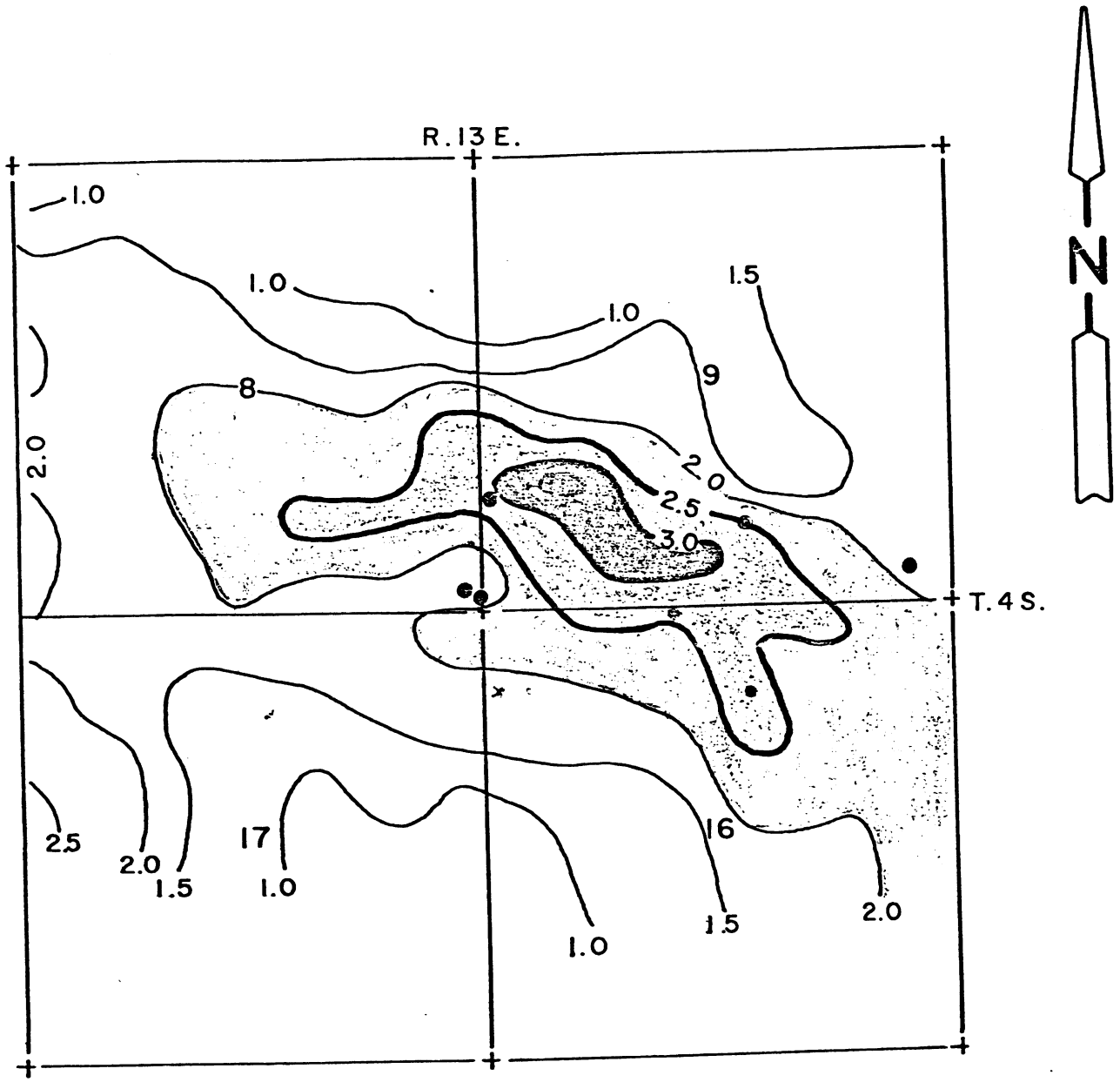
FILE NO.

CITIES SERVICE MINERALS CORPORATION

SCALE 1:24,000
DATE 31 JAN 74
DRAWN BY J.P.V.



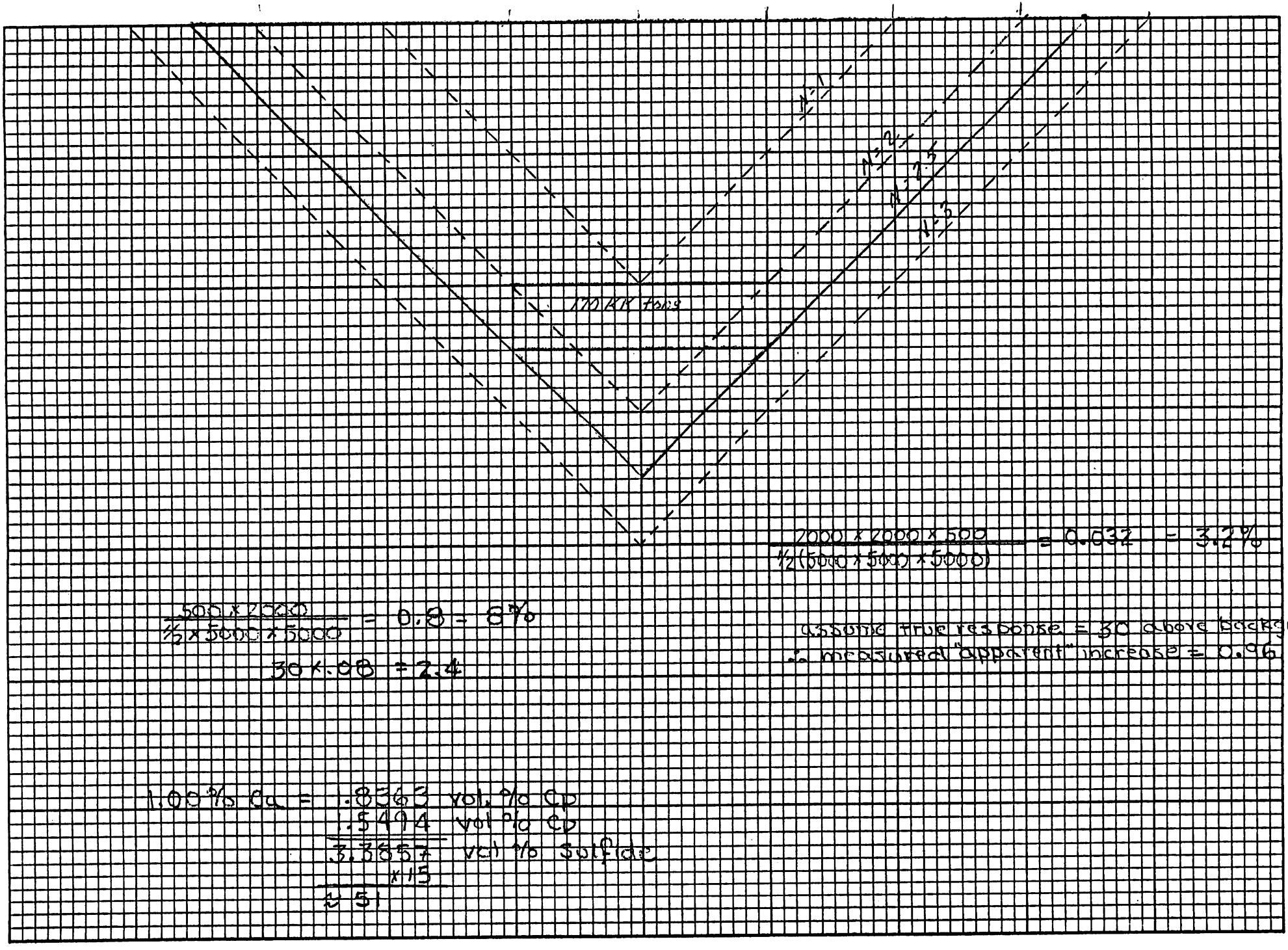
contour interval = 0.5 P.F.E.

● = existing drill hole

TITLE KELVIN PROSPECT - APPARENT PERCENT FREQUENCY EFFECT AT "n" = 1 SKETCH NO. 6

(P.F.E. over 2.5 % in red)

K&E 10 X 10 TO THE INCH 7 X 10 IN. • ALBANENE® KEUFFEL & ESSER CO. 46 0707 MADE IN U.S.A.



$$\frac{2000 \times 2000 \times 500}{\frac{1}{2}(5000 \times 500) \times 5000} = 0.032 = 3.2\%$$

$$\frac{500 \times 2000}{\frac{1}{2} \times 5000 \times 5000} = 0.8 = 8\%$$

$30 \times .08 = 2.4$

assume true response = 3σ above background

∴ measured "apparent" increase = 0.96

1.00% σc = .8363 vol. % Cp
.5494 vol % Cp
1.3857 vol % sulfide
× 15
≈ 51

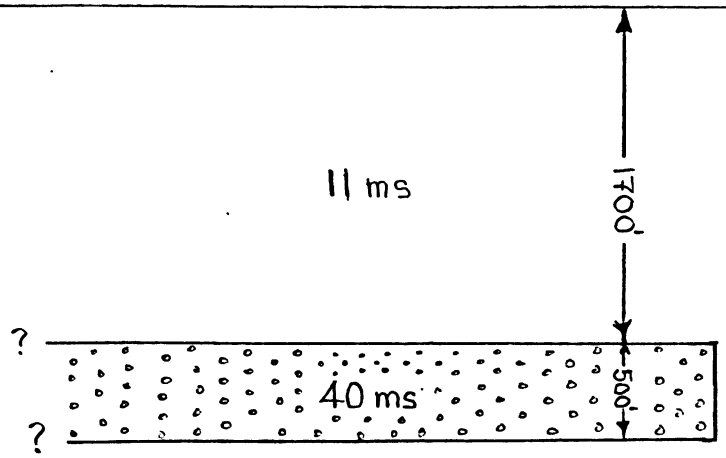
FILE NO.

CITIES SERVICE MINERALS CORPORATION

SCALE

DATE

DRAWN BY



True Response = 30 ms above a background of 10 ms.

$\rho_2/\rho_1 = 1$ $\rho_3/\rho_1 = 1$

DIPOLE-DIPOLE

n	$\%\beta_1$	$\%\beta_2$	$\%\beta_3$	read
1	95	3	<2	11.8
2	73	14	13	14.9
3	52	19	29	16.2
4	38	19	43	16.1
5	28	18	54	15.7
6	22	14	64	14.4

4.4 = Ma max.

β_1 = 11 ms
β_2 = 40 ms
β_3 = 10 ms

POLE-DIPOLE

n	$\%\beta_1+\beta_3$	$\%\beta_2$	read
1	92	8	12.4
2	85	15	14.5
3	85	15	14.5
4	87	13	13.9
5	90	10	13.0
6	92	8	12.4

2.1 = Ma max.

$\beta_1 - \beta_2$ = 10 ms
β_2 = 40 ms

TITLE

SKETCH NO.

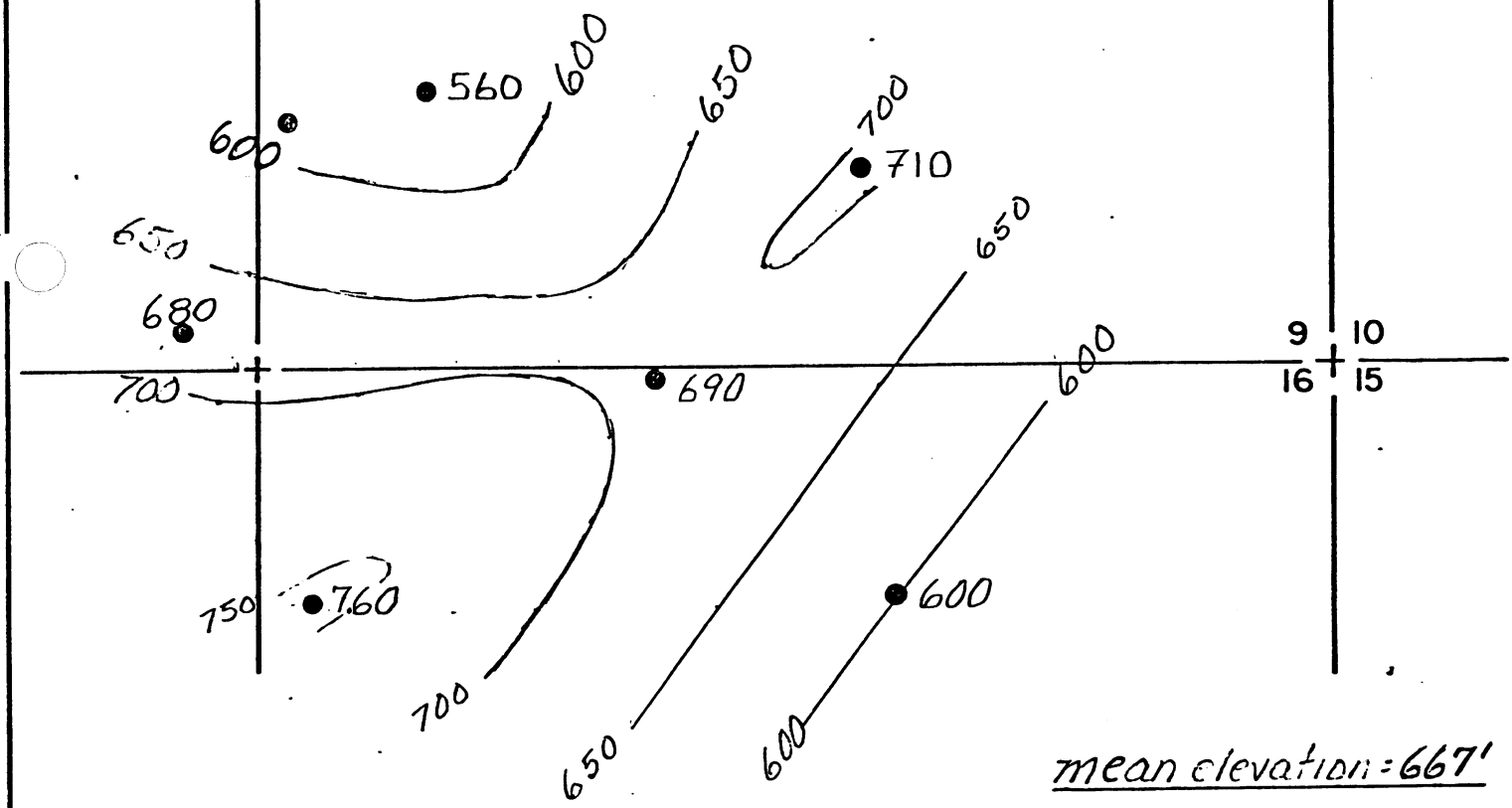
SECTION 24

KELVIN PROJECT

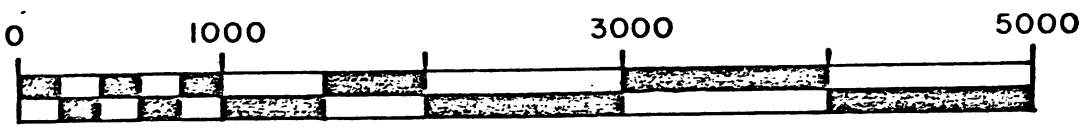
T. 4 S., R. 13E.

PINAL CO., ARIZONA

ELEVATION: MIDDLE OF "OTEGO" FAULT



mean elevation = 667'



SCALE IN FEET

JULY 1976

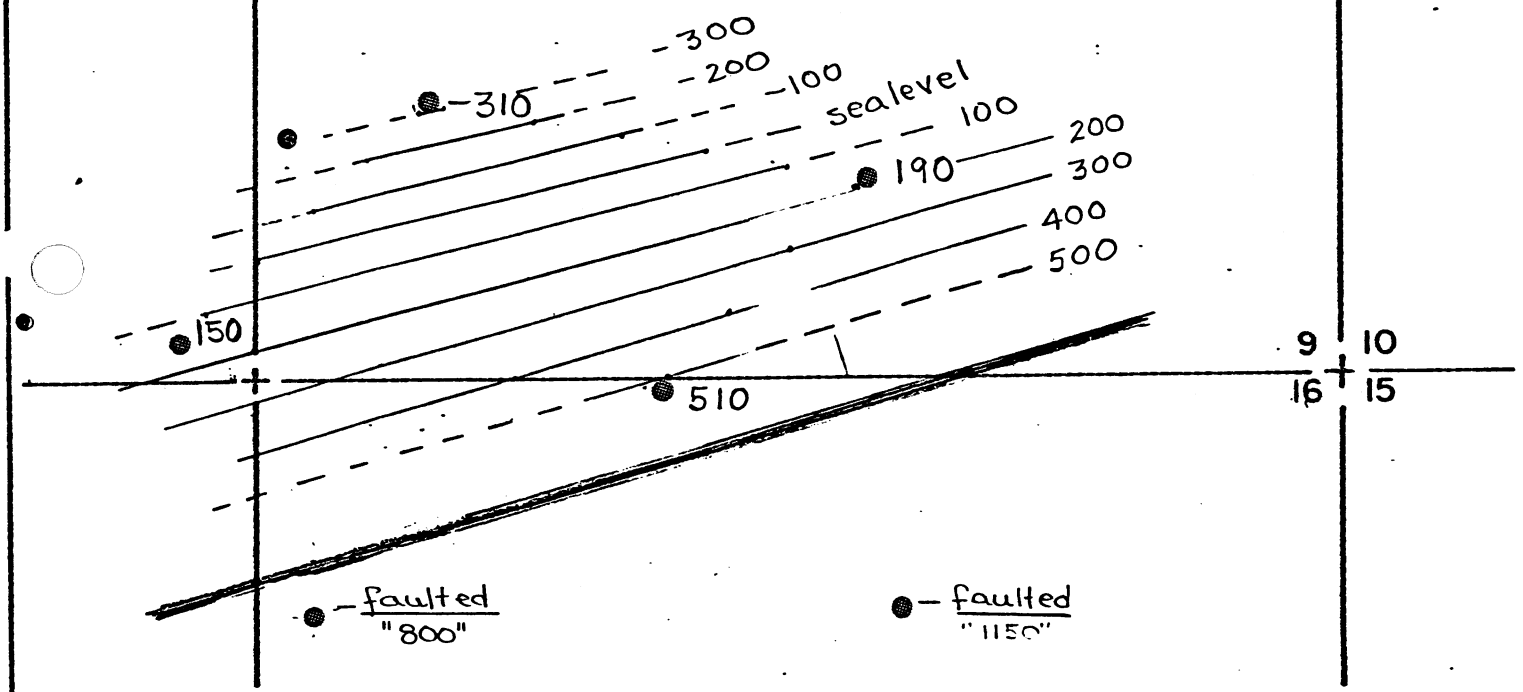
J. P. VROMAN

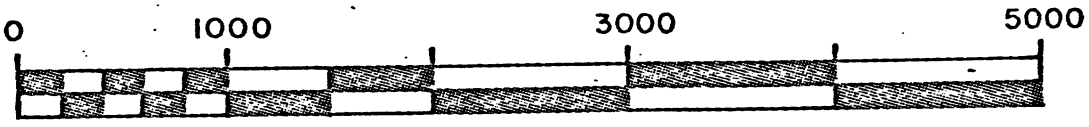
KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

ELEVATION OF "PEAK" OF COPPER ZONE





SCALE IN FEET

JULY 1976

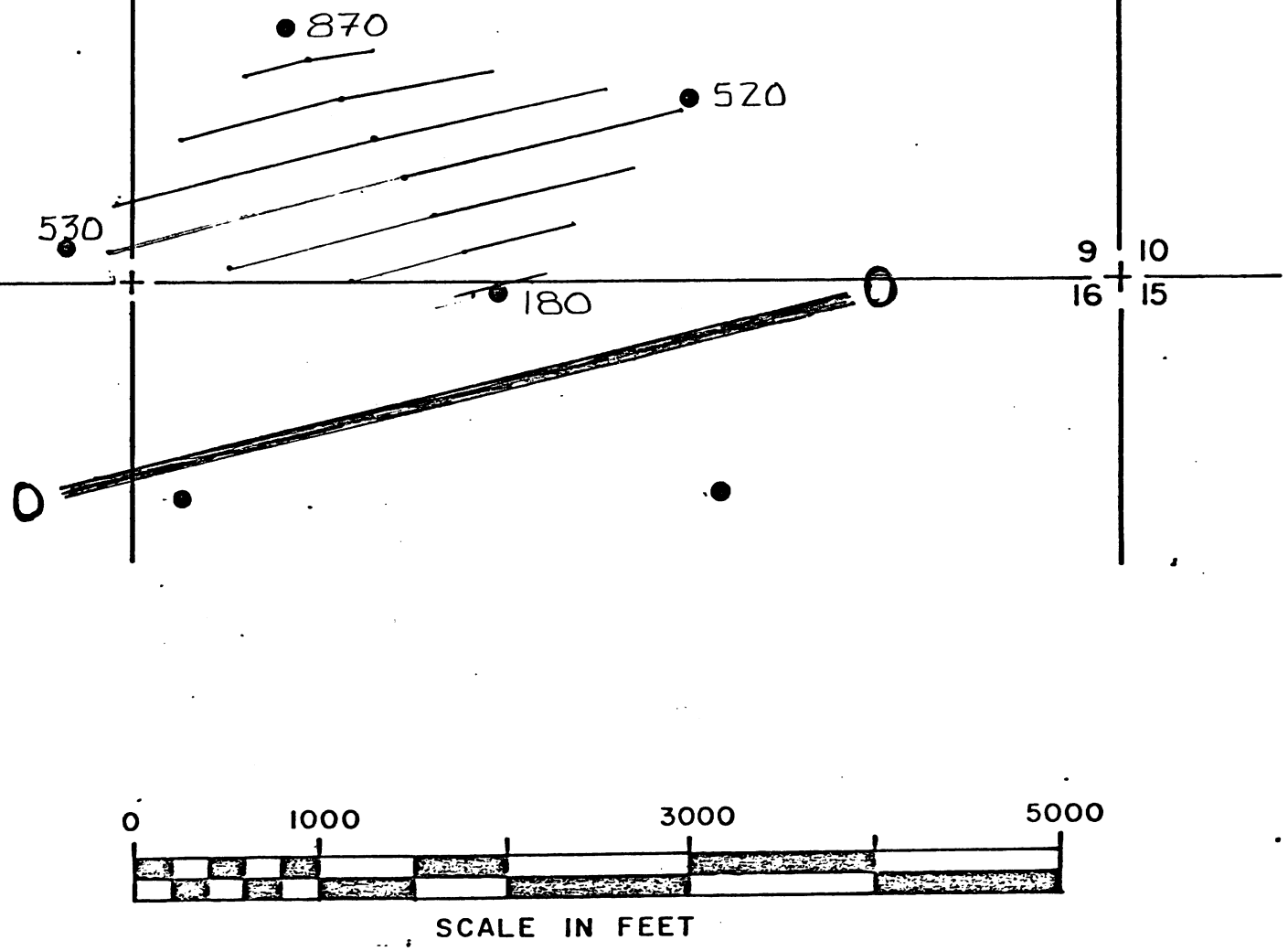
J. P. VROMAN

KELVIN PROJECT

T. 4 S., R. 13E.

PINAL CO., ARIZONA

DISTANCE BELOW OTEGO FAULT OF PEAK OF COPPER ZONE



SCALE IN FEET

JULY 1976

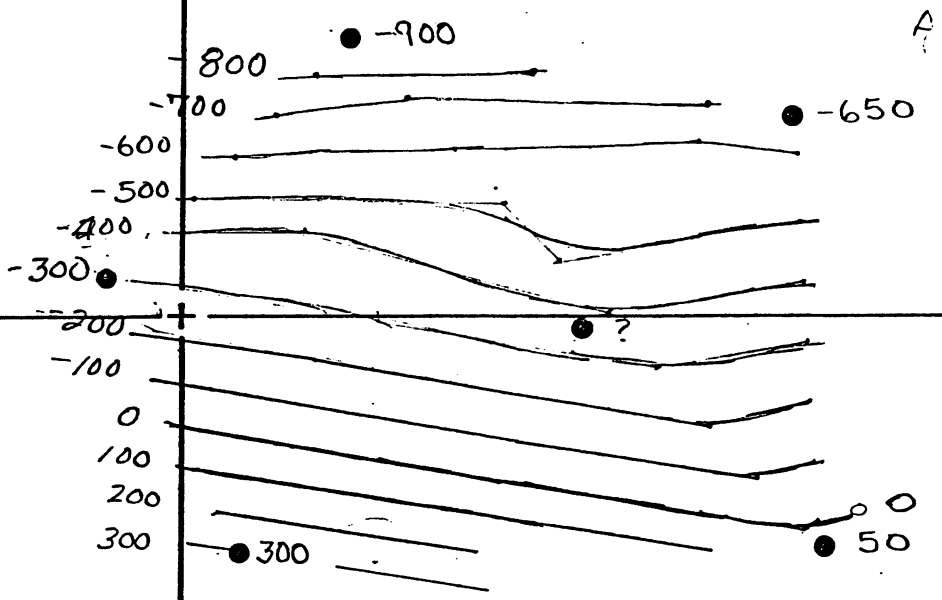
J. P. VROMAN

KELVIN PROJECT

T. 4 S., R. 13E.

PINAL CO., ARIZONA

ELEVATION OF "LOWER" FAULT



9 | 10
16 | 15

0 1000 3000 5000

SCALE IN FEET

JULY 1976

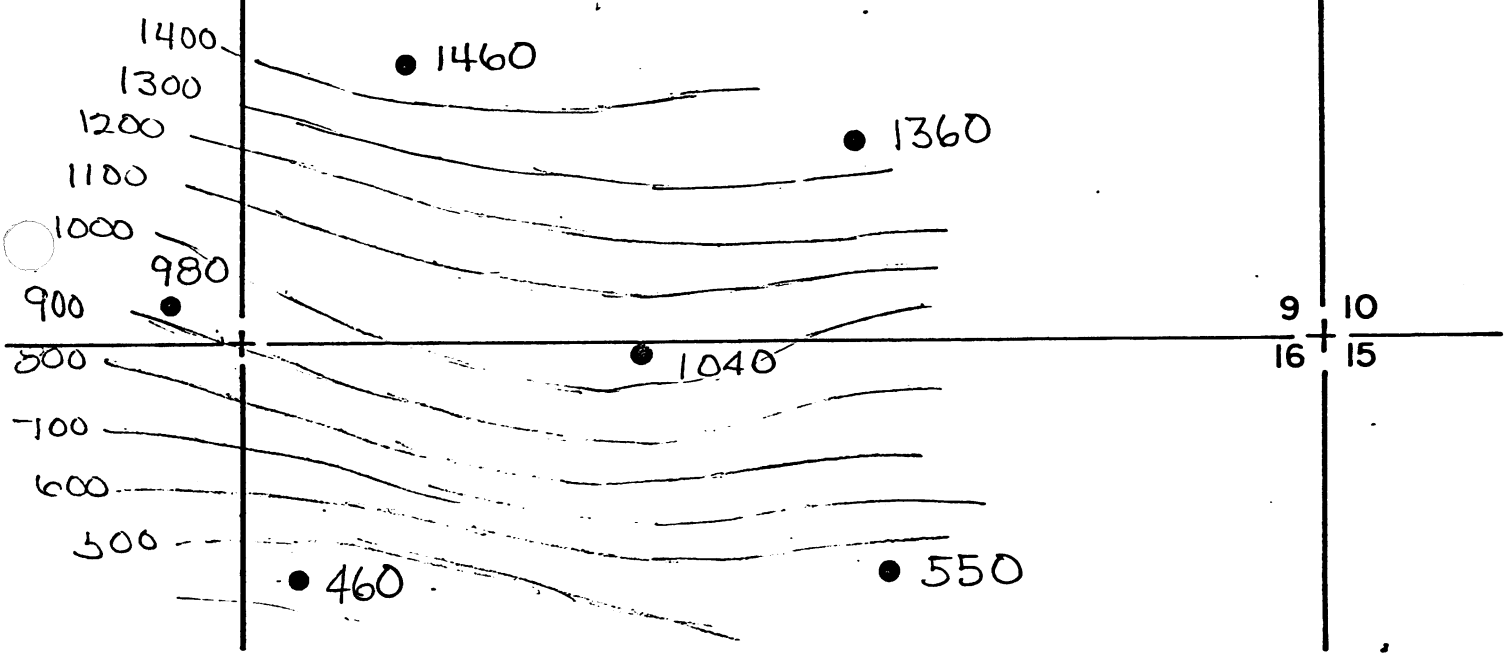
J. P. VROMAN

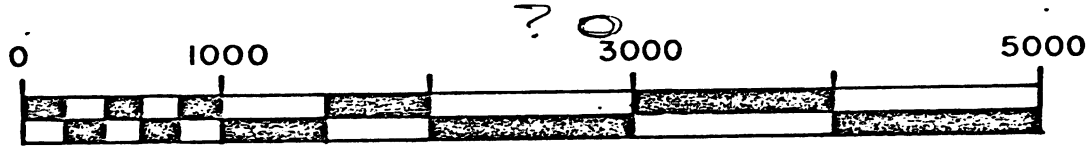
KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

THICKNESS OF "MIDDLE" BLOCK
(BETWEEN OTEGO & LOWER FAULTS





SCALE IN FEET

JULY 1976

J. P. VROMAN

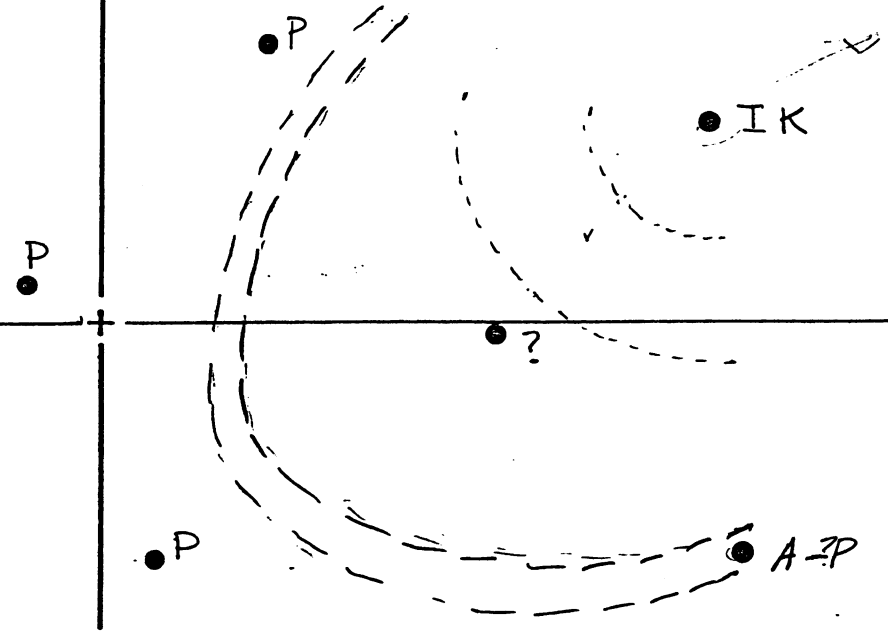
SECTION 25

KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

ALTERATION BELOW LOWER FAULT



9 | 10
16 | 15

0 1000 3000 5000

SCALE IN FEET

JULY 1976

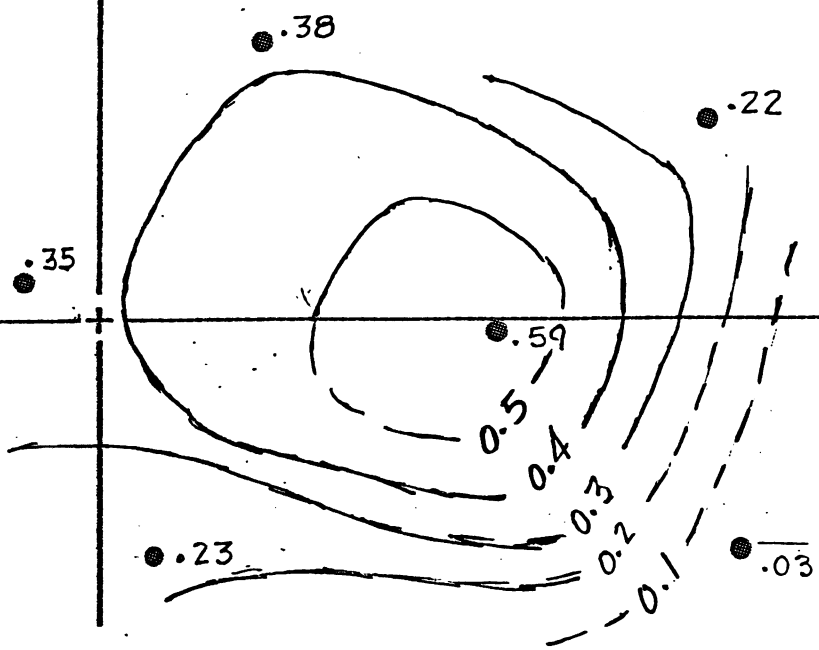
J. P. VROMAN

KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

COPPER (EQUIVALENT) GRADE WITH 0.2% CUTOFF



9 10
16 15

0 1000 3000 5000

SCALE IN FEET

JULY 1976

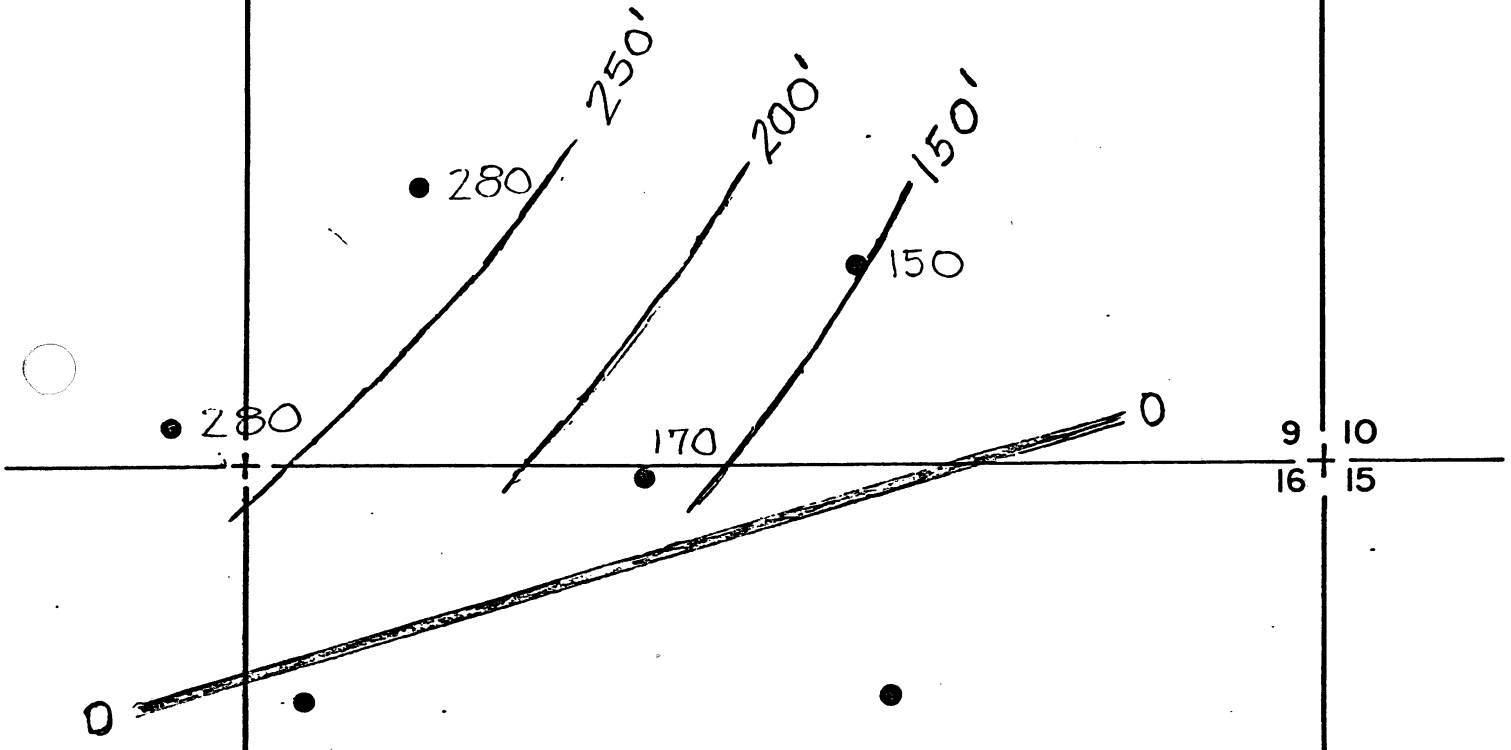
J. P. VROMAN

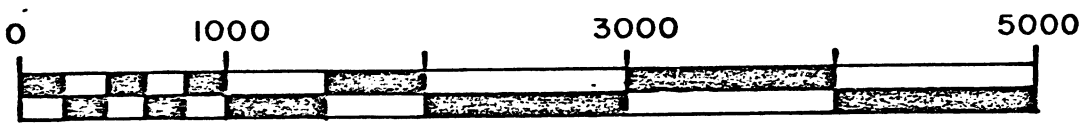
KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

THICKNESS OF "MIDDLE" COPPER ZONE





SCALE IN FEET

JULY 1976

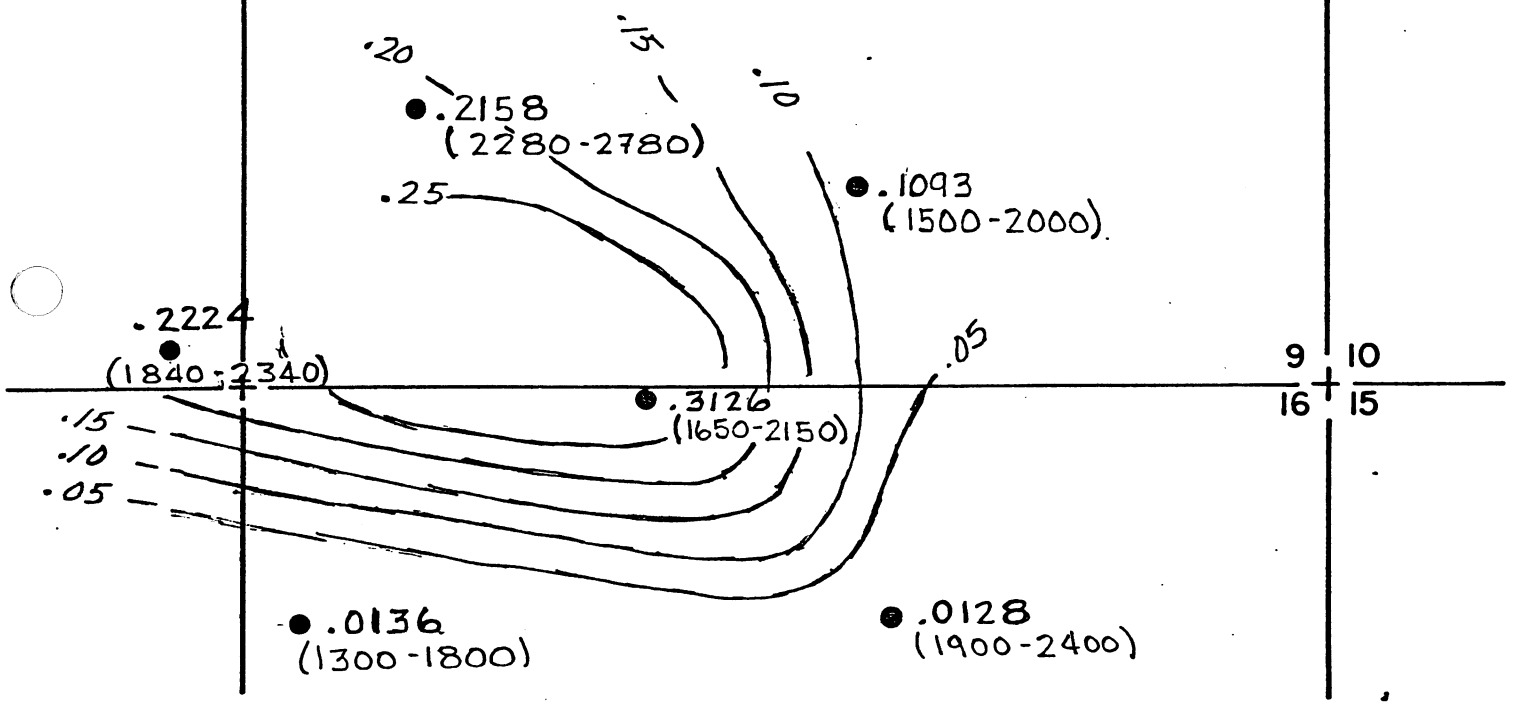
J. P. VROMAN

KELVIN PROJECT

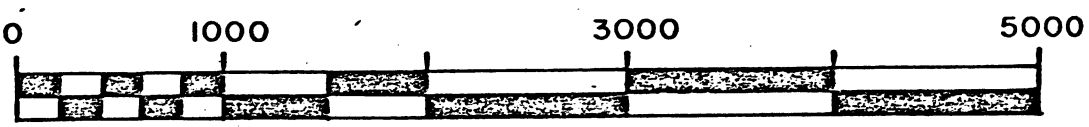
T. 4 S., R. 13 E.

