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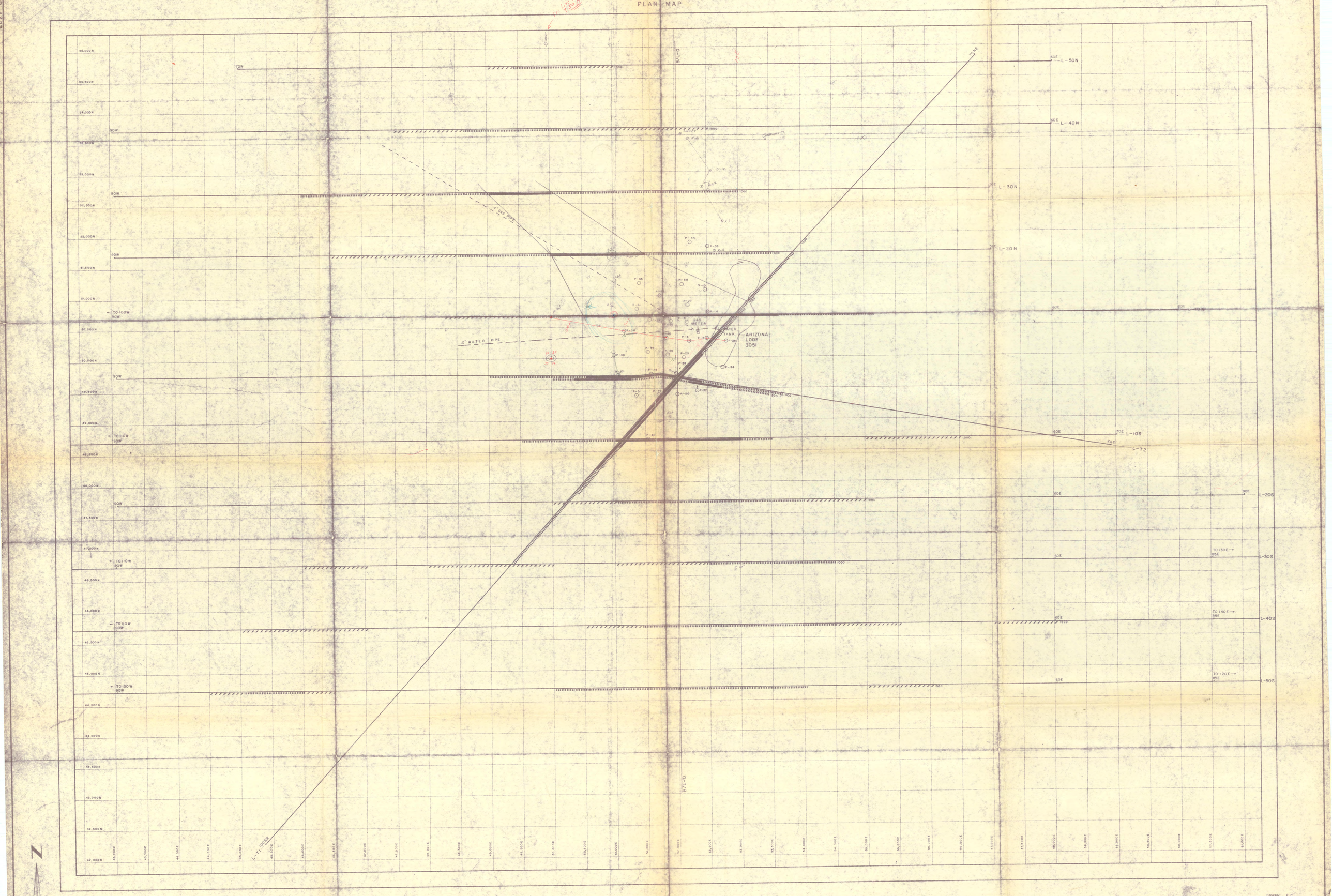
McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

PLAN MAP



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Number at the end of anomaly indicates spread used.

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

SCALE

ONE INCH EQUALS FIVE HUNDRED FEET

DRAWN: P.C.

DATE: JULY 1968

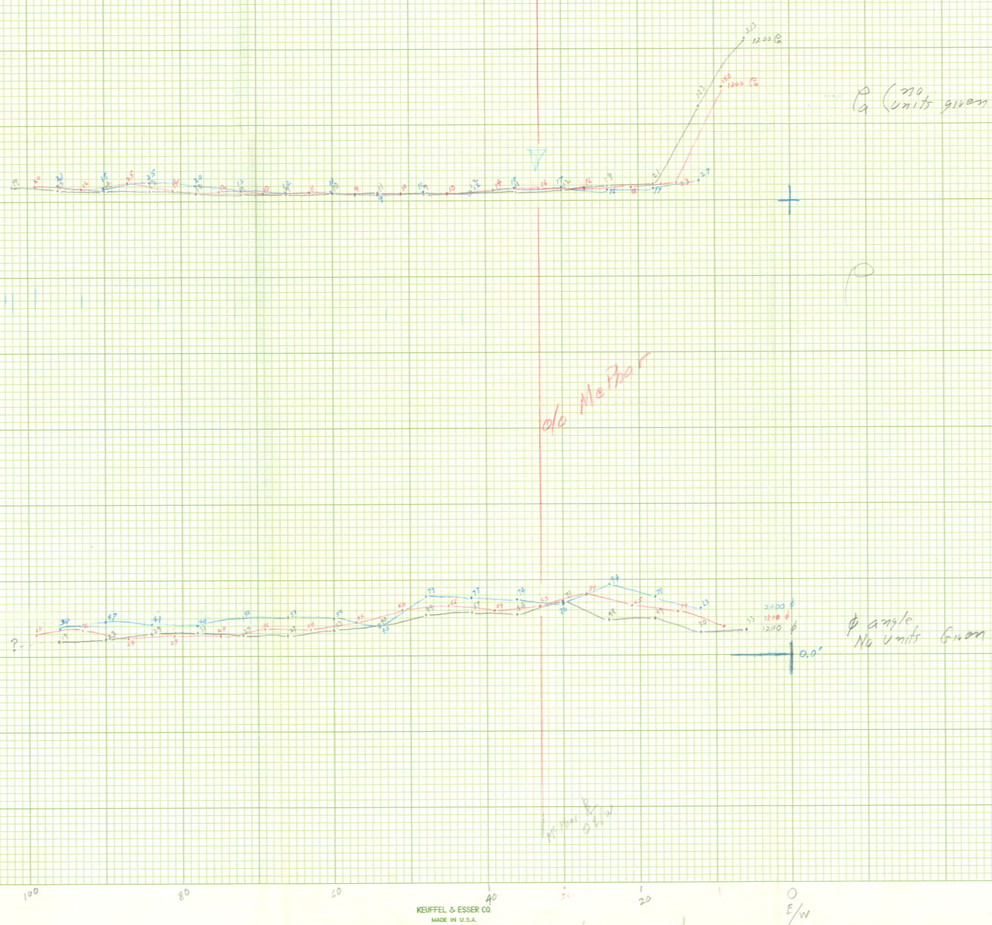
APPROVED:

DATE:

REGISTERED GEOLOGIST CERTIFICATE NO. 6788 BELL

DWG. IPP-4423

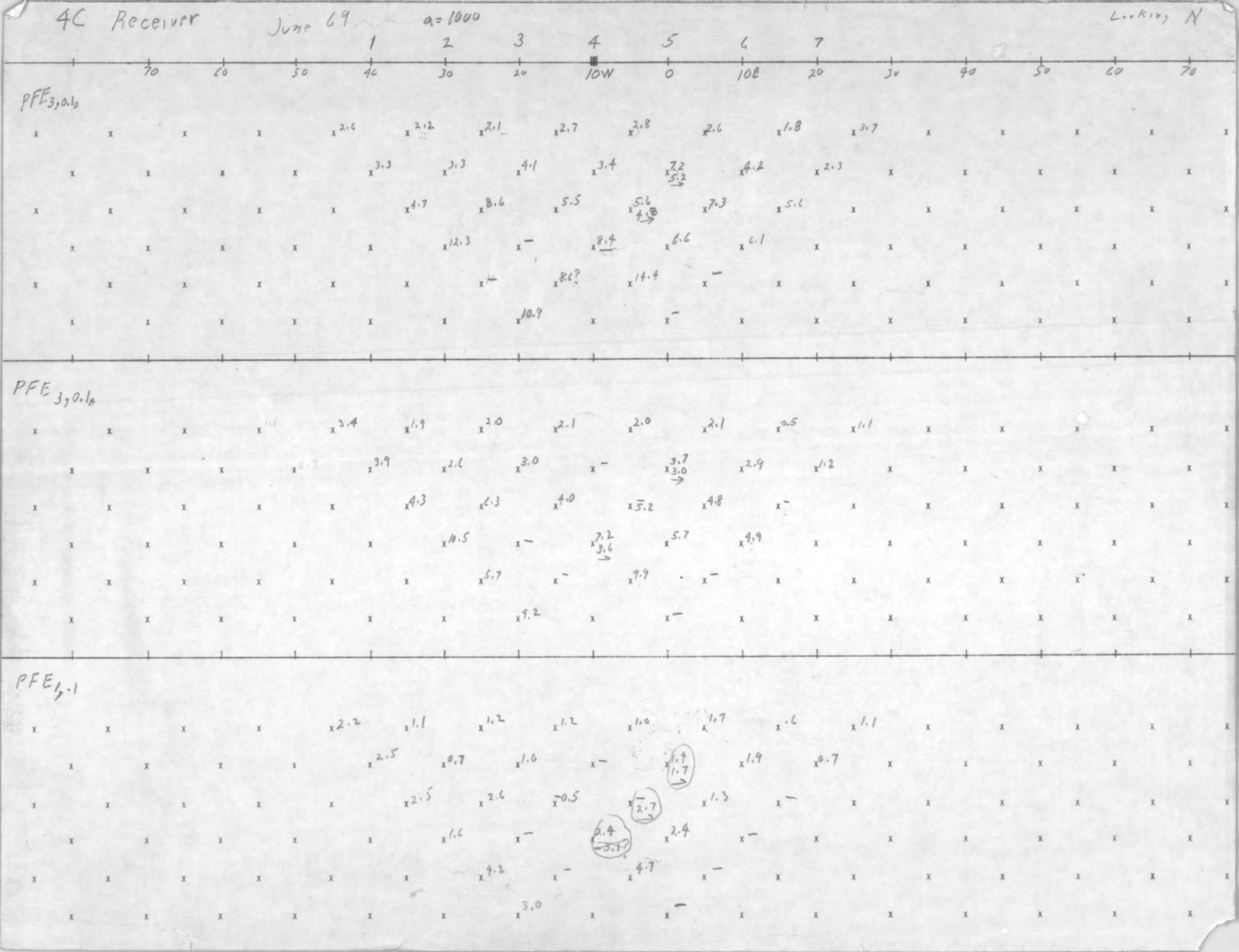
10 N)



KEUFFEL & ESSER CO.
MADE IN U.S.A.

KEUFFEL & ESSER CO.
MADE IN U.S.A.

Lake shore
Line 10 N


4C Receiver
June 69
a=1000
Looking N
1
2
3
4
5
6
7
70
60
50
40
30
20
10W
0
10E
20
30
40
50
60
70
PFE 3,0.1 D
PFE 3,0.1 A
PFE 1,.1

JOB Lakeshore 14K4C test LINE 10S SPREAD 1A

LOOKING N DATE Aug 27, 69 A= 500

CENTER -25.0 LABEL W/E FREQ. 1.0 - 0.1

COUPLING YES

2-19-70

MD

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore
LINE 105 HALF E SP. 1A DATE

PAGE Copy

SEND	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4
RECEIVE	20-25	20-15	—	10-15	—	—	5-10	—	—	—
RANGE										
DC 1	+2.1	+1.3	+1.1	+0.4	+0.5	+0.15	+0.7	+0.5	+0.3	+0.2
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	70.9	77.0	21.2	7.4	19.5	8.66	95.7	22.6	8.96	5.08
AC 2	+0.7	+0.4	+0.3	+0.2	0.0	+0.1	0.0	+0.2	0.0	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 105 HALF E SP. 18 DATE

PAGE Copy

SEND	6-7	5-6	5-4	3-4	6-7	5-6	4-5	3-4		cal
RECEIVE	0-5W	—	—	—	0-5E	—	—	—		
RANGE										
DC 1	-0.3	-0.3	-0.3	-0.3	+0.4	+0.3	+0.2	+0.1		+0.5
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	18.5	7.34	4.22	2.45	1.59	3.18	1.99	1.24		202.5
AC 2	0.0	0.0	0	+0.1	+0.6	+0.2	0.0	0.0		+1.4
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 105 SE 1A E½ Date: Copy

Send	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4		
Receive												
Time												
Range												
Current	9.0	8.0	9.0	8.0	8.0	9.0	8.0	8.0	8.0	9.0		
Send	6-7	5-6	5-4	3-4	6-7	5-6	4-5	3-4		Cal		
Receive												
Time												
Range												
Current	8.0	8.0	9.0	9.0	8.0 7.0	8.0	8.0	9.0		2.0		

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore
LINE 105 HALF W SP. 1A DATE

PAGE 2 of 7

SEND	6-7	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7
RECEIVE	25-30	30-35	———	35-40	———	———	40-45			
RANGE										
DC 1		+1.4	+1.0	+0.8	+0.6	+0.1	+0.6	+0.3	+0.1	-0.6
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		64.3	18.6	70.3	18.6	8.50	96.9	27.3	11.3	6.02
AC 2		+0.1	+0.1	+0.3	+0.2	+0.1	+0.4	+0.2	0.0	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 105 HALF W SP. 1A DATE

PAGE Copy

SEND	3-4	4-5	5-6	6-7	3-4	4-5	5-6	6-7		Cal
RECEIVE	45-50				50+55					
RANGE										
DC 1	-0.1	-0.3	-0.5	-0.7	-0.4	-0.7	-0.9	-0.9		-0.3
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	27.5	12.3	5.77	3.46	14.6	6.60	4.07	2.54		206
AC 2	+0.1	0.0	0.0	+0.1	0.0	0.0	0.0	+0.4		+0.8
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 105 sp 1A W½ Date: Copy

Send	6-7	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7		
Receive												
Time												
Range												
Current	8.0	8.0	8.0	8.0	8.0	8.0	9.0	9.0	8.0	8.0		
Send	3-4	4-5	5-6	6-7	3-4	4-5	5-6	6-7			cal	
Receive												
Time												
Range												
Current	9.0	9.0	8.0	8.0	9.0	8.0	8.0	8.0			2.0	

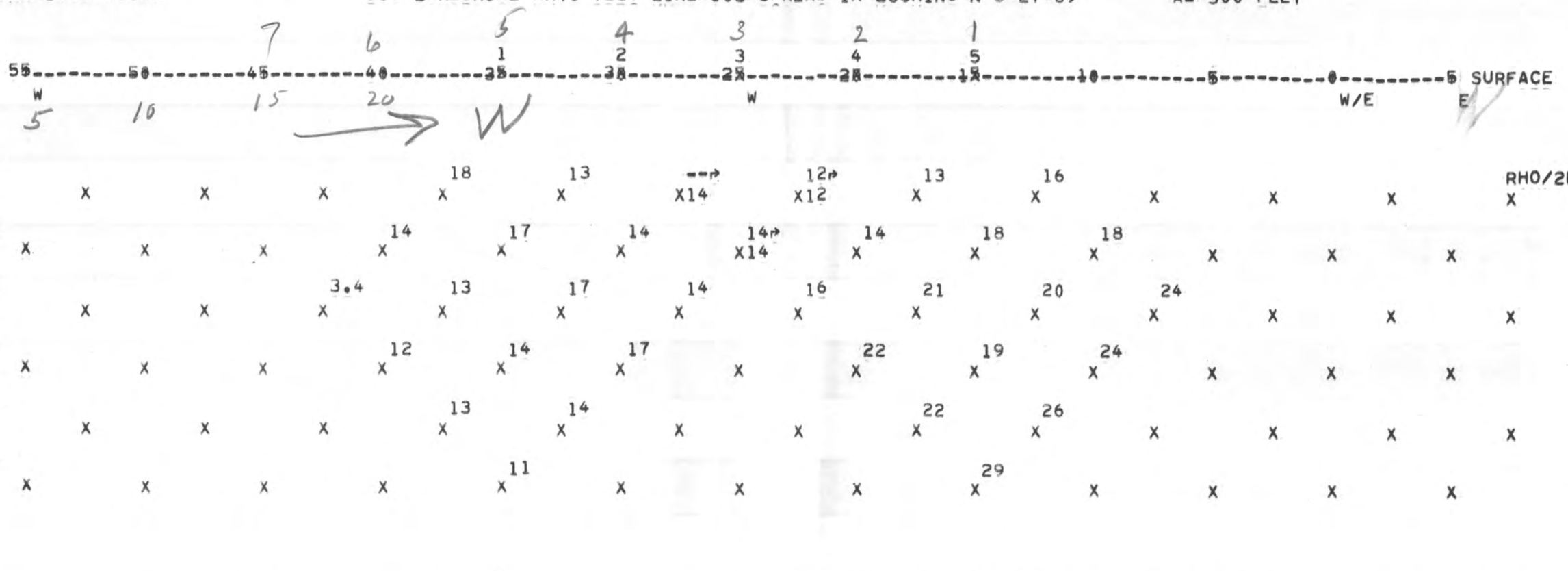
HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1A LOOKING N 8-27-69 A= 500 FEET

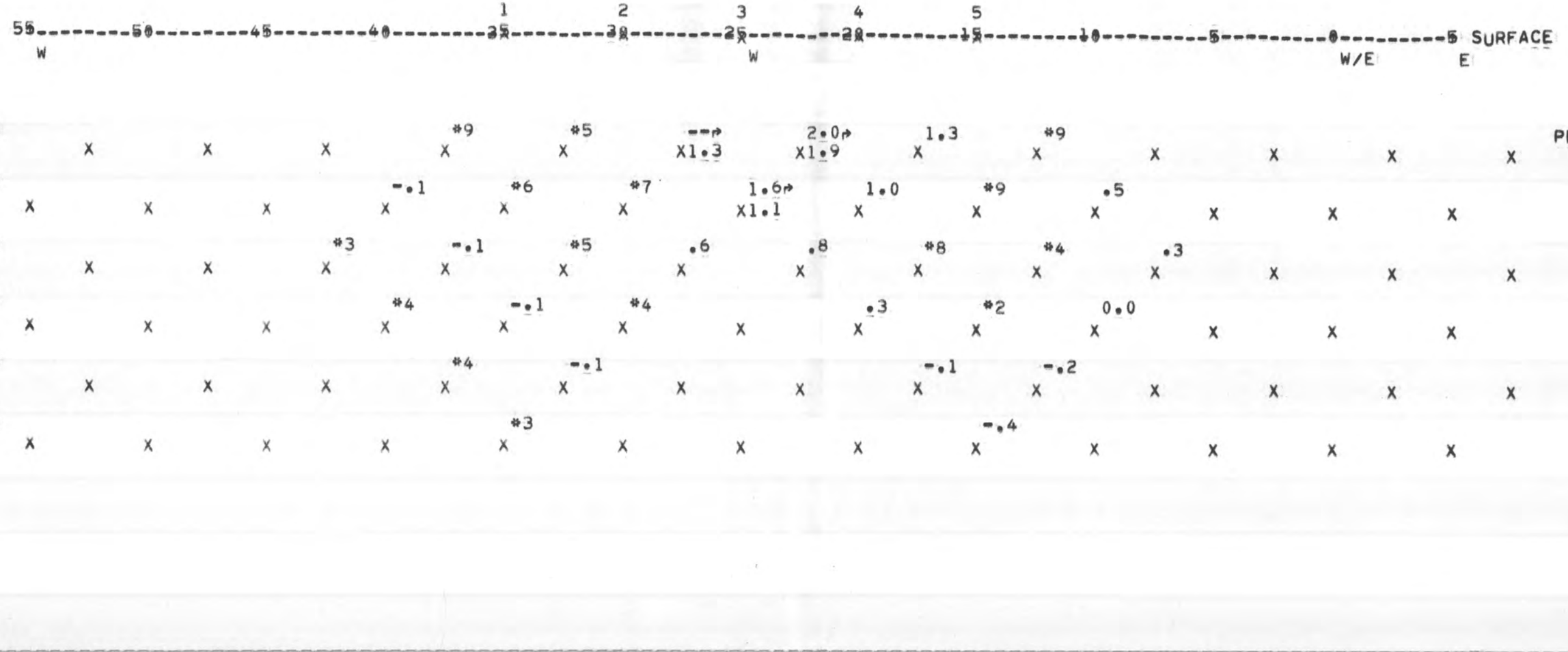
8 9 End for end

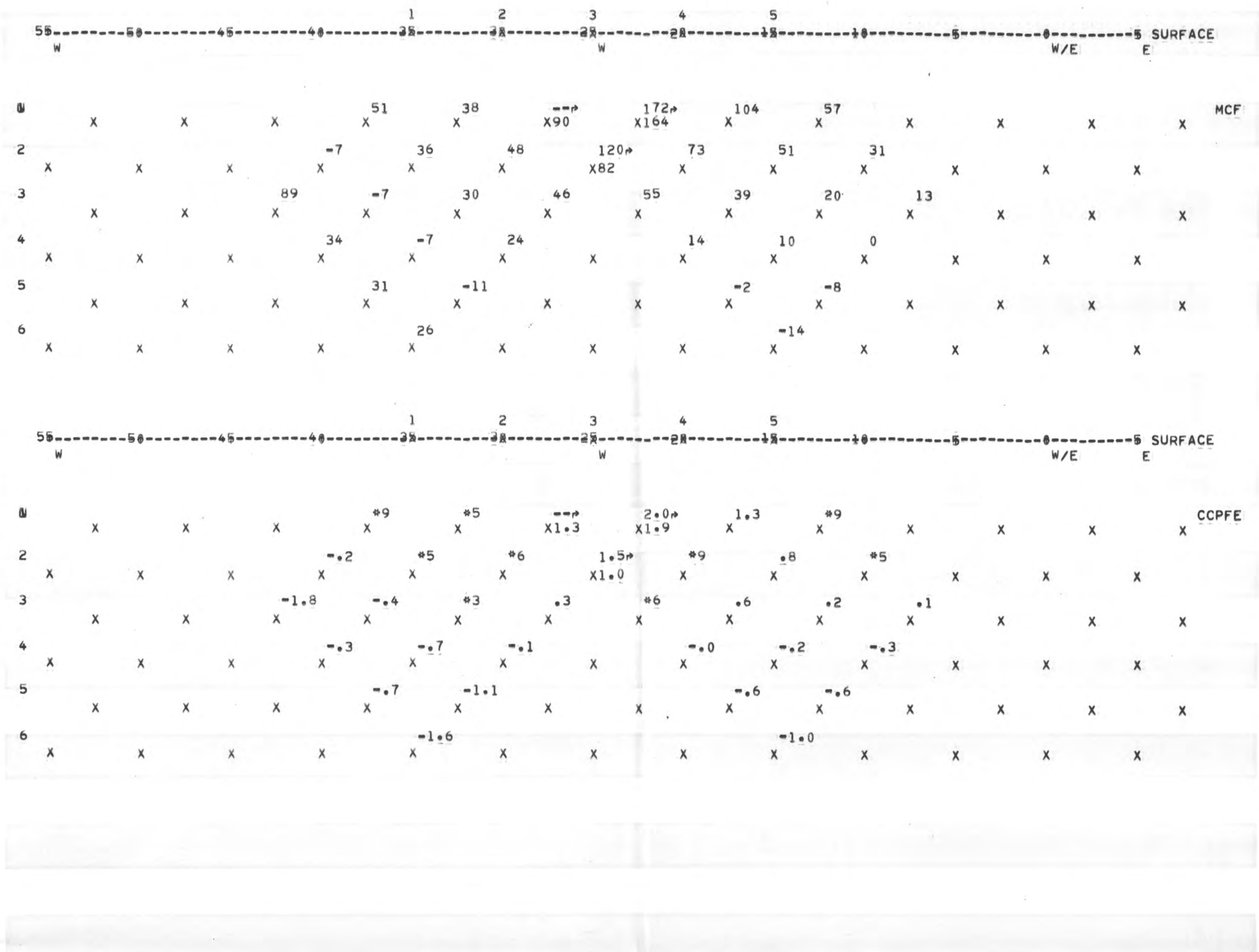
9.000	8.000	9.000	8.000	8.000	9.000	8.000	8.000	8.000	9.000	I	8.000	8.000	9.000	9.000	7.000	8.000	8.000	9.000	2.000		
21	13	11	4	5	5	7	5	3	2	DC	-3	-3	-3	-3	4	3	2	1	5	LEFT	
21	13	11	4	5	5	7	5	3	2		-3	-3	-3	-3	4	3	2	1	5	SIDE	
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6			
2.1	1.3	1.1	.4	.5	.5	.7	.5	.3	.2	PFEA	-.3	-.3	-.3	-.3	.4	.3	.2	.1	.5		
70.90	77.00	21.20	71.40	19.50	8.660	95.70	22.60	8.960	5.080	AC1	18.50	7.340	4.220	2.450	1.590	3.180	1.990	1.240	202.5		
.7	.4	.3	.2	0.0	.1	0.0	.2	0.0	0.0	AC2	0.0	0.0	0.0	.1	.6	.2	0.0	0.0	1.4		
71.15	77.15	21.23	71.47	19.50	8.664	95.70	22.62	8.960	5.080	ACA	18.50	7.340	4.220	2.451	1.595	3.183	1.990	1.240	203.9		
11.86	14.37	14.04	13.21	14.44	14.26	17.76	16.74	16.56	16.67	RHO	13.59	13.48	13.78	14.00	~~3.36~~ 12.12	11.75	12.86	11.39	.981	DC CAL	
1.9	1.3	1.1	.5	.7	.6	.9	.6	.5	.4	PFE	-.1	-.1	-.1	-.1	.3	.4	.4	.3	.200	AC CAL	
164	90	82	38	48	46	51	36	30	24	MCF	-7	-7	-7	-11	89	34	31	26			
.0	.0	.1	.0	.1	.3	0.0	.	.2	.5	CPFE	.1	.3	.6	1.0	2.1	.7	1.1	1.9			
1.9	1.3	1.0	.5	.6	.3	.9	.5	.3	-.1	CCPFE	-.2	-.4	-.7	-1.1	-1.8	-.3	-.7	-1.6			
161	88	73	35	40	24	51	30	15	-4	CCMCF	-18	-32	-51	-80	-532	-29	-53	-142			

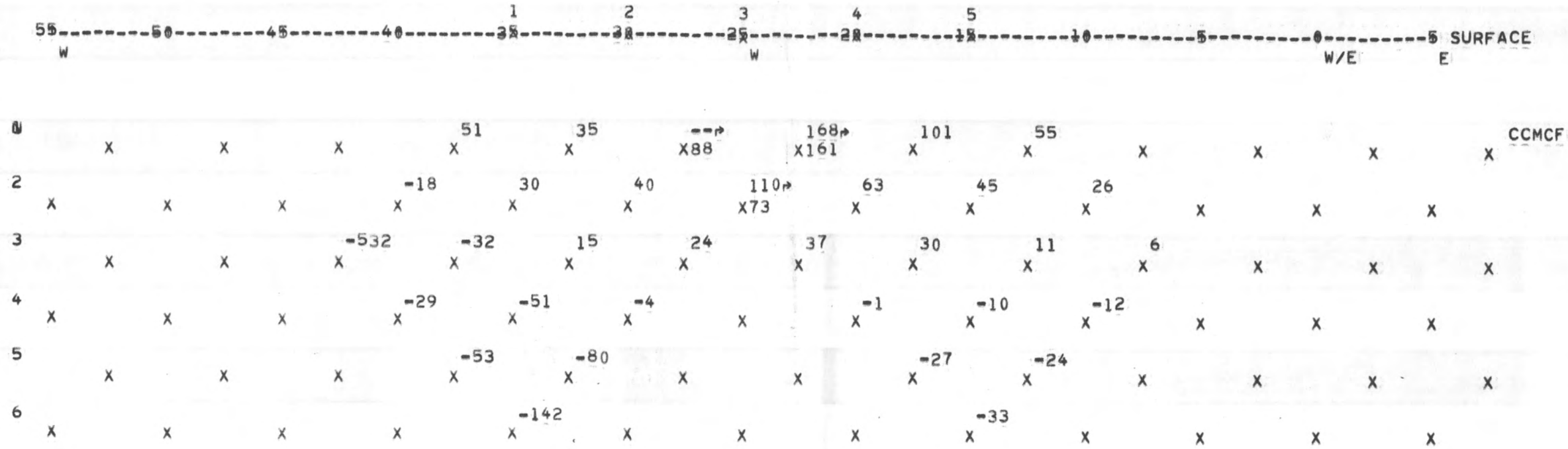
8.000	8.000	8.000	8.000	8.000	8.000	9.000	9.000	8.000	8.000	I	9.000	9.000	8.000	8.000	9.000	8.000	8.000	8.000	2.000		
14	10	8	4	2	4	3	1	-4	DC	-1	-3	-5	-7	-4	-7	-9	-9	-3	RIGHT		
14	10	8	4	2	4	3	1	-4		-1	-3	-5	-7	-4	-7	-9	-9	-3	SIDE		
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6			
0.0	1.4	1.0	.8	.4	.2	.4	.3	.1	-.4	PFEA	-.1	-.3	-.5	-.7	-.4	-.7	-.9	-.9	-.3		
0.000	64.30	18.60	70.30	18.60	8.500	96.90	27.30	11.30	6.020	AC1	27.50	12.30	5.270	3.400	14.60	6.600	4.070	2.840	206.0		
0.0	.1	.1	.3	.2	.1	.4	.2	0.0	0.0	AC2	.1	0.0	0.0	.1	0.0	0.0	0.0	.4	.8		
0.000	64.33	18.61	70.41	18.62	8.504	97.09	27.33	11.30	6.020	ACA	27.51	12.30	5.270	3.402	14.60	6.600	4.070	2.846	206.8		
*000.0	11.90	13.72	12.94	13.64	15.55	15.79	17.78	20.65	21.90	RHO	17.83	19.90	19.15	21.58	23.60	23.93	25.78	28.78	.967	DC CAL	
*000.0	2.0	1.6	1.3	1.0	.8	.9	.9	.8	.3	PFE	.5	.4	.2	-.1	.3	0.0	-.2	-.4	.700	AC CAL	
*0000.	172	120	104	73	55	57	5	39	14	MCF	31	20	10	-2	13	0	-8	-14			
0.0	.0	.1	.0	.1	.3	.0	.1	.2	.3	CPFE	.1	.2	.4	.5	.2	.3	.4	.6			
*000.0	2.0	1.5	1.3	.9	.6	.9	.8	.6	-.0	CCPFE	.5	.2	-.2	-.6	.1	-.3	-.6	-1.0			
*0000.	168	110	101	63	37	55	45	30	-1	CCMCF	26	11	-10	-27	6	-12	-24	-33			

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1A LOOKING N 8-27-69 A= 500 FEET






55 50 45 40 35 30 25 20 15 10 5 0 5
W W W/E E
SURFACE
0
51 38 172 104 57
MCF
2
-7 36 48 120 73 51 31
82
3
89 -7 30 46 55 39 20 13
4
34 -7 24 14 10 0
5
31 -11 -2 -8
6
26 -14
55 50 45 40 35 30 25 20 15 10 5 0 5
W W W/E E
SURFACE
0
*9 *5 2.0 1.3 *9
CCPFE
1.3 1.9
2
-.2 *5 *6 1.5 *9 .8 *5
1.0
3
-1.8 -.4 *3 .3 *6 .6 .2 .1
4
-.3 -.7 -.1 -.0 -.2 -.3
5
-.7 -1.1 -.6 -.6
6
-1.6 -1.0



1 2 3 4 5
55 50 45 40 35 30 25 20 15 10 5 0 5 SURFACE
W W W/E E
CCMCF
0 51 35 88 168 161 101 55
2 -18 30 40 110 73 63 45 26
3 -532 -32 15 24 37 30 11 6
4 -29 -51 -4 -1 -10 -12
5 -53 -80 -27 -24
6 -142 -33

MK4C Test

JOB Lakeshore LINE 105 SPREAD 1

LOOKING N DATE Aug 27, 19 A= 500 feet

CENTER -35.0 LABEL W / E FREQ. 1.0 - 0.1 ac

COUPLING yes

Copy

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 105 HALF W SP. 1 DATE

PAGE Copy

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	40-35	40-45	—	45-50	—	—	50-55	—	—	—
RANGE										
DC 1	+0.8	+0.4	+0.3	-0.2	-0.1	-0.3	-0.3	-0.3	-0.4	-0.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	70.3	96.9	27.3	100.0	27.5	12.3	124.0	25.2	14.6	6.60
AC 2	+0.3	+0.4	+0.2	+0.2	+0.1	0.0	+0.3	+0.1	0.0	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 105 HALF W SP. 1 DATE

PAGE Copy

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal
RECEIVE	55-60	—	—	—	60-65	—	—	—		
RANGE										
DC 1	-0.3	-0.7	-0.9	-0.9	-0.6	-1.6	-1.7	-1.2		-0.3
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	40.3	14.6	10.0	4.73	14.6	5.80	4.31	2.51		206
AC 2	+0.4	+0.2	0	+0.3	-0.0	-0.4	0.0	+0.1		+0.8
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 105 SP1 W1/2 Date: Copy

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
Receive												
Time												
Range												
Current	8.0	9.0	9.0	7.0	9.0	9.0	7.0	7.0	9.9	8.0		
Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal		
Receive												
Time												
Range												
Current	70	7.0	9.0	8.0	7.0	7.0	9.0	8.0		2.		

