.44%
214.5-224.9	2.56	A 7833	0.80	0.75	
224.9-235.2	2.52	A 7834	0.03	0.02	
235.2-244.9	2.54	A 7835	0.03	0.01	
244.9-255.1	2.53	A 7836	0.38	0.01	
255.1-266.1	2.54	A 7837	0.08	0.03	
266.1-276.8	2.67	A 7838	0.22	0.16	
276.8-288.2	2.75	A 7839 31.5' @ 1.55%	2.18	2.08	31.5' @ 1.04%
288.2-298.0	2.74	A 7840	0.19	0.10	
298.0-308.3	2.68	A 7841	0.94	0.80	
308.3-315.0	2.58	A 7842	0.11	0.05	
315.0-324.6	2.53	A 7843	0.07	0.03	
324.6-331.6	2.54	A 7844	0.13	0.04	
331.6-342.2	2.65	A 7845	0.10	0.05	
342.2-352.1	2.58	A 7846	0.06	0.02	
352.1-362.2	2.54	A 7847	0.05	0.01	
362.2-370.8	2.68	A 7848	0.04	0.01	
370.8-380.9	2.67	A 7849	0.15	0.08	
380.9-381.0	---	-----	------	----	No Recovery
381.0-391.2	2.61	A 7850	0.10	0.10	
391.2-401.4	2.66	A 7851	0.18	0.13	
401.4-410.9	2.66	A 7852	0.06	0.02	
410.9-421.5	2.65	A 7853	0.07	0.07	
421.5-432.0	2.72	A 7854	0.07	0.02	
432.0-442.9	2.52	A 7855	0.07	0.02	
442.9-453.6	2.60	A 7856	0.06	0.02	
453.6-463.3	2.52	A 7857	0.10	0.03	
463.3-473.2	2.50	A 7858	0.17	0.03	
473.2-481.2	2.64	A 7859	0.06	0.01	
481.2-491.6	2.68	A 7860	0.06	0.01	
491.6-502.7	2.63	A 7861	0.06	0.02	
502.7-512.9	2.53	A 7862	0.07	0.02	
512.9-523.3	2.68	A 7863	0.06	0.02	
523.3-533.8	2.70	A 7864	0.06	0.01	
533.8-544.5	2.75	A 7865	0.04	0.03	
544.5-555.4	2.61	A 7866	0.05	0.01	
555.4-566.6	2.68	A 7867	0.05	0.02	
566.6-576.5	2.53	A 7868 41.1' @ 2.18%	0.70	0.08	
576.5-587.1	2.58	A 7869	2.81	0.13	MO=.011
587.1-597.7	2.56	A 7870	3.30	0.20	
597.7-607.4	2.55	A 7871	2.79	0.25	MO=.012

Date 7 / 29 /68

ole No. S-101   22793.3   22773.8   1446.1

nterval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
607.4-617.8	2.62	A 7872	3.61	0.17	
617.8-628.1	2.63	A 7873	2.18	0.13	
628.1-638.5	2.55	A 7874	1.74	0.19	
638.5-648.0	2.65	A 7875	2.74	0.20	
648.0-658.3	2.55	A 7876	1.37	0.07	
658.3-668.0	2.69	A 7877	0.90	0.19	
668.0-678.0	2.63	A 7878	0.65	0.25	
678.0-688.0	2.61	A 7879	0.07	0.06	
688.0-697.3	2.67	A 7880	0.37	0.27	
697.3-704.5	2.58	A 7881	0.05	0.05	
704.5-715.0	2.54	A 7882	0.05	0.05	
715.0-725.2	2.59	A 7883	0.08	0.02	
725.2-735.2	2.57	A 7884	1.38	0.04	
735.2-745.1	2.54	A 7885	0.21	0.05	
745.1-755.2	2.79	A 7886	0.31	0.25	
755.2-764.1	2.66	A 7887 95.0' @ 1.73%	1.26	0.66	95.0' @ 0.5%
764.1-775.2	2.50	A 7888	1.89	0.08	
775.2-782.9	2.55	A 7889	1.83	0.16	
782.9-791.8	2.54	A 7890	1.19	0.07	
791.8-801.8	2.38	A 7891	3.65	0.09	
801.8-809.9	2.71	A 7892	3.65	0.06	
809.9-820.2	2.65	A 7893	2.14	0.06	
820.2-830.9	2.59	A 7894	0.06	0.02	
830.9-840.6	2.52	A 7895	0.03	0.01	
840.6-850.6	2.57	A 7896	0.03	0.01	
850.6-860.9	2.59	A 7897 28.3' @ 1.54%	0.03	0.03	28.3' @ 0.63%
860.9-870.4	2.59	A 7898	0.77	0.05	
870.4-881.2	2.52	A 7899	0.04	0.03	
881.2-889.2	2.65	A 7900	4.48	1.79	
BOTTOM					

Date 7 /24 / 68

Hole No. S-102   22023.8   22781.0   1444.2   JH

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
175.0-184.8	2.52	A7901	0.06	0.06	START OF CORE
184.8-196.0	2.58	A7902	0.03	0.02	
196.0-205.4	2.49	A7903	0.05	0.03	
205.4-215.5	2.57	A7904	0.07	0.03	
215.5-226.0	2.60	A7905	0.05	0.02	
226.0-236.1	2.51	A7906	0.06	0.02	
236.1-246.5	2.43	A7907	0.08	0.03	
246.5-256.7	2.52	A7908	0.08	0.02	
256.7-267.0	2.54	A7909	0.07	0.08	
267.0-277.3	2.55	A7910	0.06	0.03	
277.3-287.8	2.56	A7911	0.05	0.01	
287.8-298.1	2.56	A7912	0.07	0.07	
298.1-308.4	2.53	A7913	0.07	0.06	
308.4-318.8	2.54	A7914	0.06	0.02	
318.8-328.4	2.59	A7915	0.07	0.02	
328.4-338.6	2.60	A7916	0.05	0.02	
338.6-349.0	2.56	A7917	0.05	0.03	
349.0-359.3	2.58	A7918	0.05	0.03	
359.3-369.5	2.58	A7919	0.62	0.02	
369.5-379.9	2.50	A7920	0.04	0.01	
379.9-390.3	2.55	A7921	0.05	0.01	
390.3-399.4	2.60	A7922	0.03	0.01	
399.4-410.0	2.58	A7923	0.03	0.02	
410.0-416.8	2.58	A7924	0.04	0.02	
416.8-427.1	2.63	A7925	0.10	0.02	
427.1-437.5	2.68	A7926	0.13	0.02	
437.5-447.8	2.57	A7927	0.05	0.03	
447.8-458.0	2.56	A7928	0.03	0.02	
458.0-468.8	2.57	A7929	0.13	0.02	
468.8-477.6	2.44	A7930	0.95	0.03	
477.6-488.0	2.50	A7931	0.37	0.25	
488.0-498.2	2.50	A7932	0.46	0.34	
498.2-508.5	2.59	A7933	0.43	0.36	
508.5-519.0	2.56	A7934	0.62	0.49	
519.0-529.0	2.54	A7935	1.44	0.11	
529.0-539.4	2.54	A7936	0.81	0.02	
539.4-549.7	2.49	A7937	1.53	0.07	
549.7-559.8	2.52	A7938	1.78	0.02	
559.8-570.3	2.54	A7939	1.95	0.03	
570.3-580.7	2.47	A7940	1.64	0.02	
580.7-590.6	2.49	A7941	2.20	0.03	
590.6-600.7	2.45	A7942	1.26	0.02	
600.7-611.3	2.50	A7943	0.63	0.02	
611.3-618.4	2.48	A7944	0.66	0.01	
618.4-629.0	2.45	A7945	0.65	0.01	
629.0-639.7	2.53	A7946	0.59	0.01	
639.7-650.0	2.51	A7947	0.59	Tr.	
650.0-660.2	2.53	A7948	0.44	Tr.	
660.2-670.8	2.57	A7949	0.49	Tr.	
670.8-680.6	2.50	A7950	0.30	Tr.	
680.6-691.0	2.48	A7951	0.39	0.01	

51.2' @ .55% Cu

151.8' @ 1.11%

50.2' @ .30%

151.8' @ 0.02%

Date 7/ 29/ 68

·le No. S-102

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
691.0-701.4	2.48	A7952	0.15	0.01	
701.4-711.8	2.56	A7953	0.15	0.01	
711.8-721.8	2.48	A7954	0.29	0.01	
721.8-732.2	2.53	A7955	0.16	0.01	
732.2-742.6	2.50	A7956	0.12	0.01	
742.6-752.8	2.50	A7957	0.21	Tr.	
752.8-763.2	2.52	A7958	0.29	0.01	
763.2-773.5	2.58	A7959	0.31	0.01	
773.5-784.0	2.53	A7960	0.43	0.01	
784.0-794.0	2.50	A7961	0.25	0.01	
794.0-801.7	2.56	A7962	0.21	Tr.	
801.7-812.2	2.55	A7963	0.23	0.02	
812.2-822.3	2.50	A7964	0.24	Tr.	
822.3-832.4	2.52	A7965	0.26	0.01	Mo= 0.28
832.4-842.9	2.50	A7966	0.27	0.01	Mo= .020
842.9-852.4	2.48	A7967	0.28	Tr.	
852.4-858.5	2.52	A7968	0.19	Tr.	
858.5-867.0	2.49	A7969	0.19	0.01	
867.0-876.5	2.54	A7970	0.21	0.02	
876.5-886.6	2.50	A7971	0.18	0.02	
886.6-896.8	2.51	A7972	0.23	0.02	
896.8-907.2	2.47	A7973	0.35	Tr.	
907.2-918.0	2.45	A7974	0.27	Tr.	
918.0-928.2	2.51	A7975	0.19	0.04	
928.2-938.2	2.52	A7976	0.19	0.03	
938.2-945.2	2.56	A7977	0.21	0.08	
945.2-954.8	2.57	A7978	0.52	0.09	
954.8-964.2	2.67	A7979	0.48	0.12	
964.2-972.5	2.60	A7980	0.63	0.06	
972.5-979.6	2.55	A7981	0.57	0.04	
979.6-984.2	------	--------	Assume 0.70	0.02	No Recovery
984.2-990.2	2.62	A7982	0.84	0.01	
990.2-1000.0	2.68	A7983	0.30	0.04	
1000.0-1009.7	2.63	A7984	0.88	0.02	
1009.7-1019.8	2.58	A7985	0.42	0.01	
1019.8-1030.2	2.49	A7986	0.38	Tr.	
1030.2-1035.8	------	-------	-----	----	No Rec.
1035.8-1043.2	2.45	A7987	0.33	Tr.	
1043.2-1053.8	2.58	A7988	0.41	0.01	
1053.8-1064.4	2.53	A7989	0.25	0.01	
1064.4-1073.7	2.50	A7990	0.23	Tr.	
1073.7-1079.0	2.56	A7991	0.24	Tr.	
BOTTOM					

71.6' @ 0.57%

71.6' @ 0.05%

Date 7 / 31/ 68

Hole No. S-103 22031.3 22326.0 1439.8

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
256.0-266.3	2.55	A7996	0.09	0.05	START OF CORE
266.3-276.0	2.69	A7997	0.10	0.06	
276.0-286.6	2.54	A7998	0.10	0.05	
286.6-296.4	2.55	A7999	0.06	0.02	
296.4-307.0	2.47	A8000	0.06	0.02	
307.0-317.0	2.62-2.70	A8001 59.7' @ 0.70%	0.89	0.83	59.7' @ 0.63%
317.0-326.7	2.52	A8002	0.86	0.78	
326.7-336.7	2.56	A8003	0.26	0.22	
336.7-347.0	2.58	A8004	0.88	0.81	
347.0-356.7	2.49	A8005	0.78	0.71	
356.7-366.7	2.44	A8006	0.56	0.46	
366.7-376.7	2.57	A8007	0.05	0.02	
376.7-381.8	2.63	A8008	0.06	0.01	
381.8-391.8	2.61	A8009	0.04	0.04	
391.8-402.1	2.56	A8010	0.04	0.04	
402.1-412.5	2.56	A8011	0.05	0.03	
412.5-422.9	2.44	A8012	0.05	0.03	
422.9-433.0	2.67	A8013	0.04	0.02	
433.0-443.4	2.51	A8014	0.14	0.09	
443.4-453.8	2.43	A8015	0.31	0.30	
453.8-464.1	2.59	A8016 51.8' @ 0.57%	0.50	0.41	51.8' @ 0.27%
464.1-474.5	2.48	A8017	0.39	0.28	
474.5-484.7	2.63	A8018	1.20	0.40	
484.7-495.1	2.55	A8019	0.28	0.13	
495.1-505.6	2.56	A8020	0.49	0.14	
505.6-515.9	2.58	A8021 123.2' @ 0.56%	0.61	0.03	120.2' @ 0.02%
515.9-526.3	2.54	A8022	0.58	0.01	
526.3-536.9	2.50	A8023	0.64	0.04	
536.9-545.3	2.65-2.71	A8024	0.46	Tr.	
545.3-555.8	2.60	A8025	0.50	0.02	
555.8-566.0	2.76	A8026	0.79	0.12	
566.0-576.3	2.58	A8027	0.49	Tr.	
576.3-586.5	2.50	A8028	0.57	0.02	
586.5-593.8	2.53	A8029	0.44	0.02	
593.8-603.9	2.46	A8030	0.33	0.01	
603.9-613.3	2.60	A8031	0.56	0.01	
613.3-623.5	2.57	A8032	0.50	Tr.	
623.5-633.8	2.50	A8033	0.72	0.02	
633.8-643.4	2.48	A8034	0.35	0.01	
643.4-653.9	2.54	A8035	0.35	0.02	
653.9-663.4	2.55	A8036	0.30	Tr.	
663.4-674.4	2.67	A8037	0.34	0.10	
674.4-685.5	2.62	A8038 31.9' @ 0.55%	0.58	0.16	34.9' @ 0.06%
685.5-695.5	2.52	A8039	0.51	0.01	
695.5-709.3	2.67	A8040	0.55	0.01	
BOTTOM			*		

Date 8 / 8 / 68

Hole No. S-106 22242.7 22252.3 1440.2

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
215.2-225.7	2.50	A8101	0.30	0.23	Start of Core
225.7-236.2	2.51	A8102	0.19	0.13	
236.2-246.7	2.62	A8103	0.06	0.04	
246.7-257.2	2.55	A8104	0.54	0.48	
257.2-266.0	2.56	A8105	0.31	0.26	
266.0-276.8	2.57	A8106	0.46	0.06	
276.8-287.0	2.61	A8107	1.28	0.06	
287.0-296.8	2.66	A8108	1.35	0.07	
296.8-307.2	2.65	A8109	0.71	0.02	
307.2-316.2	2.70	A8110	0.70	0.01	
316.2-327.7	2.65	A8111	0.63	0.01	
327.7-334.7	2.64	A8112	0.58	0.01	
334.7-340.8	2.57	A8113	0.81	0.01	
340.8-348.3	2.58	A8114	0.74	0.01	
348.3-358.0	2.58	A8115	0.57	0.01	
358.0-368.2	2.56	A8116	0.79	0.01	
368.2-378.4	2.61	A8117	1.37	0.02	
378.4-388.6	2.70	A8118	0.88	0.03	
388.6-396.8	2.56	A8119	0.79	0.02	
396.8-406.8	2.63	A8120	0.86	0.01	
406.8-418.8	2.57	A8121	0.52	0.01	
418.8-428.2	2.57	A8122	0.56	0.01	
428.2-438.6	2.62	A8123	0.71	0.01	
438.6-447.4	2.60	A8124	0.44	Tr	
447.4-457.6	2.58	A8125	0.51	0.01	
457.6-467.9	5.61	A8126	0.64	0.01	
467.9-478.2	2.57	A8127	0.45	0.01	
478.2-488.0	2.64	A8128	0.48	Tr	
488.0-498.0	2.60	A8129	0.52	Tr	
498.0-509.7	2.58	A8130	0.37	Tr	
509.7-519.9	2.61	A8131	0.35	Tr	
519.9-527.8	2.57	A8132	0.54	0.01	
527.8-538.7	2.60	A8133	0.48	0.01	
538.7-548.9	2.59	A8134	0.67	0.01	
548.9-558.5	2.57	A8135	0.87	0.08	
558.5-568.7	2.58	A8136	0.43	0.02	
568.7-580.5	2.61	A8137	0.42	0.02	
580.5-590.5	2.56	A8138	0.49	0.02	
590.5-600.8	2.62	A8139	0.91	0.04	
600.8-612.2	2.60	A8140	0.50	0.02	
612.2-622.6	2.54	A8141	0.50	0.02	
622.6-631.4	2.58	A8142	1.28	0.02	
631.4-642.0	2.61	A8143	0.41	0.02	
642.0-653.0	2.62	A8144	0.39	0.02	
653.0-663.4	2.57	A8145	0.42	0.02	
663.4-672.2	2.54	A8146	0.63	0.02	
672.2-683.2	2.56	A8147	0.28	0.02	
683.2-693.8	2.59	A8148	0.33	0.02	
693.8-703.0	2.55	A8149	0.46	0.01	
703.0-714.1	2.56	A8150	0.57	0.01	
714.1-723.8	2.59	A8151	0.59	Tr	

30.1' @ 0.44%

30.1' @ .26%

281.7 @ 0.69% Cu

375.4' @ 0.66% Cu

396.4' @ .02% Cu

113.7 @ 0.57% Cu

@ 0.50% Cu

@ Tr % Cu

Date 8/16/68

Hole No. S-106

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
723.8-732.9	2.60	A8152	0.32	Tr	
732.9-742.1	2.59	A8153	0.56	Tr	
742.1-751.8	2.58	A8154	0.33	Tr	
751.8-755.4	----	A8155	0.52	Tr	Not possible to run Sp.
755.4-755.8	----	-----	----	--	No Recovery
755.8-756.0	----	-----	----	--	No Recovery
756.0-765.7	2.61	A8156	0.55	Tr	
765.7-775.9	2.60	A8157	0.38	Tr	
775.9-786.5	2.52	A8158	0.29	0.01	
786.5-796.0	2.52	A8159	0.36	0.01	
796.0-803.5	2.60	A8160	0.65	0.02	
803.5-804.8	----	-----	----	----	No Recovery
804.8-813.1	2.59	A8161	0.79	0.02	
813.1-823.1	2.60	A8162	0.37	0.01	
823.1-833.7	2.58	A8163	0.36	0.01	Mo=0.026
833.7-844.2	2.49	A8164	0.56	0.03	
844.2-854.7	2.58	A8165	0.31	0.03	
854.7-862.2	2.58	A8166	0.34	0.01	
862.2-867.8	----	-----	----	----	No Recovery
BOTTOM			*		

Date 8 /22 /68

Hole No. S-107 22235.2 22812.9 1446.3

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
130.0-138.1	2.48	A8201	0.03	0.02	START OF CORE
138.1-148.5	2.49	A8202	0.11	0.02	
148.5-158.4	2.56	A8203	0.10	0.02	
158.4-168.2	2.57	A8204	0.13	0.02	
168.2-178.5	2.64	A8205	0.25	0.02	Mo=0.031 ck
178.5-186.9	2.73	A8206 18.5'@ 0.66% Cu	0.63	0.02	Mo=0.030 ck 18.5'@ 0.02%
186.9-197.1	2.62	A8207	0.69	0.02	Mo=0.015 ck
197.1-207.2	2.61	A8208	0.17	0.10	
207.2-217.0	2.54	A8209	0.47	0.38	
217.0-227.4	2.57	A8210 29.2'@ 0.45%	0.39	0.31	29.2'@ 0.37%
227.4-236.4	2.51	A8211	0.50	0.42	
236.4-246.4	2.55	A8212	0.36	0.28	
246.4-258.5	2.63	A8213	0.25	0.17	
258.5-268.4	2.55	A8214	0.19	0.11	
268.4-278.6	2.63	A8215	0.19	0.10	
278.6-289.3	2.52	A8216	0.39	0.18	
289.3-298.5	2.53	A8217	0.38	0.19	
298.5-308.8	2.57	A8218	0.04	0.02	
308.8-318.8	2.69	A8219	1.02	0.04	
318.8-329.2	2.67	A8220	1.14	0.04	
329.2-339.4	2.64	A8221	0.76	0.03	
339.4-349.3	2.81	A8222 81.3'@ 0.69% Cu	0.63	0.04	81.8'@ 0.03% Cu
349.3-359.7	2.44	A8223	0.42	0.02	
359.7-369.9	2.73	A8224	0.49	0.02	
369.9-380.4	2.57	A8225	0.53	0.04	
380.4-390.6	2.64	A8226	0.54	0.02	
390.6-399.8	2.62	A8227	0.18	Tr.	
399.8-408.8	2.69	A8228	0.09	Tr.	
408.8-418.8	2.78	A8229	0.18	0.02	
418.8-429.1	2.51	A8230	0.36	0.04	
429.1-437.8	2.48	A8231	0.78	0.01	
437.8-448.6	2.56	A8232	0.80	0.02	
448.6-458.5	2.58	A8233	0.64	0.01	
458.5-468.2	2.63	A8234	0.52	0.08	
468.2-478.6	2.54	A8235 87.0'@ 0.58% Cu	0.38	0.01	87.0'@ 0.02% Cu
478.6-488.6	2.62	A8236	0.42	0.02	
488.6-497.3	2.60	A8237	0.60	0.02	
497.3-506.0	2.50	A8238	0.59	0.02	
506.0-516.1	2.57	A8239	0.56	0.02	
516.1-525.5	2.61	A8240	0.22	0.03	
525.5-535.3	2.61	A8241 20.0'@ 0.41%	0.42	0.01	20.0'@ 0.01%
535.3-545.5	2.56	A8242	0.40	0.01	
545.5-555.2	2.60	A8243	0.32	0.01	
555.2-563.9	2.58	A8244	0.31	0.02	
563.9-573.5	2.60	A8245	0.03	0.02	
573.5-583.3	2.57	A8246	0.04	0.02	
583.3-592.5	2.55	A8247 16.7'@ 0.61%	0.81	0.04	16.7'@ 0.03
592.5-600.0	2.56	A8248	0.43	0.02	
600.0-606.9	2.55	A8249	0.38	0.01	
606.9-612.3	----	-----	----	----	No Recovery
612.3-622.3	2.49	A8250	0.34	0.01	

No. S-107 2~235.2 22812.9 1446.3

Date 8 /22 /68

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
622.3-631.8	2.55	A8251	0.53	0.01	
631.8-639.0	2.60	A8252	0.39	0.02	
639.0-648.2	2.50	A8253	0.72	0.01	
648.2-657.8	2.56	A8254	0.50	0.01	
657.8-665.8	2.64	A8255	0.75	0.02	Mo=0.298
665.8-675.2	2.53	A8256	0.47	0.02	
675.2-685.6	2.49	A8257	0.43	0.01	
685.6-690.4	2.56	A8258	0.78	0.01	
690.4-695.2	----	-----	Assumed 0.65	Assumed 0.02	No Recovery
695.2-705.1	2.50	A8259	0.52	0.03	Mo=0.012
705.1-715.5	2.57	A8260	0.42	0.02	Mo=0.016
715.5-724.3	2.55	A8182	0.45	0.02	Mo=0.010
724.3-732.7	2.63	A8183	0.70	0.02	
732.7-743.4	2.56	A8184	0.40	0.02	
743.4-752.1	2.53	A8185	0.57	0.01	
752.1-763.2	2.60	A8186	0.55	0.01	Mo=0.092
763.2-770.1	2.58	A8187	0.58	0.02	
770.1-780.4	2.54	A8188	0.46	0.02	
780.4-787.2	2.57	A8189	0.57	0.02	
787.2-797.3	2.59	A8190	0.40	0.02	
797.3-806.8	2.62	A8191	0.56	0.02	
806.8-816.9	2.50	A8192	0.33	0.02	
816.9-826.6	2.56	A8193	0.45	0.01	
826.6-837.0	2.48	A8194	0.30	0.01	
837.0-848.6	2.60	A8195	0.37	Tr.	
848.6-858.7	2.46	A8196	0.29	0.01	
858.7-868.0	2.46	A8197	0.39	Tr.	Mo=0.050
868.0-878.2	2.58	A8198	0.24	0.01	Mo=0.040
878.2-888.4	2.50	A8199	0.20	0.01	Mo=0.004
BOTTOM					
					pit bottom @ 896.3'

184.5' @ 0.53% Cu

184.5' @ 0.02 % Cu

Date 9 / 6 / 68-

Hole No. S-109 22799.1 22953.2 1448.5

J.H.C

OCT 16 1968

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
106.0-113.0	2.37	A8321	0.05	0.01	START OF CORE
113.0-121.7	2.58	A8322	0.03	0.01	
121.7-131.8	2.56	A8323	0.04	0.01	
131.8-141.8	2.53	A8324	0.05	0.01	
141.8-150.8	2.52	A8325	0.05	0.01	
150.8-160.6	2.58	A8326	0.06	0.02	
160.6-169.3	2.46	A8327	0.11	0.01	
169.3-179.8	2.66	A8328	0.09	0.01	
179.8-189.0	2.53	A8329	0.06	0.01	
189.0-199.1	2.65	A8330	0.07	0.01	
199.1-209.1	2.50	A8331	0.06	0.01	
209.1-218.4	2.48	A8332	0.06	0.01	
218.4-227.1	2.55	A8333	0.07	0.01	
227.1-237.4	2.56	A8334	0.07	0.01	
237.4-246.8	2.59	A8335	0.31	0.03	
246.8-256.5	2.51	A8336	0.06	0.01	
256.5-266.3	2.42	A8337	0.09	0.02	
266.3-276.7	2.49	A8338	0.08	0.01	
276.7-286.5	2.52	A8339	0.10	0.01	
286.5-293.9	2.66	A8340	0.10	0.01	
293.9-294.2	----	------	----	----	NO RECOVERY
294.2-301.2	2.54	A8341	0.31	0.02	
301.2-311.3	2.56	A8342	1.10	0.03	
311.3-321.0	2.70	A8343	0.16	0.08	
321.0-331.5	2.72	A8344	0.08	0.01	
331.5-341.7	2.76	A8345	0.04	Tr.	
341.7-352.0	2.71	A8346	0.04	Tr.	
352.0-363.8	2.67	A8347	0.04	Tr.	
363.8-374.3	2.66	A8348	0.05	Tr.	
374.3-384.9	2.70	A8349	0.07	Tr.	
384.9-392.8	2.61	A8350	0.06	0.01	
392.8-403.3	2.70	A8351	0.07	0.01	
403.3-412.2	2.62	A8352	0.04	Tr.	
412.2-421.7	2.66	A8353	0.09	0.01	
421.7-431.6	2.66	A8354	0.10	0.02	
431.6-441.4	2.67	A8355	0.07	0.01	
441.4-451.6	2.59	A8356	0.07	0.02	
451.6-460.0	2.54	A8357	0.05	0.01	
460.0-470.4	2.66	A8358	0.08	0.01	
470.4-480.8	2.60	A8359	0.12	0.03	
480.8-491.1	2.67	A8360	0.09	0.02	
491.1-501.3	2.64	A8361	0.09	0.03	
501.3-511.7	2.65	A8362	0.07	0.02	
511.7-521.1	2.65	A8363	0.06	0.02	
521.1-531.9	2.65	A8364	0.07	0.02	
531.9-540.5	2.66	A8365	0.06	0.02	
540.5-550.8	2.64	A8366	0.25	0.07	
550.8-561.3	2.59	A8367	0.06	0.01	
561.3-571.2	2.46	A8368	0.06	0.03	
571.2-581.7	2.54	A8369	0.04	0.01	
581.7-592.0	2.55	A8370	0.03	0.01	

Date 9 /13 /68

Hole No. S-109

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
592.0-602.4	2.60	A8371	0.04	0.01	
602.4-612.7	2.62	A8372	0.04	0.01	
612.7-622.8	2.55	A8373	0.04	0.01	
622.8-633.0	2.56	A8374	0.04	0.02	
633.0-641.8	2.55	A8375	0.09	0.04	
641.8-652.3	2.52	A8376	0.88	0.77	
652.3-662.7	2.54	A8377	0.17	0.10	
662.7-673.2	2.47	A8378	0.16	0.07	
673.2-683.7	2.60	A8379	2.59	0.13	
683.7-693.3	2.63	A8380	0.23	0.19	
693.3-703.3	2.54	A8381	0.05	0.03	
703.3-713.3	2.60	A8382	0.15	0.11	
713.3-723.6	2.48	A8383	0.20	0.13	
723.6-734.1	2.75	A8384	0.14	0.06	
734.1-742.2	2.64	A8385	0.05	0.03	
742.2-752.4	2.63	A8386	0.49	0.08	
752.4-762.8	?	A8387	0.13	0.07	
762.8-772.9	2.60	A8388	0.06	0.05	
772.9-778.2	2.58	A8389	0.07	0.06	
BOTTOM					
				pit bottom @	963.5'

Hole No. S-110

27?49.6
22546.7
X or Xcol + 2.9

Y or Ycol
22983.0
22948.7
= 34.3

1448.1

Date 9/16/68
J.H.C.

OCT 15 1968

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
84.0-93.6	2.48	A8390	0.05	0.03	START OF CORE
93.6-104.1	2.56	A8391	0.08	0.06	Mo=.023
104.1-113.4	2.55	A8392	0.41	0.38	Mo=.020
113.4-123.7	2.66	A8393	0.04	0.04	Mo=.022
123.7-133.4	2.64	A8394	0.28	0.04	
133.4-143.8	2.69	A8395 34.1' @ .98% T.Cu	0.05	0.05	34.1' @ .03% O.Cu
143.8-154.3	2.70	A8396	1.30	0.05	
154.3-164.2	2.66	A8397	1.14	0.03	
164.2-174.2	2.67	A9398	0.66	0.03	
174.2-182.9	2.68	A8399	0.80	0.02	
182.9-193.0	2.75	A8400	0.04	0.01	
193.0-203.2	2.69	A8401	0.13	0.02	
203.2-213.3	2.59	A8402	0.03	0.01	
213.3-223.6	2.62	A8403	0.03	0.01	
223.6-233.3	2.68	A8404	0.63	0.05	
233.3-243.8	2.70	A8405	0.04	0.01	Mo=.019
243.8-253.8	2.65	A8406	0.07	0.02	Mo=.009
253.8-264.0	2.64	A8407	0.04	0.01	Mo=.018
264.0-274.0	2.59	A8408	0.04	0.01	Mo=.012
274.0-284.5	2.57	A8409	0.32	0.24	Mo=.017
284.5-295.0	2.62	A8410	0.81	0.10	
295.0-303.4	2.59	A8411	0.17	0.03	Mo=.022
303.4-313.9	2.89	A8412	3.84	0.07	
313.9-324.1	2.91	A8413 59.7' @ 1.54% T.Cu	2.73	0.09	59.7' @ 0.06% O.Cu
324.1-333.3	2.74	A8414	0.56	0.08	
333.3-344.2	2.80	A8415	0.90	0.04	
344.2-353.5	2.57	A8416	0.41	0.02	
353.5-363.1	2.48	A8417	0.55	0.03	
363.1-374.8	2.50	A8418	0.23	0.02	
374.8-385.5	2.74	A8419	0.21	0.02	
385.5-385.8	----	-----	0.43assumed	0.05	NO RECOVERY
385.8-396.8	2.73	A8420	0.66	0.01	
396.8-403.3	2.52	A8421	0.58	0.01	
403.3-412.8	2.55	A8422 95.7' @ 0.60% T.Cu	0.55	Tr.	95.7' @ 0.01% O.Cu
412.8-421.0	2.61	A8423	0.75	0.01	
421.0-432.5	2.62	A8424	0.55	0.01	
432.5-442.5	2.68	A8425	0.60	0.01	
442.5-451.1	2.69	A8426	0.57	0.01	
451.1-460.4	2.65	A8427	0.57	0.01	
460.4-471.2	2.84	A8428	0.60	Tr.	
471.2-479.9	2.80	A8429	0.11	Tr.	Mo=.009
479.9-489.0	2.96	A8430	0.13	Tr.	Mo=.016
489.0-498.3	2.53	A8431 30.0' @ 0.34%	0.44	0.01	30.0' @ 0.01% Mo=.010
498.3-508.5	2.62	A8432	0.65	0.01	Mo=.019
508.5-519.0	2.61	A8433	0.51	0.01	Mo=.023
519.0-529.3	2.56	A8434	0.29	0.01	Mo=.043
529.3-537.0	2.54	A8435	0.37	0.01	Mo=.017
537.0-547.8	2.53	A8436	0.31	0.0	Mo=.022
547.8-558.2	2.57	A8437	0.69	0.01	Mo=.022
558.2-566.8	2.54	A8438	0.26	0.0	
566.8-576.3	2.65	A8439	0.44	0.01	Mo=.038

Date 9 / 24 / 68

Hole No. S-110

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
576.3-585.3	2.48	A8440	0.27	0.02	Mo=.013
585.3-595.2	2.50	A8441	0.54	0.01	Mo=.011
595.2-605.4	2.50	A8442	0.43	0.01	Mo=.009
605.4-615.3	2.62	A8443	0.64	0.01	Mo=.013
615.3-625.6	2.56	A8444	0.53	0.01	
625.6-635.8	2.55	A8445	0.68	0.01	
635.8-645.2	2.58	A8446	0.71	0.01	
645.2-655.7	2.57	A8447	1.52	0.01	
655.7-665.9	2.58	A8448	1.40	0.02	
665.9-676.3	2.56	A8449	0.65	0.01	
676.3-686.5	2.55	A8450	0.43	Tr.	
686.5-696.8	2.61	A8451	2.28	0.03	
696.8-706.8	2.66	A8452	1.45	0.04	
706.8-717.0	2.57	A8453	0.80	Tr.	
717.0-727.1	2.57	A8454	0.75	Tr.	
727.1-737.3	2.68	A8455	0.65	Tr.	
737.3-749.6	2.65	A8456 297.9' @ 0.92%	1.26	0.01	297.9' @ 0.01%
749.6-757.0	2.62	A8457	1.33	0.01	
757.0-767.2	2.65	A8458	1.60	0.02	
767.2-776.6	2.58	A8459	0.75	0.01	
776.6-786.7	2.59	A8460	1.30	0.01	
786.7-796.2	2.55	A8461	0.68	0.01	
796.2-806.7	2.56	A8462	0.77	Tr.	
806.7-817.2	2.62	A8463	0.98	0.01	
817.2-827.3	2.58	A8464	0.48	0.01	
827.3-837.4	2.54	A8465	0.47	0.01	
837.4-848.1	2.56	A8466	0.85	0.01	
848.1-858.1	2.56	A8467	1.21	0.01	
858.1-868.4	2.58	A8468	0.49	0.01	
868.4-878.2	2.56	A8469	0.47	0.01	
878.2-883.2	2.48	A8470	0.54	0.01	
BOTTOM			*		

pd bottom @ 978.7

Hole No. S-111 2 946.6 22386.1 43.3

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
154.0-166.3	2.61	A 8645	0.60	0.56	START OF CORE
166.3-177.4	2.62	A 8646	0.08	0.05	
177.4-184.5	2.51	A 8647	0.06	0.02	
184.5-194.8	2.31	A 8648	0.05	0.02	
194.8-199.6	2.52	A 8649	0.06	0.01	
199.6-199.8	----	------	----	----	No Recovery
199.8-205.0	2.51	A 8650	0.07	0.01	
205.0-215.4	2.57	A 8651	0.07	0.02	
215.4-223.4	2.62	A 8652	0.04	0.01	
223.4-233.8	2.65	A 8653	0.04	0.01	
233.8-243.9	2.63	A 8654	0.04	0.01	
243.9-250.9	2.70	A 8655 17.3'@0.42%	0.45	0.41	17.3'@0.38%
250.9-261.2	2.62	A 8656	0.40	0.36	
261.2-266.9	2.73	A 8657	0.09	0.04	
266.9-277.1	2.57	A 8658	0.10	0.05	
277.1-287.2	2.58	A 8659	0.06	0.03	
287.2-297.4	2.60	A 8660	0.09	0.05	
297.4-307.5	2.68	A 8661 20.3'@0.96%	0.59	0.08	20.3'@0.07%
307.5-317.7	2.66	A 8662	1.33	0.10	
317.7-327.9	2.72	A 8663 40.6'@4.03%	9.88	1.14	40.6'@1.30%
327.9-337.9	2.75	A 8664	1.94	1.30	
337.9-348.2	2.67	A 8665	3.35	2.44	
348.2-358.3	2.66	A 8666	0.90	0.30	
358.3-370.5	2.48	A 8667 214.9'@0.56%	0.97	0.06	214.9'@0.03%
370.5-380.8	2.50	A 8668	0.45	0.03	
380.8-391.3	2.62	A 8669	0.94	0.04	
391.3-401.8	2.63	A 8670	0.57	0.05	
401.8-411.8	2.60	A 8671	0.62	0.02	
411.8-421.7	2.59	A 8672	0.41	0.01	
421.7-432.2	2.70	A 8673	0.69	0.02	
432.2-442.7	2.66	A 8674	0.56	0.02	
442.7-452.9	2.62	A 8675	0.62	0.04	
452.9-462.8	2.48	A 8676	0.45	0.01	
462.8-473.0	2.57	A 8677	0.47	0.02	
473.0-483.3	2.60	A 8678	0.65	0.02	
483.3-493.5	2.57	A 8679	0.44	0.04	
493.5-504.3	2.56	A 8680	0.42	0.04	
504.3-512.7	2.55	A 8681	0.50	0.05	
512.7-521.9	2.66	A 8682	0.56	0.04	
521.9-531.6	2.58	A 8683	0.41	0.04	
531.6-542.3	2.56	A 8684	0.52	0.03	
542.3-550.5	2.62	A 8685	0.58	0.02	
550.5-562.6	2.60	A 8686	0.39	0.02	
562.6-573.2	2.63	A 8687	0.58	0.03	
573.2-584.1	2.59	A 8688	0.26	0.02	
584.1-594.6	2.61	A 8689	0.21	0.01	
594.6-600.2	2.58	A 8690	0.36	0.01	
BOTTOM			* pit bottom @ 635		

Hole No. S-112   2 139.7 · 22634.6 · 14, K.H.C

Date 9/27/68

OCT 16 1968

Interval FROM - TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
205.2-214.4	2.36	A8517	0.63	0.49	START OF CORE
214.4-224.8	2.61	A8518	0.07	0.02	
224.8-234.5	2.48	A8519	0.05	0.02	
234.5-245.6	2.60	A8520	0.03	0.01	
245.6-255.2	2.48	A8521	0.04	0.01	
255.2-265.7	2.48	A8522	0.05	0.01	
265.7-275.8	2.73	A8523	0.03	0.01	
275.8-286.2	2.64	A8524	0.03	0.01	
286.2-296.8	2.62	A8525	0.04	0.01	
296.8-306.8	2.67	A8526	0.04	0.01	
306.8-317.2	2.61	A8527	0.05	0.01	
317.2-327.8	2.66	A8528	0.03	0.01	
327.8-338.2	2.70	A8529	0.14	0.01	
338.2-348.5	2.65	A8530	0.11	0.07	
348.5-358.2	2.78	A8531	0.08	0.05	
358.2-368.6	2.64	A8532	0.11	0.11	
368.6-373.8	2.77	A8533	0.18	0.13	
373.8-374.1	----	------	-----	----	NO RECOVERY
374.1-374.2	----	------	-----	----	NO RECOVERY
374.2-379.8	2.53	A8534 32.6' @ 1.51%	1.35	0.99	32.6' @ 1.24%
379.8-387.5	2.52	A8535	2.58	2.25	
387.5-397.5	2.53	A8536	1.40	1.12	
397.5-406.8	2.71	A8537	0.85	0.67	
406.8-416.2	2.69	A8538	0.11	0.03	
416.2-427.6	2.63	A8539	0.27	0.16	
427.6-436.9	2.79	A8540 37.9' @ 0.61%	0.67	0.47	37.9' @ 0.47
436.9-446.5	2.69	A8541	0.85	0.53	
446.5-456.2	2.58	A8542	0.60	0.36	
456.2-465.5	2.75	A8543	0.60	0.53	
465.5-475.6	2.56	A8544	0.16	0.10	
475.6-483.8	2.64	A8545	0.05	0.02	
483.8-494.6	2.61	A8546	0.05	0.01	
494.6-504.7	2.69	A8547	0.08	0.04	
504.7-511.7	2.61	A8548	0.43	0.26	
511.7-521.4	2.60	A8549	0.14	0.05	
521.4-532.0	2.58	A8550	0.08	0.03	
532.0-538.2	2.46	A8551	0.10	0.03	
538.2-549.0	2.57	A8552	0.08	0.03	
549.0-553.7	2.46	A8553 23.4' @ 0.41	0.70	0.45	23.4' @ 0.31
553.7-563.9	2.48	A8554	0.39	0.24	
563.9-572.4	2.68	A8555	0.46	0.31	[illegible]
572.4-584.9	2.51	A8556	0.08	0.04	
584.9-594.7	2.70	A8557	0.04	0.01	
594.7-605.4	2.65	A8558	0.02	Tr.	
605.4-612.8	2.64	A8559	0.07	0.03	
612.8-620.6	2.59	A8560 31.5' @ 0.73%	0.64	0.56	31.5' @ 0.62%
620.6-627.3	2.57	A8561	1.00	0.90	
627.3-635.8	2.53	A8562	0.45	0.37	
635.8-643.7	2.57	A8563	0.85	0.79	
643.7-649.3	2.56	A8564	0.81	[illegible]	