PINAL CO., ARIZONA

BEST 500' INTERCEPT



>.25% = 2200 × 1600 × 500 ≈ 150 KK TONS



SCALE IN FEET

JULY 1976

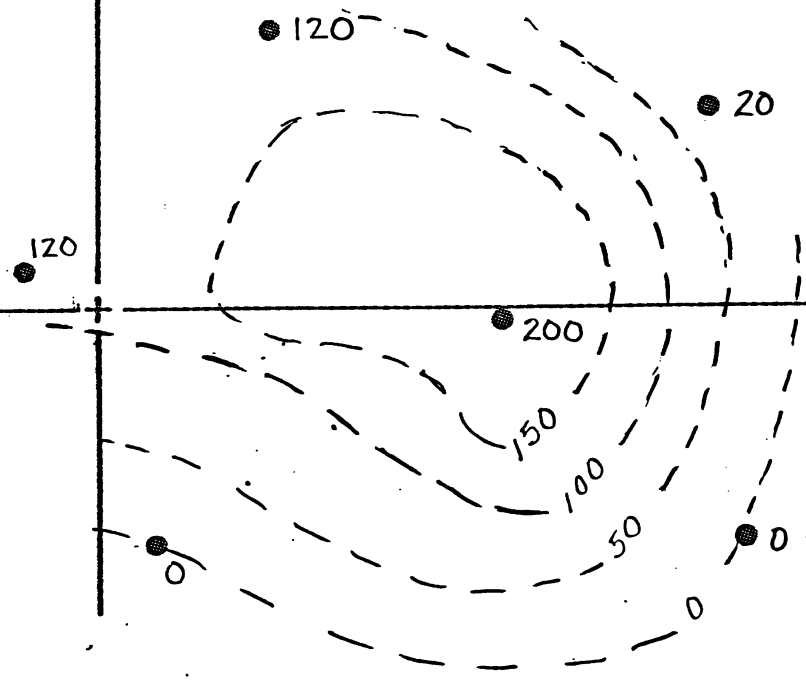
J. P. VROMAN

KELVIN PROJECT

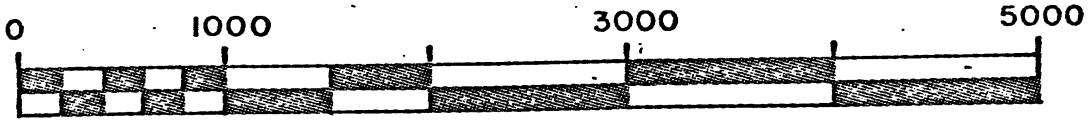
T. 4 S., R. 13 E.

PINAL CO., ARIZONA

THICKNESS OF > 0.3% COPPER



~ 50 KK tons w/ 150'
~ 75 KK tons w/ 100'



SCALE IN FEET

JULY 1976

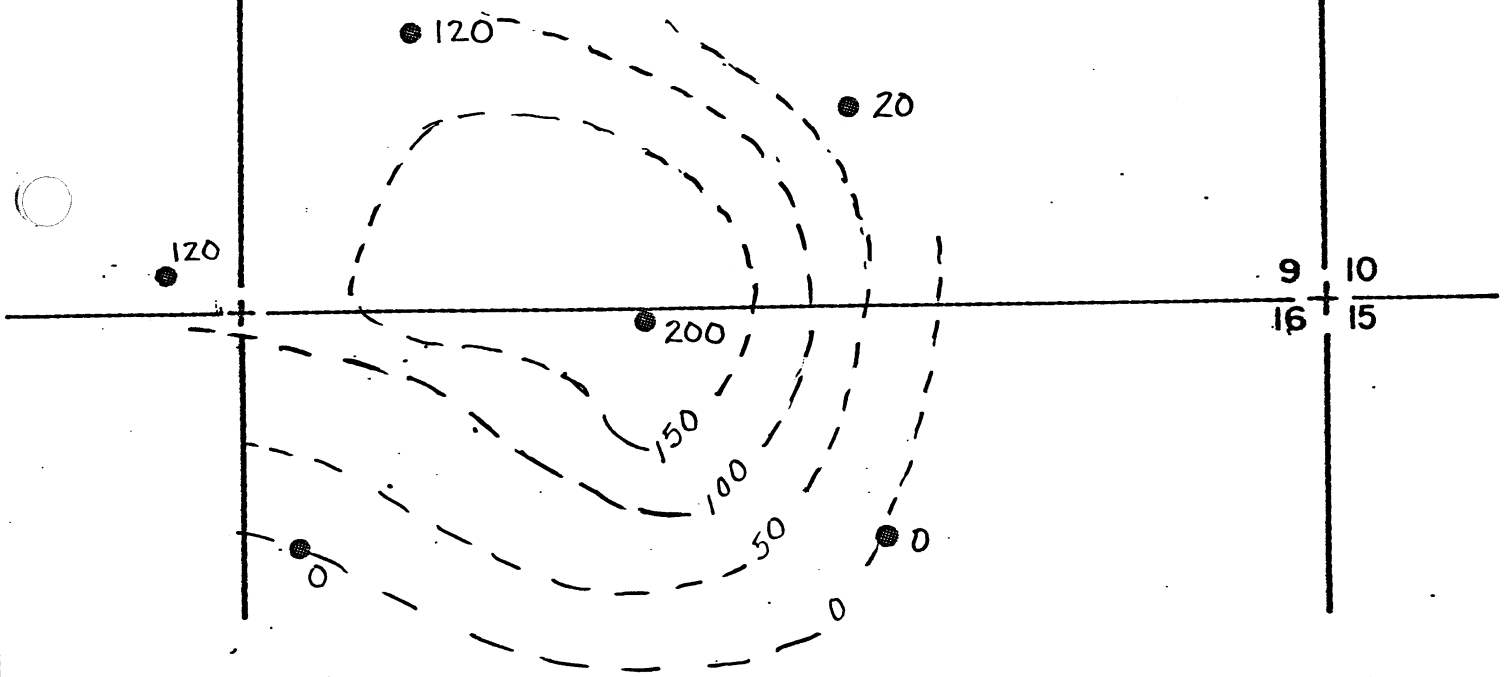
J. P. VROMAN

KELVIN PROJECT

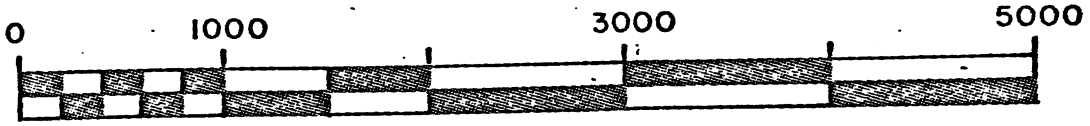
T. 4 S., R. 13 E.

PINAL CO., ARIZONA

THICKNESS OF > 0.3% COPPER



~ 50 KK tons w/ 150'
~ 75 KK tons w/ 100'



SCALE IN FEET

JULY 1976

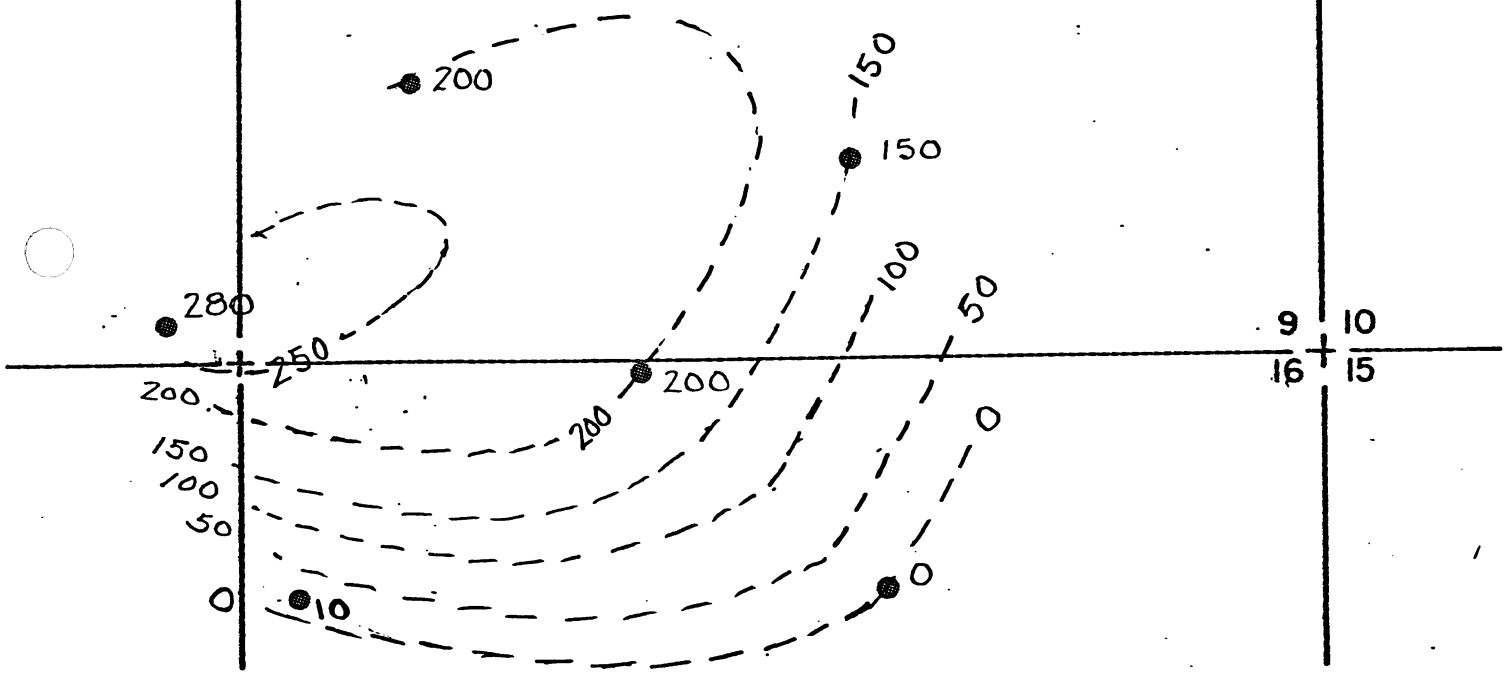
J. P. VROMAN

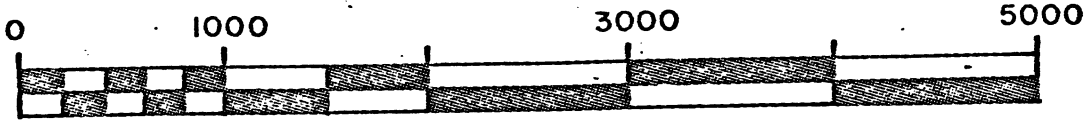
KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

THICKNESS OF > 0.2% COPPER (- - - -)





SCALE IN FEET

JULY 1976

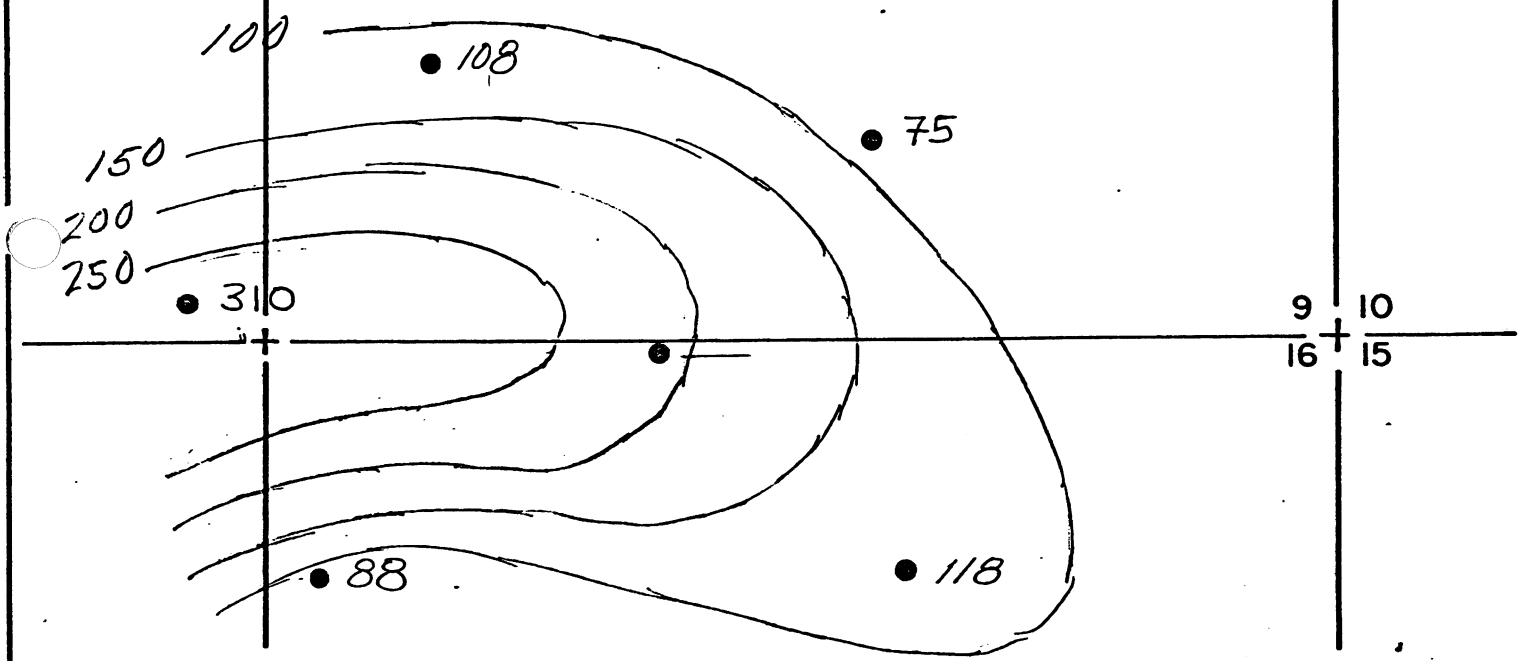
J. P. VROMAN

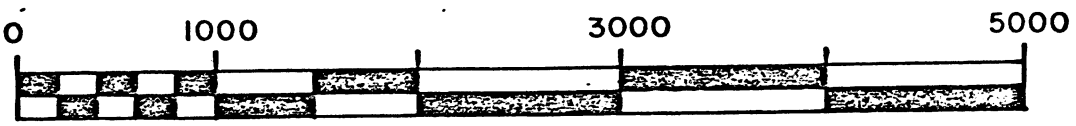
KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

COPPER BELOW LOWER FAULT (PPM)





SCALE IN FEET

JULY 1976

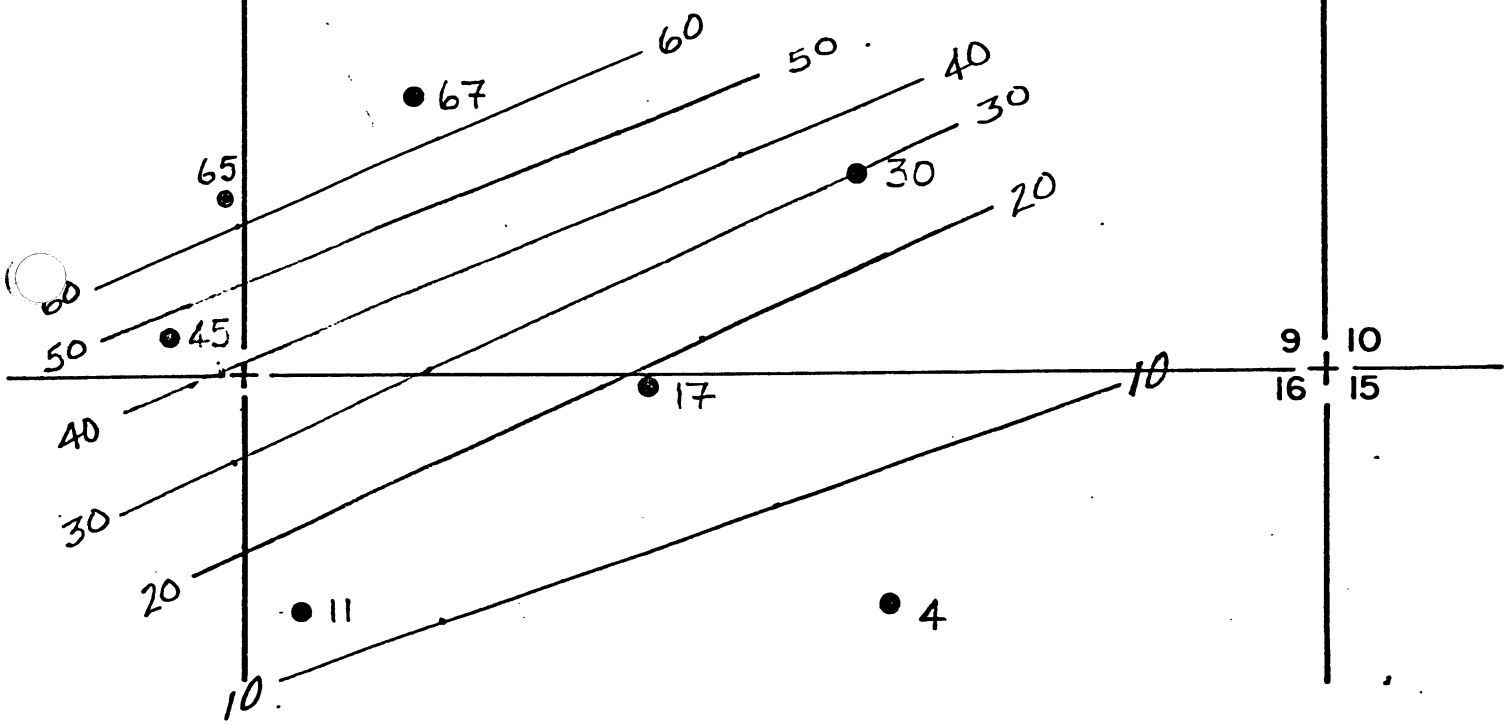
J. P. VROMAN

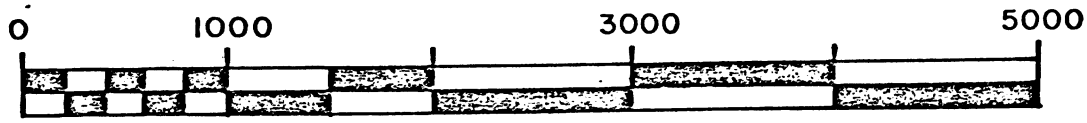
KELVIN PROJECT

T. 4 S., R. 13E.

PINAL CO., ARIZONA

INTENSITY OF MOLYBDENUM "ANOMALY"
(PPM)





SCALE IN FEET

JULY 1976

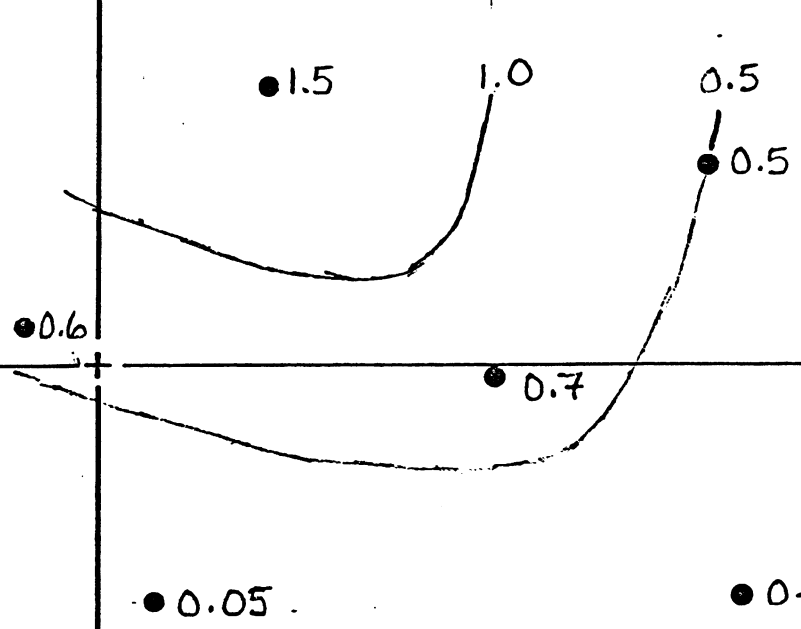
J. P. VROMAN

KELVIN PROJECT

T. 4 S., R. 13E.

PINAL CO., ARIZONA

INTENSITY OF SULFUR "ANOMALY" (%)

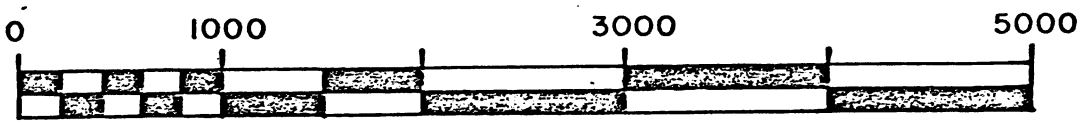


9 | 10

16 | 15

0.05

0.01



SCALE IN FEET

JULY 1976

J. P. VROMAN

SECTION 26

KELVIN PROJECT

T. 4 S., R. 13 E.

PINAL CO., ARIZONA

3000' x 2100' x 135' x .0833 ≈ 71 KK tons
= .5184 cu = .544 cu equiv.

x 4 ≈ 283 KK tons (double each dim).

≈ 160 KK tons (each dim x 1.5)

283 KK tons = .544
532 KK tons = .401
1,216 KK " = .256 — #3.8B @ 70°

135'
253'
580'

160 KK tons = .544
300 KK " = .401
685 KK " = .256

71 KK tons = .544
133 KK " = .401
304 KK " = .256 — #5 41 M @ 70°

2100'

3000'

9 | 10
16 | 15

0 1000 3000 5000

SCALE IN FEET

JULY 1976

J. P. VROMAN

KELVIN

		1	2 % Cu	3	4% Mo	5	Equiv. Copper	7	Intercept
1	2370-2380	J4	.4174		.0126		.4804		110
2	2300-2480	J4	.3512		.0108		.4052		180
3	2300-2580	J4	.2836		.0104		.3356		280
4									
5	1930-2050	J5	.5236		.0050		.5486		120
6	1930-2210	J5	.3334		.0048		.3572		280
7									
8	1930-2100	J1	.6573		.0012		.6633		170
9	1740-2100	J1	.3893		.0021		.3998		360
10									
11									
12									
13	J1-J4-J5 model - radius = 1800'						2629.5	1,900	≠ 263 KK tons
14	thickness = 310'								
15									
16									
17		360	× .3998	=	143.928				
18		280	× .3572	=	100.016				
19		280	× .3356	=	93.968				
20			920		337.912		= 0.3673% cu.eq.		
21									
22									
23		110	× .4804	=	52.844				
24		120	× .5486	=	65.832				
25		170	× .6633	=	112.761				
26		400							
27		or	~~113,100.00~~		113 KK ton		= .5786		
28									
29									
30									
31									

AMPAD EFFICIENCY® LINE No. 4636

SECTION 27

KELVIN. DRILLING DATA: 21 JU[illegible]7

HOLE #	1 TOTAL LENGTH	2 C.S.M.C. LENGTH	3 $/ft	4 total $	5 ft/shift	6	per/foot: 7 direct drilling	8 mud, addit. & water	9 casing, tooling, mob. etc.	10 assay	11 splitting	12 thin sec.	13
J1 1	2478	2478	13.24	32,809	12.8		$ 9.61	$ 1.48	$ 1.34	$ .73	$.—	$ .08	
J2 2	3014	3014	15.10	45,511	13.0		10.86	.92	2.45	.61	.22	.06	
J3 3	3004	3004	14.86	44,639	18.3		12.49	1.29	—.→	.71	.32	.05	
J4 4	3104	2513	17.67	44,405	17.7		13.73	.83	1.60	.87	.59	.05	
J5 5	2825	1425	22.72	32,376	18.5		14.07	1.89	5.18	1.08	.36	.14	
J6 6	2590	2590	18.12	46,931	16.8		13.10	1.03	2.80	.88	.23	.08	
7													
TOTAL 8	17,015	15,024		246,671									
AVERAGE 9	2836	2504	16.42	41,112	15.6		$ 12.15	1.18	1.95	.78	.28	.07	
10													
11								15.28			1.13		
12													
13													
14													
15													
16													
17													
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22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

Rock	% Pheno.	Pheno size	Phenocrysts (dec. abund) →					color	groundmass
Tql	10-40	0.3-4.0	qtz	plag.	sanad	biot	magnet.	white-cream	k-spar-qtz-plag-mag-apat-ser.
Tah		0.5-3.0	hnbld.				1.6	mea. dark gray	plag-mag-pyrox.-k-spar-qtz. antiq-ol
Tr_2	50	0.3-6.0	plag.	qtz	biot	hnbld	0.4	yell-mod gray	k-spar-qtz + plag-qtz. biot-hnbd
Tr	10-30	1.0-4.0	plag.	biot	hnbld	magnet	qtz	mea. lgt gray — lt olive gr.	same + k-spar & apatite
Ttca		0.2-6.0					0.3	grayish or. pink	
Ttc		6-12	feld	qtz			0.5		k-spar, plag, biot hnbld. magnet.
TKmr	20-30	0.5-10	plag	qtz	biot	hnbld	high	dark gray	same + k-spar (abund) & ser
TKrh	1-30	1-4	plag.	hnbd	qtz		3.9%	lt brn gray	plag hnbd mag k-spar-qtz.

Chris. Roc

SECTION 28

SECTION 29

THE KELVIN PROSPECT
PINAL COUNTY, ARIZONA

A SUMMARY GEOLOGIC REPORT

for

CITIES SERVICE MINERALS CORPORATION

by

JAMES P. VROMAN

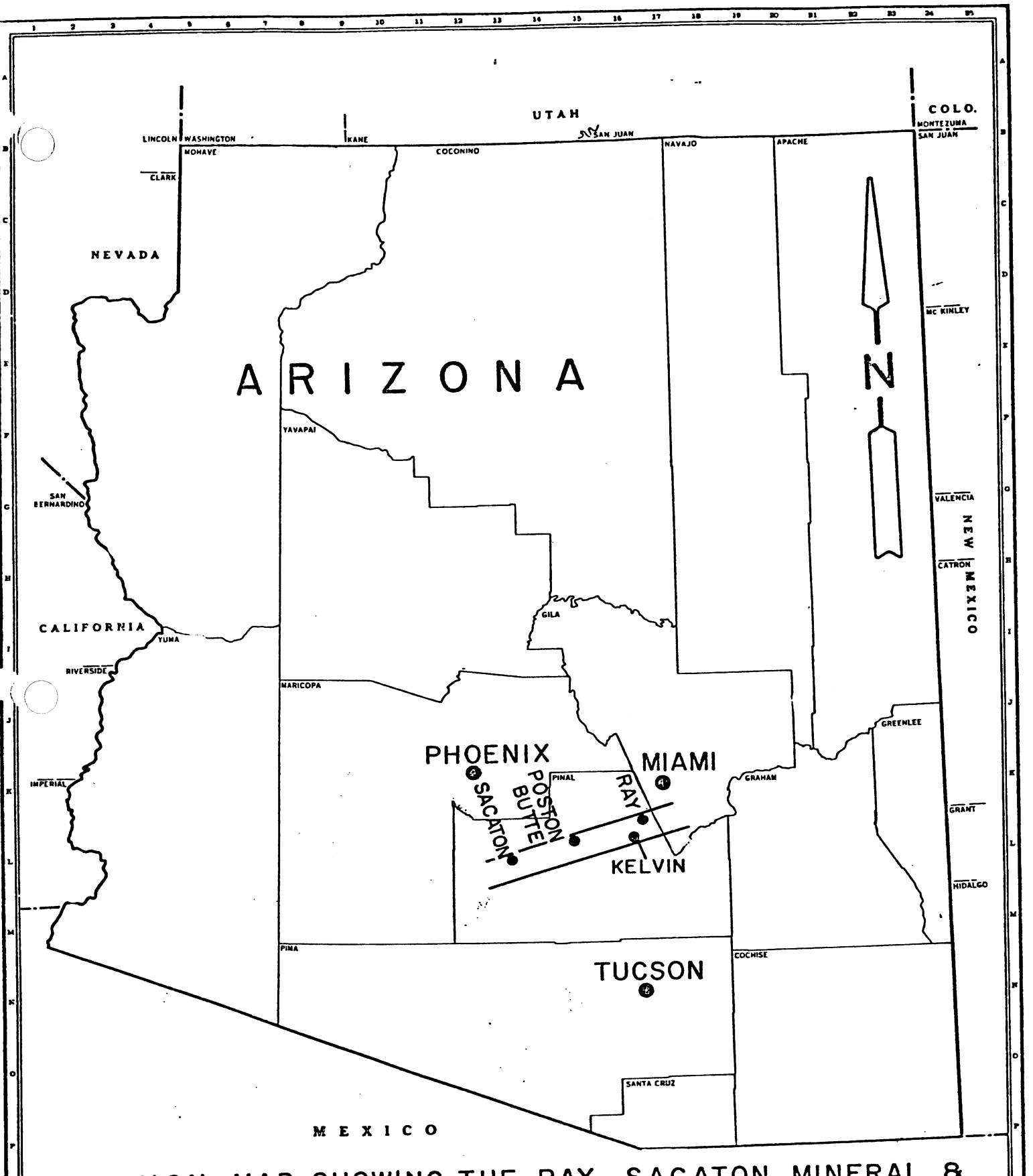
TUCSON, ARIZONA

LOCATION

The Kelvin Prospect is located in the northern portion of the Tortilla Mountains, Pinal Co., Arizona. Tucson is 60 miles south of the prospect and Phoenix is 67 miles to the west-northwest (figure 1). The prospect is situated within the Ray-Sacaton structural belt which bisects Pinal County. This belt has been defined by Schmidt (1971b) on the basis of elongate intrusive masses of intermediate composition, numerous easterly trending near-parallel dike swarms as well as similar trending mineralized fissure veins and limonite coated fractures. Features of economic interest within this structural belt include Kennecott's Ray Mine, Conoco's Poston Butte deposit and ASARCO's Sacaton Mine. Getty Oil and Hanna Mining have recently announced a significant discovery as the result of a joint venture exploration program along the west-southwest extension of this trend.

BACKGROUND

The Kelvin Prospect had been explored by several companies prior to C.S.M.C. interest in the property. During 1968-1969 Minbanco drilled nine hammer holes (total footage=7820 feet). During 1969-1970 Tipperary Resources Corporation geologically mapped the prospect at a scale of 1 inch equals 200 feet; conducted a detailed induced polarization-resistivity survey and drilled two rotary holes (1400 and 1625 feet). During early 1972 Cyprus Mines drilled a 2500 foot angle core hole on the property. Kerr-McGee drilled one 500 foot core hole in 1973. Several other major companies have made surficial geologic examinations of the prospect area over the past several years.



LOCATION MAP SHOWING THE RAY-SACATON MINERAL & STRUCTURAL BELT IN SOUTH-CENTRAL ARIZONA

J. P. VROMAN 11/75

FIGURE 1

Cities Service Minerals Corporation has controlled the property from mid-1974 until the present time. During that time they have drilled six holes (total footage=14,063 feet core plus 960 feet rotary); conducted a gradient array induced polarization-resistivity survey over a portion of the property; and sponsored a multi-element geochemical study of the +3.3 specific gravity fraction of composite sample pulps.

Most of the available core has been studied in detail (including the Cyprus and Kerr-McGee core). Approximately 12,300 feet of core has been graphically logged at a scale of 1 inch equals 20 feet. The relative amounts as well as the mode-of-occurrence of over a dozen minerals associated with hydrothermal alteration-mineralization have been routinely recorded. The core study has been supplemented by petrographic examination of over 300 thin sections. Assays for several elements have been obtained from split portions of the core. Using all the information, described immediately above, summary geologic logs at a scale of 1 inch equals 100 feet have been prepared.

A list of all the pertinent factual data developed to date is included as an addendum to this report.

LITHOLOGY

The predominant rock unit at Kelvin is the Precambrian Ruin (Oracle) Granite. The Ruin infrequently contains schlieren, some of which may be inclusions of schist and/or diorite. The Ruin is intruded by Precambrian Diabase, Cretaceous(?) intrusive breccia

and by at least five varieties of porphyritic rocks, generally granodioritic in composition, inferred to be of Tertiary-Cretaceous (Laramide) age.

STRUCTURE

Regional geologic studies indicate that the prospect area may have undergone significant eastward tilting since Laramide time. Estimates of the amount of tilting ranges from 30 degrees to approximately 90 degrees.

A shallow dipping fault has been intersected by holes J1-J6 and KE-1 (Otego Fault). This fault is possibly related to the major westerly dipping low angle fault mapped by Creasey, Peterson and Gambell (1974) in the Teapot Mountain quadrangle to the north. There is conflicting evidence concerning the age of the fault (pre-mineral vs. post-mineral). The direction and amount of movement between the hanging wall and the footwall rocks is not well understood.

Additional structures may be inferred from the available subsurface data.

ALTERATION

Above the Otego Fault alteration generally varies from weak to strong propylitic. Below the fault alteration is generally sericitic and potassic. Many of the rocks in the prospect area have apparently been overprinted by late-stage propylitic alteration.

MINERALIZATION

Hypogene copper mineralization in the form of chalcopyrite

occurs within a 400 foot to 600 foot wide zone that appears to be spatially related to the boundary between sericitic alteration and potassic alteration assemblages. The most intense copper mineralization encountered to date is (re. figure 2):

Hole	From	To	Width	%Cu	%Mo
J1	1930	2100	170'	.625	.0012
J4	2370	2480	110'	.412	.0127
J5	1930	2050	120'	.425	.0036
	Mean		133'	.507	.0051

The apparent relationship of the mineralized zone to the alteration zones and to the Otego Fault is illustrated by figure 3.

CONCLUSIONS

1. The work by Cities Service Minerals Corporation has resulted in the discovery of a porphyry copper sulfide system.

2. A 400 foot to 600 foot wide zone of increased copper mineralization dips approximately 25°N15W. The zone apparently terminates against a low angle fault to the south. The zone becomes weaker and thinner to the east.

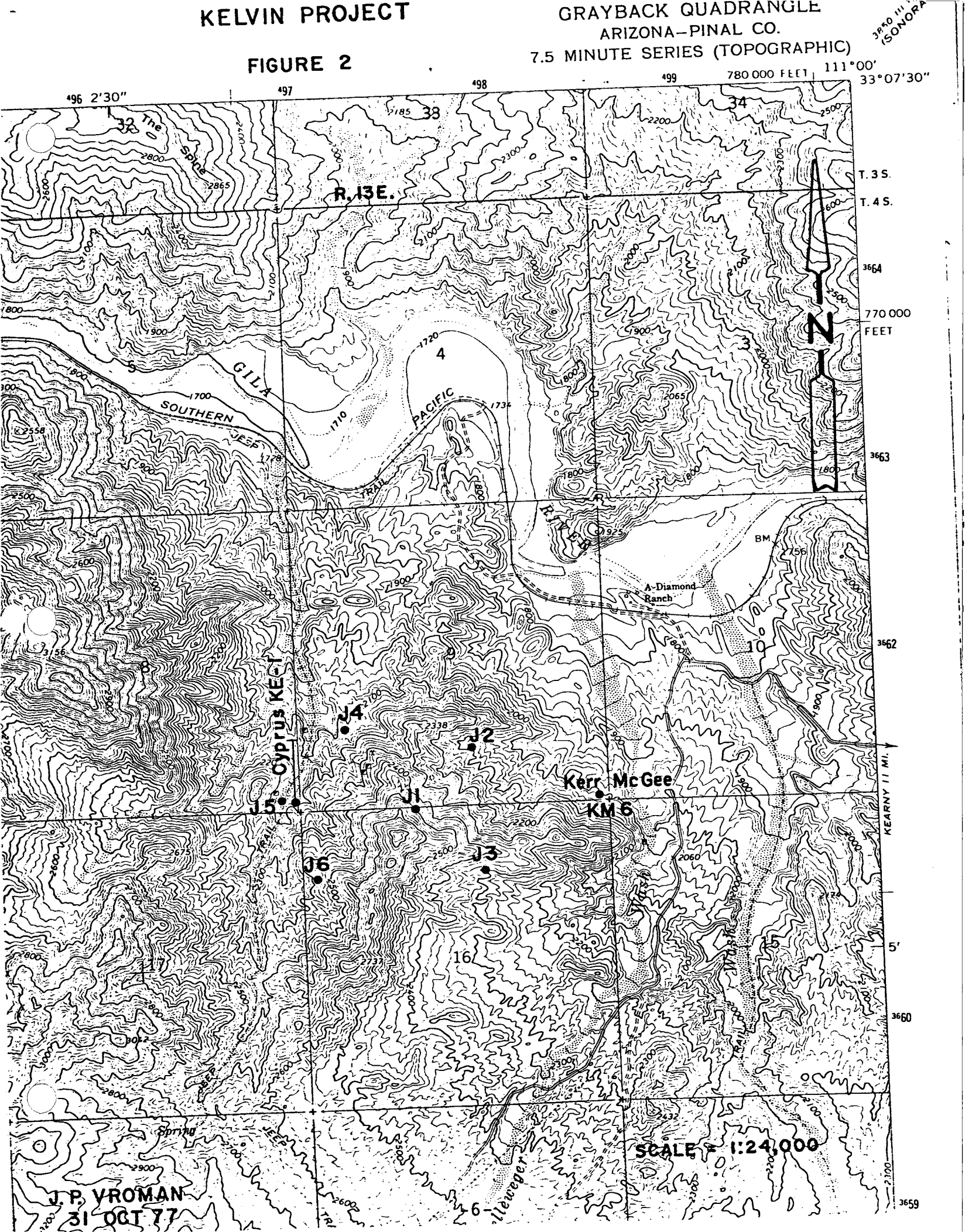
3. The dimensions of the sulfide system and the associated copper zone are not yet known.