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore
LINE 105 HALF E SP. 1 DATE

PAGE
copy

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	30-35	30-25	—	20-25	—	—	15-20	—	—	—
RANGE										
DC 1		+1.9	+1.4	+2.1	+0.9	+0.4	+1.3	+1.1	+0.5	+0.3
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		61.1	18.2	70.9	15.9	7.72	77.0	21.2	7.63	4.65
AC 2		+0.3	+0.1	+0.7	+0.2	0.0	+0.4	+0.3	+0.1	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10S HALF E SP. L DATE

PAGE Copy

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
RECEIVE	10-15	—	—	—	5-10	—	—	—		6-7
RANGE										
DC 1	+0.5	+0.5	0.0	0.0	+0.3	+0.2	-0.3	-0.1		+0.5
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	19.5	8.66	4.08	2.23	8.96	5.08	2.69	1.90		202.5
AC 2	0.0	+0.1	0.0	+0.1	0.0	0.0	-0.2	+0.2		1.4
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 105 E1/2 SP1 Date: Cg/4

Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		
Receive												
Time												
Range												
Current	1.0	7.0	6.0	9.0	7.0	6.0	8.0	9.0	7.0	6.0		
Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		cal		
Receive												
Time												
Range												
Current	8.0	9.0	7.0	6.0	8.0	9.0	7.0	6.0		2.0		

JOB Lake Shore LINE 10 S SPREAD Sp1

LOOKING North DATE 8-27,29-69 A= 500'

CENTER -30.0 LABEL W/E FREQ. 1.0 - .1
dual ac

COUPLING yes

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore Test

LINE 10 S HALF W SP. 1 DATE 8-27-29

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	30-35W	→	35-40W	→	→	40-45W	→	→	→	
RANGE	1	1	1	1	.1	1	1	1	.1	
DC 1	+1.4	+1.0	+0.8	+0.4	+0.1	+0.4	+0.3	+0.1	-0.4	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	64.3	18.6	70.3	18.6	8.50	96.9	27.3	11.3	6.02	
AC 2	+0.1	+0.1	+0.3	+0.2	+0.1	+0.4	+0.2	0	0	
AC AVG.										
S.P.	-6.2		-15.5			+22.1				
AC NOISE	.05		.05			.06				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10S HALF W SP. 1 DATE 5-27-79

SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6
RECEIVE	45-50W	→	→	→	→	50-55W	→	→	→	→
RANGE	10	1	1	.1	.1	10	1	1	.1	.1
DC 1	-0.2	-0.1	-0.3	-0.5	-0.7	-0.3	-0.3	-0.4	-0.7	-0.9
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	100	27.5	12.3	5.27	3.40	12.4	25.2	14.6	6.60	4.07
AC 2	+0.2	+0.1	0	0	+0.1	+0.3	+0.1	0	0	0
AC AVG.										
S.P.	-3.7					+9.8				
AC NOISE	.06					.06				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10-5 HALF W SP. 1 DATE 1-27-89

SEND	6-7	1-2	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5
RECEIVE	50-55W	55-60W	→				60-65W	→		
RANGE	.1	1	1	1	.1	.1	1	.1	.1	.1
DC 1	-0.9	-0.3	-0.7	-0.9	-0.9	-1.5	-0.6	-1.6	-1.7	-1.2
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	2.84	40.3	14.6	10.0	4.73	3.09	14.6	5.80	4.31	2.51
AC 2	+0.4	+0.4	+0.2	0	+0.3	-0.4	-0	-0.4	0	+0.1
AC AVG.										
S.P.		+9.0					-8.7			
AC NOISE		.06					.09			
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore Test

LINE 10-S HALF W SP. 1 DATE 8-27-79

PAGE 4

SEND	1-2	2-3	3-4	1-2	2-3	1-2		cal		
RECEIVE	65-70W →			70-75W →		75-80W		1-2		
RANGE	1	.1	.1	.1	.1	.1		10		
DC 1	-1.1	-0.9	-1.3	-0.7	-1.0	-0.6		-0.3		
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	10.3	5.12	4.14	5.06	3.12	4.39		206		
AC 2	+0.2	+0.1	-0.1	+0.2	0	-0.2		+0.8		
AC AVG.										
S.P.	-20.1			-5.4		+27.6				
AC NOISE	.09			.13		.12				
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10S HALF W SP. 1 DATE 8-27-79

SEND	5-6 X	6-7	4-5	5-6	6-7	3-4 X	4-5	5-6	6-7	2-3
RECEIVE	30-35W	→	35-40W	→	→	40-45W	→	→	→	45-50W
RANGE	20x400	20x400	20x400	20x400	20x400	20x450	20x450	20x400	20x400	20x350
VOLTAGE	420	460	395	420	455	425	440	420	455	430
CURRENT	8.0 10x500	7.0 10x500	7.0 10x500	8.0 10x500	8.0 10x500	9.0 10x500	9.0 10x500	8.0 10x500	8.0 10x500	7.0 10x500
SEND	3-4	4-5	5-6	6-7	1-2 X	2-3	3-4	4-5	5-6	6-7
RECEIVE	→	→	→	→	50-55W	→	→	→	→	→
RANGE	20x450	20x450	20x400	20x400	20x350	20x350	20x450	20x450	20x400	20x400
VOLTAGE	420	440	420	455	455	430	420	385	415	450
CURRENT	9.0 10x500	9.0 10x500	8.0 10x500	8.0 10x500	7.0 10x500	7.0 10x500	9.0 10x500	8.0 10x500	8.0 10x500	8.0 10x500

FREQUENCIES 1.0 .1

SENDER NO. 16815

OPERATOR Gary Cruze

RECEIVER NO. Mark 4C

OPERATOR Ron Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 105 HALF W SP. 1 DATE 8-27-26

SEND	1-2	2-3	3-4	4-5	5-6	1-2X	2-3	3-4	4-5	
RECEIVE	55-60W	→	→	→	→	60-65W	→	→	→	
RANGE	20X350	20X350	20X450	20X400	20X400	20X350	20X350	20X450	20X400	
VOLTAGE	450	430	420	380	410	450	425	415	380	
CURRENT	7.0 10X500	7.8 10X500	9.0 10X500	8.0 10X500	8.0 10X500	7.0 10X500	7.0 10X500	9.0 10X500	8.0 10X500	
SEND	1-2☆	2-3	3-4	1-2X	2-3	1-2			cal	
RECEIVE	65-70W	→	→	70-75W	→	75-80W			1-2	
RANGE	20X300	20X350	20X450	20X300	20X350	20X300			20X200	
VOLTAGE	495 400	420	410	495	420	490			155	
CURRENT	6.0 10X500	7.0 10X500	9.0 10X500	6.0 10X500	7.0 10X500	6.0 10X500			2.0 10X500	

FREQUENCIES 1.0 .1

SENDER NO. 16681-5

OPERATOR Gary Cruze

RECEIVER NO. Mark 4C

OPERATOR Ron Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore test

LINE 105 HALF E SP. 1 DATE 6-27-29

SEND	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	
RECEIVE	30-25W	→	25-20W	→	→	20-15W	→	→	→	
RANGE	1	1	1	1	.1	1	1	.1	.1	
DC 1	+1.9	+1.4	+2.1	+0.9	+0.4	+1.3	+1.1	+0.5	+0.3	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	61.1	18.2	70.9	15.9	7.72	77.0	21.2	7.63	4.65	
AC 2	+0.3	+0.1	+0.7	+0.2	0	+0.4	+0.3	+0.1	0	
AC AVG.										
S.P.	+2.4		-10.5			+23.4				
AC NOISE	.04		.05			.05				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

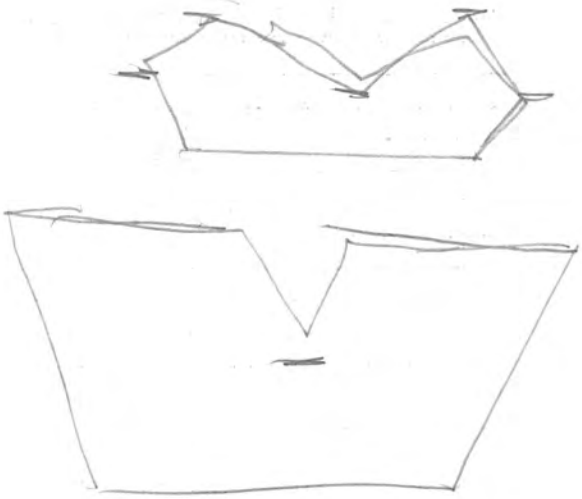
PROJECT Lake Shore Test
LINE 105 HALF E SP. 1 DATE 9-27-79

SEND	5-6	4-5	3-4	2-3	1-2	6-7	5-6	4-5	3-4	2-3
RECEIVE	15-10 W	→	→	→	→	10-5 W	→	→	→	→
RANGE	1	1	.1	.1	.1	1	1	.1	.1	.1
DC 1	+0.4	+0.5	+0.5	0	0	+0.7	+0.5	+0.3	+0.2	-0.3
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	71.4	19.5	8.66	4.08	2.73	95.7	22.6	8.96	5.08	2.69
AC 2	+0.2	0	+0.1	0	+0.1	0	+0.2	0	0	-0.2
AC AVG.										
S.P.	+20.8					-74.1				
AC NOISE	.06					.06				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10 S HALF E SP. 1 DATE 9-27-29

SEND	1-2	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4
RECEIVE	10-5W	5W-0	———	———	———	——→	0-5E	———	———	——→
RANGE	.1	1	.1	.1	.1	.1	.1	.1	.1	.1
DC 1	−0.1	−0.3	−0.3	−0.3	−0.3	−0.6	+0.4	+0.3	+0.2	+0.1
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	1.90	18.5	7.34	4.22	2.45	1.43	6.59	3.18	1.99	1.24
AC 2	+0.2	0	0	0	+0.1	0	+0.6	+0.2	0	0
AC AVG.										
S.P.		+85.0					−9.7			
AC NOISE		.07					.09			
POT RES.							Powerline at	"0"		



HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore Test

LINE 105 HALF E SP. 1 DATE 1-27-

PAGE 8

SEND	6-7	5-6	4-5	6-7	5-6	6-7		cal		
RECEIVE	5-10 E	→	→	10-15E	→	15-20E		6-7		
RANGE	.1	.1	.1	.1	.1	.1		10		
DC 1	-0.1	-0.1	-0.3	+0.2	-0.4	+1.9		+0.5		
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	4.10	2.24	1.55	1.54	1.01	1.45		202.5		
AC 2	+0.6	+0.3	0	0	+0.1	+0.4		+1.4		
AC AVG.										
S.P.	+3.7			+22.5		+10.0				
AC NOISE	.07			.09		.08				
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10 N HALF E SP. 1 DATE 8-27-25

SEND	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	5-6
RECEIVE	30-25W	→	25-20W	→	→	20-15W	→	→	→	15-10W
RANGE	20x350	20x300	20x450	20x350	20x300	20x400	20x450	20x350	20x300	20x400
VOLTAGE	440	495	425	420	490	370	420	420	490	400
CURRENT	7.0 10x500	6.5 10x500	9.0 10x500	7.0 10x500	6.0 10x500	8.0 10x500	9.0 10x500	7.0 10x500	6.0 10x500	8.0 10x500
SEND	4-5	3-4	2-3	1-2	6-7	5-6	4-5	3-4	2-3	1-2
RECEIVE	→	→	→	→	10-5W	→	→	→	→	→
RANGE	20x400	20x450	20x350	20x300	20x400	20x400	20x400	20x450	20x350	20x300
VOLTAGE	370	415	420	490	450	400	370	410	420	490
CURRENT	8.0 10x500	9.0 10x500	7.0 10x500	6.0 10x500	8.0 10x500	8.0 10x500	8.0 10x500	9.0 10x500	7.0 10x500	6.0 10x500

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore test

LINE 10 S HALF E SP. 1 DATE 5-27-2

PAGE 8

SEND	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4	
RECEIVE	5-0W				→	0-5E			→	
RANGE	20×400	20×400	20×450	20×450	20×350	20×400	20×400	20×450	20×450	
VOLTAGE	445	405	425	415	425	445	400	420	415	
CURRENT	8 10×500	8 10×500	9 10×500	9 10×500	7 10×500	8 10×500	8 10×500	9 10×500	9 10×500	
SEND	6-7	5-6	4-5	6-7	5-6	6-7		Cal		
RECEIVE	5-10E		→	10-15E	→	15-20E		6-7		
RANGE	20×400	20×400	20×450	20×400	20×400	20×400		10×200		
VOLTAGE	445	400	420	445	400	445		110		
CURRENT	8 10×500	8 10×500	9 10×500	8 10×500	8 10×500	8 10×500		2.0 10×500		

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1 LOOKING N 8-27-69 A= 500 FEET

1.0 - 0.1 ac

8.000	9.000	9.000	7.000	9.000	9.000	7.000	7.000	9.000	8.000	I	7.000	7.000	9.000	8.000	7.000	7.000	9.000	8.000	2.000	
8	4	3	-2	-1	-3	-3	-3	-4	-7	DC	-3	-7	-9	-9	-6	-16	-17	-12	-3	LEFT
8	4	3	-2	-1	-3	-3	-3	-4	-7		-3	-7	-9	-9	-6	-16	-17	-12	-3	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
.8	.4	.3	-.2	-.1	-.3	-.3	-.3	-.4	-.7	PFEA	-.3	-.7	-.9	-.9	-.6	-1.6	-1.7	-1.2	-.3	
70.30	96.90	27.30	100.0	27.50	12.30	124.0	25.20	14.60	6.600	AC1	40.30	14.60	10.00	4.730	14.60	5.800	4.310	2.510	206.0	
.3	.4	.2	.2	.1	0.0	.3	.1	0.0	0.0	AC2	.4	.2	0.0	.3	0.0	-.4	0.0	.1	.8	
70.41	97.09	27.33	100.1	27.51	12.30	124.2	25.21	14.60	6.600	ACA	40.38	14.61	10.00	4.737	14.60	5.788	4.310	2.511	206.8	
12.94	15.79	17.78	20.83	17.83	19.90	25.80	20.97	23.60	23.93	RHO	33.54	30.25	32.17	29.96	30.28	23.82	24.07	25.36	.967	DC CAL
1.3	.9	.9	.4	.5	.4	.2	.3	.3	0.0	PFE	.2	-.1	-.2	-.3	.1	-.7	-1.0	-.5	.700	AC CAL
104	57	51	19	31	20	10	17	13	0	MCF	6	-3	-6	-12	3	-29	-42	-22		

1.000	7.000	6.000	9.000	7.000	6.000	8.000	9.000	7.000	6.000	I	8.000	9.000	7.000	6.000	8.000	9.000	7.000	6.000	2.000	
19	14	21	9	4	13	11	5	3		DC	5	5	0	0	3	2	-3	-1	5	RIGHT
19	14	21	9	4	13	11	5	3			5	5	0	0	3	2	-3	-1	5	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	1.9	1.4	2.1	.9	.4	1.3	1.1	.5	.3	PFEA	.5	.5	0.0	0.0	.3	.2	-.3	-.1	.5	
0.000	61.10	18.20	70.90	15.90	7.720	77.00	21.20	7.630	4.650	AC1	19.50	8.660	4.080	2.730	8.960	5.080	2.690	1.900	202.5	
0.0	.3	.1	.7	.2	0.0	.4	.3	.1	0.0	AC2	0.0	.1	0.0	.1	0.0	0.0	-.2	.2	1.4	
0.000	61.19	18.21	71.15	15.92	7.720	77.15	21.23	7.634	4.650	ACA	19.50	8.664	4.080	2.731	8.960	5.080	2.687	1.902	203.9	
*000.0	13.11	18.14	11.86	13.51	19.04	14.37	14.04	16.15	22.92	RHO	14.44	14.26	17.18	23.48	16.56	16.67	19.77	26.12	.981	DC CAL
*000.0	1.9	1.5	1.9	1.0	.6	1.3	1.1	.6	.5	PFE	.7	.6	.2	.1	.5	.4	.0	-.0	.200	AC CAL
*0000.	149	85	164	74	32	90	82	40	22	MCF	48	46	12	6	30	24	0	-0		

JOB Lakeshore MK 4C LINE 10 S SPREAD 1

LOOKING N DATE Nov 26, 69 A= 1500 feet

CENTER -10.0 LABEL W/E FREQ. 1.0 - 0.1

COUPLING yes

M & D
12/1/69

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKE SHORE
LINE 105 HALF W SP. 1 DATE 11/26

PAGE

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	30W-45W	15W →	30W	30W	→	45W	45W	→	→	60W
RANGE	1.0	1.0	0.1	1.0	0.1	0.1	1.0	1.0	0.1	0.1
DC 1.3	1.0	.6	1.9	.5	.9	2.3	.4	.6	1.8	2.6
DC 2.1	3.0	1.9	3.5	1.2	1.7	4.2	1.0	1.3	2.6	5.2
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.			2.85							
AC 1.0	12.7	19.8	2.85	29.7	7.34	2.34	30.7	10.8	3.73	1.77
AC 2.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0
AC AVG.										
S.P.	+27.5	+26.8		+17.8			-17.1			
AC NOISE										
POT RES.		1 K								

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKE SHORE
LINE 105 HALF W SP. 1 DATE 11/26

PAGE

SEND	1-2	2-5	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	60W →	→	→	75W	75W →	→	→	900W	3-4	
RANGE	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0	
DC 1 .3	.6	1.2	1.6	5.0	.6	2.2	1.9	4.2	0.3	
DC 2 .1	1.2	2.5	4.0±1	6.4	2.0	4.4	3.2	6.4	1.2	
DC 3	1.6									
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1.0	9.13	6.66	2.23	1.40	4.20	3.15	1.33	1.04	138.	
AC 2.0	0.0	0.0	0.0±.4	1.0	0.0	0.0	0.0	0.0±.6	0.9	
AC AVG.										
S.P. +	34.7				+17.4					
AC NOISE										
POT RES.										

4.8

7electrode Spread

3.0-.1

HEINRICHS GEOEX JOB LAKESHORE MK 4C TEST LINE 10N SPREAD 1 LOOKING N 6/69 A= 1000 FEET

1.000	3.000	3.000	3.000	3.000	5.000	3.000	4.000	5.000	5.000	I	4.000	5.000	6.000	4.000	4.000	5.000	7.000	6.000	1.000	
	9	29	14	0	22	22	12	60	-55	DC	76	160		-5	15	24		33	0	LEFT
	33	84	22	46	75	-12	54	60	184		-23	10		18	35	7		-18	-19	SIDE
	9	41	16	10	64	36	3	14	2		58	165		0	40	14		38		
	30	90	19	92	24	-6	56	70	114		-32	-40		19	44	5		-21		
	13	40	19	-65	75	33	14	6	55		85	210		-6	24	21		43		
	28	86	16	128	14	-12	42	70	74		-40	0		-5	40	0		-25		
	14	44	19	-59	77	34	18	20	58		75	100		18	15	25		44		
	30	70	14	92	27	0	48	56	127		2	60		-11	62	-4		-26		
															9	24		47		
															60	12		-27		
															23	0		48		
															55	6		-30		
															24	19		50		
															35	3		-26		
															35	195		51		
															50	2				
																21				
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	2.1	6.2	1.8	2.8	5.0	1.2	3.1	4.3	7.5	pFEA	2.3	7.9	0.0	.5	3.6	2.2	0.0	1.0	-.9	
0.000	15.65	5.280	15.90	3.210	3.470	16.20	3.990	1.410	1.660	AC1	5.730	2.010	0.000	1.590	2.680	1.250	0.000	1.540	99.60	
0.0	.5	.3	.2	-.1	.2	.1	-.3	-1.4	-.3	AC2	.2	.6	0.0	0.0	-.4	-.2	0.0	0.0	0.0	
0.000	15.69	5.288	15.92	3.208	3.473	16.21	3.984	1.400	1.658	ACA	5.736	2.016	0.000	1.590	2.675	1.249	0.000	1.540	99.60	
*000.0	16.19	25.72	16.40	13.38	22.16	16.61	12.50	8.93	21.68	RHO	17.82	13.19	*000.0	42.52	21.09	15.53	*000.0	44.13	1.004	DC CAL
*000.0	2.8	7.0	2.6	3.8	5.9	2.1	4.2	5.9	8.6	PFE	3.2	8.6	*000.0	1.5	4.7	3.2	*000.0	1.9	.950	AC CAL
*0000.	172	308	161	286	266	126	336	661	395	MCF	178	651	*0000.	34	223	209	*0000.	44		
0.0	.9	2.0	.9	3.9	4.5	.9	4.2	13.4	8.1	CPFE	2.7	8.4	0.0	5.6	4.7	12.0	0.0	7.9		
*000.0	1.9	5.0	1.7	-.1	1.4	1.2	-.0	-7.5	.5	CCPFE	.5	.2	*000.0	-4.1	-.0	-8.8	*000.0	-5.9		
*0000.	116	221	106	-4	65	73	-2	-835	23	CCMCF	26	14	*0000.	-97	-1	-567	*0000.	-134		

1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	I	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
										DC										RIGHT
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PFEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	AC1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	RIGHT
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	ACA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	RIGHT
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	RHO	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		R DC CAL
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	PFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	-0.000	AC CAL
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	MCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CPFE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	CCPFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	CCMCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 05 HALF W SP. 1 DATE 11/26/82

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-15W	15-30	→	30-45	→	→	45-60	→	→	→
RANGE	Hi	→	→	→	→	Lo	Hi	→	→	Lo
VOLTAGE	440	440	440	340	430	500	400	340	410	500
CURRENT	4.0	6.0	4.0	6.0	6.0	4.5	5.0	6.0	6.0	4.5
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal 3-4
RECEIVE	60-75	→	→	→	75-91	→	→	→		
RANGE	Hi	Hi	Hi	Lo	Hi	Hi	Hi	Lo		
VOLTAGE	370	460	430	500	400	430	420	500		120
CURRENT	4.5	8.0	6.0	4.5	5.0	7.5	6.0	4.5		2.0

FREQUENCIES 10 0.3 0.1

SENDER NO. 6644-S

OPERATOR MARK

RECEIVER NO. MK 4C

OPERATOR Mike P.

COMMENTS:

0.1 @ 10 W

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKE SHORE
LINE 105 HALF E SP. 1 DATE 11/25

PAGE

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	60E	00E	15E	15E →		30E	30E	→	→	45E
RANGE	1.0	1.0	0.1	1.0	0.1	0.1	1.0	1.0	0.1	0.1
DC 1 .3	.7	.9	1.8	1.5	2.0	2.8	1.2	1.1	-.6	2.2
DC 2 .1	1.7	2.2	3.3	3.2	3.6	4.4	2.2	2.1	.6	3.5
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1 1.0	19.9	18.7	4.26	34.5	29.9	4.3	73.3	10.3	4.7	2.88
AC 2 1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-2.0	0.0
AC AVG.										
S.P.	-17.5	+35.7		+13.0			+16.6			
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKE SHORE
LINE 10S HALF E SP. 1 DATE 11/25

PAGE

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL 1	
RECEIVE	45E	→	→	60E	60E	→	→	75E	2-3	
RANGE	1.0								10	
DC 1 .3									0.2	
DC 2 .1									1.0	
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1 1.0	28.8								19%	
AC 2 1.0									0.0	
AC AVG.										
S.P.	+6.1									
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 105 HALF E SP. L DATE 11/25/68

PAGE 1

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-15 E	15-30	→	30-45	→	→	45-60	→	→	→
RANGE	Hi									
VOLTAGE	490	350	495	430	340	490	420	430	320	485
CURRENT	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal. 2-3
RECEIVE	60-75	→	→	→	75-90	→	→	→		
RANGE										Hi
VOLTAGE			Generator		Went		Out			110
CURRENT										2.0

FREQUENCIES 1.0, 0.3, 0.1

SENDER NO. 6644-5

OPERATOR WTR

RECEIVER NO. MK 4c

OPERATOR Mike P.

COMMENTS:

0.10 @ 10W

Sending

AC — 1.0

DC — 0.3 0.1

HEINRICHS GEOEX JOB LAKESHORE MK4C LINE 10S SPREAD 1 LOOKING N 11/26/69 A= 1500 FEET

4.000	6.000	4.000	6.000	6.000	4.500	5.000	6.000	6.000	4.500		I	4.500	8.000	6.000	4.500	5.000	7.500	6.000	4.500	2.000	
30	19	35	12	17	42	10	13	26	52		DC	16	25	40	64	20	44	32	64	12	LEFT
30	19	35	12	17	42	10	13	26	52			16	25	40	64	20	44	32	64	12	SIDE
1	1	2	1	2	3	1	2	3	4		N	2	3	4	5	3	4	5	6		
3.0	1.9	3.5	1.2	1.7	4.2	1.0	1.3	2.6	5.2		PFEA	1.6	2.5	4.0	6.4	2.0	4.4	3.2	6.4	1.2	
12.70	19.80	2.850	29.70	7.340	2.340	30.70	10.80	3.730	1.770		AC1	9.130	6.660	2.230	1.400	4.200	3.150	1.330	1.040	198.0	
0.0	0.0	0.0	0.0	.1	.1	0.0	0.0	.2	0.0		AC2	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	.1	
12.70	19.80	2.850	29.70	7.344	2.341	30.70	10.80	3.734	1.770		ACA	9.130	6.660	2.230	1.407	4.200	3.150	1.330	1.040	198.1	
14.69	15.10	13.25	22.50	22.35	24.35	27.85	32.76	28.65	37.19		RHO	37.04	38.33	34.73	52.08	38.49	39.40	35.97	61.89	1.010	DC CAL
1.9	.8	2.4	.1	.5	3.0	-.1	.2	1.4	4.0		PFE	.5	1.4	2.8	4.7	.9	3.2	2.0	5.2	-1.150	AC CAL
126	50	177	2	22	123	-5	5	47	109		MCF	12	35	82	91	22	82	57	85		
.7	.7	2.7	.4	1.4	2.8	.3	.8	2.2	2.9		CPFE	.7	1.5	3.2	3.0	1.5	2.7	4.8	3.6		
1.1	.1	-.4	-.3	-.9	.2	-.4	-.7	-.9	1.1		CCPFE	-.3	-.2	-.3	1.7	-.7	.6	-2.8	1.6		
78	4	-29	-16	-40	10	-16	-21	-31	31		CCMCF	-7	-5	-9	33	-18	14	-77	26		

6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000		I	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	2.000	
17	22	33	32	36	44	22	21	6	35		DC	10								10	RIGHT
17	22	33	32	36	44	22	21	6	35			10								10	SIDE
1	1	2	1	2	3	1	2	3	4		N	2	3	4	5	3	4	5	6		
1.7	2.2	3.3	3.2	3.6	4.4	2.2	2.1	.6	3.5		PFEA	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	
19.90	18.70	4.260	34.50	8.990	4.300	73.30	10.30	4.770	2.880		AC1	28.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	197.0	
.1	0.0	0.0	0.0	0.0	0.0	.1	0.0	-2.0	0.0		AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
19.91	18.70	4.260	34.50	8.990	4.300	73.34	10.30	4.722	2.880		ACA	28.80	0.000	0.000	0.000	0.000	0.000	0.000	0.000	197.0	
15.26	14.41	13.27	26.85	28.09	33.85	56.48	31.72	36.17	44.95		RHO	87.72*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0								1.015	DC CAL
.6	1.2	2.3	2.2	2.6	3.4	1.1	1.1	.6	2.5		PFE	0.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0								-1.000	AC CAL
43	83	173	82	93	100	20	35	17	56		MCF	0*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.									
.7	.7	2.7	.3	1.0	1.8	.1	.9	1.7	2.3		CPFE	.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
-.0	.5	-.4	1.9	1.6	1.6	1.0	.2	-1.1	.2		CCPFE	-.2*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0									
-2	33	-33	70	56	47	18	7	-29	5		CCMCF	-3*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.									

ENGINEERED FOR HIGH SPEED PRINTERS
BUSINESS FORMS PRINTING COMPANY

JOB Lakeshore MK 4C Test LINE 105 SPREAD 1

LOOKING N DATE Feb 5, 70 A= 1000 feet

CENTER -20.0 LABEL W / E FREQ. 1.0 - 0.1

COUPLING yes

2-9-70

MD

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake shore Test
LINE 105 HALF W SP. 1 DATE 2-5-80

PAGE 1 Copy

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	20-30	30-40	—	40-50	—	—	50-60	—	—	—
RANGE										
DC 1	1.0	1.2	0.6	0.8	1.4	1.8	1.5	1.0	0.7	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	15.4	19.0	5.38	35.3	11.0	4.39	30.4	9.01	4.17	
AC 2	0.0	0.1	0.0	0.0	0.0	0.0	0.4	0.0	0.1	
AC AVG.										
S.P.									?	
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE ____ HALF W SP. 1 DATE 8/5/[illegible]

PAGE 2

SEND										Cal
RECEIVE										
RANGE										
DC 1										0.2
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1										196.
AC 2										0.1
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 10S HALF W SP. 1 DATE 2/5

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE										
RANGE										
VOLTAGE										
CURRENT	3.	4.	4.	6.	6.	5.	4.	4.	4.	4.
SEND										Cal
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										2.

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10S HALF E SP. 1 DATE 2/15

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	20W-10	10-0	—	0-10E	—	—	10-20	—	—	—
RANGE										
DC 1		1.1	0.9	1.1	1.2	2.0	2.2	2.1	3.4	4.4
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		29.3	5.31	18.8	5.85	1.62	18.4	3.97	2.28	0.905
AC 2		0.0	0.0	0.3	0.1	-0.1	0.2	0.0	0.0	-0.4
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 103 HALF E SP. 1 DATE 2/5

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
RECEIVE	20-30	—	—	—	30-90E	—	—	—		
RANGE										
DC 1	2.5	2.6	3.4	3.4	1.2	1.8	2.2	3.5		0.3
DC 2										0.2
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	9.31	3.77	2.43	1.38	3.25	1.76	1.61	1.821		196.5
AC 2	0.0	-0.1	0.0	0.0	0.2	0.0	0.0	0.3		0.1
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT_____

LINE 10E HALF E SP. 1 DATE 8/15

PAGE

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE										
RANGE										
VOLTAGE										
CURRENT	4.	6.	4.	4.	6.	4.	4.	4.	6.	4.
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		cal
RECEIVE										
RANGE										
VOLTAGE										
CURRENT	4.	4.	6.	4.	4.	4.	6.	4.		2.

FREQUENCIES____ ____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 10S HALF W SP. ____ DATE 2-5

PAGE 1

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	10-20W →		20-30W →			30-40W →				
RANGE	1.0	0.1	1.0	0.1	0.1	1.0	0.1	0.1	0.01	
DC 1	0.8	2.2	1.0	1.0	2.8	1.2	0.6	1.4	2.8	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—	—	—	—	—	
AC 1	14.1	2.99	15.4	2.99	1.19	19.0	5.38	1.61	0.911	
AC 2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	
AC AVG.										
S.P.	15.1 →		-3.0 →			13.1 →				
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 10S HALF W SP. ____ DATE 2-5

SEND	2-3	3-4	4-5	5-6	6-7					
RECEIVE	40-50 W	→	→	→	→					
RANGE	1.0	1.0	0.1	0.1						
DC 1	0.8	1.4	1.8	0.3						
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—					
AC 1	35.3	11.0	4.39	1.00						
AC 2	0.0	0.0	0.0	-0.7						
AC AVG.										
S.P.	2.6	→		→	→					
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 105 HALF W SP. ____ DATE 2-5

SEND	1-2	2-3	3-4	4-5	5-6	6-7		Noise	Spectrum	20 sec/hr
RECEIVE	50-60 W					→		1.0	0.06 MC	± 0.02
RANGE	1.0	0.1	0.1	0.1				0.3	0.12	± 0.06
DC 1	1.5	1.0	1.5 (60 cm)	3.0/2.2				0.1	0.35	± 0.28
DC 2			0.4→1.6	1.9/5.6					0.07 Hz	
DC 3				0.3/6.2						
DC 4			(120 cm)	2.0/4.4					120 sec	60 sec
DC 5			0.9→1.1	2.1/2.6						
DC 6				-1.6/1.4				1.0	2.2	0.2 3.2
DC 7				-3.0/0.0				2.0	2.0	0.8 1.6
DC 8				-0.8-0.8				3.2	1.1	2.8 2.2
DC AVG.	—	—	—	—	—	—		4.2	0.4	2.0 1.8
AC 1	30.4	9.0	4.17	2.54				5.0	-0.2	2.3 3.8
AC 2	0.4	0.0	0.1					5.0	0.5	1.8 5.0
AC AVG.								3.6	1.4	3.6 7.4
S.P.	160.8	→	→	77.4				1.6	1.8	6.5 6.4
AC NOISE								0.6	1.6	9.9 5.0
POT RES.								1.4		7.0 4.0

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 10S HALF W SP. ____ DATE 2-5

PAGE 5

SEND.	1-2	2-3	3-4	1-2	2-3		4-5	1-2		
RECEIVE	90-90W	→		90-100W			cal	cal		
RANGE							10			
DC 1.							0.2			
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—		—	—		
AC 1							196			
AC 2							0.1			
AC AVG.										
S.P.							—			
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore Test

LINE 12S HALF E SP. ___ DATE 2-4

SEND.	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	
RECEIVE	10W-0EW		0EW-10E	→		10-20E	→		→	
RANGE	1.0	0.1	1.0	0.1	0.1	1.0	0.1	0.1	0.01	
DC 1	1.1	0.9	1.1	1.7	2.0	2.2	2.1	3.4	4.4	
DC 2										
DC 3										
DC 4						Pot wire across 8" pipeline				
DC 5							this station			
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	29.3	5.31	18.8	5.85	1.62	18.4	3.97	2.28	0.905	
AC 2	0.0	0.0	0.3	0.1	-0.1	0.2	0.0	0.0	-0.4	
AC AVG.										
S.P.	-40.0	→	42.1	→	→	5.1	→	→	→	
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 10S HALF E SP. ___ DATE 2-4

SEND.	5-6	4-5	3-4	2-3	1-2					
RECEIVE	20-30 E	—	—	—	→					
RANGE	1.0	0.1	0.1	0.1	0.1					
DC 1	3.2	2.5	2.6	3.4	3.4					
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—					
AC 1	25.6	9.31	3.77	2.93	1.38					
AC 2	0.0	0.0	-0.1	0.0	0.0					
AC AVG.										
S.P.	-1.5	—	—	—	→					
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10S HALF E SP. ____ DATE 2-4

PAGE 3

SEND	6-7	5-6	4-5	3-4	2-3	1-2				
RECEIVE	30 – 40E	→	→	→	→	→				
RANGE	1.0	0.1	0.1	0.1	0.1	0.01				
DC 1	2.5	1.8	1.2	1.8	2.2	3.5				
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—	—				
AC 1	52.8	5.07	3.25	1.76	1.61	0.821				
AC 2	0.0	0.0	0.2	0.0	0.0	0.3				
AC AVG.										
S.P.	13.7	→	→	→	→	→				
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 10S HALF E SP. ____ DATE 2-4

SEND	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4	
RECEIVE	40-50	E →			→	50-60	E →		→	
RANGE	1.0	0.1	0.1	0.1	0.1					
DC 1	2.9	2.2	2.2	2.6	3.4					
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—	—	—	—	—	
AC 1	20.9	2.82	2.42	1.53	1.54					
AC 2	0.1	0.2	−0.4	0.2	0.0					
AC AVG.										
S.P.	55.2 →				→	−13.0				
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT

LINE 10S HALF SP. DATE

SEND .	6-7	5-6	4-5	6-7	5-6		3-4	6-7		
RECEIVE	60-70	E →		70-80	E		cal	cal		
RANGE							10	10		
DC 1 .							0.3	0.2		
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—		—	—		
AC 1							197	196		
AC 2 .							0.1	0.1		
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore Test

LINE 10S HALF W SP. ___ DATE 2-5

PAGE 4

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	10-20	—	20	—	30	30	40	—	—	
RANGE	10X300	10X300	10X300	10X300	10X300	10X400	10X400	10X400	10X400	
VOLTAGE	520	640	520	520	640	340	360	700	880	
CURRENT	3A	3A	3A	3A	3A	4A	4A	4A	4A	
SEND	2-3	3-4	4-5	5-6	6-7					
RECEIVE	40-30	—	—	—	—					
RANGE	30X200	30X200	30X170	30X170	30X170					
VOLTAGE	420	520	380							
CURRENT	6A	6A	5A							

FREQUENCIES 1.0 0.1

SENDER NO. 6649-S

OPERATOR WS

RECEIVER NO. 18691 R

OPERATOR DC

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore test

LINE 20S HALF W/ SP. ____ DATE 7/6

PAGE 5

SEND	1-2	2-3	3-4	4-5	5-6	6-7				
RECEIVE										
RANGE	10X400	10X400	10X400	10X400	10X400	10X400				
VOLTAGE	320	280	320	340	680	820				
CURRENT	4A	4A	4A	4A	4A	4A				
SEND	1-2	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5	
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										

FREQUENCIES 1.0 0.1

SENDER NO. 6644-5

OPERATOR WS

RECEIVER NO. 18691R

OPERATOR DC

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake Shore Test

LINE 10S HALF E SP. ___ DATE 2/4

PAGE

SEND	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	
RECEIVE	10W-0EW		0EW-10E		→	10E-20E			→	
RANGE	30x200	10x400	10x400	30x200	10x400	10x400	10x400	30x200	10x400	
VOLTAGE	420	340	350	420	320	325	320	420	340	
CURRENT	6A	4A	4A	6A	4A	4A	4A	6A	4A	
SEND	5-6	4-5	3-4	2-3	1-2					
RECEIVE	20E-30E				→					
RANGE	10·200	10·400	10·400	30·200	10·400					
VOLTAGE	350	325	340	420	340					
CURRENT	2A	4A	4A	6A	4A					

FREQUENCIES 0.1 1.0

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT_____

LINE 102 HALF____ SP.____ DATE 2-4

SEND	6-7	5-6	4-5	3-4	2-3	1-2				
RECEIVE	30 E-	40 E-	———	———	———	→				
RANGE	10·240	10·200	10·400	10·400	30·200	10·400				
VOLTAGE	525	340	320	340	420	340				
CURRENT	2.4A	2A	4A	4A	6A	4A				
SEND	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4	
RECEIVE	40 E-	50 E-	———	———	→	50 E-	60 E-	———	→	
RANGE	10·240	10·200	10·400	10·400	30·200					
VOLTAGE	520	340	320	340	420					
CURRENT	2.4A	2A	4A	4A	6A					

FREQUENCIES____ ____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT_____

LINE 105 HALF E SP.____ DATE____

SEND	6-7	5-6	4-5	6-7	5-6		3-4	6-7		
RECEIVE	60E-	70E—	—7	70E-80E			cal	cal		
RANGE							10X200	10.200		
VOLTAGE							160	4140		
CURRENT							2A	2A		
SEND										
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										

FREQUENCIES____ ____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1 LOOKING N 2-5-70 A= 1000 FEET

3.000	4.000	4.000	6.000	6.000	5.000	4.000	4.000	4.000	4.000	I	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	2.000	
10	12	6	8	14	18	15	10	7		DC									2	LEFT
10	12	6	8	14	18	15	10	7											2	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
1.0	1.2	.6	.8	1.4	1.8	1.5	1.0	.7	0.0	PFEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.2	
15.40	19.00	5.380	35.30	11.00	4.390	30.40	9.010	4.170	0.000	AC1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	196.0	
0.0	.1	0.0	0.0	0.0	0.0	.4	0.0	.1	0.0	AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	
15.40	19.01	5.380	35.30	11.00	4.390	30.46	9.010	4.172	0.000	ACA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	196.1	
15.84	14.69	16.54	18.12	22.72	27.31	23.57	27.80	32.07	*000.0	RHO	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	1.020	DC CAL
.9	1.0	.4	.6	1.3	1.6	1.1	.9	.5	*000.0	PFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	-.150	AC CAL
54	68	27	36	55	60	49	31	16*0000.		MCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		
.2	.2	.7	.2	.5	.8	.1	.4	.7	0.0	CPFE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
.6	.8	-.3	.5	.8	.8	1.0	.5	-.2	*000.0	CCPFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		
40	52	-16	26	35	30	44	18	-5*0000.		CCMCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		

3-4 0-10E 2-3 0-10

4.000	6.000	4.000	4.000	6.000	4.000	4.000	4.000	6.000	4.000	I	4.000	4.000	6.000	4.000	4.000	4.000	6.000	4.000	2.000	
11	9	11	12	20	22	21	34	44		DC	25	26	34	34	12	18	22	35	3	RIGHT
11	9	11	12	20	22	21	34	44			25	26	34	34	12	18	22	35	2	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	1.1	.9	1.1	1.2	2.0	2.2	2.1	3.4	4.4	PFEA	2.5	2.6	3.4	3.4	1.2	1.8	2.2	3.5	.3	
0.000	29.30	5.310	18.80	5.850	1.620	18.40	3.970	2.280	.905	AC1	9.310	3.770	2.930	1.380	3.250	1.760	1.610	.821	196.5	
0.0	0.0	0.0	.3	.1	-.1	.2	0.0	0.0	-.4	AC2	0.0	-.1	0.0	0.0	.2	0.0	0.0	.3	.1	
0.000	29.30	5.310	18.83	5.853	1.619	18.42	3.970	2.280	.903	ACA	9.310	3.768	2.930	1.380	3.253	1.760	1.610	.822	196.6	
*000.0	15.04	16.32	14.47	12.02	12.58	14.32	12.35	11.97	14.39	RHO	29.07	29.45	30.76	38.03	25.04	27.29	29.24	36.24	1.017	DC CAL
*000.0	.9	.7	.7	.9	1.8	1.9	1.9	3.2	4.4	PFE	2.3	2.4	3.2	3.2	.9	1.6	2.0	3.1	-.200	AC CAL
*0000.	60	43	52	79	147	133	154	267	306	MCF	79	83	104	84	36	59	68	87		
0.0	.2	.7	.2	1.1	2.3	.2	1.0	2.4	3.5	CPFE	.3	.7	1.3	1.6	.9	1.5	2.3	2.6		
*000.0	.7	-.0	.5	-.1	-.4	1.7	.9	.8	.9	CCPFE	2.0	1.7	1.9	1.6	-.0	.1	-.3	.6		
*0000.	45	-1	35	-11	-34	116	69	65	65	CCMCF	68	58	62	42	-1	3	-9	16		

ENGINEERED FOR HIGH SPEED PRINTERS
BUSINESS FORMS PRINTING COMPANY

JOB Lakeshore MK4C Test LINE 105 SPREAD 1A

LOOKING N DATE Feb 5, 70 A= 1000 feet

CENTER 0.0 LABEL W/E FREQ. 1.0 - 0.1

COUPLING Yes

2-9-70

MD

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 105 HALF W SP. 1A DATE 2/5

PAGE copy

SEND	6-7	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7
RECEIVE	0-10W	10-20	—	20-30	—	—	30-40	—	—	—
RANGE										
DC 1		0.8	2.2	1.0	1.0	2.8	1.2	0.6	1.4	2.8
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		19.1	2.99	15.4	2.99	1.19	19.6	5.38	1.61	0.911
AC 2		0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore
LINE 10S HALF W SP. 1A DATE 2/5

PAGE Copy

SEND	3-4	4-5	5-6	6-7	3-4	4-5	5-6	6-7		Cal
RECEIVE	40-50				50-60					
RANGE										
DC 1	1.4	1.8	0.3			0.7				0.2
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	11.0	4.39	1.0			4.17				196.
AC 2	0.0	0.0	-0.2			0.1				0.1
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 105 HALF W SP. 1A DATE 2/5

PAGE

SEND	6-7	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7
RECEIVE	0-10	10-20	—	20-30	—	—	30-40	—	—	—
RANGE										
VOLTAGE										
CURRENT	3.	3.	3.	3.	3.	3.	4	4.	4.	4.
SEND	3-4	4-5	5-6	6-7				3-4		cal
RECEIVE	40-50							50-60		
RANGE										
VOLTAGE		5.								
CURRENT	4.	4.	4.	4.				6		2.