Date 10/3 /68

.ole No. S-112

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
658.0-667.5	2.62	A8566	0.25	0.17	Nat. Cu Present
667.5-677.8	2.41	A8567	0.17	0.06	Nat. Cu Present
677.8-688.1	2.54	A8568	0.24	0.03	Nat. Cu Present
688.1-697.3	2.67	A8569	0.55	0.02	
697.3-704.2	2.60	A8570	0.67	0.02	
704.2-715.7	2.63	A8571	0.59	0.01	
715.7-722.0	2.62	A8572	0.68	0.01	
722.0-729.6	2.43	A8573	0.56	0.01	
729.6-737.6	2.63	A8574	0.76	0.02	
737.6-747.8	2.59	A8575	0.61	0.01	
747.8-754.7	2.66	A8576	0.42	0.01	
754.7-761.9	not possible to run S.G.	A8577	0.70	0.02	
761.9-771.8	2.66	A8578	0.41	0.01	
771.8-781.9	2.59	A8579	0.46	0.01	
781.9-784.2	2.43	A8580	0.06	Tr.	
784.2-784.8	---	-----	-----	----	NO RECOVERY
784.8-785.1	----	-----	-----	----	NO RECOVERY
785.1-786.0	2.53	A8581	0.09	0.01	
BOTTOM					

Date 10 14 /68

Hole No. S-114 762.5 22068.5 1‑.0

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
173.0-182.3	2.56	A 8691, 24.2' @ 0.88%	0.14	0.11	Start of Core 24.2' @ 0.81%
182.3-191.8	2.72	A 8692	0.17	0.10	
191.8-202.2	2.65	A 8693	0.14	0.08	
202.2-212.5	2.67	A 8694	0.64	0.59	
212.5-222.4	2.68	A 8695	1.14	1.04	
222.4-232.8	2.60	A 8696	0.10	0.05	
232.8-243.2	2.57	A 8697	0.07	0.04	
243.2-253.1	2.55	A 8698	0.02	0.02	
253.1-264.5	2.48	A 8699	0.03	0.03	
264.5-274.9	2.63	A 8700 37.2' @ 1.05%	0.03	0.03	37.2' @ 0.07%
274.9-286.1	2.54	A 8701	0.03	0.03	
286.1-296.3	2.55	A 8702	1.74	0.03	
296.3-305.7	2.59	A 8703	0.61	0.04	
305.7-313.2	2.61	A 8704	0.82	0.11	
313.2-323.3	2.71	A 8705	0.95	0.12	
323.3-333.5	2.62	A 8706 48.7' @ 0.60%	0.36	0.06	40.7' @ 0.08%
333.5-343.2	2.62	A 8707	0.34	0.05	
343.2-352.7	2.56	A 8708	0.46	0.05	
352.7-363.6	2.69	A 8709	1.06	0.18	
363.6-373.3	2.59	A 8710	0.32	0.05	
373.3-383.9	2.67	A 8711	0.51	0.02	
383.9-384.6	----	------	[illegible]	[illegible]	No Recovery
384.6-391.9	2.60	A 8712	0.19	0.01	
391.9-400.2	2.66	A 8713	0.17	0.02	
400.2-408.4	2.64	A 8714	0.32	0.01	
408.4-415.7	2.58	A 8715 67.1' @ 0.44%	0.44	0.02	67.1' @ 0.01%
415.7-426.0	2.62	A 8716	0.36	0.01	
426.0-436.2	2.62	A 8717	0.47	0.02	
436.2-443.1	2.69	A 8718	0.52	0.02	
443.1-453.6	2.67	A 8719	0.49	0.01	
453.6-464.1	2.62	A 8720	0.38	0.01	
464.1-475.5	2.61	A 8721	0.48	0.01	
475.5-484.0	2.61	A 8722	0.30	0.01	
484.0-494.2	2.60	A 8723	0.35	0.01	
494.2-504.9	2.63	A 8724	0.36	0.01	
504.9-515.5	2.50	A 8725	0.35	0.01	
515.5-525.2	2.54	A 8726	0.28	0.01	
525.2-535.2	2.56	A 8727	0.33	0.01	
535.2-545.2	2.57	A 8728	0.28	0.01	
545.2-555.4	2.61	A 8729	0.25	0.01	
BOTTOM					

Date 10/ 19/ 68

Hole No. S-115 22 210.7 21 991.8 1436.6

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
235.0-243.3	2.54	A 8768	0.06	0.03	START OF CORE
243.3-252.7	2.45	A 8769	0.05	0.03	
252.7-260.6	2.52	A 8770	0.09	0.03	
260.6-270.8	2.53	A 8771	0.23	0.20	
270.8-281.2	2.60	A 8772	0.18	0.16	
281.2-291.1	2.68	A 8773	0.10	0.07	
291.1-301.7	2.58	A 8774	0.08	0.06	
301.7-312.2	2.61	A 8775	0.28	0.24	
312.2-322.7	2.56	A 8776	0.54	0.48	
322.7-333.2	2.57	A 8777	0.18	0.16	
333.2-342.3	2.56	A 8778	0.48	0.09	
342.3-352.3	2.58	A 8779	1.57	0.15	
352.3-362.6	2.55	A 8780	0.56	0.06	
362.6-372.8	2.64	A 8781	0.71	0.05	
372.8-383.3	2.60	A 8782	0.37	0.02	
383.3-393.1	2.61	A 8783	0.46	0.03	
393.1-401.1	2.59	A 8784	0.34	0.01	
401.1-412.0	2.51	A 8785	0.25	Tr.	
412.0-420.4	2.51	A 8592	0.31	0.01	
420.4-430.5	2.56	A 8593	0.58	Tr.	
430.5-440.5	2.58	A 8594	0.29	0.01	
440.5-450.6	2.59	A 8595	0.62	0.03	
450.6-455.6	2.62	A 8730	0.49	0.02	
BOTTOM			*		

82.4' @ 0.61% Cu

92.7' @ 0.13% Cu

* pit design bottom @ 606.2'

Date 10 / 26 / 68

Hole No. S-116 1884.5 22185.9 4372.7

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
285.0-296.4	2.51	A 8731	0.37	0.27	START OF CORE
296.4-306.5	2.46	A 8732	0.77	0.65	
306.5-316.7	2.72	A 8733	1.70	1.62	Mo= .018
316.7-326.4	2.52	A 8734	0.32	0.22	Mo= .013
326.4-336.7	2.63	A 8735	0.22	0.17	Mo= .018
336.7-344.8	2.54	A 8736	0.81	0.77	
344.8-355.1	2.45	A 8737	0.15	0.08	
355.1-365.5	2.50	A 8738	0.21	0.17	Mo= .021
365.5-375.6	2.57	A 8739	0.50	0.41	Mo= .015
375.6-385.8	2.53	A 8740	0.42	0.38	
385.8-396.2	2.56	A 8741	1.35	1.28	
396.2-406.5	2.52	A 8742	0.62	0.57	
406.5-416.4	2.51	A 8743	0.14	0.10	
416.4-423.2	2.55	A 8744	0.07	0.05	
423.2-433.3	2.45	A 8745	0.07	0.03	
433.3-444.0	2.49	A 8746	0.08	0.05	
444.0-454.1	2.57	A 8747	0.11	0.07	
454.1-462.7	2.52	A 8748	0.27	0.24	
462.7-472.7	2.54	A 8749	0.34	0.27	
427.7-481.2	2.63	A 8750	0.18	0.14	
BOTTOM			pit bottom @ 507		

44.0' @ 0.72%

44.0' @ 0.66%

Hole No. S-124 , 391.7 · 22421.5 · 14 4

S-124

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
280.6-289.0	2.61	A 9093	0.08	0.02	START OF CORE
289.0-299.4	2.57	A 9094	0.04	0.01	
299.4-311.0	2.59	A 9095	0.04	0.02	
311.0-320.8	2.58	A 9096	0.09	0.04	
320.8-331.4	2.50	A 9097	0.03	Tr.	
331.4-341.8	2.48	A 9098	0.04	0.01	
341.8-352.0	2.49	A 9099	0.12	0.02	
352.0-362.5	2.52	A 9100	0.12	0.06	
362.5-372.7	2.61	A 9101	0.10	0.05	
372.7-383.0	2.51	A 9102	0.05	0.01	
383.0-393.4	2.50	A 9103	0.38	0.02	
393.4-403.5	2.53	A 9104	0.23	0.17	
403.5-414.0	2.52	A 9105	0.11	0.06	
414.0-424.5	2.54	A 9106	0.14	0.09	
424.5-434.8	2.56	A 9107	0.13	0.08	
434.8-445.2	2.55	A 9108	0.09	0.05	
445.2-455.3	2.53	A 9109	0.34	0.26	
455.3-466.0	2.59	A 9110	0.22	0.16	
466.0-476.2	2.60	A 9111	0.35	0.26	
476.2-486.8	2.55	A 9112	0.30	0.20	
486.8-497.0	2.57	A 9113	0.59	0.54	
497.0-507.3	2.56	A 9114	0.18	0.13	
507.3-516.3	2.57	A 9115	0.71	0.67	
516.3-526.6	2.57	A 9116	0.37	0.34	
526.6-536.8	2.55	A 9117	0.20	0.14	
536.8-547.2	2.58	A 9118	0.19	0.10	
547.2-557.9	2.46	A 9119	0.29	0.20	
557.9-567.8	2.44	A 9120	0.18	0.12	
567.8-578.3	2.47	A 9121	0.66	0.08	
578.3-588.7	2.48	A 9122	0.83	0.11	Nat Cu
588.7-599.8	2.46	A 9123	0.04	0.01	Nat Cu.
599.8-610.2	2.45	A 9124	0.71	0.03	
610.2-620.6	2.48	A 9125	0.34	0.02	
620.6-631.0	2.52	A 9126	0.28	0.01	
631.0-641.5	2.56	A 9127	0.46	0.02	
641.5-651.8	2.53	A 9128	0.31	0.01	
651.8-662.2	2.50	A 9129	0.27	0.01	Mo = 0.011
662.2-672.8	2.51	A 9130	0.17	0.01	
672.8-683.2	2.50	A 9131	0.31	0.01	
683.2-693.3	2.53	A 9132	0.71	0.01	
693.3-701.9	2.51	A 9133	0.35	0.02	Mo = 0.013
701.9-710.1	2.53	A 9134	0.47	0.02	
710.1-715.0	2.52	A 9135	0.59	0.01	
BOTTOM			*		

40.4' @ 0.55 % Cu

42.1' @ 0.06 % Cu

31.8' @ 0.53 % Cu

31.8' @ 0.02 % Cu

Date 1 / 9 / 69

Hole No. S-125   21898.8   22651.5   1442.4

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
237.5-247.1	2.57	A 9136	0.08	0.05	Start of Core
247.1-257.8	2.61	A 9137	0.07	0.03	
257.8-267.9	2.60	A 9138	0.14	0.06	
267.9-278.3	2.52	A 9139	0.10	0.02	
278.3-288.5	2.55	A 9140	0.20	0.14	
288.5-298.9	2.60	A 9141	0.14	0.08	
298.9-309.3	2.57	A 9142	0.47	0.03	
309.3-318.4	2.54	A 9143	2.31	0.04	
318.4-328.8	2.41	A 9144	0.99	0.02	
328.8-335.4	2.60	A 9145	0.52	0.01	
335.4-345.4	2.59	A 9146	0.59	0.01	
345.4-351.8	2.56	A 9147	0.55	Tr.	
351.8-362.2	2.58	A 9148	0.24	Tr.	
362.2-373.9	2.60	A 9149	0.54	Tr.	
373.9-383.0	2.56	A 9150	0.18	Tr.	
383.0-393.2	2.59	A 9151	0.93	0.63	
393.2-403.4	2.57	A 9152	0.07	0.02	
403.4-413.8	2.61	A 9153	0.11	0.05	
413.8-424.0	2.60	A 9154	0.15	0.08	
424.0-434.2	2.56	A 9155	0.17	0.10	
434.2-444.4	2.52	A 9156	0.16	0.12	
444.4-454.6	2.53	A 9157	0.07	0.04	
454.6-464.8	2.60	A 9158	0.05	0.02	
464.8-475.0	2.59	A 9159	0.32	0.02	
475.0-485.2	2.55	A 9160	0.11	0.07	
485.2-495.4	2.56	A 9161	0.11	0.05	
495.4-505.6	2.59	A 9162	0.15	0.06	
505.6-518.4	2.50	A 9163	0.14	0.06	
518.4-521.3	2.54	A 9164	9.73	0.32	
521.3-534.1	2.56	A 9165	0.05	0.01	
534.1-542.8	2.62	A 9166	0.06	0.01	
542.8-553.0	2.54	A 9167	0.04	0.01	
553.0-563.2	2.53	A 9168	0.20	0.15	
563.2-573.3	2.55	A 9169	0.08	0.04	
573.3-583.7	2.44	A 9170	0.03	0.01	
583.7-588.2	2.51	A 9171	0.02	0.01	
588.2-598.2	2.53	A 9172	0.03	Tr.	
598.2-608.6	2.52	A 9173	0.03	Tr.	
BOTTOM					

75.0' @ 0.77 % Cu

75.0 @ 0.01 % Cu

pit bottom @ 612.4'

Date 1/15/69

Hole No. S-126

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
113.8-119.7	2.42	A 9174	0.04	0.02	START OF CORE
119.7-129.7	2.46	A 9175	0.06	0.05	
129.7-138.3	2.48	A 9176	0.07	0.04	
138.3-148.7	2.45	A 9177	0.05	0.02	
148.7-158.8	2.57	A 9178	0.08	0.01	
158.8-169.0	2.51	A 9179	0.10	0.02	
169.0-179.0	2.44	A 9180	0.07	0.02	
179.0-189.0	2.49	A 9181	0.04	0.01	
189.0-199.0	2.46	A 9182	0.05	0.01	
199.0-207.9	2.47	A 9183	0.05	0.01	
207.9-213.5	2.48	A 9184	0.04	0.01	
213.5-223.8	2.47	A 9185	0.04	0.01	
223.8-233.8	2.51	A 9186	0.04	0.01	
233.8-244.0	2.55	A 9187	0.04	0.01	
244.0-254.0	2.64	A 9188	0.07	0.01	
254.0-264.4	2.61	A 9189	0.05	0.02	
264.4-274.6	2.58	A 9190	0.05	0.01	
274.6-283.9	2.58	A 9191	0.07	0.01	
283.9-292.1	2.60	A 9192	0.08	0.02	
292.1-300.2	2.59	A 9193	0.12	0.02	
300.2-311.5	2.61	A 9194	0.21	0.12	
311.5-321.6	2.59	A 9195	0.18	0.13	
321.6-331.8	2.70	A 9196	0.23	0.14	
331.8-342.0	2.63	A 9197	0.42	0.10	
342.0-350.0	2.61	A 9198	0.22	0.18	
350.0-358.4	2.58	A 9199	0.14	0.08	
358.4-368.7	2.53	A 9200	0.14	0.07	
368.7-375.0	2.55	A 9201	0.07	0.02	
375.0-385.1	2.60	A 9202	0.06	0.01	
385.1-395.2	2.53	A 9203	0.04	0.01	
395.2-403.8	2.56	A 9204	0.04	0.01	
403.8-413.8	2.70	A 9205	1.52	0.04	40.7' @ 0.03% Cu
413.8-424.0	2.69	A 9206	1.89	0.03	
424.0-434.4	2.55	A 9207	0.03	0.01	
434.4-444.5	2.65	A 9208	1.05	0.05	
444.5-448.5	2.62	A 9209	0.04	0.01	
448.5-458.3	2.63	A 9210	0.04	0.01	
458.3-468.2	2.60	A 9211	0.04	0.01	
468.2-478.2	2.63	A 9212	0.05	0.01	
478.2-486.4	2.62	A 9213	0.06	0.01	
486.4-496.6	2.66	A 9214	0.05	0.01	
496.6-506.8	2.64	A 9215	0.05	0.01	
506.8-516.9	2.57	A 9216	0.05	0.01	
516.9-527.2	2.58	A 9217	0.05	0.01	
527.2-536.2	2.57	A 9218	0.07	0.02	
536.2-544.8	2.65	A 9219	0.06	0.01	
544.8-554.2	2.54	A 9220	0.07	0.01	
554.2-565.9	2.60	A 9221	0.59	0.08	Nat Cu
565.9-575.9	2.56	A 9222	1.45	0.07	
575.9-586.2	2.55	A 9223	0.25	0.03	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

40.7' @ 1.11% Cu

@ 1.54% Cu

0.10% Cu

Hole No. S-126

Date 1/20/69

Interval FROM TO	Sp. G.	SAMPLE CODE	TOTAL Cu	CuO	COMMENTS
596.2-606.2	2.54	A 9225	0.11	0.01	
606.2-615.8	2.54	A 9226	0.10	0.01	
615.8-626.2	2.56	A 9227	0.92	0.02	Nat Cu
626.2-636.2	2.53	A 9228	1.42	0.02	Nat Cu
636.2-646.2	2.55	A 9229	0.50	0.01	
646.2-656.5	2.57	A 9230	0.02	Tr	
656.5-666.7	2.58	A 9231	0.01	Tr	
666.7-676.8	2.56	A 9232	0.01	Tr	
676.8-687.0	2.58	A 9233	1.81	0.10	Nat Cu
687.0-697.2	2.56	A 9234	0.32	0.02	
697.2-707.3	2.54	A 9235	0.01	Tr	
707.3-717.3	2.52	A 9236	0.01	Tr	
717.3-723.8	2.50	A 9237	0.01	Tr	
BOTTOM					

30.4' @ 0.75% Cu

30.4' @ 0.02% CuO

pit design bottom @ 900'

Final Depth 1202.4'
Collar Elevation 1445'
Coordinates 23122.70N 22020.10E
Inclination -90°

ASARCO
GEOLOGIC-ASSAY LOG

Property *SACATON*

HOLE NO. *S. 12*
Sheet No. *1 of 11*
Date Completed *5-24-62*
Logged By *RKK & MPW*

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks
107.7	12.0	[illegible]		R.B.	0.02											
119.7	[illegible]	"		"	0.02											
126.2	6.5	[illegible]	None	80	0.04	0.03						Llm Sps.	Strong Ser.	Arg.	GRANITE	Med.-gr., strongly alt., reddish color from hem. staining. Much crushing, shearing and brecciation pre-ore. Completely leached, Llm sparse. Lm. after pyr. more abundant. Core generally solid.
127.7	1.5	"	"	83	0.02							Llm Sps.	"	"	"	Same
138.7	11.0	"	"	76	0.03	Tr.						"	"	"	"	Same
151.6	12.9	"	"	15	0.03	0.02						"	"	"	"	Same
161.8	[illegible]	"	"	100	0.02							"	"	"	"	Same; except finer-gr. facies 15?-15?'. May be aplite.
171.4	[illegible]	"	"	95	0.02							Llm	"	"	"	Same. Slightly more Llm in parts of run.
180.2	[illegible]	"	"	92	0.02							Llm Sps.	"	"	GRANITE ANDESITE	Same granite to 177'. 177-180.2. Andesite(?) dike. Dark green color. Feld. & biotite [illegible] to 1mm. groundmass re-crystallized, feld. arg.
188.2	[illegible]	"	"	73	0.04				Tr.		Tr.	Llm Sps			ANDESITE GRANITE	Andesite ? to 182±. Then [illegible] granite. 6" unleached granite with pyr. [illegible] at 188'.

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Property *SACATON*

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Logged By *RKK.*

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks
193.7	3.5	[illegible]	NONE	100	0.02							LLm Sp.	Moderate Arg	 Ser.	GRANITE	Same as above.
199.4	5.7	"	"	"	0.82				Mod.	R.	Mod.		Moderate Ser.	 Arg.	GRANITE	Light colored unleached granite, same as above. At 193.7 1½' dark colored silic[illegible] breccia with horiz. shearing. Leaching stops sharply at this silic. zone. Py diss and in fractures
210.2	10.8	"	"	100	0.23				Mod	R	Mod.		"	"	"	
217.4	7.2	"	"	100	0.60				Mod	Mod	Mod	LLm Sp.	"	"	"	Same, to 214', then leached and hem. stained
227.3	[illegible]	"	"	99	0.18				Tr		Mod	LLm mod,	"	"	"	Same. Leached first half run; second half contains leached and unleached granite with cc.
238.0	10.7	"	"	93	0.08				Tr		Tr.	LLm Sp.			"	Leached granite, except first four inches then granite as below.
246.6	[illegible]	"	"	100	0.03							LLm R.	Weak Arg.	 Ser.	Granite	Same granite as above, stained pink by hematite. Very weakly alt. Leac[illegible]. Pyritization was probably very weak No biotite showing, though some rock appears almost fresh.
256.6	[illegible]	"	"	[illegible]	0.04							LLm. R	"	"	"	Same.
260.4	3.8	"	"	82	0.02							LLm Tr.	"	"	"	Same.
267.9	7.5	"	"	100	0.02							LLm tr.	Moderate Ser.	 Arg	"	Same granite but slightly stronger alt., more hem. More breccias & shearing.
277.7	[illegible]	"	"	100	Tr								"	"	"	Same. Traces of jarosite.
287.7	10.0	"	"	100	Tr								Weak		"	Same.

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu			Mineralization					Alteration		Rock Type	Remarks
					Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other				
[illegible]	10.[illegible]	[illegible]	None	93	0.02							LLm R.	Moderate		GRANITE	Same.
													Arg	Seri		
307.2	9.5	"	"	100	0.04							LLm R.	"	"	"	Same
316.8	7.6	"	"	100	0.04							LLm Mod.	"	"	"	Same
318.5	1.7	"	"	100	2.02				Mod.		Mod	Tr.	"	"	"	Same granite not leached. Diss. & veined cc. & diss. py.
[illegible]	[illegible]	"	"	100	0.02							LLm Mod	"	"	"	Leached hem stained granite as above.
[illegible]	1.3	"	"	100	0.21				Mod.		Mod	LLm	"	"	"	Same, not leached.
[illegible]	1.[illegible]	"	"	100	0.03				Tr.			LLm Tr.	Weak		"	Same granite. No biotite. Fresh appearing pink feld may be secondary. No hem as above.
													Arg			
[illegible]	2.6	"	"	97	6.87				Mod.		Mod.	LLm Tr.	Moderate		"	Same, not leached, diss. py. & cc.
													Arg	Ser.		
[illegible]	12.5	"	"	100	Tr							LLm Mod.	"	"	"	Same granite; leached, hem flooded.
[illegible]	7.9	"	"	100	Tr							LLm Tr	"	"	"	Same. Core solid
[illegible]	7.7	"	"	85	0.02							LLm Tr	"	"	"	Same.
[illegible]	8.6	"	"	97	Tr							LLm Tr.	"	"	"	Same. Color pinkish hem. sp.
[illegible]	9.8	"	2.46	100	Tr							LLm Tr	"	"	"	Same
[illegible]	6.[illegible]	"	2.55	89	0.02							LLm Sp.	"	"	"	Same. More LLm than above. Jarosite on fractures
400.5	7.7	"	2.30	100	Tr							LLm mod.	"	"	"	Same. Sl. more hem staining. LLm locally more abundant. Some vertical fracturing.
418.1	7.[illegible]	"	2.74	[illegible]	[illegible]							LLm mod.	"	"	"	Same, as above no vert frac. Some [illegible] LLm fr. diss.

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Property *Sacaton*

HOLE NO. *5.12*
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Logged By *R.K.K.*

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks
[illegible]	10.1	[illegible]	2.45	100	Tr.							Llm mod	Moderate Arg	 Ser.	GRANITE	Same as above.
425.0	6.8	"	2.45	94	Tr.							Llm Tr.	"	"	"	Same, but slightly less Llm.
[illegible]	9.6	"	2.50	90	Tr.							Llm Tr.	"	"	"	Same. Core slightly more broken. Llm. more abundant.
44?.5	9.9	"	2.73	100	Tr.			CuOx R.				Llm mod	"	"	"	Same.
45?.?	9.7	"	2.45	100	0.12			CuSi CuOx				"	"	"	"	Same: At 451 ±1' CuSi At 452 spots CuOx.
[illegible]	10.?	"	2.52	[illegible]	0.08			CuOx				"	"	"	"	Same: More hem. than above. CuOx at 457'
[illegible]	7.?	"	2.51	96	0.0?	0.06		CuOx				"	"	"	"	Same: CuOx, diss. at 4?? . Less hem.
[illegible]	6.7	"	2.57	85	0.02							Llm Tr.	"	"	"	Same: Core softer. Some vert. shearing and brecciation. [illegible] coat on frac.
[illegible]	6.5	"	2.53	52	0.17	0.10		CuSi				Llm mod	Strong Ser	 Arg.	"	Same. Light color. Hem. sp. Vert shearing. Trace CuCO3
500.?	15.5	"	2.32	85	2.12			CuSi $CuCO_3$					Moderate Arg.	 Chl.	ANDESITE	Andesite porph. Dark green. [illegible] fn-gr rex to chlorite. Feld. pheno lath-shaped and alt. to clay. Cu Ox. + Si. on fractures. Feld. pheno generally < 1 mm.
51?.0	11.7	"	2.38	65	2.21			"					"	"	"	Same.
515.0	3.8	"	2.58	100	0.14	42.9 @ 1.50						Llm mod.	Moderate Ser.	 Arg	GRANITE	Granite same as above andesite
[illegible]	6.6	"	2.52	[illegible]	0.52	0.32		CuO[illegible]					Arg.	Chl.	ANDESITE	Same as above and [illegible] with only sparse [illegible] staining

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Property SACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks
[illegible]	4.6	"	2.48	98	0.02							LLm Sp.	Moderate Arg.	Ser	granite	Same granite as above, Very little hem. Core solid.
[illegible]	7.6	"	2.56	100	Tr							"	"	"	"	Same
[illegible]	[illegible]	"	2.54	100	0.04							"	"	"	"	Same
[illegible]	4.0	"	2.50	100	0.02							"	Weak Arg.	Ser.	"	Same : some fresh feld.
553.4	6.1	"	2.51	97	Tr							"	"	"	"	Same.
[illegible]	9.6	"	NONE	98	0.22			Cu Ox Tr				LLm Tr	"	"	"	Same.
570.6	9.6	"	2.50	93	Tr.							LLm Sp.	"	"		Same.

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LO
																UPPER PORTION OF HOLE LOGGED B
																ROGER K. KIRKPATRICK 5-24-62.
																HOLE DEEPENED 6·16·62 TO 7·5·62.
570.6-579.9	9.3			—												REAMED
579.9-586.0	6.1	NX WL	2.55	100	0.02							LIm^{Tr}	Ser &	Feld	GR	Pale reddish gr, feld. Wk Fe ox & ind [illegible]. Mod j
586.0-[illegible]	2.8	"	2.53	75								LIm^{Tr}	do		GR	Do
[illegible]-597.4	8.6	"	2.55	97	0.02				Tr		Tr	LIm	do		GR	Do - somewhat more pk-gr. Sct. ind. hm. Some
[illegible]	8.8	"	2.58	100	0.02			$CuCO_3^{wk}$				LIm	do		GR	Do - Local conc. diss ind hm & LIm. $CuCO_3$ on
606.2-616.0	9.8	"	2.52	96	0.07			$CuCO_3^{wk}$ & $CuSiO_3$				LIm^{Tr}	Ser		GR	Do - Some fg aplitic phases. Zone of bx dips 50°±, in
61[illegible]	10.0	"	2.62	99	0.25			$CuCO_3^{wk}$ & $CuSiO_3$				LIm^{Tr}	do		GR	Do - fg aplitic phases. Diffused $CuSiO_3$ & $CuCO_3$. Diss. i
626.0-[illegible]	10.0	"	2.61	99	0.18			Cu $CuSiO_3^{wk}$ & $CuCO_3$					do		GR	Somewhat more qtzose. Diffused $CuSiO_3$-CO_3. Wk ind h
636.0-[illegible]	10.0	"	2.59	95	0.17	124.4' 0.09		$CuSiO_3^{Tr}$ & $CuCO_3$				LIm^{Tr}	do		GR	More purple. Sct Tr ind hm & tr LIm. Tr $CuSiO_3$
			— —	—	— —	645 pd bottom										
[illegible]	4.8	"	2.48	20	0.21			$CuSiO_3^{Tr}$ & CO_3				LIm^{Tr}	do		GR	Do - Some bleached zones w/conc. diss ind[illegible].
[illegible]	7.7	"	2.44	71	0.04			$CuSiO_3^{Tr}$ & CO_3				LIm^{Tr}	do		GR	Tr LIm - $CuSiO_3$-CO_3. Some ind hm & gg
[illegible]	8.1		2.45	83	0.02							LIm^{Tr}	do		GR Bx	Some aplitic phases, shearing, and mylonite
66[illegible]-674.7	8.0	"	2.58	67	0.02							LIm^{Tr}	do		GR Bx	Leached, pitted, & bx. Sct diss ind hm & LI
674.7-682.4	7.7	"	2.49	77	0.02							LIm^{Tr}	do		GR Bx	Do
682.4-691.6	9.2	"	2.50	84	0.03							LIm^{Tr}	do		GR Bx	Do - fair amount shearing and mylonit
691.6-698.7	7.1	"	2.56	87	Tr							LIm^{Tr}	do		GR Bx	Do - Lt gr w/variable fog - leached, w/ ind hm & L
698.7-[illegible]	7.3	"	2.[illegible]	86	0.02							LIm	do		GR Bx	Do - some aplitic phases. Slight increase in LI
[illegible].0-714.0	10.0	"	2.56	95	Tr							LIm	do		GR Bx	Do - numerous white, kaolinized feldspars.

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Property SACATON

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu			Mineralization					Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
					Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other				
[illegible]5.0-725.0	[illegible]	NX WL.	2.50	91	0.02							Llm Tr	Ser &	Kaolin.	GR-GRBx	Do - pk-gr, Leached & ox w/diss ind hm & Llm
[illegible]25.0-732.7	7.7	"	2.46	90	Tr							Llm Tr	Ser	-	GR	Do - qtzose, purple-gr-leached & ox
[illegible]32.7-736.8	4.1	"	2.52	94	1.40				Mod		St		do		GR	Do - gr, qtzose w/diss & stringers of [illegible]cc
[illegible]36.8-741.3	5.5	"	2.50	98	0.05				Tr		Tr	Llm	do		GR	Do - but almost completely ox & leached
[illegible]41.3-751.3	10.0	"	2.58	93	0.03							Llm	do		GR	Do - Basically gr w/sct conc. diss of ind hm &
[illegible]	9.1	"	2.56	93	0.02							Llm Tr	do		GR	Do - Fair number of hm vns.
[illegible]60.4-768.5	8.1	"	2.48	91	0.05	123' @	0.08					Llm	do		GR	Do - Some zones display kaolinized white f
[illegible]	5.0	"	2.59	98	0.25			$CuSiO_3$ Tr	Tr		Tr	Llm	do		GR	Gr - Diss ind hm, Llm, and tr py-cc & $CuSiO_3$
[illegible]	5.0	"	2.59	98	13.42				St		St	Llm	do		GR	Do - Partially leached & ox w/high angle vns mass
[illegible]78.5-7[illegible]	10.5	"	2.62	100	0.22				Tr		Tr	Llm St	do		GR-Mz(?)	Ox - fg, pseudo phorp some zones. Rather st hm & Llm
[illegible]	10.0	"	2.50	100	0.02							Llm	do		GR-GRBx	Pk-gr, variable fog. Leached & ox - ind [illegible] & L
[illegible]	[illegible]	"	2.56	100	0.96			$CuSiO_3$ Tr	Mod		Mod	Llm Tr	do		GR-GRBx	Gen. qtzose & ox. Mod fog. Narrow bx zone w/py-cc
[illegible]	10.0	"	2.59	90	2.41			$CuSiO_3$ St	St		St	Llm Tr	do		GRBx-Mz	Few small patches Mz. Bx w/py-cc. St $CuSiO_3$ diffused, i
[illegible]	7.4	"	2.49	95	0.19			$CuSiO_3$				Llm Tr	do		GRBx-Mz	Do - Sct diffused $CuSiO_3$, diss ind hm & tr l
[illegible]	3.7	"	2.56	100	0.11			$CuSiO_3$ Tr				Llm Tr	do		GRBx-Mz	Do
[illegible]	4.8	"	2.52	91	0.14			$CuSiO_3$ Tr				Llm Tr	do		GRBx-Mz	Do - GR lt gr and Mz dk & hm flooded.
[illegible]	3.9	"	2.52	96	1.53			$CuSiO_3$	St		St		do		GRBx	Partial hm flooding. Sct $CuSiO_3$. Bx & gg w/py-cc
[illegible]-8[illegible]7	6.1	"	2.57	94	1.18			$CuSiO_3$ Tr	Tr		Wk	Unknown grn Cu ox	do		GR	Lt gr. Sct diss py-cc. Unidentified grn Cu oxide, min
[illegible]-8[illegible].0	3.3	"	2.50	93	0.08								do		GR	Lt gr, br & crushed. Sct diss ind hm. Some feld

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
848.0-856.0	8.0	NX[illegible]	2.46	98	0.10	95.5' @ 1.29	17.	Unknown Tr	grn Cu	ox (SO_4?)		Llm	Ser		GR	gr to reddish gr w/variable fog & feld development
856.0-864.0	8.0	"	2.52	95	0.18			$CuSiO_3$ Tr	Tr		Tr	Llm Tr	do		GR	Do
864.0-867.9	3.9	"	2.50	91	1.05				Mod		St		do		GR & DIABASE	GR similar to above. Intrusive interrupts fg diaba[illegible]/py
867.9-875.4	7.5	"	2.54	90	2.58	1740 ft / 134.6			Mod		St		do		DIABASE	gr-grn, br, w/diss & str py-cc. Diffused, brn F
875.4-88[illegible]	9.[illegible]	"	2.65	86	1.46				Mod		St	Llm Tr	do		DIABASE	Do - some sil vns & pat's. Diss & str py-cc
[illegible]	[illegible]	"	2.62	69	0.56				Mod		Mod		do		DIABASE	Do - vfg diss py-cc.
884.[illegible]-88[illegible]	3.0	"	2.52	38	0.25				Mod	Tr	wk		do		DIABASE	Do
[illegible]	[illegible]	"	2.55	90	0.24	43.9' @ 1.18			Mod	wk	Tr		do		DIABASE	Do - vns & pats of gr sil. Sct diss. cpy.
[illegible]	[illegible]	"	2.63	12	1.21				Mod	St			do		DIABASE	Do - Sct diss & frac. deposits cpy
[illegible].1-90[illegible]	1.2	"	2.57	82	0.22				wk	Tr	wk		do		DIABASE	Do - Frags small, w/gg. Suls diss & in vlt
909.9-915.4	5.5	"	2.60	78	0.29				wk	Tr	Tr		do		DIABASE	Flt zone or bx. Small crushed frags. S[illegible] diss
915.4-92[illegible]	[illegible]	"	2.4[illegible]	38	0.33				Mod to St			Llm	do		DIABASE	Shed, br. Py diss & in vns w/hm. Some ox & Llm
923.4-927.8	4.4	"	2.58	65	0.15				Mod to St		Tr	Llm	do		GR	Highly ser, br. py w/tr cc throughout. Ind hm & L
927.8-93[illegible]	[illegible]	"	2.51	90	0.42				Mod		Tr		do		DIABASE	Br, w/fair red to brn Fe ox on frac. Diss py w
931.4-936.5	5.1	"	2.4[illegible]	100	0.[illegible]				Mod	Tr	wk	Llm	do		DIABASE	Br, w/py-cpy diss. Vns of py-cc-hm. Fe ox on
93[illegible]-940.5	4.0	"	2.56	63	0.52				Mod	wk		Llm Tr	do		DIABASE	Do - cpy associated w/sil vlts. py diss. Llm on fr
940.5-942.5	2.0	"	2.40	100	0.20				St			Llm	do		DIABASE	Do - Massive vn py-hm. Some Llm on frac.
942.5-945.0	2.5	"	2.5[illegible]	100	0.34					Tr		Llm St	do		DIABASE	Do - Well br, w/gg. St Llm on one frac.
945.0-951.[illegible]	6.[illegible]	"	2.47	74	0.57				Mod	wk		MoS_2 Tr	do		DIABASE	Do - br, gg. Diss py - wk cpy. Tr MoS_2 on frac.