4. Drilling to the east or the south (to depths of at least 3000 feet) of the present drilling will likely lead to disappointing results.

5. Several lines of evidence indicate that additional drilling to the northwest, west and/or north of the present drilling may

KELVIN PROJECT

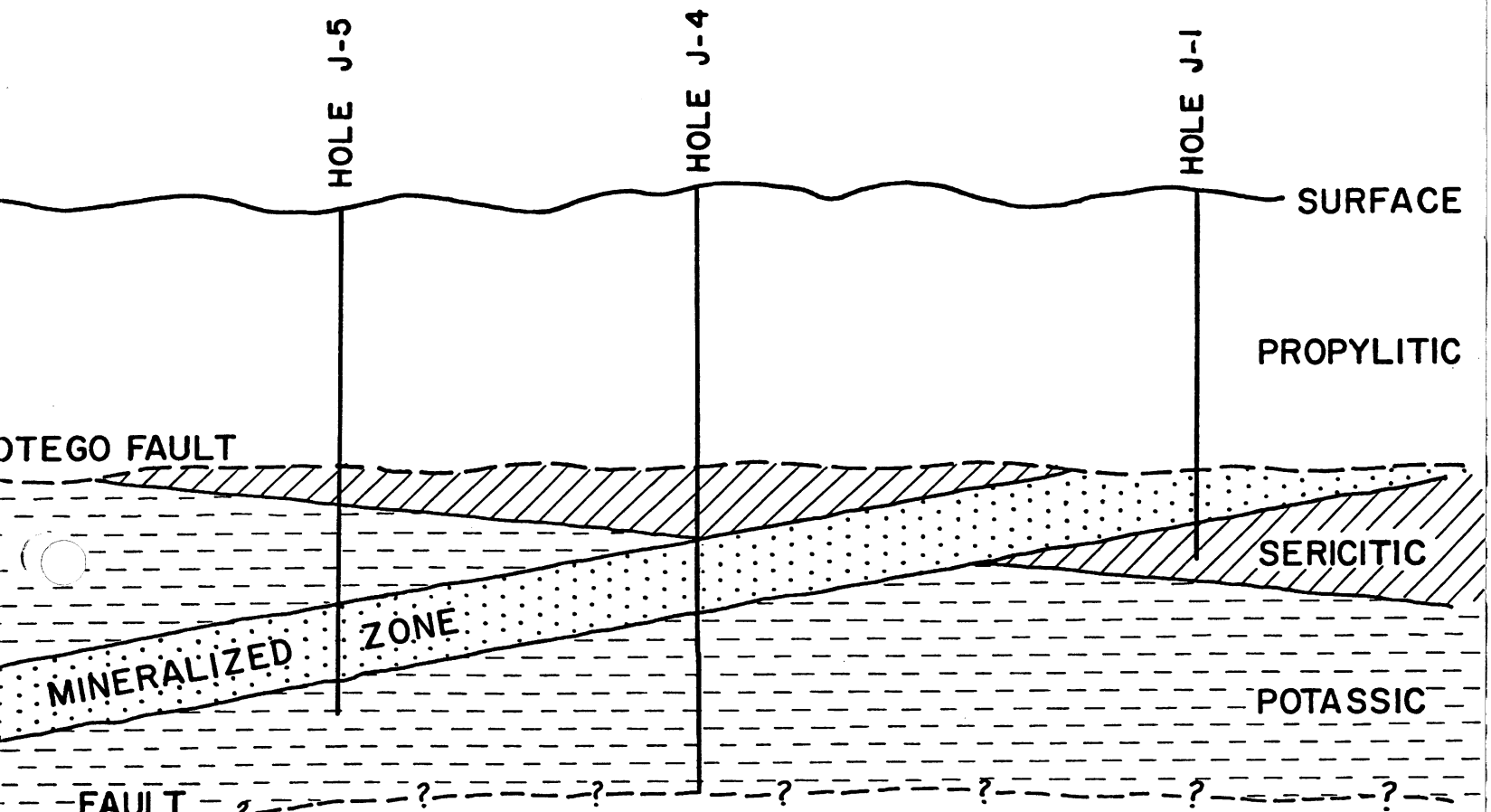
FIGURE 2



FILE NO.

CITIES SERVICE MINERALS CORPORATION

SCALE none
DATE 31 Oct 77
DRAWN BY Vroman



KELVIN PROJECT
GENERALIZED SECTION
LOOKING NORTHERLY

TITLE FIGURE 3 SKETCH NO.

result in intercepts of ore-grade material over mineable widths.

6. Cities Service Minerals Corp. would have completed additional drilling on the project if the decision to discontinue minerals exploration had not been made.

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ADDENDUM

CITIES SERVICE MINERALS CORPORATION

KELVIN PROJECT - PINAL CO., ARIZONA

LIST OF MATERIALS AVAILABLE FOR REVIEW

SURFACE GEOLOGY MAPS

U.S.G.S. Map GQ-1206 Scale: 1"=2000'
E. H. Schmidt Ph.D. Dissertation Scale: 1"1000'
W. P. Zelinski M.S. Thesis Scale: 1"=200'

DRILL HOLE RECORDS

KE-1 (1254'-2500')
KM-6
J1
J2
J3
J4
J5
J6

Logged by C.S.M.C.
Detailed logs at 1"=20'
Summary logs at 1"=100'

Skeleton samples available

Miscellaneous copies of logs of holes drilled and logged by others (pre-1974)

PETROGRAPHY

Petrographic reports on over 300 thin sections obtained from core samples from the drill holes.

GEOPHYSICS

Dipole-Dipole Induced Polarization-Resistivity Survey of Sections 8, 9, 16, 17, T.4S., R.13E.
Frequency Domain (0.3-3.0 Hz), a=1000', n=1-6, along North-South lines spaced 1000' apart.

Gradient Array Induced Polarization-Resistivity survey of S½, Sec. 16, T.4S., R.13E.
Time Domain, a=500', Δ=5000'

GEOCHEMISTRY

The following assay data is available:

elem \ hole	KE1	KM6	J1	J2	J3	J4	J5	J6
Cu	X	X	X	X	X	X	X	X
Mo	X	X	X	X	X	X	X	X
S	X	X	X	X	X	X	X	X
Zn	X	X	X	X	X	X	X	X
Co	X	X				X	X	X
Ag	X					X	X	
W						X		
Fe_3O_4*	X		X	X	X	X	X	X

* "apparent % magnetite" determined by magnetic susceptibility meter

Interpretive report concerning the distribution of 16 elements in the +3.3 g/cc fraction from holes J1, J2, J3, J4, J5, J6 and KM6.

MISCELLANEOUS

Reports, diagrams and sketches illustrating the geology, alteration and structure present in the prospect area.

Drill Summary for Drill Hole J-7

Kelvin Project - CAP No.61-94

Drill hole J-7 was collared in Ruin Granite of Precambrian age. Between the collar and total depth at 2659' drilling intersected three discernible zones of alteration and mineralization developed in a variety of intermediate intrusive lithologies, as well as andesite and diabase, and apparently separated by broad zones of strong deformation.

The first zone from 0' to 600' consists almost entirely of coarse grained Ruin Granite in which all feldspars show slight clouding but crystal forms are retained. Calcite is present as thin veinlets and clear, possibly secondary, biotite is associated with one to three percent very fine grained magnetite. Chlorite and sericite are confined to zones of fracturing and shearing. K-feldspar is also seen to form diffuse veinlets suggestive of secondary origin. Total sulfide content is less than 1% but the pyrite: chalcopyrite ratio is on the order of 1:1. Copper grade for this zone was approximately 0.02% and molybdenum content ranged from 2 to 12 ppm.

The first zone is separated from the second by a zone of strong shearing which extends from 600' to about 730'. The interval from 600' to about 1450' which comprises the second zone also consists of Ruin Granite interspersed with a variety of intermediate intrusive lithologies, as well as andesite, diabase and a variety of porphyritic rocks. Feldspars are typically lightly argillized to lightly sericitized but some K-feldspar has a texture suggestive of secondary formation as does biotite which varies from very clear to strongly chloritic. Carbonate veinlets are noted and diabase is consistently strongly chloritic. Diabase also shows consistently stronger development of sulfides than do the other lithologies. Copper values range as high as 0.1% and molybdenum content of 160 ppm are noted

but both elements average less than 0.05% and less than 10 ppm respectively. Total sulfides in the second zone were 1% or less and typical pyrite: chalcopyrite ratios were on the order of 5:1 to 8:1. Strong shearing was noted from about 1450' to about 2000' and appears to separate the lower two zones of mineralization. Rocks in the interval between 1450' and TD at 2659' include granite as well as intermediate lithologies but relatively small amounts of andesite and diabase. Ruin Granite is typically very coarse but with a faded granitic texture often showing very clear, clean feldspar grains as well as clear secondary biotite. Porphyritic rocks show evidence of weak development of secondary K-feldspar and biotite but also contain strongly chloritized biotite. Copper values average less than 0.05% and although molybdenum content averaged less than 50 ppm occasional intercepts of 150 to 160 ppm were noted. Total sulfide was 1% or less but the pyrite:chalcopyrite ratio was 1:1 to 1:2.

In general, the silicate alteration assemblege for the J-7 rocks superficially resembles potassic alteration but actually has strong propylitic affinities characterized by a quartz-illite-chlorite-K-feldspar and epidote assemblege as noted in thin section. Alteration zoning on the whole is poorly developed and tends to suggest the presence of a relatively weak hydrothermal system.

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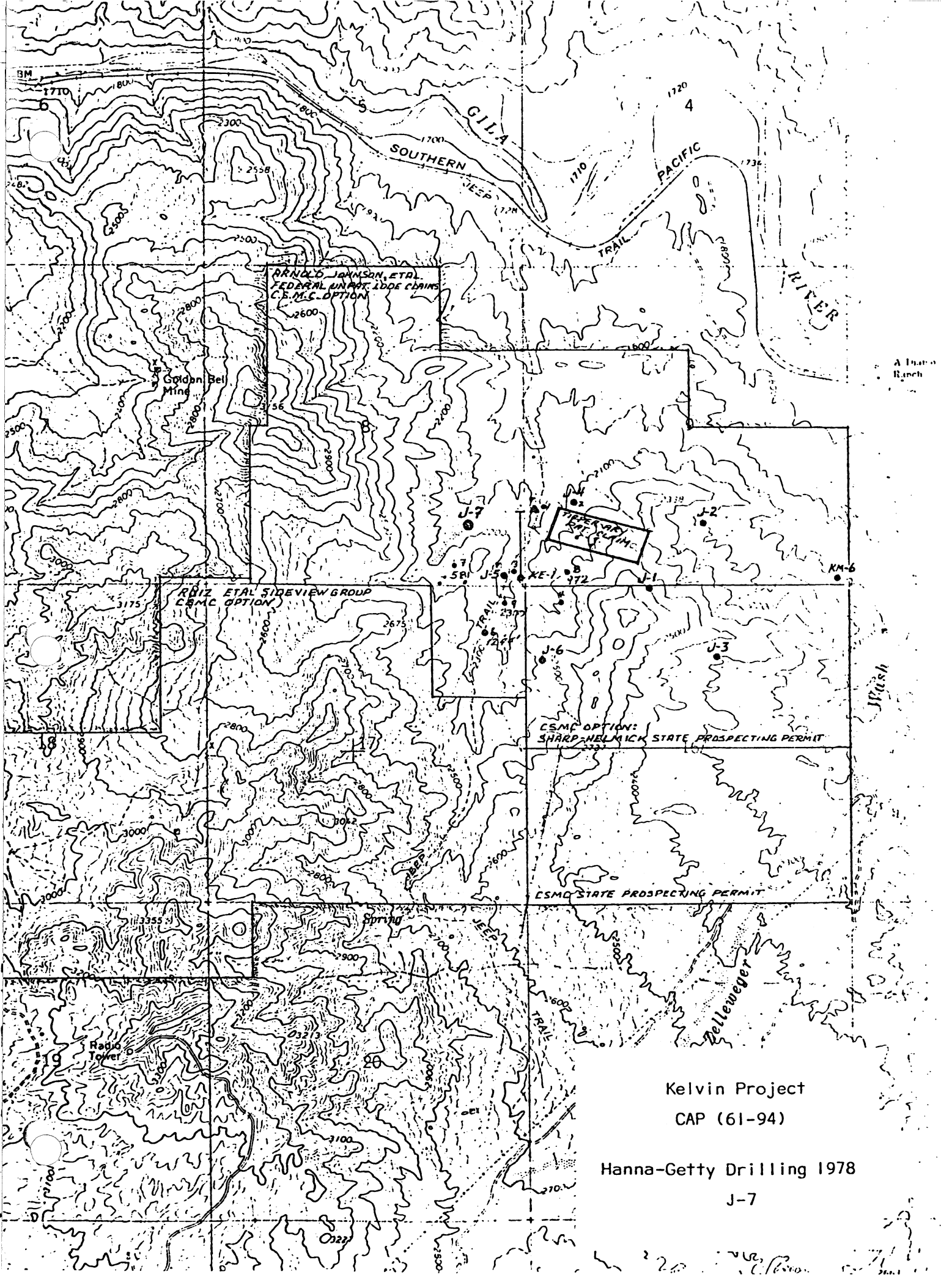

Kelvin Project

CAP (61-94)

Hanna-Getty Drilling 1978

J-7

SUMMARY OF DRILL PROJECT

Project: Kelvin (61-94) Kearney, Arizona

Date: August 14, 1978 - November 14, 1978

Type of Drill: Diamond drill - Joy-22 - hydro stat

Contractor: Joy Manufacturing Co., Tucson, Arizona

Total Cost: $51,036.76 Mud cost $8,122.14 - .159% ($42,914.62 - .189%)

Footage Drilled: 2,659 feet @ $19.194 cost per foot

Number of Holes: J-7, 2,659 feet

Summary: The drill hole was started with NX and finished NX size. Lost circulation at 1,008 feet and the hole started making water at the rate of +3-5 gal. water per minute. Had one twist off at 1,385 feet. Hole was left with 20 feet of NX casing with threaded cap.

PROJECT KELVIN - CAP PAGE 1
D.D.H. No. J-7 SCALE 1"=10' BY LCA-AAO
LOCATION — COLLAR EL 2175' DATE 11-9-78

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo

0 Rotary - No sample

10

20 Pink or [illegible]; rare Qtz Vn; yell-or FeOx(?) along fractures 30°-80° w/H.Axis; minor shattered sections

25% 1/9

30 30-34 Lt. ol. gr 5Y 5/2 Diabase; mostly shattered pcs, hematite along fractures.

7% 2/3

34-187

Pink gray 5 YR 8/1 to Lt. bl. gr 5B 7/1

2.5/4

0.5/1

40 Granite. Composition

Orthoclase - 60-70% (Rum Gr. Yr)

Plagio. 30 %

Biotite 5-10 %

Magnetite(?) 1-2% ?

3.5/5

35% 4/5

40 50 100 2①

50

Alteration. Generally fresh - clay and occasional carbonates along fractures

58% 10/10

60 shear/gouge zones: 28-29.

34-36

38-39

47-48

66-67

70.5-71

83-89

147-149

185-187.

29% 4/4

3/3

70

4.5/5

34% 4/5

80

4.5/5.5

18% 3/3.5

shear angles:

80% - 70° to 80°

20% - 20° to 60°

90

57% [illegible]

100

PROJECT _____ PAGE _____
D.D.H. No. [illegible]-7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					100					
5/5						Bt - forms as clots, normally slightly magnetic suggesting fine magnetite dust in the clots. Clots also typically salt & pepper texture but occasionally goes 1" to 2" across				
5/5					110					
5/5										
5/5					120	Orthoclase - pinkish yellow color fresh to slightly cloudy.				
5/5										
5/5						Chalcopyrite occurrence.				
10/10					130	41' - w/ Bt clot ½" across				
						174' - 175' as vn/t with py. and Bt				
						Py : cpy = 1:1				
						TS - <1%				
5/5					140	Sericite occurs rarely in some of the fractures (e.g. 176')				
10/10							140	152	60	8 ①
					150	Oxidation appears to terminate at 115'				
10/10					160					
5/5										
5/5					170					
10/10							170	180	130	6 ①
5/5					180					
5/5					190					
5/5					200					

Depth scale: 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200

Core recovery: 50%, 46%, 59%, 59%, 90%, 68%, 64%, 53%, 49%, 57%

PROJECT _____ PAGE _____
D.D.H. No. 4'-7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5% 10/10					200	190 - 330 Ruin Granite color ranges from greenish gray (5 G 6/1) to light bluish gray 5B 7/1				
32% 8.5/9					210					
31% 4.5/7					220	Alteration: = Most noticeable - abundance of magnetite (fine dust + clots) 1-3% = magnetite and biotite (secondary) occurring together in clots and occasionally in veinlets Biotite approx 5-10%				
4/5										
46% 8/8					230					
43% 10/10					240	= Carbonate normally occurring as thin veinlets throughout the section; regularly along fractures	240	250	380	8
1.5/2										
43% 10/10					250	= sec(?) K-Feldspars abundant as blebs and veins/veinlets				
3.5/4					260	= Primary? K feldspars retains crystal boundary.				
36% 3/3										
53% 9.5/10					270	= Most plagioclases cloudy although still showing distinct crystal forms.				
47% 10/10					280	= Chlorite common only at or near shear/fault zones	280	290	100	<2
56% 8/8					290	= TS < 1% ~1 pyrite/cpy = 1:1				
					300					

PROJECT Kelvin PAGE 2

D.D.H. No. K-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralizm	Alteration	Structure	Rock Type
10/10				
67% 10/10				
74% 10/10				
25% 3.5/5				
78% 7/7				
8/8				
48% 5.5/6				
64% 10/10				
64% 8/9				
65% 9.5/10				
58% 10/10				
65% 10/10				

300

Shear & Fault zones at the following:

182'- 183' 45°

206'- 207' 60°

225'- 230' 45°-60°

310 248'-250' 10°-60°

254'-267' 45°-60°

280'- 284'(?) - 50°

300' — 20°(?)

324' - 333' 10°-45°

320

330

330- 470

Ruin Granite - same as 190'-330'; probably more Bt & mag.

shear and fault zones

340

333' 45°.

350 384'-390' 60°.

415'-420' 45°-60°

427'-429' 60°

360

TS - < 1% ?

370

380

390

400

CORE ASSAYS

INTERVAL FROM	INTERVAL TO	MINERAL Cu	MINERAL Mo		
320	330	150	2		
380	390	35	2		

PROJECT [illegible] PAGE 5

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
					400				
31% 8/8									
					410				
18% 7/7									
3/2									
3/3									
					420				
83% 10/10									
					430				
64% 5.5/6									
9/9					440				
59% 7/7									
					450				
73% 7.5/8									
					460				
78% 10/10									
					470				
58% 10/10									
					480				
70% 10/10									
					490				
85% 10/10									
					500				

470-604
RUIN GRANITE - QTZ MONZ - LT. GRAY N7 TO LT. GREENISH GRAY 5GY 8/1 TO PINKISH GRAY 5YR 8/1 - VERY COARSE GRANITIC TEX. K-SPAR SUBHEDRAL W/ SLIGHTLY HAZY BORDERS. K-SPAR V. CLEAR TO LIGHTLY CLOUDED. BIO. V. CLEAR TO MOD CHLORITIC MOSTLY ANHEDRAL. PLAG. ANHEDRAL - CLEAR TO LT. CLOUDED.

PROJECT _____ PAGE 6

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type
17% 10/10				
77% 10/10				
85% 10/10				
5/5				
20% 6/6				
53% 7/7				
5 1/2/6				
23% 10/10				
51% 10/10				
39% 10/10				
33% 10/10				
40% 2/2				

500

K-SPAR FORMS OCCAS. V. DIFFUSE POORLY DEVEL VNLTS TO 1". BIO, USUALLY CHLORITIC NOTED IN OCCAS RAGGED 1/16" VNLTS. W/ MAGNETITE.

510

V. SP BLEBS CPY & DISSEM PY. TOT. SUL <1%

520

PY I = CPY. - SUL ASSOC K-VNLTS IN SOME CASES.

EST 0.02% Cu.

530

(AT 524 1" VN V. COARSE CALCITE)

540

550

560

570

580

(584-591 CONC BIO-MAG)

590

600

CORE ASSAYS

INTERVAL FROM	INTERVAL TO	MINERAL Cu	MINERAL Mo
500	510	305	12
590	600	810	4

PROJECT [illegible] PAGE [illegible]
D.D.H. No. 4.7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralizm	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
10/10					600					
3/3						604-668.5				
2/2					610	Ruin Granite · Lt. Pinkish-Greenish Gray - colors sim to 470-604 - lacks tex - def destruc & fading of original coarse granitic tex.				
6/6							610	670	90	4
6/6					620	All felds clouded - bio bleached & chloritized local dev. coarse green ser & dissem sil.				
10/10					630	Tot. sul <1% PY : CPY >10:1 EST Grade 0.02%				
5/6										
3.5/4					640					
3/3										
3/3										
1/2					650					
5/5										
4.5/5					660					
2/3										
5/5										
3.5/4					670	668.5-684				
5/5						Andesite - Lt. Gray N7 - V. fine grained - aphanitic tex. - sul v. sp. - absent - note occas carb vnlts - some frags slightly green w/ tally min devel.				
4/5					680					
3.5/4						Top & bottom cont st. broken				
3.5/4						684-770				
4.2/5					690	Ruin granite - Greenish Gray 56 % occas pink cast due K-spar - Tex is v. coarse granitic but hazy all xls subhedral & anhedral				
2.7/3					700					

Margin notes: 7% · 24% · 20% · 10% · 6% · 19% · 0% · 12% · 4% · 8%

PROJECT _____ PAGE 8

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralztn	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5			Δ		700				
4/4			Δ						
4/4			Δ Δ						
4.5/5			Δ		710				
5/5			Δ			710	720	140	2
3/3			Δ		720				
2/2			Δ						
4/4			Δ						
4.5/6			Δ		730				
4/4			Δ						
3.5/3			Δ		740				
6.5/8			Δ						
5/5			Δ		750				
3/3			Δ						
4/4			Δ		760				
5/5			Δ						
3.7/4			Δ		770				
5/5									
5/5					780				
5/5									
4.5/5					790				
4/5									
5/5					800				

700 GRANITE IS ST. FRAC

CARRIES DISSEM. & VNLT PY < 1%

710 ALL FELDS CLOUDED PLAG SHOWS GREEN SER FRACS DEVEL GREEN TALCY-SOAPY MIN.

720 CARBONATE VNS PRES NOT ABUN.

730 (at 720 NOTE MoS_2 ON FRAC)

770 - 841

RAIN GRANITE. - MED LT. GRAY N6 - SLIGHTLY PINKISH DUE K-SPAR.

780 TEXTURE IS V. COARSE GRDING GRANITIC BUT TOO IS HAZY & INDISTINCT.

790 K-SPAR IS CLOUDED - PLAG IS CLOUDED & SHOWS GREEN SER. BIO IS TRANSCHLY CHLORITIZED AND

800

PROJECT _____ PAGE _____
D.D.H. No. J-7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					800	CARRIES SIGNIF MAGNETITE.				
5/5					810					
5/5							810		50	2
3/3								820		
5/4					820					
5/5										
5/5					830					
5/5										
10/10					840	841-866.5 RUIN GRANITE - VERY LT. GRAY N8 - COARSE GRANITIC TEX BADLY FADED - V. HAZY. ROCK IS BLEACHED, CHLORITIZED. ALL FELDS CLOUDED. SULFIDES NIL MAGNETITE V. SPARSE. NOTE SP. QTZ VNLTS & CO_3 VNLTS W/ V. SP MOBILIZATION OF K-SPAR. FRACS STRONGLY GREEN & TALCY W/ HORIZ SLICKS ON 60-70° FRACS.				
5/5					850					
5/5										
5/5					860					
4/4										
5/5					870	866.5-881- ANDESITE - GREENISH BLACK 5GY 2/1 - APHANITIC TO V. SLIGHTLY PLAGIOC. CONTACTS TOP & BOTTOM ARE IRREG & INTRUSIVE AND INTO GRANITE. AND ENCLOSES INCLUSIONS OF GRANITE. NIL SULFIDES - 1/4" CARB VNLTS - TALCY FRACS.				
5/5										
5/5					880	880 - RUIN GRANITE - LT. GRAY N7 COARSE GRANITE TEX BADLY FADED. ALL FELDSPARS CLOUDED - BIO CHLORITIZM NIL SULFIDES - SP MAGNETITE ASSOC W/ BIO				
4/4										
5/5					890					
5/5										
5/5					900					

7%
41%
1' ?
5>4"
23%
36%
21%
37%
53%
57%
59%
38%
4.3' 9-5-78

PROJECT KELVIN PAGE 10
D.D.H. No. U-7 SCALE _____ BY LCA/AAO
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralizm	Alteration	Structure	Rock Type
0.5/5				
5/5				
5/5				
5/5				
5/5				
3/3				
5/5				
4/5				
3.5/4				
5/5				
4/5				
5/5				
5/5				
5/5				
3/3				
5/5				
3/4				
4/4				
2.5/3				
3.5/4				
3.5/0				

34%
21%
40%
5%
14%
56%
64%
53%
15%
14%

900 905 - 950.5 Granite, light greenish gray; most Biot chloritd. mag < 2%, CO_3 abund. along fracts, common K-feld veinlets.

910

920 } And. dkc, dark-grey, 5-10% Mag, 2% pyr. nil cpy; mag in vnlts w/ CO_2

T.S. = < 1%

930 Py:cpy = 7:1

} gougy zone 45°-80°

940

950 950.5 - 975 Diabase

Dark gray-green; abund CO_3 veinlets, mini-fractures marked by soapy green minerals; vugs filled w/ calcite common

TS - 3%

py:cpy = 3:1

960

970 cpy abund at veinlets.

} gougy zone + CO_3

980 - 1014 - Granite light gray w/ Typical Rain Granite text; w/ clouded felds and biot → chlorite (partly)

1980 gen. fractured

990 prominent structures approx 5°-10°, less prominent 60°-80°

TS - < 1%

py:cpy = 8:1

1000

CORE ASSAYS

INTERVAL FROM	INTERVAL TO	MINERAL Cu	MINERAL Mo
910	920	105	28
960	970	45	V V
990	1000	240	2

PROJECT KELVIN PAGE 11
D.D.H. No. 4-7 SCALE _____ BY LCA/AAO
LOCATION _____ COLLAR EL _____ DATE 9/11/78

% Core Recovery	Mineralization	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
3/4					1000	Mag 1-2%				
19% 1.5/2						Noticeably more occurrence of				
1/1						K. Feldspar vults..				
2/2										
2/2					1010	1013 to 1014 fractured rxs.				
0.5/1										
1/2										
0.5/1										
14% 0.5/1						1014-1017 Feldspar Bt porph dk grey; Felds completely clouded; Bt sec; ser (?)				
3/3										
4.5/5					1020	1017-1070 Ruin Granite, Light grey (N7) to pinkish gray (5YR 8/1)				
4% 4/4						Main characteristic ① heavily				
1.5/2						fractured ② super abundant				
3/4					1030	2nd ary K Feldspar veins				
9% 3/3						③ Chlorite commonly occurring;	1030	1040	390	2
5.5/6						same as alteration after				
					1040	Bt.				
22% 4/4						shear/fault/fracture zone:	1040	1050	410	6
2/2						1017-1018				
						1020-1055 - 60°(?)				
5/5					1050	Magnetite - 1-2%				
14% 5/5						TS - 1%				
						py·cpy = 5:1				
4/4					1060					
26% 7/7										
5/5					1070	1070-1124				
52% 2/2						Ruin granite, N7 to 5YR 8/1,				
3/3						more chlorite than above run.				
1/1					1080	Sec. K. Feldspar vult very common.				
1/1										
4/4						TS - 1%				
59% 5/5						py:cpy = 5:1				
						Mag - 2%				
4/4					1090					
23% 5/5										
					1100					

PROJECT Kelvin PAGE 12

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralization	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					1100				
10% 2 5/3					Fracture zones:				
2/3					1092 - 1096 45°				
					1100 - 1109 80°-90°	1100	1110	24°	<2
					1116 - 117 45°				
5/5					1110				
36% 5/5									
5/5					1120				
51% 5/5					1124 - 1133				
					Diabase; [illegible] - grey; traversed by mag/CO_3				
1/5					veins; abund fine grained Bt.				
					1130 sulphides = <1% almost all Py.				
					Felds-Bt porph (same as 1014-1017)				
39% 3/3					1134.5 - 1200				
3/3					Light grey Ruin Granite, commonly				
3/3					1140 fractured; common CO_3 veins and				
41% 5/5					K-feldspar veins; chlorite moderate	1140	1151	290	<2
					(after Bt.?) to abundant				
5/5					Mag - 1-2%; TS - 1%				
					1150 Py:cpy = 8:1				
22% 5/5					shears/faults:				
					1134 - 1134.5 45°				
4/4					1135 - 1140 60-80° — rough				
					1160 1150 - 1153 80°-90°(?)				
3/3					1158 - 1160 80° & 45°				
1.5' x 4° 39% 5/5									
					N.B: Here cpy at 1136 - 1142				
					shears/fault				
					1170 1176' - 60°				
34% 5/5					1181 - 60°				
5/5					carbonate filled open (?) tension (?)				
					fractures generally 20-30°				
					1180				
4/4									
16% 4/4									
4.5/5					1190				
37% 5/5									
					1200				

PROJECT Kelvin PAGE 13
D.D.H. No. J-7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE 9/25/78

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					1200	1217-1219				
5/5						Light orange grey Rum Gr - dissolved pink at 1212'-1219' where composition is >50% pink K. Tilts, chlorite still common	1200	1210	125	2
5/5					1210	py < 1%				
4/4						Mag - 2%				
5/5						Gr - Diab contact sharp at 35°				
5/5					1220	1219-1250				
4/4						Diabase				
4/4					1230	Dark grey diabase characterized by fine gr biotite grains and elongate biot crystal occurrence				
5/5						Carbonate veinlets common				
5/5					1240	TS - <1 (only as vults)				
5/5						mag - 1-2%				
5/5						Slip planes at 45°-35° very common.	1240	1250	165	2
5/5					1250					
5/5						1254-1269				
5/5					1260	Rum Granite: light pink w/ slight greenish tinge				
5/5						TS - <1				
3/3						mag <1				
4/4						shear planes 45°				
3/3					1270	1269-1292.5				
4/4						Diabase: dark grey w/ greenish tinge; highly fractured throughout run; seycentine (soapstone) abundant				
3/3					1280					
5/5						TS - 1% py : cpy = 1:3				
5/5						mag - 2%				
5/5					1290					
						1292.5 - 1306 (Major panel)				
					1300	sheared Rum granite light pink to slightly greenish fragments 2"-3", abund. Chlorite				

54%
22%
25%
38%
49%
33%
22%
11%
0%
6%

PROJECT Kelvin PAGE 10
D.D.H. No. J-7 SCALE ____ BY ____
LOCATION ____ COLLAR EL ____ DATE ____

% Core Recovery	Mineralization	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
+1.5 core 0'>4"					1300				
5/5					Schist - 70°				
4/4					Jmc				
100%						1305	1315	1320	46
4/4									
					1306 - 1378.5				
5/5					1310 Rem Granite Pale pink w/ light green sections				
18% 3/3									
5/5					1320 Rare CO2 vnlts				
					Mod to abund chlor				
3/3					Abund. K-Feldspars				
23% 5/5					Most Feldspars → clay				
					1330 Mag - 2%				
5/5					TS - < 1%				
26% 4/4									
					1340				
5/5									
90% 5/5									
					1350				
5/5									
24% 4/4						1350	1360	315	6
					1360				
5/5									
38% 5/5					Abund py - 1% - 2% -				
					1370				
5/5					more K-spar 1370-1378.				
23% 4.5/4.5									
13/13.5									
					1380 1378.5 - 1490				
5/5					Feldspar biotite Qtz porphyry				
59% 3/3					light - med grey ; occas.				
					K-spar vnlts ; occas CO_3 vnlts				
8/8					1390				
71%									
					1400				

PROJECT Kelum PAGE 15
D.D.H. No. _____ SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralism	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
9/9					1400 (cont'd) Magnetite veinlets - common pyrite more abundant at silicified zones	1400	1410	435	42
10/10					1410 chlorite occurs along slip planes and in the fault zones				
9/8					1420 TS - <1%				
10/10					1430				
10/10					1440				
10/10					1450	1450	1460	440	115
8/8					1460				
8/9					1470				
3/5									
4.5/4.5									
5/5					1480 Bxin				
5.5/4									
5/6					1490 1490 - 1535 Highly fractured pinkish-grey Rwin Granite				
					1500				

PROJECT Kelvin PAGE 16
D.D.H. No. _____ SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
10/10					1500	Abundant chlorite at fault planes; abundant				
6% 5/5						2nd ary K spar veinlets	1500	1510	160	160
3/3					1510	TS - <1%				
3/3										
6% 5/5										
3/3					1520					
1/4										
0 1/2										
.5/1										
1.5/2					1530					
.5/.5 3/4										
3' core 74" 8% 2/2.5						1535-1689				
3.5/4					1540	GRANITE - Qtz Mon2 Med Gray N5 Locally Pinkish Gray 5YR 8/1				
2/2						Coarse Granitic Texture. Generally				
16% 3/3						Faded and Hazy. Most Feldspar				
5/5					1550	Clouded Aren Clear Grains of Both K-Spar and Plagioclase Remain. Note occas clear Bio - most is secondary				
4/4						Note V. small incip. vnlts K-Spar				
21% 3/3						and chlorite.	1550	1560	150	28
5/5					1560	Rk st. frac & slickensided surfaces develop. Talcy soapy min.				
12% 5/5						Sulfides V. SP ± 1%				
2/2					1570	(@1547 note rnd brec frags gran par st. silicified.				
4/4										
0 4/4										
5/5					1580					
7% 3/3						(V. st. conc. K-Spar @ 1584)				
4/4					1590					
3.5% 3/3										
4/4										
					1600					

PROJECT [illegible] PAGE [illegible]
D.D.H. No. J-7 SCALE _____ BY L.C.A. AND
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Core Assays: Interval FROM	Interval TO	Mineral Cu	Mineral Mo
5/5					1600				
5/5						1600	1610	620	28
5/5					1610				
2/2									
5/5									
2.5/3					1620				
4/4									
10/10					1630				
4/4					1640				
4/4									
4/4									
3.5/3.5					1650				
3.5/3.5						1650	1660	105	4
5/5					1660				
5/5									
4/4					1670				
6/6									
5/5					1680				
3/3									
5/5									
4.5/5					1690				
4/4					1700				

Mineralzn: 15% (5/5, 5/5), 14% (2/2, 5/5), 0% (2.5/3, 4/4), 4% (10/10, 4/4), 14% (4/4, 4/4), 22% (3.5/3.5, 3.5/3.5, 5/5), 0% (5/5, 4/4), 31% (6/6, 5/5), 47% (3/3, 5/5), 6% (4.5/5, 0.5/.5, 4/4)

(1614-1616 MYLONIZED ANDESITE V. DK. GRAY)

(@1649 INCIP K-SPAR VN.)

1689-1751.5
GRANITE - QTZ MONZ - LT. GREENISH GRAY SG 8/1 - COARSE GRANITIC TEXTURE SHOWS EVIDENCE STRONG CRUSHING AND SHEARING.

PROJECT _____ PAGE _____

D.D.H. No. J-7 SCALE _____ BY LCA-AMD

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralizm	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					1700				
4.5/4.5					ALL PLAGIOCLASE STRONG CLOUDING BY GREENISH TALCY-SERICITE MINERAL.				
2/2					V. SP. SULFIDES-TEND TO OCCUR IN BLEBS W CPY I PY. TOT SMC ±1%.				
5/5					1710				
7/7									
3.5/4					1720				
4.5/4.5									
4/4					1730				
3/3.5									
4/4					1740				
3/3.5									
4.5/4.5									
1/1.5					1750				
1/1.5									
1.5/1.5									
4/5.5					1751.5-1816 GRANITE - LT. GRAY NP - SLIGHT PINKISH CAST DUE K-SPAR. VERY COARSE GRANITIC TEX. - SLIGHTLY HAZY FACES.	1750	1760	140	7
5.5/6					1760				
2/2					PLAGIOCLASE CLOUDED SUBHEDRAL K-SPAR GEN. CLOUDED - SOME CLEAR FACES REMAIN. BIO STRONGLY CHLORITIZED.				
7/7					1770				
5.5/7					SPARSE MAL ASSOC. W/ CHL. BIO. NIL OR ESSENT. NIL. SULFIDES.				
3.5/4					1780				
4/4.5					(ON SPLIT CORE NOTE ABUN V. COARSE V. CLEAR K-SPARS)				
4/3.5					1790				
2/2.5									
5/5					1800				

+30 CORE 3' >4"

PROJECT KELVIN PAGE 14
D.D.H. No. J-7 SCALE 1"=10' BY H.V.
LOCATION ____ COLLAR EL ____ DATE ____

% Core Recovery	Mineralizm	Alteration	Structure	Rock Type
33% 5/9				
4/4				
10% 3/3			Δ Δ	
2.5/3			Δ δ	
1.5/2			δ Δ	
11% 2.5/3			δ Δ	
5/5			δ	
25% 9.5/9.5				
4/4				
29% 2.5/2.5				
5/6			Δ Δ	
			Δ Δ	
16% 3.5/4			δ δ	
			Δ Δ	
4/4.5			Δ Δ	
			Δ Δ	
13% 4.5/4.5			Δ	
5/5			δ/ δ/ δ	
			Δ	
4/4			Δ	
20% 2/2			Δ Δ	
3.5/3.5				
4/5.5			Δ Δ	
4% 4/4			Δ Δ	
			Δ Δ	
2/3			Δ Δ	
0% 3/4			Δ	
3/4			Δ	
			Δ	

1800

1810

1816-1865 GRANITE - GRAY GREEN - 5GY 6/1
COARSE GRANITIC TEX - HAZY FND
STRONGLY FAWN. K-SPAR CLOUDED
PLAG OUT TO GREENISH SER(?).
BIO. STRONGLY CHLORITIZED.

1820

1830

MOD. MAG. ASSOC W/ BIO. VSP
TO NIL SULFIDES

1840

1850

1860

STRONGLY SILICIFIED FAULT CONTACT
DIPS ≈ 60° SLICKL RAKE 0°

1865-1882
MONZ POR - DARK GREENISH GRAY
CROWDED SERIATE POR TEX BIO.
STRONGLY CHLORITIC - ANHEDRAL
PLAG. STRONGLY CLOUDED.
NOTE STRONG CLOT PY-CPY
AT 1871.

1870

1880

V.ST BRECCIATED CONTACT

1882-1949.5
GRANITE - GRAY GREEN - COARSE GRANITIC
TEX. - VERY HAZY AND FAWN DUE
ALT. ALL PLAG - ENHEDRAL TO
SUBHEDRAL STRONGLY CLOUDED-K-SPAR
SUBHEDRAL TO ENHEDRAL. GEN DULLISH CAST
WITH CLOTS. BRIGHT CLEAR QUARTZ.

1890

1900

CORE ASSAYS

INTERVAL FROM	INTERVAL TO	MINERAL Cu	MINERAL Mo		
1800	1810	120	16		
1840	1850	90	12		

PROJECT _____ PAGE _____

D.D.H. No. J-7 SCALE 1"=10' BY L.C.A.