FREQUENCIES ____ ____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore Test
LINE 105 HALF E SP. 1A DATE 7-5

PAGE 4 of 7

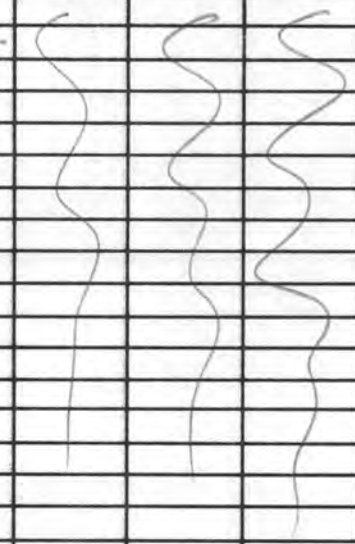
SEND	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4
RECEIVE	0-10E	10-20	—	20-30	—	—	30-40	—	—	—
RANGE										
DC 1	1.1	2.2	2.1	3.2	2.5"	2.6	2.5"	1.8	1.2	1.8
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	—	—	—	—	—	—	—	—	—	
AC 1	18.8	18.4	3.97	25.6	9.31	3.77	52.8	5.07	3.25	1.76
AC 2	0.3	0.2	0.0	0.0	0.0	-0.1	0.0	0.0	0.2	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 105 HALF E SP. 1A DATE 2/5

PAGE

SEND	6-7	5-6	4-5	3-4				2-3		Cal
RECEIVE	40-50	—	—	—				40-50		
RANGE										
DC 1	2.9	2.2	2.2	2.6				3.4		0.3
DC 2										0.2
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	20.9	2.82	2.42	1.53				1.54		196.5
AC 2	0.1	0.2	-0.4	0.2				0.0		0.1
AC AVG.										
S.P.										
AC NOISE										
POT RES.										



HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 105 HALF E SP. 1A DATE 2/5

PAGE copy

SEND	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4
RECEIVE	0-10E	10-20	—	20-30	—	—	30-40	—	—	—
RANGE										
VOLTAGE										
CURRENT	4.	4.	4.	2.	4.	4.	2.4	2.	4.	4.
SEND	6-7	5-6	4-5	3-4						col
RECEIVE	40-50	—	—	—						
RANGE										
VOLTAGE										
CURRENT	2.4	2.	4.	4.				6.		2.

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

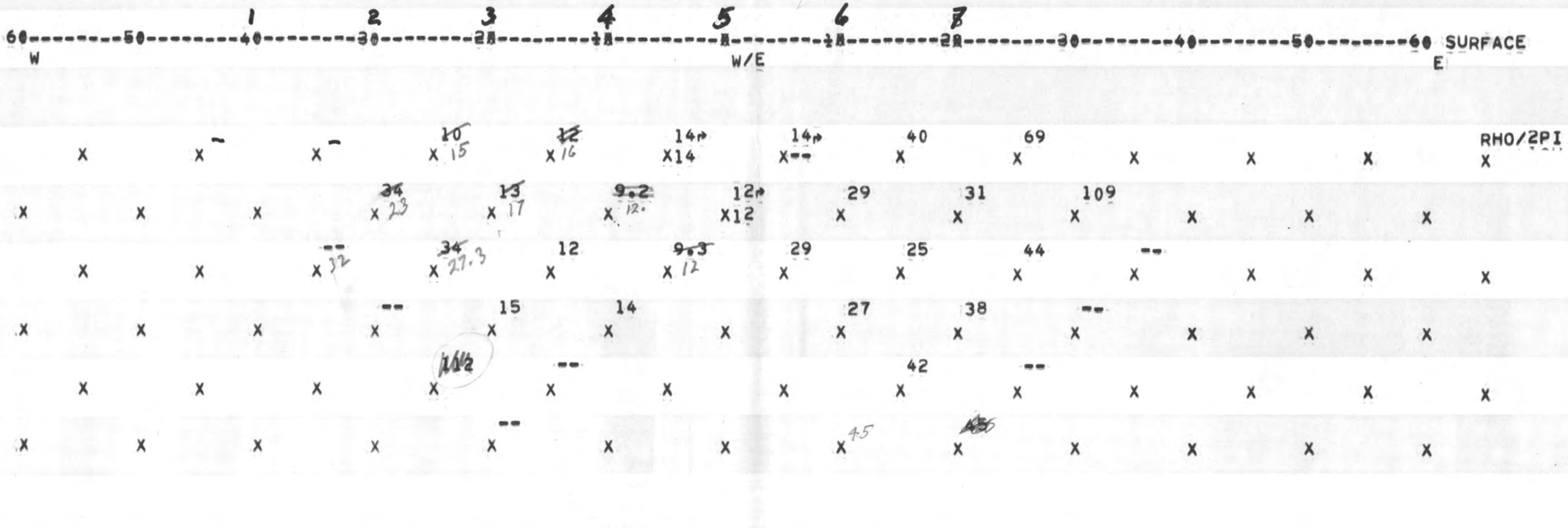
COMMENTS:

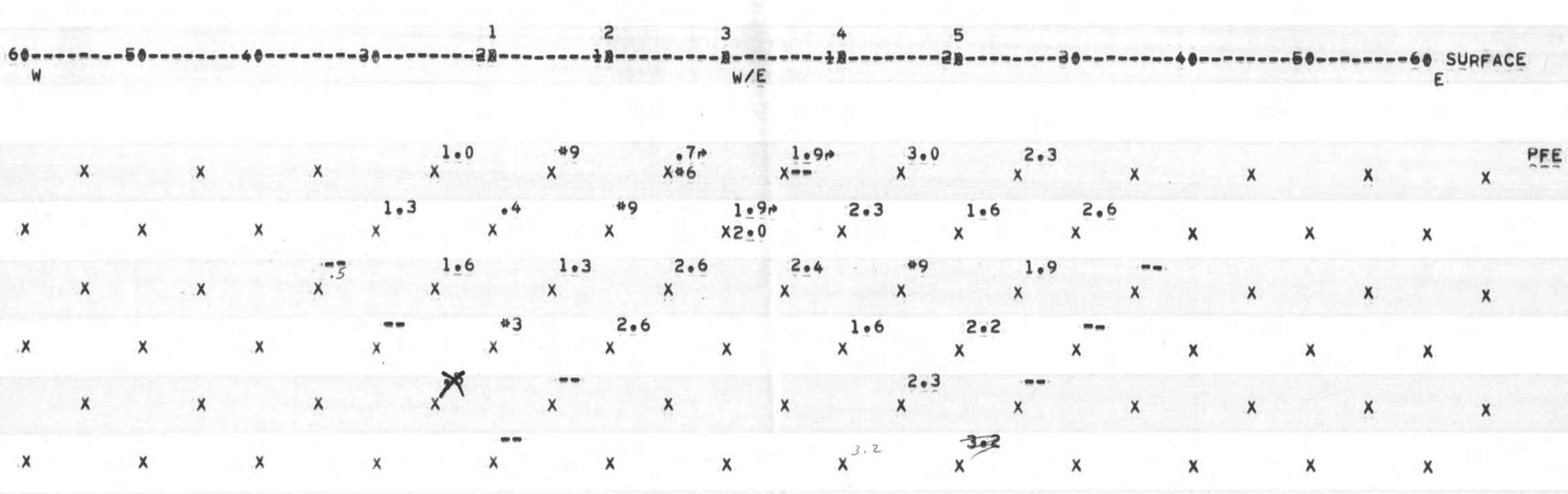
HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10 S SPREAD 1A LOOKING N DATE 2-5-70 A= 1000 FEET

3.000	3.000	3.000	4.000	3.000	4.000	6.000	8.000	4.000	4.000		I	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	2.000	
	8	22	10	10	28	12	6	14	28		DC	14	18	3					7	2	LEFT
	8	22	10	10	28	12	6	14	28			14	18	3					7	2	SIDE
1	1	2	1	2	3	1	2	3	4		N	2	3	4	5	3	4	5	6		
0.0	.8	2.2	1.0	1.0	2.8	1.2	.6	1.4	2.8		PFEA	1.4	1.8	.3	0.0	0.0	0.0	.7	0.0	.2	
0.000	14.10	2.990	15.40	2.990	1.190	19.00	5.380	1.610	.911		AC1	11.00	4.390	1.000	0.000	0.000	0.000	4.170	0.000	196.0	
0.0	.1	0.0	0.0	0.0	0.0	.1	0.0	0.0	0.0		AC2	0.0	0.0	-.2	0.0	0.0	0.0	.1	0.0	.1	
0.000	14.11	2.990	15.40	2.990	1.190	19.01	5.380	1.610	.911		ACA	11.00	4.390	.999	0.000	0.000	0.000	4.172	0.000	196.1	
*000.0	14.47	12.45	11.88	9.23	9.34	9.79	13.23	12.47	14.31		RHO	34.08	34.13	15.32	*000.0	*000.0	*000.0	112.3	*000.0	1.020	DC CAL
*000.0	.6	2.0	.9	.9	2.6	1.0	.4	1.3	2.6		PFE	1.3	1.6	.3	*000.0	*000.0	*000.0	.5	*000.0	-.150	AC CAL
*0000.	41	165	72	92	284	102	34	100	185		MCF	37	48	16	*0000.	*0000.	*0000.	4	*0000.		
0.0	.2	1.0	.3	1.5	3.3	.4	1.0	2.3	3.5		CPFE	.3	.6	3.2	0.0	0.0	0.0	.4	0.0		
*000.0	.4	1.0	.5	-.7	-.7	.6	-.5	-1.1	-.8		CCPFE	1.0	1.0	-2.9	*000.0	*000.0	*000.0	.1	*000.0		
*0000.	25	81	45	-75	-72	60	-38	-84	-58		CCMCF	29	30	-192	*0000.	*0000.	*0000.	1	*0000.		

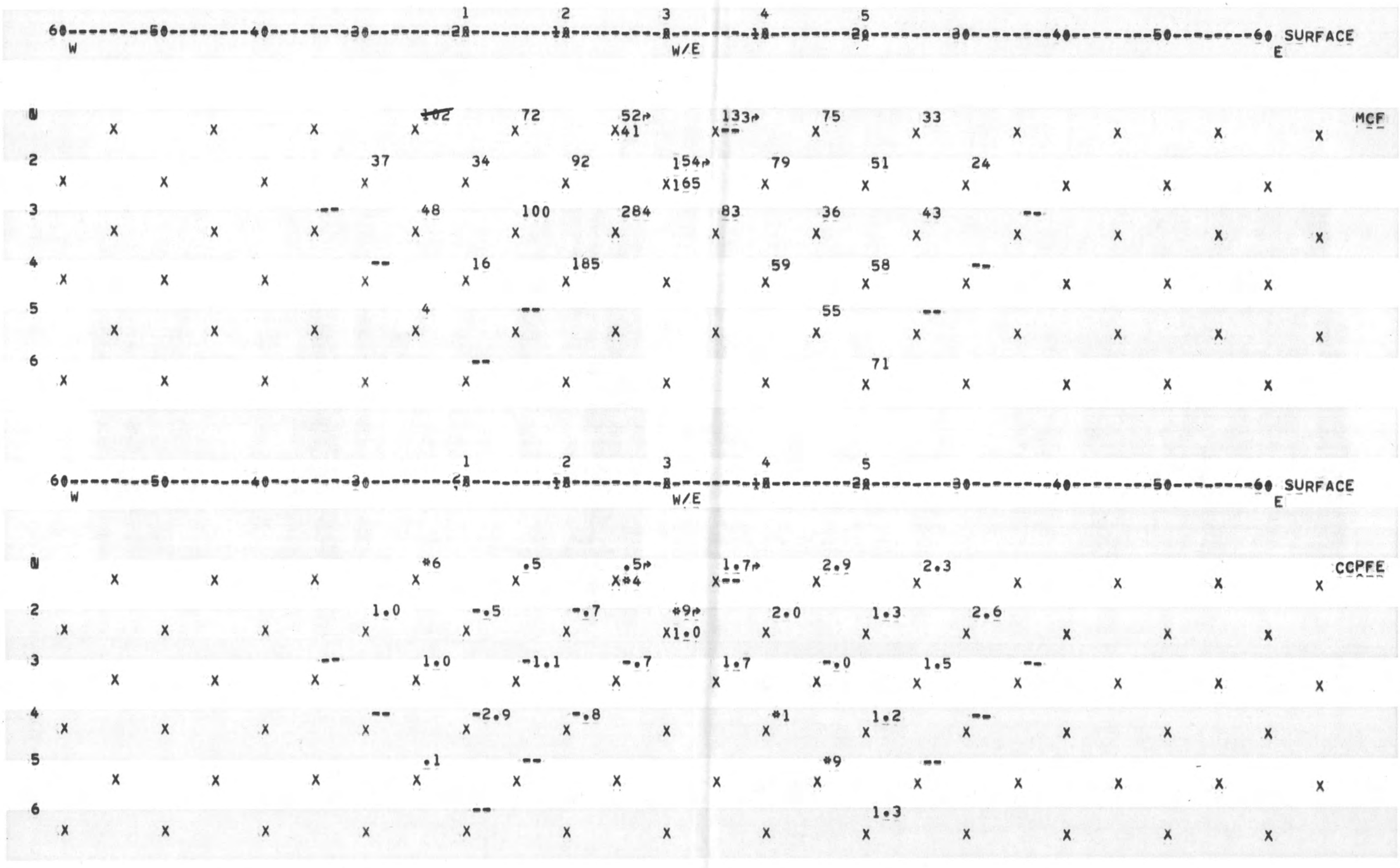
4.000	4.000	4.000	2.000	4.000	4.000	2.400	2.000	4.000	4.000		I	2.400	2.000	4.000	4.000	4.000	4.000	4.000	6.000	2.000	
11	22	21	32	25	26	25	18	12	18		DC	29	22	22	26				34	3	RIGHT
11	22	21	32	25	26	25	18	12	18			29	22	22	26				34	2	SIDE
1	1	2	1	2	3	1	2	3	4		N	2	3	4	5	3	4	5	6		
1.1	2.2	2.1	3.2	2.5	2.6	2.5	1.8	1.2	1.8		PFEA	2.9	2.2	2.2	2.6	0.0	0.0	0.0	3.4	.3	
18.80	18.40	3.970	25.60	9.310	3.770	52.80	5.070	3.250	1.760		AC1	20.90	2.820	2.420	1.530	0.000	0.000	0.000	1.540	196.5	
.3	.2	0.0	0.0	0.0	-.1	0.0	0.0	.2	0.0		AC2	.1	.2	-.4	.2	0.0	0.0	0.0	0.0	.1	
18.83	18.42	3.970	25.60	9.310	3.768	52.80	5.070	3.253	1.760		ACA	20.91	2.823	2.415	1.532	0.000	0.000	0.000	1.540	196.6	
14.47	14.32	12.35	40.24	29.07	29.45	68.69	31.44	25.04	27.29		RHO	109.2	43.89	37.67	41.84	*000.0	*000.0	*000.0	45.27	1.017	DC CAL
.7	1.9	1.9	3.0	2.3	2.4	2.3	1.6	.9	1.6		PFE	2.6	1.9	2.2	2.3	*000.0	*000.0	*000.0	3.2	-.200	AC CAL
52	133	154	75	79	83	33	51	36	59		MCF	24	43	58	55	*0000.	*0000.	*0000.	71		
.2	.2	1.0	.1	.3	.7	0.0	.3	.9	1.5		CPFE	.1	.4	1.0	1.4	0.0	0.0	0.0	1.9		
.5	1.7	.9	2.9	2.0	1.7	2.3	1.3	-.0	.1		CCPFE	2.6	1.5	1.2	.9	*000.0	*000.0	*000.0	1.3		
35	116	69	73	68	58	33	41	-1	3		CCMCF	24	33	32	21	*0000.	*0000.	*0000.	28		

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10 S SPREAD 1A LOOKING N DATE 2-5-70 A= 1000 FEET





BUSINESS FORMS PRINTING COMPANY BLUE SPACE PAK ENGINEERED FOR HIGH SPEED PRINTERS



BUSINESS FORMS PRINTING COMPANY ENGINEERED FOR HIGH SPEED PRINTERS

```
                                                  1         2         3         4         5
60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50--------60 SURFACE
  W                                                                W/E                                                  E

N                                  60        45        35→       116→      73        33                                  CCMCF
      X         X         X         X         X         X25       X--       X         X         X         X         X         X
2                                29        -38       -75       69→       68        41        24
  X         X         X         X         X         X         X81       X         X         X         X         X         X
3                          --        30        -84       -72       58        -1        33        --
      X         X         X         X         X         X         X         X         X         X         X         X         X
4                                --        -192      -58                 3         32        --
  X         X         X         X         X         X         X         X         X         X         X         X         X
5                                  1         --                                21        --
      X         X         X         X         X         X         X         X         X         X         X         X         X
6                                          --                                          28
  X         X         X         X         X         X         X         X         X         X         X         X         X

AC READING MISSING CARD   7
```

MK9 Test

JOB Lakeshore LINE 10 N SPREAD 1

LOOKING N DATE Nov 18 A= 1500 feet

CENTER -10.0 LABEL W/ E FREQ. 1.0 - 0.1

COUPLING yes

11-24-69
MD

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKE SHORE 0.0-10 WEST
LINE 10 HALF W SP. ___ DATE 11-19

PAGE 1

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	00-15W	15 → 30		30 →		45	45	→	→	60
RANGE	1.0	1.0	0.1	1.0	0.1	0.1	1.0	0.1	0.1	0.1
DC 1, 3	1.1	1.1	1.9	1.2	2.2	1.2	.6	1.5	2.0	2.4
DC 2 .1	3.1	2.9	3.6	2.4	3.9	2.7	1.8	3.0	3.6	4.4
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1 10	22.8	18.2	5.0±	22.4	4.10	7.92	25.4	7.66	2.14	2.36
AC 2 10	0.2±2	0.0	0.0	0.2	0.0±.4	0.0±1.	0.0	0.0	0.0±.4	0.0±2
AC AVG.										
S.P.	26.5	63.7		1.6			30.2			
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKESHORE 0.0-10W EST
LINE 10 HALF W SP. ___ DATE 11/19

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	60W	←	→	75	75	←	→	90	3-4	
RANGE	1.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10.0	
DC 1, 3	1.2	1.7	2.4	1.1	.6	1.1	3.1	1.6±?	0.2	
DC 2, 4	2.3	3.0	4.4	2.8	1.8	3.2	60±1	4.0	1.2	
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.			2.09	2.0						
AC 1 1.0	11.4	4.91	~~2~~	2.09?	5.11?	4.10±1	11.4?	1.40±?	198	
AC 2 1.0	0.0	0.0	0.0±1.	0.0?	0.0?	0.0?	0.0?	0.0?	0.0	
AC AVG.										
S.P.	42.3				32.2					
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore 0.0-10 West

LINE 10 HALF W SP. ___ DATE 11-69

PAGE 1

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	00-15W	15	7 30W	30W		45W	45W			60W
RANGE	H1									
VOLTAGE	465	240	465	320	240	465	480	320	240	465
CURRENT	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	3-4
RECEIVE	60W			75W	75W			90W		
RANGE	H1									
VOLTAGE	480	320	360	465	480	470	360	465		80
CURRENT	6.0A	6.0A	(9.0A)	6.0A	6.0A	9.0A	9.0A	6.0A		2.0A

FREQUENCIES 1.0 .3 .1

SENDER NO. MK4 6644-S

OPERATOR D.V.

RECEIVER NO. 4C

OPERATOR M.P.

COMMENTS:

PAGE 3

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore 0.0 60 West
LINE 10 N HALF E SP. ___ DATE 11/18

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0+5E	15 → 30		30	→	45	45	→	→	60
RANGE	1.0	1.0	0.1	1.0	1.0	0.1	10.0	1.0	0.1	0.1
DC 1 .3	1.0	1.1	2.3	1.0	1.6	2.0	1.0	2.0	2.9	2.0 ± 1
DC 2 .1	2.4	2.4	4.1	2.7	3.6	3.0	2.5	4.2	4.5	3.9
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.						±2.0				
AC 1 1/6	17.7	22.6	4.92	3.96	1.05	4.06	439.0	15.9	6.26	3.33
AC 2 1/6	0.0	0.0	0.0	0.0	0.0	0.0±2	0.0	0.0	0.0 ± 1	0.0 ± .4
AC AVG.										
S.P.	63.0	20.5		13.3			25.7			
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT LAKESHORE D.O. Towest

LINE 10 HALF E SP. ____ DATE 11/18

PAGE 4

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
RECEIVE	60	→	→	75	75	→	→	90	2-3	
RANGE	10.0	0.1	0.1	0.1					10	
DC 1 .3	1.0	2.2	2.8	2.2±2					0.1	
DC 2 .1	2.2	4.0	4.1	3.0					1.1	
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1 1.0	152.0	7.67±.4	3.72±.16	2.34±3					128	
AC 2 1.0	0.0	0.0±.6	0.0±.8	0.0±2					0.0	
AC AVG.										
S.P.	35.1									
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore 0.0-10 West

LINE 10 HALF E SP. ___ DATE 11-69

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-15E	15 →	30E	30 →		45E	45 →			60E
RANGE	H1 →									→
VOLTAGE	460	300	460	230	300	450	450	240	300	450
CURRENT	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A	6.0A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	2-3
RECEIVE	60E →			75E	75E →			90E		
RANGE	H1 →									→
VOLTAGE	450	240	300	440						100
CURRENT	6.0A	6.0A	6.0A	6.0A						2.0A

FREQUENCIES 1.0 .3 .1

SENDER NO. MK4 6644-S

OPERATOR DJZ

RECEIVER NO. UC

OPERATOR M.P.

COMMENTS:

HEINRICHS GEOEX JOB LAKESHORE MK4 TEST LINE 10N SPREAD 1 LOOKING N 11/18/69 A= 1500 FEET

6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	I	6.000	6.000	9.000	6.000	6.000	9.000	9.000	6.000	2.000	
31	29	36	24	39	27	18	30	36	44	DC	23	30	44	28	18	32	60	40	12	LEFT
31	29	36	24	39	27	18	30	36	44		23	30	44	28	18	32	60	40	12	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
3.1	2.9	3.6	2.4	3.9	2.7	1.8	3.0	3.6	4.4	PFEA	2.3	3.0	4.4	2.8	1.8	3.2	6.0	4.0	1.2	
22.80	18.20	5.010	22.40	4.100	2.920	25.40	7.660	2.140	2.360	AC1	11.40	4.910	2.090	2.090	5.110	4.100	11.40	1.400	198.0	
-.2	0.0	0.0	.2	0.0	0.0	0.0	0.0	0.0	0.0	AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
22.78	18.20	5.010	22.42	4.100	2.920	25.40	7.660	2.140	2.360	ACA	11.40	4.910	2.090	2.090	5.110	4.100	11.40	1.400	198.0	
17.60	14.02	15.55	17.17	12.76	22.45	19.36	23.63	16.60	36.90	RHO	34.93	37.87	21.79	56.30	38.94	42.24	211.2	61.06	1.010	DC CAL
2.0	1.7	2.4	1.1	2.7	1.5	.6	1.8	2.4	3.2	PFE	1.1	1.8	3.2	1.6	.6	2.0	4.8	2.8	-1.200	AC CAL
114	121	154	64	212	67	31	76	145	87	MCF	31	48	147	28	15	47	23	46		
.6	.8	2.2	.6	2.9	3.1	.5	1.3	4.5	2.9	CPFE	.8	1.6	5.7	2.8	1.5	2.5	.5	3.7		
1.4	.9	.2	.5	-.2	-1.6	.1	.5	-2.1	.3	CCPFE	.3	.2	-2.5	-1.2	-.9	-.5	4.3	-.9		
82	67	11	31	-13	-69	6	21	-124	7	CCMCF	9	6	-113	-21	-23	-11	20	-15		

6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	I	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	2.000	
24	24	41	27	36	30	25	42	45	39	DC	22	40	41	30					11	RIGHT
24	24	41	27	36	30	25	42	45	39		22	40	41	30					11	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
2.4	2.4	4.1	2.7	3.6	3.0	2.5	4.2	4.5	3.9	PFEA	2.2	4.0	4.1	3.0	0.0	0.0	0.0	0.0	1.1	
17.70	22.60	4.920	39.60	10.50	4.060	439.0	15.90	6.260	3.330	AC1	152.0	7.670	3.720	2.340	0.000	0.000	0.000	0.000	198.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
17.70	22.60	4.920	39.60	10.50	4.060	439.0	15.90	6.260	3.330	ACA	152.0	7.670	3.720	2.340	0.000	0.000	0.000	0.000	198.0	
13.58	17.34	15.36	30.48	32.61	31.34	337.2	49.68	49.04	51.87	RHO	465.7	59.79	58.05	63.22	*000.0	*000.0	*000.0	*000.0	1.010	DC CAL
1.3	1.3	3.0	1.6	2.5	1.9	1.4	3.1	3.4	2.8	PFE	1.1	2.9	3.0	1.9	*000.0	*000.0	*000.0	*000.0	-1.100	AC CAL
96	75	195	52	77	61	4	62	69	54	MCF	2	49	52	30	*0000.	*0000.	*0000.	*0000.		
.8	.6	2.3	.3	.8	2.0	0.0	.5	1.1	1.9	CPFE	0.0	.9	1.6	2.4	0.0	0.0	0.0	0.0		
.5	.7	.7	1.3	1.7	-.1	1.4	2.6	2.3	.9	CCPFE	1.1	2.0	1.4	-.5	*000.0	*000.0	*000.0	*000.0		
38	42	48	44	51	-3	4	53	47	17	CCMCF	2	34	23	-8	*0000.	*0000.	*0000.	*0000.		

ENGINEERED FOR HIGH SPEED PRINTERS
BUSINESS FORMS PRINTING COMPANY

JOB Lake Shore LINE 10 N SPREAD Sp 1

LOOKING North DATE 8-23,26-69 A= 1000'

CENTER -30.0 LABEL W/E FREQ. 1.0 - .1
dual ac

COUPLING yes

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF W SP. 1 DATE 8-23-24

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	30-40W	40-50W →		50-60W →			60-70W →			
RANGE	1	1	1	1	1	.1	1	1	.1	.1
DC 1	+0.2	+0.1	-0.1	+0.2	-0.7	0	-0.5	-0.5	0	-0.1
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	45.4	47.3	12.1	35.2	13.8	5.13	44.2	14.2	7.34	4.08
AC 2	+0.1	+0.2	-0'	+0.4	0	0	+0.2	+0.1	+0.1	-0.4
AC AVG.										
S.P.	+2.0	-8.0		-35.1			+21.5			
AC NOISE				.09			.08			
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF W SP. 1 DATE 8-23-2

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	Cal	
RECEIVE	70-80 W →				80-90 W →				1-2	
RANGE	1	.1	.1	.1	1	.1	.1	.1	10	
DC 1	-0.1	-1.1	-0.5	-0.9	-0.4	-0.8	-1.0	-0.5	-0.8	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	20.7	7.03	4.70	2.89	14.5	5.49	4.06	2.75	208.	
AC 2	+0.3	-0.5	0	-0.1	0	+0.3	-0.1	-0.3	+0.3	
AC AVG.										
S.P.	-19.7				-6.3					
AC NOISE	.09				.09					
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake Shore test

LINE 10N HALF W SP. 1 DATE

PAGE 1

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	30-40W	40-50W	→	50-60W	→	→	60-70W	→	→	→
RANGE	20x400	20x450	20x400	20x350	20x450	20x450	20x350	20x350	10x450	50x450
VOLTAGE	345	415	345	465	415	390	420	465	420	395
CURRENT	9.0 10x500	9.0 10x500	9.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500	9.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	cal	
RECEIVE	70-80W	→	→	→	80-90W	→	→	→	1-2	
RANGE	20x400	20x350	20x450	20x450	20x400	20x350	20x450	20x450	10x200	
VOLTAGE	485	470	420	395	485	470	420	345	120	
CURRENT	9.0 10x500	9.0 10x500	9.0 10x500	9.0 10x500	9.0 10x500	7.0 10x500	9.0 10x500	8.0 10x500	2.0 10x200	

FREQUENCIES 1.6 8.1

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10N HALF E SP. 1 DATE 8-23-2[illegible]

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	30-20W	20-10W →		10W-0	→		0-10E	→		
RANGE	1	1	1	1	.1	.1	1	1	.1	.01
DC 1	+1.6	+1.3	+0.8	+0.3	-0.1	+0.7	+0.5	+0.3	+0.1	+0.5
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	41.6	40.5	10.2	47.2	7.46	3.45	42.8	10.5	2.14	.863
AC 2	+0.3	+0.4	0	+0.2	0	0	+0.6	+0.3	+0.2	0
AC AVG.										
S.P.	-5.9	+61.7		-9.1			-2.3			
AC NOISE	.06	.06		.07			.08			
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore Test

LINE 10N HALF E SP. 1 DATE 8-23-26

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	cal	
RECEIVE	10-20E	→	→	→	20-30E	→	→	→	4-5	
RANGE	1	.1	.1	.1					10	
DC 1	+0.8	+0.3	+0.3						-0.7	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	14.3	5.96	2.42	1.88					20.0	
AC 2	0	-0.1	+0.2						+0.3	
AC AVG.										
S.P.	+49.8									
AC NOISE	.08									
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake Shore Test

LINE 10N HALF E SP. 1 DATE 8-23-76

PAGE 2

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	30-20W	20-10W	→	10W-0	→	→	0-10E	→	→	→
RANGE										
VOLTAGE										
CURRENT	7.0A	7.0A	7.0A	9.0A	7.0A	7.0A	8.0A	9.0A	7.0A	7.0A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	cal	
RECEIVE	10-20E	→	→	→	20-30E	→	→	→	4-5	
RANGE										
VOLTAGE										
CURRENT	8.0A	9.0A	7.0A	7.0A	8.0A	9.0A	7.0A	7.0A	2.0A	

FREQUENCIES 1.0 .1

SENDER NO. 16681 5

OPERATOR Kern

RECEIVER NO. 4C

OPERATOR R. Palmer

COMMENTS:

MK 4C

HEINRICHS GEOEX JOB LAKESHORE 69 LINE 10N SPREAD 1 LOOKING N 8/23-26/69 A= 1000 FEET 1.0 0.1

8.000	9.000	8.000	7.000	9.000	9.000	7.000	7.000	9.000	9.000	I	8.000	7.000	9.000	9.000	8.000	7.000	9.000	8.000	2.000	
2	1	-1	2	-7	0	-5	-5	0	-1	DC	-1	-11	-5	-9	-4	-8	-10	-5	-8	LEFT
2	1	-1	2	-7	0	-5	-5	0	-1		-1	-11	-5	-9	-4	-8	-10	-5	-8	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
.2	.1	-.1	.2	-.7	0.0	-.5	-.5	0.0	-.1	PFEA	-.1	-1.1	-.5	-.9	-.4	-.8	-1.0	-.5	-.8	
45.40	47.30	12.10	35.20	13.80	5.130	44.20	14.20	7.340	4.080	AC1	20.70	7.030	4.700	2.890	14.50	5.490	4.060	2.750	208.0	
.1	.2	0.0	.4	0.0	0.0	.2	.1	.1	-.4	AC2	.3	-.5	0.0	-.1	0.0	.3	-.1	-.3	.3	
45.42	47.35	12.10	35.27	13.80	5.130	44.24	14.21	7.344	4.072	ACA	20.73	7.012	4.700	2.889	14.50	5.498	4.058	2.746	208.3	
16.53	15.30	17.57	14.65	17.71	16.57	18.27	23.48	23.71	26.34	RHO	30.06	28.88	30.22	32.39	52.49	45.25	45.45	55.69	.960	DC CAL
1.1	.9	.8	.9	.2	.9	.3	.4	.9	1.0	PFE	.7	.1	.4	.1	.5	-.0	-.0	.6	.950	AC CAL
67	62	48	65	14	57	19	17	38	40	MCF	23	3	15	3	10	-0	-0	11		
.2	.2	.7	.2	.6	1.6	.2	.4	1.0	1.6	CPFE	.3	.8	1.3	2.0	.3	.8	1.3	1.5		
.9	.7	.2	.7	-.4	-.6	.2	-.0	-.1	-.5	CCPFE	.4	-.7	-.9	-1.9	.2	-.8	-1.3	-.9		
54	48	11	49	-23	-39	10	-2	-4	-21	CCMCF	13	-23	-29	-58	4	-17	-28	-16		

7.000	7.000	7.000	9.000	7.000	7.000	8.000	9.000	7.000	7.000	I	8.000	9.000	7.000	7.000	8.000	9.000	7.000	7.000	2.000	
16	13	8	3	-1	7	5	3	1	5	DC	8	3	3	0					-7	RIGHT
16	13	8	3	-1	7	5	3	1	5		8	3	3	0					-7	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
1.6	1.3	.8	.3	-.1	.7	.5	.3	.1	.5	PFEA	.8	.3	.3	0.0	0.0	0.0	0.0	0.0	-.7	
41.60	40.50	10.20	47.20	7.460	3.450	42.80	10.50	2.140	.863	AC1	14.30	5.960	2.420	1.880	0.000	0.000	0.000	0.000	207.0	
.3	.4	0.0	.2	0.0	0.0	.6	.3	.2	0.0	AC2	0.0	-.1	.2	0.0	0.0	0.0	0.0	0.0	.3	
41.66	40.58	10.20	47.25	7.460	3.450	42.93	10.52	2.142	.863	ACA	14.30	5.957	2.422	1.880	0.000	0.000	0.000	0.000	207.3	
17.62	17.11	17.15	15.35	12.43	14.49	15.69	13.66	8.93	7.23	RHO	21.04	19.39	20.24	27.44	*000.0	*000.0	*000.0	*000.0	.965	DC CAL
2.3	1.9	1.6	1.0	.7	1.5	1.0	1.0	.8	1.3	PFE	1.6	1.2	1.0	.8	*000.0	*000.0	*000.0	*000.0	.850	AC CAL
131	114	96	68	60	107	67	73	95	187	MCF	78	62	52	31	*00000	*00000	*00000	*00000		
.2	.2	.7	.2	1.0	1.9	.2	.9	3.5	8.1	CPFE	.5	1.3	2.2	2.5	0.0	0.0	0.0	0.0		
2.1	1.8	1.0	.8	-.3	-.3	.8	.1	-2.7	-6.7	CCPFE	1.1	-.1	-1.2	-1.6	*000.0	*000.0	*000.0	*000.0		
120	103	57	54	-23	-24	53	6	-298	-929	CCMCF	54	-5	-59	-58	*00000	*00000	*00000	*00000		

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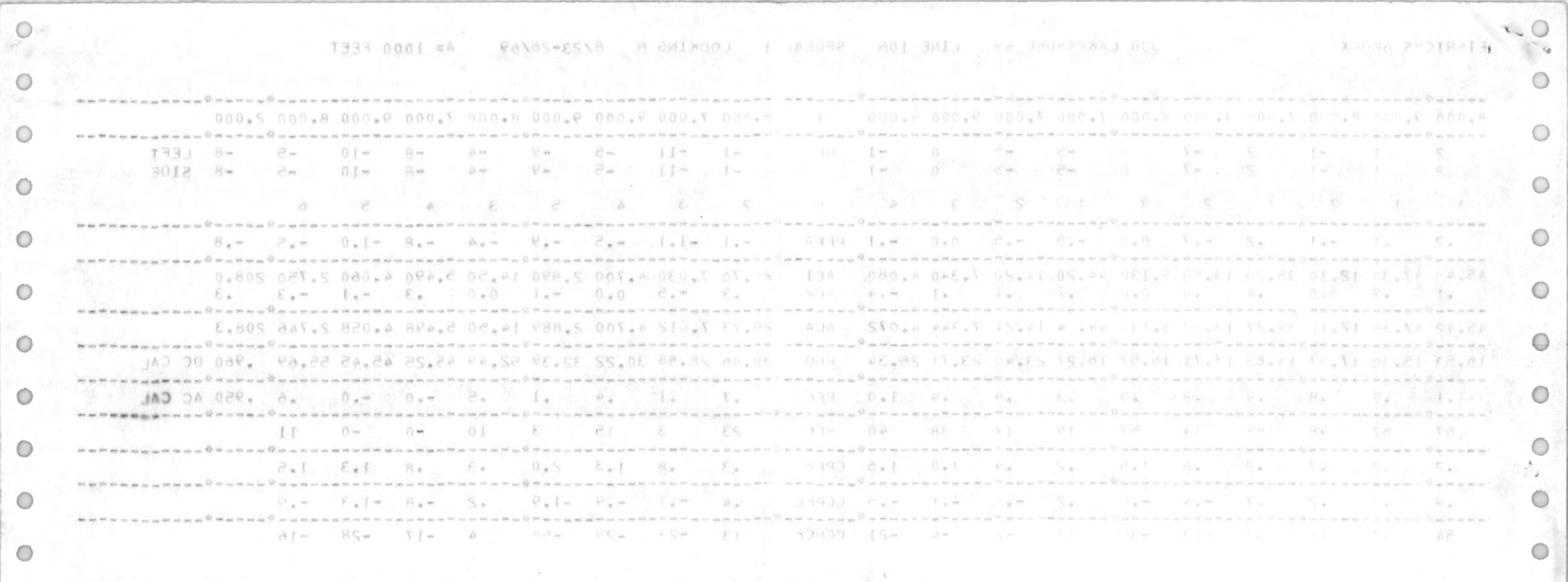