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
51.4-95[illegible]	8.0	NXWL	2.59	100	0.34				Mod	wk			Ser		DIABASE	Do - Less br. cpy w/sil vlts & diss w/py
59.4-[illegible]6.0	6.6	"	2.66	93	0.51				Mod	Mod			Ser		DIABASE	Do - once again highly br.
66.0-975.5	9.5	"	2.60	98	0.32				Mod	Mod			Ser		DIABASE	Do - some sil vns & gg
75.5-982.7	7.2	"	2.68	94	0.44				Mod	Mod			Ser		DIABASE	Do - crushed & reconstituted. Py-cpy diss
82.7-9[illegible]	7.2	"	2.69	98	1.05				Mod	St		MoS_2^{Tr}	Ser		DIABASE	Do - sil vns w/pods cpy - hm & MoS_2 smeared on f
[illegible]	7.[illegible]	"	2.60	65	0.23				Mod	Mod		MoS_2^{Tr}	Ser		DIABASE	Do - vfg diss py-cpy. Few smears MoS_2 on fr
97.0-1005.[illegible]	8.8	"	2.50	99	0.34				Mod	Mod			Ser		DIABASE	Do - still well br. py-cpy diss.
[illegible]-1014.4	8.[illegible]	"	2.49	95	0.32				wk	Mod		MoS_2^{Tr}	do		GR	Similar to that above. Pale red-gr. Sct chlor., gg. Dis
014.4-[illegible]	7.1	"	2.58	65	0.22				wk	wk		MoS_2	do		GR	Do - well br w/gg. Numerous smears MoS_2
021.5-[illegible]	1.[illegible]	"	2.57	36	0.21				wk	wk		MoS_2	do		GR	Do - highly br frags & gg.
23.1-[illegible]	2.[illegible]	"	2.57	82	0.17				wk	wk			do		GR-DIABASE	Prin. GR w/rolled pebbles DIABASE in gg. Some hm
[illegible]	6.[illegible]	"	2.60	64	0.33				wk	Mod			do		GR	Mostly highly crushed & granulated w/gg. vfg py-c
32.0-104[illegible]	8.[illegible]	"	2.58	97	0.16				wk	wk		MoS_2^{Tr}	do		GR	Do - py-cpy diss. hm vlts w/MoS_2. Much gg
40.2-10[illegible]	7.9	"	2.55	90	0.23				Mod	wk		MoS_2^{Tr}	do		GR	Do - well broken. hm on fracs & in vlts w/MoS_2
48.1-[illegible]	6.[illegible]	"	2.64	68	0.43				Mod	Mod		MoS_2^{Tr}	do		GR	Br, gg, w/sct hm & chlor. Diss py-cpy. MoS_2 tr on frac.
54.7-1[illegible]2.1	7.4	"	2.48	87	0.30				wk	Mod			do		GR	Do - crushed, w/some gg. wk, sct hm & chlor.
62.1-1066.0	3.9	"	2.56	34	0.20				Mod	Mod			do		GR	Do
66.0-[illegible]	8.[illegible]	"	2.53	[illegible]	0.29				Mod	Mod			do		GR	Do - Still well br w/some gg. Small pod cpy
73.5-1076.[illegible]	3.[illegible]	"	2.56	[illegible]	0.33				Mod	Mod		MoS_2^{Tr}	do		GR	Do - fg. diss cpy & wk hm throughout. Tr MoS_2 on

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GEOLOGIC – ASSAY LOG

Property Sacaton

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO LOG
[illegible]073.1-[illegible]	7.6	[illegible]	2.54	93	0.38				Mod	Mod			Ser	GR	Do - Sct pods & diss cpy. Wk hm
108[illegible].0-1[illegible]3.0	7.0	"	2.55	93	0.39				Mod	Mod		MoS_2 Tr	do	GR	Do - Some feld developments alt. to grn clay
[illegible]3.0-1100.9	7.9	"	2.56	97	0.39				Wk	Mod			do	GR	Do - gen more qtzose & sil w/increase in [illegible]t & f[illegible]
[illegible]5.9-1113.3	7.4	"	2.48	95	0.23				wk	wk			do	GR	Do - gr, dense. Local conc. grn, chlor (?) feld.
[illegible]8.3-1113.2	4.9	"	2.55	100	0.25				wk	wk		MoS_2 Tr	do	GR	Do - Local conc. Fe ox stained feld, biot & chlor.
1113.[illegible]-1120.1	6.[illegible]	"	2.45	95	0-.25				wk	wk		MoS_2 Tr	do	GR	Do
1120.1-1124.2	4.1	"	2.52	91	0.12				Mod	Tr		MoS_2 Tr	do	GR	Do - br, sh'ed, some gg. Tr MoS_2 on frac. Wk, s[illegible]
[illegible]	8.7	"	2.51	92	0.42				Mod	Mod			do	GR	Sct conc alt'ed feld. Diss cpy associated w/chlor.
113[illegible]-113[illegible]	4.6	"	2.52	[illegible]	0.30				Wk	Mod			do	GR	Do - feld. development common. Qtzose, wk hm.
1137.5-1143.0	5.5	"	2.54	98	0.37				Wk	Mod			do	GR	Do - fair amount biot
1143.[illegible]-1153.0	10.0	"	2.55	100	0.40				Wk	Mod			do	GR	Do - gr, qtzose. Texture suggests shearing & [illegible]nstitu[illegible]
115[illegible]-[illegible]	8.5	"	2.52	100	0.27				wk	Mod		MoS_2 Tr	do	GR	Do - Local conc. feld. developments.
116[illegible]-1170.1	8.7	"	2.54	[illegible]	0.24				wk	wk		MoS_2 Tr	do	GR	Do. Tr MoS_2 w/hm. Basal portion bx, gg & hm vn'ed.
1170.1-1173.[illegible]	3.3	"	2.46	85	0.17				Mod	Tr			do	GR	Do - br, w/gg. Some black gg w/py. Sct feld & chlo[illegible]
1173.4-1176.6	3.2	"	2.53	89	0.36	26.3 @ 0.33			Wk	Mod			do	GR	Do - highly br, w/gg. Feld developments. Sct. py-cp[illegible]
1176.6-1182.2	5.6	"	2.54	100					wk	Mod		MoS_2 Tr	do	GR	Do - still displays wk hm along frac. Diss cpy
1182.2-11[illegible]	7.4	"	2.52	[illegible]					Wk	Wk			do	GR	Do - gr, sil frags in gg. Sct py & wk hm
[illegible]-1193.6	4.0	"	2.55	47					wk	Wk			do	GR	Do - mostly lt gr, reconstituted gg

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GEOLOGIC – ASSAY LOG

Property SACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
93.4-1197.0	3.6	NXWL	2.42	82					Mod	tr			ser		GR	Do - Frags in gg displaying streaks of dk, crushed
97.0-1200.8	3.8	"	2.45	98					Mod	tr			do	-	GR	Do - some increase in hm & chlor
200.8-1202.4	1.6	"	2.44	81					wk	Tr			do		GR	Do - Mostly ground pebbles in gg
BOTTOM																

Final Depth 1241.5
Collar Elevation 1441'
Coordinates 23126.95 N 22578.54 E
Inclination -90°

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO
0.0 - 89	89	4 3/4" Bb													ALLUVIUM	BEDROCK REP'T AT 89 FT.
89 - 100	11	"			0.29										GRANITE	ASSUMED TO BE ROCK SIMILAR TO THAT DESCRIBED BELOW) 223 FT.
100 - 110	10	"			0.10											
110 - 120	10	"			0.02											NOTE: FOLLOWING REMARKS ARE FROM SHIFT REPORTS.
120 - 130	10	"			0.04											py and cc (?) in mud at 130'
130 - 1[illegible]	10	"			0.10											py and cc in cuttings at 131'; appears to a mixed zone w/vein of sulfide in oxide
140 - 1[illegible]	10	"			0.03											
[illegible]	10	"			0.02											
[illegible]	[illegible]	"			0.02											Few cuttings w/sulfide around 165'
170 - 180	10	"			TR											
180 - 190	10	"			TR / 0.02	Two ← Assays										
190 - 200	10	"			0.02											
200 - 2[illegible]	10	"			0.03											
210 - [illegible]	5	"			0.03											White chips w/py & cc at 212'
215 - 2[illegible]0	5	"			0.04											Clean sulfide zone from 218'-223'
220 - 22[illegible]	3	"			0.21											
223 ±	-	"			0.24										GRANITE	
223 - [illegible]1	8.1	[illegible]	2.69	97	0.3[illegible]			TR Turgite	✓		wk	MoS_2 TR	Serici	tized	GRANITE	Light gray, medium grained, and wl sericitized, it is still quartzose and competent. High angle veins of py-cc replacement, and [illegible] [illegible] association. Disseminations of py & cc [illegible] of MoS_2 and turgite

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Property SACATON

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Logged By NPW 5-29

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks — CORE SPLIT PRIOR TO LOG
[illegible]	6.5	NXWL	2.74	95	0.02				✓		TR	Llm TR	Sericitized		GRANITE AND PORPHYRY (?)	Similar to above to approx 231.7' where a 1.5 ft zone of well cement breccia with a hm matrix forms a ct with a fine grained, light olive-grey porphyry (?) or porphyritic phase of the granite displaying 1-2 mm, euhedral to subhedral phenocrysts of white feldspar. Oxidation and leaching w/ Llm common in this zone. Balance of run, throughout and below another bx zone consists of the above granite exhibiting py-cc in veins and disseminations alternating with intervals of oxidation, leaching, and hm diffusion.
[illegible]	10.0	"	2.69	98	0.03				✓		TR	Llm TR	do		GRANITE	Similar to above. Generally light green gray, quartzose but displays zones of bx and/or hm flooding alternating with narrow, high angle bands of oxidation, leaching w/ lim after py boxwork and traces of Llm. Some specularite and traces of turgite in veins of massive hm. Several zones exhibit diss. py with thin films of cc
[illegible]	[illegible]	"	2.50	100	0.13											
									✓		wk	Llm	do		GRANITE	Similar to above but progressively more hm stained, altered, and brecciated. Upper portion of run displays diss. py and cc w/ some oxidation along narrow high angle zones. Basal portion completely oxidized. Indigenous hm and Llm throughout
[illegible]-273.5	10.0	"	2.51	90	0.02							Llm	do		GRANITE	Similar to basal portion of above run. Well altered and exhibiting variable flooding by hm and Fe oxides ranging from yellow to red with scattered Llm. Almost entire run is brecciated and cemented in a hm matrix.

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GEOLOGIC - ASSAY LOG

Property SACATON

HOLE NO. S-3[illegible]
Sheet No. 3 OF 15
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Logged By MO 5-2[illegible]

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks: CORE SPLIT PRIOR TO LO[illegible]
[illegible]	3.2	NXWL	2.61	92	0.02								Sericilization		GRANITE	Similar to above. Mass of rather high[illegible]
																broken frags of breccia flooded by
																hm.
267.1-27[illegible]	7.9	"	2.56	91	0.03							Llm	do		GRANITE	Similar to above. Purplish gray [illegible] lig[illegible]
																greenish gray w/ variable hm [illegible]
275.0-2[illegible]	7.5	"	2.60	89	0.02							Llm			GRANITE	indigenous lim and Llm. Distorted and
																brecciated throughout.
[illegible]	3.2	"	2.61	83	0.02								do		GRANITE	The granite, similar to above, extends
															AND	to approx. 283.5 ft. Below a broken
															Mz. PORPH	contact is a monzonite porphyry with
																v.f. grained dk. green groundmass hosting
																1-2 mm white, euhedral to subhedral
																feldspar phenocrysts. Porph. displays [illegible]
																strong hm along fractures. Enough qtz [illegible]
																in porph to probably classify it as a g[illegible]
																monzonite. Wk disseminations in granite
																completely oxidized. Traces of indigenous
																lim only on fractures in porph.
[illegible]	2.1	"	2.48	95	0.06							Llm^{TR}	do		Mz. PORPH	Similar to above. Small blebs of [illegible]
															Bx.	qtz and 1-2 mm books of chlorite after
[illegible]	8.[illegible]	"	2.70	[illegible]	0.12							Llm	do		do	biotite common throughout. Generally well
																brecciated and well [illegible] in a hm
[illegible]	7.4	"	2.[illegible]	100	0.22								do		do	flooded matrix. Localized, wk. diss. [illegible]
																indigenous lim. Moderate occur. of ye[illegible]
[illegible]	9.[illegible]	"	2.5[illegible]	97	0.14							Llm^{TR}	do		do	to brick red Fe. oxides and indigenous
																lim along w/ some Llm on fractures.
																Traces of Mn oxide and occasional
																jarosite. Scattered, generally bleached
																frags. suggest inclusions of the granite
313.4-[illegible]	[illegible]	"	2.6[illegible]	94	0.10			Cu silicates and				Llm^{TR}	do		Mz. PORPH	Initially similar to above but gradational
								carbonates							AND	(?) into a granular, medium to fine grained,
															GRANITE(?)	quartzose rock exhibiting small [illegible] feldspar
																phenocrysts in an often mobile texture.
																Color ranges from the hm flooded red
																phase through greenish gray to grey.(co[illegible]

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GEOLOGIC – ASSAY LOG

Property SACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO LOG
[illegible]	(CON'T.)	NXWL											Sericitization	Mz Porph Bx.	(CON'T. FROM SHEET No.3) Entire intercept completely oxidized, displaying scattered indigenous lim and traces of Llm. Very pale green Cu silicates and carbon. on a few fractures.
32[illegible]	5.[illegible]	"	2.52	98	0.08							Llm^{TR}	do	Mz Porph Bx.	Similar to above. Generally gray to reddish gray, quartzose and well altered. Hm and indigenous lim along fractures. Local diss. of indigenous lim. Some Llm. Bx somewhat less
[illegible]	5.1	"	2.60	92	0.09							Llm^{TR}	do	Mz Porph Bx	Similar to above. More brecciated. Groundmass generally hm flooded and hosting 1-2 mm feldspar phenocrysts and in the upper portions, numerous 2-3 mm blebs of clear qtz. Hm variable, locally strong jarosite, and scattered traces of indigenous lim and Llm. Trace of Mn oxide.
[illegible]	10.[illegible]	"	2.5[illegible]	96	0.02							Llm	do	Mz Porph Bx AND GRANITE(?)	Similar to above. Quartzose [illegible] generally medium grained. Grayish purple - with hm common throughout. Few intervals closely approximate a granitic texture. Indigenous hm and Llm somewhat strong. Traces of Mn oxide.
[illegible]	[illegible]	"	2.61	9[illegible]	0.02							$Llm^{ST.}$	do	Mz Porph Bx AND GRANITE (?)	Similar to above. Very highly brecciated hm stained. Rather voggy throughout some breccia zones and along fractures. Abundant indigenous hm and Llm in these zones. All of run very quartzose and closely resembling granite.

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay – % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO L
[illegible]	4.6	NX DL.	[illegible]	100	0.76				✓		✓		Sericitization		Mz PORPH Bx AND GRANITE(?)	Similar to above. Somewhat more highly sericitized and generally grayish blue in color - mottled by hm. Very fine grained py and cc diss. throughout run
[illegible]	8.0	"	2.55	100	0.07			Cu silicates					do		Mz PORPH Bx AND GRANITE(?)	Similar to above. Well brecciated and rather highly quartzose through out. Breccia matrix hm flooded wh frags are gray green. Those that were mineralized are completely leached and oxidized. One fracture displays spongy Cu silicates.
[illegible]	[illegible]	"	2.5?	98	0.03								do		Mz PORPH Bx AND GRANITE(?)	Similar to above. Less quartzose and more porphyritic in character. Brecciat and hm flooding throughout. Oxidation a leaching complete.
[illegible]	4.?	"	2.54	92	0.04							Llm^{TR}	do		Mz PORPH Bx AND GRANITE(?)	Similar to above in all respects. Smear and brecciation rather extreme. Few traces of Llm and Mn oxides
[illegible]	3.?	"	2.62	90	0.07							Llm^{TR}	do		GRANITE	Similar to above. Brecciated, smeared, and mobile. More granitic in nature and displaying variable hm flooding Leached and pitted - with scattered disseminations of indigenous hm and Llm.
[illegible]	7.?	"	[illegible]	97	TR							$Llm^{ST.}$	do		GRANITE	Similar to above. Overall color a purple - gray. Quartzose, brecciated and exhibiting variable hm flooding rather strong indigenous hm and Ll in disseminated pods and as fracti Scattered speculorite and an underlin of chlorite.
[illegible]	8.?	"	2.51	10?	TR							Llm^{ST}	do		GRANITE	

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HOLE NO. S-3[illegible]
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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks — Core Split Prior to L[illegible]
[illegible]	10.0	NX/01	2.57	98	0.02							Llm	Sericitization		GRANITE	Similar to above. Quartzose, brecc[illegible] and moderately hm stained in some zo[illegible]. Scattered vugs and disseminations o[illegible] indigenous hm and Llm. Veinlets of specularite. Some jarosite.
[illegible]	3.0	"	2.5[illegible]	98	0.02							Llm TR	do		GRANITE AND Mz PORPH Bx	The granite, rather bleached, is similar to above. It terminates in a broken but seemingly gradational contact at approx. 405.5 ft. Below this point the rock is a fine grained, grey porphyry having 1-2 mm white to pale green feldspar phenocrysts. Variable hm flooding. Sericitization similar to above. Some frags display a green chlorite undertone. Distortion and brecciation throughout. Completely oxidized, with disseminations, pods, and veinlets of indigenous hm, lim, and [illegible] of Llm. Some specularite and jarosite.
[illegible]	1.2	"	2.62	70	TR							Llm TR			Mz PORPH AND GRANITE Bx	Similar to above. A mixture of granite frags and porphyry in a breccia matrix of hm. Again, the two rock types are seemingly almost transitional. Mineralization similar to that above.
[illegible]-414.0	6.0		2.68	95	TR										GRANITE AND Mz PORPH BX	Similar to above. Upper portion of run alternate intercepts. Basal portion a very dense, dk green, hm flooded porphyry w/white feldspar phenocrysts. Specularite in veinlets and disseminations. Scattered indigenous hm and some jarosite. Granite exhibits distortion; porphyry does not. Brecciation along narrow 45°-50° zones.

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Property S ACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay – % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO L
[illegible]-4[illegible]	10.[illegible]	[illegible]	2.5[illegible]	100	TR.								Sericitization		MzPorph AND GRANITE (?) Bx	Porphyry similar to above except for increased chlorite after biotite content and numerous small blebs of qtz. One intercept appears to a smeared, distor and bx mass of granite frags, oxidized, with minor indigenous hm scattered specularite. Variable hm flooding and fair amount of jarosit
12[illegible]-[illegible]	[illegible]	"	2.56	98	TR							Llm^{TR}	do		GRANITE AND MzPorph Bx	Principally the former, generally lig pinkish to purplish gray - displaying vario hm staining along fractures and loca concentrations of disseminations of Llm and indigenous hm. Porphyry dk green, chloritic. Jarosite common.
[illegible]			2.70	96	0.02			TR Cu carbonates				Llm^{TR}	do		MzPorph AND GRANITE Bx	Basically similar to above. Altern intercepts are identifiable as well as those which display an inter-mediate texture and suggest a impregnation or injection of the granit by the porphyry. Color ranges from pale yellowish gray to dk green - wi variable hm flooding in the dk, more porphyritic intervals. Local disseminat ions of indigenous hm and possible Ll in the more granitic zones. Traces of Cu carbonates along one vuggy vein. Some specularite and jarosite.
[illegible]-[illegible]2.5	10[illegible]	"	2.[illegible]	100	0.02							Llm^{TR}	do		MzPorph AND GRANITE Bx	Similar to above in all respects. Somewhat more physical brecciatio and an increase in indigenous hm. Scattered jarosite and traces of Ll

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HOLE NO. S-[illegible]
Sheet No. 8 of [illegible]
Date Completed
Logged By NPW [illegible]

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO
[illegible]	9.9	NX[illegible]	2.66	96	0.05			TR Cu carbonate				Llm TR	Sericitization	Mz PORPH AND GRANITE Bx	Similar to above. Much of the [illegible] appears to be transitional between the two types. Brecciation and v[illegible] hm staining throughout. Dissem[illegible] indigenous hm and Llm. Scatt[illegible] Trace of Cu carbonates in a fe[illegible] fine veinlets.
[illegible]-470.[illegible]	8.0	"	2.66	100	0.02							Llm TR	do	Mz PORPH AND GRANITE Bx	Similar to above. Again displays char[illegible] istics from those of a porphyry to thos[illegible] of a granite. Color ranges from light purple gray to hm flooded red. Brecci[illegible] common. Veinlets and diss. of specular Fair amount of indigenous hm and som[illegible] Llm. Undertone of chlorite in some zones.
[illegible]	9.9	"	2.66	100	0.03							Llm TR	do	Mz PORPH AND GRANITE (?) Bx	Generally similar to above but trending more toward a very fine grained gr[illegible] chloritic phase. Locally gra[illegible] wit[illegible] a fair amount of specularit[illegible] and variable hm flooding throughout. Scattered indigenous hm and Llm. Som[illegible] jarosite.
4[illegible]-488.7	8.4	"	2.70	100	TR							Llm TR	do	Mz PORPH Bx	Similar to above but more strongly suggesting porphyry throughout. Dense somewhat quartzose, and ranging from a chloritic gray green to a pale o[illegible] gray. Smeared, mottled by variable flooding, and brecciated throughout. Pods and high angle veinlets and fracture deposits of indigenous hm Llm. Jarosite common.

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Core Assay - % Cu Non-S	Core Assay - % Cu Average	Mineralization Oxides	Mineralization Pyrite	Mineralization Cpy	Mineralization Cc	Mineralization Other	Alteration	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO LOG
-88.7-495.0	6.3	NXWL	2.72	100	0.33			Cu (?)	wk		wk	Llm TR	Serici	tization	Mz PORPH Bx	Similar to above. Somewhat quartzose Ranging from dense, fine grained to medium grained. Color from light greenish gray to hm flooded. Scattered indigenous hm and tr. Llm. Few fractur deposits of Mn oxide which give a wk Cu reaction to Short's micro-chem tes Small vein of py and cc just above base of run.
195.0-502.0	7.0	"	2.61	99	0.05				TR		wk	Llm	do		Mz PORPH AND GRANITE Bx	Similar to above but strongly suggestin a highly distorted granite below approx 498 ft. Color ranges from pale reddish or greenish gray to hm red from flooding. Disseminations of indigenous hm and Llm One pod of sooty gray cc admixed w/ iron oxide and tr. of py.
02.0-512.0	10.0	"	2.60	100	1.00				wk		✓	Llm	do		Mz PORPH AND GRANITE Bx	Similar to above. Appears as a smear granitic texture with zones and patches of pale green feldspar development. Variable hm along fracture and flooding local zones. Disseminations and veins of indigenous hm and Llm Throughout all but last 1-1.5 ft. Thi basal interval exhibits veins and disseminations of py and cc
12.0-517.2	5.2	"	2.50	94	0.09			Cu(?)	TR		TR	Llm	do		Mz PORPH Bx	The above granitic rock goes immedia into a highly brecciated zone followed by a rather dense, dk gray to reddis brown phase of the porphyry hosting the feldspar phenocrysts and small blebs of clear qtz. Fine disseminatio of indigenous hm and Llm throughout Some diss py and cc in upper 0.5 ft. One fracture displays Mn oxide with probable admixed Cu oxide (melaconite)

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO

GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. 5-30
Sheet No. 10 OF 15
Date Completed
Logged By NPW 6-6-[illegible]

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks — CORE SPLIT PRIOR TO LO
7.2-523.3	6.1	NXWL	2.61	83	0.05							LIm TR	Sericitization		MzPORPH-GRANITE BX AND ANDESITE	The former is essentially similar to above - appears principally granitic - gray, quartzose, partially hm flooded and carrying fine disseminations of indigenous hm. At approx 520 f[illegible] broken ct. initiates an interval of d gray-green, fine grained andesite displays some hm and indigenous lim on fractures. Brecciation of granitic portions common.
23.3-528.3	5.0	"	2.60	93	0.02			TR Cu carbonates Melaconite(?)				LIm TR	do		ANDESITE AND GRANITE OR MzPORPH BX	Principally the Latter. Only a short intercept of andesite. Texture of the former still intermediate - quartzose, mobile, brecciated, and displaying variable hm flooding. Scattered indigenous hm, mostly in disseminations Traces of Cu carbonate and possible melaconite along a few fractures in the andesite.
28.3-535.0	6.7	"	2.62	93	TR			TR Melaconite(?)				LIm ST	do		GRANITE BX AND GRANITE	Similar to above - smeared, mobi[illegible], and brecciated down to approx. 532 ft. Below this point rock is more quartzose and bleached and shows less disruptior of original texture. Variable hm flood and rather strong disseminations of indigenous hm and LIm. Throughout. Tr of Mn oxide and possible melaconite on a few fractures.
35.0-545.0	10.0	"	2.62	96	1.06				ST		ST	LIm TR	do		GRANITE AND MzPORPH	Similar to above but going almost immediately into a more altered and bleached zone of what appears to be admixed granite and MzPorph. Disseminations and stringers of py and cc below approx. 536 ft. Three 25-40 mm low angle veins of massive py-cc in unsplit core [illegible] not represented by [illegible]

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-30

Date Completed
Logged By NPW 6·8·

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO L
545.0-555.0	10.0	NXWL	2.61	94	0.76				✓		✓	Llm	Sericitization		GRANITE	Similar to above. Gray and altered
															AND	with disseminations and high angle veinle
															MzPORPH	of py and cc. Basal portions become
															BX	leached and oxidized with indigeno
																hm and Llm representing the abo
																mineralization. Brecciation common
555.0-564.3	9.3	"	2.74	100	0.08							St Llm	do		Gr-Mz Bx	Admix. rk. Types - sil - mg. Diss Llm. Vn & fog of hm
564.3-572.0	7.7	"	2.68	98	0.35				mod		Rm, Yn	mod Llm	do		Mz Bx-Gr	Prin. Mz. Mix ox - suls. One vn of mass py-cc.
572.0-579.8	7.8	"	2.59	99	0.02							Tr Llm	do		Mz Bx-Gr	Prin. Gr. Sil. w/hm fog. Diss. ind. hm & Llm
579.8-583.8	4.0	"	2.68	100	Tr							Tr Llm	do		Gr Bx	Gen. well bx. variable fog. Tr Llm
583.8-593.3	9.5	"	2.55	100	Tr							Mod Llm	Ser. &	Feld.	Gr Bx	Distorted, bx. Variable fog. Mod ind. hm & Ll
593.3-603.3	10.0	"	2.49	100	0.02							Llm	Ser.		Gr Bx	Well bx. Local fog Diss., frac deposits ind hm &
603.3-613.3	10.0	"	2.52	100	0.03								Ser &	Feld	Gr Bx	Very highly distorted & bx. Fog throughout.
613.3-623.3	10.0	"	2.48	100	0.02			Tr melaconite (?)				Mod Llm	do		Mz Bx-Gr	Admixed. Sct. diss Llm. Variable fog. R jo
623.3-633.3	10.0	"	2.57	97	0.11			Tr melaconite (?)				Mod Llm	do		Gr Bx	Mod fog. Sct ind. hm & Llm. Few vlts CuSi & Cu
633.3-635.8	2.5	"	2.55	97	0.02								do		Mz Bx-Gr	Admixed, highly distorted. Vlts spec & hm. Diss ind h
635.8-645.7	9.9	"	2.46	96	0.03							Mod Llm	do		Mz Bx-Gr	Admixed, v. highly distorted & bx. Vn, diss of mod ind hm &
645.7-651.6	5.9	"	2.56	100	0.02			Tr CuOx (?)	wk		Mod	Llm	Ser		Mz Bx-Gr	Prin. Mz Bx w/ biot. & qtz. Ox except for basal w/ py-
651.6-660.6	9.0	"	3.03 ?	100	2.74				Mod		St		do		Mz Bx-Gr	Prin Mz Bx - bleached - w/ diss & vlts of py-cc
660.6-665.0	4.4	"	2.54	100	3.39				Mod		St		do		Mz Bx	Gray, shed., br., w/ vlts & diss py-cc.
665.0-673.8	8.8	"	2.57	93	0.96				Mod		St		do		Mz Bx	Similar but local fog. Diss py-cc

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO

GEOLOGIC - ASSAY LOG

Property SACATON

HOLE NO. S-30
Sheet No. 12 of 15
Date Completed
Logged By NPW 6-12-6

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
73.8-679.5	5.7	NXWL	2.52	95	3.82				Mod		St		Ser		Mz	Gray, st. alt. w/gg. Diss py-cc. One vn mass py-c
79.5-684.1	4.6	"	2.42	96	0.81				Mod		Mod		do		Mz	Similar to above. Diss py-cc. Partial ox & lea
84.1-692.6	8.5	"	2.70	100	2.12	41.0' @	2.24		Mod		St		do		Mz	Similar to above. Biot. Diss & vn of py-c ase
92.6-703.7	11.1	"	2.43	99	0.05								do		Mz Bx	w/qtz & biot. Leached, w/hm fog
703.7-713.7	10.0	"	2.50	97	0.04							TR Llm	do		Mz Bx	fg w/qtz & biot. Local fog. Diss tr Llm.
13.7-723.5	9.8	"	2.50	100	0.56			$CuCO_3$					do		Mz Bx	Qtz, feld, biot w/fog and vlts & frac deposits Cu
23.5-733.6	10.1	"	2.58	98	0.54			$CuCO_3$					do		Mz Bx	Similar to above
33.6-741.5	7.9	"	2.52	98	0.34			$CuCO_3$				Llm	do		Mz Bx	Similar to above. Tr ind hm & Llm.
41.5-751.5	10.0	"	2.57	89	0.44			$CuCO_3$				Llm^{TR}	do		Mz	Similar to above. Diss $CuCO_3$. Some j
51.5-761.5	10.0	"	2.62	100	0.12			CuSi				Llm	do		MzBx-GR	Prin. Gr.-sil. w/sct Llm & Tr CuSi. Variable fog & ind h
61.5-771.4	9.9	"	2.57	99	0.02							Llm	do		GR	Lt gr, sil, w/some feld. Sct diss & str of in hm & Ll
771.4-781.8	10.4	"	2.61	83	.68	89.2 @	0.31		wk		Mod	Llm	do		MzBx-GR	Admix rk types. Prin Mz (?). Diss & vlts py-cc
81.8-788.1	6.3	"	2.61	87	1.17											
88.1-794.5	6.4	"	2.52	99	1.08			CuSi	wk		Mod	Llm	Ser &	Feld	GR	Lt gr, sil, feld - w/diss py-cc & ox pat w/ CuSi & L
94.5-802.5	8.0	"	2.64	91	0.02			TR CuSi	TR		TR	Llm	Ser		GR	Lt. gr-grn w/variable fog. Diss ind hm, Llm, tr cc. Some b
02.5-809.9	7.4	"	2.60	81	1.31			CuSi	wk		Mod	Llm	do		GR Bx	Admix ox-cc. Diss Llm. Basal vns of cc.
09.9-814.9	5.0	"	2.45	95	2.45				Mod		ST	Llm	do		Mz-GR	Upper portion ox GR - Basal portion Mz w/vfg diss py
14.9-818.6	3.7	"	2.42	96	0.08				TR		TR	Ll$^{ST}_{m}$	do		GR Bx	St fog and bx - w/diss and pods of Llm. Tr. py-cc
18.6-825.0	6.4	"	2.59	94	1.26				Mod		ST				GR Bx	Similar but lt gr w/vfg diss py-cc. Well bx & br
25.0-829.8	4.8	"	2.63	83	1.22				Mod		ST		do		GR Bx	Similar to above in all respects. Some gg

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC - ASSAY LOG

Property SACATON

HOLE NO. S-30
Sheet No. 13 of 15
Date Completed
Logged By NPW 6.13

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LO
29.8-835.0	5.2	NXWL	2.64	89	0.99				Mod		Mod		Ser		GR Bx	Very highly alt, lt gr - Diss py-cc. Br w/much gg
15.0-841.5	6.5	"	2.55	88	1.28				Mod		Mod		do		GR Bx	Highly alt, lt gr - Well br w/fg diss py-cc
41.5-845.8	4.3	"	2.62	89	1.80				Mod		Mod		do		GR Bx	Do
15.8-851.4	5.6	"	2.61	96	1.42				Mod		Mod		do		GR	Do - Less bx, w/a few fg intercepts.
51.4-858.3	6.9	"	2.55	100	1.05				Mod		Mod		do		GR	Do - some wk feld
58.3-864.8	6.5	"	2.55	95	0.96				Mod		Mod		do		GR	Do.
64.8-873.5	8.7	"	2.43	90	1.05				Mod		Mod		do		GR	Do - Trace hm in a vn.
73.5-883.2	9.7	"	2.56	100	1.18				Mod		Mod		do		GR	Do - Feld stained pale pk
33.2-893.2	10.0	"	2.72	94	0.68				Mod		Mod		do		GR	Do - Few aplitic phases - One mass. hm vn
93.2-901.8	8.6	"	2.67	95	1.46				Mod		Mod		do		GR	Do - Somewhat more sil.
01.8-911.8	10.0	"	2.58	100	1.08				Mod		Mod		do		GR	Do - Diss & str of py-cc. Tr hm alon fracs
1.8-921.8	10.0	"	2.58	100	2.47				St		St		do		GR	Do
21.8-931.6	9.8	"	2.58	100	1.37				St		St		do		GR	Do
31.6-941.5	9.9	"	2.60	100	1.36				St		St		do		GR	Do
41.5-951.5	10.0	"	2.53	100	1.51				St		St		do		GR	Do
51.5-961.4	9.9	"	2.56	97	0.84				Mod		Mod		do		GR	Do - Partially ox to brn & yel along many vlts.
1.4-969.5	8.1	"	2.53	97	1.06	189.5 @ 1.22			Mod		St		do		GR	Do - Gr. br, w/gg - Diss & vert. vns py-cc
9.5-971.3	1.8	"	2.72	97	1.11				Mod		St		do		GR	Do - Tr yel to brn Fe ox.
						977 pit bottom										
71.3-981.3	10.0	"	2.74	93	0.43				Mod		Mod		do		GR	Do - One pat of fog and leaching

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-30
Sheet No. 14 of 15
Date Completed
Logged By NPW 6-13-

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay – % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LO
181.3-990.6	9.3	NXWL	2.50	93	0.10				Wk		Mod	LIm^{TR}	Ser		GR	Mix ox-suls. Locally st fog - Tr LIm
190.6-997.6	7.0	"	2.49	79	0.10			$CuSiO^{TR}$					do		GR	Highly distorted, some gg. Local st fog. Tr of CuSiO
997.6-1003.4	5.8	"	2.53	87	0.06			$CuSiO^{TR}$			Tr	LIm	do		GR	Do - plus tr of cc on frac.
003.4-1011.3	7.9	"	2.65	92	0.88			$CuSiO^{TR}$	Mod		Mod	LIm	do		GR	Alternate ox-sols. Diss, vlts of py-cc - Some CuSi
011.3-1021.2	9.9	"	2.51	98	0.12			$CuSiO^{TR}$	Wk		Wk	LIm	do		GR-GRBx	Similar to above. Mod fog in basal portion
021.2-1031.2	10.0	"	2.52	97	0.02							LIm	do		GR-GRBx	Do - Mod to St. fog throughout
031.2-1037.9	6.7	"	2.52	67	0.05							LIm	do		GR-GRBx	Do - Sil - st fog ē ind hm ē LIm
037.9-1044.5	6.6	"	2.53	96	0.03							LIm	do		GR-GRBx	Do - Completely ox ē partially leached. Ind hm ē l
044.5-1054.3	9.8	"	2.56	97	0.04							LIm	do		GR-GRBx	Similar to above
054.3-1057.7	3.4	"	2.56	96	0.02	al @ 0.17						LIm^{TR}	do		GR-GRBx	Do
057.7-1067.7	10.0	"	2.51	99	0.07			$CuSiO^{TR}$					do		GR-GRBx	Traces of ind hm and CuSiO on frac vlts.
067.7-1072.3	4.6	"	2.57	85	0.25			$CuSiO^{TR}$			Tr		do		GR-GRBx	Rather st brn to yel Fe ox. Tr diss cc. CuSiO on fr
072.3-1080.7	8.4	"	2.51	97	1.24				Mod		St		do		GR-GRBx	Lt gr to pk gr. Diss ē vlts of py-cc. Some fog
080.7-1087.6	6.9	"	2.55	94	0.73				Mod		Mod		do		GR-GRBx	Similar to above but partially ox along frac. Mod h
087.6-1096.8	9.2	"	2.52	63	0.36				St		Wk	Cov^{Tr}	do		GR-GRBx	Much gg and py. Variable fog and ox. Diss py-cc-c
096.8-1104.2	7.4	"	2.53	86	0.25				Mod	wk	wk	Cov^{Tr}	do		GR-GRBx	Much grinding ē gg. Diss ē vlts py-cc. First cpy obs
104.2-1113.1	8.9	"	2.64	51	0.27				Mod	wk	wk	LIm	do		GR-GRBx	Sil, w/Diss py-cpy-cc. LIm on frac. brn to orange Fe
113.1-1123.3	10.2	"	2.64	96	0.44				Mod	Mod	wk	Tr Cov	do		GR-GRBx	Sil, some fog. Diss ē vlts of cpy-py-cc ē films of cov
123.3-1130.4	7.1	"	2.56	99	0.20				Mod	Tr	Tr		do		GR-GRBx	Sil, br, w/some gg ē py. Variable fog. Diss py-cc

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-30
Sheet No. 15 of 15
Date Completed
Logged By NPW 6·14·6

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu			Mineralization					Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
					Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other				
30.4-1138.3	7.9	NXWL	2.54	91	0.20				Wk	Tr	Tr		Ser		GR-GRBx	Med gr, well br, w/variable fog. Tr diss py-cc & cp
38.3-1142.2	3.9	"	2.56	99	0.25				Wk	Tr	Tr	Tr Cov Tr Lim	do		GR-GRBx	Similar to above. Films of cov. Lim on few frac
42.2-1151.3	9.1	"	2.50	94	0.23				Wk	Tr	Tr	Tr Cov	do		GR-GRBx	Do
51.3-1160.2	8.9	"	2.48	89	0.18				Wk	Tr	Tr		do		GR-GRBx	Do - Much gg w/vlts of hm-py
60.2-1162.9	2.7	"	2.48	84	0.28				Wk	Tr	Tr	Tr Cov	do		GR-GRBx	Do - fg diss py-cc w/films cov. Tr cpy. Hm on fra
62.9-1167.1	4.2	"	2.51	92	0.42				Wk	Tr	Tr	Tr Cov	do		GR	Do - diss & vlts of py-cc; w/Tr cov. Some ind lim & bm F
67.1-1173.3	6.2	"	2.57	91	0.36				Wk	Tr	Tr	Tr Cov Tr Bn	do		GR	Do - sct. brn ox & ind lim common. Tr
73.3-1179.4	6.1	"	2.58	90	0.28				Wk	Tr	Tr	Tr Cov Lim	do		GR	Similar to above. All highly quartzose
79.4-1186.4	7.0	"	2.59	88	0.35				Wk	Tr	Wk	Tr Cov Tr Lim	do		GR	Do
86.4-1196.2	9.8	"	2.63	85	0.18				Mod	Tr	Tr	Tr Cov Tr Lim	do		GR	Do - Wk'ly sh'ed & distorted. Ox prin along vn &&
96.2-1203.0	6.8	"	2.60	97	0.28				Wk	Wk		Tr Cov Lim	do		GR	Do. Lt gr, w/pk feld. Partially leched w Lim
1203.0-1211.7	8.7	"	2.63	98	0.40				Wk	Wk	Tr	Tr MoS_2 Tr Cov	do		GR	Do - Possibly more alt. and less quartzose
211.7-1216.2	4.5	"	2.55	65	0.18				Wk	Wk	Tr	Tr Lim	do		GR	Do - Diss & vlts of suls w/partial ox.
216.2-1227.3	11.1	"	2.55	84	0.38				Wk	Mod	Tr	Tr Cov Tr Lim	do		GR	Do - Basal portion gen. crushed w/gg
227.3-1238.1	10.8	"	2.54	62	0.90	17.8' B 0.40			Wk	Mod	Wk		do		GR	Do - Diss py-cpy-cc vfg. Cc films on few fr
238.1-1241.5	3.4	"	2.49	67	0.50				Wk	Mod	Tr	Tr Lim	do		GR	Do - Fair amount of fog
BOTTOM																

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Final Depth 1187.9'
Collar Elevation 1453'
Coordinates 1660N 605E (GRID)
Inclination -90°

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-3
Sheet No. 1 of 7
Date Completed
Logged By NPW

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks — CORE SPLIT PRIOR TO L
460		4¾" RB	–													BEDROCK REP'T AT 460 FT.
460-470		4¾" RB	–		0.02											
470-480		"	–		0.02											
481.1-488.2	7.1	NXWL	2.49	74	0.02							Llm Tr	Ser		GR Bx	Variable hm in matrix. Leached & ox w/ind hm &
495.0	6.8	"	2.44	60	Tr							Llm	do		GR Bx	Do
502.6	7.6	"	2.50	33	0.02							Llm Tr	do		GR Bx	Do
506.5	3.9	"	2.53	96	0.57			$CuSiO_3$ WK					do		GR Bx	Do - 504'-505' very dk grn, vfg chlor. w[illegible]SiO$_3$
512.6	6.1	"	2.51	44	0.02								do		GR-Mz(?)-Bx	Similar to above, but may contain admixed Mz
515.4	2.8	"	2.54	99	0.14			$CuSiO_3$ Tr					do		GR BX & DIABASE	GR Bx similar to above. Ct. at approx 515 ft
524.2	8.8	"	2.54	62	0.42			$CuSiO_3$ Tr					do		DIABASE	gr-grn, fg, w/vlts & pats of hm. Tr $CuSiO_3$
526.1	1.9	"	2.49	100	0.20								do		DIABASE	Do - Local zones of bx
533.2	7.1	"	2.53	81	0.16			$CuSiO_3$ Tr					do		DIABASE Mz Bx(?)	Admixture of Types in bx. Well alt. Tr $CuSiO_3$.
536.5	3.3	"	2.64	18	0.30			$CuSiO_3$ WK					do		DIABASE BX	Frags in hm matrix. Increase in $CuSiO_3$
539.2	2.7	"	2.63	91	0.34			$CuSiO_3$					do		DIABASE-GR BX	Well alt & admixed in bx & st hm. Lt gr to very dk gr-
545.0	5.8	"	2.63	88	1.51			$CuSiO_3$ ST					do		Mz-GR BX DIABASE(?)	Highly alt & admixed w/st hm. $CuSiO_3$ set throughout.