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralization	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
12%	7.5/9				1900	BIO. STRONGLY CHLORITIZED	1900	1910	110	28
	2/2				1910	SULFIDES V. SP TO NIL. GRANITE STRONGLY CRUSHED - NO ATTIT. RECOGNIZED.				
10%	4/4									
	3.5/4									
	2.5/4				1920					
0	1.5/2									
	1/1									
	3/3									
	2/3				1930					
4%	2/3									
	3.5/4									
	3.5/4				1940					
13%	5/5					V. SHARP INT. CONT - DIPS 20°				
	4/4				1950	ANDESITE - MED. LT. GRAY N6 TO MED DK. GRAY N7. V.F. POR. TEX. NEARLY APHANITIC - STRONGLY FRAC ALONG VERT. FRACS W/ DEVEL. SOAPY TALCY GOUGE. ABUN 1/8" CO3 VNLTS - SULFIDES NOT NOTED.				
43%	5/5						1950	1960	265	K
	4/4				1960					
13%	4/4					SHARP INT. CONTACT DIPS				
	3.5/3.5					POR 1962 - 2017.5 GRANITE - LT. GRAY N7 -				
	4.5/4.5				1970	COARSE GRANITE TEX. BADLY FADED AND HAZY. ALL FELDSPARS APPEAR HAZY BIO. STRONGLY CHLORITIZED. NOTE INCP. VNLTS K-SPAR.				
4%	4/4									
	2/2.5									
	4.5/4.5				1980	SULFIDES NIL TO ABSENT. (@1964 1/2" POR. - UNMIN)				
0	2.5/3.5					MAG. SPARSE TO ABSENT.				
	3.5/4.5				1990					
28%	4/4									
	4/4				2000					

PROJECT _____ PAGE _____
D.D.H. No. J-7 SCALE 1"=10' BY L.A.
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					2000	1998	2008	95	14
20% 3/3									
2/2					2010 SHARP INT CONT DIPS 30°				
4/4									
70 5/5					C2016 NOTE INCLUSION OF POR. DESCRIBED BELOW - SUGGESTS UPPER CONTACT IRREGULAR.				
					2017.5-2022 BIO MONZ POR - MED GRAY N5 - OPEN SERIATE POR TEX - ANHEDRAL PLAG CLOUDED - SUBHED BIO CLEAR. NO SUL. NOTE VNLTS CALCITE & GRAPHITE. DK APHAN GROUNDMASS.				
5/5					2020				
26% 5/5					SHARP INT CONTACT DIPS 60°				
					2022 - 2047.5				
4/5					2030 GRANITE. LT. GRAY TO SLIGHTLY PINKISH GRAY N6 TO 5YR 8/1 - COARSE GRANITIC TEX. BADLY FADED.				
54% 5/5					ALL FELDSPARS CLOUDED - BIO STRONGLY CHLORITIZED IN SOME AREAS V. FRESH IN OTHERS.				
0/0					2040 NOTE VNLTS OF SERC 1/16 &				
27% 5/5					INCP DEVEL K-SPAR. - RK. ST. SILICIF.				
					SHARP FLAT CONT				
					2047.5 - 2059				
5/5					2050 ANDES. POR - MED GRAY N5 - OPEN SERIATE POR. TEX. ANHED. PLAG CLOUDED - BIO SUBHEDRAL V. CLEAR. CALCITE VNLTS 1/8 - 1" APHANITIC GRND MASS APHANITIC. NO SUL. FRACS DEVEL TALLY SOAPY FEEL.				
30 5/5						2050	2060	450	38
2/2					2060 SHARP CONT DIPS 70°				
3/3					2059 - 2181				
+4' core 9' core 74" 5/5					GRANITE. PINKISH GRAY 5YR 8/1 COARSE GRAN TEX. FADED.				
62% 3/4.5					2070 COARSE CLEAR K-SPAR - PROB. 2ND K SPAR.				
50% 4.5/4.5					ST. QTZ VNING & SILICIF GRAN CONTAINS IRREG. INC.				
5/5					2080 AND. POR IN TOP 2' SECTION.				
42% 5/5					NOTE V. SP. SULFIDES - LOCAL IN DISSEM FORM. PY:CPY =				
5/5					2090 1:1 OR 0.5:1 BUT TOT VOL. IS << 1%.				
58% 4.5/4.5									
5/4.5					2100				

PROJECT _____ PAGE _____
D.D.H. No. J-7 SCALE 1"=20' BY L.A.
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Core Assays: Interval From	Interval To	Mineral Cu	Mineral Mo
5/5					2000	1998	2008	95	14
3/3									
3/3									
4/4					2010				
5/5									
5/5					2020				
5/5									
4/5					2030				
5/5									
6/6					2040				
5/5									
5/5									
5/5					2050				
5/5						2050	2060	450	38
2/2									
3/3					2060				
5/5									
3/4.5					2070				
4.5/4.5									
5/5					2080				
5/5									
5/5					2090				
4.5/4.5									
5/4.5					2100				

20%

20

26%

54%

27%

30

+4' core
9' core 74"
62%

50%

42%

55%

SHARP INT CONT DIPS 30°

C2016 NOTE INCLUSION OF POR. DESCRIBED BELOW - SUGGESTS UPPER CONTACT IRREGULAR.

2017.5-2022 BIO MONZ POR - MED GRAY N5 - OPEN SERIATE POR TEX - ANHEDRAL PLAG CLOUDED - SUBHED BIO CLEAR. NO SUL. NOTE VNLTS CALCITE & GRAPHITE. DK APHAN GROUNDMASS.

SHARP INT CONTACT DIPS 60°

2022 - 2047.5

GRANITE. LT. GRAY TO SLIGHTLY PINKISH GRAY N6 TO 5YR 8/1 - COARSE GRANITIC TEX. BADLY FADED. ALL FELDSPARS CLOUDED - BIO STRONGLY CHLORITIZED IN SOME AREAS V. FRESH IN OTHERS. NOTE VNLTS OF SERC 1/16 & INCP DEVEL K-SPAR. - RK. ST. SILICIF.

SHARP FLAT CONT

2047.5 - 2059

ANDES. POR - MED GRAY N5 - OPEN SERIATE POR. TEX. ANHED. PLAG CLOUDED - BIO SUBHEDRAL V. CLEAR. CALCITE VNLTS 1/8 - 1" APHANITIC GRND MASS APHANITIC. NO SUL. FRACS DEVEL TALCY SOAPY FEEL.

SHARP CONT. DIPS 70°

2059 - 2181

GRANITE. PINKISH GRAY 5YR 8/1 COARSE GRAN TEX. FADED. COARSE CLEAR K-SPAR - PROB. 2ND K SPAR. ST. QTZ. VNING & SILICIF. GRAN CONTAINS IRREG. INC. AND. POR IN TOP 2' SECTION.

NOTE V. SP. SULFIDES - LOCAL IN DISSEM FORM. PY:CPY = 1.1 OR 0.51 BUT TOT VOL. IS << 1%.

PROJECT _____ PAGE 22

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Core Assays: Interval FROM	Interval TO	Mineral Cu	Mineral Mo
					2100				
70% 5/5									
1/1									
5/5					2110				
45% 5/5						2110	2120	205	36
4.5/5					2120				
20% 5/5									
5.5/9					2130				
5%									
1/4									
1.5/2					2140				
21% 3/3									
2.5/2.5									
2/1.5									
2.5/2.5					2150				
0.5/0.5									
4/4						2150	2160	125	4
29% 2/3									
4/4					2160				
18% 5/5									
5/5					2170				
29% 4.5/4									
5/5					2180				
58% 4.5/4.5									
5/4.5					2190				
37% 5/5									
5/5					2200				

(@2119 NOTE 6" ZONE STRONGLY CRUSHED SULFIDE MIN. - BLACK GOUGY ZONE CONTAINS V. ST. CPY-PY I 1:1)

(2129 6" ZONE V. ST PY-CPY IN NEAR VERT. VEINS.)

2181-2204 BIO. MONZ. POR. MED. BLUISH GRAY TO DARK GREENISH GRAY 5GY 4/1 TO 5B 5/1 - STRONG OPEN HIATAL POR TEX DUE BIOTIC. BIO EUHEDRAL TO SUBHEDRAL GRAINS 1/16" - 1/8" V. CLEAR AND BRIGHT.

PROJECT _____ PAGE 25

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralizn	Alteration	Structure	Rock Type
5/5			/	
5/5			/	
5/5			/	
4/4			/	
2/2			Δ	
4/4			Δ	
4.5/4.5			Δ	
3.5/4			—	
2.5/2.5			/	
5/5			/	
5/5			/	
5/5			/	
5/5			/	
5/5			/	
3.5/3.5			/	
5/4			/	
5/5			—	
5/5			—	
5/5			—	
1/1			—	
5/5			—	
5/5			—	

2200 GRANODIORITE LOCAL TEXTURE - THAT PRESENT IS BEST DESCRIBED AS V. HAZY GRANITE OR PCR.

2210 ROCK HAS UNDERGONE A GENERAL DEGREE OF SILICIFICATION AND IS CUT BY ½" VNLTS K-SPAR. EXCEPT FOR FEW FRESH K-SPAR IN VNLTS ALL FELDSPAR SHOWS END OF ALTERATION

NO SULFIDES NOTED

2230

2204 - 2220

GRANITE - SEE 2059 - 2181

2220 - 2296.5 ANDESITE - DK GRY NP - APHANITIC. CARRIES V. SP PY-CPY IN CO_3 VNLTS. ERACS TALCY SOFT.

2240 2220.5 - 2290

BIO QTZ MONZ - LT. BLUISH GRAY SB 2/1 - OPEN HIATAL POR. TEX.

ANHEDRAL PLAG TO ¼" GEN CLOUDED.

2250 BIO EUHEDRAL - SUBHEDRAL VERY CLEAR & BRIGHT. INCR QTZ - K-SPAR VNLTS.

NOTE DISSEM CPY << 1%

2260 PY : CPY 5:1

ALSO NOTE TINY VNLTS CO_3 - NOT ASSOC SULF. MIN.

2270

2290 - 2344.5

BIOTITE MONZ PCR - LT. BLUISH GRAY SB 2/1 - OPEN HIATAL POR TEX.

2280 PLAG TO ¼" VERY CLEAR - STRIAE VISIBLE - BIO IS V. CLEAR SHINY BLACK EUHEDRAL TO SUBHEDRAL - PRIN. MIN PRES. POR. TEX.

2290 NOTE POORLY DEFINED VNLTS ALONG WHICH PLAG APPEARS CLOUDED AND SERICITIZED AND ALONG WHICH V. SPARSE IRREG. K-SPAR IS DEVELOPED. ROCK IS NIL SULFIDES.

2300 SP. MONZ ...SCR. W/

CORE ASSAYS

INTERVAL FROM	INTERVAL TO	MINERAL Cu	MINERAL Mo
2200	2210	5	6
2250	2260	10	12

2% 3% 55% 36% 52% 3% 41% 44% ±3' CORE 1.6' > 2d 59% 51% 45%

PROJECT _____ PAGE 24

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
					2300					
5/5										
5/4						(2307 - K-SPAR VEINING - NO SUL)	2300	2310	185	<2
5/5					2310					
5/5										
5/5					2320	(2316 - INCIP DEVEL. QTZ. FSPAR CARB VN W/ V. SP. CLOTTED PY)				
4.5/4.5										
4.5/5					2330					
4.5/4.5										
4.5/4.5					2340					
4/4.5						2344.5-2349.5 FELDS POR - PINKISH GRAY TO GREENISH GRAY 5Y 8/1 - 5G 4/1 - CROWDED HIATAL POR. TEX - BIO ST CHL - FELDS → GRN SER SP CPY > PY. SOME K-SPAR DEV.				
5/5					2350	2349.5-2359 HEMATITIC CHL VEIN - DARK GRN GRAY 5G 4/1 TO GREENISH BLACK 5GY 2/1 - POR TEX CONSIS. OF ANNED PLAL - PARTIALLY DIGESTED IN CHLORITIC GROUNDMASS. ROCK CARRIES 15-20% SPEC. HEM. - V. SP. SULFIDES, MOSTLY PYRITE CHLORITE >50% VOL.				
5/5						← CONT. GRAD. OVER 1/2 FOOT.	2350	2360	25	85
5/5					2360	2359-66 FELDS. POR - do 2344.5-2349.5 STRONGLY BRECCIATED. GOUGY SECTIONS DEVEL TALLY SOAPY GREEN MIN - NO ATTIT TO SHR. V. SP. DISSEM. SUL MOSTLY PY.				
3/4						2366-2373.5 do				
3.5/4						2349-2359 - V. ST. SPEC. OCLAS				
4.5/4.5					2370	IRREG. CLOTS SUL. MOSTLY PYRITE ← IRREG. FAIRLY SHARP CONTACT 60°				
5/5						2373.5-2378.5 FELDS. POR - do 2344.5-2349.5 IRREG CLOTS PY-CPY AT LOWER CONTACT. ← SHARP CONTACT ±45°				
4.5/5					2380	2378.5-2390.5 [illegible] do 2349.5-2359 IN PART ST. BX W/ IRREG CLOTS PY-CPY AT UPPER CONTACT.				
4/4										
4.5/4.5					2390	2390.5-2395 FELDS. POR - do 2344.5-2349.5 - BRECCIATED STRONGLY SLICKENSIDED.				
5/5						2395-2400 [illegible] do 2349.5-2359 NOTE 1/4" VNLTS SPEC HEM.				
3/3					2400					

63%

63%

50%

47%

47%

61%

15%

42%

27%

18%

PROJECT _____ PAGE 23
D.D.H. No. J-7 SCALE _____ BY LCP.
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
4/4					2400 2400 - 2407 - FELDS. POR - do 2344.5 TO 2347.5 NOTE PSEUDO BRECCIA TOX.				
29% 3.5/3.5					CONT. ST. FRAG.	2400	2410	195	100
					2407-2412 MONZ-(?) GRANODIO - GREENISH GRAY 56%. LACKS TEX - SLIGHTLY APLITIC - FELDS CLOUDED CHLORITIC - SP PY & SP EPI ON FRAG				
5/5					2410				
57% 5/5					SHARP CONT 60° 2412-2420 MONZ-POR-MED. BLUISH GRAY SB 5/1 - OPEN HIATAL TEX. FELDS ANHEDRAL 1/4" - CLOUDED & CONN GREEN SER. SP EPI & PY ON FRAGS.				
5/5					2420 SHARP IRREG CONTACT.				
31% 4.5/4.5					2420-2464 GRANITE - LT. GRAY N7 - COARSE GRANITIC TEX - BADLY FADED				
5/5					2430 LOCALLY BRECCIATED AND LOCALLY RESEMBLING BIO MONZ., CONTAINS FREQUENT F.G. BIO. INCLUSIONS				
13% 4.5/5					ALL FELDSPARS CLOUDED BIO. CHLORITIC				
5/5					2440 NOTE POORLY DEVEL K-SPAR - QTZ VNLTS 1/4" VERY SP PY - CPY RATIO UNLESS MAY BE ON ORDER OF 1:1. LOC ST. SILICIFICATION.				
24% 4/4						2450	2460	660	50
4.5/4.5					2450				
29% 4.5/4.5									
4/5					(@2460 NOTE 1/16" GRAPHITE VEINS)				
2/2					2460 (TOP K-SPAR ALT)				
44% 4/4					2464-2472 BIO MONZ POR - PINKISH GRAY TO LIGHT BLUISH GRAY SB 7/1 - 5YR 8/1 - OPEN SERIATE POR. TEX. RK ST. SILICIF				
5/5					2470 BIO V. CLEAR: CLEAN - MOON ST. K-SPAR FLOODING - SUL. NIL TO ABSENT.				
29% 5/5					2472-2551 GRANITE - LT. BLUISH GRAY - COARSE GRANITIC TEX - BADLY FADED				
3/3					2480 RK ST. SILICIFIED - CARRIES CLEAR CLEAN BIOTITE - FLOODED W/ K-SPAR & CARRIES DK BIOTITIC INCLUSIONS.				
5/5									
35% 5/5					2490 LOCALLY RESEMBLES TEXTURE OF BIO. QTZ MONZ POR E.G. @2492 AND 2499				
40'>20. 5/5					NOTE SPARSE VNLTS OF GRAPHITE. RK STRANGLY				
35% 4/4					2500				

PROJECT _____ PAGE [illegible]
D.D.H. No. J-7 SCALE _____ BY _____
LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type		CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
22% 4.5/5, 4.5/4.5					2500 SILICIFIED & CUT BY 1/4" QTZ. VEINS. BROKEN AREAS TEND TO BE VERY TALCY & SOAPY.	2500	2510	395	14
15% 5/5, 4.5/4.5					2510 SULFIDES < 1% RATIO DIFFICULT TO ESTIMATE VARIES 1:1 TO 3:1 PY:CPY. (@2519 1/16" VNLT MoS2)				
35% 3/3, 4/4, 5/5					2520				
20% 4/4, 4/4			Δ Δ		2530 (2535-2539 - PARE STRONGLY BIOTITIC ZONE - STRONGLY FRACTURED)				
23% 3/3, 9/9			Δ Δ Δ Δ		2540 (2546 - 1' ZONE V.ST BIO)				
39% 5/5, 5/5					2550 2551 - 2659 T.D. BIO. MONZ POR. - LT. BLUISH GRAY HAZY SERIATE POR TEX - LOCALLY	2550	2560	315	6
26% 5/5, 5/5					2560 RESEMBLES RUIN GRANITE. BIO. CLEAR & SHINY - PLAG. IS EUHEDRAL TO SUBHEDRAL - OFTEN ZONED AND GENERALLY CLOUDED				
42% 5/5, 4/4					2570 ROCK IS FLOODED BY QTZ & K-FELDSPAR QTZ VNLTS 7 • 1" NOTED. NOTE SPARSE				
56% 5/5, 5/5					2580 VNLTS & DISSEM MoS2, GRAPHITE AND PYRITE-CPY. TOT. SUL << 1% PY:CPY ON ORDER OF 1:1 0.2 0.5:1				
32% 5/5, 5/5					2590 (2550-59 NOTE V.ST FRESH V.F.G. BIO)				
					2600				

PROJECT _____ PAGE 2/

D.D.H. No. J-7 SCALE _____ BY _____

LOCATION _____ COLLAR EL _____ DATE _____

% Core Recovery	Mineralzn	Alteration	Structure	Rock Type	Depth	Description	CORE ASSAYS INTERVAL FROM	TO	MINERAL Cu	Mo
5/5					2600	(2600-2610- V. St. zone				
21% 5/5						Bio - slightly chloritized)	2600	2610	495	120
5/5					2610					
17% 5/5			Δ Δ							
5/5			Δ Δ		2620	(2618' - Bio inclusion - 2")				
8% 5/5			Δ Δ							
5/5			Δ Δ		2630					
28% 5/5										
4/4					2640					
49% 5/5										
5/5					2650					
18% 5/5						(2655 - 1/16" vnlt MoS_2	2650	2659 T.D.	410	120
					2660	TD 2659' 11/10/78				
					2670					
					2680					

J. DAVID LOWELL

CONSULTING GEOLOGIST

Drill Hole No. J-7 Property Kelvin

Type Hole Location

Size Hole Co-ord CCA

Date Started Date Completed

Depth	Sample No.	Cu	Mo	Au	Ag		Description
40'-50'	J-7-1	100	2*				
140'-150'	J-7-2	"	8*				
170'-180'	J-7 3	130	6*				↑ To skyline 8/23/73
~	~						
240-250	J-7-4	380	8				
280-290	5	100	<2				
320-330	6	150	2				
380-390	7	35	2				
500-510	8	305	12				
590-600	9	810	4				
610-620	10	90	4				↑ to skyline Aug 30, 73
710-720	11	140	2				
810-820	12	50	2				↑ to skyline Sept 6/73
~	~						
910-920	J-7-13	1050	28				
960-970	J-7-14	450	<2				to skyline 9/11/73
990-1000 1000-1010	J-7-15	240	2				
1030-1040	J-7-16	390	2				
1040-1050	J-7-17	410	6				
1100-1110	J-7-18	290	<2				
1140-1150	J-7-19	290	<2				↑ to skyline 9/13/73
1200-1210	J-7-20	135	2				
1240-1250	J-7-21	165	2				
1300-1310	J-7-22	480	46				
1350-1360	J-7-23	315	6				
1400-1410	24	435	<2				
1450-1460	25	440	115				
1500-1510	26	160	160				

* [illegible]

J. DAVID LOWELL
CONSULTING GEOLOGIST

Drill Hole No. J-7 Property

Type Hole Location

Size Hole Co-ord

Date Started Date Completed

Depth	Sample No.	Cu	Mo	Au	Ag		Description
550-60	J-7-27	150	28				
600-1610	28	620	28	spl'd by JCC			10-12-78
650-60	29	105	4				to Skyline 10/13-78
700-10	30	490	10				
750-60	31	140	2				
800-10	32	120	16				
840-50	33	90	12				
900-10	34	110	28	spl'd by JCC			11/24/78
950-60	35	265	4			to Skyline 10/25	
998-2005	36	95	14				
2050-60	37	450	38				
2110-2120	38	205	36	to Skyline 11/1/78			AND
2150-60	39	125	4				
2200-2210	40	55	6				
2250-60	41	60	<2	to Skyline 11/1/78			JCC
2300-2310	42	186	<2				
2350-2360	43	25	85	to Skyline 11/9/78			AND
2400-2410	44	195	100				
2450-60	45	660	50				
2500-2510	46	395	14				
2550-2560	47	315	6				
2600-2610	48	495	120				
2650-2659	49	410	170				
			TD = 2659'				

SKYLINE LABS, INC.
P.O. Box 50106 • 1700 West Grant Road
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Arizona Registered Assayer No. 9827
William L. Lehmbeck
Arizona Registered Assayer No. 9126
James A. Martin
Arizona Registered Assayer No. 11127

CERTIFICATE OF ANALYSIS

Kelvin

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	J- 7- 1	100	2
2	2	60	8
3	J- 7- 3	130	6
4	MA- 1	5	4
5	2	5	2
6	3	20	6
7	MA- 4	20	4

JFK Maria Granjo

TO

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:

Trace analysis

CERTIFIED BY:

DATE REC'D.	DATE COMPL	JOB NUMBER
8/23/78	9/19/78	TEV 094

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Charles E. Thompson
Arizona Registered Assayer No. 9427
William L. Lehmbeck
Arizona Registered Assayer No. [illegible]
James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	J-7- 4	380	8
2	5	100	<2
3	6	150	2
4	7	35	2
5	8	305	12
6	9	810	4
7	J-7- 10	90	4

61-94

TO
PILLAR - LOWELL AND ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704
Attn.: Mr. J.D. Lowell

REMARKS:
Trace analysis

CERTIFIED BY:

DATE REC'D.	DATE COMPL.:	JOB NUMBER
8/30/78	9/11/78	TEV 098

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William L. Lehmbeck
Arizona Registered Assayer No. 9[illegible]

James A. Martin
Arizona Registered Assayer No. 11[illegible]

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm							
1	J-7-11	140	2	Kelvin						
2	J-7-12	50	2							

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

DATE REC'D	DATE COMPL	JOB NUMBER
9/7/78	9/21/78	TEV 099

SKYLINE LABS, INC.
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William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm	
1	HK-1- 1	70	<2	COPPER DICK ✓
2	2	25	<2	
3	3	25	10	
4	4	15	2	
5	5	20	2	
6	HK-1- 6	10	<2	
7	J-7-13	1050	28	} KELVIN
8	J-7-14	450	<2	}

10

PILLAR-LOWELL & ASSOCIATES
5115 N. Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK DATE SIGNED Arizona U.S.A.

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
9/13/78	9/25/78	TEV 100

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William L. Lehmbeck
Arizona Registered Assayer No. [illegible]

James A. Martin
Arizona Registered Assayer No. [illegible]

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	HK-1- 7	30	<2
2	8	15	<2
3	9	15	<2
4	HK-1- 10	15	<2
5	J -7- 15	240	2
6	16	390	2
7	17	410	6
8	18	280	<2
9	J -7- 19	290	<2
10	HK-1- 11	10	<2
11	HK-1- 12	15	2

10

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS: Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER
CERTIFICATE NO.
9425
WILLIAM L.
LEHMBECK
DATE SIGNED
Arizona U.S.A.

DATE REC'D	DATE COMPL.	JOB NUMBER:
9/19/78	10/3/78	TEV 101

SKYLINE LABS, INC.
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Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
	Returned		
1	J-7- 20	135	2
2	21	165	2
3	22	480	46
4	J-7- 23	315	6
5	HK-1- 15	5	4
6	16	5	2
7	17	5	2
8	HK-1- 18	5	2

copper Delv

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK DATE SIGNED Arizona U.S.A.

TO

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:

Trace analysis

CERTIFIED BY:

DATE REC'D:	DATE COMPL:	JOB NUMBER:
9/27/78	9/29/78	TEV 104

SKYLINE LABS, INC.
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Charles E. Thompson
Arizona Registered Assayer No.
William L. Lehmbeck
Arizona Registered Assayer No.
James A. Martin
Arizona Registered Assayer No.

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm						
1	HK-1 22	5	<2						
2	23	25	<2	copper Dick					
3	HK-1 24	40	<2						
4	J-7 24	435	<2						
5	25	440	115	Kelvin ✓ entered in J-7 [illegible]					
6	J-7 26	160	160						

PILLAR-LOWELL & ASSOCIATES
5115 N. Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER
CERTIFICATE NO.
9425
WILLIAM L.
LEHMBECK
DATE SIGNED
Arizona U. S. A.

DATE REC'D:	DATE COMPL:	JOB NUMBER
10/11/78	10/24/78	[illegible]

SKYLINE LABS, INC.
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Charles E. Thompson
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William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11[illegible]

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	BM-3 1	110	6
2	2	105	4
3	3	90	2
4	4	65	2
5	5	45	<2
6	6	30	<2
7	7	105	<2
8	8	275	<2
9	BM-3 9	40	<2
10	J-7 27	150	28
11	28	620	28
12	29	105	4
13	J-7 30	490	10

PILLAR-LOWELL & ASSOCIATES
5115 N. Oracle Road
Tucson, Arizona 85704

REMARKS: Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK Arizona U.S.A.

DATE REC'D.	DATE COMPL.	JOB NUMBER
10/13/78	10/23/78	TEV108

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Charles E. Thompson
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William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Zn ppm	Mo ppm
1	J-7- 31	140		2
2	32	120		16
3	33	90		12
4	34	110		28
5	35	265		4
6	36	95		14
7	J-7- 37	450		38
8	BM-3- 10	35	100	2
9	BM-3- 1C	5		2

Kelvin ✓

Bold M

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK DATE SIGNED 11-2-78 Arizona U.S.A.

TO:
PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
10/26/78	11/2/78	TEV 109

SKYLINE LABS, INC.
P.O. Box 50106 • 1700 West Grant Road
Tucson, Arizona 85703
(602) 622-4836

Charles E. Thompson
Arizona Registered Assayer No. 9417
William L. Lehmbeck
Arizona Registered Assayer No. 9425
James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	J-7-38	205	36
2	J-7-39	125	4
3	J-7-40	55	6
4	BM-3-2C	5	<2
5	BM-3-3C	5	2
6	BM-3-4C	1400	8
7	J-7-41C	60	2

REGISTERED ASSAYER CERTIFICATE NO. 9425 WILLIAM L. LEHMBECK STATE OF ARIZONA

TO

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
11/3/78	11/10/78	TEV 111

SKYLINE LABS, INC.
P.O. Box 50106 • 1700 West Grant Road
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Charles E. Thompson
Arizona Registered Assayer No. 9427
William L. Lehmbeck
Arizona Registered Assayer No. 9625
James A. Martin
Arizona Registered Assayer No. 11122

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	J-7- 42	185	<2
2	43	25	85
3	44	195	100
4	J-7- 45	660	50
5	BM-3- 5C	5	<2
6	BM-3- 6C	5	<2

TO

PILLAR-LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER
CERTIFICATE NO.
9425
WILLIAM L.
LEHMBECK
DATE SIGNED
Arizona

DATE REC'D	DATE COMPL.	JOB NUMBER:
11/11/78	11/28/78	TEV 112

SKYLINE LABS, INC.
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Tucson, Arizona 85703
(602) 622-4836

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

James A. Martin
Arizona Registered Assayer No. 11127

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	BM-3-7C	5	< 2
2	BM-3-8C	5	< 2
3	BM-3-9C	5	< 2
4	J-7-46	395	14
5	J-7-47	315	6
6	J-7-48	495	120
7	J-7-49	410	170

TO:
PILLAR LOWELL & ASSOCIATES
5115 North Oracle Road
Tucson, Arizona 85704

REMARKS:
Trace analysis

CERTIFIED BY:

REGISTERED ASSAYER
CERTIFICATE NO.
9425
WILLIAM L.
LEHMBECK
DATE SIGNED
Arizona U.S.A.

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
11/15/78	11/30/78	TEV 113

SUMMARY OF DRILL PROJECT

Project: Kelvin (61-94) Kearney, Arizona

Date: August 14, 1978 - November 14, 1978

Type of Drill: Diamond drill - Joy-22 - hydro stat

Contractor: Joy Manufacturing Co., Tucson, Arizona

Total Cost: $51,036.76

Footage Drilled: 2,659 feet @ $19.194 cost per foot

Number of Holes: J-7, 2,659 feet

Summary: The drill hole was started with NX and finished NX size. Lost circulation at 1,008 feet and the hole started making water at the rate of +3-5 gal. water per minute. Had one twist off at 1,385 feet. Hole was left with 20 feet of NX casing with threaded cap.

-30-

JOHN M. JOHNSON
1201 OVERSTREET
PRESCOTT, AZ 86301
(602) 778-1195

THE KELVIN PROSPECT
PINAL COUNTY, ARIZONA

A SUMMARY GEOLOGIC REPORT

for

CITIES SERVICE MINERALS CORPORATION

by

JAMES P. VROMAN

TUCSON, ARIZONA

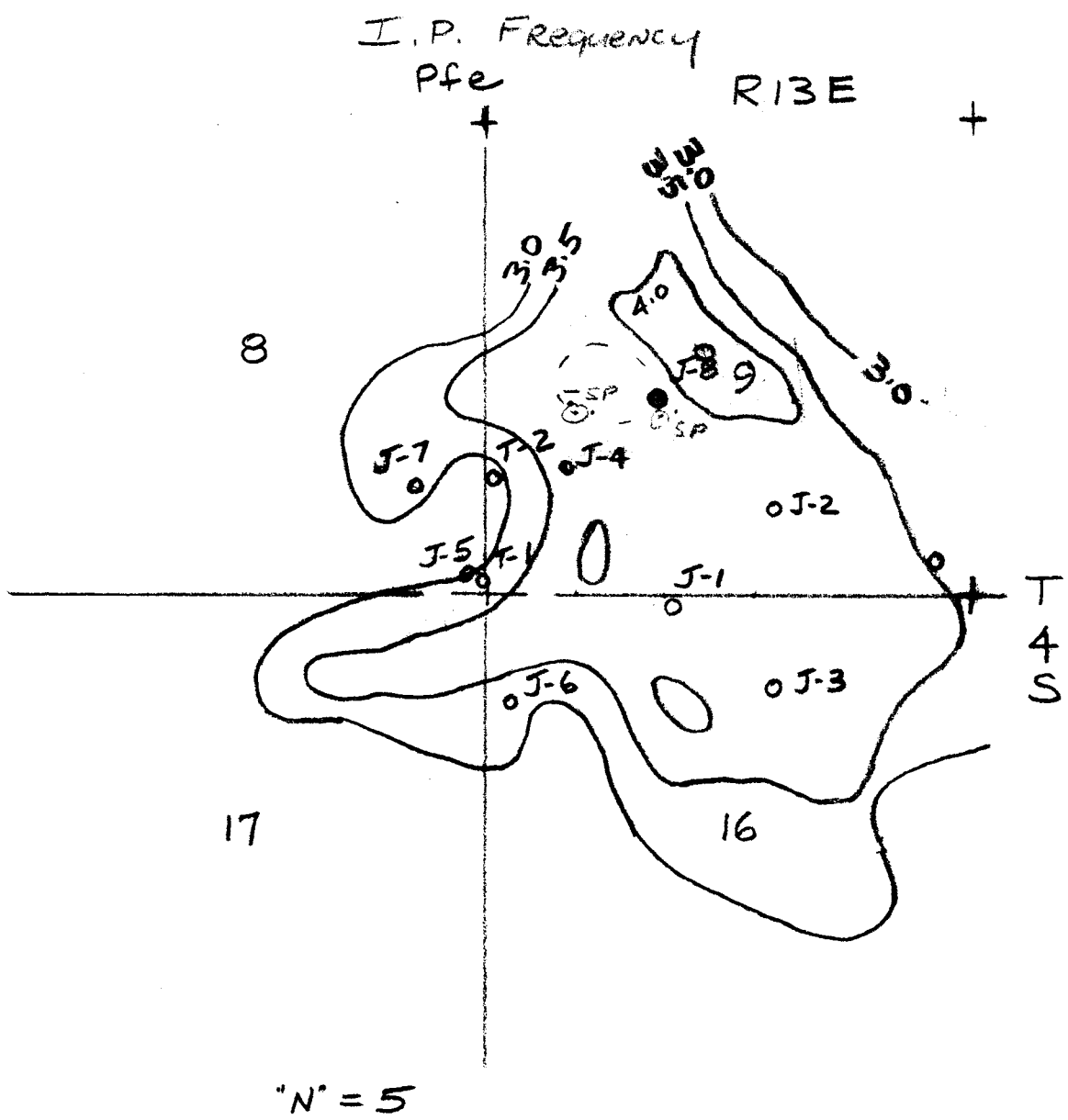
LOCATION

The Kelvin Prospect is located in the northern portion of the Tortilla Mountains, Pinal Co., Arizona. Tucson is 60 miles south of the prospect and Phoenix is 67 miles to the west-northwest (figure 1). The prospect is situated within the Ray-Sacaton structural belt which bisects Pinal County. This belt has been defined by Schmidt (1971b) on the basis of elongate intrusive masses of intermediate composition, numerous easterly trending near-parallel dike swarms as well as similar trending mineralized fissure veins and limonite coated fractures. Features of economic interest within this structural belt include Kennecott's Ray Mine, Conoco's Poston Butte deposit and ASARCO's Sacaton Mine. Getty Oil and Hanna Mining have recently announced a significant discovery as the result of a joint venture exploration program along the west-southwest extension of this trend.

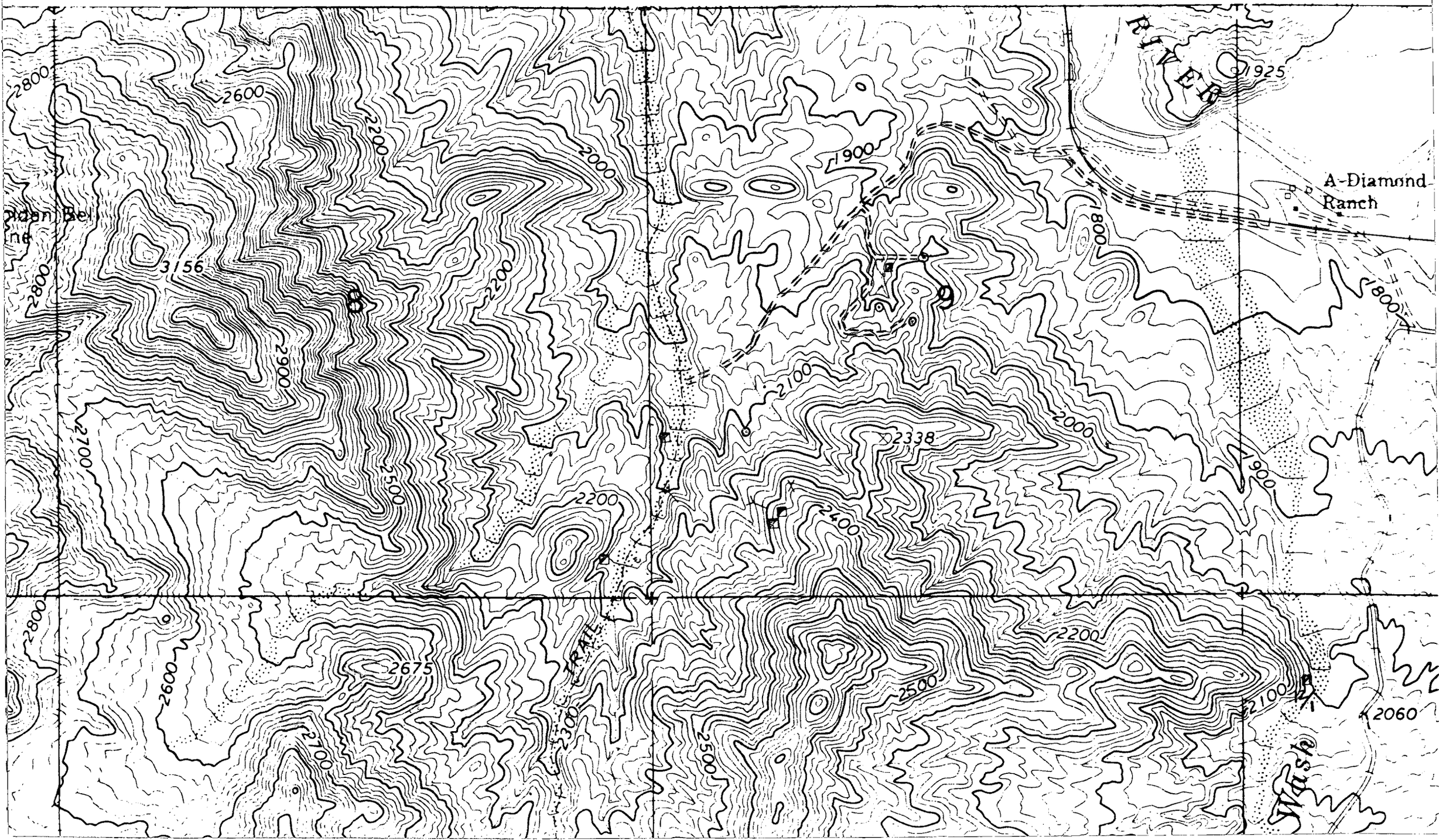
BACKGROUND

The Kelvin Prospect had been explored by several companies prior to C.S.M.C. interest in the property. During 1968-1969 Minbanco drilled nine hammer holes (total footage=7820 feet). During 1969-1970 Tipperary Resources Corporation geologically mapped the prospect at a scale of 1 inch equals 200 feet; conducted a detailed induced polarization-resistivity survey and drilled two rotary holes (1400 and 1625 feet). During early 1972 Cyprus Mines drilled a 2500 foot angle core hole on the property. Kerr-McGee drilled one 500 foot core hole in 1973. Several other major companies have made surficial geologic examinations of the prospect area over the past several years.