JOB Lakeshore LINE 10N SPREAD 1

LOOKING N DATE Aug 27, 69 A= 500 Feet

CENTER -35.0 LABEL W / E FREQ. 1.0 - 0.1

COUPLING yes

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10N HALF W SP. 1 DATE

PAGE
copy

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	35-40	40-45	—	45-50	—	—	50-55	—	—	—
RANGE										
DC 1	+0.6	0.0	+0.2	-0.6	-0.4	-1.2	-0.6	-0.4	+1.3	-0.8
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	63.7	83.1	17.2	70.4	21.2	6.82	50.1	76.2	7.99	3.19
AC 2	+0.5	+0.1	+0.2	0.0	0	-0.2	+0.1	+0.2	-0.1	+0.1
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10N HALF W SP. 1 DATE

PAGE Copy

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal
RECEIVE	55-60				60-65					
RANGE										
DC 1	-0.6	-1.0	-1.0	-1.3	-1.6	-0.8	-1.3	-0.7		-0.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	14.3	8.06	5.11	2.59	6.31	4.86	3.48	1.89		205.
AC 2	0.0	+0.1	+0.2	0.0	0.0	+0.3	0.0	0.0		+0.5
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 10N SL 1 W/2 Date: Cgg

Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
Receive												
Time												
Range												
Current	7.0	8.0	7.0	7.0	8.0	7.0	5.0	7.0	~~8.0~~ 7.0	~~7.0~~ 8.0		
Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5			col	
Receive												
Time												
Range												
Current	5.0	7.0	8.0	7.0	5.0	7.0	8.0	7.0			2.0	

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshire
LINE 16N HALF E SP. 1 DATE

PAGE copy

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	35-30	25-30	—	25-20	—	—	20-15	—	—	—
RANGE										
DC 1		+1.6	+1.9	+1.2	+1.1	+1.1	+1.1	+1.1	+1.1	+1.0
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		62.6	12.1	114.0	21.0	6.02	87.8	25.2	7.70	2.88
AC 2		+0.2	+0.7	+0.6	+0.1	0.0	+0.2	+0.1	0.0	0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10N HALF E SP. 1 DATE

PAGE Copy

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
RECEIVE	10-15				10-5W					6-7
RANGE										
DC 1	+0.4	+0.6	+0.4	+0.4	0.1	+0.6	+0.7	+0.8		0.0
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	19.9	8.38	3.25	1.39	7.36	4.11	1.87	.829		205.
AC 2	0.0	0.0	0.0	0.0	-0.1	+0.2	0.0	0.0		+0.6
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshore Line: 10N E ½ Date: copy

Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		
Receive												
Time												
Range												
Current	5.0	7.0	5.0	8.0	7.0	5.0	7.0	8.0	7.0	5.0		
Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	12			Cal	
Receive												
Time												
Range												
Current	7.0	8.0	7.0	5.0	7.0	8.0	7.0	5.0			2.0	

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake shore test

LINE 10N HALF W SP. 1 DATE 9-23-2

PAGE 1

OPEN

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	30-35 W →		35-40 W →			40-45 W →				
RANGE	10	1	1	1	1	1	1	1	.1	
DC 1	+0.9	+0.5	+0.6	+0.4	+0.5	0	+0.2	+0.1	0	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	138	30.5	63.7	27.2	11.7	83.1	17.2	11.6	5.61	
AC 2	+1.1	+0.2	+0.5	+0.2	+0.2	+0.1	+0.2	+0.2	0	
AC AVG.										
S.P.	+47.7	-6..	-6.0			-10.9				
AC NOISE	.04	.0	.05			.07				
POT RES.	0									

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF W SP. 1 DATE 8-23-2

SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6
RECEIVE	45-50	W →				50-55	W →			
RANGE	1	1	.1	.1	.1	1	1	.1	.1	.1
DC 1	-0.6	-0.4	-1.2	-0.9	-1.0	-0.6	-0.4	-1.3	-0.8	-1.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	70.4	21.2	6.82	5.56	3.46	50.1	16.2	7.49	3.19	3.07
AC 2	0	0	-0.2	0	0	+0.1	+0.2	-0.1	+0.1	-1.1
AC AVG.										
S.P.	-5.7					+15.1				
AC NOISE	.08					.07				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF W SP. 1 DATE 8-23-2

SEND	6-7	1-2	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5
RECEIVE	50-55W	55-60W	→	→	→	→	60-65W	→	→	→
RANGE	.1	1	.1	.1	.1	.1	.1	.1	.1	.1
DC 1	-0.9	-0.6	-1.0	-1.0	-1.3	-1.3	-1.0	-0.8	-1.3	-0.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	2.13	14.3	8.06	5.11	2.59	2.58	6.31	4.86	3.48	1.89
AC 2	-0.2	0	+0.1	+0.2	0	0	0	+0.3	0	0
AC AVG.										
S.P.		-35.1					+24.0			
AC NOISE		.06					.07			
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF W SP. 1 DATE 6-23-25

SEND	1-2	2-3	3-4	1-2	2-3	1-2		cal		
RECEIVE	65-70 W →			70-75 W →		75-80 W		1-2		
RANGE	.1	.1	.1	.1	.1	.1		10		
DC 1	-0.6	-1.4	-0.8	-1.0	-1.1	-1.0		-0.7		
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	4.01	3.38	2.60	2.75	2.43	2.06		205		
AC 2	0	-0.1	0	-0.2	-0.3	-0.4		+0.5		
AC AVG.										
S.P.	+5.1			+21.5	~~-22.5~~	-22.5				
AC NOISE	.09			.09		.10				
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10N HALF W SP. 1 DATE 2-23-25

PAGE 1

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	30-35W	→	35-40W	→	→	40-45W	→	→	→	
RANGE	20x450	20x500	20x350	20x450	20x500	20x400	20x350	20x450	20x500	
VOLTAGE	410	430	430	410	430	460	430	410	430	
CURRENT	9.0 10x500	10.0 10x500	7.0 10x500	9.0 10x500	10.0 10x500	9.0 10x500	7.0 10x500	9.0 10x500	10.0 10x500	
SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6
RECEIVE	45-50W	→	→	→	→	50-55W	→	→	→	→
RANGE	20x350	20x400	20x350	20x450	20x500	20x250	20x350	20x400	20x350	20x450
VOLTAGE	435	460	430	410	430	485	435	460	425	410
CURRENT	7.0 10x500	8.0 10x500	7.0 10x500	9.0 10x500	10.6 10x500	5.0 10x500	7.0 10x500	8.0 10x500	7.0 10x500	9.0 10x500

FREQUENCIES 1.0 .1

SENDER NO. 16681 5

OPERATOR Gary Cruze

RECEIVER NO. Mark 4 C

OPERATOR Ron Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10N HALF W SP. 1 DATE 8-23-25

SEND	6-7	1-2	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4
RECEIVE	50-55W	55-60W	→	→	→	→	→	60-65W	→	→
RANGE	20x500	20x250	20x350	20x400	20x350	20x450		20x250	20x350	20x400
VOLTAGE	430	485	435	455	420	410		485	435	455
CURRENT	10.0 10x500	5.0 10x500	7.0 10x500	8.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500	5.0 10x500	7.0 10x500	8.0 10x500

SEND	4-5	1-2	2-3	3-4	1-2	2-3	1-2		cal	
RECEIVE	→	65-70W	→	→	70-75W	→	75-80W		1-2	
RANGE	20x350	20x250	20x350	20x400	20x250	20x350	20x250		10x200	
VOLTAGE	470	495	435	450	480	435	480		190	
CURRENT	7.0 10x500	5.0 10x500	7.0 10x500	8.0 10x500	5.0 10x500	7.0 10x500	5.0 10x500		2.0 10x500	

FREQUENCIES 1.0 .1

SENDER NO. 166815

OPERATOR Gary Croze

RECEIVER NO. Mark 4C

OPERATOR Ron Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10N HALF E SP. 1 DATE 5-25-26

SEND	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	
RECEIVE	30-25W →		25-20W →		→	20-15W →			→	
RANGE	1	1	10	1	.1	1	1	.1	.1	
DC 1	+1.6	+1.9	+1.2	+1.1	+1.1	+1.1	+1.1	+1.1	+1.0	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6							8			
DC 7			8							
DC 8										
DC AVG.										
AC 1	62.6	12.1	11.4	21.0	6.02	87.8	25.2	7.70	2.88	
AC 2	+0.2	+0.7	+0.6	+0.1	0	+0.2	+0.1	0	0	
AC AVG.										
S.P.	+25.9		-48.3			+58.3				
AC NOISE	.04		.05			.06				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10N HALF E SP. 1 DATE 5-25-2

SEND	5-6	4-5	3-4	2-3	1-2	6-7	5-6	4-5	3-4	2-3
RECEIVE	15-10W				→	10-5W				
RANGE	10	1	.1	.1	.1	10	1	.1	.1	.1
DC 1	+0.3	+0.4	+0.6	+0.4	+0.4	+0.5	+0.5	+0.1	+0.6	+0.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	114	19.9	8.38	3.25	1.39	149	27.4	7.36	4.11	1.87
AC 2	0	0	0	0	0	+0.6	+0.1	-0.1	+0.2	0
AC AVG.										
S.P.	+1.4					+29.8				
AC NOISE	.06					.06				
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10N HALF E SP. 1 DATE 7-25-26

SEND	6-7	5-6	4-5	6-7	5-6	6-7		Cal		
RECEIVE	5-10E	→	→	10-15E	→	15-20E		6-7		
RANGE	.1	.1	.1	.1	.1			10		
DC 1	-0.4	+0.2	-0.2	-0.3	+0.1			0		
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	6.17	2.63	1.07	2.78	1.62			205		
AC 2	+0.2	0	+0.3	-0-	+0.1			+0.6		
AC AVG.										
S.P.	-59.7			+15.7						
AC NOISE	.07			.09						
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10N HALF E SP. 1 DATE F-25-2

SEND	1-2	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4
RECEIVE	10-SW	SW 0	←	←	←	→	0-SE	→	→	→
RANGE	.01	1	.1	.1	.1	.01	1	.1	.1	.01
DC 1	+0.8	+0.5	+0.6	+0.5	+0.4	+0.2	+0.8	+0.1	0	+0.8
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	.829	22.4	7.40	2.48	1.62	.745	10.7	3.93	1.44	.885
AC 2	0	+0.2	0	-0.2	+0.1	-0.1	+0.7	-0.2	0	0
AC AVG.										
S.P.		-40.7					+48.9			
AC NOISE		.07					.08			
POT RES.							By tailings		pond.	

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10N HALF E SP. ___ DATE 8-25-86

SEND	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	5-6
RECEIVE	30-25W	→	25-20W	→	→	20-15W	→	→	→	15-10W
RANGE	20x350	20x250	20x400	20x350	20x250	20x350	20x400	20x350	20x250	20x450
VOLTAGE	440	490	480	440	490	440	480	440	490	410
CURRENT	7.0 10x500	5.0 10x500	8.0 10x500	7.0 10x500	5.0 10x500	7.0 10x500	8.0 10x500	7.0 10x500	5.0 10x500	9.0 10x500
SEND	4-5	3-4	2-3	1-2	6-7	5-6	4-5	3-4	2-3	1-2
RECEIVE	→	→	→	→	10-5W	→	→	→	→	→
RANGE	20x350	20x400	20x350	20x250	20x500	20x450	20x350	20x400	20x350	20x250
VOLTAGE	430	480	440	490	435	410	440	475	445	490
CURRENT	7.0 10x500	8.0 10x500	7.0 10x500	5.0 10x500	10.0 10x500	9.0 10x500	7.0 10x500	8.0 10x500	7.0 10x500	5.0 10x500

FREQUENCIES 1.0 .1

SENDER NO. 16681S

OPERATOR Kern

RECEIVER NO. Mark 4C

OPERATOR Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake shore test

LINE 10N HALF E SP. 1 DATE 8-25-8

SEND	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4	
RECEIVE	5-0W	———	———	———	——→	0-5E	———	———	——→	
RANGE	20x450	20x450	20x350	20x400	20x350	20x450	20x450	20x350	20x200	
VOLTAGE	390	410	430	475	440	390	410	430	475	
CURRENT	9.0 10x500	9.0 10x500	7.0 10x500	8.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500	7.0 10x500	8	
SEND	6-7	5-6	4-5	6-7	5-6	6-7		cal		
RECEIVE	5-10E	———	——→	10-15E	——→	15-20E		6-7		
RANGE	20x450	20x450	20x350	20x450	20x450			10x200		
VOLTAGE	390	405	430	380	405			85		
CURRENT	9.0 10x500	9.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500	10		2.0 10x500		

FREQUENCIES 1.0 .1

SENDER NO. 166815

OPERATOR KERN

RECEIVER NO. MARK 4C

OPERATOR Elmer

COMMENTS:

HEINRICHS GEOEX JOB LAKESHORE LINE 10N SPREAD 1 LOOKING N 8-27-69 A= 500 FEET

1.0 - 0.1 sec

7.000	8.000	7.000	7.000	8.000	7.000	5.000	7.000	7.000	8.000	I	5.000	7.000	8.000	7.000	5.000	7.000	8.000	7.000	2.000	
6	0	2	-6	-4	-12	-6	-4	-13	-8	DC	-6	-10	-10	-13	-10	-8	-13	-7	-7	LEFT
6	0	2	-6	-4	-12	-6	-4	-13	-8		-6	-10	-10	-13	-10	-8	-13	-7	-7	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
.6	0.0	.2	-.6	-.4	-1.2	-.6	-.4	-1.3	-.8	PFEA	-.6	-1.0	-1.0	-1.3	-1.0	-.8	-1.3	-.7	-.7	
63.70	83.10	17.20	70.40	21.20	6.820	50.10	16.20	7.490	3.190	AC1	14.30	8.060	5.110	2.590	6.310	4.860	3.480	1.890	205.0	
.5	.1	.2	0.0	0.0	-.2	.1	.2	-.1	.1	AC2	0.0	.1	.2	0.0	0.0	.3	0.0	0.0	.5	
63.86	83.14	17.22	70.40	21.20	6.813	50.13	16.22	7.486	3.192	ACA	14.30	8.064	5.115	2.590	6.310	4.867	3.480	1.890	205.5	
13.49	15.31	14.51	14.73	15.56	14.19	14.68	13.59	15.97	11.66	RHO	16.76	16.80	18.64	18.84	18.41	20.30	22.15	22.13	.973	DC CAL
1.3	.9	1.0	.4	.6	-.1	.3	.4	2.3	.1	PFE	.4	-.1	-.1	-.3	-.0	.0	-.3	.3	.950	AC CAL
96	59	72	24	35	-11	20	33	144	9	MCF	21	-6	-8	-19	-3	0	-16	11		
.0	.0	.1	.0	.1	.3	.0	.1	.3	.7	CPFE	.1	.2	.4	.6	.2	.4	.5	.8		
1.3	.9	.9	.3	.4	-.5	.3	.3	2.0	-.6	CCPFE	.2	-.3	-.5	-1.0	-.3	-.4	-.9	-.5		
94	57	64	22	28	-32	18	23	128	-56	CCMCF	15	-20	-29	-53	-14	-17	-39	-25		

5.000	7.000	5.000	8.000	7.000	5.000	7.000	8.000	7.000	5.000	I	7.000	8.000	7.000	5.000	7.000	8.000	7.000	5.000	2.000	
16	19	12	11	11	11	11	11	10	DC	4	6	4	4	1	6	7	8	0	RIGHT	
16	19	12	11	11	11	11	11	10		4	6	4	4	1	6	7	8	0	SIDE	
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	1.6	1.9	1.2	1.1	1.1	1.1	1.1	1.1	1.0	PFEA	.4	.6	.4	.4	.1	.6	.7	.8	0.0	
0.000	62.60	12.10	114.0	21.00	6.020	87.80	25.20	7.700	2.880	AC1	19.90	8.380	3.250	1.390	7.360	4.110	1.870	.829	205.0	
0.0	.2	.7	.6	.1	0.0	.2	.1	0.0	0.0	AC2	0.0	0.0	0.0	0.0	-.1	.2	0.0	0.0	.6	
0.000	62.66	12.14	114.3	21.01	6.020	87.89	25.21	7.700	2.880	ACA	19.90	8.380	3.250	1.390	7.356	4.114	1.870	.829	205.6	
*000.0	13.30	14.44	21.10	17.75	17.81	18.56	18.64	16.27	17.03	RHO	16.71	15.42	13.64	14.30	15.40	15.13	13.78	13.70	.973	DC CAL
*000.0	1.8	1.8	1.2	1.3	1.4	1.3	1.3	1.4	1.3	PFE	.7	.9	.7	.7	.4	.8	1.0	1.1	.300	AC CAL
*0000.	135	128	57	76	79	70	72	86	76	MCF	42	58	51	49	29	53	73	80		
0.0	.0	.1	0.0	.1	.2	0.0	.	.3	.4	CPFE	.1	.3	.6	.9	.3	.5	1.0	1.5		
*000.0	1.8	1.7	1.2	1.3	1.2	1.3	1.3	1.1	.9	CCPFE	.6	.6	.1	-.2	.2	.3	.0	-.4		
*0000.	133	119	57	71	66	70	68	71	50	CCMCF	36	41	7	-17	12	18	1	-29		

2-18-70
MD

JOB Lakeshore MK 4C LINE 10 N SPREAD 1A

LOOKING N DATE Aug 27, 69 A= 500 feet

CENTER -25.0 LABEL W / E FREQ. 1.0 - 0.1

COUPLING yes

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake shore
LINE 10N HALF W SP. 1A DATE

PAGE Copy

SEND	6-7	5-6	6 7	4-5	5-6	6-7	3-4	4-5	5-6	6-7
RECEIVE	25-30	30-35	—	35-40	—	—	40-45"	—	—	—
RANGE										
DC 1		+6.9	+0.5	+0.6	+0.4	+0.5	-0.0	+0.2	+0.1	0.0
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1		138.0	30.5	63.7	27.2	11.7	83.7	17.2	11.6	5.61
AC 2		+1.1	+0.2	+0.5	+0.2	+0.2	+0.1	+0.2	+0.2	0.10
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 10N HALF W SP. 1A DATE

PAGE Copy

SEND	3-4	4-5	5-6	6-7	3-4	4-5	5-6	6-7		cal
RECEIVE	45-50				50-55					
RANGE										
DC 1	-0.4	-1.2	-0.9	-1.0	-1.3	-0.8	-1.7	-0.9		-0.7
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	21.2	6.82	5.56	3.46	7.49	3.19	3.07	2.13		205
AC 2	0.0	-0.2	0.0	0.0	-0.1	+0.1	-1.1	-0.2		+0.5
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lakeshire Line: 10N & 1A W½ Date: Coff

Send	6-7	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7		
Receive												
Time												
Range												
Current	10.0	9.0	10.0	7.0	9.0	10.0	8.0	7.0	9.0	10.0		
Send	3-4	4-5	5-6	6-7	3-4	4-5	5-6	6-7		Cal		
Receive												
Time												
Range												
Current	8.0	7.0	9.0	10.0	8.0	7.0	9.0	10.0		2.0		

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT LAKESHORE
LINE 10N HALF E SP. 1A DATE

PAGE Copy

SEND	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4
RECEIVE	20-25	15-20	—	10-15	—	—	5-10	—	—	—
RANGE										
DC 1	+1.2	+1.1	+1.1	+0.3	+0.4	+0.6	+0.5	+0.5	+0.1	+0.6
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	114.0	87.8	25.2	114.0	19.9	8.38	149	27.4	7.36	4.11
AC 2	+0.6	+0.2	+0.1	0.0	0.0	0.0	+0.6	+0.1	−0.1	+0.2
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshor

LINE 10N HALF E SP. 1A DATE

PAGE Copy

SEND	6-7	5-6	4-5	3-4	6-7	5-6	4-5	3-4		Cal
RECEIVE	0-5W				0-5E					
RANGE										
DC 1	+0.5	+0.6	+0.5	+0.4	+0.8	+0.1	0.0	+0.8		0.0
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	22.F	7.40	2.48	1.62	10.7	3.93	1.44	.885		205
AC 2	+0.2	0.0	-0.2	+0.1	+0.7	-0.2	0.0	0.0		+0.6
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

INDUCED POLARIZATION SENDER NOTES

Project: Lake Shore Line: 10N 5E 1A E/2 Date: _____

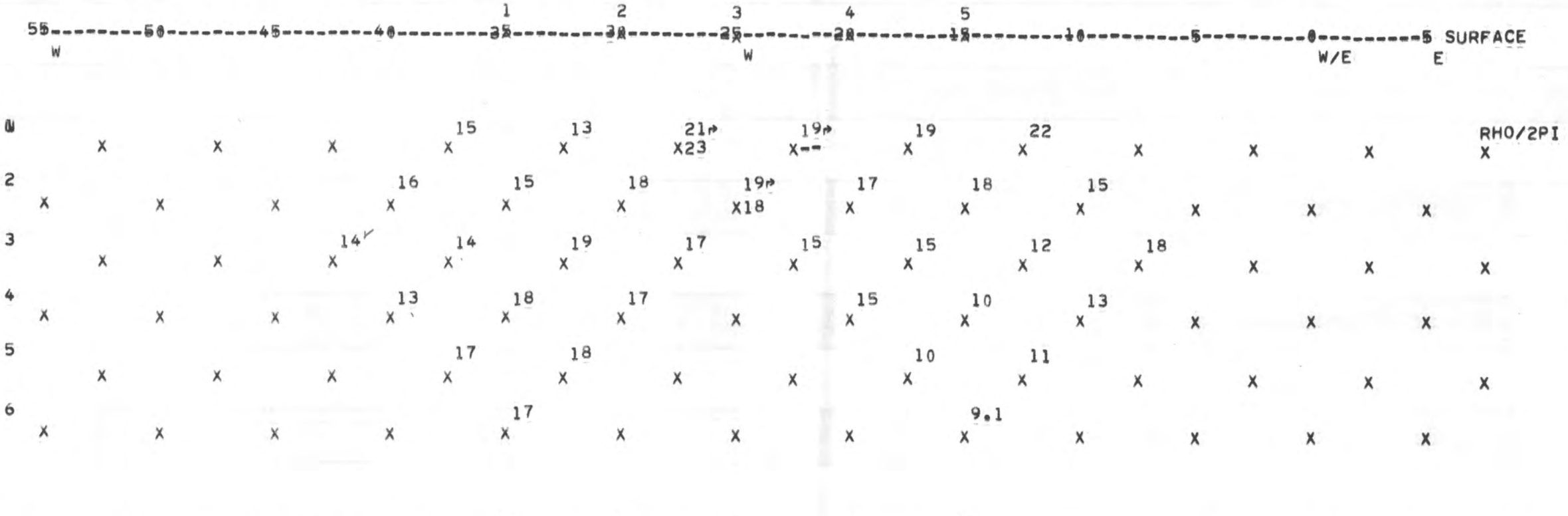
Send	3-4	4-5	3-4	5-6	4-5	3-4	6-7	5-6	4-5	3-4		
Receive												
Time												
Range												
Current	8.0	7.0	8.0	9.0	7.0	8.0	10.0	9.0	7.0	8.0		
Send	6-7	5-6	4-5	3-4	6-7	5-6	4-5	3-4			Cal	
Receive												
Time												
Range												
Current	9.0	9.0	7.0	8.0	9.0	9.0	7.0	8.0			2.0	

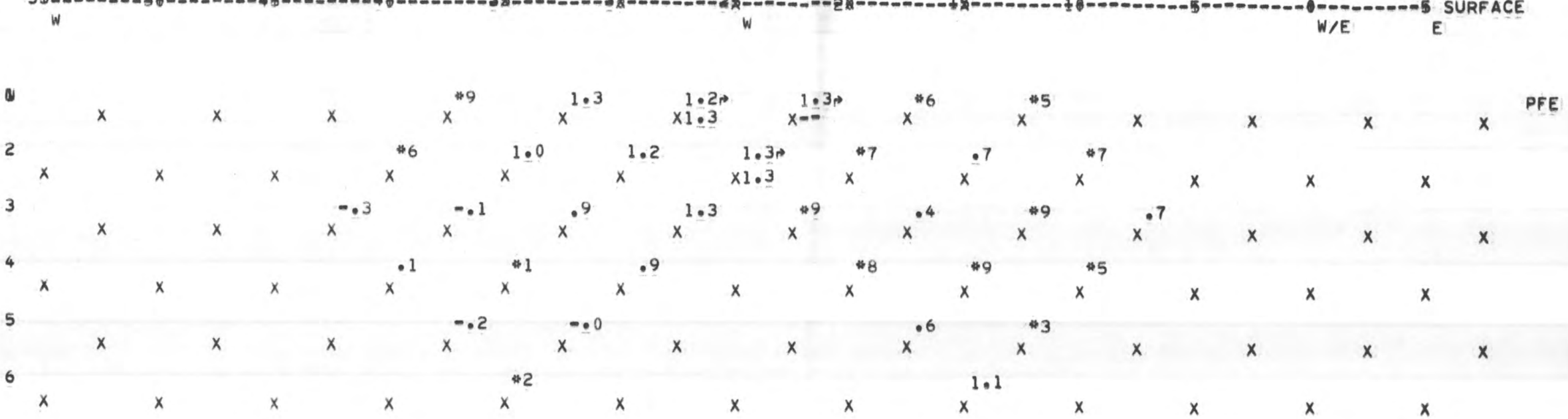
HEINRICHS GEOEX JOB LAKESHORE MK4C LINE 10N SPREAD 1A LOOKING N 8-27-69 A= 500 FEET

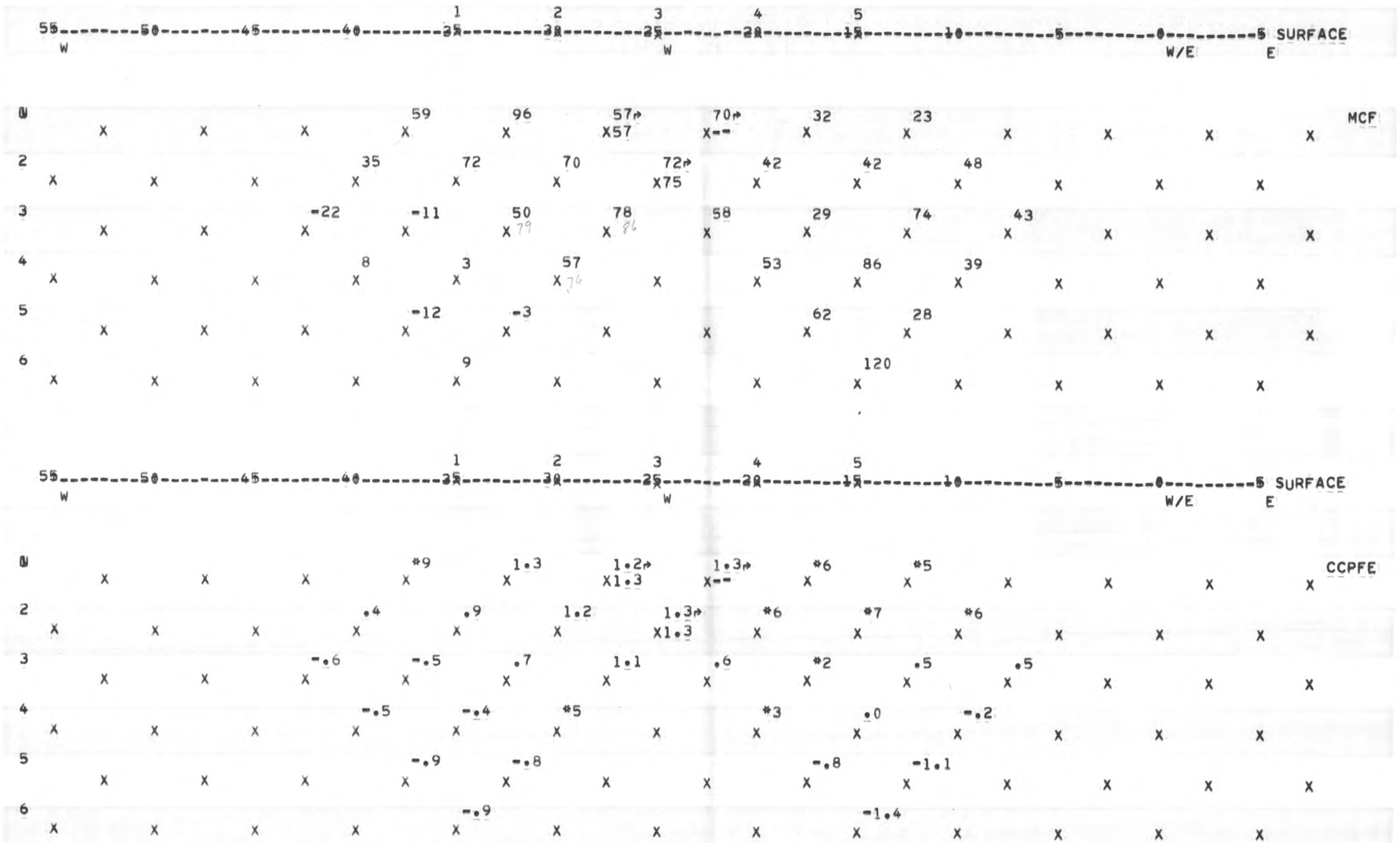
10.000	9.000	10.000	7.000	9.000	10.000	8.000	7.000	9.000	10.000	I	8.000	7.000	9.000	10.000	8.000	7.000	9.000	10.000	2.000	
	9	5	6	4	5	0	2	1	0	DC	-4	-12	-9	-10	-13	-8	-17	-9	-7	LEFT
	9	5	6	4	5	0	2	1	0		-4	-12	-9	-10	-13	-8	-17	-9	-7	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	.9	.5	.6	.4	.5	0.0	.2	.1	0.0	PFEA	-.4	-1.2	-.9	-1.0	-1.3	-.8	-1.7	-.9	-.7	
0.000	138.0	30.50	63.70	27.20	11.70	83.10	17.20	11.60	5.610	AC1	21.20	6.820	5.560	3.460	7.490	3.190	3.070	2.130	205.0	
0.0	1.1	.2	.5	.2	.2	.1	.2	.2	0.0	AC2	0.0	-.2	0.0	0.0	-.1	.1	-1.1	-.2	.5	
0.000	138.8	30.53	63.86	27.23	11.71	83.14	17.22	11.61	5.610	ACA	21.20	6.813	5.560	3.460	7.486	3.192	3.053	2.128	205.5	
*000.0	22.80	18.07	13.49	17.89	17.33	15.31	14.51	19.01	16.53	RHO	15.56	14.19	18.05	17.67	13.62	13.35	17.30	17.42	.973	DC CAL
*000.0	1.3	1.3	1.3	1.2	1.3	.9	1.0	.9	.9	PFE	.6	-.1	.1	-.0	-.3	.1	-.2	.2	.950	AC CAL
*0000.	57	75	96	70	78	59	72	50	57	MCF	35	-11	3	-3	-22	8	-12	9		
0.0	0.0	.1	.0	.1	.2	.0	.1	.2	.5	CPFE	.1	.3	.4	.7	.3	.6	.7	1.1		
*000.0	1.3	1.3	1.3	1.2	1.1	.9	.9	.7	.5	CCPFE	.4	-.5	-.4	-.8	-.6	-.5	-.9	-.9		
*0000.	57	70	94	65	65	57	64	39	29	CCMCF	28	-32	-20	-43	-46	-39	-54	-54		

8.000	7.000	8.000	9.000	7.000	8.000	10.000	9.000	7.000	8.000	I	9.000	9.000	7.000	8.000	9.000	9.000	7.000	8.000	2.000	
12	11	11	3	4	6	5	5	1	6	DC	5	6	5	4	8	1	0	8	0	RIGHT
12	11	11	3	4	6	5	5	1	6		5	6	5	4	8	1	0	8	0	SIDE
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
1.2	1.1	1.1	.3	.4	.6	.5	.5	.1	.6	PFEA	.5	.6	.5	.4	.8	.1	0.0	.8	0.0	
114.0	87.80	25.20	114.0	19.90	8.380	149.0	27.40	7.360	4.110	AC1	22.40	7.400	2.480	1.620	10.70	3.930	1.440	.885	205.0	
.6	.2	.1	0.0	0.0	0.0	.6	.1	-.1	.2	AC2	.2	0.0	-.2	.1	.7	-.2	0.0	0.0	.6	
114.3	87.89	25.21	114.0	19.90	8.380	149.4	27.41	7.356	4.114	ACA	22.42	7.400	2.478	1.621	10.74	3.926	1.440	.885	205.6	
21.10	18.56	18.64	18.59	16.71	15.42	21.91	17.91	15.40	15.13	RHO	14.64	12.10	10.42	10.41	17.54	12.79	10.54	9.14	.973	DC CAL
1.2	1.3	1.3	.6	.7	.9	.5	.7	.4	.8	PFE	.7	.9	.9	.6	.7	.5	.3	1.1	.300	AC CAL
57	70	72	32	42	58	23	42	29	53	MCF	48	74	86	62	43	39	28	120		
0.0	0.0	.1	0.0	.1	.3	0.0	.1	.3	.5	CPFE	.1	.4	.9	1.4	.2	.7	1.4	2.5		
1.2	1.3	1.3	.6	.6	.6	.5	.7	.2	.3	CCPFE	.6	.5	.0	-.8	.5	-.3	-1.1	-1.4		
57	70	68	32	36	41	23	37	12	18	CCMCF	39	43	3	-75	30	-13	-105	-157		

HEINRICHS GEOEX JOB LAKESHORE MK4C LINE 10N SPREAD 1A LOOKING N 8-27-69 A= 500 FEET






55 50 45 40 35 30 25 20 15 10 5 0 5 SURFACE
W W W/E E
0 59 96 57↱ 70↱ 32 23 MCF
X X X X X X X57 X-- X X X X X X
2 35 72 70 72↱ 42 42 48
X X X X X X X75 X X X X X X
3 -22 -11 50 78 58 29 74 43
X X X X X X79 X86 X X X X X X
4 8 3 57 53 86 39
X X X X X X X74 X X X X X X
5 -12 -3 62 28
X X X X X X X X X X X X X
6 9 120
X X X X X X X X X X X X X
55 50 45 40 35 30 25 20 15 10 5 0 5 SURFACE
W W W/E E
0 *9 1.3 1.2↱ 1.3↱ *6 *5 CCPFE
X X X X X X X1.3 X-- X X X X X
2 .4 .9 1.2 1.3↱ *6 *7 *6
X X X X X X X1.3 X X X X X X
3 -.6 -.5 .7 1.1 .6 *2 .5 .5
X X X X X X X X X X X X X
4 -.5 -.4 *5 *3 .0 -.2
X X X X X X X X X X X X X
5 -.9 -.8 -.8 -1.1
X X X X X X X X X X X X X
6 -.9 -1.4
X X X X X X X X X X X X X

```
                                                  1         2         3         4         5
55--------50--------45--------40--------35--------30--------25--------20--------15--------10--------5--------0--------5 SURFACE
  W                                                                  W                                          W/E       E

1                                   57        94        57→       70→       32        23                                      CCMCF
      X         X         X         X         X         X57       X--       X         X         X         X         X         X
2                                 28        64        65        68→       36        37        39
  X         X         X         X         X         X         X70       X         X         X         X         X         X
3                             -46       -32        39        65        41        12        43        30
      X         X         X         X         X         X         X         X         X         X         X         X         X
4                                 -39       -20        29                  18         3       -13
  X         X         X         X         X         X         X         X         X         X         X         X         X
5                                       -54       -43                            -75       -105
      X         X         X         X         X         X         X         X         X         X         X         X         X
6                                           -54                                       -157
  X         X         X         X         X         X         X         X         X         X         X         X         X

AC READING MISSING CARD  10
```

JOB Lakeshire Mk 4C Test LINE 10N SPREAD 1 ~~1000 ft~~

LOOKING N DATE June 69 A= 1000 feet

CENTER -10.0 LABEL W/E FREQ. 3.0 - 0.1

COUPLING yes

11-14-69 MD Make dummy second half (E/2)

MK 4C

PAGE 1

KHEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore MK-4C Test
LINE 10W HALF W½ SP. ____ DATE 6/20/69

	1	2	3	4	5	6
SEND	56	56	67	67	45	45	56	56	67	67
RECEIVE	10W-20W				20-30W					
RANGE	1		0.1		1		0.1		0.1	
DC 1	0.9		2.9	6.6	1.4	2.6	0.0	-6.0	2.2	6.0
DC 2	7.3		8.4	7.0	2.2	0.6	9.6	8.0	7.5	1.4
DC 3	0.9		9.1	5.0	1.6	3.1	-1.0	-5.0	6.4	9.8
DC 4	3.0		9.0	8.6	1.9	0.9	9.2	12.2	2.4	-5.6
DC 5	1.3		4.0	2.7	1.9	2.9	-6.5	-7.6	7.5	10.6
DC 6	2.8		8.6	9.8	1.6	0.9	12.8	14.5	1.4	-1.6
DC 7	1.4		4.4	5.2	1.9		-5.9	-9.5	7.7	8.6
DC 8	3.0		7.0	7.4	1.4		9.2	15.2	2.7	0.4
DC AVG.	2.09	1.82	6.37	6.2 7.1	1.83	1.7 2.6	2.44	2.5 3.4	4.54	4.7 5.6
AC 1 3	15.65 (0.5)		5.28 (0.3)		15.9 (0.2)		3.21	(-0.1)	3.47	(-0.2)
AC 2 1	0.6	0.6 1.0	2.0	1.7 2.3	0.5	0.5 0.9	1.8	1.8 2.2	2.5	2.6 3.0
AC AVG. 3	20?	—	20?	—	—	—		—		—
S.P. 1	0.5	0.1 2.0	2.0 N	1.5 2.7	0.3	0.2 R.1		— —		—
AC NOISE	0.08, 03						0.05	0.06		
POT RES.	15K	-22					40K	+26		

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10N HALF W 1/2 SP. DATE 6/20

	7		8		9		10			
SEND	34	34	45	45	56	56	67	67		
RECEIVE	30-40W							→		
RANGE	1		0.1		0.1		0.1			
DC 1	2.2	2.3	7.2	5.8	6.0	0.3	-5.5	0.6		
DC 2	-1.2	0.2	5.4	-0.2	6.0	5.6	18.4	10.5		
DC 3	3.6	2.7	0.3	4.5	1.4	2.0	0.2	6.6		
DC 4	-0.6	0.0	5.6	1.8	7.0	8.6	11.9	6.8		
DC 5	3.3	2.7	1.4		0.6	-5.5	-5.5	8.2		
DC 6	-1.2	-0.2	1.2		7.0	16.1	7.4	8.2		
DC 7	3.4	2.4	1.8		2.0	-5.2	5.8	6.0		
DC 8	0.0	0.2	4.8		5.6	7.6	12.7	8.3		
DC AVG.	1.24	1.2 2.1	2.98	3.2 4.1	3.89	4.7 5.6	7.31	7.5	8.4	
AC 1	16.2	(0.1)	3.99	(-0.3)	1.41	(-1.4)	1.66	(-0.3)		
AC 2	0.4	0.4 0.8	1.6	1.6 2.0	3.9	4.1 4.5	4.3	4.4	4.8	
AC AVG.										
S.P.	0.2	0.1 2.0	1.3	1.1 3.0	0.9	2.1 4.0	5.0	5.3	7.2	
AC NOISE	0.03	0.09								
POT RES.	41K		+3.0							

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore

LINE ____ HALF ____ SP. ____ DATE 6/20

SEND	23	23	34	34	45	45	56	56	67	67
RECEIVE	40-50 W									→
RANGE	1		0.1		0.1		0.1		0.1	
DC 1	6.6		7.6		16.0	6.0			-5	-18 7
DC 2	-4.0		-23 .53	-0.4	1.0	11.0			+18 18	+25 28
DC 3	7.0		5.8 35	5.6 52	16.5	16.0 110			0 18	+3 8
DC 4	-4.5		-3.2 26	0.6 62	-4.0	-5.0 140			+19 19	+5 13
DC 5	7.0		4.5 53	6.1 67	21.0	20.0			-6 15	+8 28
DC 6	-4.2		-4.0 .05	-2.0 .1	0.0	-7.0 170			-5	+20 17
DC 7	7.1		7.5 75		10.0	22.0 150			+18 13	-7
DC 8	-4.4		0.2 -7		6.0	-2.0 200			-11 7	
DC AVG.	1.36	1.2 2.1	2.48	2.4 3.3	7.93	7.5 8.4			7.67	7.7
AC 1	17.25	(+0.3)	5.73	+0.2	2.01	+0.6	.83	-	1.59	(±2.0)
AC 2	0.5	0.4 0.8	1.5	1.5 1.9	3.5	3.3 3.7	+A?		+6.0	+6.0 AC 6.0
AC AVG.	19?		—		—					
S.P.	0.2	0.0 1.9	0.9	0.7 2.6	4.6	4.4 6.3				
AC NOISE										
POT RES.										