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

Date Completed
Logged By NPW

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO L
552.3	7.3	NXWL	2.57	93	0.39			$CuSiO_3$					St. Sericitization & Kaolinization	DIABASE OR Mz-GR Bx	Very highly altered. Dk grn to bleached. Local mass. hm.
562.3	10.0	"	2.75	99	2.82	563 [illegible]		$CuSiO_3$ brochantite (?)					do	DIABASE & GR Bx	Very highly alt. Mass hm & qtz. $CuSiO_3$ & brochantite (?)
569.2	6.9	"	2.77	100	0.87			$CuSiO_3$ brochantite (?)					Ser	DIABASE Bx	Local well alt. black to gr-grn. $CuSiO_3$, brochantite (?), Mn ox, st
575.0	5.8	"	2.50	64	0.54	576	0.95	$CuSiO_3$ Cu ox (?)					Ser	DIABASE Bx	Frags in hm matrix. Sct $CuSiO_3$ & tr Cu ox (?)
585.8	10.8	"	2.60	09	0.20			$CuSiO_3$ Tr					Ser	DIABASE BX APLITIC GR	Diabase as above. Aplitic GR in basal portion.
592.8	7.0	"	2.44	96	0.18			brochantite (?) Tr			Tr	Llm Tr	St. sericitization & Kaolinization	DIABASE (?)	Gen. very highly alt & bleached. vlt of brochantite & cc. diss ind hm-Ll
598.5	5.7	"	2.36	96	0.07							Llm	do	DIABASE (?)	Very highly bleached & alt. Variable fog along frac. Diss Llm & ind
606.7	8.2	"	2.45	43	0.04							Llm	do	DIABASE (?)	Mostly bleached. Basal portion gr-grn w/pseudo-porph texture. Ind
613.1	6.4	"	2.47	93	0.11							Llm	do	DIABASE (?)	Well alt, somewhat bleached. Brn Fe ox, ind hm, & Llm
615.4	2.3	"	2.40	66	0.06								do	DIABASE (?)	Less bleached & alt. Red to brn Fe ox on frac.
625.4	10.0	"	2.44	37	0.04							Llm Tr	do	DIABASE (?)	Local bx & bleaching. Sct diss ind hm & tr Ll
627.9	2.5	"	2.42	87	0.02								Ser-Kaol.	GR Bx	Br, alt, sh'ed - similar to above. Some hm & brn Fe ox.
633.2	5.3	"	2.42	62	0.03								do	GR Bx	Do
641.3	8.1	"	2.47	23	0.02								do	GR Bx	Do - some st bx & hm. Tr ind lim
644.9	3.6	"	2.53	70	0.05							Llm St	do	GR Bx	Do - st bx, alt, ind hm, and Llm
646.5	1.6	"	2.85	100	3.32			brochantite Tr			St		Ser	GR Bx	Mass bx & hm w/qtz. Vert vns of cc-py-hm. Tr brochantite
648.5	2.0	"	2.48	95	0.18			$CuSiO_3$ Tr			Mod		do	GR Bx	Mass bx & hm w/qtz. Upper portion displays cc-tr $CuSiO_3$
661.0	12.5	"	2.53	31	0.02							Llm Tr	do	GR Bx	Lt. pk-gr, qtzose. wk fog, tr Llm & Sct spots Mn ox.
665.8	4.8	"	2.53	37	0.08							Llm Tr	do	GR Bx	Variable fog. Diss & frac. deposits of Llm & ind hm

Final Depth
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ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-35

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu			Mineralization					Alteration		Rock Type	Remarks
					Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other				CORE SPLIT PRIOR TO Lo
677.2	11.4	NXWL	2.47	29	0.02							Llm^{Tr}	Ser		Gr Bx	Do-reddish gr to grn-gr. Sct ind hm & tr Llm
685.0	7.8	"	2.49	19	Tr							Llm	do		Gr Bx	Do-Variable fog. Diss & pods Llm
688.6	3.6	"	2.52	67	0.02								do		Gr Bx	Do-Uniform, wk fog throughout.
693.2	4.6	"	2.58	100	Tr								do		Gr Bx	Do-Somewhat more sh'ed. Variable fog
702.3	9.1	"	2.52	79	Tr							Llm^{Tr}	do		Gr Bx	Do-Sct diss ind hm & Llm
713.0	10.7	"	2.53	81	Tr							Llm	do		Gr Bx	Do-Diss & small str ind hm & Llm
714.9	1.9	"	2.54	90	2.27			$CuSO_4^{Mod}$	Mod		Mod		do		Gr Bx	Do-but qtzose w/diffused brochantite(?) & diss. py-cc
723.0	8.1	"	2.54	87	Tr							Llm	do		Gr Bx	Do-Gen mod fog & diss. fg ind. hm & Llm
733.0	10.0	"	2.46	26	0.02							Llm^{Tr}	do		Gr Bx	Do-only tr. Llm
739.3	6.3	"	2.52	83	0.03							Llm^{Tr}	do		Gr Bx	Do
749.2	9.9	"	2.64	26	0.02							Llm	do		GR Bx	Do
752.4	3.2	"	2.52	100	0.08							Llm^{Tr}	do		GR Bx	Do-Few streaks dk, fg chlor(?)
764.4	12.0	"	2.50	33	0.04							Llm^{Tr}	do		GR Bx	Do-Less fog-sct diss spec, ind hm, and Llm
768.3	3.9	"	2.57	66	Tr							Llm^{Tr}	do		GR Bx	Do-Rather intense bx w/fog toward base
772.3	4.0	"	2.53	41	Tr								do		GR Bx	Do-Uniform bx and fog
778.1	5.8	"	2.50	36	0.02								do		GR Bx	Do-somewhat Wk'er fog
795.0	16.9	"	2.54	15	0.02							Llm^{Tr}	do		GR Bx	Do-Few lt grn-gr zones w/diss ind hm & tr Ll
801.5	6.5	"	2.52	55	Tr							Llm^{Tr}	do		GR Bx	Do
807.7	6.2	"	2.56	100	0.02							Llm^{Tr}	do		GR Bx	Do

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
814.6	6.9	NXWL	2.58	100	0.03							Llm	Ser		GR Bx-GR	Some zones free of bx. Diss & str of ind hm & Ll
824.6	10.0	"	2.64	94	0.45			$CuSiO_3^{Tr}$	Mod		Mod	LlmSt	do		GR BX-GR & APLITE	Do - Increase in ind hm & Llm. Basal diss & vert. vns py-c
830.5	5.9	"	2.54	100	4.26				St		St	Llm^{Tr}	do		GR	Lt grn-gr, mobile texture. Diss & mass high angle vn py-c
838.6	8.1	"	2.55	97	0.88				Mod		St	Llm^{Tr}	do		GR	Do - Diss py-cc. Some hm fog & minor leaching
848.5	9.9	"	2.56	94	0.02							Llm	do		GR-GRBx	Increase in fog. Sct ind hm & Llm.
852.7	4.2	"	2.51	96	0.02							Llm^{Tr}	do		GR	Uniform wk fog - sct. ind hm & Llm
864.3	11.6	"	2.57	73	1.29				St		St	Llm	do		GR	Lt. gr w/diss & a mass vn of py-cc. Mod leaching.
871.8	7.5	"	2.56	96	0.02							Llm^{Tr}	do		GR-GRBx	cg, w/fog creating marbled effect. Sct ind hm & tr Llm
879.5	7.7	"	2.58	87	0.06							Llm^{Tr}	do		GR-GRBx	Do - one 3 in. intercept of dk grn chlor or Am (?)
889.5	10.0	"	2.51	95	0.08							Llm^{Tr}	do		GR	Uniform fog & alt. anhedral feld. developments. Sct. ind hm & Ll
898.4	8.9	"	2.51	98	0.11							Llm^{Tr}	do		GR-GRBx	Do
906.7	8.3	"	2.49	94	0.06							Llm^{Tr}	do		GR-GRBx	Do
914.0	7.3	"	2.46	96	0.08							Llm^{Tr}	do		GR-GRBx	Do
921.0	7.0	"	2.48	50	0.02							Llm^{Tr}	do		GR-GRBx	Do
926.8	5.8	"	2.60	95	0.04							LlmSt	do		GR-GRBx	Do - some zones st'ly alt. w/ st Llm & ind hm
934.9	8.1	"	2.53	98	0.14			$CuSiO_3^{Tr}$				Llm^{Tr}	do		GR	Becomes lt. reddish to grn-gr. Tr $CuSiO_3$ on few frac.
945.0	10.1	"	2.62	59	0.31			$CuSiO_3$				Llm^{wk}	do		GR	Do - Sct diss ind hm & Llm w/wk to mod $CuSiO_3$.
950.9	5.9	"	2.59	45	0.08			$CuSiO_3^{Tr}$				Llm^{Tr}	do		GR	Do - some increase in fog. Little gg.
955.0	4.1	"	2.56	18	0.03								do		GR	Do

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay – % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO LOG
58.3	3.3	NXWL	2.51	43	0.04							Llm^{Tr}	Ser	GR	Broken w/variable fog. Sct tr. diss ind hm & tr Llm.
62.2	3.9	"	2.52	93	0.02							Llm^{wk}	do	-GR	Do
9.9	7.7	"	2.56	22	0.04							Llm^{wk}	do	GR	Do - little gg
4.6	4.7	"	2.52	51	0.03								do	GR-GRBx	Lt gr w/ increase in fog & bx.
6.3	1.7	"	2.48	42	0.02								do	GRBx	Highly alt & sh'ed
0.2	3.8	"	2.53	79	0.03								do	GRBx	cg, br, w/uniform fog & lg, alt, auhedral felds.
0.3	10.1	"	2.52	16	0.05								do	GR Bx	Do
4.2	3.9	"	2.52	91	0.04							Llm^{Tr}	do	GR	Lt gr to purple, br, w/sct diss ind hm & Llm
8.6	4.4	"	2.47	71	0.03								do	GR-GRBx	Cg, qtzose w/variable fog. Some gg.
06.3	7.7	"	2.46	87	Tr							Llm	do	GR-GRBx	Do
08.3	2.0	"	2.54	60	0.02								do	GR	Do
11.9	3.6	"	2.57	94	0.03							Llm	do	GR	Do
19.0	7.1	"	2.54	92	0.07			CuSiO$_3^{Tr}$				Llm	do	GR	Do - basal portion very highly ser. w/tr CuSiO$_3$
23.5	4.5	"	NONE	87	0.23			CuSiO$_3^{Tr}$				Llm	do	GR	Gen lt. gr w/variable fog
25.6	2.1	"	2.53	80	0.16	452.2 @ 0.19		CuSiO$_3^{Tr}$					do	GR	Do - wk. sct tr CuSiO$_3$ on fractures.
27.3	1.7	"	NONE	0	—										NO RECOVERY
30.0	2.7	"	2.54	80	0.46				Tr		wk		do	Gr-GrBx	Gen cg w/variable fog. vfg py-cc in local conc.
35.0	5.0	"	2.49	53	0.54				wk		mod		do	Gr-GrBx	Do - in all respects
36.2	1.2	"	2.52	94	1.12				Tr		Tr		do	GR	Mostly aplitic w/wk fog - only sct tr py-cc

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th	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG
0.4	4.2	NXWL	2.50	100	1.95				st		st		Ser		GR-APLITE	fg, gr, well alt. w/vfg py-cc diss. throughout
5.3	4.9	"	2.62	89	0.77				mod		st		do		GR-APLITE	Do - Little fog & ox. Local bx.
.2	4.9	"	2.64	87	0.77				mod		st		do		GR-APLITE	Do
.5	3.3	"	2.61	39	0.70				mod		st		do		GR-APLITE	Do
.2	3.7	"	2.57	98	0.66				mod		st		do		GR-APLITE	Do
.1	1.9	"	2.61	84	0.72				mod		st		do		GR-APLITE	Do
.0	8.9	"	2.57	94	0.57	44.7' @	0.77		wk		mod	LIm st	do		GR-APLITE	Do - rather extensive ox & leaching w/LIm
.0	4.0	"	2.54	97	0.46				wk		mod	LIm mod	do		GR-APLITE	Do - sulfides themselves somewhat wk'er
.0	5.0	"	2.50	96	0.31				wk	Tr	mod		do		GR-APLITE	Do - First obs. tr of cpy
.0	5.0	"	2.60	55	0.23				wk	Tr	wk		do		GR-APLITE	Do
3.0	6.0	"	2.56	83	0.18				wk	Tr	wk		do		GR-APLITE	Do - some increase in hm along frac.
.0	9.0	"	2.55	92	0.14				wk	Tr	Tr	MoS_2 Tr	do		GR-APLITE	Do - vfg diss cpy-py, tr cc, cov, and MoS_2. Wk fog
.5	9.5	"	2.56	97	0.13				wk	Tr	Tr		do		GR-APLITE	fg, gr, w/variable wk fog. Sct diss py-cpy-Tr cc
.5	8.0	"	2.58	95	0.12				wk	Tr	Tr	LIm Tr	do		GR-APLITE	Wk variable fog - some leaching & ox.
3	7.8	"	2.53	97	0.25				wk	wk	Tr		do		GR-APLITE	Do - but very little ox.
5	3.2	"	2.61	95	0.14	55.4' @	0.18		st		Tr		do		GR-APLITE	Do - wk fog, vlts & pods of py. Tr diss cc
4	1.9	"	2.52	71	0.14				wk	Tr	Tr		do		GR-APLITE	Do - wk fog - diss py & tr cc & cpy
6	4.2	"	2.54	93	0.62				wk	Tr	Tr		do		GR-APLITE	Do - somewhat coarser grained
1	3.5	"	2.60	92	0.97				Mod	Mod	Tr		do		GR-APLITE MZ PORPH	GR-APLITE st alt, w/gg. Ct w/Mz at approx 1134.5 ft.

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epth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOG.
37.8	2.7	NXWL	2.58	84	0.60	10' @	0.74		Mod	St	Tr(?)	hm Tr	Sericitic & Talcose (?)		Mz PORPH	Very dk gr-grn to black w/white anhedral feld 2-7 mm. St. chlor
42.5	4.7	"	2.54	99	0.38				Mod	Mod			do		Mz PORPH	Do - st chlor throughout. Vtls of py-hm. Diss py-cpy
51.6	9.1	"	2.53	97	0.23				Mod	Wk			do		Mz PORPH	Do -
56.3	4.7	"	2.60	100	0.26				St	Wk			do		Mz PORPH	Do -
																All well br - intercepts of gg
65.4	9.1	"	2.56	98	0.46				Mod	Mod			do		Mz PORPH	Do
69.3	3.9	"	2.57	94	0.46				Mod	Mod			do		Mz PORPH	Do
79.4	10.1	"	2.44	93	0.26				Mod	Wk		MoS_2 Wk	do		Mz PORPH	Do - Smears of MoS_2 along one slip
83.9	4.5	"	2.58	81	0.38				Mod	Wk			do		Mz PORPH	Do
87.9	4.0	"	2.56	95	0.42	50' @	0.35		Mod	Mod			do		Mz PORPH	Do -
TTOM																

Final Depth 1079.0' ?
Collar Elevation 1445 ?
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Property SACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks 5102
																RoBIT DRILLING DONE w/FOAM
170	170	5" RoBIT													ALLUVIUM & CGL	- Chips of grn Ox Cu fr c. 165'.
																BEDROCK PLACED AT 170 F
171	1	5" Ro BIT													Bx'ED MP	Chips of grn Ox Cu in cuttings
175.0																START OF DD CORE - DEPTH OF
																171' FOR ROTARY ≈ 175' FOR DD.
184.8	9.8	NXWL	2.52	100	0.06	0.06		Tr $CuSiO_4$					qtz	+ ser	Bx'ED MP	A mg, qtzose, mod'ly-st'ly alt'ed MP. Except
196.0	11.2	"	2.58	100	0.03	0.02		No Cu	min	obs.			"	"		for first run, rk unusually intact. Diss bi
205.4	9.4	"	2.49	100	0.05	0.03		"	"	"			"	"		throughout. Mod hm throughout -- st in ma
215.5	10.1	"	2.57	99	0.07	0.03		"	"	"			"	"		of bx zones. Struct trends gen'ly high an
226.0	10.5	"	2.60	91	0.05	0.02		"	"	"			"	"		Sct'ed wk - mod, diss ind lm. Tr diss spec.
																$CuSiO_4$ in first run, no other Cu min obs.
																CORE BELOW SPLIT PRIOR TO LOGGING.
236.1	10.1	"	2.51	100	0.06	0.02		"	"	"			"	"	MP-GR(?)	As above, but containing short intercept
246.5	10.4	"	2.43	97	0.08	0.03		"	"	"			"	"	Bx	w/ a granitoid texture ... possibly onl
256.7	10.2	"	2.52	98	0.08	0.02		"	"	"			"	"		qtzose MP.
267.0	10.3	"	2.54	99	0.07	0.06		"	"	"		st ind lm	"	"		Rk displays well developed granitoid textu
277.3	10.3	"	2.55	98	0.06	0.03		"	"	"		" " "	"	"		" " " " " "
287.8	10.5	"	2.56	97	0.05	0.01		"	"	"			"	"		Textures more porph'ic.
298.1	10.3	"	2.56	100	0.07	0.07		"	"	"			"	"		" " "
308.4	10.3	"	2.53	92	0.07	0.06		"	"	"			"	"		" " "
318.8	10.4	"	2.54	95	0.06	0.02		"	"	"			"	"		" " "
328.4	9.6	"	2.59	100	0.07	0.02		"	"	"			"	"		" " " . Sct'ed jarosite
38.6	10.2	"	2.60	97	0.05	0.02		"	"	"			"	"	GR(?) Bx	Rk reddish tan, mg, ē qtzose. Textures
49.0	10.4	"	2.56	100	0.05	0.03		"	"	"			"	"	w/ SOME	mostly granitoid, w/ short intercepts of
59.3	10.3	"	2.58	100	0.05	0.03		"	"	"			"	"	MP(?)	dense, gry, MICRO-GR(?) or SILIC PORPH(?).
69.5	10.2	"	2.58	98	0.62	0.02		Tr Cu wad	mod		st		"	"		Sct'ed, fg, ind lm. Wk to st hm. Cu min
79.9	10.4	"	2.50	96	0.04	0.01		No Cu	min	obs.			"	"		noted opposite individual interval. In gen, th
90.3	10.4	"	2.55	97	0.05	0.01		"	"	"			"	"		py-cc associated w/ zns where mod-high
99.4	9.1	"	2.60	98	0.03	0.01		Tr Cu wad					"	"		angle vns cut core; Massive, w/ borderi
10.0	10.6	"	2.58	95	0.03	0.02		No Cu	min	obs.			"	"		zns of diss.
16.8	6.8	"	2.58	84	0.04	0.02		"	"	"			"	"		
27.1	10.3	"	2.63	100	0.10	0.02			Tr-wk		wk		"	..		

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Property SACATON

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Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay – % Cu			Mineralization					Alteration		Rock Type	Remarks S102
					Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other				CORE SPLIT PRIOR TO LOGGING.
437.5	10.4	NXWL	2.68	97	0.13	0.02			Tr-wk		mod-st	Diss Lim	qtz.	ser	GR(?)Bx	Rk as described above.
447.8	10.3	"	2.57	95	0.05	0.03		No Cu	min	obs		"	"	"	w/SOME	
458.0	10.2	"	2.56	99	0.03	0.02		"	"	"		"	"	"	MP (?)	Leached, vert, open vlts. All rk st'ly qtzos
468.8	10.8	"	2.57	94	0.13	0.02			wk		mod	"	"	"		All of py-cc in basal portion of run.
477.6	8.8	"	2.44	97	0.95	0.03			wk-mod		st	"	"	"	MP-GR	Textures become principally porph . St
488.0	10.4	"	2.50	96	0.37	0.25		Mod-ST $CuSO_4$				"	"	"	Bx	high-angle trend form ct w/above GR.
498.2	10.2	"	2.50	100	0.46	0.34		Mod-ST $CuSO_4$ & $CuSiO_4$				"	"	"	MP Bx	below c. 480' is dk, gry, st'ly porph'ic.
508.5	10.3	"	2.59	95	0.43	0.36		WK $CuSiO_4$					"	"		
519.0	10.5	"	2.56	90	0.62	0.49		wk-mod $CuSiO_4$ & $CuSO_4$					"	"		
529.0	10.0	"	2.54	99	1.44	0.11		TR $CuSiO_4$	wk-mod		Mod-St	"	"	"	MP Bx-	As above to c. 525.5'. Below this pt.
															FLT ZN,	a. 3' flt-zn of gg--Struct trends, mo
															& GR	high angle. Basal portion of run is
																mg, mod'ly-st'ly alt'ed GR which dis
																diss, str's, & high-angle frac surface
																crusts of py-cc.
539.4	10.4	"	2.54	95	0.81	0.02			wk-mod		st		"	"	GR &	Gen'ly lt gry, & essentially free of hm
549.7	10.3	"	2.49	96	1.53	0.07			mod		st		"	"	GR Bx	stain. Diss, small pods, & frac-slip sme
559.8	10.1	"	2.52	99	1.78	0.02			mod		mod-st		"	"		of py-cc.
570.3	10.5	"	2.54	95	1.95	0.03			wk-mod		mod-st		"	"	GR-MP	GR as above. Appears to be an int
580.7	10.4	"	2.47	98	1.64	0.02			wk		wk-mod		"	"	Bx	intercept of MP
															GR Bx &	Rk as above, but displaying intense g
590.6	9.9	"	2.49	96	2.20	0.03			mod		mod-st	cov (?)	"	"	FLT ZONE	ulation & distortion. Struct trends varia
600.7	10.1	"	2.45	97	1.26	0.02			wk-mod		mod-st	"	"	"		
611.3	10.6	"	2.50	97	0.63	0.02							"	"		Ct. w/lower MP prob'ly c. 607'-608'.
618.4	7.1	"	2.48	59	0.66	0.01			tr	wk-mod	tr-wk	cov (?) bn (?)	"	"	MP Bx &	Typical MP - gry to hm red, br, distorted,
629.0	.6		2.45	97	0.65	0.01			wk-mod	wk-mod	tr(?)		"	"	FLT Zone	granulated. Diss py & cpy (?). Few f. vlts
																cpy &/or bn. Tr cc.
639.7	10.7	"	2.53	96	0.59	0.01			mod	wk-mod	tr (?)		"	"	MP-GR	Above MP to c. 630'-631'... GR below.
650.0	10.3	"	2.51	97	0.59	TR.			mod	mod-st			"	"	Bx-FLT	in a flt zn. Both rk types display some
															zone	w/ind lm on fracs. More MP 643'-64

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC — ASSAY LOG

Property SACATON

HOLE NO. S-
Sheet No. 3 o
Date Completed
Logged By

S102

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Mo	Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks CORE SPLIT PRIOR TO LOGGING
660.2	10.2	NXWL	2.53	100	0.44	TR.			mod	mod-st			qtz.	ser	GR Bx	Rk as above... St'ly distorted, shr'ed,
670.8	10.6	"	2.57	97	0.49	TR.			mod	wk-mod			"	"		often soft. Wk-mod hm throughout - Loca
																zns of gg.
680.6	9.8	"	2.50	97	0.30	TR.			mod	wk-mod			"	"	GR-MP	Again both rk types, w/ the b lpe
															Bx	M.P. In general shr'ed, rotten, and con
																ing intercepts of gg.
691.0	10.4	"	2.49	92	0.39	0.01		Tr CuCO3(?)	wk-mod	wk-mod	wk-mod		"	"	MP Bx	Similar to above rk. V'ts cc. Crusts Cu
701.4	10.4	"	2.48	96	0.15	0.01		Tr CuSiO3	wk	tr-wk	tr(?)		"	"		Rather st chlor (?) or serp (?)
711.8	10.4	"	2.56	95	0.15	0.01		Tr CuSiO3	wk	tr-wk	tr-wk		"	"		" " " " "
721.8	10.0	"	2.48	97	0.29	0.01			wk	tr-wk			"	"		" " " " "
732.2	10.4	"	2.53	100	0.16	0.01			mod	tr-wk			"	"	MP-GR	As above -- Displaying mixed rk types.
742.6	10.4	"	2.50	96	0.12	0.01			mod	tr-wk			"	"	Bx & FLT	
752.8	10.2	"	2.50	96	0.21	TR.			mod	wk-mod			"	"	Zone	← Principally GR
763.2	10.4	"	2.52	97	0.29	0.01			wk-mod	wk-mod			"	"		" " "
773.5	10.3	"	2.58	98	0.31	0.01			wk-mod	wk-mod		Ind lm	"	"	MP Bx	As above - rk gen'ly fg-mg, differentiall
784.0	10.5	"	2.53	94	0.43	0.01			wk-mod	wk-mod		Ind lm	"	"		flooded w/ hm. Sat'ed zns of st serp (?
794.0	10.0	"	2.50	100	0.25	0.01			wk-mod	mod-st		" "	"	"		or chlor (?). Mod-st ind hm whe ated
801.7	7.7	"	2.56	96	0.21	TR.			wk-mod	wk-mod		Ind lm Llm(?)	"	"		Diss fg py & cpy. Few thin v'lts containi
812.2	10.5	"	2.55	92	0.23	0.02			mod-st	wk-mod	st vn cc	" "	"	"		both sul's.
822.3	10.1	"	2.50	98	0.24	TR.			mod-st	wk-mod		" "	"	"		
832.4	10.1	"	2.52	97	0.26	0.01	0.028		mod	st	Tr-wk vn cc	Ind lm, Llm & MoS2	"	"		
842.9	10.5	"	2.50	98	0.27	0.01	0.020		mod	wk-mod		" "	"	"		
852.4	9.5	"	2.48	100	0.28	TR.			wk-mod	wk-mod		Tr MoS2	chlor	"	MP Bx &	Ct between rk change is a flt zn c. 846'-8
858.5	6.1	"	2.52	97	0.19	TR.						spec	"	"	SILIF MP	Rk is dense, lt grey-red tan, & qtzose.
867.0	8.5	"	2.49	76	0.19	0.01			wk-mod	wk-mod		" "	"	"	or GR(?)	← Granitoid textures
876.5	9.5	"	2.54	96	0.21	0.02			mod	wk-mod			"	"	GR Bx &	Granitoid textures as above. Rk st'ly dis
886.6	10.1	"	2.50	90	0.18	0.02			wk-mod	wk			"	"	FLT(?) ZN	ed, shr'ed, & granulated below c. 873.5'. Fai
896.8	10.2	"	2.51	92	0.23	0.02			wk-mod	wk			"	"		amount chlor & gg.
907.2	10.4	"	2.47	88	0.35	TR.			wk-mod	wk			"	"		
918.0	10.8	"	2.45	74	0.27	TR.			wk-mod	wk-mod			"	"	GR Bx	Rk as above but more intact.
928.2	10.2	"	2.51	100	0.19	0.04			wk-mod	wk-mod		Tr MoS2	"	"		
938.2	10.0	"	2.52	100	0.19	0.03			wk-mod	wk-mod		Tr MoS2	"	"		

Final Depth
Collar Elevation
Coordinates
Inclination

ASARCO
GEOLOGIC - ASSAY LOG

Property SACATON

HOLE NO. S-1(
Sheet No. 4 of
Date Completed
Logged By NPW

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Oxides	Pyrite	Cpy	Cc	Other	Alteration		Rock Type	Remarks S102
945.2	7.0	NXWL	2.56	97	0.21	0.08	192.4' @ 0.26		wk-mod	wk-mod			qtz	ser	GR Bx	Rk is gen'ly mg, mod'ly-st'ly alt'ed,
													&	chlor		qtzose, & wk'ly chlor'ic. Distortion, shr
																and breakage common. Local, wk hm
																Diss, fg sul throughout.
954.8	9.6	"	2.57	95	0.52	0.09			wk-mod	wk			"	"	GR Bx &	As above, but containing a short inters
															AN(?) or	dk grn-blk AN (?) or DB(?) w/a felty texture
															DB(?)	Chlor (?) & Serp(?) w/ hm v. st in this
																rk.
964.2	9.4	"	2.67	100	0.48	0.12			wk-mod	wk-mod			Serp	chlor	AN(?) or	As above. A very st'ly br & serpentinized
972.5	8.3	"	2.60	100+	0.63	0.08			med	wk-mod			"	"	DB(?)	and/or chloritized Rk. Texture residual, fg
979.6	7.1	"	2.55	100	0.57	0.04			mod	wk-mod			"	"		& felty. Diss & fine vlts py-cpy. Local, w
984.2	4.6	"	No	REC	—	—			—	—			—	—		med hm.
990.2	6.0	"	2.62	95	0.84	0.01			mod	mod-st			"	"		
1000.0	9.8	"	2.68	98	0.30	0.04			mod	mod-st		Tr MoS_2	"	"	AN(?) or	As above to c.992'. Below this is a m
															DB(?) &	qtzose GR similar to that above -- prob
													qtz	ser	GR Bx	more sil. Wk-mod hm on fracs. Diss &
																vlts py-cpy. Tr MoS_2
1009.7	9.7	"	2.63	90	0.88	0.02	64.5' @ 0.58		mod	st			"	"	GR Bx	Similar to above in all respects.
1019.8	10.1	"	2.58	96	0.42	0.01			med	mod-st			"	"		
1030.2	10.4	"	2.42	95	0.38	TR.			mod-st	wk-mod			"	"		
1035.8	5.6	"	No	REC	—	—			—	—			—	—		
1043.2	7.4	"	2.45	96	0.33	TR.			mod	wk		Tr MoS_2	"	"		
1053.8	10.6	"	2.58	99	0.41	0.01			mod	wk-mod		"	"	"		
1064.4	10.6	"	2.53	96	0.25	0.01			med	mod		"	"	"		
1073.7	9.3	"	2.50	86	0.23	TR.			mod	wk-mod		"	"	"		
1079.0	5.3	"	2.56	87	0.24	TR.	69.3' @ 0.33		wk	wk		"	"	"		
BOTTOM																

Final Dep. 786.0'
Collar Elevation 1443 ?
Coordinates
Inclination -90°

A. ARCO
GEOLOGIC - ASSAY LOG
Property SACATON

5112

HOLE NO. S-1
Sheet No. 1 of 4
Date Completed 10/1
Logged By RHL

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Cu Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks 5 112 CORE SPLIT PRIOR TO LOG
0-205.2	205.2	5 1/8" KB												Alluvium	Bedrock reported at 201'.
205.2-214.4	9.2	NXWL	2.36		0.63	0.49		WK	—	—	—		Sericitized & Kaolinized	Gr	St. alt. granite, granulated. Oxidized. Mod Cu Ox to 209.2'.
214.4-224.8	10.4	"	2.64		0.07	0.02		—	—	—	—		do	Gr(?)	Int. becomes incr. granulated with st. FeOx @ 21 to end of int.
224.8-234.5	9.7	"	2.48		0.05	0.02		—	—	—	—		do	Gr(?)	St. broken. Orig. rock type obscure. Leached and oxidized.
234.5-245.6	11.1	"	2.60		0.03	0.01		—	—	—	—		do	Gr	Do. No Cu min. obs. so far.
245.6-255.2	9.6	"	2.48		0.04	0.01		—	—	—	—		do	Gr.	Do. Vivid hem. stain of matrix.
255.2-265.7	10.5	"	2.48		0.05	0.01		—	—	—	—		do	Mz/Gr?	Appears as a mixed assemblage, but distinct due to alteration obscure. Shows brecciation places.
265.7-275.8	10.1	"	2.73		0.03	0.01		—	—	—	—	270.9' Spec.	do	Gr ?	Granitoid features faintly discernable at tim Mod-st. hematite, especially where brecciated.
275.8-286.2	10.4	"	2.64		0.03	0.01		-	-	-	-	WK Lim	do	"	Do.
286.2-296.8	10.6	"	2.62		0.04	0.01		-	-	-	-	do	do	"	Indig. lim. coating fract. with occ. py casts. N Cu min. obs.
296.8-306.8	10.0	"	2.67		0.04	0.01		—	—	—	—	do	do	"	Mod-st. brecciation of interval healed by Fe Otherwise as above.
306.8-317.2	10.4	"	2.61		0.05	0.01									Mod-st. hem. flooding of matrix. Occ. frs. of specularite. Some jarosite coating fract. with
317.2-327.8	10.6	"	2.66		0.03	0.01		—	—	—	-	WK Lim.	do	"	lim. Mod. brecciation last 10' to 332.2'. No visible Cu min.
327.8-338.2	10.4	"	2.70		0.14	0.01									
338.2-348.5	10.3	"	2.65		0.11	0.07								:	Essentially as above. WK. silicif. St. hem. esp
348.5-358.2	9.7	"	2.78		0.08	0.05		—	—	—	—		Sericitized	"	cially along fract. Noted some silver adamant platy x'tals @ 355.2' - Ferri molybdite? w/ jaros

Final Dep... 786.0
Collar Elevation
Coordinates
Inclination -90°

A. ARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO. S-1
Sheet No. 2 of 4
Date Completed 10/4/
Logged By RHL

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Cu Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks 5112
															CORE SPLIT PRIOR TO LOG
358.2-368.6	10.4	NxWL	2.64		0.11	0.11									
								tr	–	–	–	tr spec.	Sericitized	Gr	Brecciated with wk. jarosite coating fract.
368.6-373.8	5.2	"	2.77		0.18	0.13									Mod-st. hematites. Tr. CuOx @ 373.0'.
373.8-374.1	0.3	"			NO RECOVERY										
374.1-374.2	0.1	"													
374.2-379.8	5.6		2.53		1.35	0.99									A fine grained rock with mod-st. FeOx throughout
379.8-387.5	7.7	"	2.52		2.58	2.25		mod	–	–	–	–	wk. Kaolinized	And.	In general a dark grey groundmass with conspicuo
387.5-397.5	10.0		2.53		1.40	1.12							wk. sericitized	porph(?)	alt, sometimes Cu stained, feldspar [illegible] (3-5 mm
397.5-406.8	9.3		2.71		0.85	0.67									length) Sparse euhedral biotite, with occ. qtz phenoc
															Locally weakly magnetic. CuOx (botryoidal in per
															along veinlets and fractures.
406.8-416.2	9.4		2.69		0.11	0.03									
416.2-427.6	11.4	"	2.63		0.27	0.16		wk	–	–	–	–	do	"	In general as above, but weak CuOx. For
427.6-436.9	9.3		2.79		0.67	0.47									the most part the rock is thoroughly he-
436.9-446.5	9.6		2.69		0.85	0.53									matized. Bi is "fresh" (2nd?)
446.5-456.2	9.7	"	2.58		0.66	0.36		wK	–	–	–	–	do	And porph	Textural change: – Sericitized small (1-3 mm
														(?) Gr.	length) feldspar phenos set in FeOx stained matr
							91.3 @ 0.87								At 454.4' abrupt change to sericitized grani
															to end of int. Steeply dipping contact.
456.2-465.5	9.3	91.3 "	2.75		0.60	0.53		wk	–	–	–	–	Sericitized	Gr. And	And. porph(?) to 458.2', thence fine to med gr
													Kaolinized	porph.	CuOx along fract. surf.
465.5-475.6	10.1	"	2.56		0.16	0.10		tr	–	–	–	tr spec.	do	Gr?	As above with indig. lim coating fractures. Tr.
															jarosite. CuOx persists as encrustations and a
															fract.
475.6-483.8	8.2	"	2.64		0.05	0.02		–	–	–	–	–	do	Gr-Mz?	Variable textured and qtzose granitoid.
483.8-494.6	10.8		2.61		0.05	0.01									Locally st. hem flooding in particular where
															brecciated. Scattered indig. lim.
494.6-504.7	10.1	"	2.69		0.08	0.04		–	–	–	–	–	do	Gr Mz ?	As above. Last foot of int. f.gr. and. porp
														And. porph.	

Final Depth 786.0'
Collar Elevation
Coordinates
Inclination -90°

ASARCO
GEOLOGIC-ASSAY LOG

Property SACATON

HOLE NO. S-
Sheet No. 3 of 4
Date Completed 10/
Logged By RHL

5112

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu Total	Non-S	Average	Mineralization Cu Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks CORE SPLIT PRIOR TO LOG
504.7-511.7	7.0	11X(WL)	2.61		0.43	0.26		tr	–	–	–		Kaolinized		Abrupt change @ 507' to f.gr. And.porph(?) sh
511.7-521.4	9.7		2.60		0.14	0.05							Sericitized	And.porph (?)	occ. incl. of granitoid rock. Wkly chloritized.
521.4-532.0	10.6		2.58		0.08	0.03									hem. of matrix. locally Text. variable. Granito
532.0-538.2	6.2		2.46		0.10	0.03								Gr(?)	qtzose segments from 532.0-532.6' and 535.8-53
538.2-549.0	10.8	"	2.57		0.08	0.03									
549.0-553.7	4.7		2.46		0.70	0.45		wk	–	–	–	tr.spec	do	And.porph	Essentially an interfingering seq...
553.7-563.9	10.2		2.48		0.39	0.24								Gr, Mz?	And.porph(?) with qtzose granitoid rock.
563.9-572.4	8.5		2.68		0.46	0.31									(Gr/Mz?). Bx'ed where especially st. Fe
															Occ. CuOx stain within groundmass and along
															fract. space, but conspic. qtz. phenos within the
															rock. (And?)
572.4-584.9	12.5		2.51		0.08	0.04		tr	–	–	–	–	Kaolinized	And.porph	St. FeOx pervasive throughout. Orig. text obliter
584.9-594.7	9.8	"	2.70		0.04	0.01							wk. silicif	(?)	Orig. feldspar → qtz. in places. Mod. fractur
594.7-605.4	10.7		2.65		0.02	Tr.	147' @ 0.16							Mz?	Porph. text. discernable at times.
605.4-612.8	7.4		2.64		0.07	0.03		tr-mod	–	–	–	–	Kaolinized	And.porph	Brecciated, sheared, hematized volc. rock(?)
612.8-620.6	7.8	"	2.59		0.64	0.56							Chloritized	(?)	Occ. weakly alt. portions show a fine gr. green
620.6-627.3	6.7		2.57		1.00	0.90							(in part)		mass, dk-grey in colour with euhedral feldspar
627.3-635.8	8.5		2.53		0.45	0.37									phenocrysts. Stly chlor/serp. in part. Tr. Cu
635.8-643.7	7.9		2.57		0.86	0.79		wk	–	–	–	Cu	Kaolinized	And.porph	Principally as above. Rock is mostly ... massive
643.7-649.3	5.6	"	2.56		0.81	0.48							Sericitized	(?)	hematite. St. sh'd broken from 643.7-649.
649.3-658.0	8.7		2.58		0.21	0.13									Noted brilliant adamantine red xtals of ... @
658-667.5	9.5		2.62		0.25	0.17									644.7' Feldspar → clay or sericite. Tr.
															malachite, native Cu from 658.0-666.5'.
667.5-677.8	10.3		2.41		0.17	0.06			SULPHIDES			Cu	do	And.porph	As above. Pyrite @ 686.6', where core beco
677.8-688.1	10.3	"	2.54		0.24	0.03		–	wk	↓	wk	Cu		(?)	granitoid in character. Cov and cc found @ 68
688.1-697.3	9.2		2.67		0.55	0.02								Mz/Gr,	Remainder to 704.2 is quartzose, sericitized.
697.3-704.2	6.9		2.60		0.67	0.02								686.6'	st FeOx throughout. Tr. native Cu.
704.2-715.7	11.5		2.63		0.59	0.01		–	wk-mod	wk-mod	wk		Sericitized	Mz/Gr	Brecciated, quartzose, sericitized with mo
715.7-722.0	6.3		2.62		0.68	0.01									FeOx. Cpy dissem. w/cov. St. broken from
722.0-729.6	7.6		2.53		0.56	0.01									727.6 - 729.6'.
729.6-737.6	8.0		2.63		0.76	0.02		–	wk	wk	wk		do	"	Strongly brecciated interval.