I.P. Frequency



"N" = 5

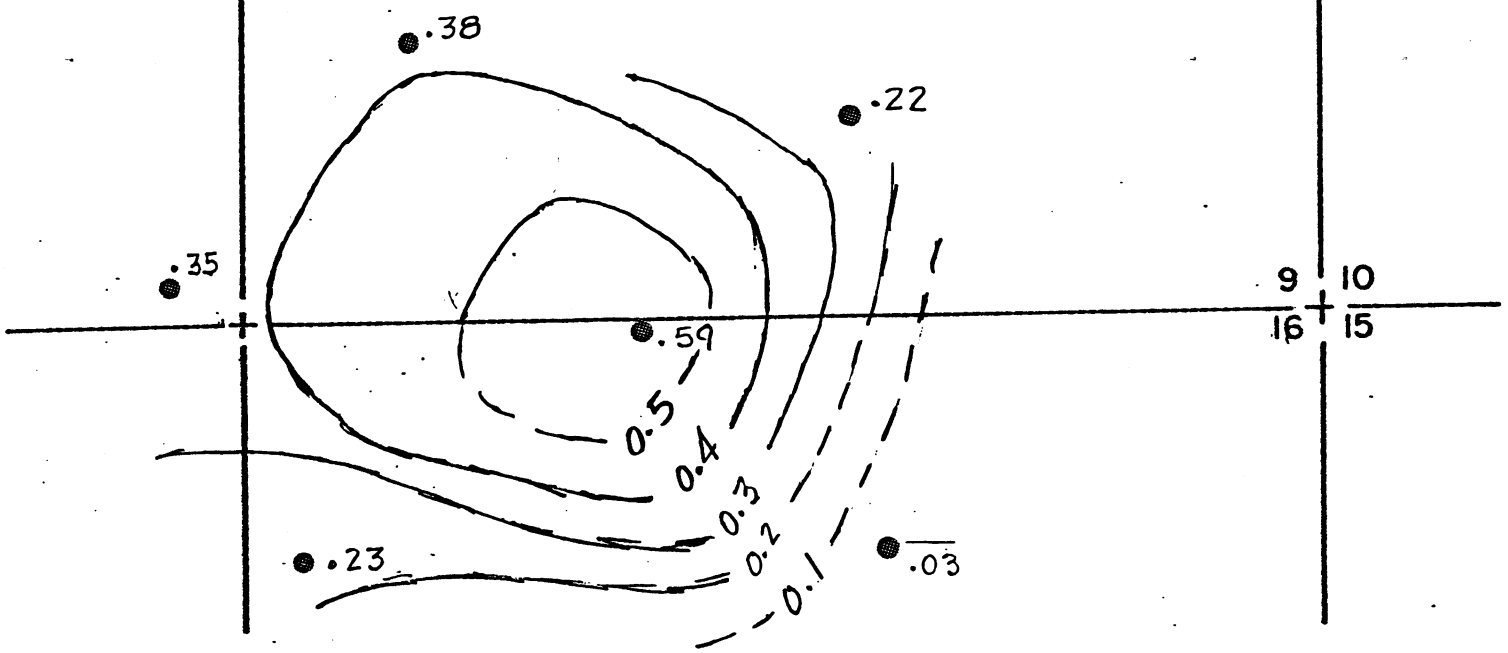

RIVER
1925
A-Diamond
Ranch
2800
2600
2200
2000
1900
1800
3156
2900
2700
2500
2100
2338
2400
2675
TRAIL
Wash
2060

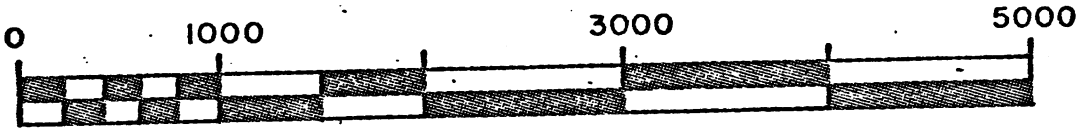
KELVIN PROJECT

T. 4 S., R. 13E.

PINAL CO., ARIZONA

COPPER (EQUIVALENT) GRADE WITH 0.2% CUTOFF

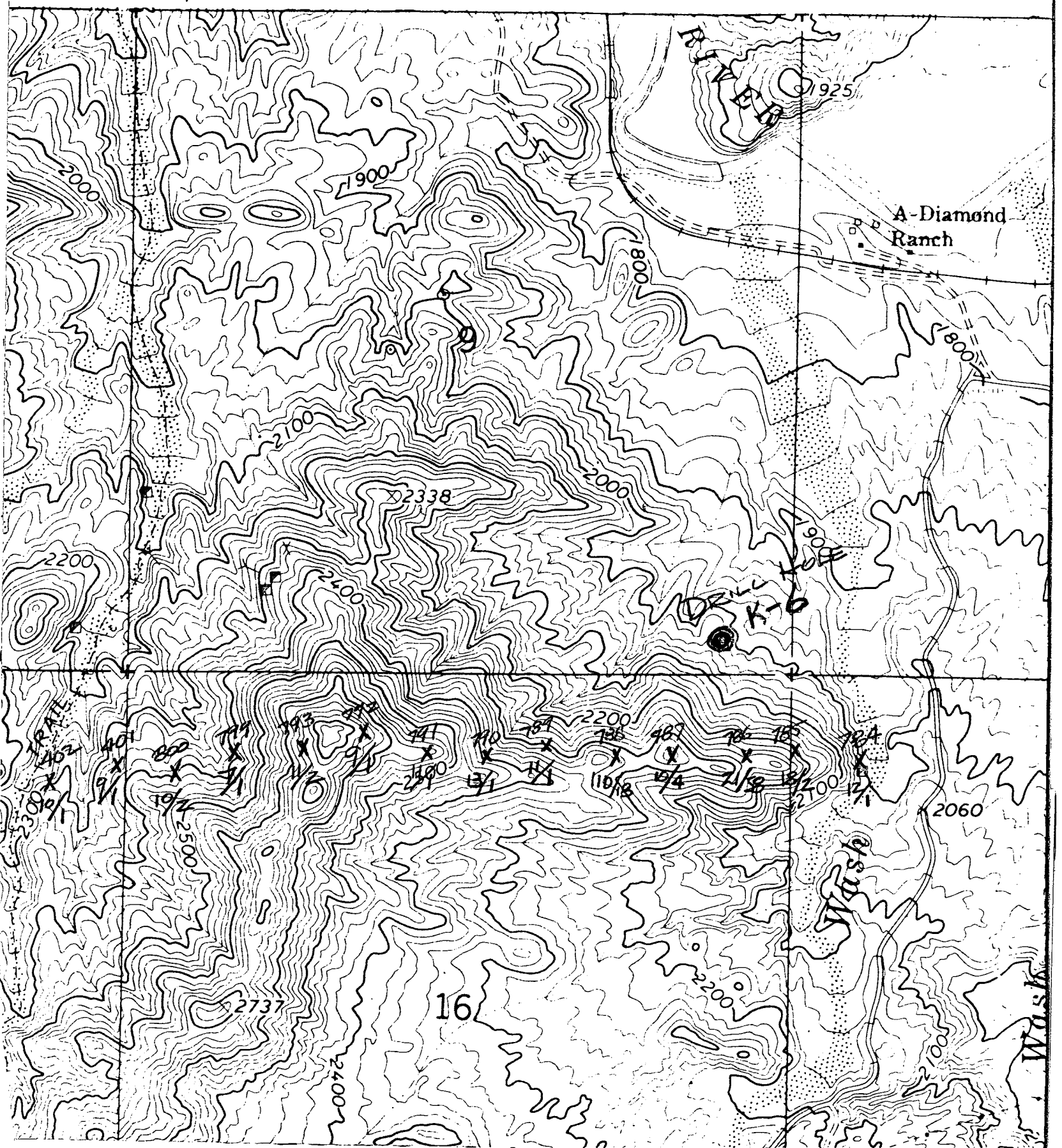




SCALE IN FEET

JULY 1976

J. P. VROMAN



RIVER
1925
A-Diamond
Ranch
1900
2000
1800
2100
2338
2200
2400
DRILL HOLE
K-6
TRAIL
2300
2500
2737
2060
Wash
16

AAA ARIZONA PEST CONTROL
229 N. Marina • Prescott, AZ 86301 • (602) 445-2391

Reinstated Fraction		200 feet easterly	1300 feet westerly
Reinstated Fraction	1	50 feet southerly	1150 feet northerly
	2	50 feet southerly	1450 feet norhterly

Tipperary	1	350 feet southerly	970 feet northerly
	2	450 feet southerly	870 feet northerly
	3	1260 feet southerly	60 feet northerly
	4	1220 feet southerly	100 feet northerly
	5	1260 feet southerly	60 feet northerly
	6	500 feet southerly	820 feet northerly
	7	160 feet southerly	1160 feet northerly
	8	10 feet southerly	1310 feet northerly
	9	10 feet southerly	1310 feet northerly
	10	200 feet southerly	1120 feet northerly
	11	50 feet southerly	1270 feet northerly
	12	200 feet southerly	1120 feet northerly
	13	300 feet southerly	1020 feet northerly

Black Copper	1	50 feet northerly	1270 feet southerly
	2	60 feet northerly	1260 feet southerly
	3	20 feet northerly	1300 feet southerly
	4	75 feet northerly	1245 feet southerly
	5	30 feet northerly	1290 feet southerly
	6	10 feet northerly	1310 feet southerly
	7	236 feet westerly	1264 feet easterly
	8	80 feet westerly	1420 feet easterly
	9	204 feet westerly	1296 feet easterly
	10	50 feet westerly	1450 feet easterly
	11	230 feet westerly	1270 feet easterly

AAA ARIZONA PEST CONTROL
229 N. Marina • Prescott, AZ 86301 • (602) 445-2391

October 27,1980

E. Grover Heinrichs
1802 West Grant Road
Tucson, Arizona

Dear Grover:

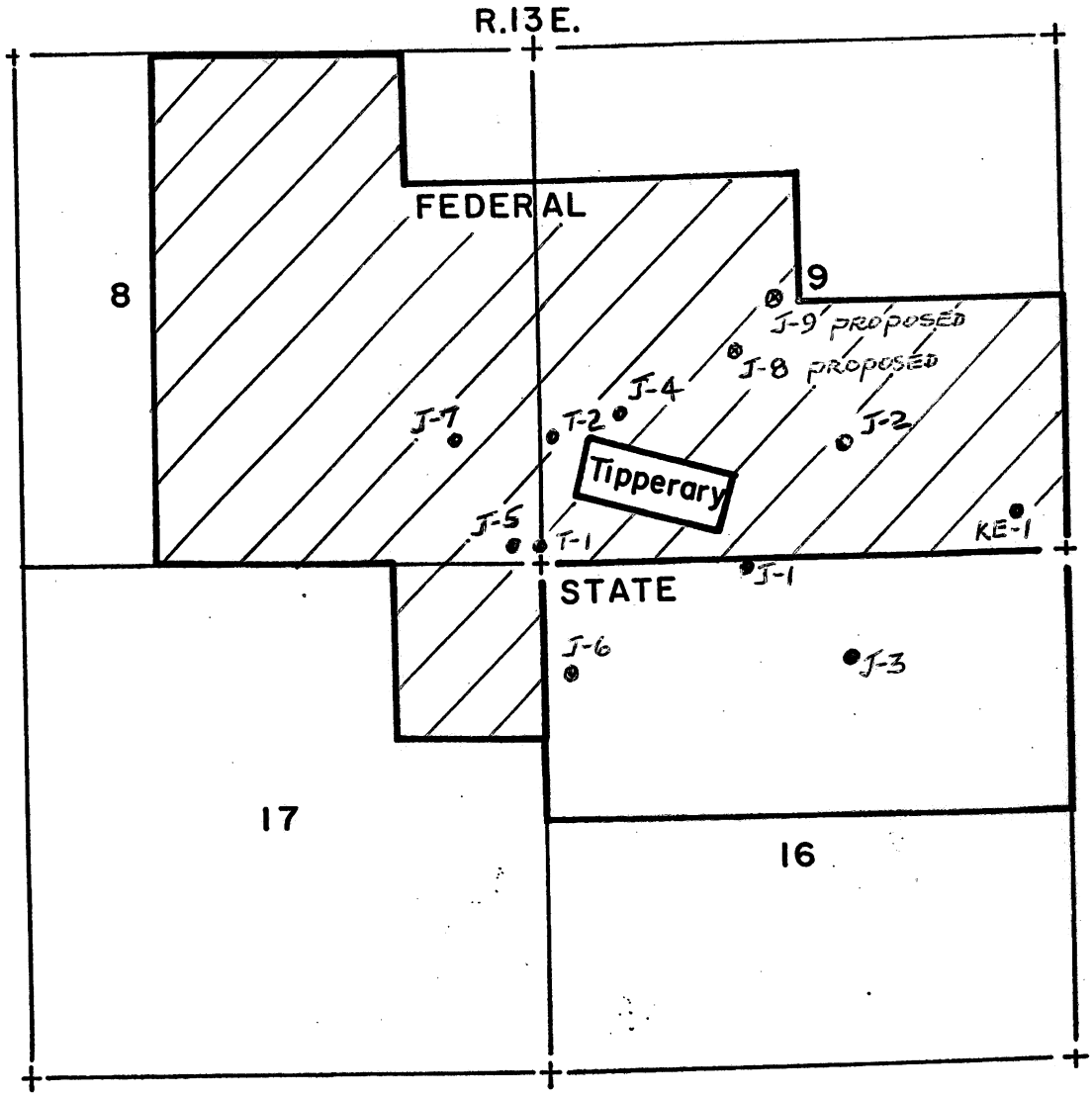
Please find enclosed the following data regarding the location monuments.

Rare Metals	1	750 feet easterly	750 feet westerly
	2	750 feet easterly	750 feet westerly
	3	500 feet easterly	1000 feet westerly
	4	500 feet easterly	1000 feet westerly
	5	500 feet easterly	1000 feet westerly
	6	500 feet easterly	1000 feet westerly
	7	500 feet westerly	1000 feet easterly
	8	500 feet westerly	1000 feet easterly
	9	500 feet westerly	1000 feet easterly
	10	500 feet easterly	1000 feet westerly
	11	500 feet easterly	1000 feet westerly
	12	500 feet easterly	1000 feet westerly
Gray Copper	1	750 feet westerly	750 feet easterly
	2	750 feet westerly	750 feet easterly
	3	750 feet westerly	750 feet easterly
	4	750 feet westerly	750 feet easterly
	5	750 feet westerly	750 feet easterly
	6	750 feet westerly	750 feet easterly
	7	750 feet westerly	750 feet easterly
Hidden Treasure	1	25 feet easterly	1475 feet westerly
	2	25 feet easterly	1475 feet westerly
	3	25 feet easterly	1475 feet westerly
	4	25 feet easterly	1475 feet westerly
Reinstated	1	50 feet easterly	1450 feet westerly
	2	100 feet easterly	1400 feet westerly
	3	50 feet southerly	1450 feet northerly
	4	1270 feet southerly	50 feet northerly
	5	50 feet southerly	1270 feet northerly
	6	30 feet southerly	1290 feet northerly
	7	25 feet southerly	1295 feet northerly

FILE NO.

CITIES SERVICE MINERALS CORPORATION

SCALE 1:24,000
DATE 20FEB74
DRAWN BY J.P.V.



Johnson Claim Group

Existing Drill Holes

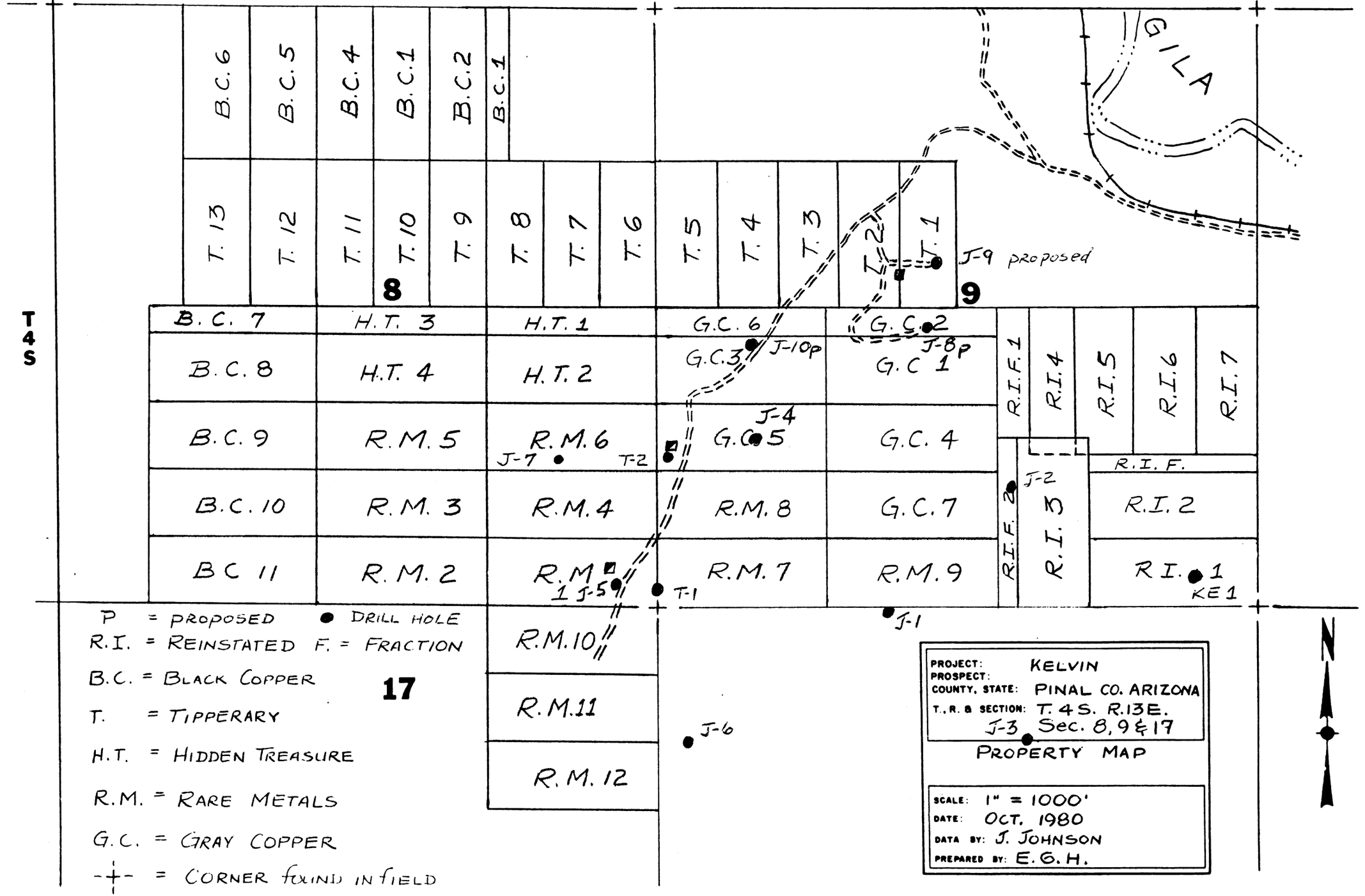
Proposed Drill Holes 10-20-80
Sites & Road work complete

TITLE KELVIN PROSPECT - SURFACE LAND STATUS

SKETCH NO. 11

R 13 E

T 4 S



P = PROPOSED ● DRILL HOLE

R.I. = REINSTATED F. = FRACTION

B.C. = BLACK COPPER

T. = TIPPERARY

H.T. = HIDDEN TREASURE

R.M. = RARE METALS

G.C. = GRAY COPPER

-+- = CORNER FOUND IN FIELD

PROJECT: KELVIN
PROSPECT:
COUNTY, STATE: PINAL CO. ARIZONA
T., R. & SECTION: T. 4 S. R. 13 E.
J-3 Sec. 8, 9 & 17

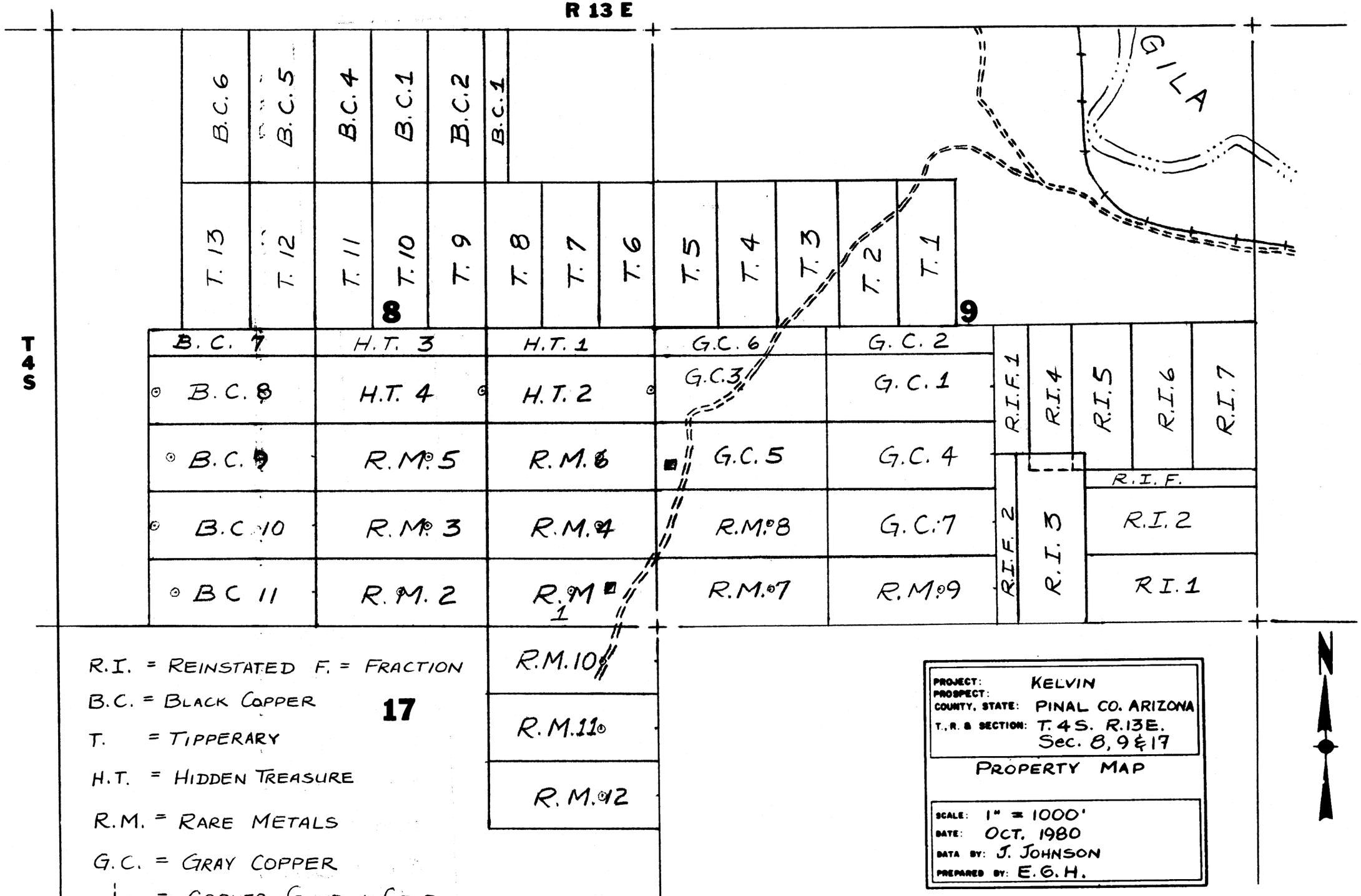
PROPERTY MAP

SCALE: 1" = 1000'
DATE: OCT. 1980
DATA BY: J. JOHNSON
PREPARED BY: E. G. H.

N

R 13 E

T 4 S



R.I. = REINSTATED F. = FRACTION

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PROJECT: KELVIN
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T., R. & SECTION: T. 4 S. R. 13 E. Sec. 8, 9 & 17

PROPERTY MAP

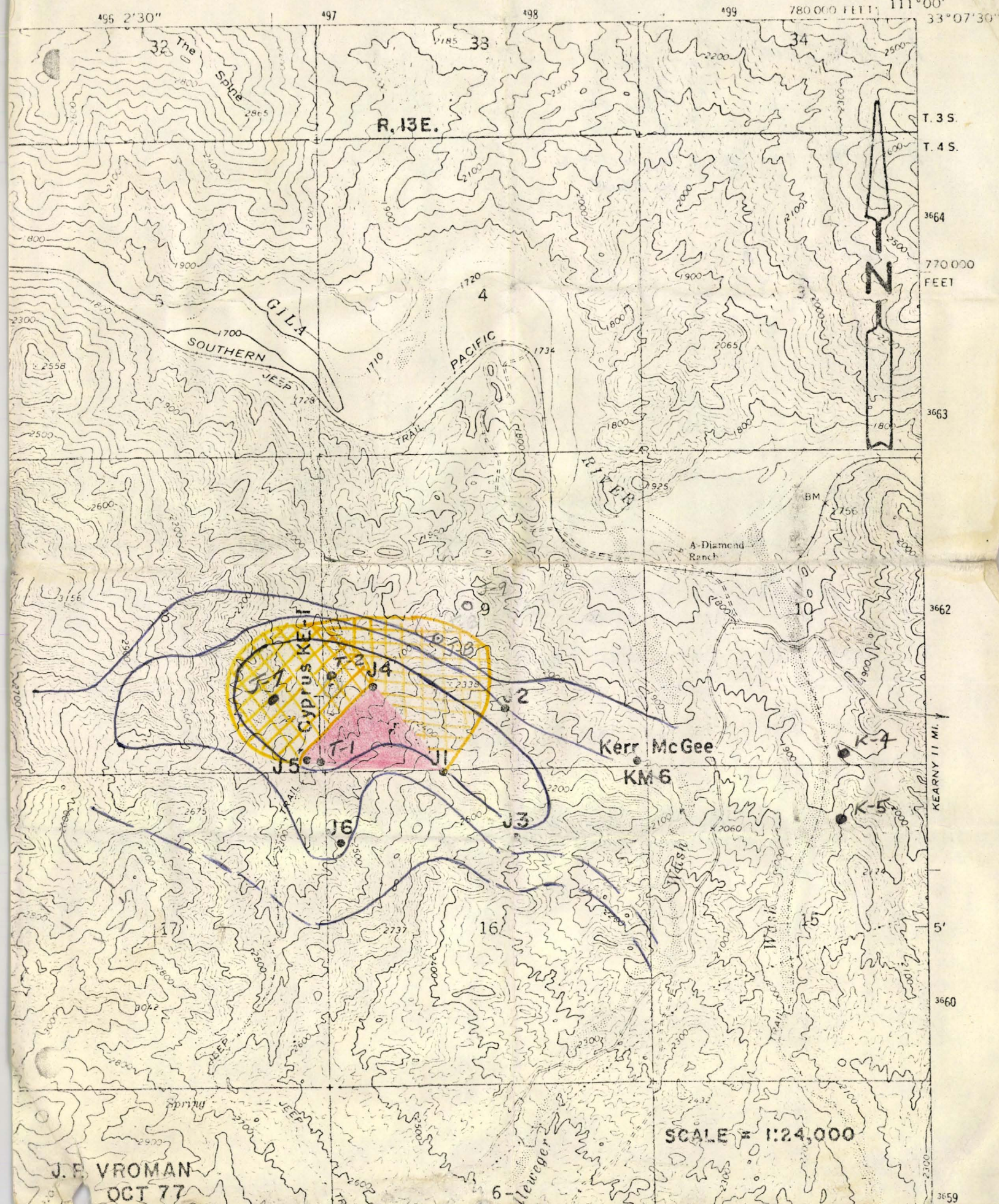
SCALE: 1" = 1000'
DATE: OCT. 1980
DATA BY: J. JOHNSON
PREPARED BY: E. G. H.

N

KELVIN PROJECT

FIGURE 2

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



114

Bearing N45E

1. N65°W from 200' N45E of J-8

2. 514' to Gray Copper No 6 Loc Mon.

3 At 700' N45°E 114' N80°W to Saddle & J-9

Randall Marchese

2250' from near J-4 @ Saddle on Rd to Gate

6700.8

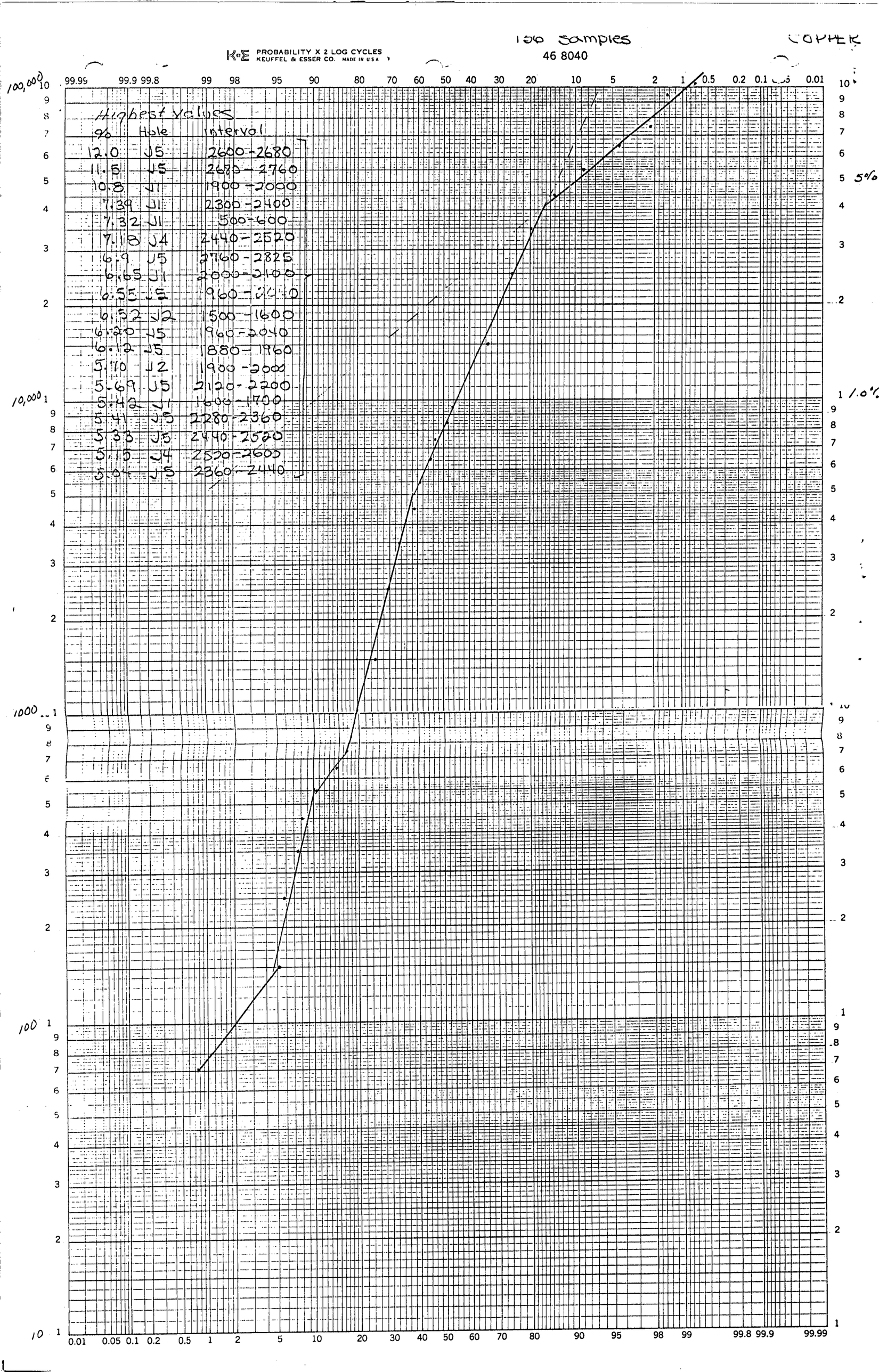
4500' from saddle near J-4 to tressle & 400' more to River (Gila)

5.4 to 7.1 Fl. Hiway & junction Rd to A Diamond R. & Saddle @ J-4

K·E PROBABILITY X 2 LOG CYCLES
KEUFFEL & ESSER CO. MADE IN USA

156 samples
46 8040

COPPER



Highest values

%	Hole	interval
12.0	J5	2600-2680
11.5	J5	2680-2760
10.8	J1	1900-2000
7.39	J1	2300-2400
7.32	J1	500-600
7.18	J4	2440-2520
6.9	J5	2760-2825
6.65	J1	2000-2100
6.55	J5	1960-2040
6.52	J2	1500-1600
6.20	J5	1960-2040
6.12	J5	1880-1960
5.70	J2	1900-2000
5.69	J5	2120-2200
5.42	J1	1600-1700
5.41	J5	2280-2360
5.33	J3	2440-2520
5.15	J4	2520-2605
5.04	J5	2360-2440

R. I. 3914 AUGUST 1946

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

REPORT OF INVESTIGATIONS

EXPLORATION OF THE COPPER BUTTE MINE MINERAL CREEK MINING DISTRICT PINAL COUNTY, ARIZ.

BY

HARLOW D. PHELPS

R.I. 3914,
August 1946.

REPORT OF INVESTIGATIONS

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

EXPLORATION OF THE COPPER BUTTE MINE, MINERAL CREEK MINING DISTRICT, PINAL COUNTY, ARIZ.[1]

By Harlow D. Phelps[2]

CONTENTS

	Page
Introduction	1
Acknowledgments	1
Location and accessibility	2
Ownership	2
History and production	2
Physical features	3
Living conditions	4
Geology	4
Ore occurrence	5
Development and mining	6
Work done by Bureau of Mines	6

INTRODUCTION

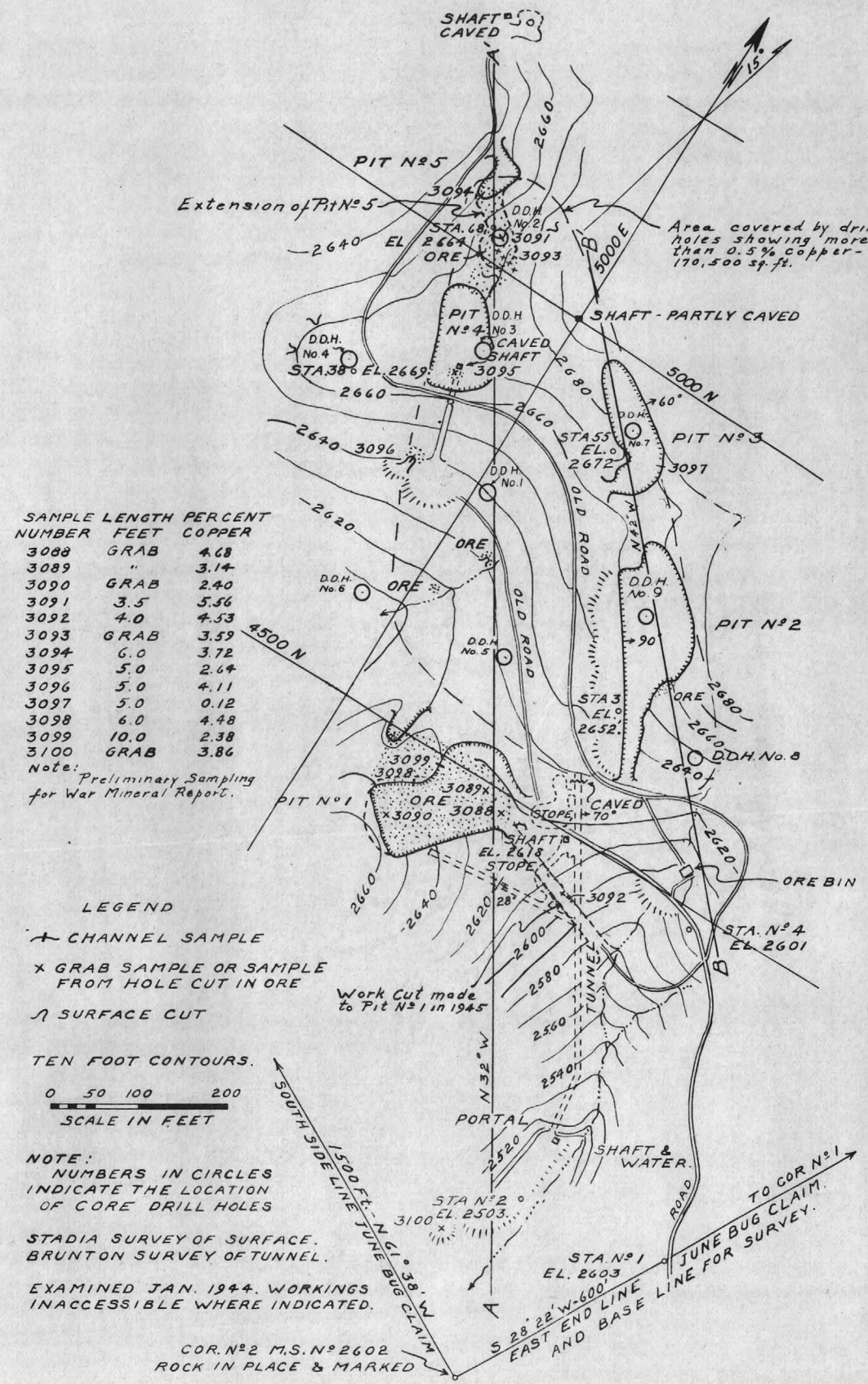
The Copper Butte mine was examined, surveyed, and mapped (fig. 1) by a Bureau of Mines engineer in January 1944. As a result, it was decided to diamond-drill the deposit, using Bureau of Mines equipment, and drilling was started October 14, 1944, under the supervision of two Bureau engineers, and stopped April 5, 1945. Nine holes were drilled for a total of 1,274 feet, not including 48 feet on a lost hole. Figures 2 and 3 are sections at AA' and BB' of figures 1, and show the adjusted average assays of drill-hole samples. Figures 4 and 5 are separate maps of holes 4 and 6, respectively.

ACKNOWLEDGMENTS

In its program of exploration of mineral deposits, the Bureau of Mines has as its primary objective the more effective utilization of our mineral resources, to the end that they make the greatest possible contribution to the national security and economy. It is the policy of the Bureau to publish the facts developed by each exploitation project as soon as practicable after its conclusion. The Mining Branch, Lowell B. Moon, chief, conducts preliminary examinations, performs the actual exploratory work, and prepares the final report. The Metallurgical Branch, R. G. Knickerbocker, chief, analyzes samples and performs beneficiation tests. Both these branches are under the supervision of R. S. Dean, Assistant Director.

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 3914."

2/ Mining engineer, Bureau of Mines.



SAMPLE NUMBER	LENGTH FEET	PERCENT COPPER
3088	GRAB	4.68
3089	"	3.14
3090	GRAB	2.40
3091	3.5	5.56
3092	4.0	4.53
3093	GRAB	3.59
3094	6.0	3.72
3095	5.0	2.64
3096	5.0	4.11
3097	5.0	0.12
3098	6.0	4.48
3099	10.0	2.38
3100	GRAB	3.86

Note: Preliminary Sampling for War Mineral Report.

LEGEND

+ CHANNEL SAMPLE

× GRAB SAMPLE OR SAMPLE FROM HOLE CUT IN ORE

SURFACE CUT

TEN FOOT CONTOURS.