Cal

3 99.6 +0

1 -0.4

1 -0.0 -1.9 dc AC -1.9

-0.95

+0.4

+1.9

HEINRICHS GEOEXPLORATION CO.

1000'W of #1 — omit punch

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 1 HALF W SP. 1 DATE 6/21/16

PAGE 4

SEND	12	12	23	23	34	34	45	45	56	56
RECEIVE	50-60									
RANGE	1.0		0.1		0.1		0.1		.01	
DC 1	+2 +5.6	+1.0 +1.7	-9 -10.8		+1.5 +0.9		+24 +24			
DC 2	+9 +6.7	+3.4 +2.9	+14 +15.6		+3.5 +6.0		+7 +12			
DC 3	+4.2 +5.7	+0.8 +0.6	-9.5 -11.2		+4.0 +2.3		+14 +6		Too	
DC 4	+7.8 +7.2	+3.6 +3.8	+14.3 +16.2		+4.4 +5.5		+5 +17			
DC 5	+4.8	+0.8 +0.4	-10.0 -11.3		+2.4 +2.4		+21 +3		Noisy	
DC 6	+6.4	+1.9 +3.6	+15.3 +16.2		+4.0 +3.5		0.0 +17.5			
DC 7	+5.0	+2.5 +0.1	-11.1 -11.0		+1.5 +3.5		+5 +2			
DC 8	+6.6	+2.6 +4.0	+15.4 +12.4		+6.2 +5.0		-4 +21			
DC AVG.	2.07	1.7	2.37	2.4	3.56	3.9	11.29	11.4		
AC 1 3	14.5 (0.7)		4.65 (0.0)		2.68 (-0.4)		1.25 (-0.2)		.689 (-0.4)	
AC 2 1	+1.0	0.8	+1.8	1.8	+2.2	2.3	+5.8 Noisy	5.9	+5.5 Noisy	
AC AVG.	+1.6	1.0	+2.0	2.0	+2.1	2.9	+8.4	8.6	+3.5	
S.P.	-35.8	-35.8								
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

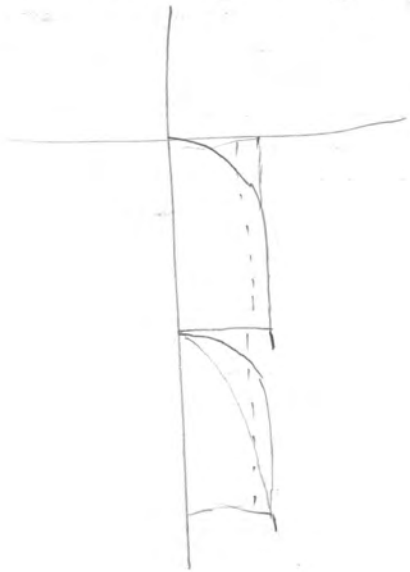
PROJECT _____

LINE ____ HALF ____ SP. ____ DATE ____

PAGE 2

SEND	67	67	12	12	23	23	34	34	45	Cal
RECEIVE		→	70-80	W						
RANGE	0.1									
DC 1	+33 +47									0.07
DC 2	-18 -27								0.1 Hz	-1.9
DC 3	+38 +48									
DC 4	-21 -30									-1.9
DC 5	+43 +50									
DC 6	-25 -26								1.0 Hz	-0.4
DC 7	+44 +51									
DC 8	-26									
DC AVG.	9.93									
AC 1 3	1.54 (00)									99.1
AC 2 1	+5.8									+0.0
AC AVG.	+7.3									
S.P.	-38.0									
AC NOISE	0.6									
POT RES.										

1 2 3 4 5 6 7 α β γ



HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT LAKE SHORE

LINE 10N HALF W SP. ___ DATE 6-20

PAGE 1

	1	2	3	4	5	6	7	8	9	10	
SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7		
RECEIVE	10-40W	20W	20W	30W	→	30-40W		→			
RANGE	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi		
VOLTAGE	70	220	340 ✓	70 ✓	370 ✓	380 ✓	430 ✓	120 ✓	370 ✓		
CURRENT	3.0	3.0	3.0	3.0	5.0	3.0	4.0	5.0	5.0		
SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6	
RECEIVE	40-50W	→	→	→	→	50-60W	→	→	→	→	
RANGE	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	
VOLTAGE	510 ✓	480 ✓	510 ✓	150 ✓	440/290	510	480	460	500	180	
CURRENT	3.0	4.0	5.0	6.0	6.0/4.0	3.0	3.0	4.0	5.0	7.0	

FREQUENCIES 1Hz / ___

SENDER NO. 6644

OPERATOR HIX

RECEIVER NO.

OPERATOR

COMMENTS:

6-7 Hi — 5.0

5-6 Hi — 4.0

4-5 Hi — 4.0

3-4 — 40 — 4.0

2-3 — 40 — 3.0

1-2 — 60 — 3.0

✓ = Same for Paul.

3. — F — A-C

1. — E —

.3 — D —

.1 — C —

3.0 — F A-C

42
42
39
43
41
42
44

1
713
7
61

41857

20928

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT LAKE SHORE
LINE 10N HALF W SP. ___ DATE 6-20

SEND	6-7 (18)	1-2	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4
RECEIVE	50-60W	60-70W	→	→	→	→	→	70-80W	→	→
RANGE	HI	HI	HI	HI						
VOLTAGE	440	510	510	440						
CURRENT	6.0	3.0	3.0	4.0						
SEND	4-5	1-2	2-3	3-4			CAC			
RECEIVE	80W	80-90W	→	→			1-2 W			
RANGE							HI			
VOLTAGE							190			
CURRENT							1.0			

FREQUENCIES ALL
SENDER NO. 6644
OPERATOR HIX
RECEIVER NO.
OPERATOR

COMMENTS:
1-2 — ~~40~~ HI — 3.0
2-3 — HI — 3.0
3-4 — HI — 4.0
4-5 — HI — 4.0
5-6 — HI — 4.0
6-7 — HI — 4.0

LF

DOC- 1

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Field Notes for 7 electrode array:
by E-W line & going W first
Center at 10W

W ½

5-6 6-7	4-5 5-6 6-7	3-4 4-5 5-6 6-7
10W-20W	20W-30W	30W-40W

2-3 3-4 4-5 5-6 6-7	1-2 2-3 3-4 4-5 5-6 6-7
40W-50W	50W-60W

1-2 2-3 3-4 4-5 5-6	1-2 2-3 3-4 4-5
60W-70W	70W-80W

1-2 2-3 3-4
80W-90W

E ½

S.P. only	S.P. Only	4-5 3-4 2-3 1-2
10W-0E/W	0E/W-10E	10E-20E

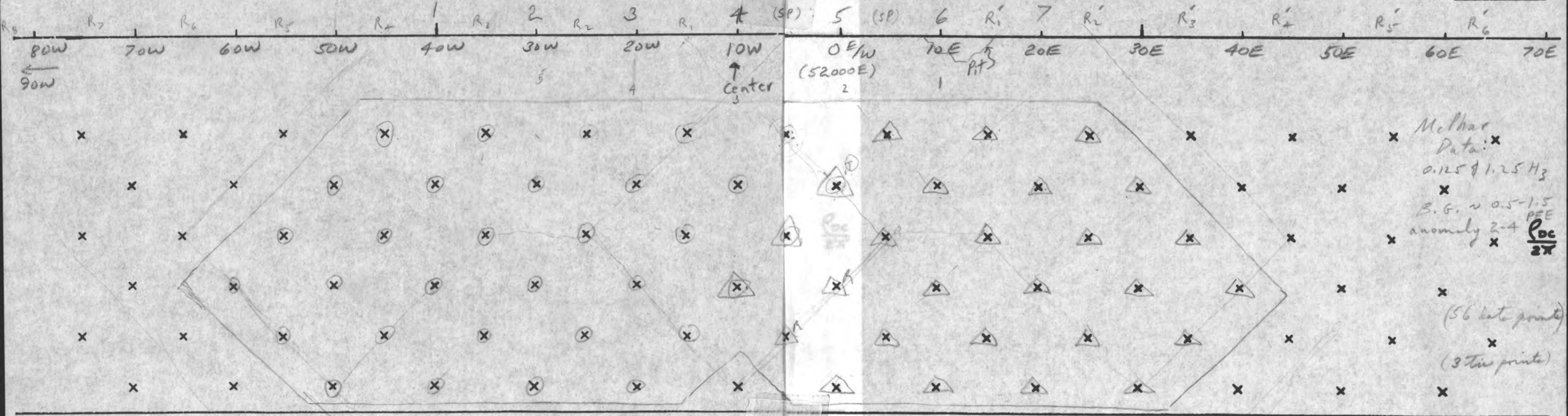
5-6 4-5 3-4 2-3 1-2	6-7 5-6 4-5 3-4 2-3 1-2
20E-30E	30E-40E

6-7 5-6 4-5 3-4 2-3	6-7 5-6 4-5 3-4
40E-50E	50E-60E

6-7 5-6 4-5
60E-70E

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING

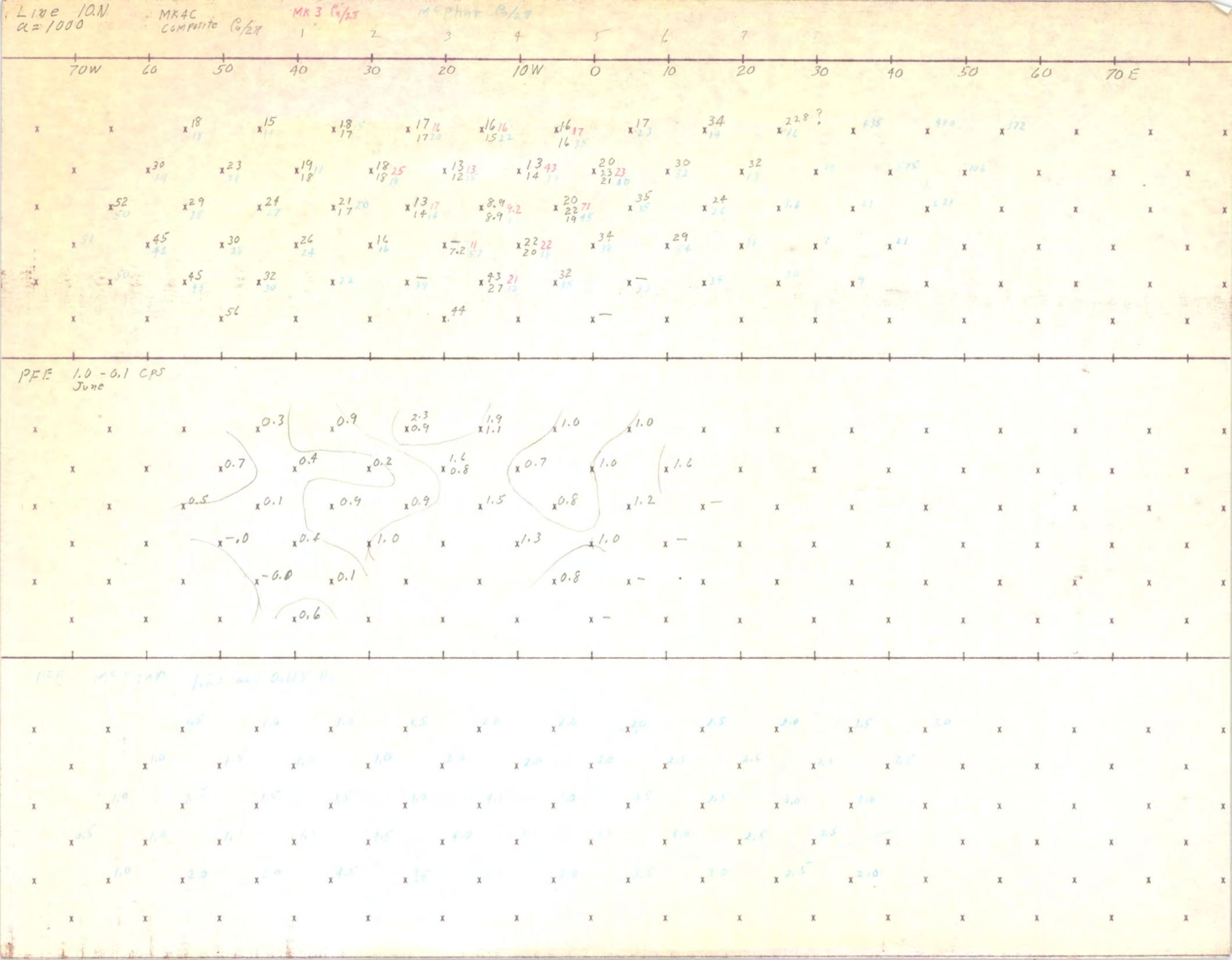
HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING North



AREA Lakeshore Mine LINE 10N (50700N) a = 1000' SCALE: 1"=1000' DATE: Test MK4C, MK4B

MK3 Receivers (MK 4 Sender)

LINE a = ' SCALE: DATE: June, 1969


Line 10.N
a = 1000
MK4C
Composite ρa/2π
MK 3 ρa/2π
McPhar ρa/2π
70W
60
50
40
30
20
10W
0
10
20
30
40
50
60
70E
PFE 1.0 - 0.1 CPS
June

Aug 18

John Reynolds Shed test I.R. work
stripping. test may interfere

Snyder

$ 17.25 $ 175 182 175 181 175 181 174 183 175 182

1.0 Hz

MK 3 Test Coke Stove

n=1 (S 6-7)(R 0-100)

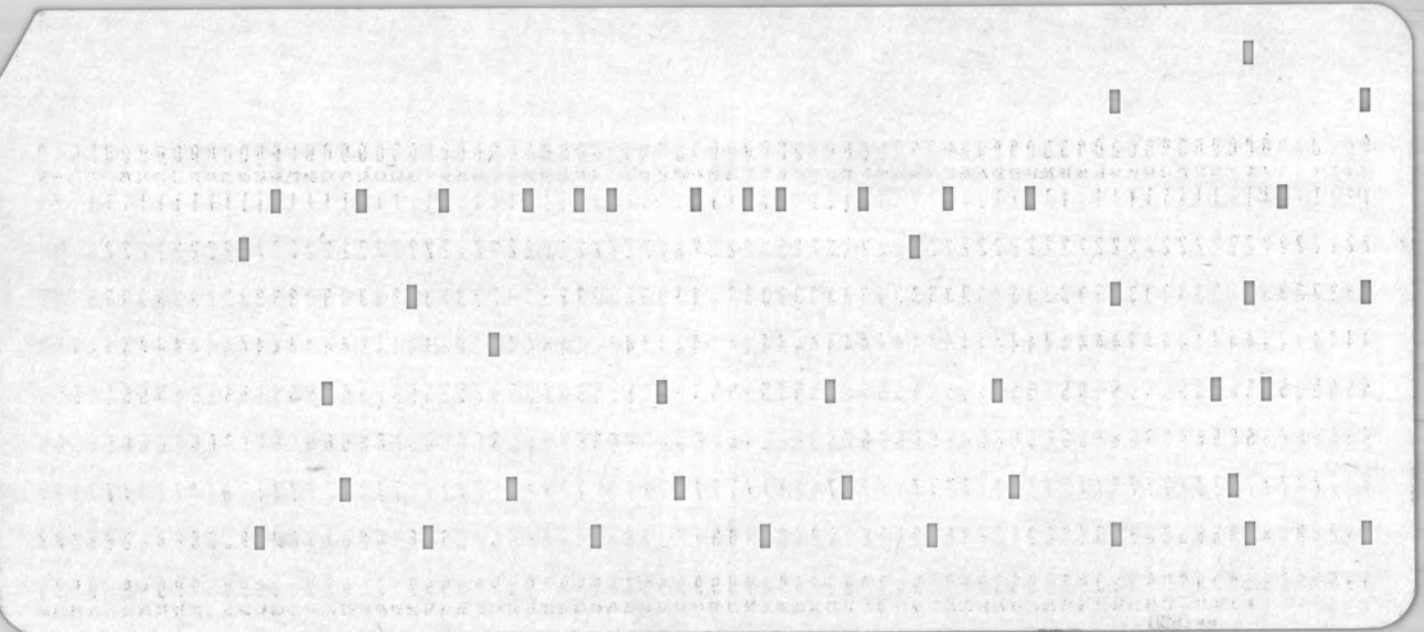
IBM 5081

$ 15.75 $ 175, 182 175 181 175 181 174 183 175 182

3.0Hz

MK 3 Lake shore test

IBM [5081]



HEINRICHS GEOEXPLORATION CO.

19.5
17.4

PAGE 1

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 10 S HALF W SP. 1 DATE 11/26/89

SEND	4-5								CW.	
RECEIVE	0-15W			Test						
RANGE	1.0									
DC 1	+19.2					AC = .8				
DC 2	-17.1					DC = .05				
DC 3	+19.7									
DC 4	-17.7		~2.1 PFE							
DC 5	+23.4									
DC 6	-18.8									
DC 7	+24.8									
DC 8	-20.1									
DC AVG.										
AC 1	1255									
AC 2	~0									
AC AVG.										
S.P.	+12.6									
AC NOISE										
POT RES.										

We want

USE
4C Test
Sander Notes

HAGUE TIRE CENTER

1111 SO. KOLB ROAD AT 22nd STREET
TUCSON, ARIZONA

Phone 298-4829

LEE
OF CONSHOHOCKEN

NEW - USED

RETREADS

4B

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 1 HALF W SP. 1 DATE 6/20

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	10W →	→20W	20W	→	→30W	30W	→	→	→40W	
RANGE	1.0	0.1	1.0	0.1	0.1	0.1	0.1	0.1	0.1	
DC 1	-1 5.8	0.0 7.5	1.2 2.1	-2.7 7.8	6.9 4.0	1.0 1.21	1.4 3.3	11.9 -5.9	16.0 -3.0	
DC 2	-1.8 6.4	1.5 7.5	1.1 2.4	-4.1 7.2	6.0 4.0	1.34 1.01	1.2 4.7	5.9 -7.2	16.8 -8.1	
DC 3	-1.8 11	0.0 7.5	1.0 2.3	-2.7 5.5	3.5 7.6	1.3 0.7	0 23.85	9 2 -5.8	17.1 -2.5	
DC 4	6.4 7.6	-0.1 8.4	1.0 3.2	-2.1 9.4	0.6 9.3	1.0 1.4	1.0 3.4	18 0 -13	11.1 2.2	
DC 5	6.2 7.9	1.0 7.2	0.1 3.2	3.8 1.2	0.7 7.9	1.2 0.4	2.0 1.0	20.0 -12	7.9 1.9	
DC 6	6.5 -2.2	0.2 7.4	-0.2 3.5	-1.0 5.5	1.1 7.5	1.6 1.1	0.2 6.0	11.7 -2.9	12.9 2.7	
DC 7	1.8 -2.3	-0.1 10.5	-0.4 3.5	-2.8 7.6		1.0 1.0	0.3 4.2	10.4 -6.4	10.6 3.0	
DC 8	7.0 -2.3	-1.2 8.1	-0.4 4.1	-4.4 9.1		1.5 0.8	0.8 3.8	13.6 -12.0	7.5 4.2	
DC AVG.										
AC 1.3	16.0 .6	5.52 0.2	16.1 .05	3.37 0.0	3.6 4.0	16.5 0.0	4.16 -0.1	4.52 -0.5	1.76 0.0	
AC 2.1	0.4	1.2	.05	.05	1.5	0.2	0.5	1.5	2.0	
AC AVG.3	1.6	2.3	.08	1.4	2.8	0.6	1.5	3.0	4.0	
S.P.	+20.4		-32.1			+6.1				
AC NOISE						.05				
POT RES.	15K		5			47K				

4B

PAGE 2

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 1 HALF W SP. 1 DATE 6/20/68

SEND	2-3	3-4	4-5	5-6	6-7		Cal.			
RECEIVE	4-5-0	→	→	→	→					
RANGE	1.0	0.1	0.1	0.01	0.1		-5.4			
DC 1	+2.0 1.6	0.8	-6.1 -17.0		+17 +13		3.0			
DC 2	+0.1 0.2	-24 +10.0	17.5 +6.0		+2 +9		-5.4			
DC 3	2.0 1.7	+10.0	-7.5 +20		+7 -5		3.0			
DC 4	0.3	-6.8	+23 +1.0		-5 +14		-5.4			
DC 5	1.6	+9.2	-8.0 +11.0		+17 +8		3.0			
DC 6	0.3	-4.5	+21.0 +4.5		-5 +3					
DC 7	1.8	+6.4	-11.5 +1.0		+19 +2					
DC 8	0.6	-3.3	+25.0 +10.0		-8					
DC AVG.										
AC 1 3	17.5 0.0	5.95 +0.1	2.14 +0.5	.7/8	1.70 -0.6		102. 0.0			
AC 2 1	0.1	+0.8	+1.8	+3.5	+3.0		-0.8			
AC AVG 3	0.6	1.2	3.6	+4.9	4.6		-0.8			
S.P.	4 4.0				-5.1					
AC NOISE										
POT RES.										

start at cut beyond #1

4B

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE

PROJECT Lake Shore

LINE ____ HALF W1/2 SP. ____ DATE 6/21

SEND	1-2	2-3	3-4	4-5	[illegible]	5-6	6-7			
RECEIVE	50-60									
RANGE	1.0	0.1	0.1	0.1		.01	0.1			
DC 1	+2.5	4.2 6.2	8 7.0	18 -2	-10 6		4 17	19 24		
DC 2	+1.2	-2.0 -3.0	-1 0.5	1 11	21 14		5 2	-3 -8		
DC 3	+1.2	5.5 6.2	6 7.0	9 6	3 2		8 14	22 24		
DC 4	+1.7	-2.2 -2.7	0 -1.0	17 16	14 17		7 3	0 -10		
DC 5	0.2	5.5 6.0	5.5 8.0	-5 -6	9 -2		8 13	17 23		
DC 6	+2.7	3.2 -2.5	1.0 0	25 24	4 15		8 4	-4 -7		
DC 7	+0.2	5.7 4.7	5.0 5.5	-10 -8	9 8		12 13	20 23		
DC 8	+2.5	-2.5 -1.7	1.0 -1.0	22 24	9 1		4 3	6 -9		
DC AVG.										
AC 1 (3	14.6 +0.2	4.81 +0.3	2.79 +0.0	1.34 →	0.0 ±2.	.671 0±4.	1.63 →	.5 ±1		
AC 2 1	+0.2	+0.6	+1.1	+2.5 ±2.		+5 ±2.	+5 ±1.			
AC AVG. .3	+0.9	+1.2	+2.3	+5.0		5.5 ±1.	7 ±0.4			
S.P.	-36.3									
AC NOISE								0.08		
POT RES.								14.K		

2000 form #1

4D

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE

PROJECT _____

LINE _____ HALF W½ SP. _____ DATE 6/21

SEND	1-2	2-3	3-4							
RECEIVE	60-70									
RANGE										
DC 1				AC	Noise	up	to	2 mv	on	MK 3+4s
DC 2				DC	Noise			ditto		
DC 3						spikes		to	15 or 20 MV	
DC 4										
DC 5										
DC 6										
DC 7										
DC 8	No Read	No Read								
DC AVG.										
AC 1 1.0										
AC 2										
AC AVG.										
S.P.	0.0									
AC NOISE										
POT RES.										

4C Receiver test
Test Line

7 electrode Spread
Centered at 10W

not used on 4C 6/20/69

frequencies 3.0, 1.0, 0.3, 0.1

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page 1

Project Lake Shore Line 10N W½ Field date 6/20/69 Data page 1 Comp. date _____ . Comp by CSL PGH

(A) Send	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7			
(B) Receive	10W-20W	—	20-30W	—	—	30-40W	—	—	—			
(C) n separation												
(D) I	3.0	3.0	3.0	3.0	5.0	3.0	4.0	5.0	5.0			
(E) ~~Vdc~~ (avg) PFE 0.1 DC	2.09	6.37	1.83	2.44	4.54	1.24	2.98	3.89	7.31			
(F) DCcal	1.004											
(G) Kn x 10^{-3}	3.0	12.	3.0	12.0	30.0	3	12	30.0	60			
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ 3.0 Hz	15.65 (0.5)	5.28 (0.3)	15.9 (0.2)	3.21 (-0.1)	3.47 (-0.2)	16.2 (0.1)	3.99 (-0.3)	1.41 (-1.4)	1.66 (-0.3)			
(J) ~~AC noise x 2~~ 1.0 Hz	0.6	2.0	0.5	1.8	2.5	0.4	1.6	3.9	4.3			
(K) ~~Vac (corr) = $\sqrt{I^2 - J^2}$~~ 0.3 Hz	—	—	—	—	—	—	—	—	—			
(L) ~~AC-DC cal.~~ 0.1 Hz	0.5	2.0	0.3	—	—	0.2	1.3	0.9	5.0			
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2) 0.1 DC 1.0 / 0.1 AC 0.3	2.8 / 2.0 1.0 / —	7.2 / 3.7 2.3 / —	2.7 / 2.1 0.9 / —	3.4 / — 2.2 / —	5.6 / — 3.0 / —	2.1 / 2.0 0.8 / —	4.1 / 3.0 2.0 / —	5.5 / 4.0 4.5 / —	8.4 / 7.2 4.8 / —			
(O) MCF=(M-1)(10^5)/H												
	-22		+26			+3.0						
	1.0	1.4	1.2	—	—	1.2	1.0	-.5	2.4			

Project PFE 1.1 Line _____ Field date _____ Data page _____ Comp. date _____ Comp by _____

(A) Send	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6	6-7	CAL
(B) Receive	40-50W	→	→	→	→	50-60W	→	→	→	→	→	1-2
(C) n separation												
(D) I	3.0	4.0	5.0	6.0	6.0	3.0	3.0	4.0	5.0	7.0	4.0	1.0
(E) ~~Vdc~~ (avg) PFE 0.1 DC	1.36	2.48	7.93	—	7.67	2.07	2.37	3.56	11.29	—	9.93	(0.1) 0.0/-1.9
(F) DCcal												+0.95
(G) Kn x 10^{-3}	3	12	30	60	105	3	12	30	60	105	168	
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ 3.0	17.25 (0.3)	5.73 (0.2)	2.01 (0.6)	—	1.59 (±2.)	14.5 (0.7)	4.65 (0.0)	2.68 (-0.4)	1.25 (-0.2)	.639 (-.4)	1.54 (0.0)	(3) 99.6 +0
(J) AC noise x 2 1.0	0.5	1.5	3.5	—	6.0	1.0	1.8	2.2	5.8	5.5 Noisy	5.8	(1) -0.4
(K) Vac (corr) = $\sqrt{I^2 - J^2}$	—	—	—	—	—	—	—	—	—	—	—	—
(L) AC-DC cal. 0.1 ac	0.2	0.9	4.6	—	—	1.6	2.0	2.1	8.4	3.5	7.3	0.1 -1.9
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2) 0.1 DC 1.0 / 0.1 AC 0.3	2.2 / 1.9 0.8 / —	3.3 / 2.6 1.9 / —	8.6 / 6.3 3.7 / —	— / — —	8.6 ±2 6.4 / —	2.6 / 3.4 1.2 / —	3.3 / 3.9 0.4 / —	4.7 / 4.3 2.7 / —	12.3 / 10.5 6.3 / —	5.7 6 / —	10.9 / 9.2 6.2 / —	
(O) MCF=(M-1)(10^5)/H												
	?					-36					-38	
	1.1	.7	2.6	—	—	2.2	2.5	1.6	4.2	-.3	3.0	

155972

4C receiver test

Center 10W!

Frequencies 3.0, 1.0, 0.3, 0.1

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page 2

Project Lakeshore Line 10N E½ Field date 6/24/69 Data page _____ Comp. date _____. Comp by 69F

(A) Send	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2			Cal
(B) Receive	10-20E				20-30E							
(C) n separation												
(D) I	6.0	5.0	4.0	4.0	9.0	6.0	5.0	4.0	4.0			1.0
(E) Vdc (avg)	2.65	5.00	4.60	—	1.789	4.20	7.667	6.20	15.6			0.3
(F) DCcal												.983
(G) Kn x 10^{-3}	3	12	30	60	3	12	30	60	105			
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ 3.0	33.2 (0.4)	8.26 (0.0)	2.74 (0.0)	1.29 (0.4)	97.9 (0.3)	14.9 (0.2)	5.84 (1.2)	2.30 (-0.5)	1.20 (2.0)			101.5 (0.4)
(J) AC noise x 2 1.0	1.0	1.6	2.8 ± .5	7.0 ± 1.0	0.3	1.4 ± 0.5	4.4 ± 0.8	3.4 ± 0.4	6.5 ± 1.5			0.3
(K) Vac(corr) = $\sqrt{I^2 - J^2}$ .3	2.0	3.4	4.0 ± .5	6.0 ± 2.0	1.0	+2.9	5.0	5.5	7.5 ± 1.5		-0.2	0.4
(L) AC-DC cal. .1	1.9	2.6	3.4 ± .3	3.6 ± 0.5	0.4	2.6	4.4	5.0	10.5			-0.8
(M) ρ dc/ρac=ExL/K		AC +8.6										
(N) PFE=(M-1)(10^2) 0.10 1.0 / 0.10 0.3	2.6 0.5 / 2.1 1.6	5.2 1.3 / 3.0	4.8 2.5 / 5.2	— 6.7 / 3.6	1.8 -.1 / 0.5	4.2 1.0 / 2.9	7.3 3.5 / 4.8	6.6 3.3 / 5.7 5.5	14.4 5.2 / 9.9			
(O) MCF=(M-1)(10^5)/H												

+34.0 2.7 -3.1 -5.9 .6 +1.9 +1.3 +2.4 +9.7

Project _____ Line 1.7 1.7 Field date _____ Data page _____ Comp. date _____ Comp by _____

(A) Send	6-7	5-6	4-5	3-4	2-3	1-2						
(B) Receive	30-40E											
(C) n separation												
(D) I	7.0	9.0	6.0	5.0	4.0	—						
(E) Vdc (avg)	4.00	2.50	5.633	6.00	—	—						
(F) DCcal												
(G) Kn x 10^{-3}	3	12	30	60	105							
(H) ρ dc=ExFxGx10^3/D												
(I) Vac Σ 3.0	514.0 (0.2)	23.5 (0.0)	4.77 (-0.3)	2.44 (-0.5)	1.04 (?)							
(J) AC noise ~~x 2~~ 1.0	0.4	0.8	3.0	—	—							
(K) Vac (corr) = $\sqrt{I^2 - J^2}$	1.1	1.9	3.5	5.0	6.0 ± 1							
(L) AC-DC cal. 0.1	0.8	0.8	—	5.0	~~10 ± 100~~							
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	3.7 0.0 / 1.1	2.3 .5 / 1.2	5.6 3.0 / —	6.1 — / 4.9	—							
(O) MCF=(M-1)(10^5)/H												

-4.2 1.1 0.7 — — —

14.9 81

F83 (8)

MK 3 Test

JOB Lakeshore Test LINE 10 N SPREAD 1

LOOKING N DATE June A= 1000

CENTER 10.0 LABEL W/W FREQ 3.0 — 0.1

COUPLING yes

4 Aug 69

Boom 3. — .1
1. — .1

3, 1, ~~.3~~ .1, 3.