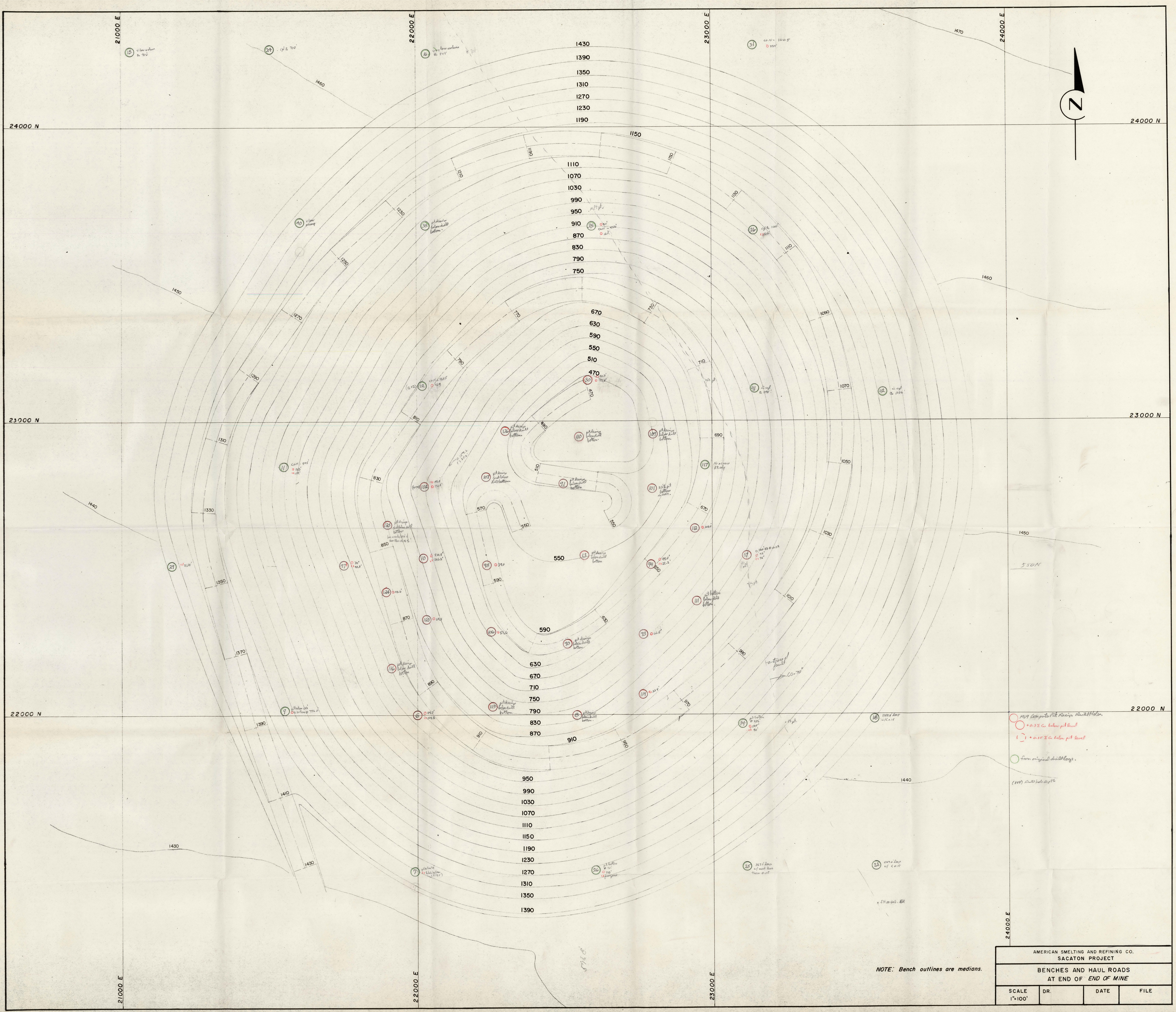
Final Depth 786.0
Collar Elevation
Coordinates
Inclination -90°

ASARCO
GEOLOGIC – ASSAY LOG

Property SACATON

HOLE NO S-1
Sheet No. 4 of 4
Date Completed 10/4
Logged By RHL

Depth	Interval	Core Size	Sp Grav	Core Rec %	Core Assay - % Cu: Total	Non-S	Average	Mineralization: Oxides	Pyrite	Cpy	Cc	Other	Alteration	Rock Type	Remarks 5112
															CORE SPLIT PRIOR TO LOG
737.6-747.8	10.2	NXWL	2.59		0.61	0.01		—	wk-mod	wk-mod	tr	—	Sericitized	Gr/Mz	Mod-st. broken core with just traces of cov-
747.8-754.7	6.9	"	2.66		0.42	0.01		—	mod	wk	—		do	Mz?	Gen. f-to mod. gr. quartzose rock, and in pla
754.7-761.9	7.2				0.70	0.02									shows strong brecciation. cc. no longer
													-		observed. Mod. Fe ox.
761.9-771.8	9.9	"	2.66		0.41	0.01	16.9' @ 0.53	—	mod	wk		tr. spec.	Kaolinized	Gr-Mz	Mod-st. quartzose, brecciated. Tex[illegible]lly
771.8-781.9	10.1		2.59		0.46	0.01							Sericitized	(?)	resembles granite in places, but could also be
														And. porph?	silicif. monz. WK-mod indic. lim. Volc. @ 780'.
781.9-784.2	2.3	"	2.43		0.06	Tr.		None observed					Kaolinized	And. porph	Sh'd, chloritized/serp. with wk. sericitized feldsp
784.2-784.8	0.6				No Recovery									(?)	phenos. and "fresh" black biotite (2nd?) set in a
784.8-785.1	0.3				" "		780 pit bottom								dk greenish-grey groundmass. No sulphides
785.1-786.0	0.9		2.53		0.09	0.01	4.1' @ 0.07								obs. Last foot of int. highly chlor/serp.
	E.O.H.														



N
21000 E
22000 E
23000 E
24000 E
24000 N
23000 N
22000 N
1430
1390
1350
1310
1270
1230
1190
1150
1110
1070
1030
990
950
910
870
830
790
750
710
670
630
590
550
510
470
1470
1460
1450
1440
NOTE: Bench outlines are medians.
AMERICAN SMELTING AND REFINING CO.
SACATON PROJECT
BENCHES AND HAUL ROADS
AT END OF END OF MINE
SCALE
1"=100'
DR.
DATE
FILE

Footage & Grade below final pit bottom:

Hole	Footage	Grade	
S-12	124.4	0.09	
	pit bottom @ 645 ft.		
	123.5	0.08	
	95.5	1.29	some 0.10 mixed w/hi grade.
	43.9	1.18	405.7' @ 1.31
	244.3	0.33	529.2 @ 0.52
S-30	189.5	1.22	
	pit bottom @ 977 ft		
	94.4	0.17	
	173.8	0.40	270.2 @ 0.32
S-35	59.6	0.95	
	pit bottom @ 563 ft.		
	(12.0 ± of above is below pit bottom)		
	452.2	0.19	
	44.7	0.77	
	55.4	0.18	160.6 @ 0.44
	10.4	0.74	
	50.1	0.35	612.8 @ 0.26
S-102	82.0	0.22	
	pit bottom @ 755 ft.		
	192.4	0.26	
	64.5	0.58	
	69.3	0.33	326.2 @ 0.34

S-112	147.3	0.16
	169.1	0.53
	1.1	0.06

pit bottom @ 783 ft

	3.0	0.07

Hole S8 lower 115 ft ran 0.35% (below pit)

Hole S24: lower 180 ft ran 0.33 (outside pit).

Sec. O

Hole S7 from 349.5 – 519.5' (outside pit)
variable from low of — to hi of —
bottom ran. 1.4 @ 0.32
1.3 @ 0.18
0.9 @ 0.12
3.4 @ 0.14
3.0 @ 0.17
2.0 @ 0.14
1.3 @ 0.11
1.5 @ ? No sample.
1.0 @ 0.14.

next to lower 80' ran 0.45
Hole S6 lower 140' ran 0.30 (below pit)

with 0.6 @ 0.42
5.6 @ 0.14
2.0 @ 0.24
4.1 @ 0.24
10.5 @ 0.14
7.4 @ 0.24
4.3 @ 0.32
5.0 @ 0.29
bottom

Hole S10 lower 230 ft ran 0.28 (below pit)

with 9.7 @ 0.25
4.9 @ 0.24
4.9 @ 0.44
4.9 @ 0.30
4.6 @ 0.30
4.4 @ 0.18
9.7 @ 0.23
4.9 @ 0.19
bottom

Hole S12 lower 145' ran 0.23 ([illegible])
Not the lower 26 feet [illegible]

lower samples ran
8.7 @ 0.42
4.6 @ 0.30
5.5 @ 0.37
10.0 @ 0.40
8.5 @ 0.27
8.6 @ 0.24
3.3 @ 0.17
3.2 @ 0.36

1262

← Sec. 1100 E

Hole S31 lower 100' ran 0.61 overall

with 8.1 @ 0.24
8.0 @ 1.24
0.4 - lost sample
7.0 @ 0.38
6.6 @ 0.42
0.4 @ - lost sample
4.3 @ 0.22
bottom @ 1329'.

Hole S36 hole bottomed in bedrock @ 1346'.

60±   1188 − 60 = 1128 (1127.4)

50±   1128 − 50 =   ~~1027.4~~ 1077.4

50'   5.0 x 0.23
6.0 x 0.18
~~9.0 x 0.14~~
9.5 x 0.13
8.0 x 0.12
7.0 x 0.25
3.2 x 0.14
1.9 x 0.14

Sec. 575E. Hole: S30

lower 180 ft ran @ 0.47%   (way below pit

with last samples @

8.7 @ 0.40
4.5 @ 0.18
11.1 @ 0.38
10.8 @ 0.70
3.4 @ 0.50
bottom

Hole S35

lower 60 ft ran @ 0.44%   (way below & outside pit)

with last samples @

9.1 @ 0.23
4.7 @ 0.26
9.1 @ 0.46
3.9 @ 0.46
10.1 @ 0.26
4.5 @ 0.38
4.0 @ 0.42
bottom

Hole S91 lower 135 ft ran 0.54% (below pit)
with last sample @

Hole S13 : lower 170 ft ran @ 0.44% (below pit)
with last sample @

10.0	@	0.38
3.3	@	0.41
3.8	@	0.34
2.3	@	0.66
10.6	@	0.50
5.8	@	0.43
2.6	@	0.25
4.8	@	0.29

bottom

Hole S90 lower 158 ran ? (below pit [illegible]).

4-7- Max thickness:

8- Sec. 2750E. cove ~~[illegible]~~ body 550' faulted bottom.

10- 12- Sec. 575E pit ~~[illegible]~~ body 450' end of DDH.

13- Sec. 0E pit " 800' end of DDH (lower

24- 600 ft low grad ≅ 0.133

30- 31- Sec. 0N. ~~[illegible]~~ body 350' end of DDH (lower gr in bottom

35- 36- over 140' @ 0.30

Sec. 550N pit body 800' with bottom of DDH S10

90- winning. 230 ft @ 0.28

91- Sec. 1650N cove body 350' faulted

Sec. 2200N cove body 600 ft faulted.

Cove	pit
550 f	450 DDH
350 f	800 D
600 f	350 DDH
	800 DDH

1: 30,000

Sec. 2200N
15 (752') 24 (700') 14 (547') 31 (1239') gr (min) 53 min 96 gr (779') 37 (1919') 100
l 920-1020
1020-1150 (0.50)
1150-1239 (0.61)
l 1070-1280
1280-1700 (1.40)
1700-?
l 1200-1380
1380-1570 silic
1570-1860 (0.58)
SAC. BAS FLT
1860-1919-sch.

Sec. 1650N
40 (523') gr 38 (801') 35 (1188') mp (min) 36 (1346') did not pen X fault
l 500-1020
1020-1075 (0.72)
1075-1125 (?)
1125-1188 (0.44)

Sec. 1100N.
12 (1202') gr 30 (1242') gr (min) 41 (1268') 50 across X fault ? serin 42 across X fault.
l 130-860
860-910 (1.15)
910-1010 (0.46)
1010-1175 (0.33)
?
l 80-770
770-980 (1.26)
980-1070 (?
1070-1170 (0.46)
1170-1242 (0.47)
11 (1238')
l 370-930
930-1060 (0.77)
1060-1220 (0.31)
97 95 91 94

Sec. 550N.
29 (1305') gr 16 (1144') mp 13 (849') mp (min) 17 (828') gr
l 240-360.
360-470 (1.90)
470-570 (0.63)
570-1144 (0.35)
l 135-440
440-560 (1.75)
560-690 (0.74)
690-849 (0.44)
f l 520-730
730-755 (0.55)

Sec. 0
9 (774') mp 6 (654') mp 90 8 (459') mp 14 (571') gr 18 (1218') sc-gr
l 390-540
l 270-300
300-435 (0.96)
430-505 (0.45)
505-654 (0.30)
l 200-320
320-360 (0.78)

7 (520') mp 26 (434') mp 25 (367') mp 23 (507') sc-mp
l 90-210.
210-250 (0.68)
250-410 (0.33)

l = leached

97 x (610') mp
l 340-380
380-530 (?)

95 x (902') mp
l 140-400
400-720 (0.92)
720-860 (0.45)

94 x (860') mp min
l 170-~~440~~.
440?-650 (0.74)
650-730 (0.57)

53 x (1779')
l 1100-1200
1200-1380 (1.05)
1380-1470 (0.29)
1470-1650 (0.47)
?

37 x (1869')
l 1000-1270
1270-1500 (+1% silic
1500-1780 (+1% cc
1780-1869 (0.48
Sac. bas. flts

Sec. 0 East Sec. 575E Sec. 1100E Sec. 1650E

Need Aa-16A.3.19B

USBM Bull 621, p.556 –

WES - [illegible] holes, especially one somewhere between SC-13 and Sec. corner 13|18 / 24|19 and one near the 1/4 corner between holes SC-8 and SC-10; Kurtz

W.E.S.
OCT 8 1970

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

October 5, 1970

MR. ~~WRK~~ S-I-B ~~RBG~~
READ AND RETURN
PREPARE ANSWERS HANDLE
FILE INITIALS

TO: W. E. Saegart

FROM: B. E. Kilpatrick

SUBJECT: Review of Santa Cruz Project
Pinal County, Arizona

Summary

Deep drilling through alluvial cover on the Santa Cruz Project encountered significant alteration and chalcocite-enriched copper mineralization that warrants additional testing of the area by two new holes.

Introduction

Drilling through alluvial cover on the Sacaton Project during 1962-1963 revealed a concealed zone of alteration and copper mineralization that was cut by a series of high-angle faults. These faults caused considerable vertical displacement in the secondarily enriched copper mineralization. The mineralization terminates against a low-angle fault that has been inferred to be a "gravity slide" that displaced the Sacaton deposit from a mineralized center to the southwest in the Casa Grande Valley.

Subsequent deep drilling through alluvial cover in the Casa Grande Valley during 1964-1965 revealed an area of alteration and apparently uneconomic copper mineralization that was inferred to be the "root" of the Sacaton deposit. A total of 17 holes were drilled on the Santa Cruz Project using a rotary drill to penetrate the alluvial overburden and to spot-core the bedrock. Drill hole depths ranged from less than 1000 ft. to over 4000 ft., with an average depth of 2400 ft. Core runs in bedrock varied from around 10 ft. to over 100 ft., although the average run was around 20 ft. Ore-grade sulfide copper mineralization was encountered in a short intercept in one hole only and the project was abandoned.

At your request, I have reviewed the drill core in order to re-evaluate the alteration and mineralization encountered during the Santa Cruz drilling. The lithologies, structure, alteration and mineralization in each drill hole were recorded with special attention being given to the interpretation of the indigenous iron oxides in the leached capping that was encountered in the core. This information is briefly discussed below and is presented on the accompanying illustrations.

Lithology

Five bedrock rock units were recognized during my review of the Santa Cruz drill core: granite, aplite, diabase, biotite quartz monzonite porphyry, and andesite. The granite is probably Precambrian in age and the aplite appears to be closely related to the granite. The granite consists of coarse-grained intergrowths of quartz and pink microcline, with occasional large euhedral microcline phenocrysts scattered throughout the rock. Biotite occurs as an accessory mineral. The aplite is a fine-grained, sugary-textured rock that intrudes the granite in minor amounts. The diabase is a gray-green fine-grained mafic rock that intrudes the granite and is probably also Precambrian in age. The Precambrian rocks are cut by the biotite quartz monzonite porphyry, which is a gray rock consisting of fine-to-medium grained feldspar phenocrysts accompanied by abundant medium-grained euhedral biotite "books," set in an aphanitic ground mass. The andesite was not positively identified as it is pervasively altered wherever it occurs; however, it is a gray, aphanitic rock that appears to be intrusive in origin.

Most of the drilling encountered only Precambrian rocks, predominantly the granite (Fig. 4). The porphyry seems to occur as dikes cutting the Precambrian host rocks in the central part of the drilling area, but two holes (SC-14 and SC-16) encountered relatively thick intercepts of porphyry which may indicate that a substantial mass of porphyry occurs in central part of the area. The andesite occurs only in minor amounts.

Alteration

Alteration in the Santa Cruz area is mainly argillic and chloritic, accompanied by minor amounts of sericite and specular hematite. Pervasive sericitic alteration was encountered in one drill hole only, SC-13, in the central part of the area (Fig. 1). A zone of moderate alteration (predominantly argillic) surrounds this hole and extends in a northeasterly direction over an inferred area of approximately two square miles. Alteration beyond this area consists mainly of weak chloritization.

Mineralization

Copper mineralization in the Santa Cruz area consists of oxides (mainly chrysacolla) developed during the leaching of secondarily enriched sulfides. Drill hole SC-12 penetrated approximately 300 feet of bedrock in which abundant copper oxides were encountered in the upper part of the hole, but only traces of copper oxides occur in weakly altered, leached rock at the bottom of the hole.

Short intercepts of ore-grade chalcocite mineralization mixed with iron oxides were encountered in the bottom of drill hole SC-13. One 4-ft. intercept ran 1.05 per cent copper; the next 5 ft. interval 56 ft. lower (separated from the first by rock-bit drilling) ran 0.59 per cent copper. Weak sulfides also occur in drill holes SC-14 and 15, with copper values in the short core intercepts running between 0.1 and 0.3 per cent.

The leached bedrock is flooded with exotic red iron oxides that mask the ingigenous limonites developed during the oxidation of the sulfides. Much of these exotic iron oxides may be developed after specular hematite, rather than sulfides; however, some obvious "live limonite" (hematite) after chalcocite is apparent in drill holes in the central part of the area. I have attempted to estimate the strength of the original copper mineralization from an interpretation of the "live limonite," oxide copper, and assay data. The strongest copper mineralization occurs in drill holes SC-12 and SC-13 and the inferred area of relatively high-grade copper mineralization occurs in section 13 (Fig. 2). This area is surrounded by significant, but weaker, copper mineralization in an area that roughly coincides with the area of moderate alteration.

Structure

Inspection of the drill core from the Santa Cruz Project reveals that most of the rock is highly fractured. The core from the drill holes in the central part of the area is strongly fractured, but the core in the north-east part of the area is even more intensely fractured and sheared, indicating a major fault zone. A plot of the intensity of fracturing (Fig. 3) suggests a strong northeast structural trend. As this trend coincides with the better mineralization, it may represent a pre-mineral trend. However, the intense shearing in drill holes SC-14, 15 and 16 suggests a cross-fault or structural intersection in the area of these drill holes.

The shearing in the drill core appears to be definitely post-mineral in age. Contouring the depths to bedrock encountered in the Santa Cruz drilling yields further evidence for a cross-fault (Fig. 5). The bedrock surface forms a broad "high" in Section 13 that drops off abruptly to the northeast and southeast, indicating possible fault displacement, with the northeast block being down-dropped. Bedrock depths in the central part of the section probably average around 1500 feet, but drop off abruptly to around 2500 feet to the northeast.

Conclusions

Deep drilling through alluvial cover during the Santa Cruz Project encountered a broad area of mineralization and alteration southeast of the Sacaton deposit, on an extension of the same elongated trend the Sacaton deposit occurs on. Mineralogic evidence indicates that the copper mineralization that was encountered consists mainly of an oxidized portion of a previous "chalcocite blanket"; however, the area was not adequately tested to rule out the possibility of finding significant amounts of preserved chalcocite enrichment. The existence of ore-grade chalcocite in the bottom of drill hole SC-13 indicates that more of such mineralization may occur in the vicinity. Furthermore, the probable existence of post-mineral block faulting in the area suggests that additional chalcocite enrichment could have been preserved in a down-dropped block northeast of the area that was tested during the Santa Cruz drilling. (This possibility depends on the relative ages of the oxidation vs. the faulting, however, for the faulting could be post-oxidation in age.) The northeast trend of the alteration and mineralization is open-ended and supports the possibility of encountering additional mineralization to the northeast. Bedrock depths in the southwestern block (Section 13) should average around 1500 feet, but bedrock depths in the northeastern block will be deeper, probably around 2500 feet.

Recommendations

Two additional holes have been recommended, one in the NE 1/4 of Section 13, T.6N, R.4E, and one in the southern 1/2 of Section 7, T.6N, R5E, as shown on Fig. 5. The hole in Section 13 should be drilled first to test the possible extension of known chalcocite mineralization in SC-13 and the hole in Section 7 should be drilled next to test the possibility of additional preserved chalcocite mineralization in the down-dropped fault block. A third hole should probably be programmed to supplement the results of the first two holes.

B.E. Kilpatrick

B.E. Kilpatrick

BEK:mw
Att.

References

Wojcik, J. R., 1966, Santa Cruz Summary, Pinal County, Arizona; Asarco files (Tucson) Aa-16A.3.19c

JDS.

AMERICAN SMELTING AND REFINING COMPANY
Tucson Arizona

November 5, 1970

TO: W. E. Saegart

FROM: J. D. Sell

Re: J. R. Wojcik Proposal
Sacaton Exploration
Pinal County, Arizona

At your request, I have reviewed in a rapid manner the suggestion of J. R. Wojcik (August 6, 1970) that additional values of appreciable copper is present and possibly expandable below the present pit design at Sacaton.

In addition to the geology and assay files, I have also reviewed the computer printout of bench data by C. E. Williams.

The available information supports Wojcik's suggestion and geological and gross mineral trend features suggest continued mineralization in the 0.3% to 0.5% copper range under the present pit design with the probable extension of such values to the north and northwest. These values are averages for thick, 300-600 foot, known sections, and higher-grade zones are also present within these thick sections.

Attachment A is submitted to exhibit the gained information. Of the twenty-three holes which penetrate the design pit bottom and are in mineralized rock, the following points are revealed:

a. Only one hole has values of less than 0.15% copper.

b. Three have only values between 0.15-0.30%.

c. Eight have values of over 0.3% just under the pit and subsequently pass into values between 0.15-0.30%.

d. Two have values of 0.15-0.30% just below the pit and pass into values of over 0.30%.

e. Eight have only values of over 0.30% copper in the drilled columns below the pit design.

Review of five holes surrounding the bottom area of the pit show the following distribution of values from above the pit limit and extending to the bottom of the hole.

Hole	Footage	Grade	Comment	
S-12	124.4	0.09		
	Pit bottom at 645 feet			
	123.5	0.08		
	95.5	1.27		
	43.9	1.18	405.7 @ 1.31	529.2 @ 0.52
	266.3	0.33		
S-30	189.5	1.22		
	Pit bottom at 977 feet			
	96.4	0.17	270.2 @ 0.32	
	173.8	0.40		
S-35	59.6	0.95		
	Pit bottom at 563 feet			
	452.2	0.19		
	44.7	0.77		
	55.4	0.18		612.8 @ 0.26
	10.4	0.74	160.6 @ 0.44	
	50.1	0.35		
S-102	82.0	0.22		
	Pit bottom at 755 feet			
	192.4	0.26		
	64.5	0.58	326.2 @ 0.34	
	69.3	0.33		
S-112	147.3	0.16		
	169.1	0.53		
	1.1	0.06		
	Pit bottom at 783 feet			
	3.0	0.07		

The above information suggests that thickness in excess of 200 feet of over 0.30% copper is presently under the central part of the pit and extends to the north and northwest, as well as in depth, but its extent is unknown for lack of drill data.

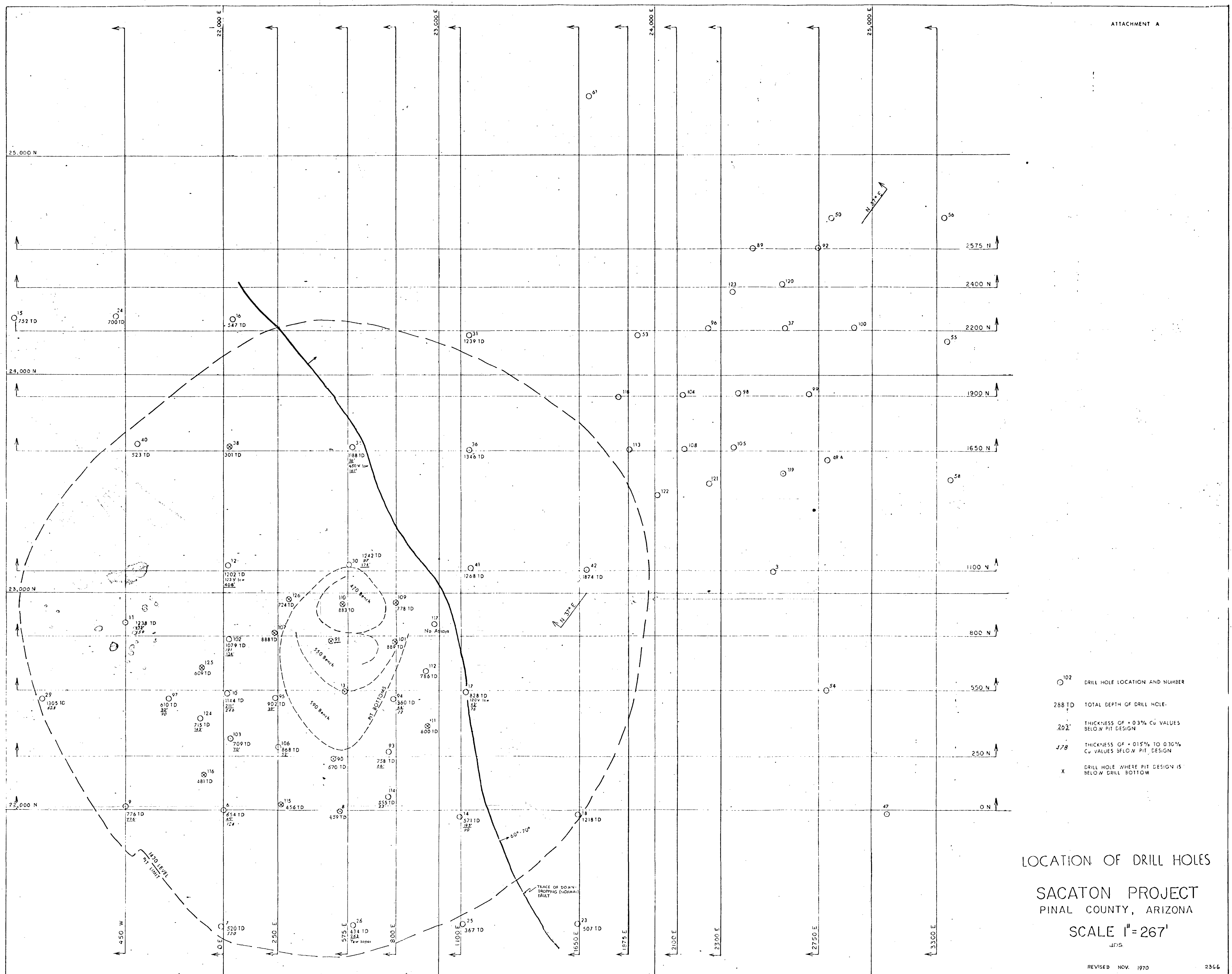
The information further suggests that thicknesses in excess of 200 feet and ranging between 0.15-0.30% copper is mainly present in the south and western part of the pit area.

No firm facts support appreciable chalcocite values to the north and northwest, but the data is certainly open-ended and commercial values and thicknesses are possible. A few deep holes in the area are justified for control and information on the mineral distribution.

James D. Sell

James D. Sell

JDS:mw


ATTACHMENT A
LOCATION OF DRILL HOLES
SACATON PROJECT
PINAL COUNTY, ARIZONA
SCALE 1" = 267'
JDS
REVISED NOV. 1970
2366
102 DRILL HOLE LOCATION AND NUMBER
288 TD TOTAL DEPTH OF DRILL HOLE.
262' THICKNESS OF + 0.3% Cu VALUES BELOW PIT DESIGN
478 THICKNESS OF + 0.15% TO 0.30% Cu VALUES BELOW PIT DESIGN
X DRILL HOLE WHERE PIT DESIGN IS BELOW DRILL BOTTOM
22,000 E
23,000 E
24,000 E
25,000 E
25,000 N
24,000 N
23,000 N
22,000 N
2575 N
2400 N
2200 N
1900 N
1650 N
1100 N
800 N
550 N
250 N
0 N
450 W
0 E
250 E
575 E
800 E
1100 E
1650 E
1875 E
2100 E
2300 E
2750 E
3300 E
N 37° E
1430 LEVEL PIT LIMIT
470 Bench
550 Bench
590 Bench
PIT BOTTOMS
TRACE OF DOWN-DROPPING (NORMAL) FAULT
60°-70°
No Assays

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

February 19, 1974

TO: W. L. Kurtz

FROM: J. D. Sell

Balla-Beck Sacaton Map
Pinal County, Arizona

The Drafting Department has recently completed the "Geology Map of the Sacaton Mountains" at a scale of 1"=2000'. The map is Balla's compilation, revision and remapping of the project initiated by D. Beck in 1963-1964.

James D. Sell
J. D. Sell

JDS:lb
Attach.

ROUTE:

JHCourtright 9/12
FTGraybeal
JDSell
FILE

SMELTING AND REFINING COMPANY
ARIZONA

April 4, 1974

FILE MEMORANDUM

Sacaton

Barry Watson, U.S. Borax, says that their drilling (near "Y" area) indicated a zone in the "Three Peaks monzonite" that was up to 400' wide and about a mile long, that contained .1 to .2 copper as chalcopyrite. Leaching was up to 300'.

At a 1,000' depth, still in Three Peaks monzonite.

W. L. Kurtz

WLK:lb

cc: RBCummings

J. D. Sell

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

April 24, 1974

Memorandum to: W. L. Kurtz

From: F. T. Graybeal

Sullivan property
Sacaton district
Pinal County, Arizona

On April 23, 1974, J. D. Sell, R. B. Cummings, and I reviewed some drill core from the Sacaton Mtns. with Bob Kistler, Chief Geologist and Barry Watson respectively of U.S. Borax and Larry Loidolt of California Exploration Corp., a consulting company. Borax had recently completed 7 diamond drill holes in Sect. 7 and 12 about 4 miles NNE of the Sacaton mine (between the corundum vein and the freeway) on property optioned from Sullivan. They became interested due to an earlier Sullivan hole which averaged 200 ft. of 0.8% Cu (oxide).

The drilling was guided by rock chip geochemical sampling partly collected from shallow auger holes through the soil. This work and the drilling are said to have defined a zone striking N70°E which measures about 1 mile long and 1000 to 4000 ft. wide, although opinions on the width differed. Oxidation is roughly 100 ft. deep with very little leaching and only rare traces of chalcocite. Weak iron staining and rare copper oxide occurrences are said to mark the zone at the surface which J. D. Sell noted was originally mapped by Kinnison and Blucher.

Hole #4 (1038 ft. deep) was apparently the best mineralized and is located 1/2-3/4 mile west of the Silica pit near a bulldozer cut in copper oxides. We are not certain of the location and maps were not available. The host rock in this hole was a fresh, equigranular or weakly porphyritic-looking quartz monzonite with about 7% biotite (5% coarse books, 2% finer-grained shreddy material). The rock was well oxidized to 100 ft. with spotty azurite-malachite-tenorite and probably averaged about 0.4% Cu. The highest grade primary sulfide interval was from 100-250 ft. and averaged 0.30% Cu. This zone contained possibly 0.5 percent irregularly distributed quartz and K-feldspar veins. In addition there were several 12" zones of massive K-feldspar alteration, with minor associated epidote and chlorite, which contained abundant disseminated and vein-controlled chalcopyrite and magnetite. Over the interval from 100-250 ft. I estimate about one percent sulfides with pyrite:chalcopyrite = 1:1 equally distributed as disseminations and in veins. Petrographic work reportedly showed that the sulfides were often randomly disseminated throughout the rock, and were not spatially associated with any one mineral. The chalcopyrite was obviously more abundant in K-feldspar-rich zones. Below 250 ft. the grade drops rapidly to the bottom of the hole which was very fresh.

The core we saw in the other holes was mostly fresh, somewhat broken, with minor pyrite. A number of percussion holes were also drilled near hole #4 to test for additional copper oxides, although no significant results were found. Some of the later diamond drill holes were angled under hole #4 to determine whether the higher grade zone was dipping, but it was apparently a local feature. U.S. Borax plans to drop their option, and from what we saw the property appears to be of no further economic interest.

It is interesting, however, that the alteration and mineralization is characteristic of deep parts of known potassic alteration zones in other porphyry copper deposits. It is also interesting that the shape, size, and direction of elongation in this zone are very similar to the Sacaton alteration zone. The implication is that the Sullivan zone may be the root of the Sacaton zone, the latter possibly being emplaced by gravity sliding. This would suggest that the Santa Cruz zone is also a slide plate rather than the <u>in situ</u> root as earlier proposed and that other slide plates may remain to be found.

The exploration importance of this hypothesis is obvious and it thus becomes important to know the shape and location of the Sullivan zone as exactly as possible. We should, therefore, attempt to acquire the Sullivan data and review it in the field.

F. T. Graybeal

F. T. Graybeal

FTG:lb

cc: JDSell

File

April 25, 1974

American Smelting & Refinery
P.O. Box 5747
Tucson, Arizona 85703

Attention: Mr. James Sell
Exploration Division

Dear Sir:

Mr. Barry Watson, resident manager of U.S. Borax, Tucson, had asked permission for you to review the core from the most recent drilling of Section 7 and 8, Township 5S, Range 6E, which I willingly granted. My reasoning is that I would like to create better feelings and establish a more acceptable business relationship.

I am at this time very willing to show additional information to you in hopes of your considering a joint venture or option.

Respectfully submitted,

James Sullivan, President
J. Sullivan Company, Inc.
P.O. Box 3241
Scottsdale, Az 85257

JS/jm

cc: Mr. Fred Graybeal
Mr. Robert Cummings

AMERICAN SMELTING AND REFINING COMPANY
TUCSON ARIZONA

September 10, 1974

Memorandum for: H. G. Kreis

From: W. L. Kurtz

I should like you to devote the majority of your office and field time to a study of the Santa Rosa-Sacaton-Poston Butte-Ray porphyry copper belt. Asarco has previously done considerable work in this belt, but we still consider it as a permissive zone for the discovery of new porphyry copper deposits.

Previous Asarco generated data includes gravity, aeromagnetics, I.P., water well analyses, geologic mapping, and drilling. Your work should synthesize all of this data to help decipher the complex geologic history of this region. Of particular importance is the post-Laramide period of complex faulting, volcanism, and erosion which has had a profound influence on such deposits as Sacaton and Santa Cruz. Your study should be amply supplemented with field work. This regional approach should allow selection of permissive covered areas for testing with a geologic drill. Currently Mr. Courtright is developing a geologic drill program and you should freely discuss your work and ideas with him.

Your attention is directed to the following reports:

- Table Top Reconnaissance by Sell
- Progress Report on the Structural Geology (Nappe) Program by Giesecke
- Sacaton Mineral Belt by Giesecke
- Sacaton Project
- Santa Cruz Project
- Gila Project
- Poston Butte Project
- Blackwater Project
- Red Hills Project
- Ray West Project
- Santa Rosa Project
- Santa Rosa South Project
- Casa Grande Valley Water Well data by James
- Poston Butte Area Water Well data by James
- J. C. Balla's PhD dissertation

Besides the above list, much other information exists in our files that should help you.

W. L. Kurtz
W. L. Kurtz /lb

WLK:lb

cc: TCOsborne; JHCourtright;
JDSell; FTGraybeal

July 24, 1975

R. B. Cist
JDS.

81 years old
Frieda J. I. Mattheorman
944 Prospect Street
Honolulu, Hawaii

A few notes on Mrs. Mattheorman was learned this past Tuesday in Casa Grande. The information was obtained from Mrs. Gladys Albright, a retired teacher, who was my Second Grade teacher & who still resides in Casa Grande.

Mrs. M. taught the first grade in C.G. many years ago and in the afternoons taught latin at the High School. Mrs. Albright took her course as a freshman. Mrs Albrights maiden name is Wilson and she and her brother "Blinky" Wilson are well acquainted with Mrs M and have corresponded with her throughout the years. Blinky owns the Mercury dealership located in the big ship just past five points on the Gila Bend Highway in Casa Grande.

Blinky's son Jay Wilson recently recieved a letter from Mrs. Mattheorman. Mrs Albright apparently read the letter but would make no further comment. Jay is the star salesman in real estate for the firm of "Orm Ellis Company" in Casa Grande.

Mrs. M. apparently has land holdings in the Casa Grande Valley & in Hawaii. Mrs. M's brother is very well to do and is retired in the San Diego area. Her nephew Bill (and Pat) Isom farm a large block of ground west of Casa Grande and is apparently one of the more successful farmers. The Isom children, Tom and Pam, attend the C.G. schools.

(Jay Wilson tried farming in the Stanfield area but was unsuccessful and hence ended up in real estate, and being a home-grown lad, has done quite well.)

JDS

JDS

ASARCO

Exploration Department
Western USA

January 30, 1976

Memorandum for T. C. Osborne

Santa Cruz
Arizona

On January 29, 1976, Mr. Graybeal and I met at Freeport's Reno office with Messrs. Cook, Flint, Karras, Buckner, and Cornelius. Though a difference of opinion on when to initiate drilling exists, there is little difference of opinion on number and location of drill holes needed on "The Lands" and on "Peripheral Lands".

The following was agreed upon:

1. Purchase Dunlap's option now.

2. Drill one hole on "The Lands" east of SC-16 near the National Exhibition Company (San Francisco Giants) to evaluate the desirability of acquiring this land. Drilling to commence in the second quarter.

3. Contact El Paso Natural Gas to determine time schedule and dollars relative to moving the pipeline.

4. Mr. Osborne and/or Mr. Hecox communicate directly with Mr. Cook (Freeport Reno telephone #702-323-2251) concerning status of NAAC negotiations.

5. T. D'Ambrosio offer to purchase Mormino's option with Newmont to learn terms of option.

6. Asarco drill a minimum of five holes on "Peripheral Lands". Drilling to commence after the anniversary date of the Mormino option <u>unless</u> data from 3, 4, 5 above indicate necessity of an earlier starting date. Encouraging drill results would lead to additional drilling.

7. D. Cook will send letter to Collins Trust (draft read by Graybeal and Kurtz).

8. Should Asarco's drilling and related expenses not aggregate $300,000 on the "Peripheral Lands", Asarco will seriously consider drilling two or more holes in the oxide zone on "The Lands" (drilling to start after anniversary of Collin's option).

9. Freeport, specifically K. Cornelius, will be consulted prior to spudding any hole.

10. Asarco will provide Freeport with key to core shed.

Not considering any land payments, the estimated cost for the minimum program is estimated at:

"The Lands" (1 rotary hole, spot core)	$40,000	Asarco account
"Peripheral Lands" (5 holes)	$240,000	($120,000 Asarco's share)

W. L. Kurtz

W. L. Kurtz

WLK:lb

cc: D.Cook, Freeport-Reno
K.Cornelius, Freeport-Tucson
FTGraybeal
RBCrist

File - Sacaton District 3/1/76

FROM: W. L. KURTZ

To: FTG/JDS/HBK

Hans Jacobsen, Phelps Dodge, states they drilled a hole near Stanfield and got bedrock at shallow depth (not stated but guess about 2,000 or less).