0 50 100 200

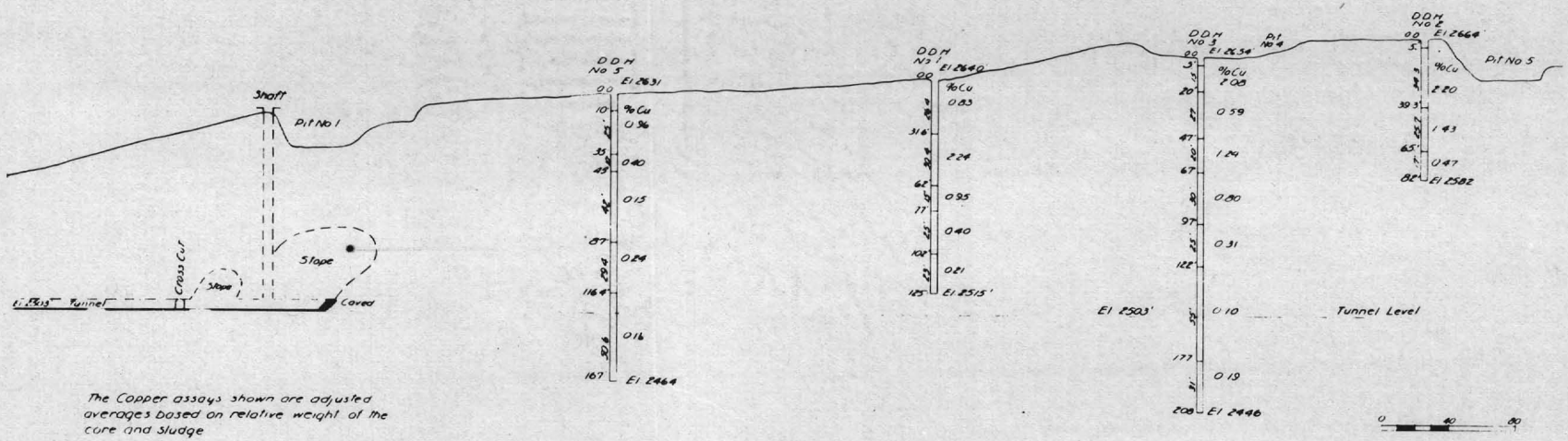
SCALE IN FEET

NOTE:
NUMBERS IN CIRCLES INDICATE THE LOCATION OF CORE DRILL HOLES

STADIA SURVEY OF SURFACE.
BRUNTON SURVEY OF TUNNEL.

EXAMINED JAN. 1944. WORKINGS INACCESSIBLE WHERE INDICATED.

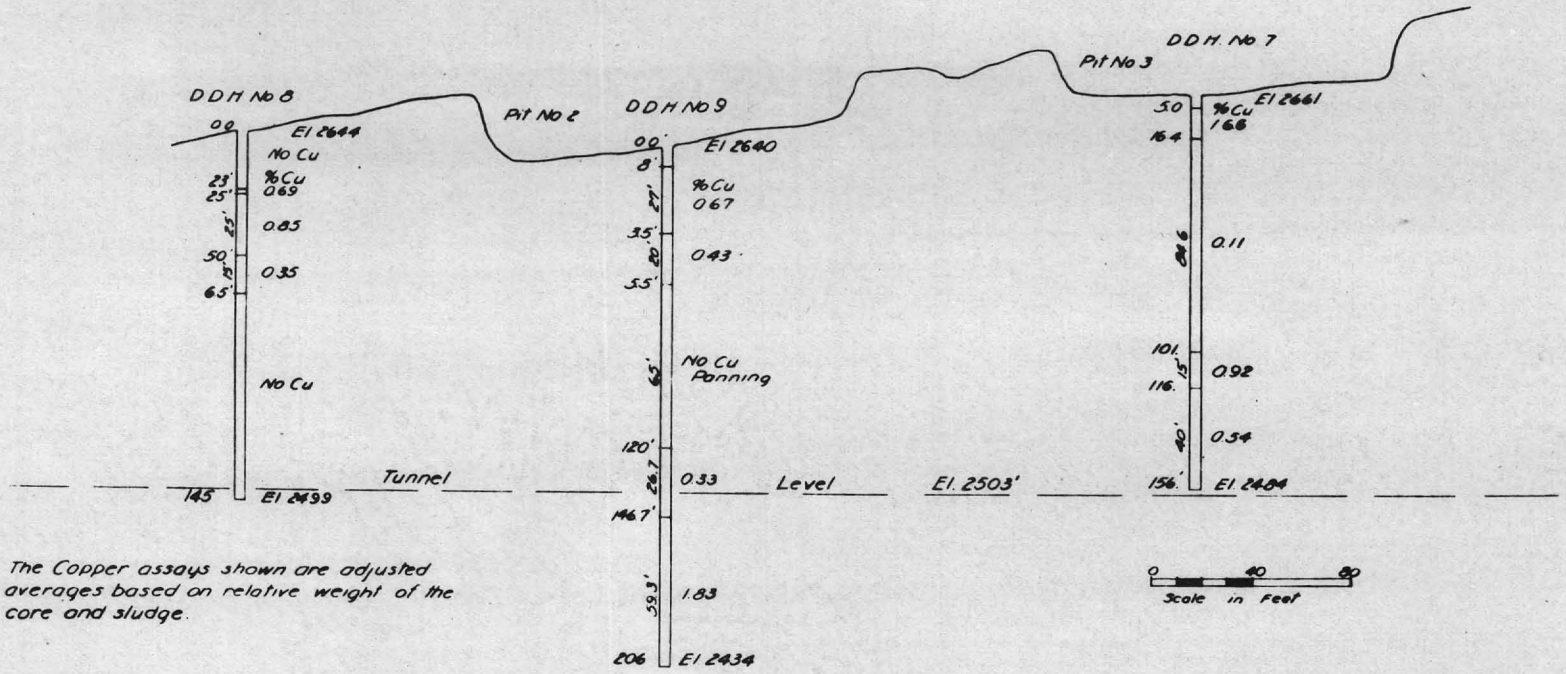
FIG. 1 - MAP OF COPPER BUTTE MINE - 1471



The Copper assays shown are adjusted averages based on relative weight of the core and sludge

PROJECTION ON VERTICAL SECTION A-A'-N32°W

FIG 2-COPPER BUTTE MINE-PROJECT 1471-PINAL COUNTY, ARIZ.

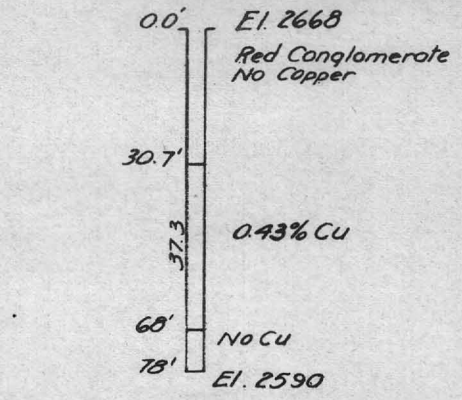


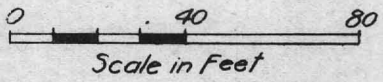
The Copper assays shown are adjusted averages based on relative weight of the core and sludge.

PROJECTION ON VERTICAL SECTION B-B'- N 42°W

FIG. 3-COPPER BUTTE MINE - PROJECT 1471 - PINAL COUNTY, ARIZ.

U.S. DEPARTMENT OF INTERIOR - BUREAU OF MINES

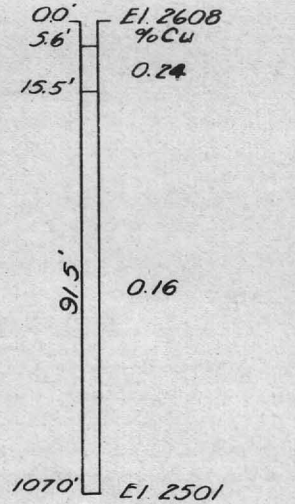


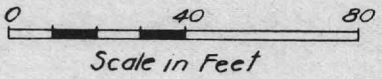


D.D. Hole No. 4

FIG. 4 - COPPER BUTTE MINE - 1471 - PINAL CO, ARIZ.

U.S. DEPARTMENT OF INTERIOR - BUREAU OF MINES





D.D. Hole No. 6

FIG 5 - COPPER BUTTE MINE - 1471 - PINAL CO, ARIZ.

TABLE 1. - Ore shipments

Date	Tons	Gold, oz. per ton	Silver, oz. per ton	Copper, percent
2/4/42	8.703	-	0.12	4.42
6/12/42	10.508	-	0.26	4.85
11/28/42	42.485	-	-	3.83
12/15/42	29.243	-	-	3.56
12/17/42	49.410	-	-	4.35
12/24/42	48.072	-	-	3.72
12/31/42	41.501	-	-	3.74
	229.922		Weighted average	3.95

No further shipments were made by the present owner until August 1, 1943, when shipments were started to the American Smelting & Refining Co. at Hayden. A total of 1,357.92 dry tons having a weighted average of 2.88 percent copper was shipped during the remainder of 1943. This ore was mined from surface pit 1 (fig. 1).

Shipments in 1944 totaled 5,140.75 dry tons averaging 3.1 percent copper. All of this ore was mined from surface pits, the greatest part coming from pit 1.

Shipments for 1945 up to August 1, amounted to 13,916.1 dry tons averaging 2.96 percent of copper. All of the ore shipped since July 1943 has gone to the American Smelting & Refining Co. smelter at Hayden.

The ore mined from the surface by the present owner has all come from pits 1, 2, and 5. No accurate record has been kept of the tonnage mined from the various pits.

After the Bureau's drilling disclosed 20 feet of ore at hole 2, mining operations were started there, and it is estimated that 1,700 tons of that ore had been mined from cut 5 up to August 1945. Only about 94 tons had been mined from pit 2, as selective mining and sorting was necessary to keep the ore up to shipping grade.

The total ore shipped by the present owner, from the first shipments in 1942 to July 1945, inclusive, was 20,644.6 dry tons averaging 3 percent copper. The moisture, as assayed by the smelter, averages about 10 percent, giving a total of 22,709 tons of ore mined.

PHYSICAL FEATURES

The mine is situated on a saddle or small divide in the Tortilla Mountains west of Ray. From this saddle the drainage is toward the south and west by three gulches. The run-off eventually reaches the Gila River. The river, about 3 miles south and several hundred feet lower, can be seen from

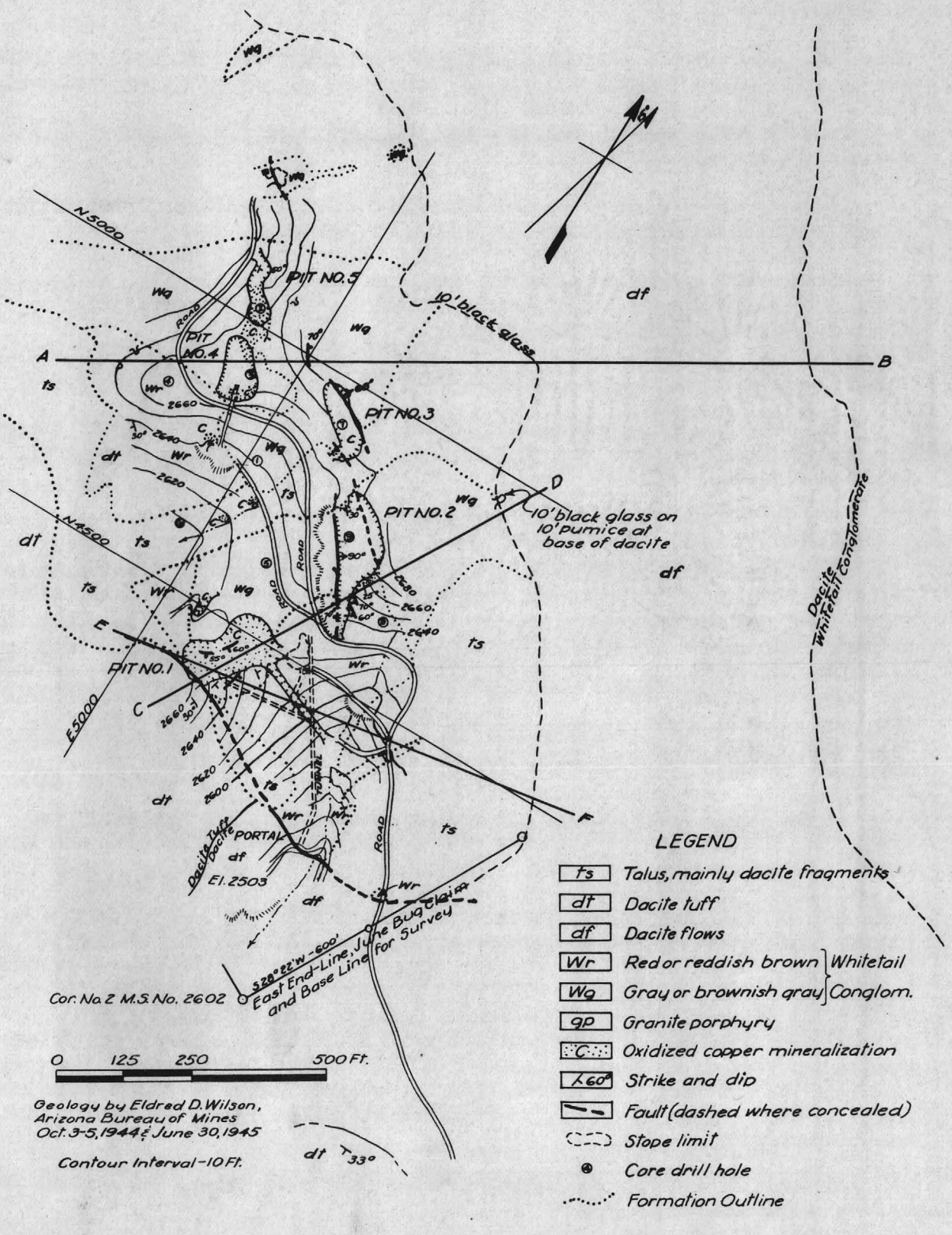
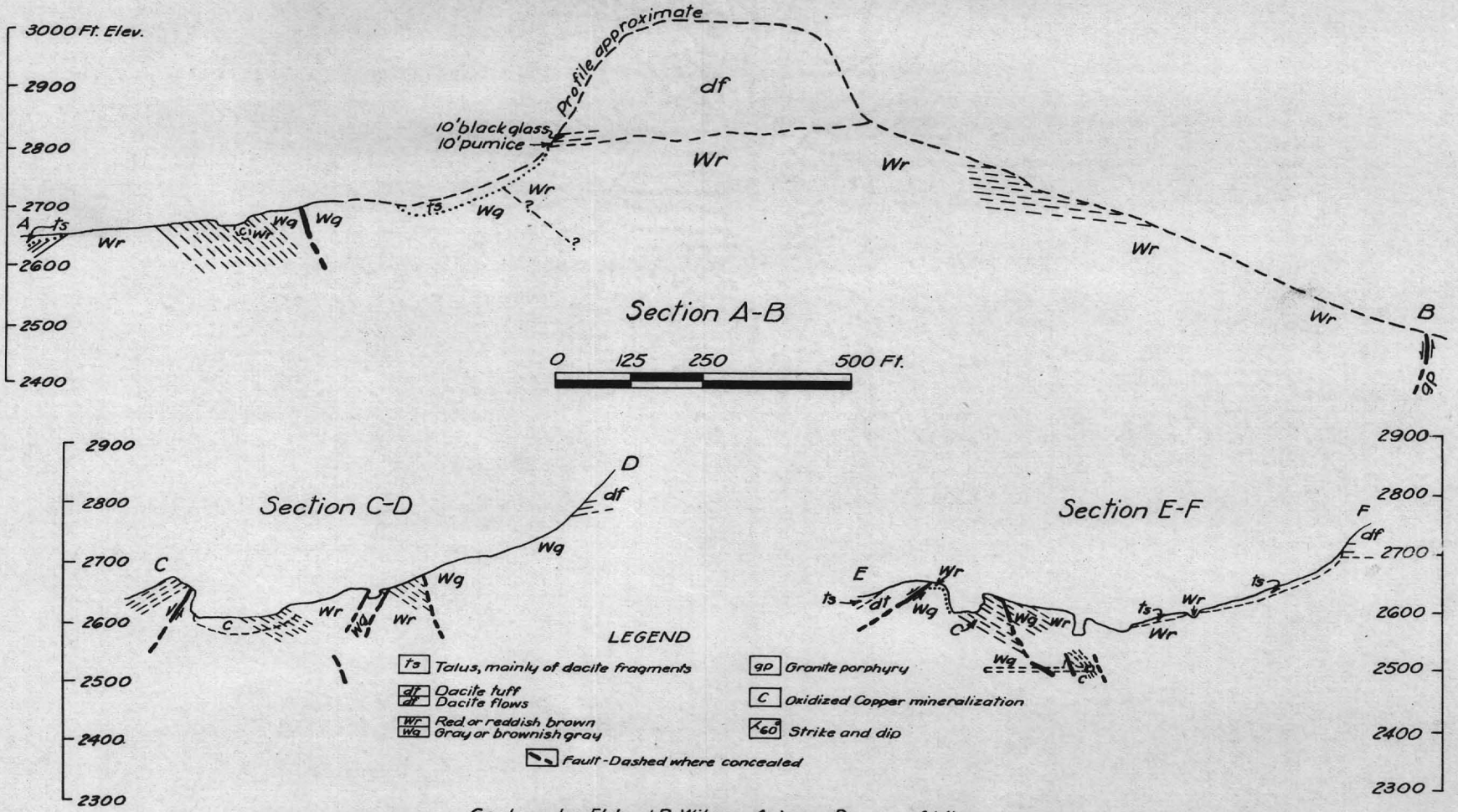


FIG. 6 - COPPER BUTTE PROJECT 1471, PINAL COUNTY, ARIZONA



Geology by Eldred D. Wilson, Arizona Bureau of Mines

FIG. 7 - COPPER BUTTE PROJECT 1471, PINAL COUNTY, ARIZONA

In this area the thickness of the Whitetail conglomerate and the kind of rocks upon which it rests are not revealed.

At several places in the Copper Butte area, the Whitetail, as shown by pit and mine workings and by drill holes, is impregnated with oxidized copper minerals. This mineralization apparently favors certain series of beds, but the extent to which these beds are mineralized horizontally and down the dip has not been determined. The faulting does not seem to have guided or controlled the mineralization.

As pointed out by Ransome,5/ the Whitetail conglomerate was formed as a result of profound erosion during which the principal supergene enrichment at Ray and Miami occurred. The Copper Butte deposit may represent placer or alluvial material formed when this erosion cut into the outcrop of some preexisting copper ore body not now exposed.

In places, as east of pit 1, beds of high iron oxide content overlie the copper-bearing beds. In other places, however, as shown by drill hole 4, the beds below reddish iron oxide outcrops are poor in copper. This may be regarded as evidence that the iron outcrops do not represent gossans above the copper, but rather that the iron was oxidized before its deposition in the conglomerate.

As the Whitetail is a rather tight formation that does not admit of much water circulation except along faults, there was no great opportunity for migration of iron or copper-bearing solutions through it. Consequently, no important zone of supergene enrichment is anticipated here.

ORE OCCURRENCE

The copper minerals are mostly chrysocolla and malachite. A small amount of tenorite occurs with the ore in the surface pits. Azurite is found in some of the ore, particularly from the stopes at the tunnel level. The ore carries only a trace of gold and silver.

The copper minerals are found almost entirely in beds or zones of the so-called gray conglomerate. Apparently there is no clearly defined division between the barren and the copper-bearing conglomerate. The change from one to the other is gradual in some places and abrupt in others. Copper is not evenly disseminated throughout the rock.

The red iron-stained conglomerate carries little or no copper. Sample 3097 (fig. 1), which was taken entirely from a red oxidized conglomerate, assayed only 0.12 percent copper.

There is considerable faulting. Often a fault is found separating the gray from the red conglomerate, as shown in the accompanying sections.

5/ Ransome, F. L., Work cited in footnote 4, p. 173-174.

The locations of the diamond-drill holes are shown on figure 1. The vertical projections at A-A' and B-B' are shown on figures 2 and 3. No drilling could be done close to pit 1 because of blasting and mine operations then in progress. It was intended to drill all the holes to a depth somewhat below the tunnel level. This procedure was not always possible because of mechanical difficulties encountered. The ground proved very difficult and costly to drill. Very little core was recovered, and the ground caved badly in places.

Hole 9, which was drilled to a depth of 69 feet below the tunnel level, showed 60 feet of 1.83 percent copper, with the bottom of the hole still in copper conglomerate. Holes 3 and 5 showed a trace of copper in about 50 feet of conglomerate below the tunnel level. No change was apparent in the oxidized character of the ore below that level.

The adjusted average of the first 10 feet of ore (5 to 15 feet) at hole 2 is 2.50 percent copper. The adjusted average for 20 feet of ore is 2.20 percent copper. After drilling was completed at this hole, the owner began mining at pit 5, 30 feet to the northwest. He carried the pit to the southeast to include the hole. At the time of writing, it was 30 feet beyond the hole and included the first 10 feet of ore indicated by the drilling.

A total of 974.2 tons of ore shipped from here averaged 3.29 percent copper. The minimum assay on any shipment was 2.89 percent copper, and the maximum was 3.61 percent copper. This was ore not mixed with material from any other pit. There is no apparent reason for the discrepancy between the diamond drillhole assays and the assay of the ore shipments, except for the fact that the copper content varies considerably throughout the copper-bearing conglomerate.

Smelter returns showed very little variation in the percentage of silica, alumina, and lime in the ore shipments. The average was approximately 60 percent SiO_2, 11 percent Al_2O_3, and 0.4 percent CaO.

To save unnecessary assaying, only composite assays of diamond drillhole samples were made for silica and alumina. None was made for lime. The composite sludge assays for alumina in holes 1, 2, 3, 5, and 8 averaged 11.3 percent Al_2O_3, the minimum being 9.9 percent and the maximum 12.5 percent. Holes 7 and 9 in pits 3 and 2 averaged 23.2 and 30.1 percent Al_2O_3, respectively. The copper content was better where the Al_2O_3 was lower. No composite assays were made for holes 4 and 6, as the samples assayed less than 0.5 percent copper.

Core recovery varied from a minimum of 1.6 percent in hole 8 to a maximum of 12.0 percent for hole 6. The average was 6.5 percent.

The assay results and log of the diamond drill holes are given on the following pages.

Diamond drill-hole log (Cont'd.)

Footage			Recoveries						Core diam., in.	Sample Nos.		Description and remarks
			Core		Sldg.	In percent						
From	To	Feet	Feet	Gm.	gm.	Core	Sldg.	Wtr.		Core	Sldg.	
110.0	115.0	5.0	0.8	140	6465	16	142	100	7/8		9409	Limestone and qtzt. core; sand sludge.
115.0	120.0	5.0	1.3	310	7045	26	161	100	"		9410	Mostly limestone core; sand sludge.
120.0	125.0	5.0	1.0	230	7880	20	177	100	"		9411	Do.

5.2 - 27.0 feet drilled with casing to 5.2 feet.
27.0 - 31.6 feet drilled with casing to 27.0 feet.
31.6 - 41.7 feet drilled with casing to 31.6 feet.
41.7 - 125.0 feet drilled with casing to 41.7 feet.

R.I. 3914

Composite samples, hole 1

Footage			Sample Nos.		Analyses							
					Core, percent			Sludge, percent			Composite*	
From	To	Feet	Core	Sldg.	Group	SiO_2	Al_2O_3	Group	SiO_2	Al_2O_3	SiO_2	Al_2O_3
5.2			3381	3382								
			and	9395								
			9447	to								
	31.6	26.4		9397	4	69.94	6.92	1	63.67	12.21	63.7	12.2
31.6			9448	9398								
			3384	3385								
			3386	3387								
			3388	3389								
			3390	3391								
	62.0	30.4	9449	9399	5	59.58	6.77	2	63.20	9.98	63.2	10.0
62.												
			9450	9400								
			9451	9401								
	77.0	15.0	3392	3393	6	87.02	4.60	3	60.10	12.45	60.1	12.5

*Sludge only.

Record of diamond drill-hole values

Footage			Sample Nos.		Analyses		Adjusted average*	
From	To	Feet	Core	Sldg.	Core, percent Cu.	Sludge, percent Cu.	Percent Cu.	Av. Cu.
5.0	10.0	5.0	3395	3396	5.11	2.40	2.50	
10.0	15.0	5.0	3397	3398	0.21	2.55	2.50	
15.0	20.0	5.0	3399	3400	0.67	2.05	2.03	
20.0	25.0	5.0	9351	9352	0.81	2.22	2.19	
25.0	30.0	5.0	9353	9354	0.94	2.14	2.09	
30.0	35.0	5.0	9355	9356	0.11	2.22	2.22	
35.0	39.3	4.3	9357	9358	0.35	1.88	1.87	
								2.20
39.3	45.0	5.7	--	9359		1.17	1.17	
45.0	50.0	5.0	9360	9361	0.46	1.27	1.27	
50.0	55.0	5.0	9362	9363	0.78	1.88	1.87	
55.0	60.0	5.0		9412		1.59	1.59	
60.0	65.0	5.0		9413		1.26	1.26	
								1.43
65.0	70.0	5.0		9414		0.63		
70.0	75.0	5.0		9415		0.40		
75.0	77.0	2.0		9416		0.41		
77.0	82.0	5.0		9417		0.45		
							0.47	

Composite Sample

5	55	50	9351	9363	65.32 percent SiO_2	10.6 percent Al_2O_3
55	65	5	9412	9413	55.86 percent SiO_2	11.5 percent Al_2O_3

*Based upon relative weights of core and sludge recovered.

Diamond drill-hole log (Cont'd.)

Footage			Recoveries						Core diam.,	Sample Nos.	
			Core		Sldg.	In percent					
From	To	Feet	Feet	Gm.	gm.	Core	Sldg.	Wtr.	in.	Sldg.	Description and remarks
132.0	141.0	9.0	1.0	235	6800	11	83	70	7/8	9386	Ls. and qtzite. core; no copper panned.
141.0	147.0	6.0	0.3	70	4800	5	86	60	"	9387	Qtzite. and ls. core; poor copper panning.
147.0	157.0	10.0	1.1	235	10450	11	114	100	"	9388	Qtzite., qtz., and ls. core; poor copperpanning.
157.0	167.0	10.0	1.5	325	10800	15	119	95	"	9389	Ls., qtzite., and sch. core; poor copper panning.
167.0	177.0	10.0	0.5	120	7670	5	83	100	"	9390	Ls. and qtzite core; fair copper panning.
177.0	187.0	10.0	1.2	290	11620	12	128	100	"	9391	Do.
187.0	195.0	8.0	0.4	60	6640	5	87	75	"	9392	Ls. and qtzite. core; poor copper panning.
195.0	205.0	10.0	0.8	180	14130	8	154	100	"	9393	Qtzite., ls., sch., and amphibolite core; poor copper panning.
205.0	208.0	3.0	0.4	80	7110	13	260	80	"	9394	Qtzite., qtz., and sch. core; poor copper panning.

5.0 - 37.0 feet drilled with casing to 5.0 feet.
37.0 - 118.0 feet drilled with casing to 37.0 feet.
118.0 - 141.0 feet drilled with casing to 106.5 feet.
141.0 - 167.0 feet drilled with casing to 106.5 feet.
167.0 - 208.0 feet drilled with casing to 160.5 feet

Qtzite. = quartzite
Qtz. = quartz
Ls. = limestone
cg. = conglomerate
sch. = schist.

Composite samples, hole 3

Footage			Sample Nos.		Analyses							
					Core, percent			Sludge, percent			Composite*	
From	To	Feet	Core	Sldg.	Group	SiO_2	Al_2O_3	Group	SiO_2	Al_2O_3	SiO_2	Al_2O_3
5			9468	9364								
			9469	9365								
	20	15	9470	9366	8	78.10	7.10	12	57.64	12.26	57.6	12.3
20			9471	9367								
			9472	9368								
			9473	9369								
			9474	9370								
	47.0	27	9375	9371	9	90.56	3.38	13	57.88	11.42	57.9	11.4
47			9476	9372								
			9477	9373								
			9478	9374								
	67	20	9479	9375	10	86.00	3.96	14	60.64	11.34	60.6	11.3
67			9480	9376								
			9481	9377								
			9482	9378								
			-	9379								
	97	30	9483	9380	11	63.18	8.46	15	56.20	11.54	56.2	11.5

*Sludge only.

Diamond drill-hole log

HOLE NO.: 5
Location: 4631 N., 5129 E.
Elevation of collar: 2631 feet
Depth: 167 feet
Dip: Vertical
Bearing: - -
Date begun: 1/12/45
Date finished: 1/29/45

Theoretical weight, in grams, of sludge per foot of hole:
Bx-- 2352
Ax-- 1466
Ex-- 938

Footage			Recoveries: Core		Recoveries: Sldg.	Recoveries: In percent			Core diam.,	Sample Nos.	
From	To	Feet	Feet	Gm.	gm.	Core	Sldg.	Wtr.	in.	Core Sldg.	Description and remarks
0	10.0	10.0							1-5/8		0-3 feet overburden; 3-10 feet congl.
10.0	15.0	5.0	0	0	7375	0	99	100	1-3/16	9423	Conglomerate; poor copper panning.
15.0	20.0	5.0	1.0	520	12775	20	188	100	"	9424	Ls. and qtzt. core; poor copper panning.
20.0	25.0	5.0	0.2	55	8150	4	112	100	"	9425	Qz. with cu. on fractures; fair cu panning
25.0	30.0	5.0	0	0	18300	0	250	100	"	9426	Conglomerate; good copper panning.
30.0	35.0	5.0	0	0	15275	0	209	100	"	9427	Conglomerate; poor copper panning.
35.0	40.0	5.0	0.4	125	17510	8	243	100	"	9428	Qtzt., sch., and qz. core; poor copper panning.
40.0	45.0	5.0	0.1	20	12250	2	168	100	"	9429	Qtzt. core; poor copper panning.
45.0	50.0	5.0	0.4	90	12250	8	170	100	"	9430	Qtzt. and ls. core; poor copper panning.
50.0	55.0	5.0	0.5	150	9900	10	138	100	"	9431	Qtzt. and ls. core; poor copper panning.
55.0	60.0	5.0	0.7	180	8750	14	122	100	"	9432	Qtzt. and sch. core; poor copper panning.
60.0	65.0	5.0	0.4	165	12540	8	175	100	"	9433	Ls. and qz. core; poor copper panning.
65.0	70.0	5.0	1.0	370	7425	20	107	100	"	9434	Ls. core; poor copper panning.
70.0	75.0	5.0	1.0	440	10075	20	146	100	"	9435	Ls., qtzt., and chert core; poor copper panning.
75.0	82.0	7.0	0.4	110	12125	6	119	100	"	9436	Sch., ls., and qtzt. core; very poor copper panning.
82.0	87.0	5.0	0.4	130	12725	8	177	100	"	9437	Qtzt. and sch. core; very poor copper panning.
87.0	92.0	5.0	0.3	75	10375	6	143	100	"	9438	Ls. and sch. core; fair copper panning.

Record of diamond drill-hole values

Footage			Sample Nos.		Sample	Analyses							
						Core, percent			Split	Sludge, percent		Adjusted average*	
From	To	Feet	Core	Sludge	No.	Cu	SiO_2	Al_2O_3	assay	Cu	Re assay	percent Cu	Av. Cu
0	10.0	10.0											
10.0	15.0	5.0		9423						1.24		1.24	
15.0	20.0	5.0	10072	9424		0.08	55.05	5.65		0.52		0.50	
20.0	25.0	5.0	10073	9425		1.35				0.90		0.90	
25.0	30.0	5.0		0426						1.17		1.17	
30.0	35.0	5.0		9427						0.99		0.99	0.96
35.0	40.0	5.0		9428						0.55		0.50	
40.0	45.0	5.0		9429						0.30		0.30	0.40
45.0	50.0	5.0		9430						0.17			
50.0	55.0	5.0		9431						0.18			
55.0	60.0	5.0		9432						0.10			
60.0	65.0	5.0		9433						0.15			
65.0	70.0	5.0		9434						0.12			
70.0	75.0	5.0		9435						0.16			
75.0	82.0	7.0		9436						0.14			
82.0	87.0	5.0		9437						0.19			0.15
87.0	92.0	5.0		9438	10025+				0.27	(0.08)	0.19	0.23	
92.0	102.0	10.0		9439	10026+				0.24	(0.20)	0.24	0.24	
102.9	109.6	7.6		9440	10027+				0.27	(0.38)	0.27	0.27	
109.6	116.4	6.8		9441					0.22	(0.14)	0.22	0.22	0.24
116.4	127.0	10.6		9442					0.09			0.09	
127.0	137.0	10.0		9443					0.20			0.20	
137.0	147.0	10.0		9444					0.08			0.08	
147.0	157.0	10.0		9445					0.07			0.07	
157.0	167.0	10.0		9446					0.11			0.11	0.11

Other analyses

			10072	9424						SiO_2	Al_2O_3	SiO_2	Al_2O_3
15.0	25.0	10.0	10073	9425			55.05	55.65		53.66	9.94	53.7	9.9

+Split assays of sludge.

*Based upon weights of core and sludge.

1042

Record of diamond drill-hole values

Footage			Sample Nos.		Analyses	
From	To	Feet	Core	Sldg.	Sludge, percent. Cu.	Adjusted average, percent Cu.
0	5.6	5.6				
5.6	8.7	3.1		9452	0.21	
8.7	13.7	5.0		9453	0.24	
13.7	15.5	1.8		9454	0.30	0.24
15.5	20.5	5.0		9455	0.17	
20.5	27.4	6.9		9456	0.15	
27.4	32.0	4.6		9457	0.14	
32.0	37.0	5.0		9458	0.12	
37.0	47.0	10.0		9459	0.13	
47.0	52.5	5.5		9460	0.20	
52.5	61.2	8.7		9461	0.07	
61.2	71.0	9.8		9462	0.19	
71.0	81.0	10.0		9463	0.27	
81.0	91.0	10.0		9464	0.16	
91.0	93.0	2.0		9465	0.13	
93.0	102.0	9.0		9466	0.18	
102.0	107.0	5.0		9467	0.10	0.16

Diamond drill-hole log (Cont'd.)

Footage		Recoveries							Core diam., in.	Sample Nos.		Description and remarks
		Core			Sldg. gm.	In percent						
From	To	Feet	Feet	Gm.		Core	Sldg.	Wtr.		Core	Sldg.	
131.0	136.0	5.0	0.1	20	14850	2	318	90	7/8		10006	Grn. cgl., qtzt. core; poor/fair cu. pan.
136.0	141.0	5.0	0.3	60	13500	6	292	90	"		10007	Grn. cgl., qtzt. and sch. core; poor/fair cu. pan.
141.0	151.0	10.0	0.9	160	19800	9	215	90	"		10008	Grn. cgl., qtzt. and ls. core; poor/fair cu. pan.
151.0	156.0	5.0	0	0	13950	0	297	90	"		10009	Grn. cgl., poor/fair cu. pan.

5.0 - 16.4 feet drilled with casing at 5.0 feet.
16.4 - 78.2 feet drilled with casing at 16.4 feet.
78.2 - 156.0 feet drilled with casing at 78.2 feet.

grn. = green
cgl. = conglomerate
cu. = copper
qtzt. = quartzite
ls. = limestone
sch. = schist

Composite samples, hole 7

Footage			Sample Nos.		Analyses							
					Core, percent			Sludge			Composite*	
From	To	Feet	Core	Sldg.	Group	SiO_2	Al_2O_3	Group	SiO_2	Al_2O_3	SiO_2	Al_2O_3
5			10062	9486								
			10063	9487								
	16.4	11.4	10064	9488	E	73.07	14.83	F	55.21	16.67	55.2	16.7
101.0			10065	9500								
			10066	10001								
	116.0	15	10067	10002	H	79.97	10.31	G	66.53	25.06	66.5	25.1
116			10068	10003								
			-	10004								
			-	10005								
			10069	10006								
			10070	10007								
	151.0	35	10071	10008	I	76.22	5.96	J	55.96	27.83	56.0	27.8

*Sludge only.

Diamond drill-hole log (Cont'd.)

Footage			Recoveries: Core		Recoveries: Sldg.	Recoveries: In percent			Core diam.,	Sample Nos.		Description and remarks
From	To	Feet	Feet	Gm.	gm.	Core	Sldg.	Wtr.	in.	Core	Sldg.	
115.0	125.0	10.0	0	0	24000	0	256	100	7/8			Red cgl.; qtzt. & sch core; no copper panned.
125.0	135.0	10.0	0	0	25700	0	274	80	"			Do.
135.0	145.0	10.0	0.2	35	18900	2	201	75	"			Red cgl., qtzt. core; no copper panned.

8.0 - 14.2 feet drilled with casing at 8.0 feet.
14.2 - 25.0 feet drilled with casing at 14.0 feet.
25.0 - 40.0 feet drilled with casing at 25.0 feet.
40.0 - 65.0 feet drilled with casing at 40.0 feet.
65.0 - 145.0 feet drilled with casing at 65.0 feet.

cgl. = conglomerate
qtzt. = quartzite
grn. = green
sch. = schist

Diamond drill-hole log

HOLE NO.: 9
Location: 4752 N., 5241 E.
Elevation of collar: 2640 feet
Depth: 206 feet
Dip: Vertical
Bearing: - -
Date begun: 3/20/45
Date finished: 4/5/45

Theoretical weight, in grams, of sludge per foot of hole:
Bx-- 2352
Ax-- 1466
Ex-- 938

Footage			Recoveries: Core		Recoveries: Sldg.	Recoveries: In percent			Core diam., in.	Sample Nos.		Description and remarks
From	To	Feet	Feet	Gm.	gm.	Core	Sldg.	Wtr.		Core	Sldg.	
0	8.0	8.0										Loose fill.
8.0	13.0	5.0	0.2	135	15950	4	132	100	1-5/8	10028	10044	Grn. and buff cgl., qtzt. core; fair Cu panned.
13.0	20.0	7.0	0.5	290	13950	7	86	100	"	10029	10045	Grn. and buff cgl., qtzt. and sch. core; poor Cu panned.
20.0	25.0	5.0	0.5	135	5630	10	78	100	1-3/16	10030	10046	Buff cgl., qtzt. core; poor Cu panned.
25.0	35.0	10.0	0.4	105	11150	4	77	100	"	10031	10047	Do.
35.0	45.0	10.0	0.3	55	18350	6	126	95	"	10032	10048	Do.
45.0	55.0	10.0	0.2	55	14300	2	98	80	"	10033	10049	Buff cgl., qtzt. core; very poor Cu panned.
55.0	120.0	75.0	0.4			1		100	1-3/16, 7/8			Red cgl., qtzt. core; no Cu panned.
120.0	130.0	10.0	0.2	35	20700	2	222	100	7/8	10034	10050	Red and buff cgl., qtzt. core; very poor Cu panned.
130.0	139.2	9.2	0.9	200	6500	10	77	100	"	10035	10051	Red cgl., qtzt. core; no Cu panned.
139.2	146.7	7.5	0.2	30	8850	3	126	100	"	10036	10052	Buff cgl., qtzt. core; very poor Cu panned.
146.7	156.0	9.3	0.4	60	8650	4	100	95	7/8	10037	10053	Green cgl. qtzt. core; poor Cu panned.
156.0	166.0	10.0	0.3	30	8650	3	93	100	"	10038	10054	Green cgl. qtzt. and cgl. core; poor Cu. panned.
166.0	171.0	5.0	0.2	20	11750	4	252	100	"	10039	10055	Green cgl. qtzt. core; good Cu panned.

Record of diamond drill-hole values

Footage			Sample Nos.		Analyses			
					Core, percent	Sludge, percent	Adjusted average*	
From	To	Feet	Core	Sldg.	Cu.	Cu.	percent Cu.	Av. Cu.
8.0	13.0	5.0	10028	10044	0.14	1.22	1.21	
13.0	20.0	7.0	10029	10045	0.10	0.87	0.86	
20.0	25.0	5.0	10030	10046	0.15	0.45	0.44	
25.0	35.0	10.0	10031	10047	0.06	0.38	0.38	0.67
35.0	45.0	10.0	10032	10048	0.11	0.40	0.40	
45.0	55.0	10.0	10033	10049	0.15	0.46	0.46	0.43
120.0	130.0	10.0	10034	10050	0.05	0.21	0.21	
130.0	139.2	9.2	10035	10051	0.04	0.40	0.40	
139.2	146.7	7.5	10036	10052	0.12	0.39	0.39	0.33
146.7	156.0	9.3	10037	10053	0.10	1.69	1.69	
156.0	166.0	10.0	10038	10054	1.85	1.77	1.77	
166.0	171.0	5.0	10039	10055	0.40	2.02	2.02	
171.0	176.0	5.0	10040	10056	0.48	2.02	2.02	
176.0	181.0	5.0	10041	10057	0.20	1.92	1.92	
181.0	183.5	2.5	-	10058		1.92	1.92	
183.5	191.0	7.5	10042	10059	0.18	1.72	1.72	
191.0	196.0	5.0	-	10060		1.83	1.83	
196.0	206.0	10.0	10043	10061	0.18	1.64	1.64	1.83

*Based upon relative weight of core and sludge recovered.