MK-3

Test

PAGE 1

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 1 HALF W SP. 1 DATE 6/20/69

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	10-20W	→	20-30W	→	→	30-40	→	→	→	
RANGE	30 164	10 60	30 15.5	10	10	30	10	3	3	
DC 1	172	57	167	109	120	168	430 442	1.47 1.43	180 177	
DC 2	163	60	154	103	114	166	415 400	1.61 1.60	187 196	
DC 3	176	57	168	110	124	168	430 450	1.44 1.43	187 173	
DC 4	163	60	153	103	114	165	410 395	1.62 1.65	183 197	
DC 5	177	57	170	108	122	168	435 435	1.40 1.42	192 174	
DC 6	163		153	103	113	167	4.0	1.63 1.66	185 196	
DC 7			169	110	125	168	445	1.40 1.36	179 176	
DC 8			153	101	113	166	4.0	1.67 1.72	193 192	
DC AVG.	3 1.0									
AC 1	14.9 16.3	5.1 5.55	14.2 15.6	9.2 9.2	10.0 11.2	14.6 16.1	3.62 4.1	1.33 1.47	1.55 1.74	
AC 2	15.0 16.4	5.1 5.55	14.2 15.5	10.1 9.2	10.0 11.2	14.6 16.2	3.65 4.02	1.33 1.46	1.56 1.73	
AC AVG.										
S.P.	+23.1		+28.0			+8				
AC NOISE	0.08		.09			.04				
POT RES.	3.0	3.0	3.0	3.0	5.0	3.0	4.0	5.0	5.0	

MK 3 R

PAGE 2

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 1 HALF W SP. 1 DATE 6/24/82

SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6
RECEIVE	40-50				→	50-60				
RANGE	30	10	3	3	3					
DC 1	175 182	690 570	230 242	90 89	121 104					
DC 2	175 181	659 581	217 260	100 76	127 125					
DC 3	175 181	621 618	200 258	98 78	145 //					
DC 4	174 183	610 615	218 234	90 96	120 130					
DC 5	175 182	615 615	230 234	85 81	95 169					
DC 6		620 590	236 208	102 81	70 129					
DC 7		640 683	362 205	101 63	127 126					
DC 8			244 214	125 50	105 121					
DC AVG.										
AC 1	15.75 /	5.38 /	1.95 /	0.76 /	1.0 1.01	3.0 Hz				
AC 2	17.2 /	5.87 /	2.15 /	0.85 /	1.3 1.5	1.0 Hz				
AC AVG.										
S.P.	-4.7									
AC NOISE										
POT RES.	3.0	4.0	5.0	6.0	6.0					

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

MK 3

PROJECT Lakeshore
LINE 1 HALF W SP. 1 DATE 6/20/6

PAGE 4

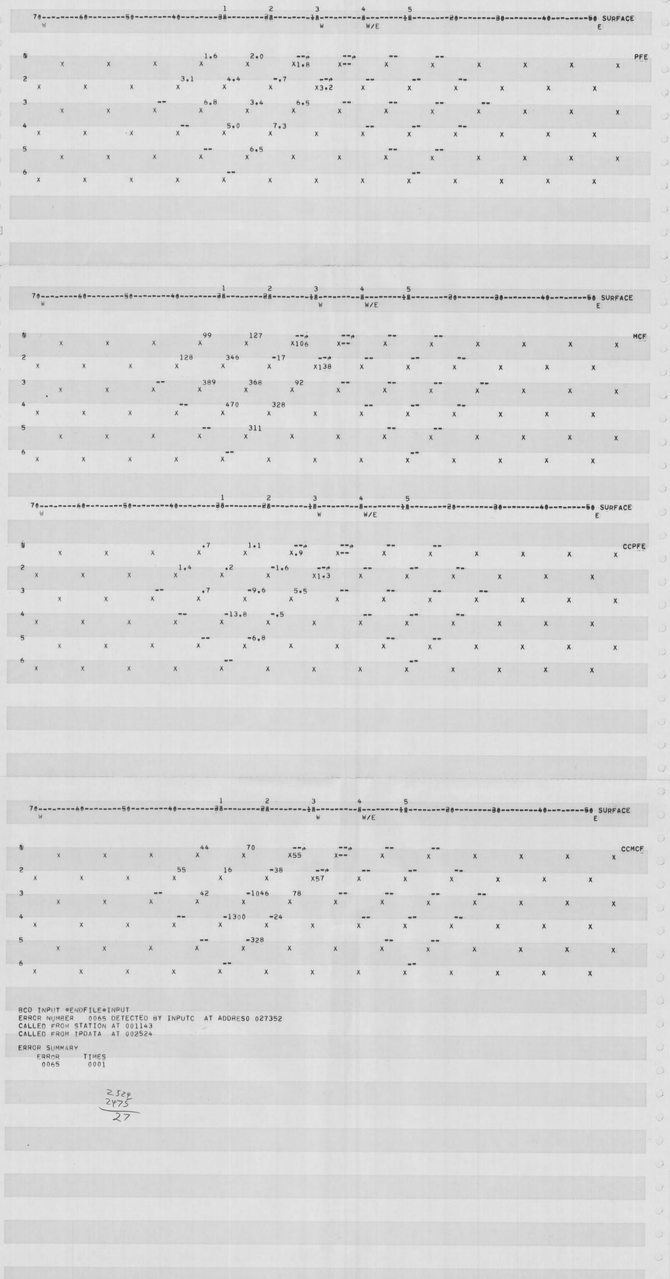
SEND	4-5	1-2	2-3	3-4			CAL			
RECEIVE	→	80-90W	→	→			1-2			
RANGE							300			
DC 1							100 100			
DC 2							100 100			
DC 3							100 100			
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1							90 1			
AC 2							98 1			
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

```
HEINRICHS GEOEX  (MAR 69)    JOB LAKESHORE MK3 TEST  LINE 10N SPREAD 1  LOOKING N JUNE 69        A=1000 FEET, FREQUENCIES  .10 AND 1.0

*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 3.000 3.000 3.000 3.000 3.000 5.000 3.000 4.000 5.000 5.000    I    3.000 4.000 5.000 6.000 6.000 6.000 6.000 6.000 1.000
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
       164    60   155   109   120   138   430   147   180   DC      640   230    90   121                               100  LEFT
       172    57   167   106   114   166   415   161   187           570   242    84   104                               100  SIDE
       163         154   110   124   168   430   144   187           659   217   100   127
       176         168   103   114   165   410   162   183           581   260    76   125
       163         153   108   122   168   435   140   192           621   200    98   145
       177         170   103   113   167     /   163   185           618   255    78     /
       163         153   110   125   168   400   140   179           610   218    90   120
                   169   101   113   166   445   167   193           615   234    96   120
                   153                     400   143   177           615   230    85    95
                                           442   160   196           615   234    81   169
                                           400   143   173           620   236   102    70
                                           450   165   197           590   208    81   124
                                           395   142   174           640   262   101   127
                                           435   166   196           683   205    63   126
                                                 136   176                 244   125   105
                                                 172   192                 219    50   121

   1     2     3     4     5     6     7     8     9    10    PT.     11    12    13    14    15    16    17    18
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
       336   117   322   215   234   304   845   308   367   DC     1210   472   174   225                               200
       335         321   216   238   334   845   305   374   SUMS   1229   459   184   231
       339         322   213   238   333   840   306   370          1240   477   176   252
       339         321   211   236   333   845   302   375          1202   460   174   270
       340         323   211   235   335   845   303   377          1239   455   176   240
       340         323   213   238   335   845   303   364          1228   473   168   215
                   322   211   238   334   842   307   372          1225   452   186   264
                   322                     842   310   370          1230   464   181   239
                                           850   303   373          1230   464   166   194
                                           845   303   369          1235   470   183   251
                                           830   308   370          1210   444   183   253
                                                 307   371          1230   470   182   231
                                                 308   370          1323   467   164   226
                                                 302   372                 449   188
                                                 308   368                 463   175

*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
       -.6   0.0   0.0   1.0  -1.1  -7.8    .2    .8  -1.0   DC     -1.9   2.0  -1.9  -5.4                               0.0
       -.9         -.3   1.5    .5   1.3    .2   -.2    .9   DEVS    -.3   -.8   3.8  -2.8
        .2         0.0    .1    .5   1.0   -.4    .2   -.2            .6   3.1   -.8   6.0
        .2         -.3   -.9   -.3   1.0    .2  -1.2   1.1          -2.5   -.6  -1.9  13.6
        .5          .3   -.9   -.7   1.6    .2   -.8   1.7            .5  -1.6   -.8    .9
        .5          .3    .1    .5   1.6    .2   -.8  -1.8           -.4   2.2  -5.3  -9.6
                   0.0   -.9    .5   1.3   -.1    .5    .3           -.7  -2.3   4.9  11.0
                   0.0                     -.1   1.5   -.2           -.3    .3   2.1    .5
                                            .8   -.8    .6           -.3    .3  -6.4 -18.4
                                            .2   -.8   -.5            .1   1.6   3.2   5.6
                                          -1.6    .8   -.2          -1.9  -4.0   3.2   6.4
                                                  .5    .1           -.3   1.6   2.6  -2.8
                                                  .8   -.2           7.3   1.0  -7.5  -4.9
                                                -1.2    .3                -2.9   6.0
                                                  .8   -.8                  .1  -1.3

   1     1     2     1     2     3     1     2     3     4     N       2     3     4     5     3     4     5     6
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 16.91 5.850 16.1010.643 11.84 16.49 4.215 1.528 1.854   DCA   6.166 2.313  .887 1.189 0.000 0.000 0.000 0.000100.00
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 16.30 5.550 15.60 9.200 11.20 16.10 4.100 1.470 1.740   AC1   5.870 2.150  .850 1.300 0.000 0.000 0.000 0.000 98.00
 0.000 16.40 5.550 15.50 9.200 11.20 16.20 4.020 1.460 1.730   AC2   5.870 2.150  .850 1.500 0.000 0.000 0.000 0.000 98.00
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 16.35 5.550 15.55 9.200 11.20 16.15 4.060 1.465 1.735   ACA   5.870 2.150  .850 1.400 0.000 0.000 0.000 0.000 98.00
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0 16.91 23.40 16.10 42.57 71.01 16.49 12.65  9.17 22.25   RHO   24.66 17.35 10.64 20.80*000.0*000.0*000.0*000.0 1.000 DC CAL
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0   1.3   3.3   1.5  13.4   3.6    .0   1.8   2.2   4.7   PFE     2.9   5.4   2.2 -16.8*000.0*000.0*000.0*000.0  .980 AC CAL
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*0000.    80   141    91   314    50     2   139   239   212   MCF     119   313   209  -807*0000.*0000.*0000.*0000.
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
   0.0    .2    .4    .2    .2    .2    .2   1.0   3.4   2.0   CPFE     .4   1.5   5.0   3.5   0.0   0.0   0.0   0.0
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0   1.2   2.9   1.3  13.2   3.3   -.2    .7  -1.2   2.7   CCPFE   2.5   3.9  -2.8 -20.3*000.0*000.0*000.0*000.0
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*0000.    68   122    78   309    47   -10    58  -132   123   CCMCF   102   226  -264  -974*0000.*0000.*0000.*0000.

 CARD  1  POINT  1     $     $                                                                          MISSING AC READING
                             ****

*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000    I    1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
                                                               DC                                                        10  RIGHT
                                                                                                                         10  SIDE
   1     2     3     4     5     6     7     8     9    10    PT.     11    12    13    14    15    16    17    18
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
                                                               DC                                                        20
                                                               SUMS
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
                                                               DC                                                        0.0

   1     1     2     1     2     3     1     2     3     4     N       2     3     4     5     3     4     5     6
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   DCA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   AC1   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   AC2   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   ACA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0   RHO   *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*0.000 DC CAL
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0   PFE   *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0 1.000 AC CAL
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.   MCF   *0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   CPFE    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0   CCPFE *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0
*-----*-------------*-------------------*--------------------*-------*-------------------------------*-----------------*-----*-----------
*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.   CCMCF *0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.
```

```
HEINRICHS GEOEX  (MAR 69)    JOB LAKESHORE MK3 TEST  LINE 10N SPREAD 1  LOOKING N JUNE 69        A=1000 FEET, FREQUENCIES  .10 AND 1.0

                                          1        2         3         4        5
 70---------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50 SURFACE
  W                                                        /0W       W/E                                               E

 N                                    16         16       --        --       --       --                                    RHO/2PI
      X         X         X         X          X        X17       X--       X        X        X        X        X        X
 2                               25        13        43      --        --       --       --
  X         X         X         X         X         X        X23       X        X        X        X        X        X
 3                          --        17        9.2       71       --        --       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 4                               --        11        22                --       --       --
  X         X         X         X         X         X         X         X        X        X        X        X        X
 5                                    --        21                         --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 6                                         --                                  --
  X         X         X         X         X         X         X         X        X        X        X        X        X

                                          1        2         3         4        5
 70---------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50 SURFACE
  W                                                         W        W/E                                               E

 N                                    .0         1.5      --        --       --       --                                    PFE
      X         X         X         X          X        X1.3      X--       X        X        X        X        X        X
 2                               2.9       1.8       13.4    --        --       --       --
  X         X         X         X         X         X        X3.3      X        X        X        X        X        X
 3                          --        5.4       2.2       3.6      --        --       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 4                               --        2.2       4.7               --       --       --
  X         X         X         X         X         X         X         X        X        X        X        X        X
 5                                    --        -16.8                      --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 6                                         --                                  --
  X         X         X         X         X         X         X         X        X        X        X        X        X

                                          1        2         3         4        5
 70---------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50 SURFACE
  W                                                         W        W/E                                               E

 N                                    2          91       --        --       --       --                                    MCF
      X         X         X         X          X        X80       X--       X        X        X        X        X        X
 2                               119       139       314     --        --       --       --
  X         X         X         X         X         X        X141      X        X        X        X        X        X
 3                          --        313       239       50       --        --       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 4                               --        209       212               --       --       --
  X         X         X         X         X         X         X         X        X        X        X        X        X
 5                                    --        -807                       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 6                                         --                                  --
  X         X         X         X         X         X         X         X        X        X        X        X        X

                                          1        2         3         4        5
 70---------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50 SURFACE
  W                                                         W        W/E                                               E

 N                                    -.2        1.3      --        --       --       --                                    CCPFE
      X         X         X         X          X        X1.2      X--       X        X        X        X        X        X
 2                               2.5       .7        13.2    --        --       --       --
  X         X         X         X         X         X        X2.9      X        X        X        X        X        X
 3                          --        3.9       -1.2      3.3      --        --       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 4                               --        -2.8      2.7               --       --       --
  X         X         X         X         X         X         X         X        X        X        X        X        X
 5                                    --        -20.3                      --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 6                                         --                                  --
  X         X         X         X         X         X         X         X        X        X        X        X        X

                                          1        2         3         4        5
 70---------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40--------50 SURFACE
  W                                                         W        W/E                                               E

 N                                    -10        78       --        --       --       --                                    CCMCF
      X         X         X         X          X        X68       X--       X        X        X        X        X        X
 2                               102       58        309     --        --       --       --
  X         X         X         X         X         X        X122      X        X        X        X        X        X
 3                          --        226       -132      47       --        --       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 4                               --        -264      123               --       --       --
  X         X         X         X         X         X         X         X        X        X        X        X        X
 5                                    --        -974                       --       --
      X         X         X         X         X         X         X         X        X        X        X        X        X
 6                                         --                                  --
  X         X         X         X         X         X         X         X        X        X        X        X        X


BCD INPUT *ENDFILE*INPUT
ERROR NUMBER    0065 DETECTED BY INPUTC  AT ADDRESO 027347
CALLED FROM IPDATA  AT 006464

ERROR SUMMARY
   ERROR     TIMES
    0065      0001
```

```
MEINRICHS GEOEX  (MAR 69)     JOB LAKESHORE MK3 TEST  LINE 10N SPREAD 1  LOOKING N JUNE 69          A=1000 FEET, FREQUENCIES  .10 AND 3.0

 3.000 3.000 3.000 3.000 3.000 3.000 4.000 5.000 5.000   I   3.000 4.000 5.000 6.000 7.000 8.000 9.000 1.000
                                                                                                    100 LEFT
  164   60  155   109   120   138   435   147   180   DC    640   230    90   121                   100 SIDE
  172   57  167   106   114   166   415   161   187         570   242    84   104
  163       154   110   124   168   430   144   187         659   217   100   127
  176       168   103   114   165   410   162   193         581   260    76   125
  163       153   108   122   168   435   140   192         621   200    98   145
  177       170   103   113   167     /   163   185         618   255    78     /
  163       153   110   125   168   400   140   179         610   218    90   120
            169   101   113   166   445   167   193         615   234    99   120
            153                 .   400   143   177         615   230    85    95
                                    442   160   196         615   234    81   149
                                    400   143   173         625   236   102    70
                                    450   165   197         590   208    81   124
                                    395   142   174         640   262   101   127
                                    435   166   196         683   205    63   126
                                          136   176               244   125   105
                                          172   192               219    50   121

  1    2    3    4    5    6    7    8    9   10   PT.        11   12   13   14   15   16   17   18
                                                                                              200
      336  117  322  215  234  304  845  308  367   DC    1210  472  174  225
      335       321  216  238  334  845  305  374   SUM5  1229  459  184  231
      339       322  213  238  333  840  306  372         1240  477  176  252
      339       321  211  236  333  845  302  375         1202  460  174  270
      340       323  211  235  335  845  303  377         1239  455  176  240
      340       323  213  238  335  845  303  384         1228  473  168  215
                322  211  238  334  842  307  372         1225  452  166  294
                322                842  310  370         1230  464  181  239
                                   850  303  373         1230  464  166  194
                                   845  303  369         1235  470  183  251
                                   830  308  370         1210  444  183  253
                                        307  371         1230  470  182  231
                                        308  370         1323  467  164  226
                                        312  372               449  188
                                        308  368               463  175

   -.6   .0    0.0   1.0  -1.1  -7.8   .2    .8  -1.0   DC    -1.9   2.0  -1.9  -5.4                0.0
   .10         -.0   1.8    .5   1.3    .2   -.2    .9   DEV3    .3   -.8   3.8  -2.8
   .2          0.0    .1    .5   1.0   -.4    .2   -.2           .6   3.1   -.6   .8
   .2          -.3   -.9   -.3   1.0    .2  -1.2   1.1          -2.5   -.6  -1.9  13.6
   .5           .3   -.9   -.7   1.6    .2   -.8   1.7           .5  -1.0    .8    .9
   .5           .3    .1    .5   1.6    .2   -.8  -1.8          -.4   2.2  -5.3  -9.6
                .0   -.0    .5   1.3   -.1    .5    .3          -.7  -2.1   4.9  11.2
                0.0                   -.1   1.5   -.2          -.3    .3   2.1    .5
                                      .2   -.8    .5           -.3    .3  -6.4  -10.4
                                    -1.6    .8   -.2          -1.9   -.0   3.2   5.6
                                      .5    .1   -.1           -.3   1.0   2.0  -2.8
                                            .8   -.2           7.3   1.0  -7.5  -4.9
                                          -1.2    .3                -2.9   5.0
                                            .8   -.8                 .1  -1.3

  1    1    2    1    2    3    1    2    3    4   N    2    3    4    5    3    4    5    6
 1.000 16.91 5.850 16.1101.693 11.84 10.49 4.215 1.528 1.854   DCA   0.166 2.313  .887 1.189 0.000 0.000 0.000 0.000100.00
 0.000 14.90 5.100 14.20 9.200 10.00 10.40 3.621 1.330 1.550   AC1   5.380 1.950  .760 1.000 0.000 0.000 0.000 0.000 90.00
 0.000 15.28 5.100 14.2015.100 10.00 10.40 3.651 1.330 1.550   AC2   5.380 1.950  .760 1.010 0.000 0.000 0.000 0.000 90.00
 0.000 14.95 5.100 14.20 9.150 10.00 10.40 3.635 1.330 1.555   ACA   5.380 1.950  .760 1.005 0.000 0.000 0.000 0.000 90.00
+000.0 16.91 23.40 16.10 42.57 11.01 10.49 12.65 9.17 22.25   RHO   24.66 17.35 10.64 20.80*000.0*000.0*000.0*000.0 1.000 DC CAL
+000.0  1.8   3.2   2.0   -.7   6.5    1.0   4.4   3.4   7.3   PFE    3.1   6.8   5.0   6.5*000.0*000.0*000.0*000.0 .900 AC CAL
+0000.  108   138   127   -17    92    99   346   388   328   MCF    128   389   470   311*0000.*0000.*0000.*0000.
   0.0   .9   1.9   .9    .9   1.0   .9   4.2  13.0   7.8  CPFE   1.8   6.0  18.8  13.3   0.0   0.0   0.0   0.0
+000.0   .9   1.3   1.1  -1.6   5.5   .7    .2  -9.6   -.5  CCPFE  1.4   .7  -13.8  -6.8*000.0*000.0*000.0*000.0
+0000.   55    57    70   -38    78    44    16 -1046   -24  CCMCF   55    42 -1300  -328*0000.*0000.*0000.*0000.

CARD  1  POINT  1     $   $                                                          MISSING AC READING
                      ****

 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000   I   1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
                                                                                                    10  RIGHT
                                                                                                    10  SIDE
  1    2    3    4    5    6    7    8    9   10   PT.        11   12   13   14   15   16   17   18
                                                    DC
                                                    SUM5                                            20
                                                    DC                                             0.0

  1    1    2    1    2    3    1    2    3    4   N    2    3    4    5    3    4    5    6
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   DCA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   AC1   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   AC2   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000   ACA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
+000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0   RHO  *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0 DC CAL
+000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0   PFE  *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0 1.000 AC CAL
+0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.   MCF  *0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0  CPFE   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
+000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0  CCPFE *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0
+0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.  CCMCF *0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.*0000.
```

MEINRICHS GEOEX (MAR 69) JOB LAKESHORE MK3 TEST LINE 10N SPREAD 1 LOOKING N JUNE 69 A=1000 FEET, FREQUENCIES .10 AND 3.0




```
BCD INPUT *ENDFILE*INPUT
ERROR NUMBER   0065 DETECTED BY INPUTC  AT ADDRESS 027352
CALLED FROM STATION AT 001143
CALLED FROM IPDATA  AT 002524

ERROR SUMMARY
    ERROR      TIMES
     0065        001
```

2 Reg
2475
27

HEINRICHS GEOEX JOB LAKESHORE 69 LINE 10S SPREAD SP1 LOOKING N 8/27-29/69 A= 1000 FEET

8,000 9,000 8,000 7,000 8,000 8,000 7,000 7,000 8,000 8,000 I 7,000 7,000 8,000 8,000 7,000 7,000 8,000 8,000 2,000

9 0 0 -4 -6 -3 -4 -7 -3 -2 DC -4 -2 3 3 -11 -13 LEFT
9 0 0 -4 -6 -3 -4 -7 -3 -2 -4 -2 3 3 -11 -13 SIDE

1 1 2 1 2 3 1 2 3 4 N 2 3 4 5 3 4 5 6

.9 0.0 0.0 -.4 -.6 -.3 -.4 -.7 -.3 -.2 PFEA -.4 -.2 .3 .3 -1.1 0.0 0.0 0.0 -1.3

39.80 18.40 16.22 66.40 7.070 8.410 84.26 22.70 3.420 4.510 AC1 31.40 13.60 2.380 3.420 9.940 0.000 0.000 0.000 208.5
.3 .2 .2 0.0 -.3 .1 .2 0.0 .1 .1 AC2 .2 -.4 .1 .1 -.2 0.0 0.0 0.0 .2

39.86 18.42 16.22 66.40 7.059 8.414 84.28 22.70 3.422 4.512 ACA 31.43 13.57 2.379 3.422 9.930 0.000 0.000 0.000 208.7

14.63 5.96 23.61 27.54 10.24 30.55 34.93 37.55 12.43 32.80 RHO 52.10 56.52 17.40 43.75 40.94*000.0*000.0*000.0 .958 DC CAL

2.1 1.3 1.3 1.0 .9 1.0 .9 .7 1.0 1.1 PFE .9 1.4 1.7 1.6 .1*4000.0*000.0*0000.0 1.400 AC CAL

147 218 55 36 93 34 26 19 85 35 MCF 17 25 101 38 10*00000*00000*00000

.2 .8 .4 .1 1.3 .7 .1 .2 2.3 1.2 CPFE .1 .3 2.7 1.3 .5 0.0 0.0 0.0

.0 .5 .9 .9 -.4 .3 .8 .5 -1.3 -.5 CCPFE .8 1.1 -1.4 .3 -.1*000.0*000.0*0000.0

131 84 36 33 -38 11 24 12 -102 -1 CCMCF 14 19 -56 7 -2*00000*00000*00000

7,000 7,000 8,000 9,000 7,000 7,000 9,000 7,000 7,000 8 DC 3 5 12 14 -4 RIGHT
17 6 3 1 1 -1 0 0 0 8 3 5 12 14 -4 SIDE

1 1 2 1 2 3 1 2 3 4 N 2 3 4 5 3 4 5 6

1.7 .6 .3 .1 .1 -.1 0.0 0.0 0.0 .8 PFEA .3 .5 1.2 1.4 0.0 0.0 0.0 0.0 -.4

43.49 125.5 12.20 33.70 21.70 5.450 46.40 6.000 5.610 2.040 AC1 9.220 2.150 2.750 1.630 0.000 0.000 0.000 0.000 205.0
.6 .2 .2 .1 0.0 .2 .1 0.0 0.0 .2 AC2 .1 -.4 .2 .1 0.0 0.0 0.0 0.0 .3

43.53 125.6 12.21 33.72 21.70 5.455 46.42 6.000 5.610 2.042 ACA 9.225 2.146 2.747 1.631 0.000 0.000 0.000 0.000 205.3

18.53 53.90 23.97 11.01 36.47 22.86 15.15 7.84 23.55 17.26 RHO 12.08 7.05 23.36 24.28*000.0*000.0*000.0*000.0 .974 DC CAL

1.9 1.0 .7 .6 .6 .3 .5 .5 .5 1.2 PFE .8 1.2 1.8 1.9*000.0*000.0*000.0*000.0 .550 AC CAL

105 20 31 54 18 15 33 70 23 72 MCF 66 177 79 78*00000*00000*00000*00000

1.8 1.0 .3 .3 .4 -.7 .3 -1.* -.5 -1.5 CCPFE -.3 -3.5 -.0 -1.0*000.0*000.0*000.0*000.0

96 19 13 23 11 -30 18 -172 -19 -87 CCMCF -23 -491 -1 -40*00000*00000*00000*00000

HEINRICHS GEOEX JOB LAKESHORE 69 LINE 10S SPREAD SP1 LOOKING N 8/27-29/69 A= 1000 FEET

Electrodes Mixed up

1 2 3 4 5
90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

RHO/2PI

PFE

MCF

CCPFE

CCMCF

JOB Lake Shore LINE 10-S SPREAD Sp 1

LOOKING North DATE 8-27-29-69 A= 1000'

CENTER ~~North~~ -30.0 LABEL w/E FREQ. 1.0 - .1
dual ac

COUPLING yes

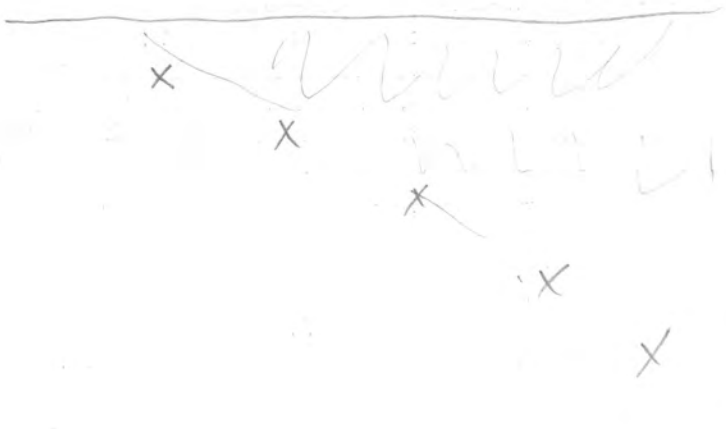
VOID

electrodes Mixed up

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore test
LINE 10-5 HALF W SP. 1 DATE 8-27-29

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	30-40W	40-50W →		50-60 W →			60-70W →			
RANGE	1	1	1	1	.1	.1	1	1	.1	
DC 1	+0.9	0	0	-0.4	-0.6	-0.3	-0.4	-0.7	-0.3	-0.2
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	39.8	18.4	16.0	66.4	7.07	8.41	84.2	22.7	3.42	4.51
AC 2	+0.3	+0.2	+0.2	0	-0.3	+0.1	+0.2	0	+0.1	+0.1
AC AVG.										
S.P.	-19.1	+14.9		+9.6			-17.4			
AC NOISE	.05	.06		.06			.08			
POT RES.										



HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lake Shore Test

LINE 10-S HALF W SP. 1 DATE 8-27-29

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	cal	
RECEIVE	70-80W →				80-90W →				1-2	
RANGE	1	1	.1	.1	.1	.1			10	
DC 1	-0.4	-0.2	+0.3	+0.3	-1.1				-1.3	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	31.4	13.6	2.38	3.42	9.94	5.06			208.5	
AC 2	+0.2	-0.4	-0.1	+0.1	-0.2				+0.2	
AC AVG.										
S.P.	+28.5				-9.7					
AC NOISE	.09				.13					
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore test

LINE 10S HALF W SP. 1 DATE 6-27-2?

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	30-40W	40-50W	→	50-60W	→	→	60-70W	→	→	→
RANGE	20x400	20x450	20x400	20x350	20x400	20x400	20x350	20x350	20x400	20x400
VOLTAGE	425	470	425	440	415	425	415	430	410	420
CURRENT	8.0 10x500	9.0 10x500	8.0 10x500	7.0 10x500	8.0 10x500	8.0 10x500	7.0 10x500	7.0 10x500	8.0 10x500	8.0 10x500
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	cal	
RECEIVE	70-80W	→	→	→	80-90W	→	→	→	1-2	
RANGE	20x350	20x350	20x400	20x400	20x350	20x350	20x400	20x400	10x200	
VOLTAGE	415	430	410	420	415	425			155	
CURRENT	7.0 10x500	7.0 10x500	8.0 10x500	8.0 10x500	7.0 10x500	7.0 10x500	8.0 10x500	8.0 10x500	2.0 10x5$_8$	

FREQUENCIES 1.0 .1

SENDER NO. 16681-5

OPERATOR Gary Croze

RECEIVER NO. Mark 4C

OPERATOR Ron Palmer

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10S HALF E SP. 1 DATE 8-27-2

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	30-20W	20-10W	→	10W-0	→	→	0-10E	→	→	→
RANGE	1	10	1	1	1	.1	1	.1	.1	.1
DC 1	+1.7	+0.6	+0.3	+0.1	+0.1	-0.1	0	0	0	+0.8
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.		50.3								
AC 1	43.4	125.5	12.2	33.7	21.7	5.45	46.4	6.00	5.61	2.04
AC 2	+0.6	+0.2	+0.2	+0.1	0	+0.2	+0.1	0	0	+0.2
AC AVG.										
S.P.	-12.0	+24.8		+15.4			-20.1			
AC NOISE	.05	.06		.07			.09			
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lake Shore Test
LINE 10S HALF E SP. / DATE 8-27-29

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	cal	
RECEIVE	10-20E	→	→	→	20-30E	→	→	→	4-5	
RANGE	.1	.1	.1	.1					10	
DC 1	+0.3	+0.5	+1.2	+1.4					+0.4	
DC 2										
DC 3										
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	9.22	2.15	2.75	1.63					205.	
AC 2	+0.1	-0.4	-0.2	+0.1					+0.3	
AC AVG.										
S.P.	+35.5									
AC NOISE	.08									
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT _____

LINE 10S HALF E SP. ____ DATE 8-27-7

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	30-20W	20-10W	→	10-0W	→	→	0-10E	→	→	→
RANGE	20x350	20x350	20x300	20x450	20x350	20x350	20x450	20x450	20x350	20x350
VOLTAGE	500	420	420	455	425	500	425	455	425	500
CURRENT	7.0 10x500	7.0 10x500	6.0 10x500	9.0 10x500	7.0 10x500	7.0 10x500	9.0 10x500	9.0 10x500	7.0 10x500	7.0 10x500
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		cal
RECEIVE	10-20E	→	→	→	20-30E	→	→	→		4-5
RANGE	20x450	20x450	20x350	20x350	20x400					20
VOLTAGE	470	455	425	495						200X10
CURRENT	9 10x500	9 10x500	7 10x500	7 10x500	8 10x500					2.0

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

```
HEINRICHS GEOEX  (MAR 69)   JOB LAKESHORE TEST   LINE 10N   SPREAD 4   LOOKING N   JUNE 69      A=1000 FEET, FREQUENCIES  .10 AND 3.0

*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 3.000 3.000 3.000 3.000 3.000 3.000 3.000 4.000 5.000 5.000     I    3.000 4.000 5.000 6.000 6.000 6.000 6.000 6.000 1.000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   175   164    60   155   109   120   138   430   147   180    DC      640   230    90   121                              100  LEFT
   182   172    57   167   106   114   166   415   161   187            570   242    84   104                              100  SIDE
   175   163         154   110   124   168   430   144   187            659   217   100   127
   181   176         168   103   114   165   410   162   183            581   260    76   125
   175   163         153   108   122   168   435   140   192            621   200    98   145
   181   177         170   103   113   167     /   163   185            618   255    78     /
   174   163         153   110   125   168   400   140   179            610   218    90   120
   183              169   101   113   166   445   167   193            615   234    96   120
   175              153                     400   143   177            615   230    85    95
   182                                       442   160   196            615   234    81   169
                                             400   143   173            620   236   102    70
                                             450   165   197            590   208    81   124
                                             395   142   174            640   262   101   127
                                             435   166   196            683   205    63   126
                                                   136   176                  244   125   105
                                                   172   192                  219    50   121

     1     2     3     4     5     6     7     8     9    10   PT.     11    12    13    14    15    16    17    18
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   357   336   117   322   215   234   304   845   308   367    DC     1210   472   174   225                              200
   357   335         321   216   238   334   845   305   374   SUMS    1229   459   184   231
   356   339         322   213   238   333   840   306   370           1240   477   176   252
   356   339         321   211   236   333   845   302   375           1202   460   174   270
   356   340         323   211   235   335   845   303   377           1239   455   176   240
   355   340         323   213   238   335   845   303   364           1228   473   168   215
   357              322   211   238   334   842   307   372           1225   452   186   264
   358              322                     842   310   370           1230   464   181   239
   357                                       850   303   373           1230   464   166   194
                                             845   303   369           1235   470   183   251
                                             830   308   370           1210   444   183   253
                                                   307   371           1230   470   182   231
                                                   308   370           1323   467   164   226
                                                   302   372                  449   188
                                                   308   368                  463   175

*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
    .1   -.6   0.0   0.0   1.0  -1.1  -7.8    .2    .8  -1.0    DC     -1.9   2.0  -1.9  -5.4                              0.0
    .1   -.9         -.3   1.5    .5   1.3    .2   -.2    .9   DEVS     -.3   -.8   3.8  -2.8
   -.2    .2         0.0    .1    .5   1.0   -.4    .2   -.2             .6   3.1   -.8   6.0
   -.2    .2         -.3   -.9   -.3   1.0    .2  -1.2   1.1           -2.5   -.6  -1.9  13.6
   -.2    .5          .3   -.9   -.7   1.6    .2   -.8   1.7             .5  -1.6   -.8    .9
   -.4    .5          .3    .1    .5   1.6    .2   -.8  -1.8            -.4   2.2  -5.3  -9.6
    .1               0.0   -.9    .5   1.3   -.1    .5    .3            -.7  -2.3   4.9  11.0
    .4               0.0                     -.1   1.5   -.2            -.3    .3   2.1    .5
    .1                                        .8   -.8    .6            -.3    .3  -6.4 -18.4
                                              .2   -.8   -.5             .1   1.6   3.2   5.6
                                            -1.6    .8   -.2           -1.9  -4.0   3.2   6.4
                                                    .5    .1            -.3   1.6   2.6  -2.8
                                                    .8   -.2            7.3   1.0  -7.5  -4.9
                                                  -1.2    .3                 -2.9   6.0
                                                    .8   -.8                   .1  -1.3

     1     1     2     1     2     3     1     2     3     4     N       2     3     4     5     3     4     5     6
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 17.83 16.91 5.850 16.1010.643 11.84 16.49 4.215 1.528 1.854    DCA   6.166 2.313  .887 1.189 0.000 0.000 0.000 0.000100.00
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 15.75 14.90 5.100 14.20 9.200 10.00 14.60 3.620 1.330 1.550    AC1   5.380 1.950  .760 1.000 0.000 0.000 0.000 0.000 90.00
 15.75 15.00 5.100 14.2010.100 10.00 14.60 3.650 1.330 1.560    AC2   5.380 1.950  .760 1.010 0.000 0.000 0.000 0.000 90.00
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 15.75 14.95 5.100 14.20 9.650 10.00 14.60 3.635 1.330 1.555    ACA   5.380 1.950  .760 1.005 0.000 0.000 0.000 0.000 90.00
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 17.83 16.91 23.40 16.10 42.57 118.4 16.49 12.65  9.17 22.25    RHO   24.66 17.35 10.64 20.80*000.0*000.0*000.0*000.0 1.000 DC CAL
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   1.9   1.8   3.2   2.0   -.7   6.5   1.6   4.4   3.4   7.3    PFE     3.1   6.8   5.0   6.5*000.0*000.0*000.0*000.0  .900 AC CAL
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   105   106   138   127   -17    55    99   346   368   328    MCF     128   389   470   311*00000*00000*00000*00000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
    .8    .9   1.9    .9    .9    .5    .9   4.2  13.0   7.8   CPFE     1.8   6.0  18.8  13.3   0.0   0.0   0.0   0.0
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   1.1    .9   1.3   1.1  -1.6   6.0    .7    .2  -9.6   -.5  CCPFE     1.4    .7 -13.8  -6.8*000.0*000.0*000.0*000.0
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
    60    55    57    70   -38    51    44    16 -1046   -24  CCMCF      55    42 -1300  -328*00000*00000*00000*00000

*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000     I    1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
                                                                DC                                                      10  RIGHT
                                                                                                                        10  SIDE
     1     2     3     4     5     6     7     8     9    10   PT.     11    12    13    14    15    16    17    18
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
                                                                DC                                                      20
                                                               SUMS
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
                                                                DC                                                      0.0

     1     1     2     1     2     3     1     2     3     4     N       2     3     4     5     3     4     5     6
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000    DCA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000    AC1   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000    AC2   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000    ACA   0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0    RHO  *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*0.000 DC CAL
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0    PFE  *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0 1.000 AC CAL
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
*00000*00000*00000*00000*00000*00000*00000*00000*00000*00000    MCF  *00000*00000*00000*00000*00000*00000*00000*00000
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   CPFE     0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0  CCPFE *000.0*000.0*000.0*000.0*000.0*000.0*000.0*000.0
*-----*-------------*------------------*--------------------*-------*------------------*-----------------------*-----*------------
*00000*00000*00000*00000*00000*00000*00000*00000*00000*00000  CCMCF *00000*00000*00000*00000*00000*00000*00000*00000
```

```
HEINRICHS GEOEX  (MAR 69)   JOB LAKESHORE TEST   LINE 10N   SPREAD 4   LOOKING N   JUNE 69      A=1000 FEET, FREQUENCIES  .10 AND 3.0

                                         1         2         3         4         5
  ↑---------↑---------↑---------↑---------X---------X---------X---------X---------X---------↑---------↑---------↑---------↑ SURFACE
 50W       40        30        20        10       0W/W      10W       20        30        40        50        60       70W

N                                                                                                                        RHO/2PI
1        X         X         X        X16       X16       X--↗      X--↗      X--       X--       X         X         X         X
                                                          17        18
2   X         X         X        X25       X13       X43       X--↗      X--       X--       X--       X         X         X
                                                               23
3        X         X        X--       X17       X9.2      X118      X--       X--       X--       X--       X         X         X
4   X         X         X        X--       X11       X22       X         X--       X--       X--       X         X         X
5        X         X         X        X--       X21       X         X         X--       X--       X         X         X         X
6   X         X         X        X         X--       X         X         X         X--       X         X         X         X

                                         1         2         3         4         5
  ↑---------↑---------↑---------↑---------X---------X---------X---------X---------X---------↑---------↑---------↑---------↑ SURFACE
 50W       40        30        20        10       0W/W      10W       20        30        40        50        60       70W

N                                                                                                                        PFE
1        X         X         X        X1.6      X2.0      X--↗      X--↗      X--       X--       X         X         X         X
                                                          1.8       1.9
2   X         X         X        X3.1      X4.4      X-.7      X--↗      X--       X--       X--       X         X         X
                                                               3.2
3        X         X        X--       X6.8      X3.4      X6.5      X--       X--       X--       X--       X         X         X
4   X         X         X        X--       X5.0      X7.3      X         X--       X--       X--       X         X         X
5        X         X         X        X--       X6.5      X         X         X--       X--       X         X         X         X
6   X         X         X        X         X--       X         X         X         X--       X         X         X         X

                                         1         2         3         4         5
  ↑---------↑---------↑---------↑---------X---------X---------X---------X---------X---------↑---------↑---------↑---------↑ SURFACE
 50W       40        30        20        10       0W/W      10W       20        30        40        50        60       70W

N                                                                                                                        MCF
1        X         X         X        X99       X127      X--↗      X--↗      X--       X--       X         X         X         X
                                                          106       105
2   X         X         X        X128      X346      X-17      X--↗      X--       X--       X--       X         X         X
                                                               138
3        X         X        X--       X389      X368      X55       X--       X--       X--       X--       X         X         X
4   X         X         X        X--       X470      X328      X         X--       X--       X--       X         X         X
5        X         X         X        X--       X311      X         X         X--       X--       X         X         X         X
6   X         X         X        X         X--       X         X         X         X--       X         X         X         X

                                         1         2         3         4         5
  ↑---------↑---------↑---------↑---------X---------X---------X---------X---------X---------↑---------↑---------↑---------↑ SURFACE
 50W       40        30        20        10       0W/W      10W       20        30        40        50        60       70W

N                                                                                                                        CCPFE
1        X         X         X        X.7       X1.1      X--↗      X--↗      X--       X--       X         X         X         X
                                                          .9        1.1
2   X         X         X        X1.4      X.2       X-1.6     X--↗      X--       X--       X--       X         X         X
                                                               1.3
3        X         X        X--       X.7       X-9.6     X6.0      X--       X--       X--       X--       X         X         X
4   X         X         X        X--       X-13.8    X-.5      X         X--       X--       X--       X         X         X
5        X         X         X        X--       X-6.8     X         X         X--       X--       X         X         X         X
6   X         X         X        X         X--       X         X         X         X--       X         X         X         X

                                         1         2         3         4         5
  ↑---------↑---------↑---------↑---------X---------X---------X---------X---------X---------↑---------↑---------↑---------↑ SURFACE
 50W       40        30        20        10       0W/W      10W       20        30        40        50        60       70W

N                                                                                                                        CCMCF
1        X         X         X        X44       X70       X--↗      X--↗      X--       X--       X         X         X         X
                                                          55        60
2   X         X         X        X55       X16       X-38      X--↗      X--       X--       X--       X         X         X
                                                               57
3        X         X        X--       X42       X-1046    X51       X--       X--       X--       X--       X         X         X
4   X         X         X        X--       X-1300    X-24      X         X--       X--       X--       X         X         X
5        X         X         X        X--       X-328     X         X         X--       X--       X         X         X         X
6   X         X         X        X         X--       X         X         X         X--       X         X         X         X
```

JOB Lakeshore
MK 4C Test LINE 10N SPREAD 1

LOOKING N DATE June 69 A= 1000 foot

CENTER -20.0 LABEL W/E FREQ. 3.0 0.1

COUPLING yes

Make dummy
(W 1/2)
11-13-69
MD

1 array

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE 1 HALF E SP. 1 DATE 6/24/66

PAGE 1

4C omit punch

SEND	4-5	3-4	2-3	1-2	5-6		4-5	3-4	2-3	1-2
RECEIVE	10-20E			→	20-30E					→
RANGE	7.0	0.1	0.1	0.1	1.0	+3.2 +3.6	1.0	0.1	0.1	0.1
DC 1	+7.2 +6.0	+11 +8.5	+7 -2			0.0 -0.8	+11 -6	-5 -7	-7 -2	+8 -18
DC 2	-1.4 -1.8	-2 +7	+6 +7			+3.0 +3.8	-7 +12	+20 +21	+20 +18	+32 +42
DC 3	+6.6 +5.9	+8 +6.5	+2 +3			0.0 +0.4	+17 -4	-5 -7	-12 -5	-12 -10
DC 4	-1.4 +0.1	+4 +0.5	+8 +5			+3.2 +4.0	-8 +15	+20 +22	+25 +17	+34 +64
DC 5	+6.0 +5.6	+13 +30	+10 -10			-0.2 +0.3	+16 -5	-3 -9	-13 0	-14 -24
DC 6	-0.4 -0.5	-1 +8.5	+8 +15			+3.4 +4.4	-8 +15	+19 +24	+24 +12	+40 +65
DC 7	+6.6 +5.6	+4.5 +4.5	-3 +7			-0.3 +0.9	+11 -5	-3 -5	-3 -7	0 -30
DC 8	-0.6 -0.4	+3.5 +2.0	+15 +3			+3.3 +4.1	-5	+19 +23	+15 +15	+26 +60
DC AVG.	2.15	5.00	4.10	—		-0.6 0.0	+17 +20	7.167	6.20	15.0
AC 1 3.	33.2 (+0.4)	8.26 (0.0)	2.74 (0.0)	1.29 (+0.4)	97.9 (+.3)	1.789	14.9 (+0.2)	5.84 (+1.2)	2.30 (-0.5)	1.20
AC 2 1.	+1.0	+1.6	+2.8 ± 0.5	+7.0 ± 1.0	+0.3		+1.4 ± 0.5	4.4 ± 0.8	+3.4 ± 0.4	5-8 (+2)
AC AVG. 2	+2.0	+3.4	+4.0 ± 0.5	+6.0 ± 2.0	+1.0		+2.9	+ 5.0	+5.5	7.5 ± 1.5
S.P.	34.0	.3 ± .1 MV	noise @ .1		0.5					-5.9
AC NOISE	+1.9	2.6	+3.4 ± 0.3	+3.6 ± 0.5	0.4		+2.6	+4.4	+5.0	+10.5
POT RES.		.1 ± 0.0	5 MV noise @ 3.0				45K			

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

4c

PROJECT Lakeshore

LINE 1 HALF E SP. 1 DATE 6/24/6

	6-7	5-6	4-5	3-4	2-3	1-2	5-6	4-5	3-4	Cal
SEND										
RECEIVE	30-40E					→	50-60E			
RANGE	10	1.0	0.1	0.1	0.1					
DC 1	+1 +2	+8 +6	+2 +8	+17 +17						
DC 2	+7 +7	-1 -2	+3 -3	0 -8						0.4 -1.0
DC 3	+1	+6 +8	+14 +18	+12 +25						
DC 4	+7	-3 -2	-7 -1	-3 -20						
DC 5	+1	+7 +7	+11 +13	+24 +25						
DC 6	+7	-2 -2	+2 -3	-7						
DC 7	+1	+8 +7	+16 +17	+8						
DC 8	+7	-3 -1	-4 -7	+3						
DC AVG.	4.00	2.50	5.00	6.00						
AC 1 3.0	514.(+.2)	23.5 (0.0)	4.77 (-.3)	2.44 (-.5)	1.04					101.5
AC 2 1.0	+0.4	+0.8	+3.0	—	—					+0.4
AC AVG. 3	+1.1	+1.9	+3.5	+5.0	+6.0 ± 1					
S.P.					-4,2					
AC NOISE	+.8	+.8	—	+5.0	10 ± 100					
POT RES.										