Hole based on gravity — He states the geophys was correct.

Apparently barren hole. Be good to find location — he would not say specifically where.

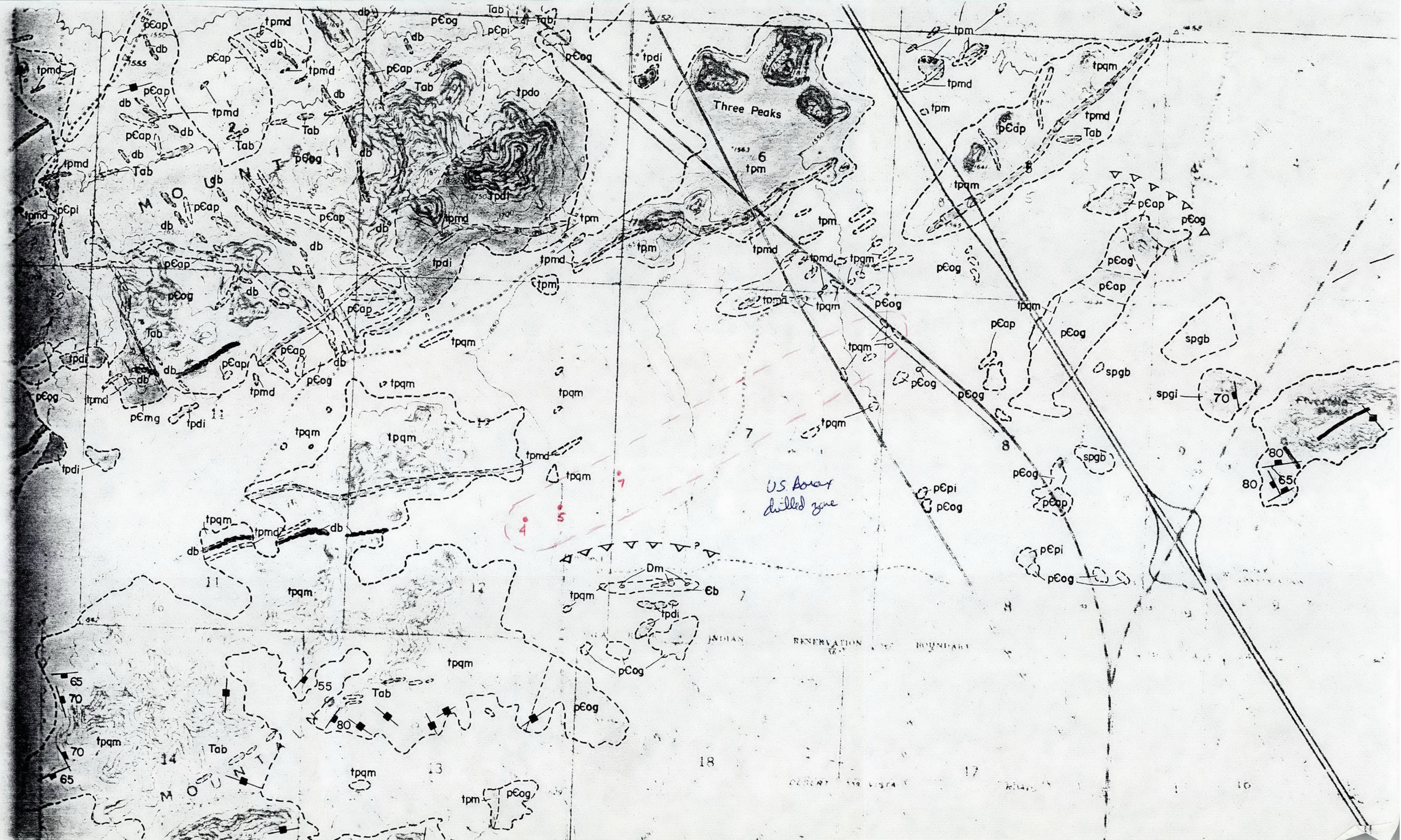
cc: JHC

FROM: F. T. GRAYBEAL 5/28

TO: JD Self
WLKurtz

CASA GRANDE

Still + Cowell + Still are doing gravity work throughout the E ½ of Stanfield Quad and NW ¼ of the Chuichu Quad. Apparently work being done by summer students who showed Steve Bergin their maps.



Three Peaks
U.S. Army drilled zone
INDIAN RESERVATION BOUNDARY
M O U N T
M O U N T
tpmd
tpm
tpqm
tpdi
tpdo
pЄap
pЄog
pЄpi
pЄmg
Tab
db
Dm
Єb
spgb
spgi
4
5
7
6
7
8
11
12
13
14
18
17
16

Laramide	Tab	andesite-basalt.
	spgc	Sac. PK Gr Corefacies 49.0±1.0
	spgi	" " " Intermed. 61.2 ±1.9
	spgb	" " " border
	tpmd	ThreePKs monzonite-aplite dikes
	tpqm	" " qtz mon. core 71.3±2 my
	tpm	" " mon. intermed. facies
	tpdi	" " Diorite inner border
	tpdo	" " " outer border
Pal	Dm	Martin Ls
	€b	Bolsa Qtzite
p€	db	diabase 840± 26my
	p€ap	Aplite
	p€mg	Microgranite 857±26 my
	p€og	Oracle Granite 1240±37 my
	p€pi	Pinal Schist

To: Jim

Date: 4-14 Time: 10:00

WHILE YOU WERE OUT

M Walter Heinrichs

of

Phone
Area Code Number Extension

TELEPHONED		PLEASE CALL	
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	

RETURNED YOUR CALL [X]

Message: Hasn't been able to come up with the info you asked for but will keep looking

Operator: [illegible]

No. 2725 S Clark Office Products Phone 298-2374

4/9/76

Heinrichs

800-900 ft. in drill (?)
? on oxide copper
prob. Jim Sullivan has info.

Walt Will ck data out.

Geology of the Sacaton Deposit, by Robert B. Cummings

INTRODUCTION

To be submitted to new Porphyry Volume edited by SR Titley (1978)

The Sacaton copper deposit is located in Pinal County, Arizona, about 6 miles northwest of Casa Grande and 65 miles northwest of Tucson. The mine is on a gently sloping pediment south of the Sacaton Mountains. In the mine area vegetation is sparse, the climate is semiarid, and the average elevation is 1,450 feet.

Early in 1961 Asarco geologists examined a small outcrop of leached capping 1.5 miles south of pre-mineral outcrops in the Sacaton Mountains. This outcrop forms a low hill about 30 feet high and 300 feet in diameter surrounded by Quaternary alluvium. The hill is underlain by granite and thin monzonite porphyry dikes and exhibits pervasive phyllic alteration. Interpretation of the leached capping suggests the outcrop contained about 2 percent pyrite by volume with traces of chalcocite.

With the altered outcrop as a positive exploration lead a drilling program was initiated which eventually outlined two zones of ore-grade copper mineralization. The relative position of the ore bodies to the Sacaton Mountains and the discovery outcrop is illustrated on Figures 1 and 2. The West ore body is presently being mined by open pit methods; the East ore body will eventually be mined by block caving methods. Full-scale production from the west ore body commenced in February 1974 and currently averages approximately 11,000 tons of ore per day.

This paper is based on data obtained from pit mapping at 1"=100' and diamond drill core logging. Because the East ore body is known only through diamond drilling most of the discussion and conclusions in this paper relate to the West ore body, although generalized comparisons will be made between the two ore bodies.

GENERAL GEOLOGY

Regional Setting

The Sacaton deposit occurs in the Desert Region of the Basin and Range Province of Arizona. At the close of Older Precambrian time the Oracle Granite batholith intruded Pinal Schist. In Younger Precambrian time Apache Group sediments were deposited and igneous activity resulted in the emplacement of the Sacaton Granite northwest of the mine and numerous diabase dikes. During the Paleozoic the Sacaton Mine area was probably near the northern limit of the Sonoran Geosyncline. An unknown thickness of Paleozoic sediments was deposited and later eroded along with most of the Apache Group rocks. During the Laramide Orogeny two granitic stocks, the Three Peaks Monzonite and the Sacaton Peak Granite, were emplaced in the vicinity of the mine. Cenozoic faulting, uplift, and erosion took place with the deposition of continental sediments and development of the present topography.

Rock Types

The geology of the Sacaton Mountains is shown on Figure 1. Pinal Schist, the oldest rock exposed, occurs almost entirely as quartz-muscovite schist roof pendants in the Precambrian granite.

Precambrian granite intrudes the Pinal Schist as a large mass in the northwest portion of the Sacaton Mountains. Smaller exposures are also found in the central portion of the mountains and just south of the Sacaton deposit in the discovery outcrop. The rock is coarse grained, consisting of quartz and orthoclase (some of which occurs as phenocrysts to 1.5 inches in length) with minor plagioclase and biotite. Balla (1972) correlates this granite with the Oracle Granite from the San Manuel area based on ~~because of~~ petrographic similarities. His K-Ar date of 1240 million years for the rock is younger than the Oracle Granite at San Manuel, but he postulates that this discrepancy is due to an argon loss.

A younger Precambrian granite stock intrudes the Oracle Granite in the southern part of the Sacaton Mountains. Exposures of the granite are elongated roughly parallel to the southern limit of the main mass of Oracle Granite (N60°E). This rock is fine to medium grained and contains quartz, orthoclase, muscovite, and minor amounts of plagioclase. Balla (1972) obtained a K-Ar date of 857 million years for the rock and named it the Sacaton Granite.

Numerous northwesterly-trending diabase dikes intrude the large mass of Oracle Granite. A whole-rock K-Ar date of 841 million years was obtained on the diabase by Balla (1972).

One small exposure of Paleozoic rocks is found in the Sacaton Mountains about 3.5 miles northeast of the mine. The outcrop consists of quartzite and limestone which have tentatively been identified as Cambrian Bolsa Quartzite and Devonian Martin Limestone (Wilson, 1969). These rocks contain a small corundum deposit and are in probable fault contact with surrounding Laramide intrusive rocks.

Two Laramide granitic stocks comprise most of the eastern two-thirds of the Sacaton Mountains. The Three Peaks Monzonite, oldest of the two rocks, occurs directly north of the mine and intrudes the Oracle and Sacaton Granites. Balla (1972, p. 27 and 28) states: "The Three Peaks stock is a composite, zoned, epizonal pluton which is aligned in a northeasterly direction. The stock consists of four different facies. Beginning at the contact with the Precambrian Oracle Granite, the facies are: a diorite border facies, which is divisible into a fine-grained outer zone and a coarser-grained inner zone; an intermediate monzonite facies; and a central, monzonite, core facies." Exposures of the core facies are the most abundant. This rock is a medium-grained, equigranular, biotite monzonite composed of plagioclase, orthoclase, biotite, quartz, and accessory sphene and magnetite. Balla's average date on biotite from the core facies in 71.3±2 million years.

The other Laramide stock, the Sacaton Peak Granite, makes up the eastern portion of the Sacaton Mountains. It is similar to the Three Peaks Stock in form (both are composite, zoned stocks) and mineralogy, but distinctly different in texture. Three distinct facies are present. The border facies is a medium-grained biotite quartz monzonite with 15 percent biotite and a gneissic texture. The intermediate facies is a medium-grained, slightly porphyritic, biotite quartz monzonite with prominent quartz phenocrysts and less biotite than the border facies. The core facies is a medium to coarse-grained, slightly porphyritic granite with orthoclase phenocrysts up to 1.5 inches in length. The stock is called a granite after the composition of the core, but the overall composition of the stock is that of a quartz monzonite. An isotopic age of 61.2 ± 1.9 million years was found for the intermediate facies (Balla, 1972).

Structure

A major northeasterly-trending structural lineament has been recognized passing through the Globe-Miami district toward Ajo. Mayo (1958) named this trend the Jemez Zone. Balla (1972) postulates that the Jemez Zone was active intermittently from Precambrian to Tertiary time. He feels that this zone controlled the emplacement of the Precambrian Oracle and Ruin Granites and the Laramide granitic stocks.

Knowledge of the major structural features in the Sacaton Mine area is derived primarily from drilling information. The Sacaton ore bodies and alteration zone are confined to an allochthonous structural block which rests on a low-angle structure referred to as the Basement Fault. The allochthon is elongated in a northeasterly direction and measures at least 4 miles in length, up to 1.5 miles in width, and from 1,200 to 2,200 feet thick. Northwesterly-striking normal faults divide the allochthonous rocks into several horst and graben units as shown on Figure 2. Autochthonous rocks below the Basement Fault are part of the Pinal Schist.

GEOLOGY OF THE ORE BODIES

Rock Types

With the exception of the Pinal Schist, found below the Basement Fault, all pre-mineral rocks in the vicinity of the ore bodies are pervasively altered. In addition, two stages of brecciation are present, often resulting in an intimate mixture of rock types. These features have complicated the delineation and identification of the rocks. Figures 3, 4a, and 5 show the distribution of rock types in the ore bodies. Figures 4b and 6 show the distribution of sulfides in the West and East orebodies, respectively.

Pinal Schist. A complex of metamorphic rocks which is thought to be Pinal Schist is found below the Basement Fault. Rock types include quartz-biotite-chlorite schist, metamorphosed granitic rocks, gneiss, and metavolcanic rocks. This diversity of rock types is not found outcropping in Pinal Schist exposures in the area, but due to the degree of metamorphism they have been assigned to this unit. Similar rocks have not been identified in the upper plate of the Basement Fault.

Oracle Granite. The Oracle Granite varies in composition from granite to quartz monzonite. The rock is coarse grained, weakly porphyritic, and composed of quartz, orthoclase, plagioclase, and minor biotite. Subhedral phenocrysts of orthoclase up to 1.2 inches in length occur locally. A relative increase of plagioclase over orthoclase often accompanies the large orthoclase phenocrysts, resulting in a quartz monzonite composition. Thin, irregular, and discontinuous aplitic dikes cut the granite and are thought to be related to it. Where intense alteration, brecciation, and granulation occur the only means of identifying the granite is the abundance of coarse-grained, sheared quartz.

The granite is the predominate rock type in the East ore body where it occurs as a large brecciated mass and as the major constituent of mixed breccias. In the West ore body granite occurs in brecciated masses on both the north and south sides of the pit. It also makes of varying proportions of the mixed breccias in the central portion of the pit.

Diabase. A tentative age of Younger Precambrian has been assigned to this rock. The original composition of the diabase has been masked by hydrothermal alteration, but a good relict diabasic texture is present. The rock now consists of lath-shaped aggregates of sericite and clay after plagioclase in a matrix of fine-grained, shreddy biotite and mafic minerals.

The diabase occurs as irregular dikes intruding granite and as xenoliths in the younger monzonite porphyry. In the West ore body the dikes are generally restricted to the large mass of granite on the north side of the pit. The dikes exposed in the pit strike north to north-northwest, vary greatly in dip, and reach a maximum thickness of 30 feet.

Monzonite Porphyry. Monzonite porphyry intrudes granite and diabase. Although the monzonite porphyry in the mine area cannot be correlated to either of the Laramide stocks in the Sacaton Mountains, it is assumed to be Laramide in age. Variations in the texture and composition of the monzonite porphyry are common. Typically it exhibits phenocryst to groundmass ratios ranging from 40:60 to 60:40. The composition of the medium-grained phenocrysts is typically as follows: 75 percent euhedral plagioclase (0.08 to 0.16 inches in length); 10 to 15 percent euhedral biotite books (0.08 inches in width); 10 percent subhedral quartz (0.08 to 0.12 inches in diameter); and 1 to 3 percent subhedral orthoclase (0.08 to 0.12 inches in diameter). The groundmass is a fine-grained intergrowth of feldspar and quartz but alteration obscures the identification of the feldspars.

Textural and modal variations in the monzonite porphyry include phenocryst to groundmass ratios from 70:30 to 25:75, accessory hornblende phenocrysts, phenocryst size, phenocryst composition, and megascopic differences in the appearance of the groundmass. The above-mentioned variations in the monzonite porphyry may be gradational over a few tens of feet but in the mixed breccias variations in texture and composition are common from one fragment to the next.

Intense quartz-sericite alteration obscures the quantity of primary quartz which was originally present in the groundmass of the monzonite porphyry. The original composition of the monzonite porphyry may have been that of quartz monzonite.

Monzonite porphyry intrudes the older rocks in the West ore body forming mixed breccias, monolithic breccias, large poorly-defined dike-like masses, and thin well-defined but discontinuous dikes. Xenoliths of granite are common in the monzonite porphyry. Drilling results and pit mapping indicate that the greatest thickness of monzonite porphyry occurs in the center of and to the west of the West ore body. Monzonite porphyry intruding the granite masses on the north and south sides of the pit occurs as dikes. A northeasterly trending mass of monzonite porphyry intrudes the granite in the southern portion of the East ore body. Elsewhere it occurs as moderate to steeply dipping dikes and in mixed breccias.

Quartz Monzonite Porphyry. This rock intrudes the granite and diabase and is thought to be Laramide in age. Texturally and mineralogically the quartz monzonite porphyry is identical to the monzonite porphyry. It is distinguished from the monzonite porphyry by the presence of 10% or more clear quartz phenocrysts.

Quartz monzonite porphyry occurs as monolithic and mixed breccias, irregular masses, and dike-like bodies in the west and southwest portions of the West ore body and in the East ore body. Gradational contacts are common between the quartz monzonite porphyry and the monzonite porphyry and definitive crosscutting relationships have not been found. Because of spacial relationships and similarities in texture and composition, monzonite porphyry and quartz monzonite porphyry are considered to be comagmatic in origin.

Mixed Breccias. Both the East and West ore bodies contain substantial volumes of brecciated rock. The predominant rock types in the breccias are monzonite porphyry, quartz monzonite porphyry, and granite. Differentiation of the mixed breccias is based on the rock type of the dominant breccia fragment. Following is the mixed breccia classification used on Figures 3, 4a, and 5:

> Mixed Granite-Porphyry Breccia. Mixed breccia in which granite fragments comprise 51 to 84 percent of the total volume of fragments.
> ?
>
> Mixed Porphyry-Granite Breccia. Mixed breccia in which porphyry fragments (monzonite or quartz monzonite) comprise 50 to 84 percent of the total volume of fragments.

Mixed breccias containing 15 percent or less foreign fragments are not differentiated from corresponding monolithic breccias. For example, a breccia with 10 percent granite fragments and 90 percent monzonite porphyry fragments is designated monzonite porphyry breccia. Detailed descriptions of the breccias are contained in the section on structure.

Contacts between mixed breccias and monolithic breccias are often gradational. In places, however, weakly brecciated monzonite porphyry dikes and masses appear to intrude the mixed breccias. This relationship suggests that emplacement of the monzonite porphyry post-dates as well as pre-dates the formation of the mixed breccias.

Mixed breccias are found throughout the West ore body but appear to be concentrated between the granite masses on the north and south sides of the pit. As might be expected, granite-porphyry breccias generally occur in close proximity to masses of granite or granite breccia. Drill hole data suggests that the mixed breccias grade at depth into monzonite porphyry and monzonite porphyry breccia. In the East ore body mixed breccias generally occur in close proximity to monzonite porphyry dikes and masses.

Dacite Porphyry. Dacite porphyry dikes, probably of early Tertiary age, intrude older rocks in both ore bodies. The dacite porphyry contains phenocrysts of sodic plagioclase, quartz, and biotite. Phenocrysts make up 15 to 25 percent of the rock and vary from 0.08 to 0.16 inches in diameter. The groundmass is an aphanitic granular intergrowth of feldspar, quartz, chlorite, and biotite.

Two dacite porphyry dikes, about 250 feet apart, trend N65°E through the central portion of the West ore body (Fig. 3). In the East ore body, a single dacite porphyry dike is found south of the block cave limits (Fig. 5). The presence of weak alteration and sulfide mineralization in the dacite porphyry suggests that it was intruded during the later stages of mineralization.

Conglomerate. A Tertiary terrestrial conglomerate is found in fault contact with the older rocks. The exact age of this unit is not known, but indirect structural evidence suggests it is equivelant in age to the mid-Tertiary Whitetail Conglomerate. The conglomerate at Sacaton contains sub-angular to sub-rounded clasts comprising 40 to 60 percent of the unit in a silty to gritty, moderately well-indurated matrix. Clasts in the conglomerate are mostly Oracle Granite and Pinal Schist with small amounts of monzonite porphyry. Fragments of leached capping are not uncommon.

Dips in the conglomerate are variable. They average 0 to 20° to the north or northeast on the east side of the pit and 30 to 60° to the north or northeast on the west side of the pit. The conglomerate reaches a maximum thickness of at least 1,750 feet east of the pit and at least 2,500 feet to the west of the pit.

Alluvium. An average thickness of 100 feet of Quaternary alluvium is deposited over the older rocks in the area of the East and West ore bodies. This material is loosely consolidated sand and silt. Occasional fragments of partially decomposed Three Peaks Monzonite are found toward the base of the unit.

Structure

Several periods of deformation have produced a complex structural picture at Sacaton. Each of the periods is characterized by fracturing, faulting, and brecciation.

Fracturing. Rocks occurring in and around the ore bodies are well fractured. As a result, much of the rock tends to break into fragments less than 12 inches in diameter. Locally, fractures in the leached capping and the upper portion of the enriched zone are healed by supergene alteration minerals and the rock breaks into coarser fragments.

Although all possible fracture orientations occur, mapping of fractures indicates that two preferred orientations are present. Mineralized fractures strike from N50°E to E-W (Fig. 7) and generally dip greater than 70° in either direction. These fractures are often well healed with supergene sulfides or indigenous limonite and are often unbroken in pit faces.

The preferred orientation of barren fractures is N-S to N20°W. Most are close to vertical in dip, but moderate and low-angle dips are also present. Transported limonite often occurs lining these fractures and many exhibit slickensides which indicate horizontal movement. Displacements on the barren fractures are thought to be minor and probably resulted from adjustment to more significant displacement on faults.

Faulting. A great number of minor faults are mapped in the West ore body. The faults are often variable in strike and dip and are usually difficult to trace along strike. The prevailing strike direction is N60°E to E-W. Slickensides on some of the faults indicate that horizontal components of displacement are relatively common. Generally, the lack of predictable lithologic contacts to act as markers makes the direction and magnitude of displacement difficult to estimate. Total displacement on most of the faults is thought to be less than 100 feet. Both pre-mineral and post-mineral movement is often present.

Two post-mineral normal faults control the bedrock-conglomerate contact in the vicinity of the West ore body. The Sacaton Fault bounds the ore body on the east side. It strikes from N-S to N45°W (the average strike in the pit area is N20°W) and dips about 60° east. Conglomerate in the hanging wall of the fault on the upper benches of the pit is well indurated, but is not crushed or deformed. Chrysocolla often cements the conglomerate in this area. In the footwall of the fault pre-mineral rocks are intensely fractured. On the south side of the pit these rocks are so severely crushed and granulated (for a thickness of up to 40 feet) that the original rock type cannot be identified. Vertical displacement on the Sacaton Fault is at least 1,500 feet. This fault is of major significance because it divided a continuous zone of chalcocite mineralization into two separate ore bodies.

The West Fault bounds the west side of the West ore body. It strikes N45°W curved? rotated? adjacent to the northern portion of the ore body and swings to N20°E adjacent to the southern portion. The dip of the fault varies from 10° to 30° to the west. As with the Sacaton Fault, conglomerate occurs in the hanging wall and pre-mineral rocks occur in the footwall. Conglomerate in the hanging wall is well indurated (in the upper benches) but is not crushed or deformed. Pre-mineral footwall rocks contain numerous fractures which parallel the fault, but crushing and granulation are absent.

The amount of displacement on the West Fault is unknown, but the thickness of conglomerate to the west of the pit suggests that it could be on the order of several thousand feet. Rotational movement is indicated by steep dips in the conglomerate of the hanging wall.

Several minor faults offset the Sacaton and West Faults in the area of the West ore body. However, the pausity of these structures compared to their abundance in the West ore body suggests that movement on the Sacaton and West Faults post-dates the bulk of the minor faulting.

The South Fault forms the southern limit of the East ore body. It strikes E-W and dips an average of 45° south. The hanging wall is conglomerate while pre-mineral rocks occur in the footwall. Maximum vertical displacement is at least 800 feet. Drilling suggests that the South Fault is terminated against the Sacaton Fault west of the East ore body.

The above-described normal faults and the mineralized rocks containing the Sacaton deposit are terminated at depth on the Basement Fault. The fault plane (known only by drilling) takes the shape of a shallow trench, the axis of which trends to the northeast. Along the axis of the trench the fault plane is slightly undulating. It varies in dip from 0° to 20° and is found at depths of 1,800 to 2,200 feet below the ground surface. The sides of the trench dip from 20° to 40° toward the axis. North of the ore bodies drilling suggests that the Basement Fault is truncated against a steeply dipping, northeasterly trending structure which brings the Three Peaks Monzonite into fault contact with the rocks of the upper and lower plates.

The plane of the Basement Fault is composed of sheared, undulating zones of brecciated upper and lower plate rocks and thin zones of firm but sheared chloritic to hematitic gouge. The average thickness of the fault is about five feet. Lower plate rocks of the Pinal Schist complex are often crushed and sheared for distances of up to 40 feet below the fault. Mineralized upper plate rocks are crushed and brecciated for distances of up to 200 feet above the fault.

The direction of movement of the upper plate of the Basement Fault is unknown at the present time. Lower plate rocks are void of mineralization, suggesting that movement was on the order of several miles.

Brecciation. Two periods of brecciation are found at Sacaton. The earliest period of brecciation is pre-mineral. It is related to the intrusion of the monzonite porphyry, and is a major ore control in the West ore body. Post-mineral brecciation is superimposed on and is more extensive than the earlier brecciation. Both types of brecciation are present in the West ore body, but post-mineral brecciation is the only type occurring in the East ore body.

Pre-mineral brecciation occurs as monolithic breccias and mixed breccias. Diagnostic features of this period of brecciation are subtle and often difficult to recognize because of pervasive hydrothermal alteration, transported iron oxide minerals, and post-mineral brecciation. The breccia consists of tightly packed fragments set in a well-cemented matrix. Breccia fragments commonly vary from 0.2 inches to 6 feet in diameter. The presence of larger fragments or blocks is suspected, but has not been verified. Fragments are usually subangular to subrounded but angular and rounded forms are also present. The matrix of the breccia consists of small rock fragments and rock flour and usually comprises 5 to 20 percent of the rock. Angular vugs are a diagnostic feature of the pre-mineral breccia. They occur between fragments in the breccia and vary in size from 0.2 to 2.0 inches. Breccia vugs commonly occupy 1 to 5 percent of the breccia and are partially to totally filled with one or more of the following: specular hematite, indigenous iron oxide minerals, hypogene sulfides, supergene sulfides, and terminated quartz crystals.

An intimate mixture of rock types occurs as fragments in the pre-mineral breccia. The dominant rock types are monzonite porphyry and granite with minor quartz monzonite porphyry and rare diabase. The limit of significant pre-mineral brecciation on the 1030 bench is shown on Figure 3. Rock type designations found on Figures 3, 4a, and 5 do not reflect the intensity of brecciation or differentiate between pre-mineral and post-mineral brecciation. Included in the pre-mineral breccia are the following rock type designations in decreasing order of abundance: monzonite porphyry breccia, mixed porphyry-granite breccia, mixed granite-porphyry breccia, quartz monzonite porphyry breccia, and granite breccia. The relative abundance of granite breccia and granite-porphyry breccia increases outside the limit of significant pre-mineral brecciation. Drilling and pit mapping suggest that the relative abundance of monzonite porphyry in the pre-mineral breccia increases below the 1030 bench.

The usual measures of brecciation intensity such as fragment mixing, fragment shape and size, and fragment to matrix ratio do not identify a center of brecciation or a zonation of brecciation intensity. However, the quantity of vugs in the pre-mineral breccia defines a zonal pattern of brecciation intensity consisting of a strongly brecciated central core with 3 percent or more breccia vugs and a border zone of brecciation with greater than one percent but less than 3 percent breccia vugs. The quantity of breccia vugs is thought to be directly related to the intensity of pre-mineral brecciation. Specular hematite is almost always present in the vugs and can be used as a gauge of pre-mineral brecciation intensity.

The breccia core is irregular in plan (Figs. 3 and 4a) and measures roughly 450 feet by 600 feet with a slight elongation to the northeast. Although the outline of the core is somewhat variable from bench to bench in the pit, the north and south margins have an overall steep dip to the north. The contact between the core and the border zone is usually gradational. The border zone forms an irregular sheath which almost completely surrounds the core. The limit of significant pre-mineral brecciation as shown on Figure 3 corresponds to the outer margin of the border zone or the core where the border zone is absent. Beyond the border zone, the effects of pre-mineral brecciation are lost and post-mineral brecciation predominates.

Post-mineral brecciation has affected the rocks in a number of ways depending on rock composition, degree and type of alteration, and relative location in the ore bodies. Manifestations of this period of brecciation include shattering, crushing and granulation, mixing of rock types, and the presence of linear breccia structures containing crushed sulfides.

Shattering occurs as a random network of closely-spaced, through-going fractures. It is ubiquitous in both ore bodies, but is more obvious where the dominant rock type is monzonite porphyry or quartz monzonite porphyry. In certain dike-like bodies of monzonite porphyry post-mineral brecciation consists of thoroughly shattered rock. The only significant fragment and matrix development occurs on thin (up to one inch) breccia structures. Crushed sulfides occur on some fractures. The absence of significant crushing and clast development may be due, in part, to less intense phyllic and argillic alteration in the groundmass of these monzonite porphyry bodies.

Crushing and granulation are pervasive in the granite. These features occur as discontinuous fissures which cut quartz and orthoclase grains. Where this type of deformation is only weakly developed igneous textures are easily recognizable and fragment and matrix development is poor. Crushing and granulation in the granite may be equivalent to the intense shattering in the monzonite porphyry. This incipient stage of brecciation is usually restricted to the granite breccias. Granite occurring in the mixed breccias is more intensely deformed.

With increasing post-mineral brecciation the igneous textures of the rocks involved become obscure and fragment and matrix development increases. Matrix commonly makes up to 10 to 30 percent of the rock. It consists of gouge, rock flour, crushed sulfides, and broken mineral grains. Because of intense cataclastic deformation, fragments in well-developed post-mineral breccias are not as well-defined as those in pre-mineral breccias. They commonly range in size from less than 0.2 inches to over 15 feet, and in shape from subangular to subrounded. Mixing of rock types is common in these breccias. They generally occur as mixed, granite, and monzonite porphyry breccias.

Linear breccia structures are an integral part of the post-mineral brecciation. These structures contain rock and mineral grain fragments (usually comprising 20 to 40 percent of the structure) in a fine-grained matrix. The fragments are rounded to subrounded and vary from 0.05 to 2.0 inches in diameter. Frequently the fragments are slightly elongated parallel to the structure walls. The matrix consists of rock flour, gouge, crushed sulfides and small mineral fragments. Bands of varying matrix composition are common in the structures creating a pseudo-flow texture. Crushed, contorted, and sometimes folded sulfide veinlets often occur in the structures. Commonly the breccia structures reach 6 inches in thickness. In the leached capping and chalcocite blanket they are "healed" by supergene minerals (probably silica and chalcocite). The breccia structures usually strike northeast with steep to moderate dips, but low-angle structures are not uncommon.

Post-mineral brecciation occurs throughout the East and West ore bodies. The overall intensity of this brecciation is somewhat variable but seems to be greater on the south side of the West ore body. In the area of the East ore body post-mineral brecciation increases in intensity toward the Basement Fault.

Alteration

Hypogene Alteration. Two hypogene alteration assemblages, potassic and phyllic, have been identified at Sacaton. Propylitic alteration has not been identified.

Alteration minerals occurring in rocks of the potassic assemblage include varying quantities of biotite, chlorite, quartz, sericite, and clay, with traces of calcite and anhydrite. Secondary K-feldspar is either absent or identical in color and texture to magmatic K-feldspar. Secondary biotite and chlorite characterize the potassic assemblage. Since phyllic and supergene alteration are superimposed upon and largely destroy potassic alteration it is uncertain how much of the quartz, sericite, and clay are part of the original potassic suite.

Potassic alteration is often well developed in the monzonite porphyry and quartz monzonite porphyry and is always well developed in the diabase. The granite rarely exhibits weak potassic alteration. In the porphyries fine-grained biotite with a "shreddy" texture, considered here to be secondary, is found disseminated in the groundmass. The biotite occurs as discrete grains, irregular aggregates, and as fringes around primary biotite phenocrysts. Microscopically, primary biotite is brown while the secondary variety has a greenish cast. Disseminated sulfides are sometimes found with the secondary biotite. Thin biotite veinlets are rarely present. Secondary biotite may make up 40 percent of the groundmass in places where later quartz and sericite alteration is not severe. The original mafic minerals in diabase are almost totally replaced by biotite. In the granite secondary biotite occasionally replaces primary biotite. Intense development of secondary biotite in any of the rocks does not significantly destroy primary igneous textures.

Rocks with potassic alteration may contain chlorite altering from secondary and primary biotite. These rocks always exhibit quartz, sericite and clay alteration of groundmass and phenocryst feldspars. The chlorite is thought to be part of the potassic assemblage while most of the quartz, sericite, and clay are probably associated with the later phyllic assemblage. Some quartz veining along with traces of calcite and anhydrite are also part of the potassic suite.

The apparent intensity of potassic alteration in the porphyries is variable and is attributed to varying degrees of destruction of secondary biotite by subsequent phyllic alteration. In general the intensity of secondary biotite is greater in monzonite porphyry breccias and dikes than in quartz monzonite porphyry or mixed breccias.

Phyllic alteration is characterized by quartz, sericite, and clay; but quartz and sericite predominate. Secondary silica in the porphyries occurs as a fine-grained replacement of the groundmass (intergrown with sericite and clay). Minor amounts of quartz are also found with sericite and clay replacing plagioclase phenocrysts in the porphyries and granite. Quartz-sulfide veinlets are associated with the phyllic assemblage, comprising up to one percent of the rock by volume.

Sericite is the major alteration product of the phyllic assemblage, constituting up to 50 percent of the rock. In the porphyries sericite replaces plagioclase phenocrysts, biotite phenocrysts, secondary biotite grains, and the groundmass. It replaces plagioclase, biotite, and orthoclase in granite. Gray alteration selvages bordering quartz-sulfide and sulfide veinlets occur in all the mineralized rocks. The selvages are commonly up to 1 inch thick and are composed of fine-grained intergrowths of sericite and quartz with some clay. Within the selvages igneous textures are often totally destroyed.

Clay minerals make up varying amounts of the phyllic assemblage. Clay generally occurs with sericite in the groundmass of the porphyries and as an alteration of feldspar in the porphyries, granite, and diabase. Kaolinite is thought to be the major clay mineral, but others are also present.

Intense phyllic alteration occurs locally in the granite and monzonite porphyry, but where present it almost totally obliterates igneous rock textures. Igneous textures are preserved in most of the altered rock although quartz is the only original mineral remaining. With decreasing alteration fresh orthoclase is observed in granite and fresh biotite phenocrysts are found in the porphyries. The presence of fresh biotite is interesting because the same rock will exhibit extensive replacement of the groundmass by quartz and sericite and total replacement of plagioclase phenocrysts by sericite and clay.

The major occurrence for both alteration assemblages is one of pervasive flooding of the rock. Fracture control of alteration minerals occurs rarely in the potassic assemblage but may make up to 10 or 20 percent of the alteration minerals in the phyllic assemblage. Occasionally the presence of phyllic selvages seems to be obscured by brecciation and supergene alteration.

The phyllic assemblage clearly postdates potassic alteration as evidenced by the alteration of secondary biotite to sericite in phyllic selvages of sulfide veins. Balla (1972) reports a K-Ar age of 64.5±1.4 million years for drill core containing sericite and kaolin from the hypogene sulfide zone in the vicinity of the deposit.

Hypogene Alteration Zoning. The classical hypogene alteration zoning pattern found in some porphyry copper deposits has not yet been recognized at Sacaton, perhaps due to the limited area of available information. Potassic alteration in the Laramide intrusive rocks was originally widespread and probably well developed in both ore bodies. Variations in the intensity of potassic alteration appear to be related to the effects of later phyllic alteration and not to a hypogene zoning pattern. The intensity of phyllic alteration does exhibit a crude zonal pattern. A zone of strong phyllic alteration occupies the south and central portion of the West ore body and all of the East ore body. This zone has a northeasterly trend and is continuous between the two ore bodies. At right angles to this trend the intensity of phyllic alteration gradually decreases.

Supergene Alteration. Supergene alteration associated with the process of secondary enrichment of sulfides has modified the suite of hypogene alteration minerals. Effects of this supergene overprint are not always assessable because post-enrichment oxidation and leaching often penetrate the chalcocite blanket into the primary sulfide zone.

Erratically distributed silicification of probable supergene origin is found in the oxidized zone and the upper portions of the enriched zone. In areas where supergene silicification is well developed the rock is very competent and fractures are well healed. Some parts of the chalcocite blanket are well healed enough to prevent oxidation and pods of supergene sulfide ore up to 100 feet in diameter are left perched in the leached capping.

An undetermined quantity of the sericite and clay appears to be of supergene origin. The main evidence for this assumption comes from differences in the megascopic appearance of rocks from the oxidized zone and enriched zone compared to rocks from the primary sulfide zone. Igneous textures and phyllic selvages are more readily visible in the primary sulfide zone. It is thought that the selvages and textures are preserved because the rock has not been flooded by supergene solutions.

Minor quantitites of supergene alunite are present in the enriched zone. The alunite occurs as fracture fillings and pods up to 0.1 inches in thickness.

Mineralization

Nature of the Ore Bodies. The West ore body is contained within the limits of the horst formed by the Sacaton and West Faults. Within this horst block is a northerly dipping zone of chalcocite enrichment which has been disected and partially destroyed by post-enrichment oxidation. Ore grade primary mineralization is present below much of the chalcocite mineralization. Both types of mineralization are mined in the West ore body.

The West ore body is roughly oval in plan and measures approximately 1,400 feet by 1,000 feet with a slight north-south elongation. It varies in thickness from less than 100 feet at the margins to over 700 feet in the central portion. Before mining was initiated ore reserves were estimated at 33.0 million tons of 0.76 percent copper with a cutoff of 0.30 percent copper. The overall waste to ore ratio is 4.8:1.

The East ore body occurs in the graben on the east side of the Sacaton Fault. The bulk of the material to be mined is part of the south dipping zone of chalcocite enrichment. Primary mineralization does not reach ore grade and will be mined only in order to obtain the overlying chalcocite mineralization. In plan the East ore body measures approximately 750 feet by 850 feet. The thickness of ore varies from about 100 feet to 400 feet. Ore reserves are estimated to be 12 to 14 million tons of +1.0 percent copper.

Hypogene Mineralization. The major hypogene sulfide minerals are pyrite, chalcopyrite, and molybdenite. Traces of bornite and sphalerite have been observed in concentrate samples but have not been identified megascopically. Minor quantities of gold and silver are also present along with occasional magnetite veins. Quartz occurs as terminated crystals in breccia cavities and as veinlets which usually contain sulfides.

Hypogene sulfides occur as disseminated grains, veins, and vug fillings. Disseminated sulfides are more abundant in granite and strongly brecciated rocks than in the porphyries and weakly brecciated rocks. In the West ore body disseminated grains usually comprise less than 50 percent of the hypogene sulfides, but in the East ore body, where granite breccia is the main rock type, disseminated grains make up over 50 percent of the sulfides. Locally, disseminated sulfides are more abundant in phyllic alteration selvages and in secondary biotite sites. The intensity of breccia vug mineralization is directly related to the volume of breccia vugs in the rock. In the core of the pre-mineral breccia, sulfides filling these cavities may comprise 30 percent of the total sulfide content.