November 29, 1952.

Mr. Fred Searls, Jr.,
Room 1501,
14 Wall Street,
New York 5, New York.

Dear Mr. Searls:

During October 30-November 1, 1952, I accompanied Mr. E. R. Bennett into areas west and south of the Mitchell-Ray mine. As directed in your letter of October 15, my purpose was to point out to him the quarter sections that include localities wherein potentially mineralized schist or porphyry may not have an overburden of other formations exceeding 600 or 800 feet.

Mr. Bennett requested me to summarize for you the evidence and reasoning upon which my conclusions or selections were based.

General Statement

The overburden formations include Whitetail conglomerate, dacite, Gila (?) conglomerate, tuff, and recent gravels. Occupying a structural basin whose interior has been modified intermittently by folding, faulting, and erosion, these formations are lenticular. Thus, for example, the overburden ranges from nothing in the vicinity of the southeast corner of section 25, T. 3 S.,

R. 12 E., to a known total of 1,855 feet in the Purcell churn-drill hole only 4,000 feet away.

In general, the overburden tends to be relatively thin on structural highs which developed during the following intervals:

a) By the end of Whitetail sedimentation.

b) After Whitetail deposition but before eruption of the dacite.

c) After eruption of the dacite but before the end of Gila (?) conglomerate deposition.

d) After deposition of the Gila (?) conglomerate and tuff.

A concealed orebody of considerable magnitude is inferred from the extent and distribution of the copper placers. Interpretation of the evidence so far obtained suggests its relation to a zone of structural crossing which partially is reflected in the structural highs.

Main Structural Features

It is believed that the main structural features throughout the southern Arizona region have been developing intermittently through long periods of geologic time, along zones of ancient heritage. A pattern of generally north-south and east-west shear faults, major folds of northwesterly trend, and tension fissures of northeasterly and northwesterly trend is common to many of the districts.

The shear fault zones are occupied in many places by intrusive bodies. Renewed faulting of normal type may follow the shear breaks and tension fissures, although the east-west shears, particularly, tend to be marked by reverse movement and accompanying east-west folds. This general pattern, of course, is subject to local complications, and some of its features may be obscured or concealed by recent formations.

In the area south from Superior and west of Ray, shear breaks of the east-west type are indicated by the Magma fault, the southern segment of the Walnut reverse fault, the porphyry intrusive bodies of Ray, and the Spine structure, (See Plate 1). North-south shears are exemplified by the northern segment of the Walnut reverse fault, and the dikes that systematically trend northward from Cochran probably occupy shear faults of this type. The zig-zag course of the Concentrator normal fault appears to follow north-south shears and northwest tension fissures. The Whitetail basin, of northerly trend, is mainly of tectonic origin.

Spine Syncline

Immediately south of Copper Butte, the older rocks and also the Whitetail conglomerate, dacite, and lower portion of the tuff are folded into a westward-trending syncline (See Plates 1, 2, and 3). The southern limb of

this fold forms the Spine, a sharp ridge which rises 1,400 feet above the Gila River. As shown by the Purcell churn-drill hole, this syncline has depressed the pre-Whitetail surface of the schist to an elevation of 700 feet, and the lower limit of complete oxidation to 100 feet above sea level. The fold becomes obscure eastward on a surface of crystalline rocks, and westward it passes beneath younger tuff.

The Spine syncline shows strongly in the Tertiary rocks opposite the southern termination of the Concentrator fault system. Towards this locality, the fold plunges from both east and west, and away from it the fold broadens.

Spine Fault

A southward-dipping reverse fault, here termed the Spine fault, strikes along the northern limb of the Spine syncline (See Plate 1). East of the west branch of the Concentrator fault it brings Pinal schist on the south over Whitetail conglomerate on the north. The east and west branches of the Concentrator fault are not traceable southward beyond the Spine fault, but apparently the post-dacite and post-tuff displacement on them was resolved into renewed, but normal, movement on a segment of the Spine fault zone. Such downward displacement might account for the plunge of the syncline towards the Concentrator fault.

Projected westward along the strike, the Spine fault would intersect the Hells Peak rhyolite plug, in accordance with the tendency of shear faults to form channels for igneous invasion. With a dip of 55 degrees southward, the Spine fault would cross the Purcell churn-drill hole at the Whitetail-schist contact where 100 feet of gouge was encountered (See Plate 2).

North of the Spine fault, the dacite-Whitetail contact is marked by a pronounced angular unconformity that appears to be lacking south of the fault.

The Whitetail Conglomerate and Copper Placers

The Whitetail conglomerate was deposited in a basin which concurrently was in process of structural development. The formation attained an irregular thickness depending upon topography of the basin. As exposed beneath the dacite, the Whitetail is not more than 20 feet thick at the eastern end of the Spine syncline (See Plate 3), and possibly more than 3,000 feet thick in sec. 35 at the mouth of Walnut Canyon, although in the latter locality it may be duplicated by faulting. It thins northeastward from the Blue Bird area (See Plates 4 and 2) but thickens in the Spine syncline southwest of Copper Butte.

So far as known, the placer copper minerals, as well as the abundant red iron oxide, do not occur at or near the base of the Whitetail, but rather high in the section. Therefore, the copper and iron minerals were derived from

areas of basement rock which were not exposed to erosion until late in the Whitetail cycle.

Copper placers of this size, extent, and metal content are rather unusual; they must have formed under some special conditions whereby active uplift of portions of the parent orebody kept pace with erosion. In this connection, the Spine fault and associated folds (See Plates 1 and 2) seem worthy of consideration; possibly the steep northern front of this structure fed the Mitchell placers, while the more gentle, southern backslope supplied the relatively lower grade, spotty placers of the Red Hills (Buckeye) area.

Structural Highs

As portions of the parent mineralized area occupied a structural high relatively late in the cycle of Whitetail deposition, the ultimate Whitetail cover on that area would have been considerably less than maximum.

The angular unconformity between dacite and Whitetail north of the Spine fault reflects pre-dacite deformation of the Whitetail and possibly renewed uplift along the Spine fault. On the resulting structural high, dacite would be thin or lacking.

After eruption of the dacite, considerable Gila (?) conglomerate, consisting partly of dacite fragments but largely of reworked Whitetail, was deposited within a local drainage basin. This basin appears to have been

deepest near the Spine fault southeast of Hells Peak. The structural implications of this impressive local accumulation have not been appraised.

After deposition of the Gila (?) conglomerate, dikes and glassy plugs of dacitic to rhyolitic composition invaded portions of the shear fault zones. Exploding at the surface, the glassy material formed extensive tuff deposits which in turn were invaded by the continuing rise of the intrusive bodies. Owing probably to renewed movement along the Spine fault, the lower tuff beds exposed in the Spine syncline were sharply folded, whereas the superjacent tuff beds there show progressively less flexing.

Thus, intermittent uplift along the Spine fault during successive intervals is indicated.

Deduced Location of the Parent Orebody

If the reasoning set forth in the preceding paragraphs is valid, the parent orebody from which the placer copper minerals were derived should lie within the approximate area suggested on P. C. Benedict's map RS-2. This suggestion is encouraged by the structural features and mineralization that were revealed in the Purcell churn-drill hole. On the other hand, hidden complications probably exist, and some of the projections assumed may not be justified. Not nearly enough geologic work has yet been done in this area and surrounding areas to obtain all

of the available facts pertaining to the problem. Much evidence could be gained from a comprehensive study of the lithology, unconformities, and deformation of the Whitetail.

Geophysical investigation of an area somewhat wider than the "hypothetical ore" area would seem to be desirable, as discussed in subsequent paragraphs.

Areas Suggested for Geophysical Work (Cf. Pl. 1)

T. 3 S., R. 13 E.

Sec. 30, SW ¼: Includes deep southward-flowing gulch a few hundred feet east of line of cross-section of Plate 2. Overburden probably is of medium thickness above structural high south of Spine syncline and near "hypothetical orebody."

T. 3 S., R. 12 E.

Sec. 25, SE ¼ of SE ¼: Overburden may be less than 750 feet thick above or near potentially mineralized area south of Spine syncline. (See Plate 2) Same may be true for SW quarter of SE quarter of this sec. 25.

Sec. 24, SW ¼ of NW ¼ and W ½ of SW ¼: Whitetail is unconformable beneath dacite in northern portion of this locality. At big bend in Walnut Canyon, Whitetail is separated from Gila (?) conglomerate on the west by a north-south fault.

T. 3S., R. 12 E., (cont'd)

The steeply upturned beds of Whitetail are of the fine-grained to silty type (See Plate 4) characteristic of the lowermost portion of that formation. Hence, in this segment of the canyon the overburden presumably is not very thick.

Sec. 25, N ½ of NW ¼: This tract offers a possibility for probing the buried structural high which may occur immediately south of the Spine fault as projected.

Sec. 27 and N ½ of Sec. 34: In gulches of this large Whitetail area (See Plate 6), the Whitetail possibly is less than 800 feet thick, owing to the relative nearness of the western edge of the Whitetail basin and possible faulting.

The copper mineralization within the rhyolite dike in the western part of sec. 27 resembles inclusions; if so, it may have been brought up from the Whitetail or from underlying schist.

W ½ of Sec. 26 and N ½ of Sec. 35: The Whitetail in these tracts shows considerable deformation and hence might be relatively thin in portions of the western deep gulch. In the eastern portion of sec. 35, however, it appears to be very thick.

Sincerely yours,

 Eldred D. Wilson

Plate 1.- Index map of the Copper Butte (Mitchell-Ray), Walnut Canyon, and Red Hills (Buckeye) areas. Base enlargement of portion of U.S.G.S. Florence quadrangle topographic sheet (1902). Scale approximately 1.5 inches = 1 mile, contour interval 100 feet.

- fault
- Wr, Walnut reverse fault
- C, Concentrator fault
- CW, Concentrator fault, west branch
- CE, Concentrator fault, east branch
- Sf, Spine fault
- Projected or inferred trace of Spine fault on pre-Whitetail surface and coincident with synclinal axis
- Spine syncline
- Tracts suggested for geophysical work.

Plate 1.- Index map of the Copper Butte (Mitchell-Ray), Walnut Canyon, and Red Hills (Buckeye) areas. Base enlargement of portion of U.S.G.S. Florence quadrangle topographic sheet (1902). Scale approximately 1.5 inches = 1 mile, contour interval 100 feet.

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- CE, Concentrator fault, east branch
- Sf, Spine fault
- Projected or inferred trace of Spine fault on pre-White-tail surface and coincident with synclinal axis
- Spine syncline
- Tracts suggested for geophysical work.

Teapot Mt.
B.M. 3761
Canyon
SILVER BELL MINE
Walnut Spring
B.M. 2838
Copper Canyon
Granite Mt.
Smiths Ranch
Walnut Canyon
Hells Pk
Copper Butte
Mitchell
The Spine
RIVER
Cochran
R.12 E.
R.13 E.
3500
3000
2500
2000

Pl. 1

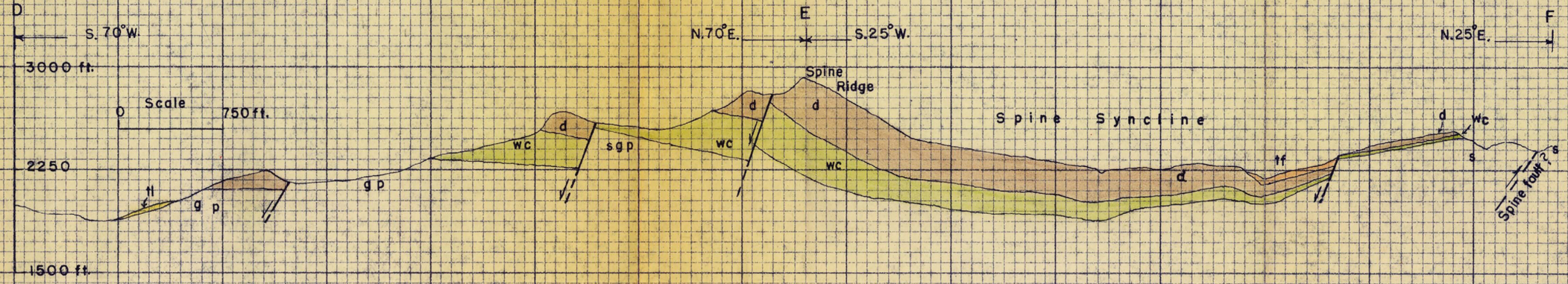


Plate 3.- Cross section along line D-E-F of Plate 1.

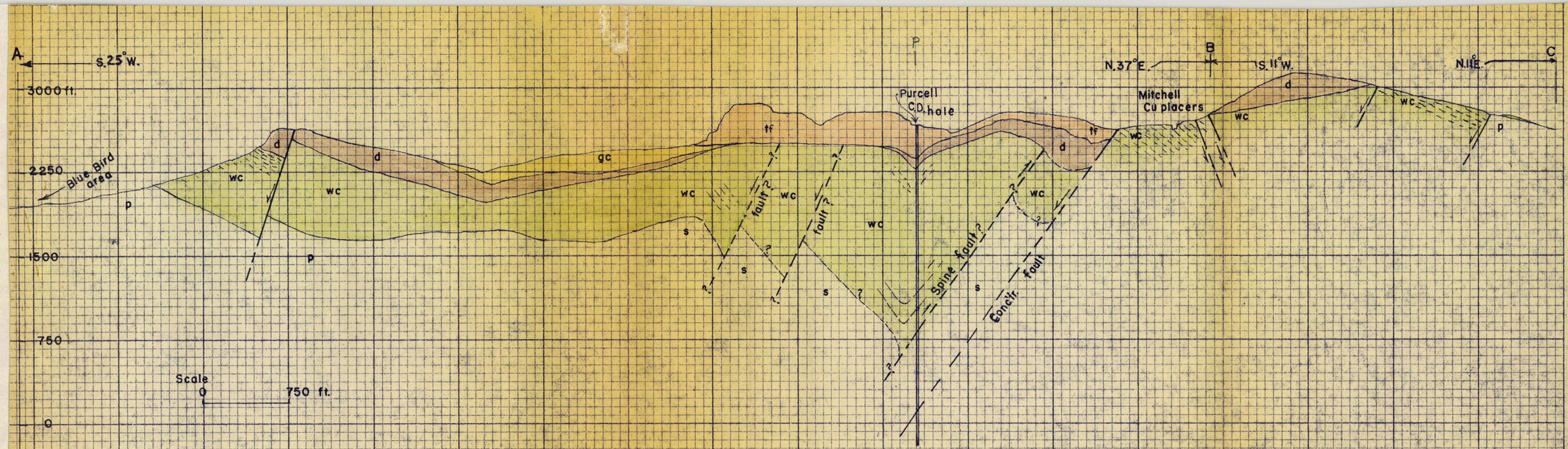


Plate 2.- Cross section along line A-P-B of Plate 1.

Pl. 2

Plate 2 - s, schist; p, porphyry; wc, whitetail conglomerate; d, dacite; gc, Gila (?) conglomerate; tf, tuff.

Plate 3 - s, schist; g, granite; p, porphyry; wc, Whitetail conglomerate; d, dacite; tf, tuff; tl, talus.

Plate 4.- Looking from Buckeye group southeastward across Walnut Gulch at Whitetail slopes immediately north of Blue Bird area. Dacite cap rock on upper left dipping approximately 30 degrees northward.

Plate 5.- Steeply upturned silty beds of lower portion of Whitetail at big bed of Walnut Canyon.

Plate 6.- Looking northward at northwestern portion of Red Hills (Buckeye) area. Slopes of Whitetail conglomerate capped by dacite.

May 6, 1980

Mr. Donald R. Kunz
KUNZ & WAUGH, LTD.
2600 First Federal Savings Building
3003 North Central Avenue
Phoenix, Arizona 85012

Dear Don:

Enclosed herewith for your files is a copy of the "Memorandum of Agreement and Power of Attorney", with the attached "Exhibit 1". This has been recorded by the Pinal County Recorder as Instrument No. 646883, Docket No. 1030, Page No. 1008-639, dated April 24, 1980.

Sincerely,

E. Grover Heinrichs

EGH:vh
enc.
cc: Mr. John Mark Johnson
(without enclosures)

Copy of Instrument #646883 given to Ramon Shannon by EGH on 5-6-80.

(4)

April 22, 1980

Recorder's Office
Pinal County
Florence, Arizona 85232

Gentlemen:

For recording purposes, enclosed you will find an original executed copy with attachments, of a Memorandum of Agreement and Power of Attorney (7 total pages).

Also enclosed is our check #147 in the amount of $4.00 to cover your fees in connection with recording and returning the above described document to me. If the enclosed amount is not sufficient, please advise and we will forward the additional amount to you at once.

Sincerely,

E. Grover Heinrichs

EGH:vh
enc. (2)

Recorder's
Fee info
Up to 5 pages - $3.00
50¢ per addt'l page
Deeds cost more

September 19, 1980

Mr. J. D. Schlottmann
12938 West Oregon Drive
Lakewood, Colorado 80228

Dear Mr. Schlottmann:

We now have other people looking at the Kelvin Property, and I am in need of the data loaned to you in early July (Volumes I and II).

Your most urgent attention to this matter would be appreciated. Thank you.

Sincerely,

E. Grover Heinrichs

EGH:vh

Data returned 9-29-80

Dear Mr S, offer
We now have
people looking at the
Kelvin Property and I am
in receipt of the data I owned to you
in week of July 1st (Volumes I & II)
in early July. Your most urgent
attention to this matter could be appreciated
Thankyou. EGH. 9/18/80

303/ 989-7222 J.D. Schlottman
748-1446 Shannon
778-1195 John Johnson
801/322-3401 Dewoeth Williams
Joe Foster

July 7, 1980

Mr. J. D. Schlottmann
12938 West Oregon Drive
Lakewood, Colorado 80228

Dear Mr. Schlottmann:

Enclosed are Volumes I and II of the Kelvin Prospect. Please review the enclosed data for the purpose of forming a managing partnership for the express purpose of drilling further holes on the subject property to prove up the commercial viability of the property. It is further expressly understood that this is an exploratory situation and subject to the approval of the property owners.

The property requires a minimum of 6,000 feet of drilling and an expenditure of approximately $300,000.00, to drill and supervise the project. Ramon Shannon, you and myself would be the general partners. The limited partners would be your stock group. The property owners require a minimum of $2,500,000.00 for 57 claims, plus an annual rental fee. We are thinking of adding an additional $1,000,000.00 as our share, which would now be split three (3) ways.

If all this sounds reasonable to you, Ramon has expressed his interest and I am willing to go ahead for my part. I am now working on obtaining the owners' views on this. In the interest of time we are shipping this data via Federal Express for your earliest review and comments.

As we have had limited contact with each other, I think that an exchange of resumes would be in order. Mine is enclosed and we would appreciate receiving yours at your earliest opportunity.

Sincerely,

E. Grover Heinrichs

EGH:vh
enc. (3)

cc: Mr. Ramon Shannon (w/o enclosures)

December 21, 1979

E. Grover Heinrichs
Suite 110-4
1802 W. Grant Rd.
Tucson, AZ 85705

Dear Grover:

Enclosed is the copy of the option agreement you requested. Also enclosed are copies of an amendment and short form for recordation that might be helpful.

After checking the enclosed agreement, I realized that a Delivery of Data paragraph was not included in this copy, although it was included in the final agreement which we signed in 1974, along with a higher downpayment. Therefore, below is a Delivery of Data paragraph which I think should be inserted where appropriate.

_____ agrees that in the event this Agreement* is terminated at any time in accordance with the terms hereof, it will furnish and deliver to Optionors within a reasonable period after the date of termination, copies of all factual data which it has gathered on the mining claims which are the subject matter of this Agreement.

Sincerely,

John M. Johnson

* assays, core, cuttings, geochemical, geological & geophysical reports & data

TO John M. Johnson | AT 1201 Overstreet Prescott AZ. 86301

SUBJECT Agreement & Power of Attorney | DATE 12-24-79

Enclosed are 4 machine copies of the above described agreement, a revised 2nd draft to reflect recent phone conversations with you. If you find everything in order please sign & notarize all copies & return three copies to me & keep one for your file.

DUPLICATE

SIGNED

Yours truly

No reply is necessary

DATE | SIGNED

Rediform ®
4S 469
Poly Pak (50 sets) 4P469

SEND PARTS 1 AND 3 WITH CARBON INTACT -
PART 3 WILL BE RETURNED WITH REPLY

DETACH AND FILE FOR FOLLOW-UP

8. It is further expressly understood and agree by all parties herein, that all monies paid during the lease option period will not apply to the purchase of the property, whether or not the purchase of the property is exercised.

In the event the purchase of the claims is exercised, all parties will be so notified by the optionee in writing, delivered by U. S. Registered Mail. At that time, the rental payments will cease, and ten (10) yearly payments, payable at the commencement of each year and on the anniversary date of notification of intent to purchase, the sum of Two Hundred and Fifty Thousand Dollars ($250,000.00) for each year will be paid to the Principals, until a total of Two Million Five Hundred Thousand Dollars ($2,500,000.00) has been paid to the Principals. A commission will be paid to Shannon and Heinrichs on any overage to the minimum amounts as herein stated. Such overage sum to be shared equally between them as their entitled commission payment.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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

3750 I SW (PICKET POST MTN.)

3750 IV SW (PINAL RANCH)

111°07'30" 33°15' 489000m.E. 490 PHOENIX 68 MI. SUPERIOR (U.S. 60 & 70) 3.7 MI. 492 5' 493 R.12 E. 3750 I SE (SUPERIOR) R. 13 E. 495 496 2'30" 770 000 FEET 498 499 111°00' 33°15'

3678000m.N. 3677 3676 3675 12'30" T. 2 S. T. 3 S. 3673 3671 3670 10' 3669 3668 3667 780 000 FEET 3666 33°07'30" 111°07'30" 750 000 FEET 3665000m.N. 33°07'30" 111°00' 810 000 FEET

TONTO NATIONAL FOREST

Wood Canyon · Arnett Creek · Oak Creek · Devils Canyon · Rawhide Canyon · Grapevine Spring · Spring · Pack Trail · Jeep Trail · Forest Boundary · National Forest Boundary · BM 2952 · BM 3760 · White Water Spring · Lime Point 4203 · Walnut Spring · USLM 3673 · Water Tank · Water Tanks · Leaching Ponds · Ray 2528 · Ray · Last Turn Hill · Sandow Hill · West Pit · Copper Canyon · Sleeping Beauty Mountain · Teapot Mountain · Red Hills · Lakel Flat · Sonora Hill · Granite Mountain · White Canyon · Copper Butte · USLM 2602 · Copper Butte Mine · The Rincon · The Spine

3750 II NW (MINERAL MTN.) · 3750 II SW (NORTH BUTTE) · 3750 III NW (SONORA) · 3750 III SW (KEARNY)

KEARNY 9.2 MI. WINKLEMAN (ARIZ. 77) 19 MI.

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Fine red dashed lines indicate selected fence lines

GN MN 0°02' 1 MIL 14° 249 MILS

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

ARIZONA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

TEAPOT MOUNTAIN, ARIZ.
N3307.5—W11100/7.5

1964

AMS 3750 II NE—SERIES V898

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1965

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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

3750 II NW (MINERAL MTN.)

3750 II NE RAY 7.5 MI. (TEAPOT MTN.)

3850 III NW (SONORA)

3750 II SW (NORTH BUTTE)

(KEARNY) 3850 III SW

(CROZIER PEAK) 3850 IV NW

111°07'30" 33°07'30" 489000m E. 490 491 492 5' R. 12 E. R. 13 E. 495 496 2'30" 497 498 499 780 000 FEET 111°00' 33°07'30"

T. 3 S. T. 4 S. T. 5 S.

3664000m N. 3663 3662 3661 5' 3660 3659 3657 3656 2'30" 3655 3654 3653 3652 730 000 FEET 33°00'

770 000 FEET 3664 3663 3662 5' 3660 3659 3657 3656 2'30" 3655 3654 3653 3652000m N. 33°00'

FLORENCE 34 MI. FLORENCE 21 MI. KEARNY 11 MI.

GILA RIVER PACIFIC SOUTHERN JEEP TRAIL Walnut Canyon Wash Zellweger Wash Rudsey Wash Donnelly Wash

Prospects Water Tank 3570△ Grayback Radio Tower Spring Golden Bell Mine A-Diamond Ranch Substation ▲USLM 2395 Peg Leg Well BM×2625 Wooley Mine Wolley Prospects Well Donelly Tea Cup Ranch Tortilla

The Spire

Mapped, edited, and published by the Geological Survey
in cooperation with the Bureau of Reclamation

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 12, shown in blue

Fine red dashed lines indicate selected fence lines

GN MN 0°02' 1 MIL 14° 249 MILS

UTM GRID AND 1964 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Light-duty ——— Unimproved dirt - - - - -

ASTRO BLUEPRINT CO.
4655 E. BROADWAY
TUCSON, ARIZONA 85711
327-3421

ARIZONA ■ QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

GRAYBACK, ARIZ.
N3300—W11100/7.5

1964

AMS 3750 II SE—SERIES V898

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1970

NOTES ON THE GEOLOGY OF THE COPPER BUTTE AREA, ARIZONA

by Eldred D. Wilson, Geologist, Arizona Bureau of Mines

ROCKS

The rocks exposed in the Copper Butte area are as follows:

Tertiary	(Rhyolite porphyry plugs and dikes. (Tuff. (Intervolcanic (Gila?) conglomerate. (Dacite. (Whitetail conglomerate.
Unconformity	-
Late Cretaceous to Early Tertiary	(Quartz monzonite porphyry stocks and dikes. (Quartz diorite dikes.
Pre-Cambrian	- Pinal schist.

The Pinal schist, limited on the west by fault contact with Tertiary rocks, crops out in Walnut Canyon, north of Copper Butte, and in an overthrust plate southeast of the Copper Butte mine.

Dikes of quartz monzonite porphyry and quartz diorite intrude the schist.

Limiting the schist on the south, east of Copper Butte ridge, is an outcrop of light-colored porphyry more than a square mile in extent. This rock is lithologically similar to the quartz monzonite porphyry stock of Granite Mountain (described in U.S.G.S. Prof. Paper 115), with which it appears to be continuous. This outcrop is bounded on the west by fault contact with the Whitetail conglomerate of Copper Butte ridge.

As at Ray, the Paleozoic strata have been removed by pre-dacite erosion, and the Whitetail rests unconformably upon Pinal schist.

The general character of the Whitetail is described in the U. S. Bureau of Mines R.I. 3914. Deposited as alluvial fans or occupying hollows upon an irregular to rugged surface of erosion, the Whitetail is of variable thickness. In the north end of Copper Butte ridge it amounts to approximately 350 feet.

Dacite, with a maximum thickness of 450 or 500 feet, overlies the Whitetail conglomerate and in places overlaps older rocks. It rests upon an irregular surface of erosion and thins out in places.

The intervolcanic conglomerate overlies dacite west of Copper Butte and overlaps Whitetail where the dacite thins out. It resembles Gila conglomerate and evidently occupies a small local basin.

Tuff, in places 600 feet thick, overlies the intervolcanic conglomerate. As the tuff thins out in places, it probably was deposited after the dacite had undergone considerable erosion.

Plugs and dikes of glassy rhyolite porphyry cut through the tuff and older rocks in the vicinity of the high, round butte west of Walnut Creek.

STRUCTURE

The Whitetail prevailingly dips eastward or northeastward. Its inclination as a rule is 30°-35° but steepens

near faults and flattens under the eastern flank of Copper Butte ridge. In general the areal extent of the formation from east to west may be explained as duplication by step-faulting.

Folding and low-angle faulting are evident in the schist along Walnut Canyon, north of Copper Butte Ridge. Southeast of the mine, an inconspicuous overthrust brings schist over Whitetail.

The two most conspicuous faults of the area strike north-northwestward, dip about 60° westward, and flank both sides of Copper Butte ridge. The East fault brings quartz monzonite porphyry against Whitetail along the eastern flank of this ridge. The West fault, with a vertical displacement of possibly 450 feet southwest of the Copper Butte mine, drops tuff and dacite on the southwest against Whitetail and schist on the northeast.

A deep, sharp syncline, southwest of and subparallel to the West fault, shows prominently in the tuff and dacite.

COPPER DEPOSITS

Evidence for placer or alluvial origin of the Copper Butte deposit may be summarized as follows:

1. Subangular to slightly rounded fragments of schist in the Whitetail conglomerate show replacement by the oxidized copper minerals (chiefly chrysocolla).

2. The mineralization is largely discontinuous and limited to scattered fragments.

3. In places where local structures have afforded permeability, there have been some solution, migration, and redeposition of the copper, but the areas of staining exposed in the Whitetail as a rule are discontinuous and small. Drilling revealed that secondary copper mineralization occurs in the dacite within the deep, sharp syncline; that occurrence probably represents lateral and downward migration from the Whitetail.

4. Fragments of limestone in the conglomerate show no replacement by copper minerals except where the limited solution and migration are evident. It is readily observed that copper mineralization is poor or entirely absent where the conglomerate contains abundant limestone pebbles; this relation was demonstrated by the drilling results tabulated in the U. S. Bureau of Mines R.I. 3914. If the copper had been deposited from solutions, rather than as placer material, the limestone fragments should have been mineralized. On the contrary, the best ore is where the conglomerate consists chiefly of schist.

5. The ore shows no obvious relation to fissures.

6. The conglomerate, with its sandy to clayey cement, is relatively tight and impervious to solutions.

7. The conglomerate shows no hydrothermal alteration, no veins, and no open channels.

8. There is no known primary or hypogene copper mineralization anywhere in this region as young as the

Whitetail conglomerate; the primary deposits at Globe, Miami, Superior, and Ray are definitely pre-Whitetail in age.

9. It has been demonstrated (Ransome, U.S.G.S. Prof. Paper 115) that the Whitetail was formed during a long cycle of erosion, concurrently with the secondary enrichment at Ray, Miami, and Globe. At Miami, Ray, and Copper Butte, this erosion stripped away the Paleozoic rocks and cut into the pre-Cambrian schist. The outcrops of any ore bodies in the older rocks would, under very rapid erosion, have contributed oxidized fragments to the alluvial debris.

The conditions for such rapid erosion may have been provided by continuing fault movement, probably of overthrust or reverse type, within the area of hypogene or primary mineralization. In this region, intense compressive deformation culminated with intrusion of quartz monzonite porphyry, with which the primary mineralization was genetically connected. This compression continued to a limited or mild extent for some time after the porphyry invasion, as evidenced by the syncline affecting the tuff and by the low-angle fault which brings schist over Whitetail southeast of the mine.

Evidence that the copper-bearing Whitetail originated west-southwest of Copper Butte is as follows:

1. Copper in the Whitetail fades out to the north and east of the Copper Butte mine. On the south and west it is downthrown by the West fault. There is a little evidence of

primary mineralization east of the West fault; pyrite is apparent in the porphyry at the northeast foot of Copper Butte Ridge, and the overthrust schist plate southeast of the mine shows an area of leached capping adjacent to the West fault.

2. Whitetail exposed in the canyons south of the mine shows no copper.

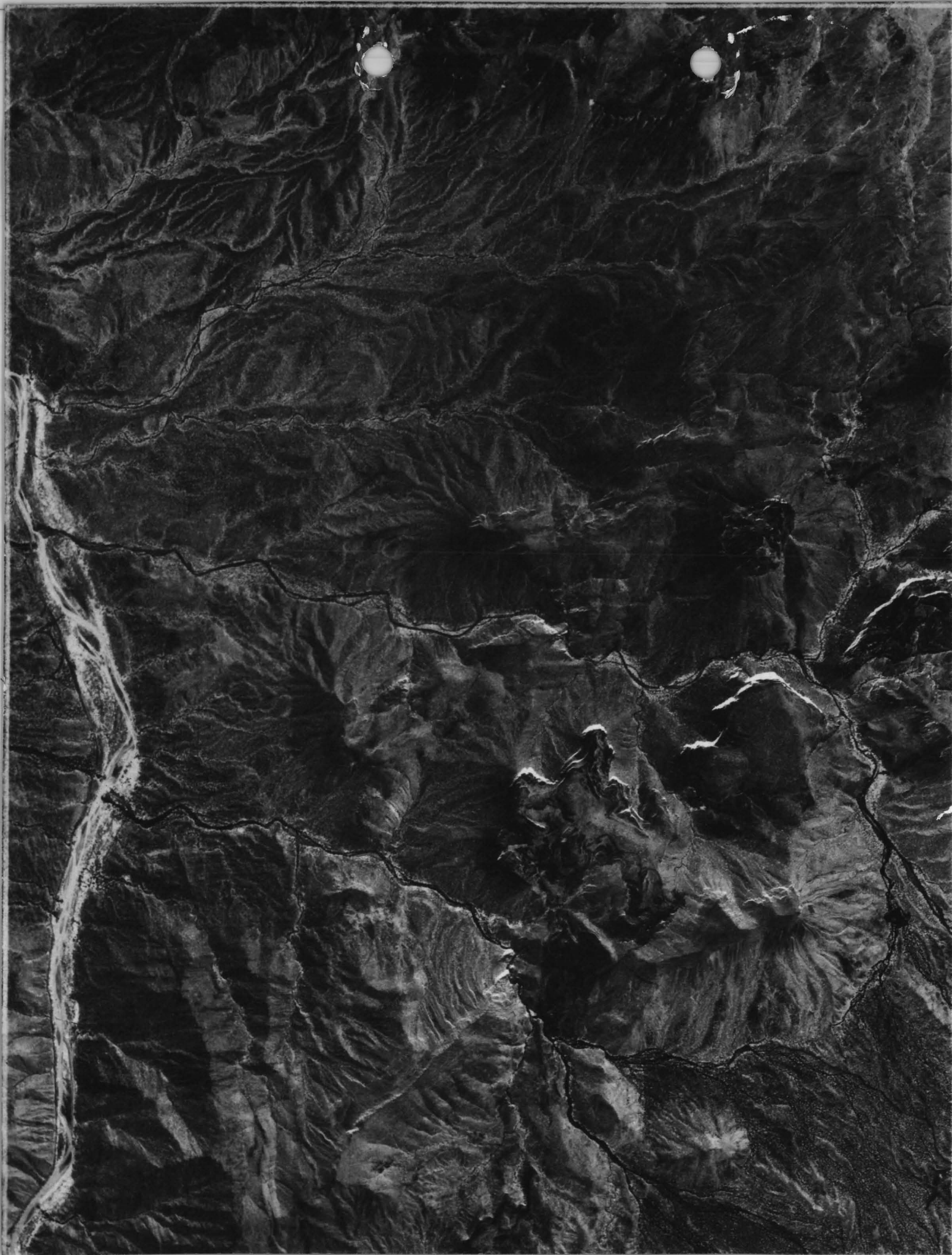
3. To the northwest, between Superior and Copper Butte, and also to the south across Gila River, the pre-Whitetail surface sloped east-northeastward.

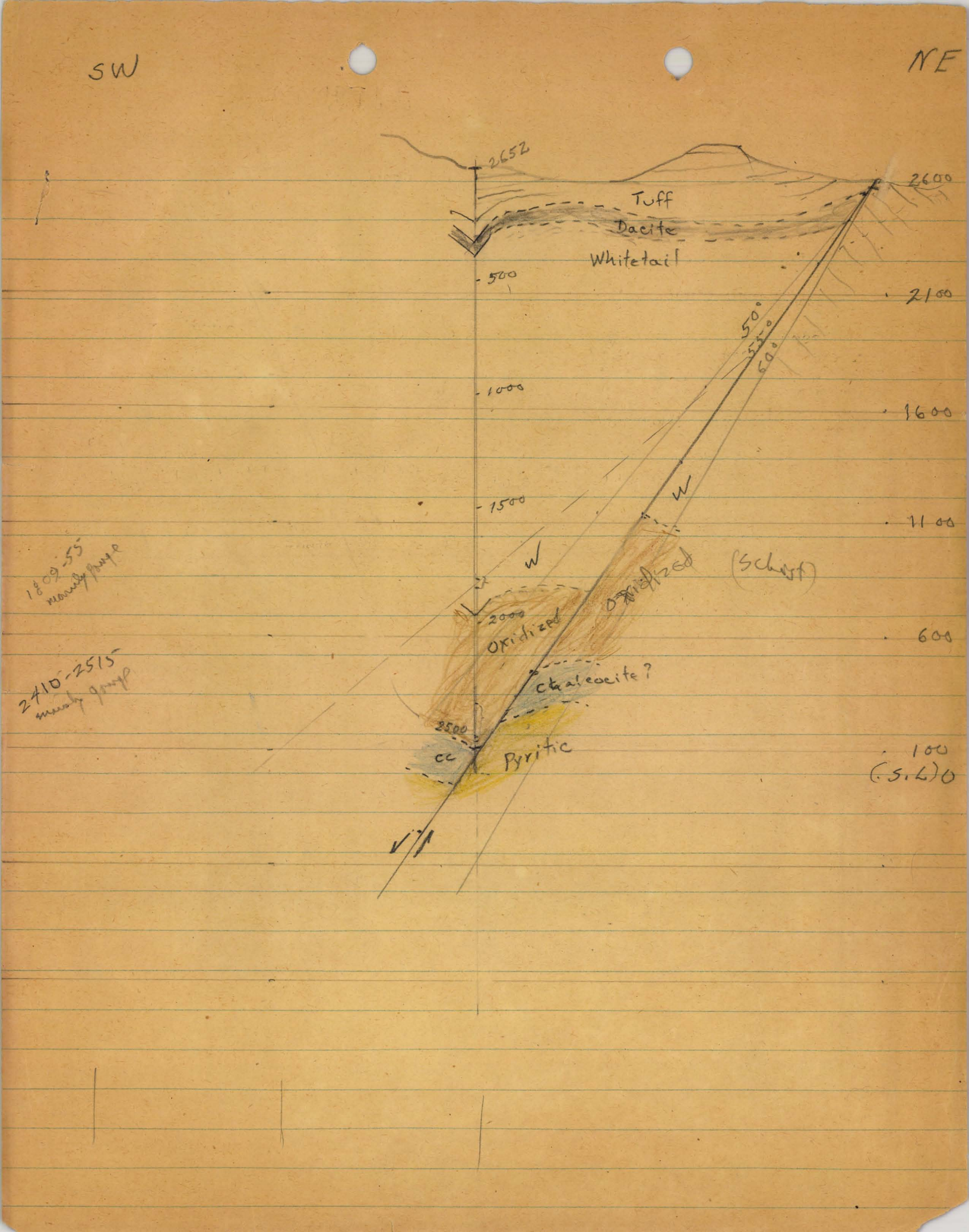
4. The prevailing east-northeast dip of the Whitetail, interpreted as initial or original dip augmented by deformation, suggests that the placer conglomerate was derived west-southwest of the Copper Butte mine.

The following points indicate that the Whitetail placer copper did not travel far from its original source:

1. The Whitetail pebbles or fragments are prevailingly angular.

2. Copper minerals would tend to be ground up and scattered, rather than concentrated, if subjected to such alluvial transportation, particularly in the rigorous environment of an alluvial fan. Chrysocolla has a lower specific gravity than most rocks.