CA2 G-7 Scale 10
CORRENT Set 10.15
15

3 0
1 +.3
.3 +.4
.1 -.8
.1 +.4 -1.0 +.4 -1.0 = ave
3 +.4

HEINRICHS GEOEXPLORATION CO.

I.P. SENDER NOTES

Dummy in — omit punch

PROJECT LAKESHORE

LINE 1 HALF E SP. 1 DATE 6-24

PAGE

SEND	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2	CAL.
RECEIVE	6-7	→	→	→	→	→	→	→	→	Hi
RANGE	Hi	Hi	Lo	Lo	Hi	Hi	Hi	Lo	Lo	
VOLTAGE	510	500	560	620	200	510	500	550	600	70
CURRENT	6.0	5.0	4.0	4.0	9.0	6.0	5.0	4.0	4.0	1.0
SEND	6-7	5-6	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3
RECEIVE	~~3-4~~ 9-10	→	→	→	→	→	→	→	→	→
RANGE	Hi	Hi	Hi	Hi	Lo	Lo				
VOLTAGE	500	200	500	490	540					
CURRENT	7.0	9.0	6.0	5.0	4.0					

FREQUENCIES HLL

SENDER NO. 6644

OPERATOR HIX

RECEIVER NO MK 4 ; 4B,

OPERATOR

omit punch

COMMENTS:
1-2 — Lo - 5.0
2-3 — Lo - 5.0
3-4 — Hi - 5.0
4-5 — Hi — 6
5-6 — Hi — 9,
6-7 — Hi - 7.0

JOB 4C Test LINE 10N SPREAD F, II.

LOOKING N DATE June 69 A= 1000 feet

CENTER 20.0 LABEL w/E FREQ. 3.0 - 0.1

COUPLING yes

11-13-69
MD

7 array

west center
-40.0

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Lakeshore
LINE 10N HALF W SP. Fill DATE 5mc

PAGE

SEND	2-3	1-2	2-3							Cal
RECEIVE	40-50W	50-60	—							
RANGE	1	1	0.1							
DC 1	6.6	1.0 1.7	-9 -10.8							0.6
DC 2	-9.0	3.4 2.8	14 15.6							-1.9
DC 3	7.0	0.8 0.6	-9.5 -11.0							
DC 4	-9.5	3.6 3.8	14.3 +16.2							
DC 5	7.0	0.8 0.4	-10.0 -11.8							
DC 6	-9.2	1.9 3.6	+15.3 16.2							
DC 7	7.1	2.5 0.1	-11.1 -11.0							
DC 8	-9.9	2.6 4.0	+15.4 16.4							
DC AVG.	[redacted]									
AC 1	17.25	14.5	4.65							99.6
AC 2	+0.5	+0.7	0.0							0.0
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lakeshore

LINE 10N HALF W SP. F/L DATE

PAGE

SEND	2-3	1-2	2-3							Cal
RECEIVE	40-50W	50-60	—							
RANGE										
VOLTAGE										
CURRENT	3	3	3							1.0
SEND										
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										

FREQUENCIES _____ _____

SENDER NO.

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Lakeshore

LINE full HALF E SP. Fill DATE

PAGE

SEND	6-5	6-7	5-6							Cal
RECEIVE	20-30E	30-40	—							
RANGE	1.0	10	1.0							
DC 1	0.0 -0.8	+1	+8 +6							+0.4
DC 2	+3.0 +3.8	+7	-1 -2							-1.0
DC 3	0.6 +0.4	+1	+6 +8							
DC 4	+3.2 +4.6	+7	-3 -2							
DC 5	-0.2 +0.3	+1	+7 +7							
DC 6	+3.4 +4.4	+7	-2 -2							
DC 7	-0.3 +0.5		+8 +7							
DC 8	+3.3 +4.1		-3 -1							
DC AVG.	-0.6 0.0									
AC 1	97.9	514.0	23.5							101.5
AC 2	+0.3	+0.2	0.0							+0.4
AC AVG.										
S.P.										
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Lake Shore

LINE E HALF Fill SP. ___ DATE ___

PAGE

SEND	5-6	6.7	5-6							Cal
RECEIVE	20-30E	30-40	—							
RANGE										
VOLTAGE										
CURRENT	9.0	7.0	9.0							1.0
SEND										
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										

FREQUENCIES ___ ___

SENDER NO.

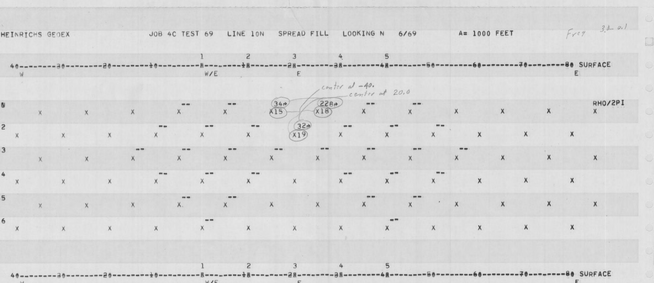
OPERATOR

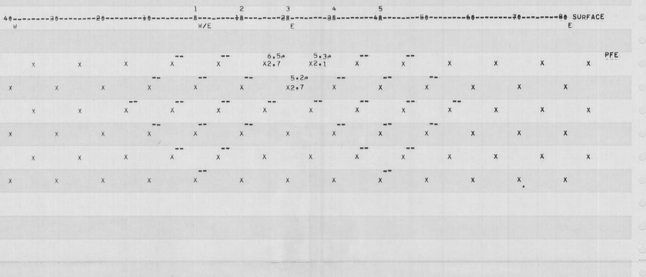
RECEIVER NO.

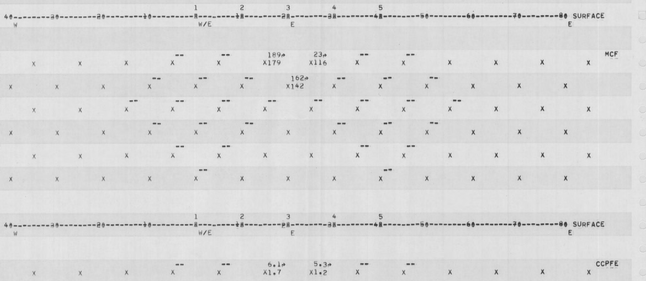
OPERATOR

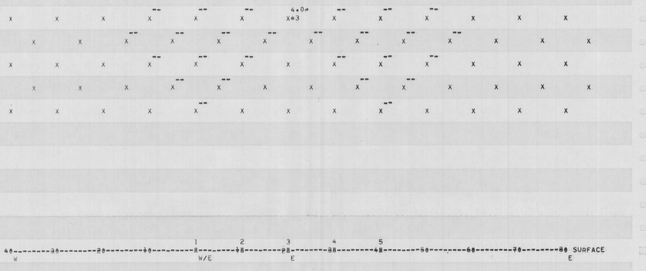
COMMENTS:

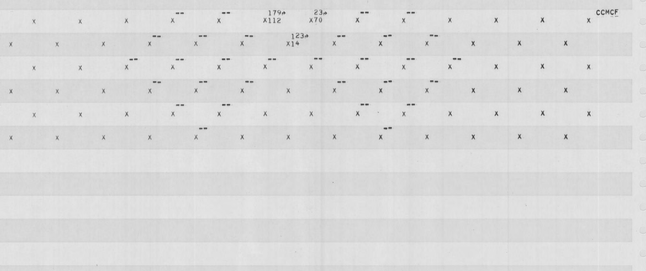
```
HEINRICHS GEOEX  Lakefore   JOB 4C TEST 69   LINE 10N   SPREAD FILL   LOOKING N   6/69        A= 1000 FEET

 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000  I   3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000 1.000
                                                                   DC                                                      0 LEFT
   -66    10    -9                                                                                                     -19 SIDE
   -40    34    14
    70     8   -95
   -65    36   143
    70     8  -100
   -42    19   153
    71    25  -111
   -44    26   154
          19  -108
          28   156
           6  -116
          38   162
           4  -113
          36   162
           1  -110
          40   161

  1    1    2    1    2    3    1    2    3    4    N   2    3    4    5    3    4    5    6
 1.6   2.1  1.8  0.0  0.0  0.0  0.0  0.0  0.0  0.0  PFEA  0.0  0.0  0.0  0.0  0.0  0.0  0.0  -.9
17.2% 14.5% 4.6% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% AC1  0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 99.6%
   .5    .7   .2   0.0  0.0  0.0  0.0  0.0  0.0  0.0  ACE  0.0  0.0  0.0  0.0  0.0  0.0  0.0   0.0
17.2% 14.5% 4.6% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% ACA  0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 99.6%
17.7% 15.0% 19.1%*000.0*000.0*000.0*000.0*000.0*000.0  RHO  *000.0*000.0*000.0*000.0*000.0*000.0*000.0* 1.0% DC CAL
  2.1   2.7  2.7*000.0*000.0*000.0*000.0*000.0*000.0  PFE  *000.0*000.0*000.0*000.0*000.0*000.0*000.0* .9% AC CAL
  116   179  162*0000.*0000.*0000.*0000.*0000.*0000.*0000.  MCF  *0000.*0000.*0000.*0000.*0000.*0000.*0000.
    .8   1.0   2.5  0.0  0.0  0.0  0.0  0.0  0.0  0.0  CPPE  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
   1.2   1.7   .3*000.0*000.0*000.0*000.0*000.0*000.0*000.0  CCPPE *000.0*000.0*000.0*000.0*000.0*000.0*000.0
   70   112   14*0000.*0000.*0000.*0000.*0000.*0000.*0000.  CCMCF *0000.*0000.*0000.*0000.*0000.*0000.*0000.

 6.000 7.000 9.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000  I   1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
                                                             DC                                                     94 RIGHT
   35     1     8                                                                                                -190 SIDE
   32     7    -1
    0     7    -5
    6     7    -3
   -2     1     6
   34     7    -2
   -3           8
   33          -3
   -5           6
   -8          -2
   38          -5
    4           7
   46          -2
    3           7
   44          -1
   41
    0

  1    1    2    1    2    3    1    2    3    4    N   2    3    4    5    3    4    5    6
 1.6   .4   .3  0.0  0.0  0.0  0.0  0.0  0.0  0.0  PFEA  0.0  0.0  0.0  0.0  0.0  0.0  0.0  -.8
97.9% 91.4% 23.5% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% AC1  0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 101.5
   .3    .2   .1  0.0  0.0  0.0  0.0  0.0  0.0  0.0  ACE  0.0  0.0  0.0  0.0  0.0  0.0  0.0   .4
98.0% 91.6% 23.5% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% ACA  0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 101.7
34.2% 228.3% 32.9%*000.0*000.0*000.0*000.0*000.0*000.0  RHO  *000.0*000.0*000.0*000.0*000.0*000.0*000.0* .9% DC CAL
  6.5   5.3   5.2*000.0*000.0*000.0*000.0*000.0*000.0  PFE  *000.0*000.0*000.0*000.0*000.0*000.0*000.0* 5.0% AC CAL
  189    23   152*0000.*0000.*0000.*0000.*0000.*0000.*0000.  MCF  *0000.*0000.*0000.*0000.*0000.*0000.*0000.
    .3    .0    .1  0.0  0.0  0.0  0.0  0.0  0.0  0.0  CPPE  0.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0
   6.1   5.3   4.0*000.0*000.0*000.0*000.0*000.0*000.0  CCPPE *000.0*000.0*000.0*000.0*000.0*000.0*000.0
   179    23   123*0000.*0000.*0000.*0000.*0000.*0000.  CCMCF *0000.*0000.*0000.*0000.*0000.*0000.*0000.
```











HEINRICHS GEOEX *MK 4C Test* JOB LAKESHORE/69 LINE 10N SPREAD 1 LOOKING N 6/69 A= 1000 FEET *3.0 - 0.1*

1	1	2	1	2	3	1	2	3	4	DC N	2	3	4	5	3	4	5	6		LEFT
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	I	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	PFEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	AC1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	LEFT
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	AC2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	ACA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	LEFT
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	RHO	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		R DC CAL
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.	*000.0	*000.0	PFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	-0.000	AC CAL
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	MCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CPFE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.	*000.0	*000.0	CCPFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	CCMCF	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	*0000.		

1.000	1.000	1.000	1.000	1.000	1.000	6.000	5.000	4.000	4.000	I	6.000	5.000	4.000	4.000	6.000	5.000	4.000	4.000	1.000

			DC							
72	11	-7		11	-5	-7	18	-8	17	4 RIGHT
-14	-2	6		-7	20	20	32	3	0	-10 SIDE
66	8	2		17	-5	-12	-12	14	12	
-14	4	8		-8	20	25	34	-7	-3	
60	13	10		16	-3	-13	-14	11	24	
-4	-1	8		-8	19	24	40	2	-7	
66	45	-3		11	-3	-3	0	16	8	
-6	35	15		-5	19	15	26	-4	3	
60	85	-2		17	-7	-2	-18	8	17	
-18	7	7		-6	21	18	42	-3	-8	
59	65	3		12	-7	-5	-10	18	25	
1	5	5		-4	22	17	64	-1	-20	
56	30	-10		15	-9	12	-24	13	25	
-5	85	15		-5	24	0	65	-3		
56	45	7		15	-5	-7	-30	17		
-4	20	3		-5	23	15	60	-7		

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.9	.5	0.0	PFEA	.4	.8	.6	1.6	.5	.6	0.0	0.0	-.3	
0.000	0.000	0.000	0.000	0.000	0.000	33.20	8.260	2.740	1.290	AC1	14.90	5.840	2.300	1.200	4.770	2.440	1.040	0.000	101.5	
0.0	0.0	0.0	0.0	0.0	0.0	.4	0.0	0.0	.4	AC2	.2	1.2	-.5	0.0	-.3	-.5	0.0	0.0	.4	
0.000	0.000	0.000	0.000	0.000	0.000	33.27	8.260	2.740	1.293	ACA	14.91	5.875	2.294	1.200	4.763	2.434	1.040	0.000	101.7	
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	16.84	20.16	20.40	*000.0	RHO	29.57	34.89	34.30	31.61	23.69	29.11	*000.0	*000.0	.983	DC CAL
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	2.9	3.4	1.0	*000.0	PFE	.8	.7	1.4	2.1	1.2	1.3	*000.0	*000.0	.500	AC CAL
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	175	170	47	*0000.	MCF	28	19	40	65	49	46	*0000.	*0000.		
0.0	0.0	0.0	0.0	0.0	0.0	.9	2.3	4.9	0.0	CPFE	1.4	2.5	4.6	8.1	4.1	5.6	0.0	0.0		
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	2.1	1.1	-4.0	*000.0	CCPFE	-.6	-1.9	-3.2	-6.0	-2.9	-4.3	*000.0	*000.0		
*0000.	*0000.	*0000.	*0000.	*0000.	*0000.	123	55	-195	*0000.	CCMCF	-20	-53	-94	-190	-124	-147	*0000.	*0000.		

HEINRICHS GEOEX JOB LAKESHORE/69 LINE 10N SPREAD 1 LOOKING N 6/69 A= 1000 FEET *3.0 - 0.1*

```
                                        1     2     3     4     5
 80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                     W                   W/E                                         E

 N                            --       --      --*      --*     --       17                                         RHO/2PI
 1       X       X       X       X       X       X--     X--     X       X       X       X       X       X
 2                        --       --      --      --*     --      20      30
 2  X       X       X       X       X       X       X--     X       X       X       X       X       X
 3                    --      --      --      --      --      20      35      24
         X       X       X       X       X       X       X       X       X       X       X       X       X
 4                        --      --      --              --      34      29
    X       X       X       X       X       X       X       X       X       X       X       X       X
 5                            --      --                      32      --
         X       X       X       X       X       X       X       X       X       X       X       X       X
 6                                --                              --
    X       X       X       X       X       X       X       X       X       X       X       X       X
```

```
                                        1     2     3     4     5
 80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                     W                   W/E                                         E

 N                            --       --      --*      --*     --       2.9                                        PFE
 1       X       X       X       X       X       X--     X--     X       X       X       X       X       X
 2                        --       --      --      --*     --      3.4      .8
 2  X       X       X       X       X       X       X--     X       X       X       X       X       X
 3                    --      --      --      --      --      1.0      *7      1.2
         X       X       X       X       X       X       X       X       X       X       X       X       X
 4                        --      --      --              --      1.4      1.3
    X       X       X       X       X       X       X       X       X       X       X       X       X
 5                            --      --                      2.1     --
         X       X       X       X       X       X       X       X       X       X       X       X       X
 6                                --                              --
    X       X       X       X       X       X       X       X       X       X       X       X       X
```

```
                                        1     2     3     4     5
 80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                     W                   W/E                                         E

 N                            --       --      --*      --*     --       175                                        MCF
 1       X       X       X       X       X       X--     X--     X       X       X       X       X       X
 2                        --       --      --      --*     --      170      28
 2  X       X       X       X       X       X       X--     X       X       X       X       X       X
 3                    --      --      --      --      --      47      19      49
         X       X       X       X       X       X       X       X       X       X       X       X       X
 4                        --      --      --              --      40      46
    X       X       X       X       X       X       X       X       X       X       X       X       X
 5                            --      --                      65      --
         X       X       X       X       X       X       X       X       X       X       X       X       X
 6                                --                              --
    X       X       X       X       X       X       X       X       X       X       X       X       X
```

```
                                        1     2     3     4     5
 80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                     W                   W/E                                         E

 N                            --       --      --*      --*     --       2.1                                        CCPFE
 1       X       X       X       X       X       X--     X--     X       X       X       X       X       X
 2                        --       --      --      --*     --      1.1      -.6
 2  X       X       X       X       X       X       X--     X       X       X       X       X       X
 3                    --      --      --      --      --      -4.0      -1.9      -2.9
         X       X       X       X       X       X       X       X       X       X       X       X       X
 4                        --      --      --              --      -3.2      -4.3
    X       X       X       X       X       X       X       X       X       X       X       X       X
 5                            --      --                      -6.0     --
         X       X       X       X       X       X       X       X       X       X       X       X       X
 6                                --                              --
    X       X       X       X       X       X       X       X       X       X       X       X       X
```

```
                                        1     2     3     4     5
 80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                     W                   W/E                                         E

 N                            --       --      --*      --*     --       123                                        CCMCF
 1       X       X       X       X       X       X--     X--     X       X       X       X       X       X
 2                        --       --      --      --*     --      55      -20
 2  X       X       X       X       X       X       X--     X       X       X       X       X       X
 3                    --      --      --      --      --      -195      -53      -124
         X       X       X       X       X       X       X       X       X       X       X       X       X
 4                        --      --      --              --      -94      -147
    X       X       X       X       X       X       X       X       X       X       X       X       X
 5                            --      --                      -190     --
         X       X       X       X       X       X       X       X       X       X       X       X       X
 6                                --                              --
    X       X       X       X       X       X       X       X       X       X       X       X       X
```

HEINRICHS GEOEX (MAR 69) JOB LAKESHORE TEST LINE 10N SPREAD 4 LOOKING N JUNE 69 A=1000 FEET, FREQUENCIES .10 AND 1.0

VOID

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18		
3.000	3.000	3.000	3.000	3.000	3.000	3.000	4.000	5.000	5.000	I	3.000	4.000	5.000	6.000	6.000	6.000	6.000	6.000	1.000	
175	164	60	155	109	120	138	430	147	180	DC	640	230	90	121					100	LEFT
182	172	57	167	106	114	166	415	161	187		570	242	84	104					100	SIDE
175	163		154	110	124	168	430	144	187		659	217	100	127						
181	176		168	103	114	165	410	162	183		581	260	76	125						
175	163		153	108	122	168	435	140	192		621	200	98	145						
181	177		170	103	113	167	/	163	185		618	255	78	/						
174	163		153	110	125	168	400	140	179		610	218	90	120						
183			169	101	113	166	445	167	193		615	234	96	120						
175			153				400	143	177		615	230	85	95						
182							442	160	196		615	234	81	169						
							400	143	173		620	236	102	70						
							450	165	197		590	208	81	124						
							395	142	174		640	262	101	127						
							435	166	196		683	205	63	126						
								136	176			244	125	105						
								172	192			219	50	121						

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
357	336	117	322	215	234	304	845	308	367	DC	1210	472	174	225					200
357	335		321	216	238	334	845	305	374	SUMS	1229	459	184	231					
356	339		322	213	238	333	840	306	370		1240	477	176	252					
356	339		321	211	236	333	845	302	375		1202	460	174	270					
356	340		323	211	235	335	845	303	377		1239	455	176	240					
355	340		323	213	238	335	845	303	364		1228	473	168	215					
357			322	211	238	334	842	307	372		1225	452	186	264					
358			322				842	310	370		1230	464	181	239					
357							850	303	373		1230	464	166	194					
							845	303	369		1235	470	183	251					
							830	308	370		1210	444	183	253					
								307	371		1230	470	182	231					
								308	370		1323	467	164	226					
								302	372			449	188						
								308	368			463	175						

.1	-.6	0.0	0.0	1.0	-1.1	-7.8	.2	.8	-1.0	DC	-1.9	2.0	-1.9	-5.4	0.0
.1	-.9		-.3	1.5	.5	1.3	.2	-.2	.9	DEVS	-.3	-.8	3.8	-2.8	
-.2	.2		0.0	.1	.5	1.0	-.4	.2	-.2		.6	3.1	-.8	6.0	
-.2	.2		-.3	-.9	-.3	1.0	.2	-1.2	1.1		-2.5	-.6	-1.9	13.6	
-.2	.5		.3	-.9	-.7	1.6	.2	-.8	1.7		.5	-1.6	-.8	.9	
-.4	.5		.3	.1	.5	1.6	.2	-.8	-1.8		-.4	2.2	-5.3	-9.6	
.1			0.0	-.9	.5	1.3	-.1	.5	.3		-.7	-2.3	4.9	11.0	
.4			0.0				-.1	1.5	-.2		-.3	.3	2.1	.5	
.1							.8	-.8	.6		-.3	.3	-6.4	-18.4	
							.2	-.8	-.5		.1	1.6	3.2	5.6	
							-1.6	.8	-.2		-1.9	-4.0	3.2	6.4	
								.5	.1		-.3	1.6	2.6	-2.8	
								.8	-.2		7.3	1.0	-7.5	-4.9	
								-1.2	.3			-2.9	6.0		
								.8	-.8			.1	-1.3		

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
17.83	16.91	5.850	16.10	10.643	11.84	16.49	4.215	1.528	1.854	DCA	6.166	2.313	.887	1.189	0.000	0.000	0.000	0.000	100.00	
17.25	16.30	5.550	15.60	9.200	11.20	16.10	4.100	1.470	1.740	AC1	5.870	2.150	.850	1.300	0.000	0.000	0.000	0.000	98.00	
17.25	16.40	5.550	15.50	9.200	11.20	16.20	4.020	1.460	1.730	AC2	5.870	2.150	.850	1.500	0.000	0.000	0.000	0.000	98.00	
17.25	16.35	5.550	15.55	9.200	11.20	16.15	4.060	1.465	1.735	ACA	5.870	2.150	.850	1.400	0.000	0.000	0.000	0.000	98.00	
17.83	16.91	23.40	16.10	42.57	118.4	16.49	12.65	9.17	22.25	RHO	24.66	17.35	10.64	20.80	*000.0	*000.0	*000.0	*000.0	1.000	DC CAL
1.3	1.3	3.3	1.5	13.4	3.6	.0	1.8	2.2	4.7	PFE	2.9	5.4	2.2	-16.8	*000.0	*000.0	*000.0	*000.0	.980	AC CAL
72	80	141	91	314	30	2	139	239	212	MCF	119	313	209	-807	*00000	*00000	*00000	*00000		
.2	.2	.4	.2	.2	.1	.2	1.0	3.4	2.0	CPFE	.4	1.5	5.0	3.5	0.0	0.0	0.0	0.0		
1.1	1.2	2.9	1.3	13.2	3.5	-.2	.7	-1.2	2.7	CCPFE	2.5	3.9	-2.8	-20.3	*000.0	*000.0	*000.0	*000.0		
62	68	122	78	309	29	-10	58	-132	123	CCMCF	102	226	-264	-974	*00000	*00000	*00000	*00000		

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18		
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	I	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
										DC									10	RIGHT
																			10	SIDE
										DC SUMS									20	
										DC									0.0	

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	DCA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	AC1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	AC2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	ACA	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	RHO	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*0.000	DC CAL
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	PFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	1.000	AC CAL
*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	MCF	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CPFE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	CCPFE	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0	*000.0		
*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000	CCMCF	*00000	*00000	*00000	*00000	*00000	*00000	*00000	*00000		

HEINRICHS GEOEX (MAR 69) JOB LAKESHORE TEST LINE 10N SPREAD 4 LOOKING N JUNE 69 A=1000 FEET, FREQUENCIES .10 AND 1.0

VOID

```
                                        1         2         3         4         5
 ^---------^---------^---------^---------X---------X---------X---------X---------X---------^---------^---------^---------^ SURFACE
 50W       40        30        20        10        0W/W      10W       20        30        40        50        60        70W

N                                                                                                                   RHO/2PI
1        X        X        X        X16       X16       X-->      X-->      X--       X--       X         X         X         X
                                                        17        18
2  X        X        X        X25       X13       X43       X-->      X--       X--       X--       X         X         X
                                                           23
3        X        X        X--      X17       X9.2      X118      X--       X--       X--       X--       X         X         X
4  X        X        X        X--       X11       X22       X         X--       X--       X--       X         X         X
5        X        X        X        X--       X21       X         X         X--       X--       X         X         X         X
6  X        X        X        X         X--       X         X         X         X--       X         X         X         X
```

```
                                        1         2         3         4         5
 ^---------^---------^---------^---------X---------X---------X---------X---------X---------^---------^---------^---------^ SURFACE
 50W       40        30        20        10        0W/W      10W       20        30        40        50        60        70W

N                                                                                                                   PFE
1        X        X        X        X.0       X1.5      X-->      X-->      X--       X--       X         X         X         X
                                                        1.3       1.3
2  X        X        X        X2.9      X1.8      X13.4     X-->      X--       X--       X--       X         X         X
                                                           3.3
3        X        X        X--      X5.4      X2.2      X3.6      X--       X--       X--       X--       X         X         X
4  X        X        X        X--       X2.2      X4.7      X         X--       X--       X--       X         X         X
5        X        X        X        X--       X-16.8    X         X         X--       X--       X         X         X         X
6  X        X        X        X         X--       X         X         X         X--       X         X         X         X
```

```
                                        1         2         3         4         5
 ^---------^---------^---------^---------X---------X---------X---------X---------X---------^---------^---------^---------^ SURFACE
 50W       40        30        20        10        0W/W      10W       20        30        40        50        60        70W

N                                                                                                                   MCF
1        X        X        X        X2        X91       X-->      X-->      X--       X--       X         X         X         X
                                                        80        72
2  X        X        X        X119      X139      X314      X-->      X--       X--       X--       X         X         X
                                                           141
3        X        X        X--      X313      X239      X30       X--       X--       X--       X--       X         X         X
4  X        X        X        X--       X209      X212      X         X--       X--       X--       X         X         X
5        X        X        X        X--       X-807     X         X         X--       X--       X         X         X         X
6  X        X        X        X         X--       X         X         X         X--       X         X         X         X
```

```
                                        1         2         3         4         5
 ^---------^---------^---------^---------X---------X---------X---------X---------X---------^---------^---------^---------^ SURFACE
 50W       40        30        20        10        0W/W      10W       20        30        40        50        60        70W

N                                                                                                                   CCPFE
1        X        X        X        X-.2      X1.3      X-->      X-->      X--       X--       X         X         X         X
                                                        1.2       1.1
2  X        X        X        X2.5      X.7       X13.2     X-->      X--       X--       X--       X         X         X
                                                           2.9
3        X        X        X--      X3.9      X-1.2     X3.5      X--       X--       X--       X--       X         X         X
4  X        X        X        X--       X-2.8     X2.7      X         X--       X--       X--       X         X         X
5        X        X        X        X--       X-20.3    X         X         X--       X--       X         X         X         X
6  X        X        X        X         X--       X         X         X         X--       X         X         X         X
```

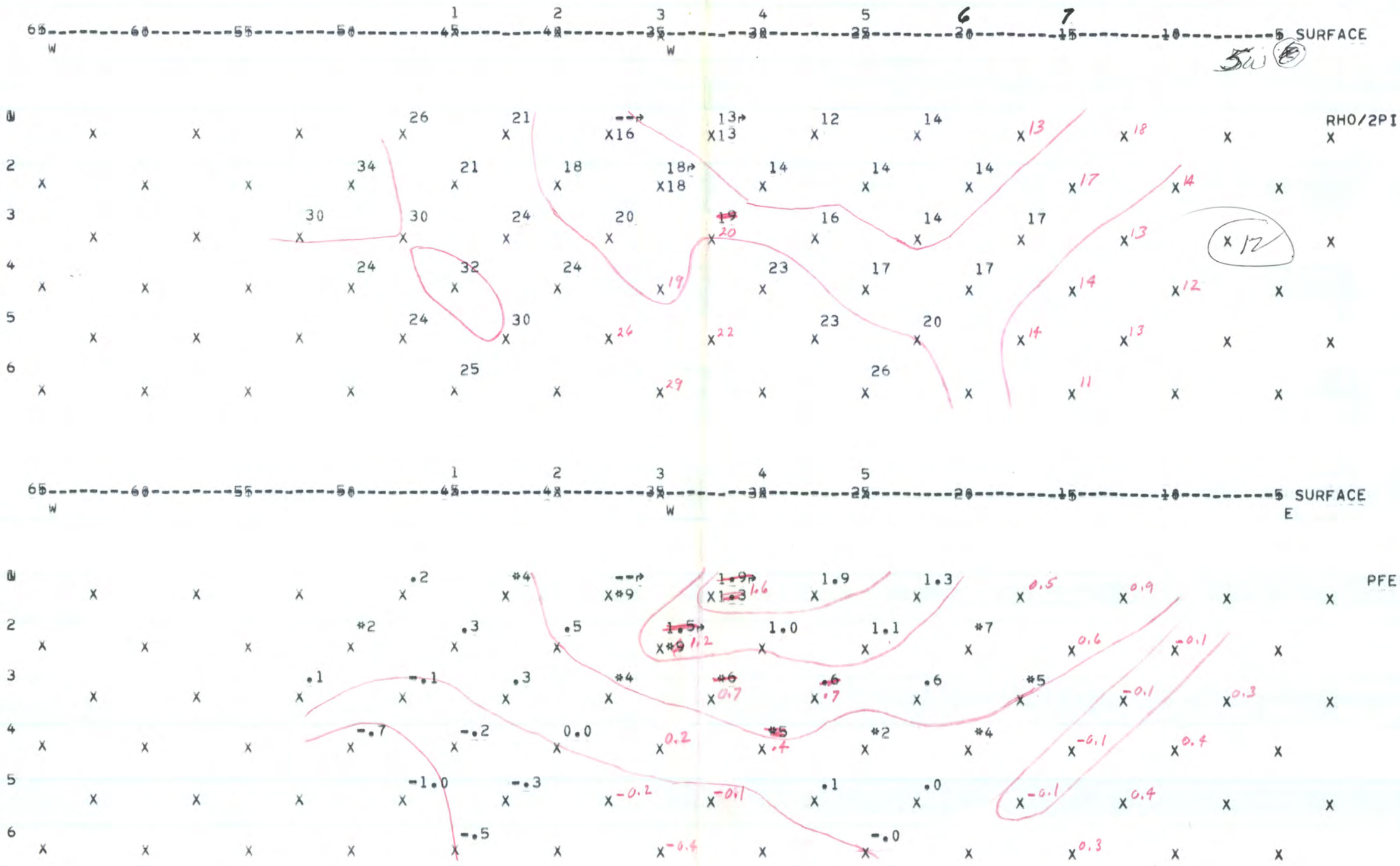
```
                                        1         2         3         4         5
 ^---------^---------^---------^---------X---------X---------X---------X---------X---------^---------^---------^---------^ SURFACE
 50W       40        30        20        10        0W/W      10W       20        30        40        50        60        70W

N                                                                                                                   CCMCF
1        X        X        X        X-10      X78       X-->      X-->      X--       X--       X         X         X         X
                                                        68        62
2  X        X        X        X102      X58       X309      X-->      X--       X--       X--       X         X         X
                                                           122
3        X        X        X--      X226      X-132     X29       X--       X--       X--       X--       X         X         X
4  X        X        X        X--       X-264     X123      X         X--       X--       X--       X         X         X
5        X        X        X        X--       X-974     X         X         X--       X--       X         X         X         X
6  X        X        X        X         X--       X         X         X         X--       X         X         X         X
```