Four types of sulfide-bearing veins occur at Sacaton. The type which is responsible for the bulk of vein mineralization contains pyrite and varying quantities of chalcopyrite and quartz. Chalcopyrite usually comprises 0 to 40 percent of the veins and quartz is generally less than 10 percent. These structures commonly vary from discontinuous paper thin veins to semi-continuous veins up to 0.1 inches in thickness and rarely they reach a thickness of 6 inches. The thicker veins are more continuous along strike. Quartz-pyrite±chalcopyrite veins up to one inch in thickness are common but are relatively unimportant to the total sulfide content of the deposit. Occasional quartz-pyrite±molybdenite and quartz-molybdenite veins postdate the other vein types.

The total sulfide content for both ore bodies is quite variable, ranging from about 1.0 to 4.0 percent by volume. Rock type and pre-mineral brecciation cannot be directly correlated to variations in total sulfide content. North and south of the ore bodies the total sulfide content decreases in a fashion similar to the overall alteration intensity. Drilling and pit mapping have defined a zone within which the grade of hypogene mineralization is at least 0.40 percent copper as chalcopyrite. As seen on Figure 2 this arcuate shaped zone is continuous between and underlies most of both ore bodies. Copper grades approaching 0.70 percent are found within the zone in the vicinity of the pre-mineral breccia. Outside the zone the copper grade gradually drops off to less than 0.10 percent copper. The pyrite to chalcopyrite ratio varies from 1:1 to 3:1 within the zone and increases to 10:1 or more outside the zone. Molybdenite occurs in quartz veins and as smears on fractures. The molybdenum content averages approximately 0.010 percent for the West ore body and 0.025 percent for the East ore body.

Supergene Mineralization. Chalcocite and covellite are the only supergene sulfides recognized at Sacaton. Covellite constitutes less than 5 percent of the supergene sulfide content and is generally found near the base of the enriched zone. The paucity of specular hematite below the zone of secondary sulfide enrichment suggests that it is also of supergene origin.

The intensity of secondary enrichment is greatest at the top of the enriched zone and decreases gradually toward the base. In the upper portions of the enriched zone chalcocite completely replaces chalcopyrite and partially replaces pyrite. Toward the base of the zone chalcopyrite is partially replaced and pyrite is rimmed by thin coatings of chalcocite. The enrichment factor (the ratio of supergene copper grade to hypogene copper grade) varies from 3:1 to 5:1 for both ore bodies.

The most important control for supergene enrichment is the grade of primary mineralization. The bulk of economic supergene mineralization is underlain by primary sulfides averaging at least 0.40 percent copper. The mode of occurrence of primary sulfides also appears to control the intensity of supergene enrichment. Higher grade chalcocite mineralization in the East ore body is associated with a high percentage of disseminated sulfides. Rock type and structure locally exhibit control over supergene mineralization but predictable patterns have not been recognized.

The chalcocite blanket in the West ore body is irregular in thickness, grade, and continuity. These irregularities are caused by tilting, post-enrichment oxidation, and possibly by fault offsets. In the south and central portion of the ore body the base of the blanket dips gently to the north (Fig. 4b). Drill hole data suggests that the dip steepens abruptly or that the blanket is downdropped on the order of 200 to 300 feet on the north side of the breccia core. It is not known whether this has been caused by a fault offset or if some unrecognized control has allowed enrichment to penetrate deeper into the primary zone. On the west side of the ore body the blanket dips to the west. The blanket varies in thickness from less than 50 feet on the margins to 500 feet on the north side of the breccia core.

The chalcocite blanket in the East ore body varies in thickness from 200 to 400 feet. On the east side of the ore body the thickness of supergene sulfides is reduced by deep leaching. The top of the blanket on the south side is displaced by the South Fault. The base of supergene enrichment dips 20° to 30° to the south.

Leached Capping and Enrichment History. A typical suite of leached capping minerals is found after the oxidation and leaching of primary and secondary sulfides. Hematite, goethite, and jarosite in varying proportions occur as indigenous minerals filling former sulfide sites. Transported iron oxide minerals are common in the leached capping, usually making up a greater volume of the rock than their indigenous equivalents. They commonly occur as fracture fillings and as a flooding of the rock.

The intensity of transported iron oxide has complicated rock type identification and leached capping interpretation. The highest grade supergene mineralization is overlain by leached capping in which the indigenous iron oxides are relatively rich in hematite and exhibit a "live" or pulverulent texture. A relatively high ratio of indigenous iron oxides to transported iron oxides is also indicative of good enrichment.

The thickness of leached capping varies from less than 100 feet to over 650 feet in the West ore body. The thicker intercepts of capping are found on the north side of the ore body. Over most of the East ore body the capping varies from about 15 feet to 225 feet in thickness. The thin intercepts occur in the southern portion of the ore body where the South Fault displaces the bulk of the capping. On the east and north margins of the ore body where greater thicknesses of capping are preserved, up to 650-foot intercepts are found.

Where thorough leaching has occurred, the capping assays between 0.03 and 0.10 percent copper. Substantial quantities of oxidized copper minerals are found erratically distributed through the capping of both ore bodies. In the East ore body the oxide minerals usually occur just above chalcocite mineralization and are thought to have resulted from in-place oxidation of chalcocite along zones of deep oxidation. Copper grades of over 1.0% are common. In-place oxidation is also found in the West ore body but generally the oxides occur over a greater horizontal range and the copper has probably been transported from the point of oxidation. Chrysocolla, brochantite, and malachite are the most common oxidized copper minerals. In upper portions of the capping chrysocolla predominates while brochantite and malachite predominate in the lower portions. Other oxidized copper minerals present in the capping include atacamite, azurite, antlerite, cuprite, native copper, and neotocite. Metatorbernite and pseudomalachite are rare.

The ore bodies at Sacaton have undergone two periods of oxidation and leaching. The first period resulted in the formation of what was probably a uniform high grade chalcocite blanket that was continuous through the East and West ore bodies. Although the absolute age of enrichment is not known, clasts of leached capping in hanging wall conglomerate of the Sacaton and West Fault indicate that at least some and probably all of the original blanket formed prior to movement on these faults.

The second period of oxidation and leaching modified and partially destroyed the original blanket. In the East ore body the effects of this period of post-enrichment oxidation were less severe than in the West ore body. Deep zones of oxidation cut into the chalcocite blanket on the eastern margin of the East ore body. The bulk of the copper that was oxidized remains in situ as oxidized copper minerals. Some of the copper was leached and deposited as chalcocite. The major portion of the area to be mined was unaffected by this process and remains as the economic core of the deposit.

Within the limits of the West ore body the effects of post-enrichment oxidation are diverse and are distributed in an erratic fashion. A complete range occurs from total oxidation of sulfide minerals to partial oxidation where only 10 or 20 percent of the sulfides are destroyed. Total oxidation of the blanket occurs in zones ranging in width from 650 feet to less than 3 feet. Complete leaching is common but in places copper remains as oxides.

The vertical extent of thorough post-enrichment oxidation (where at least 75% of the sulfides have been oxidized) is shown in Figure 4b. South of the pre-mineral breccia core occasional "fingers" of thorough oxidation penetrate the blanket. Most of the blanket and upper portion of the hypogene zone exhibit a pervasive, partial oxidation of sufides. Copper is generally leached in this area. Within the breccia core thorough post-enrichment oxidation penetrates and destroys a significant portion of the blanket. Thorough oxidation has penetrated to depths of at least 550 feet below the pre-mine ground surface. Some copper was deposited as oxides but the bulk was leached. North of the breccia core irregular zones of oxidation cut the blanket. These zones penetrate up to 1,150 feet below the pre-mine surface.

As a result of the second period of oxidation and leaching, the chalcocite blanket in the West ore body is extremely erratic and discontinuous. Mineable zones of high grade chalcocite mineralization are often surrounded by completely leached material. This feature requires careful grade control and sorting of the ore during mining.

The fact that post-enrichment oxidation is much more severe in the West ore body than in the East ore body suggests that its intensity is related to movement on the

Sacaton Fault. Uplift of the West ore body along the fault probably raised the original chalcocite blanket above the existing water table. At that time oxidation and leaching took place in the western blanket and penetrated the margin of the eastern blanket along permeable structural zones. Pre- and post-mineral brecciation acted as local controls for this destructive stage of oxidation and leaching. The abundance of thorough oxidation in the pre-mineral breccia core (Fig. 4b) suggests that the permeability of this zone was a major control.

Much copper leached from the original blanket in the West ore body was probably flushed completely out of the mine area by ground water. The possibility also exists that some copper was redeposited as chalcocite. Deep chalcocite mineralization on the north side of the deposit could have resulted from oxidation and redeposition of the central portion of the original blanket.

Geologic History

In chronological order the major geologic events in the Sacaton Mine area include the following:

Formation of the Pinal Schist;
Intrusion of the Precambrian Oracle Granite;
Intrusion of diabase dikes;
Intrusion of monzonite porphyry and quartz monzonite porphyry;
Pre-mineral brecciation;
Hypogene alteration and sulfide mineralization;
Intrusion of dacite porphyry dikes;
Erosion cycle with formation of original chalcocite blanket;
Subsidence and deposition of Whitetail(?) conglomerate;
Normal faulting (West, Sacaton, and South Faults) and post-mineral brecciation;
Post-enrichment oxidation;
Movement on Basement Fault and further post-mineral brecciation;
Quaternary alluvium.

Rather than being discrete events, the intrusion of the porphyries and pre-mineral brecciation were probably intermittent events which overlapped in time. In addition post-enrichment oxidation may have taken place in several cycles starting before deposition of the conglomerate and continuing through large scale displacement on the Basement Fault.

Discussion

Although the Sacaton porphyry copper deposit is similar in many respects to other porphyry copper deposits in southwestern North America, significant differences do exist. Any comparison of the Sacaton deposit to the "typical" porphyry copper is complicated by the fact that much of the deposit and surrounding alteration zone is known only through drilling. In addition, post-mineral faulting displaces portions of the mineralized system relative to originally adjacent portions of the system. With these limitations in mind, the model presented by Lowell and Guilbert (1970) will be used to compare the Sacaton deposit with the "typical" porphyry copper.

The main pre-ore host at Sacaton is Precambrian granite. The composition, age, and controlling structures of the igneous host rock are similar to the model of Lowell and Guilbert (1970). Drilling suggests the igneous host at Sacaton occurs as a northeasterly elongated stock which measures at least 1000 by 2000 feet. The West ore body occurs at the northeastern end of the stock around the zone of pre-mineral brecciation. The present levels of exposure in the West ore body are thought to represent the apex of the stock.

At Sacaton the shape of the deposit, type of deposit boundaries, hypogene plus supergene grade, and hypogene grade are similar to the model of Lowell and Guilbert (1970). Roughly equal proportions of ore occur in the pre-ore host and the igneous host at Sacaton. In most porphyry copper deposits the bulk of the ore is in the igneous host. With total mineable reserves of less than 50 million tons, the Sacaton deposit would appear to be smaller and contain less tonnage than the typical porphyry copper deposit. However, prior to normal faulting and post-enrichment oxidation the deposit may well have contained over 200 million tons of ore grade material.

Although the gross aspects of hypogene alteration at Sacaton are similar to the model of Lowell and Guilbert (1970), substantial differences do exist. Potassic alteration is present, but secondary K-feldspar has not been recognized. The potassic assemblage is not recognized as a discrete zone due to partial destruction by a later pervasive phyllic assemblage. The intensity of phyllic alteration decreases away from the center of mineralization. Argillic and propylitic alteration assemblages have not been noted.

Hypogene sulfide minerals at Sacaton are similar to the model except that bornite, sphalerite, and galena are virtually absent, even on the margins of the deposit. Chalcopyrite mineralization is zoned, but is not related to a discrete alteration zone. The lowest pyrite to chalcopyrite ratios occur in both the phyllic and potassic assemblages. As is typical of most porphyry deposits the total sulfide content is lower in the potassic assemblage than the phyllic assemblage. At Sacaton rocks exhibiting potassic alteration commonly have a total sulfide content of 1.0 to 2.0 percent by volume (1.8 to 3.6 percent by weight) while rocks with phyllic alteration vary from 1.0 to 4.0 percent by volume (1.8 to 7.2 percent by weight). The zone of better chalcopyrite mineralization does not appear to be surrounded by a halo of abundant pyrite.

Although mineralized breccia zones are common in porphyry copper deposits, the breccias usually do not make up a significant proportion of the ore in the southwestern United States. At Sacaton a significant proportion of the ore in the West ore body occurs in the pre-mineral breccia.

Supergene enrichment at Sacaton is typical of most porphyry copper deposits. However, the post-enrichment history of the deposit is much more complex than the typical case. Two generations of faulting and tectonic brecciation followed by destructive oxidation and leaching modified the chalcocite blankets in both ore bodies. The extent and complexity of this activity does not often occur (or evidence of it is not preserved) in porphyry copper deposits.

Pertinent features which must be considered in order to develop a theory of origin for the pre-mineral brecciation are as follows:

1. Pre-mineral brecciation does not occur as a well-defined pipe but as a rather poorly-defined zone. Generally the contacts of the zone are gradational. Radial

fractures do not occur around the zone.

2. Contacts indicating that the pre-mineral breccias are intrusive have not been found.

3. Certain phases of the monzonite porphyry locally intrude the pre-mineral breccia.

4. The percentage of monzonite porphyry fragments in the pre-mineral breccia increases with depth.

5. Most breccia fragments are subangular to subrounded and are tightly fitted together.

6. Linear breccia structures described as part of the post-mineral brecciation contain pseudo-flow textures which may have resulted from fluidization. These structures are considered to be post-mineral due to the presence of crushed sulfides. However, it is possible that the linear breccia structures originated with the pre-mineral breccia as fluidized zones, were later mineralized, and finally re-brecciated during post-mineral brecciation.

Pre-mineral brecciation at Sacaton resulted from a complex series of events and probably involved a number of different breccia-forming mechanisms. Subsidence and collapse are thought to be the primary mechanisms of breccia formation. After intrusion of the monzonite porphyry the overlying granite either collapsed into a void created by exsolution and entrapment of vapors from crystallization of the magma (Norton and Cathles, 1973) or subsided due to temporary retreat of the magma. In either instance breccias may have developed in the manner envisioned by Gates (1959, p. 812) for breccia pipes in the Shoshone Range, Nevada:

> "The pressures of magma and gas open cracks overhead; gas rushes into some of these, tearing fragments from the walls which, in turn, assist in further brecciation by abrasion, attrition, and wedging; magma rushes into others, quickly chills and evolves more gas which brecciates the rocks ahead; still others may be filled with breccia formed by rock bursts."

If the void was formed by magma retreat caving and rock bursting would have contributed significantly to the filling of the cavity. Several periods of collapse probably occurred along with intermittent intrusive pulses. During the intrusive pulses "mineralization stoping" (Locke, 1926) may have contributed to the brecciation. The result was a zone of thoroughly mixed and brecciated granite and monzonite porphyry which was subsequently altered and mineralized.

Post-mineral brecciation is thought to be tectonic in origin. It is associated with large-scale normal faulting in the area and with movement along the Basement Fault.

Acknowledgments

Credit should be given to former Asarco geologists John E. Kinnison and Arthur G. Blucher for recognizing the significance of the Sacaton discovery outcrop. The exploration program which delineated the Sacaton deposit was directed by Messrs. Kenyon Richard and J. Harold Courtright.

The writer wishes to acknowledge a number of Asarco geologists for their assistance in the form of stimulating discussions on the geology of Sacaton. These individuals include S. A. Anzalone, G. B. Bailey, J. H. Courtright, S. R. Davis, F. T. Graybeal, H. G. Kreis, W. L. Kurtz, J. D. Sell, G. J. Stathis, and P. G. Vikre. Messrs. Anzalone, Graybeal, and Vikre were particularly helpful in the preparation of this paper. Mr. Donald A. Melhado prepared the illustrations. Permission to publish this paper was granted by ASARCO Incorporated.

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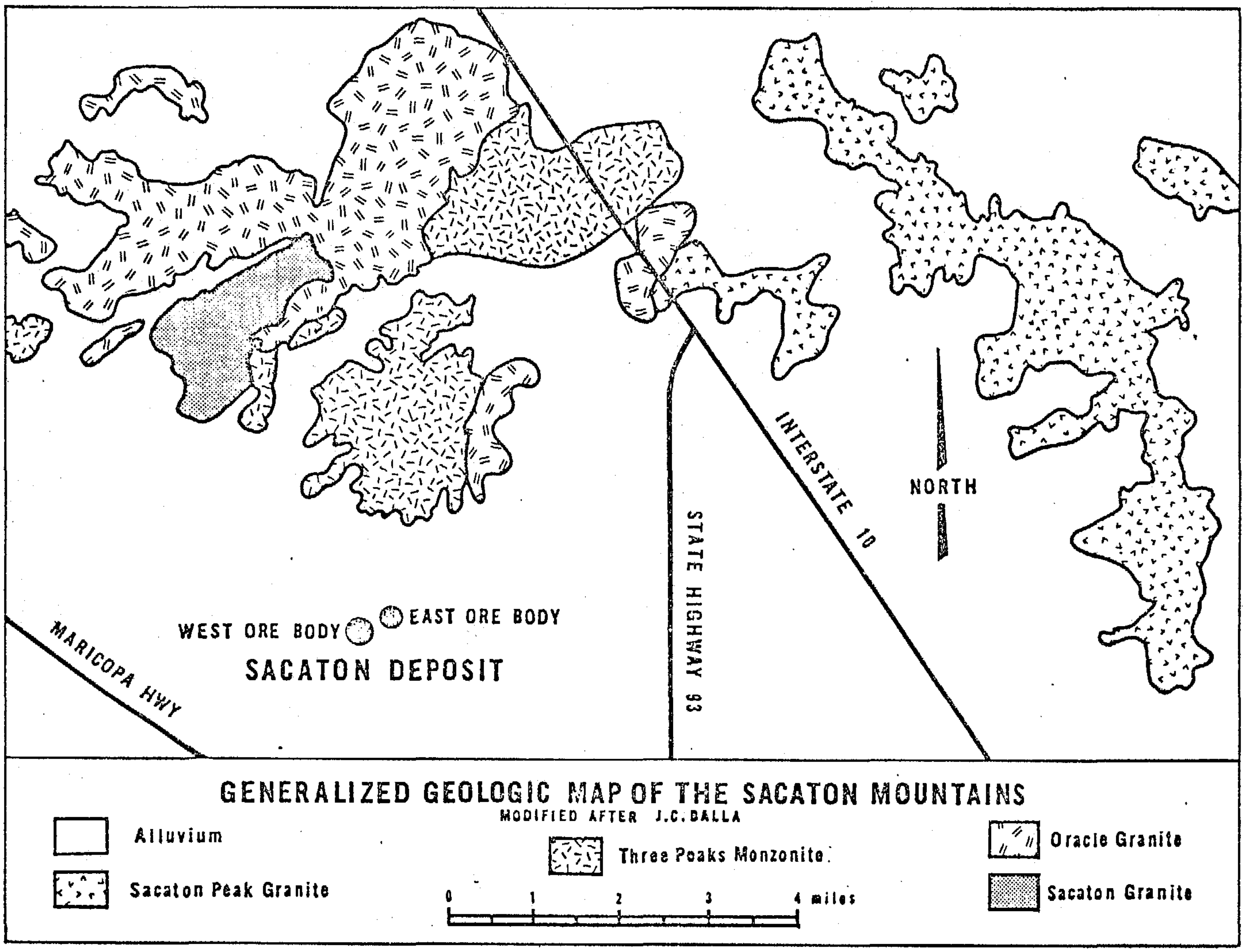
Figure 1	- Generalized geologic map of the Sacaton Mountains.
Figure 2	- Generalized plan and section showing the limits of the East and West ore bodies.
Figure 3	- Geologic map of the 1030 bench, West ore body.
Figure 4a	- Section B-B' through the West ore body showing rock types.
Figure 4b	- Section B-B' through the West ore body showing distribution of sulfides.
Figure 5	- Section C-C' through the East ore body showing rock types.
Figure 6	- Section C-C' through the ~~West~~ East ore body showing distribution of sulfides.
Figure 7a & b	- Strike frequency diagrams for veins and fractures from the 1070 bench in the West ore body. 7a shows the strike frequency for 292 veins and mineralized fractures. 7b shows the strike frequency for 152 unmineralized fractures. The length of each 10° strike segment is proportional to the percentage of total strike measurements.

Fig 1

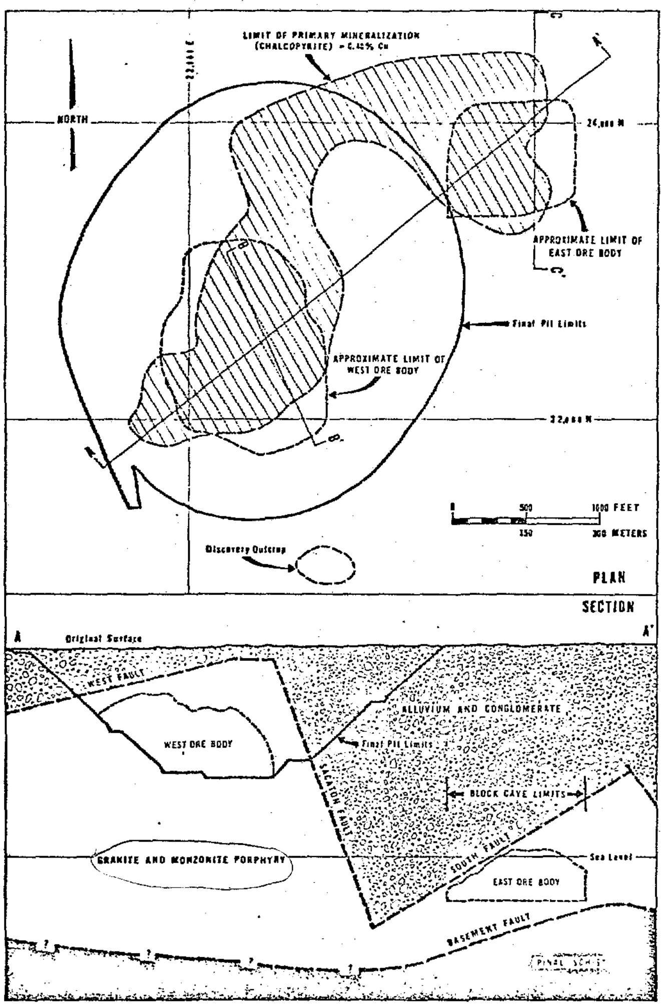


FRED LIKES THIS

SAME SIZE

Fig 2

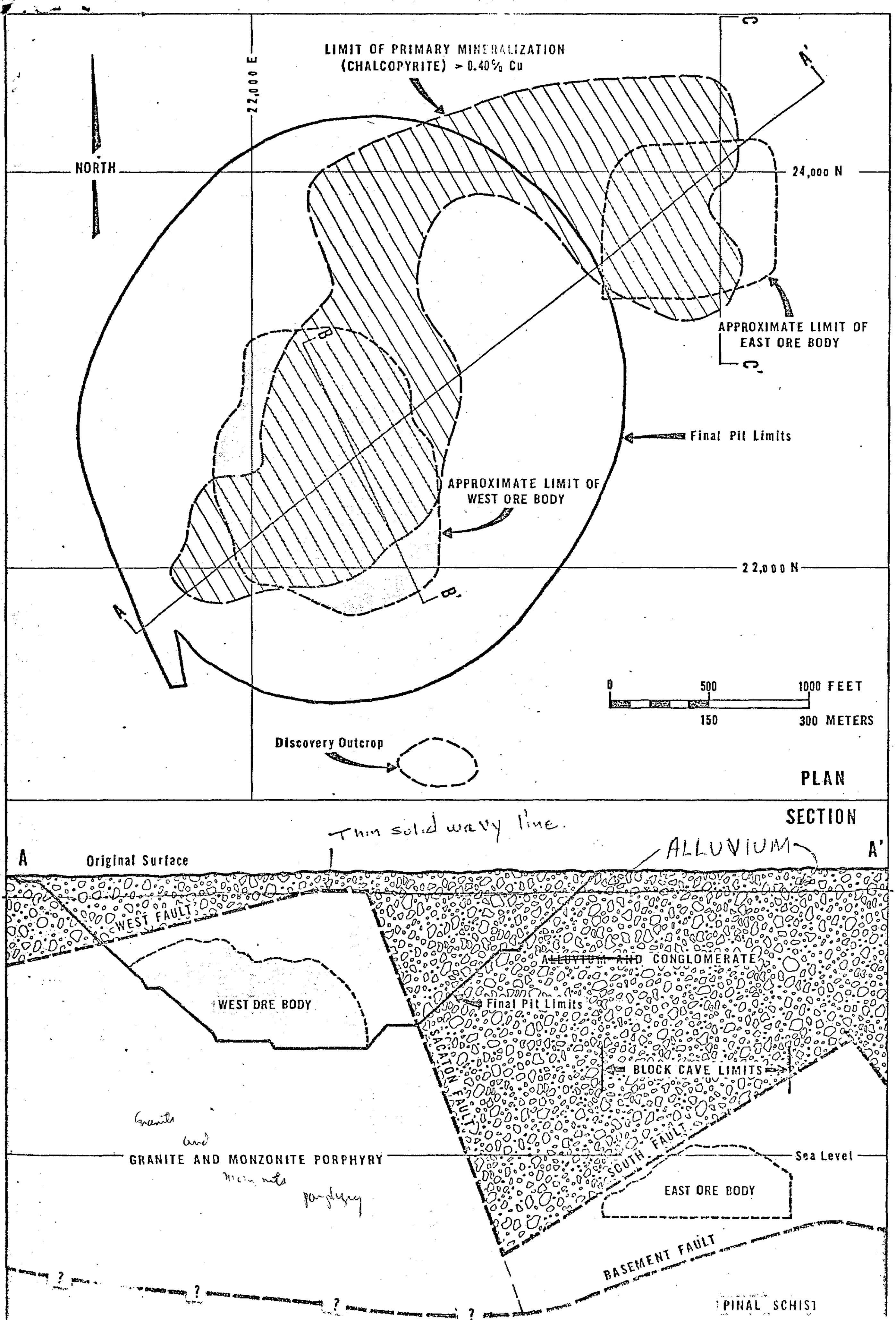
This size?
Or the next page?



7"

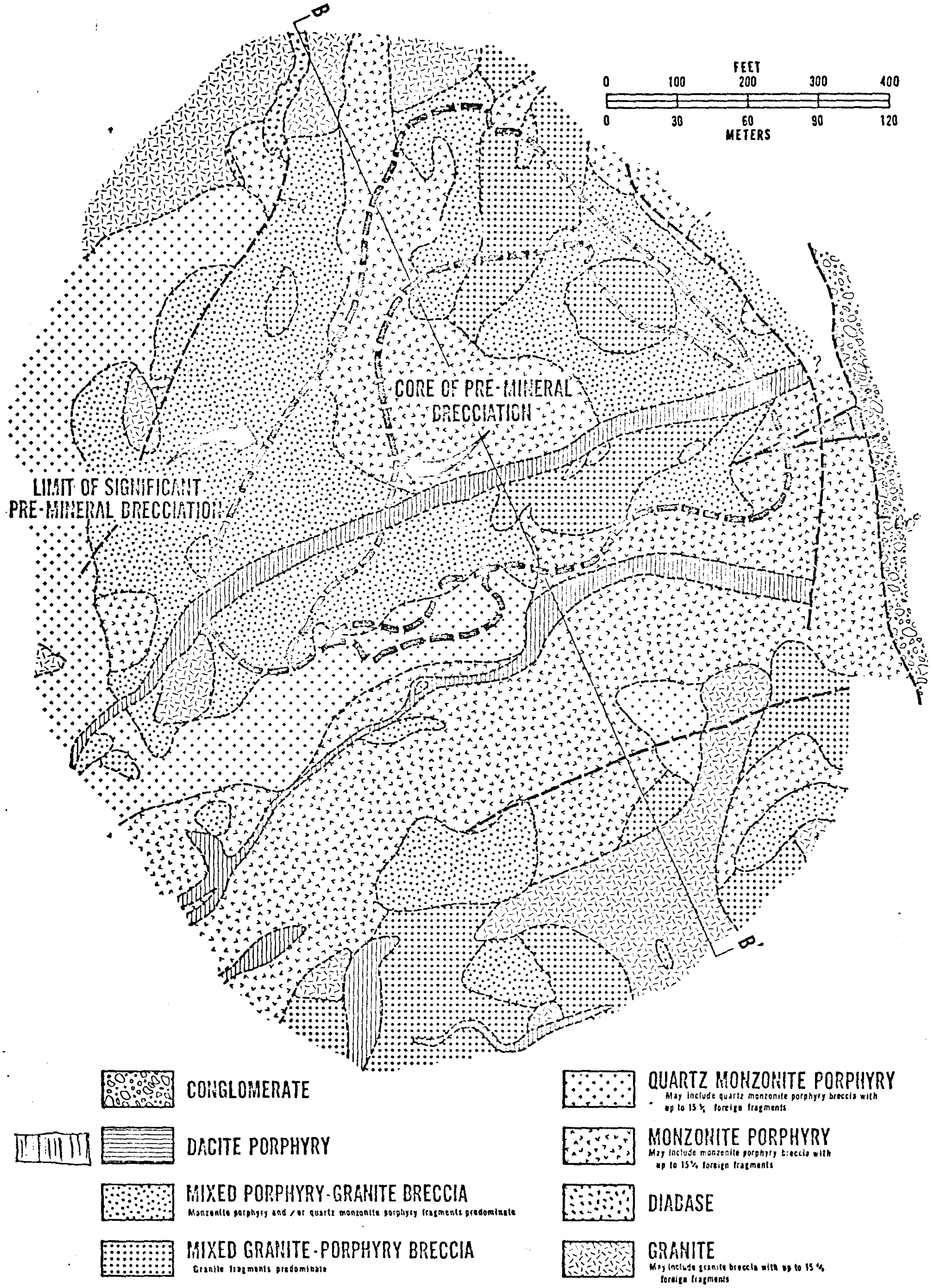
3.5"

Fig 2



LIMIT OF PRIMARY MINERALIZATION (CHALCOPYRITE) > 0.40% Cu
22,000 E
NORTH
24,000 N
22,000 N
A
A'
B
B'
C
C'
APPROXIMATE LIMIT OF EAST ORE BODY
Final Pit Limits
APPROXIMATE LIMIT OF WEST ORE BODY
0
500
1000 FEET
150
300 METERS
Discovery Outcrop
PLAN
SECTION
Thin solid wavy line.
ALLUVIUM
Original Surface
WEST FAULT
~~ALLUVIUM~~ AND CONGLOMERATE
WEST ORE BODY
Final Pit Limits
SACATON FAULT
BLOCK CAVE LIMITS
Granite and
GRANITE AND MONZONITE PORPHYRY
Monzonite porphyry
SOUTH FAULT
Sea Level
EAST ORE BODY
BASEMENT FAULT
PINAL SCHIST

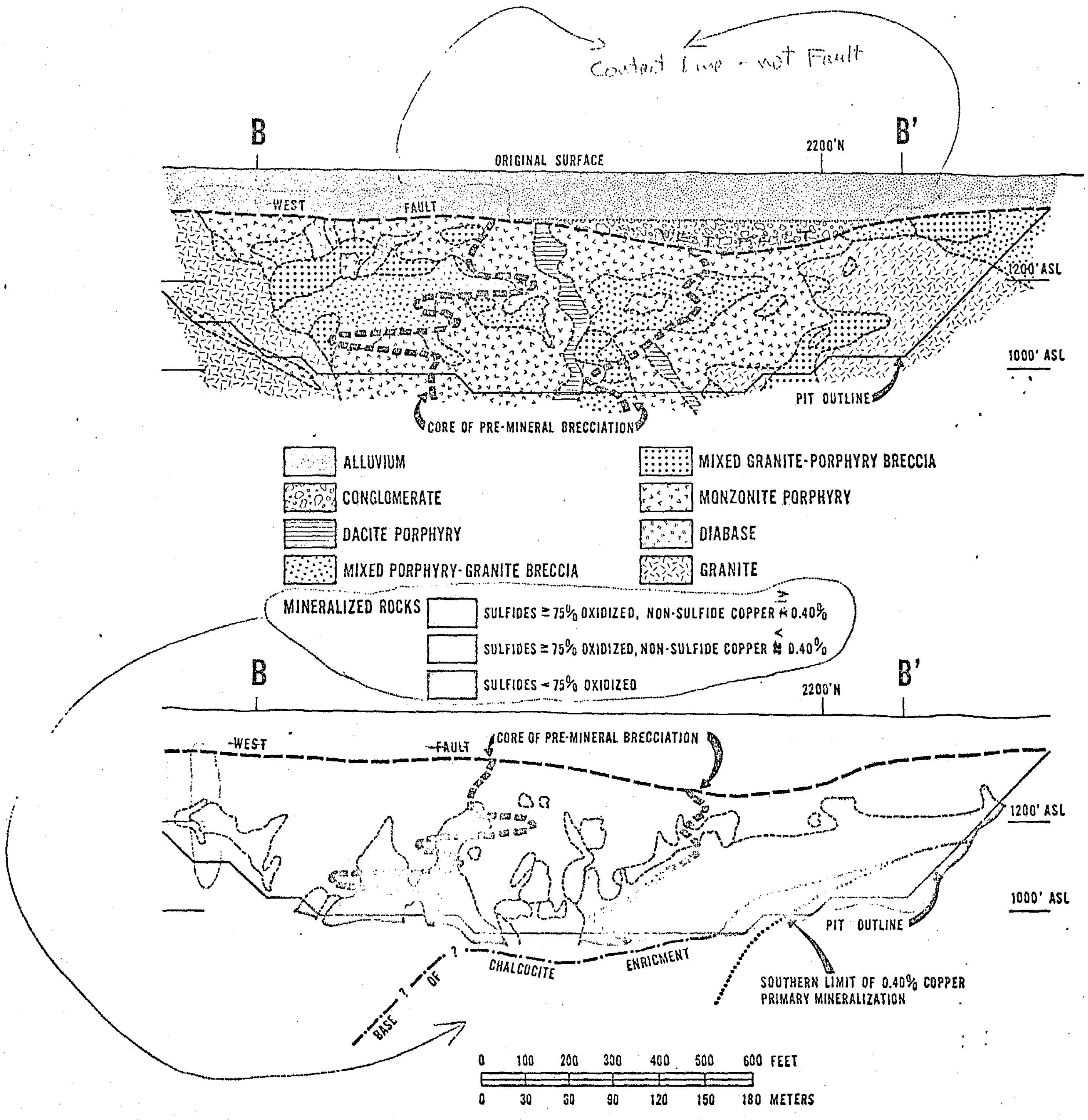
Fig 3


B
B'
FEET
0
100
200
300
400
0
30
60
90
120
METERS
CORE OF PRE-MINERAL BRECCIATION
LIMIT OF SIGNIFICANT PRE-MINERAL BRECCIATION
CONGLOMERATE
DACITE PORPHYRY
MIXED PORPHYRY-GRANITE BRECCIA
Monzonite porphyry and / or quartz monzonite porphyry fragments predominate
MIXED GRANITE-PORPHYRY BRECCIA
Granite fragments predominate
QUARTZ MONZONITE PORPHYRY
May include quartz monzonite porphyry breccia with up to 15 % foreign fragments
MONZONITE PORPHYRY
May include monzonite porphyry breccia with up to 15% foreign fragments
DIABASE
GRANITE
May include granite breccia with up to 15 % foreign fragments

(21)

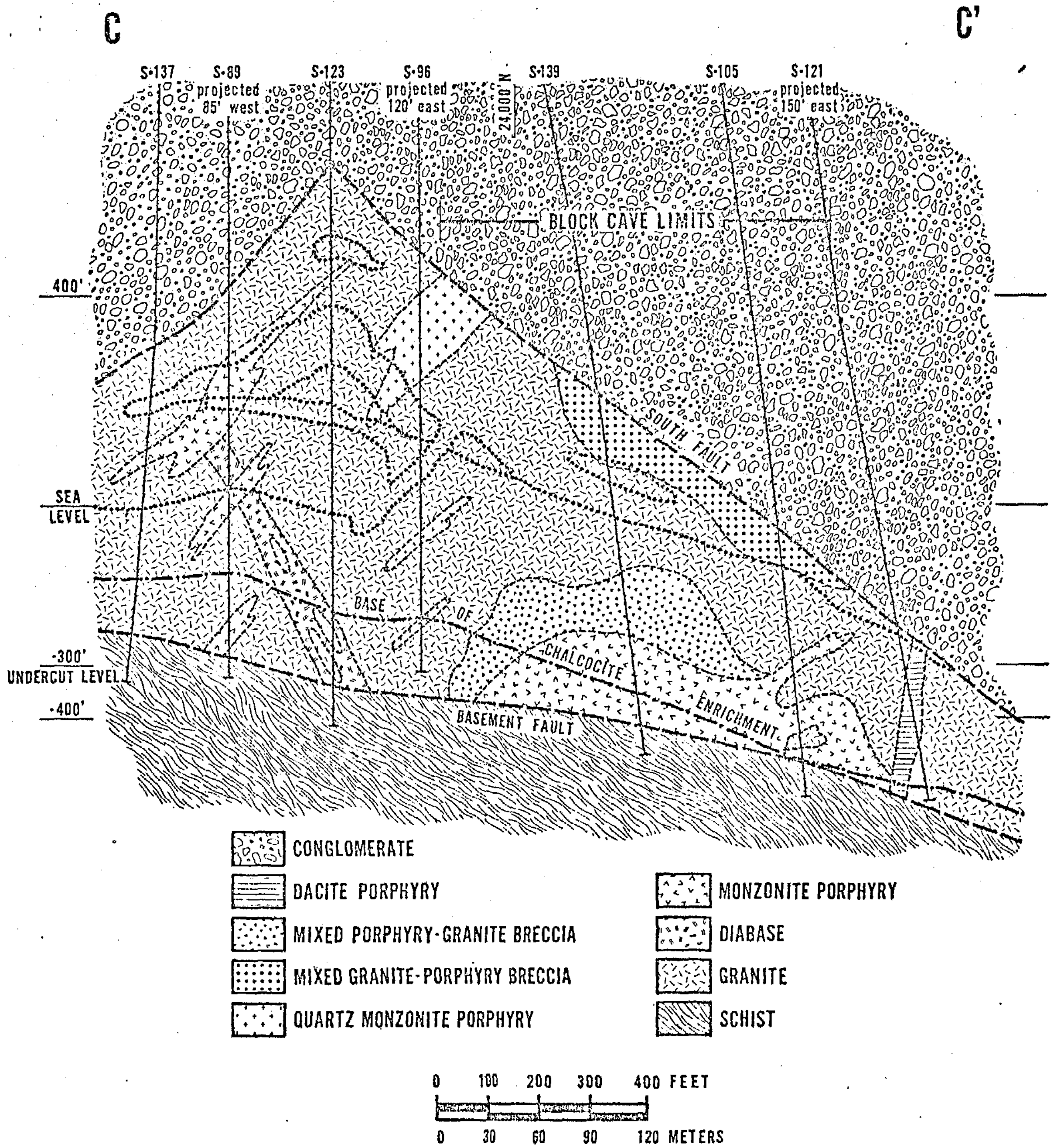
DIP

Fig 4a+b



Contact Line - not Fault
B
B'
2200'N
ORIGINAL SURFACE
WEST
FAULT
1200' ASL
1000' ASL
PIT OUTLINE
CORE OF PRE-MINERAL BRECCIATION
ALLUVIUM
CONGLOMERATE
DACITE PORPHYRY
MIXED PORPHYRY-GRANITE BRECCIA
MIXED GRANITE-PORPHYRY BRECCIA
MONZONITE PORPHYRY
DIABASE
GRANITE
MINERALIZED ROCKS
SULFIDES ≥ 75% OXIDIZED, NON-SULFIDE COPPER ≥ 0.40%
SULFIDES ≥ 75% OXIDIZED, NON-SULFIDE COPPER < 0.40%
SULFIDES < 75% OXIDIZED
B
B'
2200'N
WEST
FAULT
CORE OF PRE-MINERAL BRECCIATION
1200' ASL
1000' ASL
PIT OUTLINE
BASE ? OF ? CHALCOCITE ENRICMENT
SOUTHERN LIMIT OF 0.40% COPPER PRIMARY MINERALIZATION
0 100 200 300 400 500 600 FEET
0 30 60 90 120 150 180 METERS