SW
NE
2652
2600
Tuff
Dacite
Whitetail
500
2100
50°
55°
60°
1000
1600
1500
1100
W
W
(Schist)
2000
Oxidized
Oxidized
600
Chalcocite?
2500
cc
Pyritic
100
(.5.4)0
1809-55
2410-2515

2508 - 13 → Pannings show a little py -
" give Cu test

2542 - 49 → strong Cu no py > cp for B+Cu
2565 - 70 → strong " some py > " " " "

2600 - 09 → strong Cu some py
2631 - 40 → strong Cu much py
2646 - 51 → some Cu " "
2640 - 2646 med Cu " "

2518 - 24 → very little py - no Cu
2530 - 36 → no py - no Cu
2536 - 42 → no py → med Cu -

295 - dacite

1975 - 2055 - Red-brown
2055 - ~~2065~~ 2082 - very red cased to ab 2135

~~1840-45 - gg~~

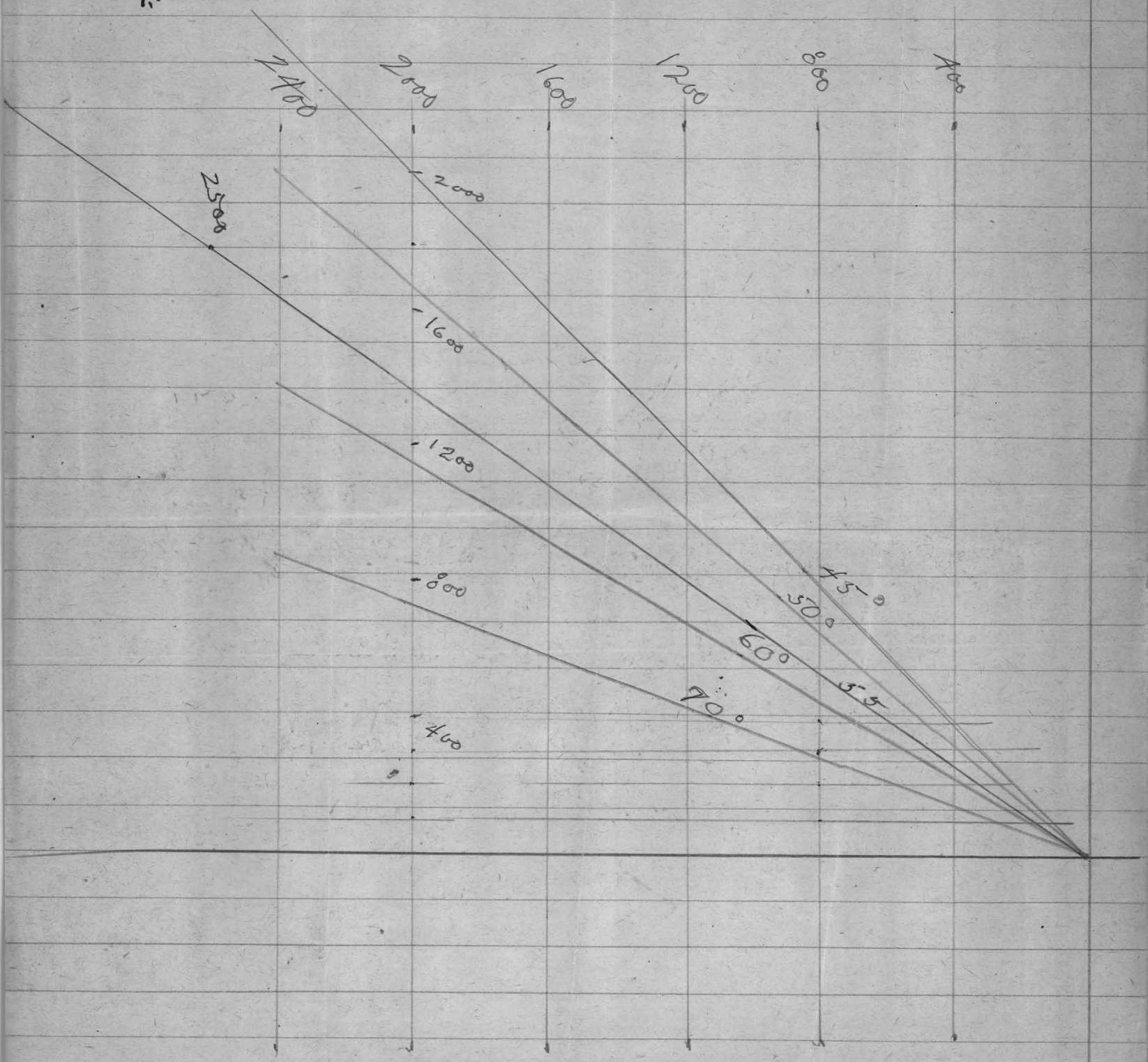
0 - 295 - tuff

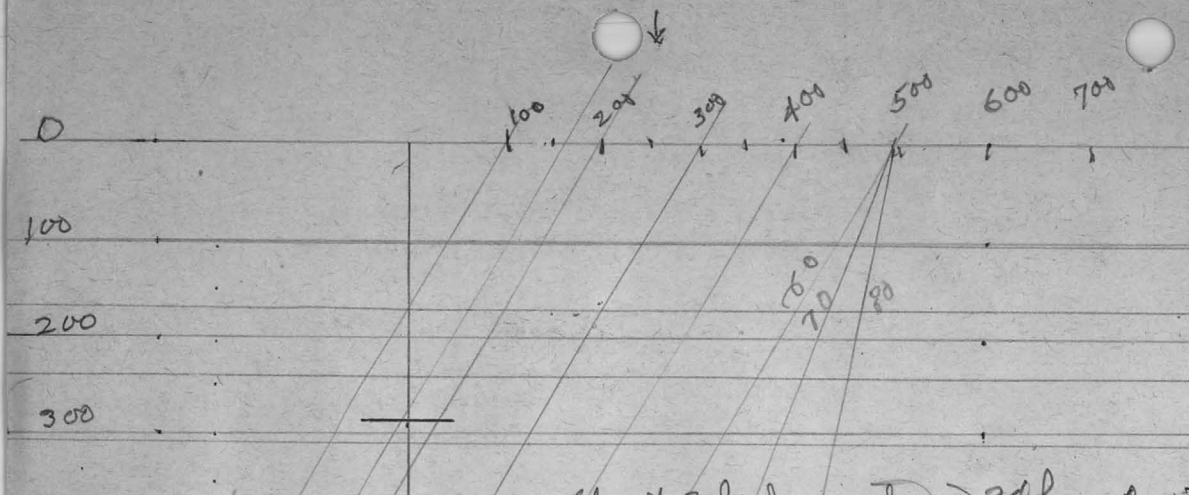
295 - 370± - dacite
370± - 1975 - whitelail, gray
1809 - 1855 - mostly gg
1855 - 1975 - wt brown gg
1975 - 1995 - Red-brown, schist
1995 - 2000 - Consid py, much gtz
2055 - 2082 - very red sch cased to ab 2135

2082 - 2410 - red-brown Sch
2410 - 2508 - mainly gg
2508 - 2518 - sch - pannings show a little py, give sl microchem test Cu
2518 - 2530 - " " " " " " no Cu
2530 - 2536 - sch no py - no Cu
2536 - 2542 sch no py - some (med) Cu -
2542 - 2549 sch Strong Cu - no py
2565 - 2570 sch Strong Cu - some py
2570 - 2600 - schist ~~no~~
2600 - 2609 sch Strong Cu some py
2609 - 2631 schist
2631 - 2640 sch Strong Cu much py
2640 - 2646 sch med Cu much py
2646 - 2651 sch Some Cu much py

tuff → ~~250-350~~ 295
dacite 400 - 550
whitetail 500 - 700

1,150 – 1600





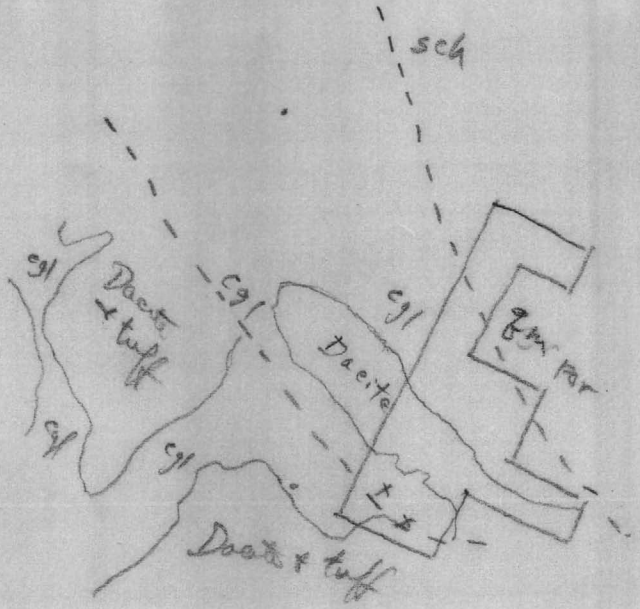
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600

2700?
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11

about 2 holes water in 24 hrs, 8-7-51

8-13-51 Rate 70' per day.

B.M. 3761
Teapot Mt.
Canyon
SILVER BELL MINE
Walnut Spring
B.M.
2838
Copper Canyon
10'
Granite Mt.
Smiths Ranch
Walnut Canyon
The Spine
RIVER
Cochran
(Ray 1/62500)
3500
3000
2500
2000


sch
cgl
Dacite + tuff
cgl
cgl
Dacite
cgl
cgl
Dacite + tuff

Purcell Churn-Drill Hole on Jim Group, Copper Butte Area

(Samples of drill cuttings examined by Eldred D. Wilson with binocular microscope in year 1951)

Depth, feet

0- 295 - Tuff.
295- 370*- Dacite.
370*-1809- Whitetail, gray.
1809-1855 - Much gouge.
1855-1975 - Whitetail.
1975-1995 - Red-brown, schist.
1995-2000 - Considerable pyrite, much quartz. Schist.
2000-2030 - Considerable pyrite, much quartz. Schist brownish.
2030-2055 - Schist brownish-red.
2055-2082 - Very red schist. Much quartz at 2080.
2082-2095 - Brownish-red schist.
2095-2125 - Brownish-red schist. Much quartz, some pyrite.
2125-2265 - Brownish-red schist. Cased to about 2135.
2265-2345 - Brownish-red schist, some pyrite.
2345-2410 - Brownish-red schist.
2410-2508 - Mainly gouge.
2508-2518 - Schist. Pannings show a little pyrite, give microchemical test for Cu.
2518-2530 - Schist. A little pyrite.
2530-2536 - Schist. No Cu.
2536-2542 - Schist. No pyrite, some Cu (by microchemical tests).
2542-2549 - Schist. No pyrite, strong Cu (by microchemical tests).
2549-2565 - Schist with some pyrite.
2565-2570 - Schist. Some pyrite, strong Cu (by microchemical tests).
2570-2600 - Schist.
2600-2609 - Schist. Strong Cu (by microchemical tests).
2609-2631 - Schist.
2631-2640 - Schist. Much pyrite, strong Cu (by microchemical tests).
2640-2651 - Schist. Much pyrite, some Cu (by microchemical tests).

*Plus or minus.

A S S A Y R E P O R T

Nov. 5, 1951

Mr. Jack Pardee

HOLE #1	SAMPLE NO.	%Cu.	Oz. Ag.	Oz. Au.
"	32	0.04	0.01	0.001
"	33	0.03		
"	34	0.06		
"	35	Tr	Tr	Tr
"	36	0.07		
"	37	0.01		
"	38	0.07		
"	39	0.03		
"	40	0.06	0.02	0.002
"	41	0.06		
"	42	0.04		
"	43	0.04		
"	44	0.02		
"	45	0.01	Tr	Tr
"	46	0.01		
"	47	0.04		
"	48	0.04		
"	49	0.04		
"	50	0.07	0.02	0.002
"	51	0.05		
"	52	0.06		
"	53	0.05		
"	54	0.04		
"	55	0.04	0.01	0.001
"	56	0.05		
"	57	0.04		
"	58	0.06		
"	59	0.05		
"	60	0.05	0.02	0.002
"	61	0.06		
"	62	0.05		
"	63	0.04		
"	64	0.05		
"	65	0.05	0.02	0.002

34 Assays for copper @ 75¢ $25.50
28 " " Ag.&Au.@ 1.00 28.00
$53.50

Remit to H.O.Coles
P.O.Box 1414
Miami, Arizona

Pd. J. Mck. P.

Hole 1

Sample No.

Nov. 27, 1951

66	.05	92	05
67	05	93	04
68	04	94	09
69	0 tr	95	08
70	07	96	1 tr
71	04	97	05
72	03	98	07
73	07	99	06
74	06	100	08
75	05	101	05
76	03	2577-2600	.11
77	0 tr	2600-2609	.10
78	0 tr	2609-2619	.14
79	06	2619-2631	.14
80	0 tr	2631-2640	.08
81	01	2640-2646	.06
82	03	2646-2651	.06
83	0 tr	2657-2656	.06
84	0 tr		
85	0 tr		
86	03		
87	03		
88	0 tr		
89	03		
90	0 tr		
91	0 tr		

Dec. 8

Hole Sample	Cu	Zn	Ag	Au
			oz.	oz
108	.04			
109	.04			
110	.05			
111	.07			
112	.05			
113	.05		tr	tr
114	.04			
115	.03			
116	.05	0.1		
117	.06	tr		
118	.03	tr	tr	tr
119	.03	0.1		
120	.05	tr		
121	.05	tr		
122	.07	tr		
123	.03	tr	tr	tr

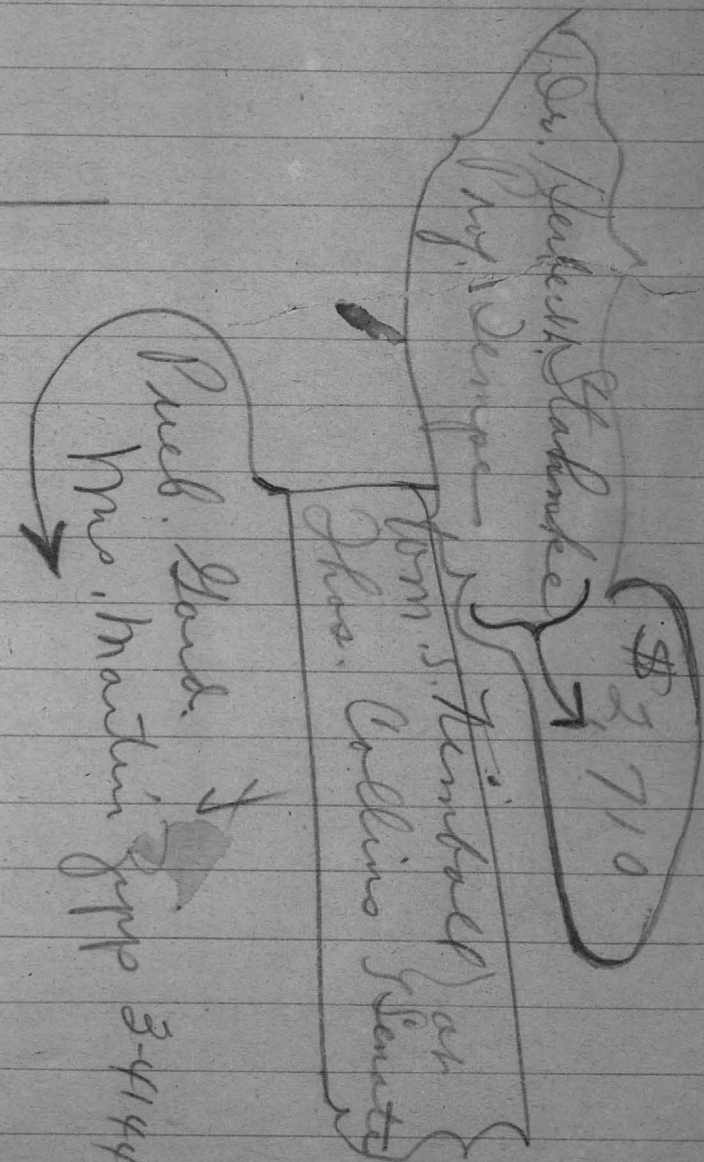
Jan. 11, 195-

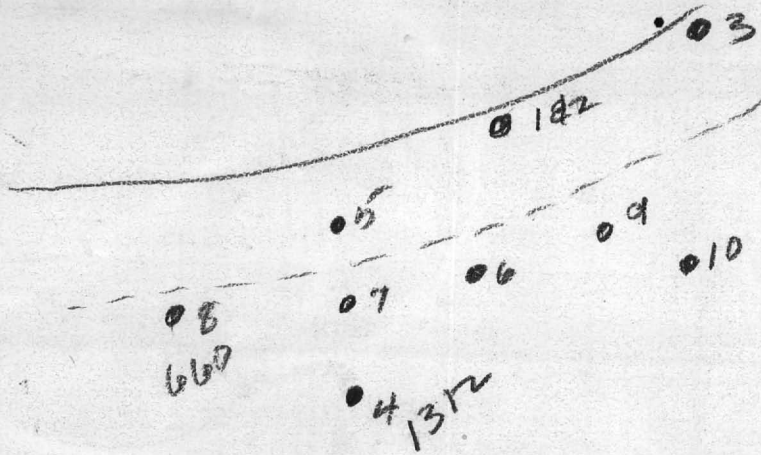
First Set

108	.07
109	.06
110	.07
111	.05
113	.05
115	.05
116	05
117	05
118	04
119	06
120	05
122	04
124	05
125	08
126	04
127	05
128	04
129	05
130	05
131	04
132	04
133	07
134	04
135	05
136	04
137	04
138	03
139	04
140	06
141	04
142	04

Exp Accts

1-10 - 1-31	59.29
2/1 - 2/7/x3	15.45
3/7 - 3/17	35.67
4/16 - 4/19	24.40
5/1 - 5/7	45.44 ?
6/1 - 6/9	27.55
7/x8 - 7/31	11.75
8/4 - 8/26	45.51
9/15/9/27	37.30
10/x - 10/x8	91.48
10/30 - 10/31	12.25
11/1 - 11/26	72.85
	498.94





105
MADE IN U. S. A.

WALNUT CANYON MINING COMPANY

D.D. Hole No.4

Location- 13,435N, 15,108E
Collar Elevation- 2,338 feet
Dip - Vertical
Drilling started- April 20, 1949
Hole completed at 1312 feet- August 2, 1949

NX Bit	0-962
BX "	962-1027
AX "	1027-1312

Core Recovery	Assay To Depth	%Cu	Description of Core
550' 100%	- - - -	- -	0-550': Dacite flow, with phenocrysts of quartz, feldspar and biotite in dense brownish pink groundmass. Scattered veinlets of calcite and of a white clay mineral (biedellite?) along irregular cracks and joints. Flow banding at 35 to 60 degrees to the hole, averaging between 40 and 45 degrees. About 546', a little green copper stain. A little iron-oxide and manganese oxide.
25' 100%	550-555	0.27	550-575': Same brownish pink dacite, but the irregular white veinlets of clay mineral show some copper stain and chrysocolla. Flow banding at 40 degrees to the hole.
	560	0.39	
	565	0.28	
	570	0.30	
	575	0.20	
62.7' 96.5%	580	0.60	575-640: Same buff to pink dacite. Chrysocolla and malachite occur at widely scattered intervals, associated with white clay mineral, along irregular joints and cracks. The veinlets do not show parallelism to each other or to the flow banding. In places, rock is weakly broken and brecciated and veinlets with copper are more numerous. Some veinlets of white carbonate also, but these contain little copper. A little green copper also occurs in very widely scattered spots in the rock, either in vesicles or in altered phenocrysts or inclusions. The rock is generally fresh and there is no evidence of hydrothermal alteration near the cupriferous veinlets.
	585	0.62	
	590	0.56	
	595	0.32	
	600	0.28	
	605	0.56	
	610	0.60	
	615	0.32	
	620	0.40	
	625	0.44	
	630	1.16	
	635	0.58	
	640	0.64	
104.7' 80.5%	650	0.28	640-770: Same buff to pink dacite, with flow banding at approximately 45 degrees to core. Some irregular veinlets of white clay mineral and of calcite. Little malachite and chrysocolla at widely separated intervals.
	660	0.28	
	670	0.28	
	680	0.26	
	690	0.26	

Note: Assays above 640 foot depth made from split core. Sludge assays below 640 feet.

WALNUT CANYON MINING COMPANY

D.D. Hole No. 4 - page 2

Core Recovery	Sludge Assay To Depth	%Cu	Description of Core
	690-700	0.26	640-770: (Assay results - continued)
	710	0.33	
	720	0.28	
	730	0.27	
	740	0.26	
	750	0.26	
	760	0.33	
	770	0.31	
69.3' 99%	780	0.38	770-840: Same rock and mineralization as recovered from 640 to 770 foot depth.
	790	0.39	
	800	0.38	
	810	0.40	
	820	0.36	
	830	0.36	
	840	0.32	
65' 100%	850	0.33	840-905: Same buff to pink dacite with white veinlets of quartz, chalcedony and clay mineral, locally containing a little malachite and chrysocolla. Flow banding at 45 degrees to 60 degrees to hole.
	860	0.32	
	870	0.37	
	880	0.37	
	890	0.37	
	900	0.33	
	910	0.36	
18' 100%	920	0.36	905-923: Black, glassy vitrophyre with some irregular areas of pink dacite. Little copper in the vitrophyre.
19.5' 85%	930	0.58	923-946: Rosy pink dacite with scattered angular schist fragments. Vague rock banding at 55 degrees to hole. The dacite lightens in color to grayish white at bottom and may be a welded tuff. Malachite and chrysocolla occur in three ways: associated with white veinlets of chalcedony, quartz, and clay mineral; in specks and blebs in rock; and in places in dacite around rims of schist fragments. The copper minerals are scattered and are not prominent.
	940	0.45	

WALNUT CANYON MINING COMPANY

D.D. Hole No. 4 - page 3

Core Recovery	Sludge To Depth	Assay %Cu	Description of Core
1.4' / 23%	940-952	0.52	946-952: Hard Whitetail conglomerate with sub-angular schist pebbles in a gray to brown matrix. Few white veinlets have a little green copper. Some reddish brown iron-oxide in the conglomerate.
3.8' / 6.9%	957	0.51	952-1007: (Whitetail conglomerate) Fragments recovered consist of coarse-grained granite and schist, with one fragment of gray porphyry at 985 and of quartzite at 990. At 963 feet is some limey, brown conglomerate matrix with seams of chrysocolla and malachite. Some of the granite shows brown iron-oxide in body of rock.
	962	0.66	
	BX casing to 962 feet		
	967	0.40	
	972	0.40	
	977	0.42	
	982	0.48	
	987	0.42	
	992	0.34	
	997	0.34	
	1002	0.40	
	1007	0.28	
			Below 1007 there is no visible copper in the core recovered. The low copper assays in the sludge were probably obtained from friable veinlets which did not core.
8' / 10%	1012	0.28	1007-1087: Every run has fragments of both schist and granite. Schist is generally fresh gray, except for iron-oxide on joints. Some granite shows brown iron-oxide in body of rock (Whitetail conglomerate.)
	1017	0.30	
	1022	0.30	
	1027	0.30	
	AX casing to 1027 feet		
	1032	0.14	
	1037	0.16	
	1042	0.16	
	1047	0.20	
	1052	0.16	
	1057	0.22	
	1062	0.29	
	1067	0.31	
	1072	0.30	
	1077	0.28	
	1082	0.34	
	1087	0.30	
	AX casing to 1087 feet		
1.3' / 6.5%	1092	0.34	1087-1107: Schist fragments only. (Probably Whitetail)
	1097	0.28	
	1102	0.22	
	1107	0.18	

WALNUT CANYON MINING COMPANY

D.D. Hole No. 4 - pg. 4

Core Recovery	Sludge Assay To Depth	%Cu	Description of Core
4.0' 20%	1107-1112	0.40	1107-1127: Definite brown conglomerate with angular schist pebbles (Whitetail).
	1117	0.25	
	1122	0.35	
	1127	0.30	
13.40' 12.75%	1132	0.16	1127-1232: Fragments recovered are quartz sericite schist, with definite conglomerate recovered at intervals. Conglomerate has red matrix and angular to sub-angular schist pebbles. Bedding is indefinite but suggestion is that lineation is at wide angle to core. No copper seen in core recovered. At 1115' an andesite porphyry fragment, and at 1230' a dark porphyry fragment (diabase?). The schist recovered is generally fresh but shows some red iron-oxide facings.
	1137	0.15	
	1142	0.11	
	1147	0.10	
	1152	0.12	
	1157	0.14	
	1162	0.17	
	1167	0.20	
	1172	0.21	
	1177	0.14	
	1182	0.14	
	1187	0.18	
	1192	0.16	
	1197	0.14	
	1202	0.14	
	1207	0.16	
	1212	0.17	
	1217	0.15	
	1222	0.16	
	1227	0.16	
	1232	0.18	
0.65' 2.6%	1237	0.18	1232-1257: Fragments of gray schist with some aplite at 1250 feet.(Probably Whitetail)
	AX casing to 1237 feet		
	1242	0.08	
	1247	0.10	
	1252	0.13	
	1257	0.08	
1.45' 7.25%	1262	0.08	1257-1277: Fragments of gray schist, some slightly bleached and altered schist, and a little aplite. Few specks of iron oxide. Driller reports sludge slightly more brown in color and rock softer. (Probably Whitetail).
	1267	0.07	
	1272	0.06	
	1277	0.07	
	1282	0.08	1277-1302: No core. Possibly West Fault.
	1287	0.08	
	1292	0.06	
	1297	0.05	
	1302	0.05	
1.35' 13.5%	1307	0.06	1302-1312: Quartz diorite fragments and cores.
	1312	0.04	

Hole completed at 1312 feet on August 2, 1949.

SUMMARY OF ASSAYS IN COPPER BUTTE HOLE 4

Depth		Vertical Interval	Assay Copper	Product
550-575'	- Core sample	25'	0.285%	7.2
575-640	- " "	65	0.545	35.4
640-710	- Sludge sample	70	0.279	19.5
710-770	- " "	60	0.285	17.1
770-840	- " "	70	0.370	25.9
840-920	- " "	80	0.351	28.1
920-946	- " "	26	0.508	13.4
550-946'	- TOTAL DACITE -	396'	0.370%	146.6
946-962	- Sludge sample	16	0.562	9.0
962-1002	- " "	40	0.400	16.0
1002-1027	- " "	25	0.310	7.3
1027-1057	- " "	30	0.173	5.2
1057-1127	- " "	70	0.296	20.7
1127-1177	- " "	50	0.150	7.5
1177-1237	- " "	60	0.156	9.3
1237-1277	- " "	40	0.084	3.3
1277-1312	- " "	35	0.060	2.1
946-1312	TOTAL CONGLOMERATE	366	0.219%	80.4
550-1312	COMPLETED HOLE	762	0.298%	227.0

- - - - - - - - - - -

Cumulative assays of various intervals -

Above 1/2% copper -	In dacite	575-640 - 65' at 0.55%
	At dacite-cong. contact	920-962 - 42' at 0.53%
Above 0.30% copper In dacite and conglomerate		575-1027 - 452' at 0.380%
Above 0.17% copper In dacite and conglomerate		550-1127 - 577' at 0.355%
Above 0.14% copper In dacite and conglomerate		550-1237 - 687' at 0.322%

WALNUT CANYON MINING COMPANY

D.D. Hole No. 4 - page 5

Summary of Hole

Core recovery in the dacite was excellent, approximating 100% for 946 feet of dacite cut in the hole. Although of less than mineable grade, the persistence of copper mineralization for almost seven hundred feet (687 feet averaging 0.322% copper) is notable.

Core Recovery	Sludge Assay To Depth	%Cu	Rock Type
100%	- - - - - - -		0-550: Pink dacite flow, with flow banding averaging about 45 degrees to the hole. Joints filled by veinlets of calcite and kaolinite.
92%	* 550-575	0.29	550-905: Pink dacite. Below 550 feet the veinlets carry copper oxide mineralization as chrysocolla, malachite, and as a light green stain in the kaolinite. Copper content of the dacite varies directly with the amount of fracture, and is most abundant where jointing approaches brecciation.
	* 575-640	0.544	
	640-740	0.28	
	740-900	0.35	
* Split core assayed from 550 to 640 foot depth.			
100%	900-923	0.36	905-923: Vitrophyre and buff dacite, together showing a coarsely banded structure. Joint fillings in vitrophyre show less copper mineralization than those in dacite.
85%	923-946	0.51	923-946: Rose pink dacite.
9.7%	946-962	0.56	946-1087: Whitetail conglomerate. Pebbles mainly gray schist, matrix is reddish brown sand.
	962-1002	0.40	
	1002-1042	0.24	
	1042-1087	0.27	
6.5%	1087-1107	0.26	1087-1107: Probably Whitetail conglomerate Core recovery slight, comprised of schist fragments, some showing red iron-oxide facings.
11.5%	1107-1147	0.23	1107-1277: Whitetail conglomerate. Small sections of conglomerate core containing pebbles in reddish brown sand matrix recovered intermittently to 1232 feet. The presence of granite and aplite pebbles with the schist pebbles recovered in intervening runs also indicates probable conglomerate.
	1147-1187	0.16	
	1187-1237	0.155	
	1237-1277	0.084	
	1277-1302	0.062	1277-1302: NO CORE - Possibly West Fault
13.5%	1302-1312	0.05	1302-1312: Quartz diorite fragments.(Basement?)

Hole completed at 1312 feet, August 2, 1949

Tucson, Arizona
September 20, 1949

Respectfully submitted,

Seton S. Williams

1/4 COR. 13 18 1/4 COR.

24 19

JIM #1 JIM #2 JIM #3 JIM #4 JIM #5 JIM #6 JIM #7 JIM #8 JIM #9 JIM #10 JIM #11 JIM #12 JIM #13 JIM #14 JIM #15 JIM #16 JIM #17 JIM #18 JIM #19 JIM #20 JIM #21 JIM #22 JIM #23 JIM #24 JIM #25 JIM #26 JIM #27 JIM #28 JIM #29 JIM #30 JIM #31 JIM #32 JIM #33 JIM #34 JIM #35 JIM #36 JIM #37 JIM #38 JIM #39 JIM #40 JIM #41 JIM #42 JIM #43 JIM #44 JIM #45 JIM #46

X SPRING

BLUFF

BLUFF

W.C. 200' S. OF TRUE COR.

W.C. 200' S. 59° 58' E. OF TRUE COR.

W.C. 200' S. 59° 58' E. OF TRUE COR.

CANYON

WALNUT

1/4 COR. 1/4 COR. 1/4 COR. 1/4 COR.

24 19
25 30

COPPER BUTTE #1 COPPER BUTTE #2 COPPER BUTTE #3 COPPER BUTTE #4 COPPER BUTTE #5 COPPER BUTTE #6 COPPER BUTTE #7

COPPER BUTTE PEAK & RIDGE

COCHISE COCHISE #2

OPEN PIT (WORKING)

JUNE BUG JUNE BUG #2

Road to Copper Butte Mine

Old Road

T. 3 S. R. 12 E.
T. 3 S. R. 13 E.

W — E
S

Approximate Location of D.D. Holes shown by red dots

° INDICATES CORNER, END & LOCATION MONUMENTS SET DURING MARCH & APRIL 1947
42 TO 46 INC. SET IN MAY 1947

MAP SHOWING

"JIM" GROUP OF MINING CLAIMS

LOCATED BY C.M. TAYLOR

IN MINERAL CREEK MINING DISTRICT

IN SECTIONS 24, 25, 19 & 30, T. 3 S., R. 12 & 13 E.

G. & S.R., B. & M., PINAL CO., ARIZONA

SCALE: ~1" = 500' APRIL 1947

BVR

T3S, R12E

T3S, R13E

14 13 / 23 24

18 17 / 19 20

23 24 / 26 25

19 20 / 30 29

Walnut Canyon

Qal — ALLUVIUM

Tr — RHYOLYTIC INTRUSIVE WITH SOME PORPHYRY

Tdt / Tc — TUFF (Tdt) INTERFORMATIONAL CONGLOMERATE (Tc)

Td — DACITE

Tw — WHITETAIL CONGLOMERATE (RED)

Tw — WHITETAIL CONGLOMERATE (GREY)

gp — GRANITE PORPHYRY WITH INTRUSIVES

pCs — SCHIST

ORE

VERTICAL BEDS

HORIZONTAL BEDS

SYNCLINE

STRIKE & DIP

"JIM" GROUP OF MININC CLAIMS

MINERAL CREEK MINING DISTRICT, PINAL CO., ARIZONA

1000' 500' 0 1000' 2000' 3000' 4000' 5000'

SCALE 1" = 1000'

CONTOUR INTERVAL - 100'

COPPER BUTTE CLAIMS ENCLOSED IN RED

21 APRIL 1947

C.G.R.

Colin Rose

Before 1948

NOTES ON THE GEOLOGY OF THE COPPER BUTTE AREA, ARIZONA

by Eldred D. Wilson, Geologist, Arizona Bureau of Mines

ROCKS

The rocks exposed in the Copper Butte area are as follows:

Tertiary	(Rhyolite porphyry plugs and dikes. (Tuff. (Intervolcanic (Gila?) conglomerate. (Dacite. (Whitetail conglomerate.
Unconformity	-
Late Cretaceous to Early Tertiary	(Quartz monzonite porphyry stocks and dikes. (Quartz diorite dikes.
Pre-Cambrian	- Pinal schist.

The Pinal schist, limited on the west by fault contact with Tertiary rocks, crops out in Walnut Canyon, north of Copper Butte, and in an overthrust plate southeast of the Copper Butte mine.

Dikes of quartz monzonite porphyry and quartz diorite intrude the schist.

Limiting the schist on the south, east of Copper Butte ridge, is an outcrop of light-colored porphyry more than a square mile in extent. This rock is lithologically similar to the quartz monzonite porphyry stock of Granite Mountain (described in U.S.G.S. Prof. Paper 115), with which it appears to be continuous. This outcrop is bounded on the west by fault contact with the Whitetail conglomerate of Copper Butte ridge.

As at Ray, the Paleozoic strata have been removed by pre-dacite erosion, and the Whitetail rests unconformably upon Pinal schist.

The general character of the Whitetail is described in the U. S. Bureau of Mines R.I. 3914. Deposited as alluvial fans or occupying hollows upon an irregular to rugged surface of erosion, the Whitetail is of variable thickness. In the north end of Copper Butte ridge it amounts to approximately 350 feet.

Dacite, with a maximum thickness of 450 or 500 feet, overlies the Whitetail conglomerate and in places overlaps older rocks. It rests upon an irregular surface of erosion and thins out in places.

The intervolcanic conglomerate overlies dacite west of Copper Butte and overlaps Whitetail where the dacite thins out. It resembles Gila conglomerate and evidently occupies a small local basin.

Tuff, in places 600 feet thick, overlies the intervolcanic conglomerate. As the tuff thins out in places, it probably was deposited after the dacite had undergone considerable erosion.

Plugs and dikes of glassy rhyolite porphyry cut through the tuff and older rocks in the vicinity of the high, round butte west of Walnut Creek.

STRUCTURE

The Whitetail prevailingly dips eastward or northeastward. Its inclination as a rule is 30°-35° but steepens

near faults and flattens under the eastern flank of Copper Butte ridge. In general the areal extent of the formation from east to west may be explained as duplication by step-faulting.

Folding and low-angle faulting are evident in the schist along Walnut Canyon, north of Copper Butte Ridge. Southeast of the mine, an inconspicuous overthrust brings schist over Whitetail.

The two most conspicuous faults of the area strike north-northwestward, dip about 60° westward, and flank both sides of Copper Butte ridge. The East fault brings quartz monzonite porphyry against Whitetail along the eastern flank of this ridge. The West fault, with a vertical displacement of possibly 450 feet southwest of the Copper Butte mine, drops tuff and dacite on the southwest against Whitetail and schist on the northeast.

A deep, sharp syncline, southwest of and subparallel to the West fault, shows prominently in the tuff and dacite.

COPPER DEPOSITS

Evidence for placer or alluvial origin of the Copper Butte deposit may be summarized as follows:

1. Subangular to slightly rounded fragments of schist in the Whitetail conglomerate show replacement by the oxidized copper minerals (chiefly chrysocolla).

2. The mineralization is largely discontinuous and limited to scattered fragments.

3. In places where local structures have afforded permeability, there have been some solution, migration, and redeposition of the copper, but the areas of staining exposed in the Whitetail as a rule are discontinuous and small. Drilling revealed that secondary copper mineralization occurs in the dacite within the deep, sharp syncline; that occurrence probably represents lateral and downward migration from the Whitetail.

4. Fragments of limestone in the conglomerate show no replacement by copper minerals except where the limited solution and migration are evident. It is readily observed that copper mineralization is poor or entirely absent where the conglomerate contains abundant limestone pebbles; this relation was demonstrated by the drilling results tabulated in the U. S. Bureau of Mines R.I. 3914. If the copper had been deposited from solutions, rather than as placer material, the limestone fragments should have been mineralized. On the contrary, the best ore is where the conglomerate consists chiefly of schist.

5. The ore shows no obvious relation to fissures.

6. The conglomerate, with its sandy to clayey cement, is relatively tight and impervious to solutions.

7. The conglomerate shows no hydrothermal alteration, no veins, and no open channels.

8. There is no known primary or hypogene copper mineralization anywhere in this region as young as the

Whitetail conglomerate; the primary deposits at Globe, Miami, Superior, and Ray are definitely pre-Whitetail in age.

9. It has been demonstrated (Ransome, U.S.G.S. Prof. Paper 115) that the Whitetail was formed during a long cycle of erosion, concurrently with the secondary enrichment at Ray, Miami, and Globe. At Miami, Ray, and Copper Butte, this erosion stripped away the Paleozoic rocks and cut into the pre-Cambrian schist. The outcrops of any ore bodies in the older rocks would, under very rapid erosion, have contributed oxidized fragments to the alluvial debris.

The conditions for such rapid erosion may have been provided by continuing fault movement, probably of overthrust or reverse type, within the area of hypogene or primary mineralization. In this region, intense compressive deformation culminated with intrusion of quartz monzonite porphyry, with which the primary mineralization was genetically connected. This compression continued to a limited or mild extent for some time after the porphyry invasion, as evidenced by the syncline affecting the tuff and by the low-angle fault which brings schist over Whitetail southeast of the mine.

Evidence that the copper-bearing Whitetail originated west-southwest of Copper Butte is as follows:

1. Copper in the Whitetail fades out to the north and east of the Copper Butte mine. On the south and west it is downthrown by the West fault. There is a little evidence of

FACSIMILE BOND

primary mineralization east of the West fault; pyrite is apparent in the porphyry at the northeast foot of Copper Butte Ridge, and the overthrust schist plate southeast of the mine shows an area of leached capping adjacent to the West fault.

2. Whitetail exposed in the canyons south of the mine shows no copper.

3. To the northwest, between Superior and Copper Butte, and also to the south across Gila River, the pre-Whitetail surface sloped east-northeastward.

4. The prevailing east-northeast dip of the Whitetail, interpreted as initial or original dip augmented by deformation, suggests that the placer conglomerate was derived west-southwest of the Copper Butte mine.

The following points indicate that the Whitetail placer copper did not travel far from its original source:

1. The Whitetail pebbles or fragments are prevailingly angular.

2. Copper minerals would tend to be ground up and scattered, rather than concentrated, if subjected to such alluvial transportation, particularly in the rigorous environment of an alluvial fan. Chrysocolla has a lower specific gravity than most rocks.