Figure 5



from this
to this
50%

Fig 6

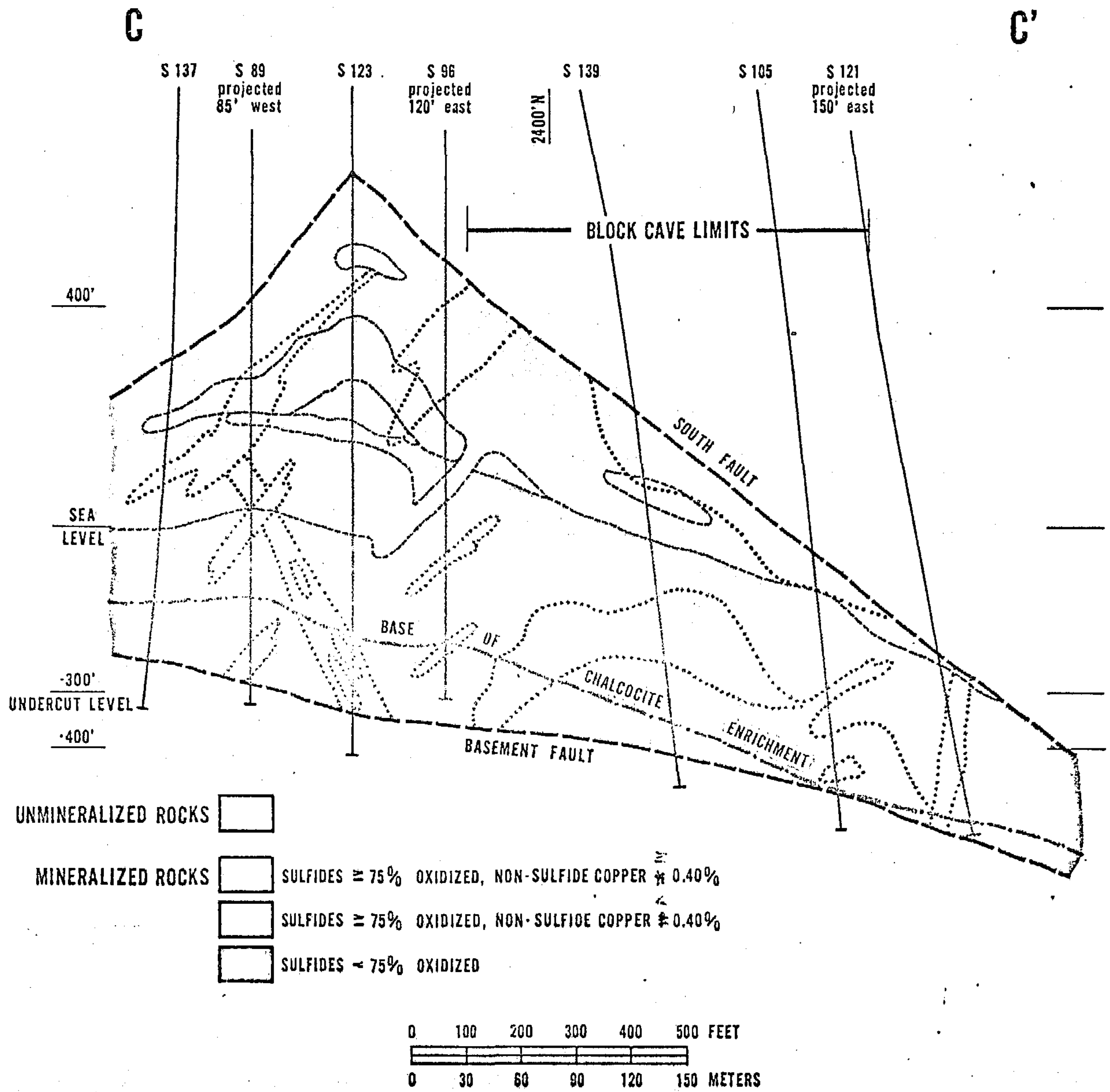
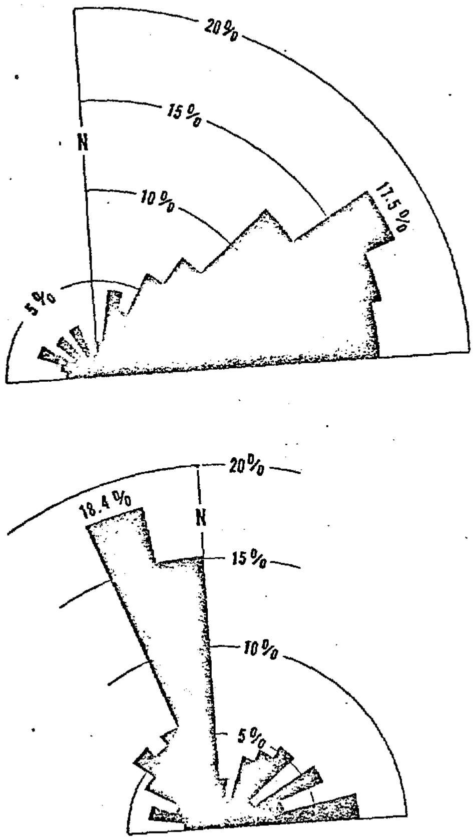

C
C'
S 137
S 89 projected 85' west
S 123
S 96 projected 120' east
2400'N
S 139
S 105
S 121 projected 150' east
BLOCK CAVE LIMITS
400'
SEA LEVEL
-300' UNDERCUT LEVEL
-400'
SOUTH FAULT
BASE OF CHALCOCITE ENRICHMENT
BASEMENT FAULT
UNMINERALIZED ROCKS
MINERALIZED ROCKS
SULFIDES ≥ 75% OXIDIZED, NON-SULFIDE COPPER ≥ 0.40%
SULFIDES ≥ 75% OXIDIZED, NON-SULFIDE COPPER < 0.40%
SULFIDES < 75% OXIDIZED
0 100 200 300 400 500 FEET
0 30 60 90 120 150 METERS

Fig 7a+b



FROM THIS

TO THIS

47%

??
17-18
No sample

Samples with both types of zircons
1, 2, 3, 6, 7, 8, 11, 19, 20 — Pє og &/or aplite

Samples with clear zircons plus hornblende
9, 10, 12, 13, 14, 26. — Sacaton Peak

Samples with clear zircons only
4, 5, 15, 21, 24 — Three Peaks

Samples w/ No zircons
22, 23, 25. — Three Peaks.

from Balla's map.

pєog 1, 2, 3, 6, 19, 20, 21 prob. taken in 3 pks
Tpgm (core facies) 4, 5
pє aplit (?) 7, 8
Sacaton Peak spgb (border facies), 9, 12.
Lgn (gneiss) 10, 11 ? or piece of og out there? — Red pє gneissoid in Laramide
spgi (intermediate facies), 13; 14, 15 — 3 pks?
Tpdo Three Peaks diorite porphyry. 22
Tpdi 23, 24, 25, 27? or
pє mg (microgranite) 26, (857 my)! — (maybe Sacaton Peak contaminated)

Samples based on DBB report on Heavy Mineral, Dec. 11, 1964 (3.19D.)
& located on JC Balla's map.

Univ Ari Prod.

Sacaton Area

16A-3-19B March 25, 1964, JCK Union Oil Drilling

East of Schwartz Hill DDH #1 Sec. ~~4~~ 1, T6S, R5E. 300' in valley cgl.

DDH #2 SE 1/4 SW 1/4 Sec. 24, T5S, R5E.
rotary w/ occ. core samples to 826. Br @ 650(?) hem. soaked bx.
826-1455 T.D. Cored. pE(?) granite bx soaked w/ hematite, some qtz porphyry. Hi angled shears, erratic chrysocolla along steep fractures & flooding rock. 1034-1076 = 1.34% Cu.

DDH #3 Center of SE 1/2 Sec 21, T5S, R5E.
rotary to 225. Br @ 215(?).
225-344 T.D. Cored. Mafic granodiorite w/ considerable magnetite. Prob. diorite or granodiorite. No alteration. Hole drilled on edge of magnetic high.

DDH #4 Center of S 1/2 of SW 1/4 Sec. 24, T5S, R5E
rotary w/ occ-core runs to 675' T.D.
Probably Gas Line cgl. Last 50-100' might have been unaltered Coolidge granite (?). Poor core recovery & frag suggest hole did not reach in bedrock.

(Note hole 4 is north of fault; hole 2, South of fault.

Info on Union Oil Drilling via Walt Heinrich
May 28, 1974.

DDH #1. Drilled at corner of Winnie 15, 16, 17, 18 claims
Center of S½, SE¼ of Sec. 1, T6S, R5E
364 feet deep.

DDH #2. Drilled on Dt #2 claim
Near ¼ corner of Sec. 24-25, T5S, R5E
1455 feet deep.

DDH #3. Drilled at corner of Agnes #3, 4, 5, & 6.
Center of SE¼ of Sec. 21, T5S, R5E
344 feet deep.

DDH #4. Drilled at corner of Dt #1, 2, 3, & 4.
(1400-1500 ft NW of #2).
In Sec. 24, T5S, R5E
675 feet deep.

Center SE 1/4

#3 Agnes 3, 4, 5, 6 — 344'
Sec 21 · T5 R5

1400–1500 NW #2 ?
#4 St 1-2-3-4 Corn ?
Sec 24; T5S R5E cor.
675'

#2 St #2 Sec 24 (1/4-25)
1455' T 5S R 5E

#1 Winnie 15, 16, 17, 18
Sec 1, T6S R5E 364'
C of S1/2 SE1/4

ASARCO

Southwestern Exploration Division

June 8, 1983

To: F. T. Graybeal

From: J. D. Sell

Block Cave-In Situ Leaching
Some Thoughts
Sacaton-Santa Cruz Area
Pinal County, Arizona

H. G. Kreis has released three papers expressing thoughts germane to the topic of Block Cave-In Situ Leaching which I believe you will find more than interesting. The papers are:

1) Percentage of Draw to Block Cave a Leach Column (May 31, 1983);

2) Mining of the Hanna-Getty Deposit, Pinal County, Arizona (June 1, 1983);

3) In Situ Leaching, Sacaton-Santa Cruz Area, Pinal County, Arizona (June 1, 1983).

To add my 2-copper-cents, I believe:

1) ASARCO should acquire a portion of the Hanna-Getty deposits, such as the Hanna position;

2) the use of Northrop Services should be at the reduced rate as HGK suggests, and rapidly move into a full, 3 hole to 5 hole test when appropriate;

3) Sacaton East, with its shaft in and a level started, has a good percentage of the cost already in and is a logical and very useful area to test either a straight leach or the block cave-in situ leach parameters before committing the mega-bucks for the Santa Cruz area.

James D. Sell

James D. Sell

JDS/cg

cc: HGKreis
JRStringham

ASARCO

Exploration Department
Western USA

June 8, 1983

F. T. Graybeal
New York Office

In-Situ and Block-Cave Leaching

Concerning the recent memoranda on this subject by you, Sell and Kreis and the Davidson unsolicited report I have the following comments:

1) The Hanna-Getty deposit is, in my mind, the best oxide/cc deposit for either block-cave leach or in-situ leach. H. Kreis' proposal for a block-cave leach utilizing the Sacaton mill might make this deposit competitive at lower copper prices than he states. I would encourage Asarco to acquire this deposit. The chances of discovering a better grade deposit in the southwest are slim. I believe our test money would be better spent here than on our Santa Cruz deposit.

2) Sacaton being above the groundwater table would not be a particularly good deposit for in-situ testing but would be an excellent block-cave leach candidate.

3) SX-EW has to be favored over cement copper.

4) Present Federal underground injection control regulations and the proposed State of Arizona regulations will add to the cost of an operation but it is unlikely that they will prevent an operation. Good PR will be needed.

5) I agree with Kreis' comments concerning Davidson.

W. L. Kurtz

WLK/cg

cc: JRStringham
JDSell
HGKreis

Dec. 16, 1983
Santa Cruz

FROM: W. L. KURTZ

To: JRS
HGK
JDS

Meetings with Freeport
advanced one week

Jan 11th — Parks to property
with JRS/HGK
Jan 12th — 1/4 meeting Tucson
office

ASARCO

Southwestern Exploration Division

December 15, 1983

H. G. Kreis
J. R. Stringham

Santa Cruz Project

Alan Parks, District Manager, Freeport Minerals will arrive in Tucson January 3, 1984. You will give him a thorough tour of Santa Cruz-Ollerton Farm-Amoco on Wednesday, January 4th.

On Thursday we will hold a formal meeting which Mr. Cook of Freeport will attend.

Alan Parks may want to spend Friday here to further discuss the Santa Cruz Project.

Mr. Stringham should call Parks to work out the details of Parks' schedule. (Freeport, Reno 702-323-2251)

W. L. Kurtz

WLK:mek

W. L. Kurtz

cc: R. L. Brown
J. D. Sell
D. R. Cook - Freeport, Reno

UURI

PHILLIP MICHAEL WRIGHT
TECHNICAL VICE PRESIDENT
DIRECTOR, EARTH SCIENCE LABORATORY
UNIVERSITY OF UTAH RESEARCH INSTITUTE

RESEARCH PARK
391 CHIPETA WAY
SUITE C
SALT LAKE CITY, UTAH 84108

OFFICE: (801) 524-3422

Brown&Root U.S.A., Inc.

Dr. W. Joseph Schlitt, P.E.
Manager of Technology
Mineral & Metal Industries

Post Office Box 4574
Houston, TX 77210-4574
(713) 575-4438 Telex 4620200

John T. Kline
Chief Metallurgist

noranda

Noranda Lakeshore Mines, Inc.
P. O. Box C-6
Casa Grande, Ariz. 85222

(602) 836-2141

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mountain states research & development
4370 South Fremont Ave.
Tucson, Arizona 85714

A Division of Mountain States Mineral Enterprises, Inc.

JOHN McDONALD
Assistant Vice
President

(602) 792-2800

TWX: 510 600 7949
ELN: 629 14 139

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
SAFETY EFFICIENCY
MINERAL INDUSTRIES

JON K. AHLNESS
MINING ENGINEER

U.S. BUREAU OF MINES
5629 MINNEHAHA AVE. SOUTH
MINNEAPOLIS, MINNESOTA 55417
PHONE: 612-725-3465

725-4500

To JDS

Date 5/27 Time 12:55

WHILE YOU WERE OUT

M John Ahlness

of US Bur of Mines

Phone 612 - 725 - 3465

Area Code Number Extension

TELEPHONED	✓	PLEASE CALL	✓
CALLED TO SEE YOU		WILL CALL AGAIN	
WANTS TO SEE YOU		URGENT	

RETURNED YOUR CALL

Message Will be leaving office in about 1 1/2 hours - will call you tomorrow if you don't reach him today.

Operator Mary

09

John Claus

8:30 AM Lakeshore

AMPAD EFFICIENCY® 23-006 50 SHEET PAD

JDS – can you handle

Call From FTG Re: USBM 5/27/86

Lakeshore on the 29th in morning

Tour Santa Cruz in pm — for all contractor who want to visit

(Paul Musgrove, GM at Lakeshore; call if want to go underground am 29th

Contact in USBM: ~~John Jo A~~ Jon Ahlness 612-725-3465

Call to determine 1) where meet in Casa Grande / Santa Cruz
2) confirm they want into warehouse to look at core-on-floor.
3) take keys; assay logs

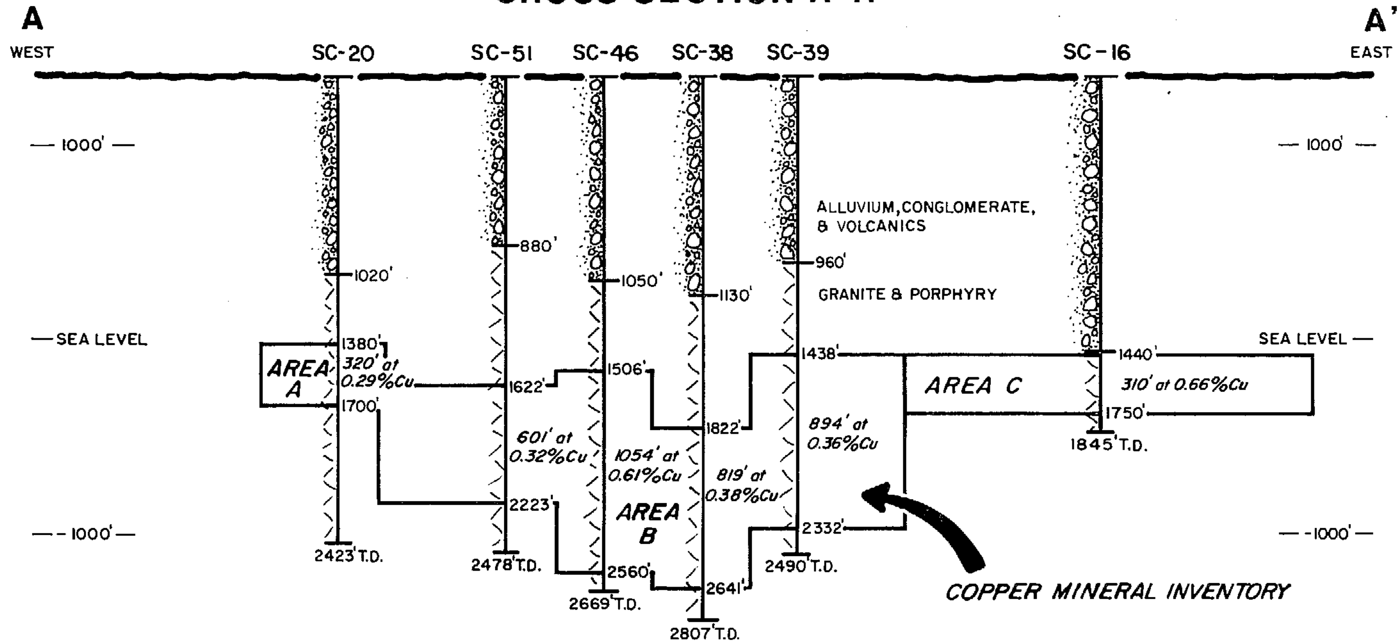
.5-3
4 1½

3.3
6 1½
5.6

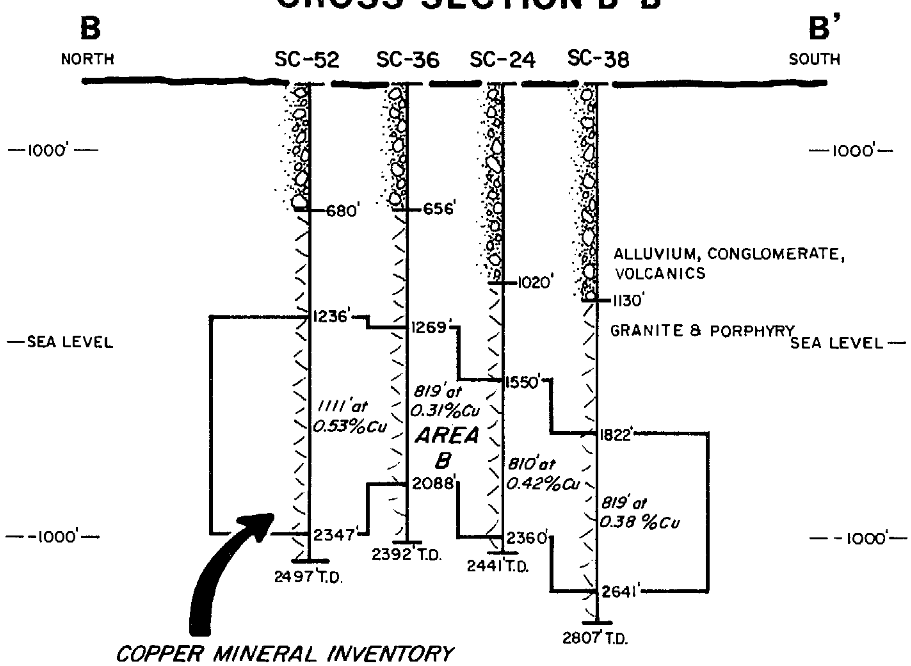
702/237-5788

653

CROSS SECTION A-A'



CROSS SECTION B-B'



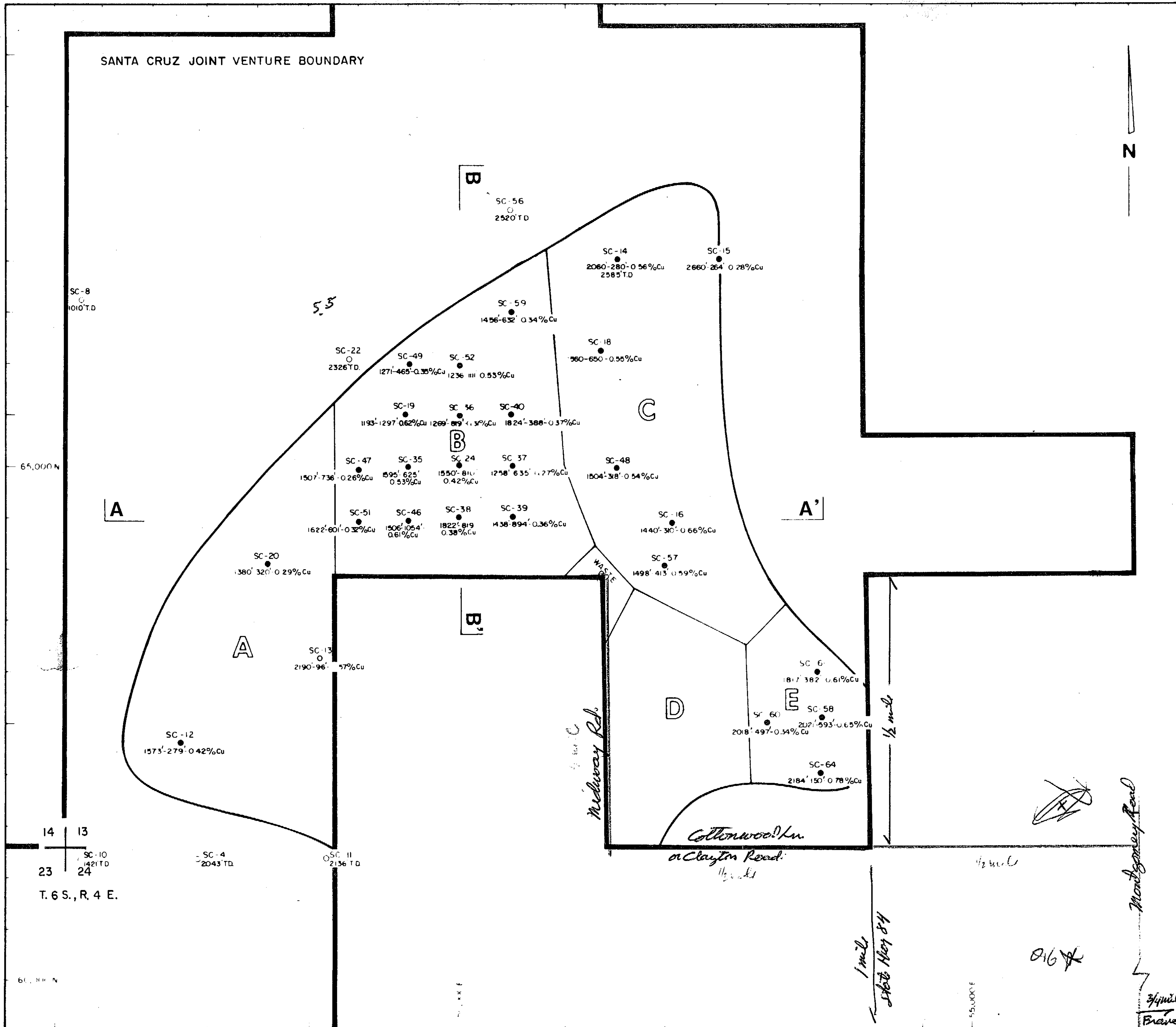
SANTA CRUZ PROJECT
PINAL COUNTY, ARIZONA

ASARCO-FREEPORT
COPPER MINERAL INVENTORY
CROSS SECTIONS A-A', B-B'

0 1000' 2000'
FEET

H.G.K. 9,1985

FIGURE-2



EXPLANATION

A — Inventory cross section

SC-19 ● Drill hole used in copper mineral inventory
1236'-111'-0.53%Cu — Percent copper — Inventory thickness — Depth to top of inventory

ASARCO-FREEPORT COPPER MINERAL INVENTORY

AREA	DEPTH (ft top)	THICKNESS (ft)	TONS (million)	GRADE (%Cu)	FT·% (Copper)	Lbs Cu (billion)
ACID SOLUBLE COPPER						
A	1540	362	150	0.29	105	0.87
B	1500	750	340	0.41	308	2.79
C	1790	372	190	0.54	201	2.05
D	2220	300	70	0.49	147	0.69
E	2000	395	50	0.56	221	0.56
sub total	1730	461	800	0.43	198	6.96

SANTA CRUZ PROJECT
PINAL COUNTY, ARIZONA

ASARCO-FREEPORT COPPER MINERAL INVENTORY

H.G.K. ASARCO Incorporated Jan. 1982

0 1000' 2000'

Revised 9/85

mn 6298 dam 9/85

JDS

ASARCO

Southwestern Exploration Division

May 22, 1986

FILE NOTE

Santa Cruz Project
Pinal County, Arizona

The U.S. Bureau of Mines has sent out a RFP (Request for Proposal) for a "Generic In Situ Copper Mine Design Manual."

One such site, for work that is part of the RFP, is at the Santa Cruz Project.

Thus contractors bidding on the RFP may be calling Asarco for information -- No information should be given other than to refer them to:

Contract Specialist David J. Askin
Phone: (303) 236-0291
Bureau of Mines, Branch of Procurement
Room A-1608, Bldg. 20
Denver Federal Center
Denver, CO 80225

James D. Sell

James D. Sell

JDS:mek

cc: F.T. Graybeal
W.L. Kurtz
W.D. Gay
H.G. Kreis
M.E. Kavanagh
F.R. Koutz
T. Dalla Vista

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT	1. CONTRACT ID CODE	PAGE OF PAGES 1 2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
Two	5/21/86		

6. ISSUED BY CODE

U. S. Department of the Interior
Bureau of Mines

7. ADMINISTERED BY *(If other than Item 6)* CODE

U. S. Bureau of Mines
Contract Section A
Building 20, Denver Federal Center
Denver, Colorado 80225

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

CODE FACILITY CODE

(✓) **9A. AMENDMENT OF SOLICITATION NO.** J0267001

9B. DATED (SEE ITEM 11) May 5, 1986

10A. MODIFICATION OF CONTRACT/ORDER NO.

10B. DATED (SEE ITEM 13)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers [ ] is extended, [X] is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 0 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return ______ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

1. Site visits to the Noranda Lakeshore Mine and the Santa Cruz site described in Phase II of the Scope of Work will take place on May 29, 1986. The Noranda visit will begin at 8:30 A.M. and the Santa Cruz visit will be held in the afternoon. A Bureau of Mines representative will be at the sites for the tours. If you plan to attend one or both visits, please contact Mr. Jon Ahlness of the Twin Cities Research Center on (612) 725-3465 for all pertinent details.

2. The following changes are made to Page 8 of the RFP document in Phase I of the Scope of Work.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY *(Signature of Contracting Officer)*	16C. DATE SIGNED

List of Attendees
Preproposal Conference - May 16, 1986
RFP No. J0267001
Generic In Situ Copper Mine Design Manual

1. V. Rajaram
   Private Consultant
   Downers Grove, Illinois

2. ✓Clement Chase
   K. D. Engineering
   Tucson, Arizona

3. Charles E. Brechtel
   J. F. T. Agapito
   Grand Junction, Colorado

4. Dr. James A. Procarione
   ✓Mike Wright
   University of Utah
   Research Institute
   Salt Lake City, Utah

5. Duane L. Whiting
   Dames & Moore
   Salt Lake City, Utah

6. Grant Bums
   Engineers International, Inc.
   Murray, Utah

7. Boyd N. Possin
   Foth & Van Dyke
   Green Bay, Wisconsin

8. ✓Rudy Jacobsen, Inc.
   In Situ
   Laramie, Wyoming

9. J. Lonergan
   E T I
   Tucson, Arizona

10. J. C. Stouch
    Kaiser Engineers, Inc.
    Pittsburgh, Pennsylvania

11. William F. Sutton
    St. Joe Minerals
    Monaca, Pennsylvania

12. ✓W. J. Schlitt
    Brown & Root
    Houston, Texas

13. Michael F. Dunn
    Terraform Engineers
    Naperville, Illinois

14. F. T. Graybeal
    Asarco
    New York, New York

15. Dr. Donald Davidson
    SAIC
    McLean, Virginia

16. S. B. George Cirolini
    A. D. Taylor
    Bechtel Civiland Minerals
    San Francisco, California

17. Robert H. King
    Colorado School of Mines
    Golden, Colorado

18. Al Kuestermeyer
    Pincock, Allen & Holt
    Tucson, Arizona

19. Roger E. Palmerberg
    Gutierrez - Palmenberg
    Phoenix, Arizona

ASARCO

Exploration Department
Southwestern United States Division

December 19, 1985

Dr. William C. Larson
U.S. Bureau of Mines
Twin Cities Mining Research Center
5629 Minnehaha Ave. S
Minneapolis, Minn. 55417

Santa Cruz Project
Data to USBM

Dear Bill:

I enjoyed meeting with you in Tucson, and I was pleased to review our Santa Cruz Project with you.

Fred Graybeal wants you to have more data on the Santa Cruz Project, and he asked me to send you the data shown in the following list. All of this data accompanies this letter.

- Data to USBM -

- List of Santa Cruz Project data (H.G.K., 8/27/82 report, Table 21 with H.G. data deleted)
- List of core that was photographed
- Detailed geologic logs with explanation sheets[1]
- Reconn. geologic logs with explanation sheet[1]
- Rock structure - strength logs with explantation sheets[1]
- Assay sheets with interval-grade computations[1]
- Drill hole directional survey reports[1]
- List of drill hole surveys projected to T.D.'s
- Temperature survey of SC-36 (att. to direct. survey report)
- Acid leach tests (T.D.H. memo of 12/11/79).
- Table 18, sulfuric acid-bottle leach tests (H.G.K. report of 7/27/82)
- Plan map of drill holes (MN-6298 w/some fringe holes deleted)
- Memo on copper oxide assays (H.G.K. memo of 12/30/81)
- Chalcocite, native copper, and cuprite (A.R.R. memo of 1/5/82)
- Figure 36, continuity of copper oxide mineralization (H.G.K. report of 7/27/82 with CG-7 deleted).

1. For drill holes SC-19, -24, -35, -36, -37, -38, -39, -40, -46, -47, -49, -51, -52, -58, -59, -60, -61, and -64.

If you have any questions or want to discuss ways to evaluate the data, please give me a call. Also, I would be glad to make a geologic presentation and/or show the Santa Cruz drill core to all the USBM people who are interested.

Best wishes for the holidays.

Sincerely,

Hank

Henry G. Kreis
Senior Geologist

HGK:mek

cc: F. T. Graybeal - N.Y.

bl.cc: W. L. Kurtz

P.S. Bill, with the holidays, vacation time, and year end work commitments on other projects, I won't be available to work on Santa Cruz until early January. At that time I'll call you to let you know I'm available.

The accompanying data is your copy to work with, and I can easily supply you with another copy.

19 1618 → 1797

46 1570 → 2040

52 1220 → 2152

58 2023 → 2204

5/29/86

TES, DEC, SAA, SLB, VM, JDS

Santa Cruz
USBM

Bill Larson and Dave Millenacker may be in Tucson Asarco's Office Wed June 18 or Thurs June 19 to review USBM plans. Date will be firmed up later but would be good if most of you could attend.

KURTZ

JDS

ASARCO

Southwestern Exploration Division

June 2, 1986

F. T. Graybeal
New York Office

In Situ Field Review
for Contractors
Lakeshore & Santa Cruz
Pinal Co., AZ

The day of May 29, 1986 was spent with the potential contractors bidding on the USBM Proposal of the in situ generic study. The contractors had been invited for a field inspection of the two site areas at Lakeshore and Santa Cruz.

List of Participants:

Jon K. Ahlness, Mining Engineer, USBM, Minn., MN
*Clement Chase, K.D. Engineering, Tucson, AZ
Tom Clary, ? Independent ?, Miami, AZ
William M. Greenslade, Dames & Moore**, Phoenix, AZ
Brent Hiskey, UofA, Tucson, AZ
Roy Huff, SAIC**, McLean, VA
*Rudy Jacobson, In Situ Inc., Laramie, WY
John McDonald, Mt. States R&D, Tucson, AZ
*W. Joseph Schlitt, Brown & Root, Houston, TX
Randy Scott, Pincock, Allen & Holt**, Tucson, AZ
Ralph Weeks, Sergent, Hauskins, & Beckwith, Phoenix, AZ
*Phillip M. Wright, UofUtah Research Inst., SLC, UT.

*Indicates person was at the preproposal conference in Milwaukee on May 15, 1986.

**Indicates company representative was at May 15, 1986 meeting.

At Lakeshore the meeting was conducted by John T. Kline, Chief Metallurgist, along with Paul Musgrove, Manager, and Ernie Ahrens, Chief Geologist. A slide presentation was made emphasing the ore zone and the best method for obtaining core, i.e., by drilling underground from a drift beneath the oxide orebody. Drilling from the overlying fanglomerate is undesirable as the hole must pass thru a heavily weathered paleosol with added costs and sometimes failure to penetrate! They also mentioned that a $1000 fee is collected by the Tribe before outside contractors can do any work on the land. Also "a working agreement" would be necessary for any underground drilling so as not to interfere with Noranda's crews and work. Also, as Noranda only works an 8 hour shift and locks the gates, any further work would involve "extra security," and, if underground, "support people," all to be paid by the contractor.

Of course they did mention that office space, telephones, core shed, water, electricity, and air was available at some consideration.

A few minor pieces of core were shown.

Two maps were passed out: 1. Drill-Hole Location Map with surface geology and topography (1" = 200'), and 2. Development composite of underground mine (1" = 200') (in Tucson file).

Kline also made a strong pitch on the availability of the in-place extraction plant, etc. All in all, the presentation was for the benefit of the USBM and not for the contractors.

Questions were mostly on drilling costs, and then engineering parameters such as water flow, permeability/porosity, and plant costs. No answers given except to say that any Noranda data available to the USBM was releasable. Jon Ahlness said that he hoped to have some data out by next week.

At the Santa Cruz area, I took them to the quarter section above H-G, which is the best drilled area B, and showed them the drilling plan (revised 9/85, #6298) and the cross-sections A-A' and B-B' (#6310). I also read off the footage figures for bedrock and top of oxide inventory and noted the depth increase from north to south. I said that some holes may be available for reentry (as did Lakeshore), but said that rotary drilling to within the inventory, cased and sealed, with coring and testing below would be less risky and cheaper in the long run. Those like Clary who have had experience with reentering holes tended to agree. At the core shed, holes SC-19, -46, -52 and -61 were already laid out in parts of the mineral zone and I had stood up the lids on two or three boxes spaced six to seven boxes apart. I mentioned that they could look at any box. About a 20 minute look-thru was the average. A few questions were asked: a. what was the total calcite content? (Answer: Can't answer that from experience, but it was not much as it was not added to the logging form.) b. permeability/porosity, and geophysical logs? (Answer: Not run as such, except for hole deviation measurements.) Clary added a few questions, such as, how firm is the reserve estimate? (Answer: From plan map figures and the number of drill holes/spacing.) Does Hanna-Getty still own the adjacent parcel. (Answer: Now part of Texaco and I've not heard of any sale.)

It was apparent that it was "old homeweek" for the Greenslade, Huff, Jacobson, Schlitt and Wright group, with the rest out for the exposure. As the day was quite warm, and the core shed was hot, the GHJSW group left for a beer after the meeting was terminated.

James D. Sell

JDS:mek

James D. Sell

6/4/86

TES, SAA, DEC, SLB, VM, JDS   US Bureau Mines

Mr. Graybeal has informed me the USBM will hold their meeting on June 17th, 8:00 am at Asarco's 3rd floor conference room. Probably take 1/2 day.

Hope you all can make it.

Kurtz

JDS

ASARCO

Southwestern Exploration Division

June 4, 1986

J. D. Sell
W. D. Gay

<u>Santa Cruz</u>

A Peter Fratt (263-7629) of Phoenix called to inquire if any lands in Trust 1270 were for sale. I told him not at this time, but some might be for sale before the end of the year. He said he would call again in several months to inquire if any land is for sale.

I told him some of Sacaton Mine land was for sale.

W. L. Kurtz

WLK:mek

cc: T. E. Scartaccini

SAA / DCC / SCB / VM / TCS / JBS

ASARCO

Exploration Department
Frederick T. Graybeal
Chief Geologist

June 5, 1986

Mr. W. L. Kurtz
Tucson Office

In Situ Copper Mining
Santa Cruz Project,
Arizona

Dear Mr. Kurtz:

Bill Larson and Dan Millenacher of the USBM will conduct a meeting in Tucson Tuesday, June 17, 1986 at 8 A.M. in the Tucson office to discuss:

1) the current RFP for design and engineering

2) environmental permitting for both the RFP and a later pilot-scale demonstration test, and

3) the actual demonstration test including construction, production of copper, restoration and wrap-up.

Mr. Larson thinks the meeting will take all morning and that we will need an overhead projector.

Please reserve the conference room and advise Messrs. Scartaccini, Burrill, Martz, Crowell, Anzalone, and Sell of this meeting. Freeport will probably not attend. Mr. Muth will attend the meeting, but may not arrive until 9 A.M. or so. Mr. Millenacher will try to have a draft of the envionmental permitting flowsheet to you before the meeting which should be circulated to at least Messrs. Burrill and Martz.

Very truly yours,

F. T. Graybeal

F. T. Graybeal

FTG:mr
cc: R. L. Brown
R. J. Muth
R. J. Kupsch

RECEIVED
JUN 9 1986
EXPLORATION DEPARTMENT

ASARCO

Southwestern Exploration Division

JDS

June 27, 1986

Verle Martz
Tucson Office

Santa Cruz Joint Venture
Permit Phase II
USBM In Situ Program

The Phase II program, scheduled to start on or about January 1, 1987 will consist of drilling one or more (probably less than four) holes in the NE¼, Sec. 13, T6S, R4E, Pinal County, Arizona. These holes will be rotary drilled with a five or six inch bit through 600-1,000' of alluvium and moderately indurated conglomerate into a bedrock of Precambrian granite and Laramide intrusives where they will be cased with the casing cemented into the bedrock. Beneath the casing 200-1,000 feet of 3" diamond drilling will be done in each hole.

Water, probably obtained from nearby water wells, may be injected into the bedrock and pumping from bedrock may also occur. I doubt pumping and injecting will exceed 50 gpm with disposal of all pumped water back down the cased hole. This testing will not affect the ground water level -- no draw down will occur.

Drill contractors have not yet been selected. They will be registered in Arizona.

The Santa Cruz Joint Venture has 3609 acre feet per year of grandfathered Type 1 non-irrigation groundwater rights, Certificate No. 58-110104, dated 22 December 1983.

Please determine what permits we need and then let's discuss them before filing.

W. L. Kurtz

WLK:mek

W. L. Kurtz

JDS

ASARCO

Exploration Department
Western USA

W. L. Kurtz
Manager

June 27, 1986

Mr. James Marie
USGS, Water Resources Div.
Federal Building
301 W. Congress
Tucson, AZ 85701

Dear Mr. Marie:

Per instructions of Dan Millenacher, USBM Twin Cities Research, we are hand-delivering to you Santa Cruz Joint Venture geologic logs for holes SC-24, 35, 36, 37, 38, 47, 52, and available driller's reports; also a geophysical log by Birdwell for hole SC-24.

Please return all items.

Sincerely,

W. L. Kurtz

W. L. Kurtz

WLK:mek
encs.

cc: D. Millenacher, USBM