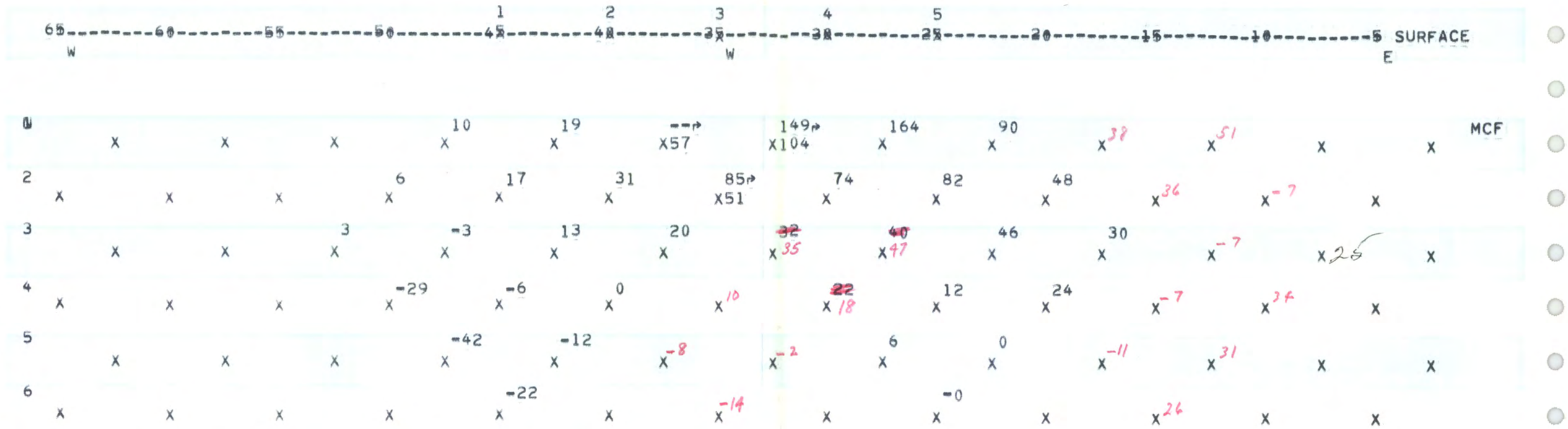
```
                                                1         2         3         4         5
65--------60--------55--------50--------45--------40--------35--------30--------25--------20--------15--------10--------5 SURFACE
  W                                                                W                                                    E

0                                        18        22        -->       133->     57        70                                    CCMCF
      X         X         X         X         X         X57       X94       X         X         X         X         X         X
2                                  15        23        28        119->     71        68        36
  X         X         X         X         X         X         X64       X         X         X         X         X         X
3                            -14       -20       128       -32       66        71        41        12
      X         X         X         X         X         X         X         X         X         X         X         X         X
4                                  -17       -29       -56                 50        7         18
  X         X         X         X         X         X         X         X         X         X         X         X         X
5                                        -39       -53                           -17       1
      X         X         X         X         X         X         X         X         X         X         X         X         X
6                                            -25                                     -29
  X         X         X         X         X         X         X         X         X         X         X         X         X
```

AC READING MISSING CARD 12

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1 LOOKING N 8-27-69 A= 500 FEET

1.0 - 0.1 4c





```
                                   1         2         3         4         5
65--------60--------55--------50--------45--------40--------35--------30--------25--------20--------15--------10--------5 SURFACE
 W                                                          W                                                          E

0                                  10        19        --→       149→      164       90        38        51        X         X   MCF
     X         X         X         X         X         X57       X104      X         X         X         X         X         X
2                                  6         17        31        85→       74        82        48        36        -7        X
 X         X         X         X         X         X         X51       X         X         X         X         X         X
3                                  3         -3        13        20        32        40        46        30        -7        X25       X
     X         X         X         X         X         X         X35       X47       X         X         X         X         X
4                                  -29       -6        0         10        22        12        24        -7        34        X
 X         X         X         X         X         X         X         X18       X         X         X         X         X
5                                  -42       -12       -8        -2        6         0         -11       31        X         X
     X         X         X         X         X         X         X         X         X         X         X         X         X
6                                  -22                 -14                 -0
 X         X         X         X         X         X         X         X         X         X         X         X         X

AC READING MISSING CARD  10
```

HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10S SPREAD 1 LOOKING N 2-5-70 A= 1000 FEET

1.0 - 0.1 ac

80 70 60 50 40 30 20 10 0 1 2 3 4 5 6 7 SURFACE

W W W/E E

Power Line

steel pipe line now in Jan, 70

RHO/2PI

PFE

Hilton
Thurs — Wed

Fred Johnson

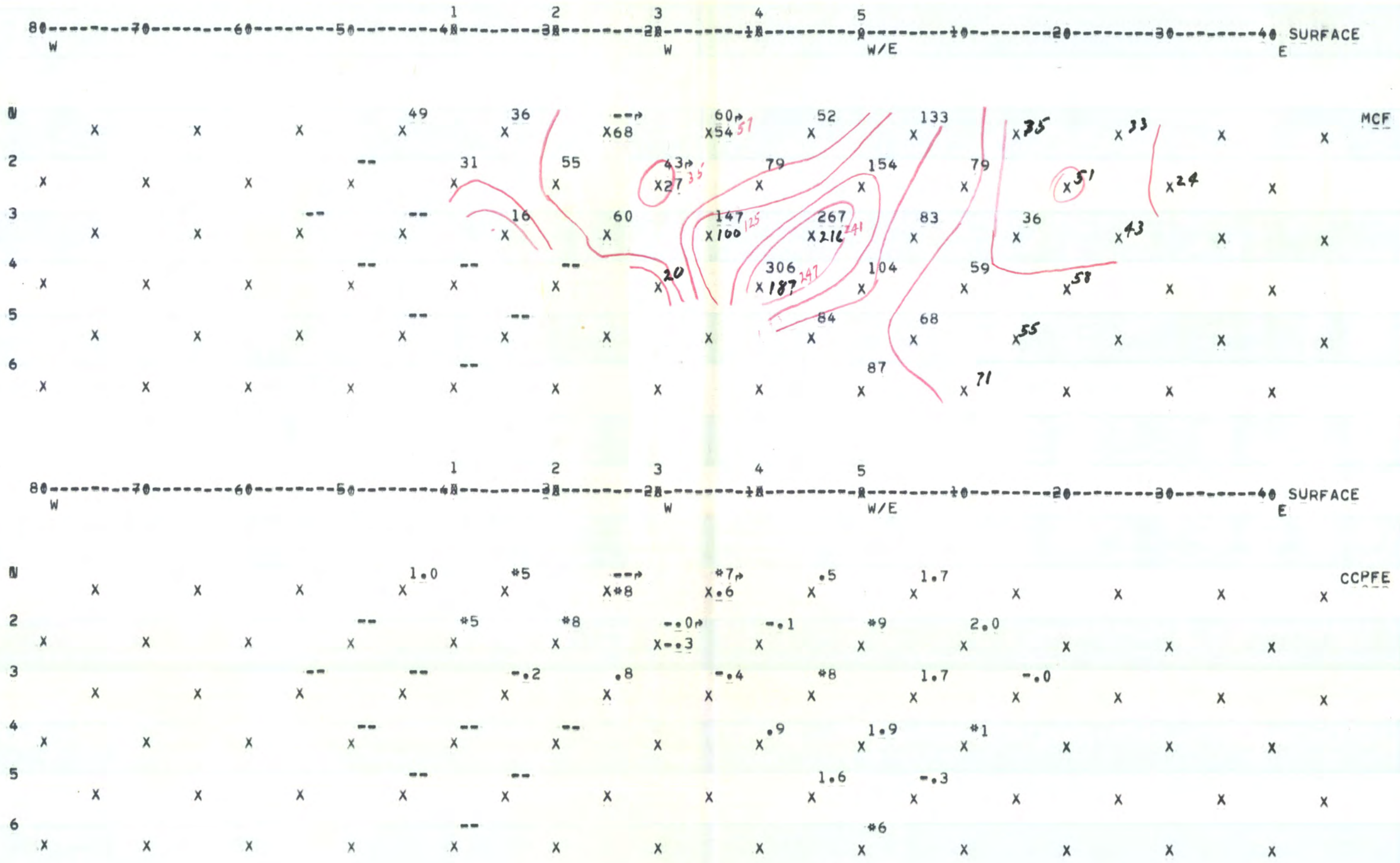
1 – 2nd week of next month

I.P. near Safford

Geol. ~~Geol~~ porphyry Copper

$250/day.

$150/day Geologist



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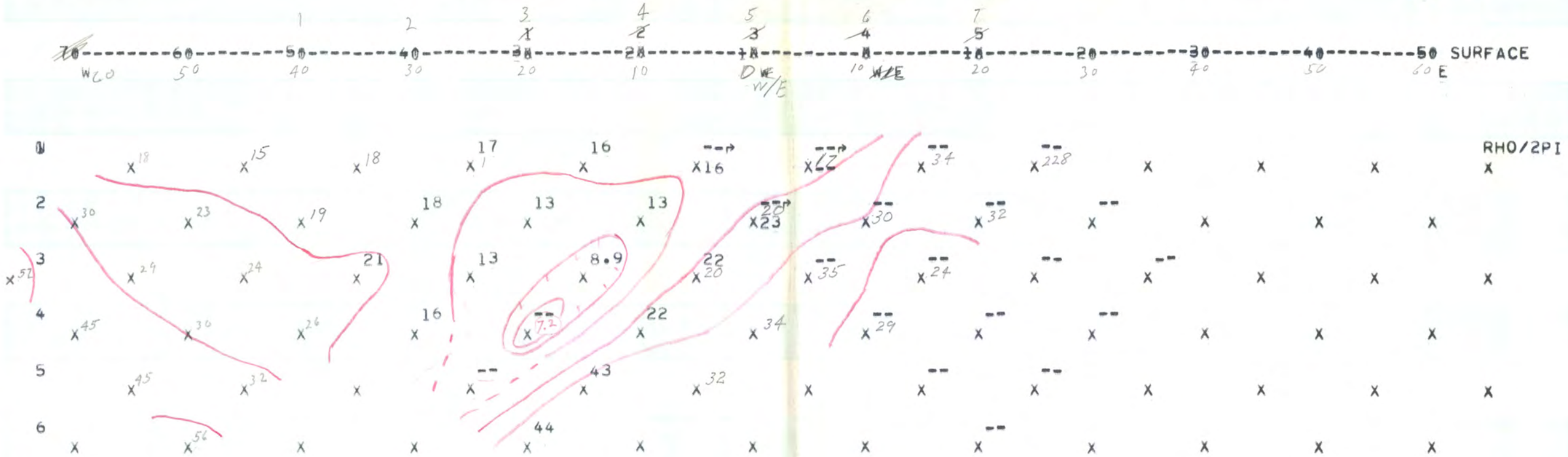
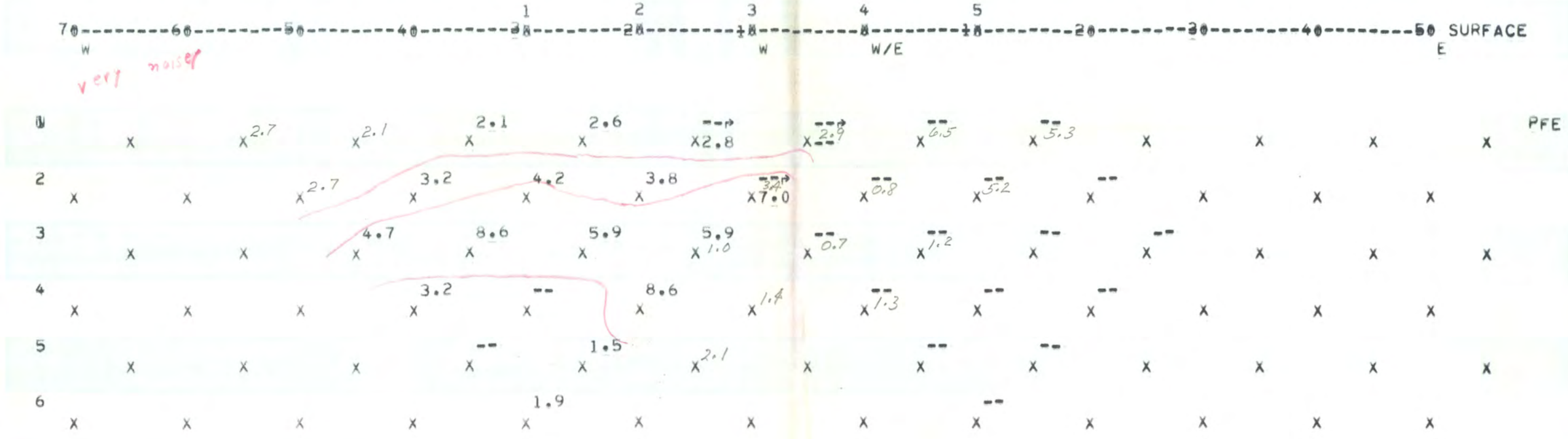
BUSINESS FORMS PRINTING COMPANY

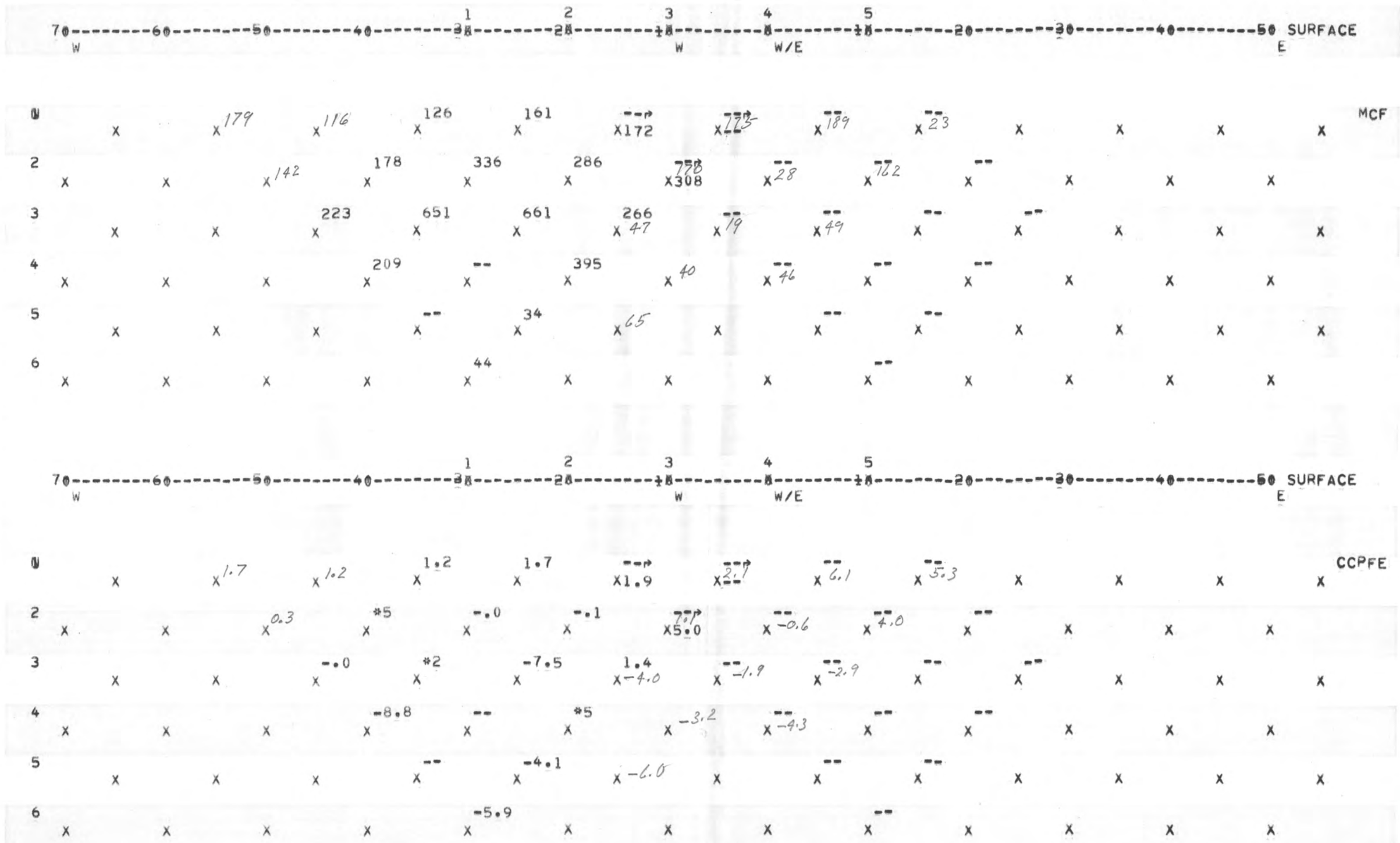
```
                                                  1         2         3         4         5
80--------70--------60--------50--------40--------30--------20--------10--------0--------10--------20--------30--------40 SURFACE
  W                                                                W                W/E                                  E

N                                          44        26        -->       45->       35        116                                  CCMCF
      X         X         X         X         X         X52       X40       X         X         X         X         X         X
2                                   --        18        35        -1->      -11       69        68
  X         X         X         X         X         X         X-16      X         X         X         X         X         X
3                                --        --        -5        30        -34       65        58        -1
      X         X         X         X         X         X         X         X         X         X         X         X         X
4                                   --        --        --                  65        62        3
  X         X         X         X         X         X         X         X         X         X         X         X         X
5                                   --        --                                  42        -9
      X         X         X         X         X         X         X         X         X         X         X         X         X
6                                         --                                                  16
  X         X         X         X         X         X         X         X         X         X         X         X         X

AC READING MISSING CARD   5
AC READING MISSING CARD   5
```

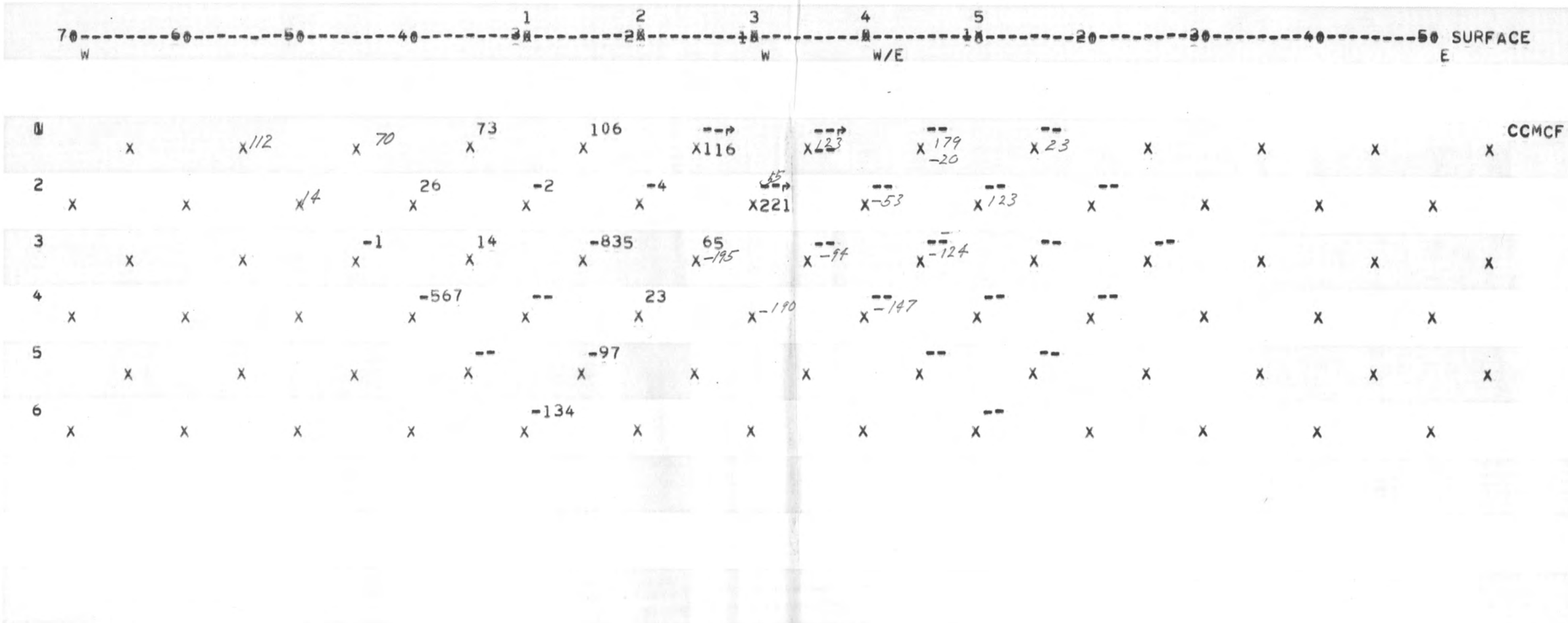
HEINRICHS GEOEX JOB LAKESHORE MK 4C TEST LINE 10N SPREAD 1 LOOKING N 6/69 A= 1000 FEET

3.0 - 0.1





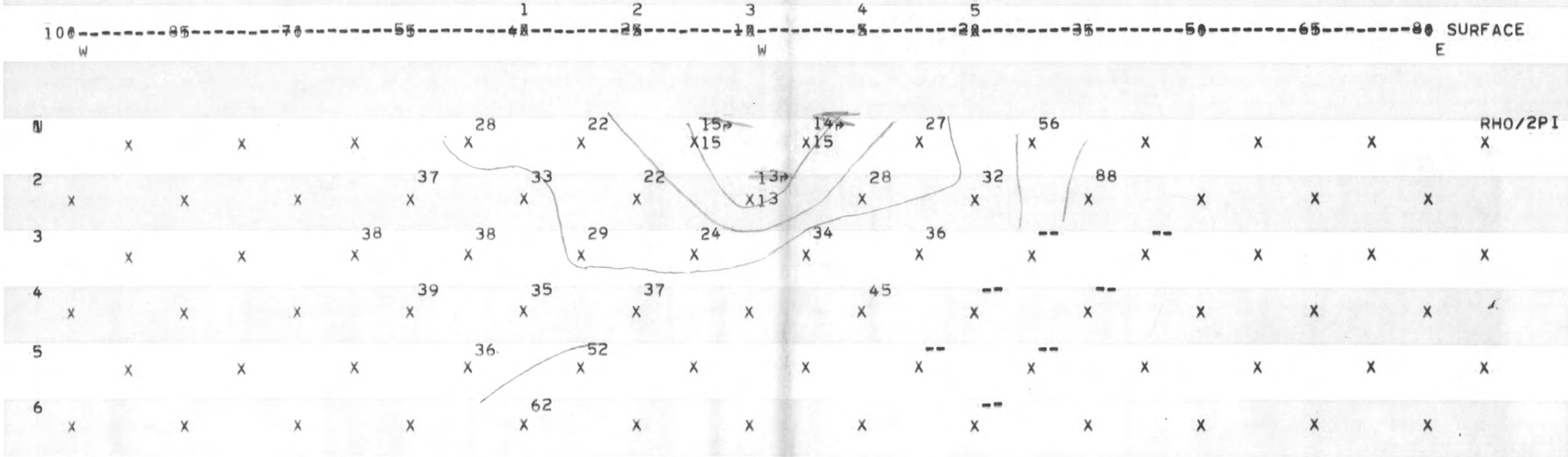

70 60 50 40 30 20 10 0 10 20 30 40 50 SURFACE
W W W/E E
MCF
0 179 116 126 161 172 189 23
2 142 178 336 286 308 28 182
3 223 651 661 266 47 19 49
4 209 395 40 46
5 34 65
6 44
70 60 50 40 30 20 10 0 10 20 30 40 50 SURFACE
W W W/E E
CCPFE
0 1.7 1.2 1.2 1.7 1.9 6.1 5.3
2 0.3 5 -.0 -.1 5.0 -0.6 4.0
3 -.0 2 -7.5 1.4 -4.0 -1.9 -2.9
4 -8.8 5 -3.2 -4.3
5 -4.1 -6.0
6 -5.9

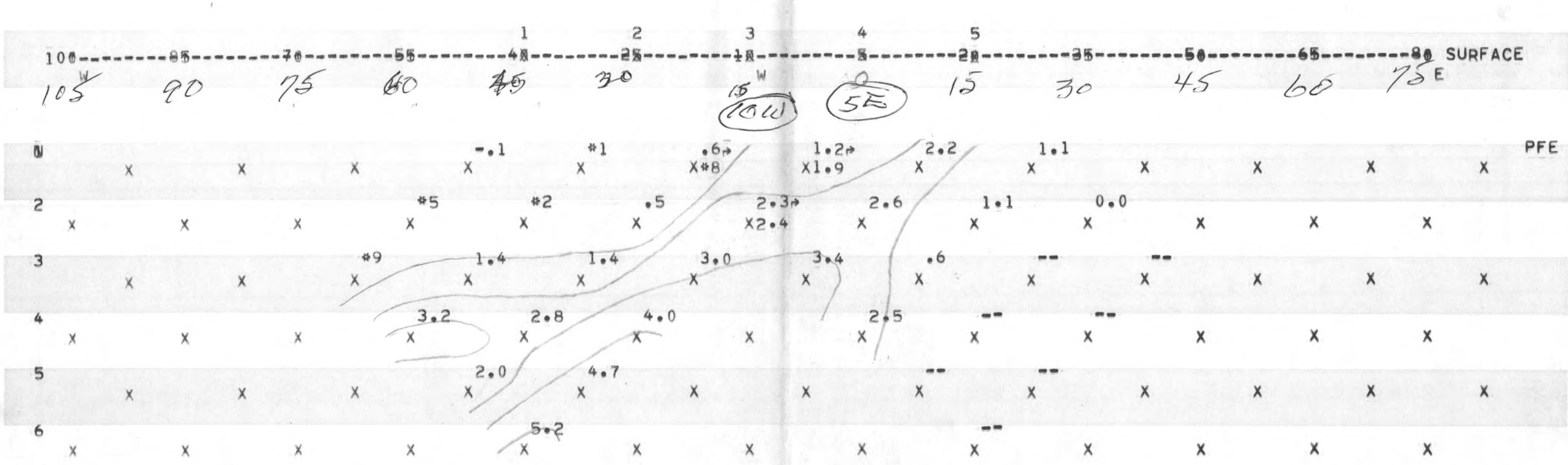


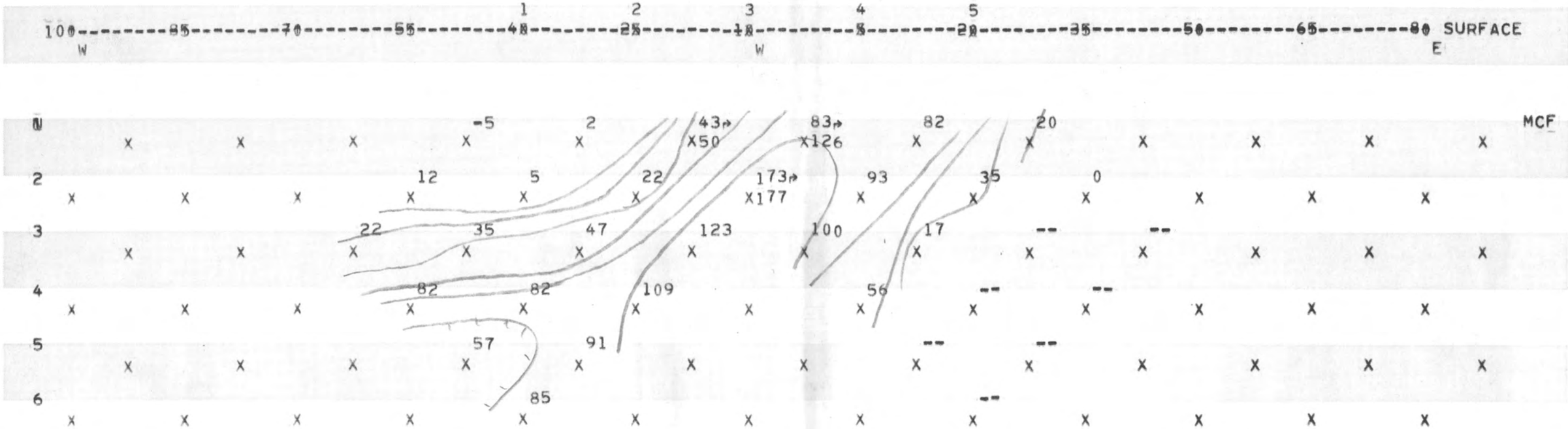
70 60 50 40 30 20 10 0 10 20 30 40 50 SURFACE
W W W/E E
1 2 3 4 5
1 112 70 73 106 116 123 179 -20 23
2 14 26 -2 -4 55 221 -53 123
3 -1 14 -835 65 -195 -94 -124
4 -567 -- 23 -190 -147
5 -- -97
6 -134
CCMCF

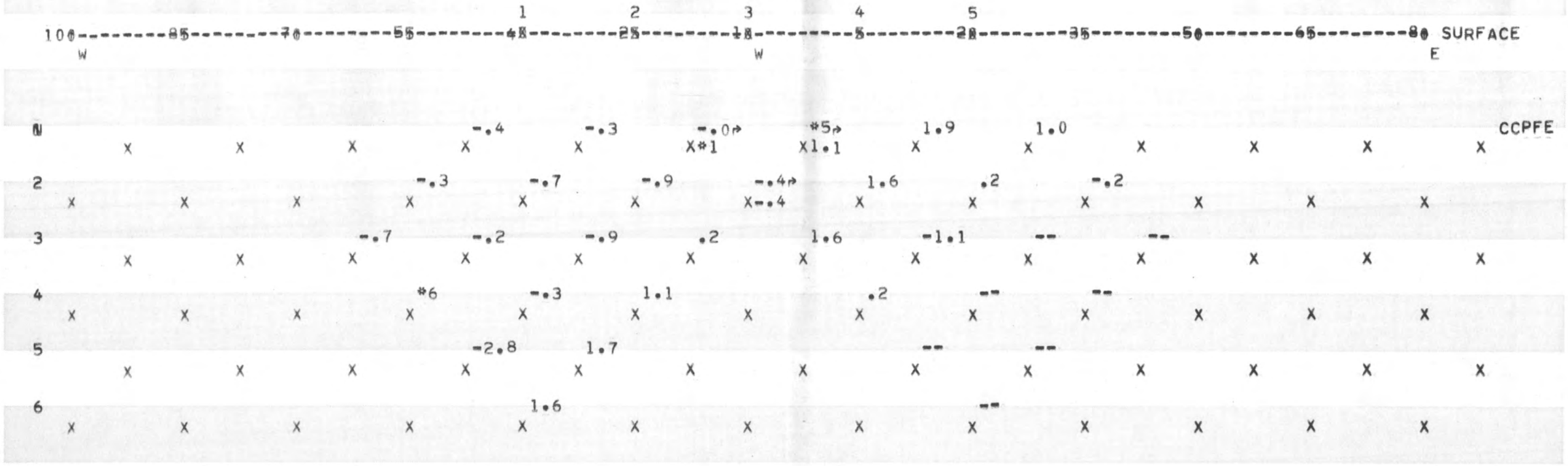
HEINRICHS GEOEX JOB LAKESHORE MK4C LINE 10S SPREAD 1 LOOKING N 11/26/69 A= 1500 FEET

1.0 - 0.1 ac

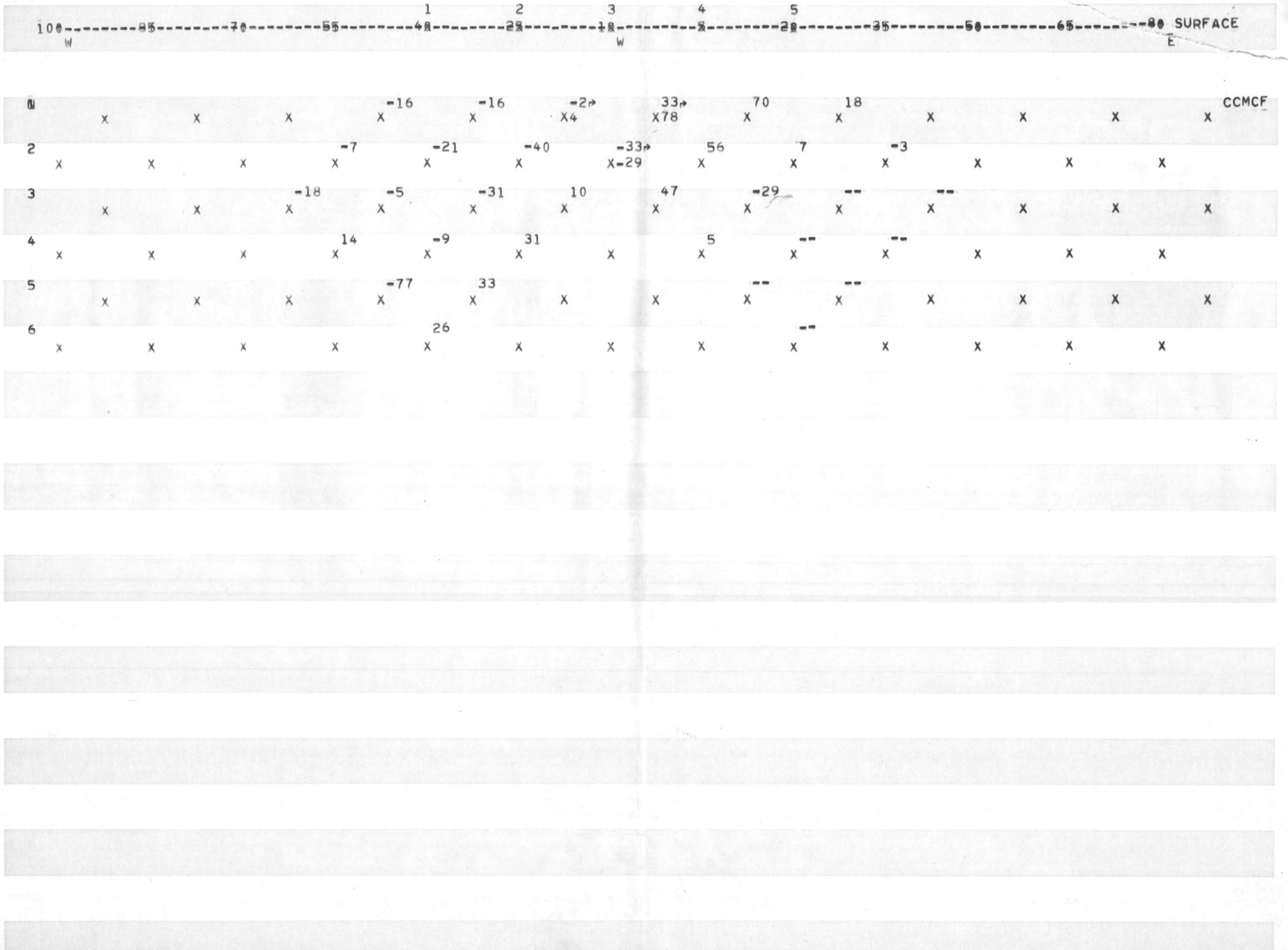








ENGINEERED FOR HIGH SPEED PRINTERS
BUSINESS FORMS PRINTING COMPANY

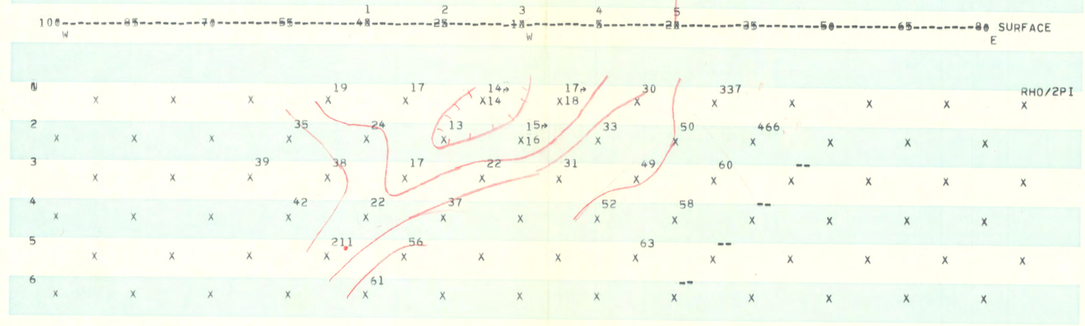


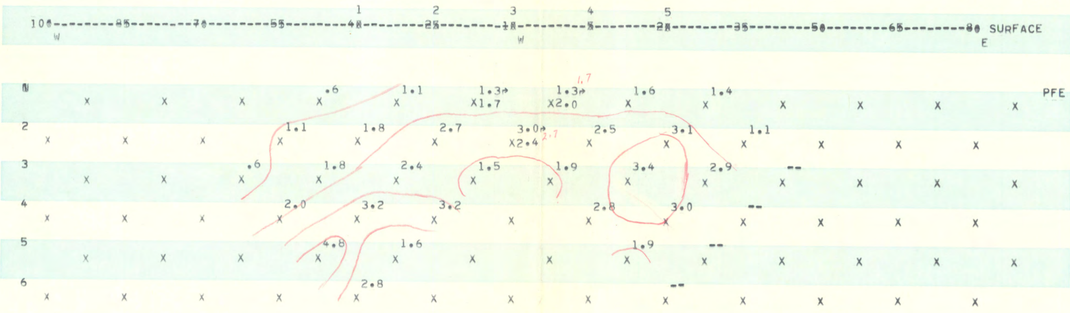
BUSINESS FORMS PRINTING COMPANY BLUE RIBBON ENGINEERED FOR HIGH SPEED PRINTERS

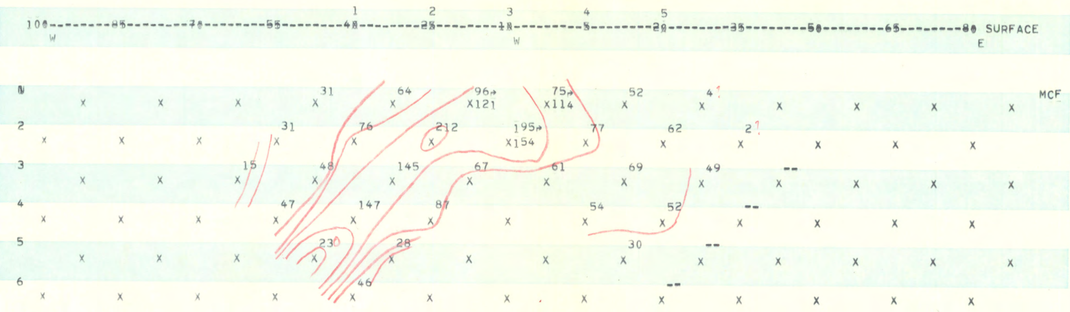
HEINRICHS GEOEX JOB LAKESHORE MK4C TEST LINE 10N SPREAD 1 LOOKING N 11/18/69 A= 1500 FEET

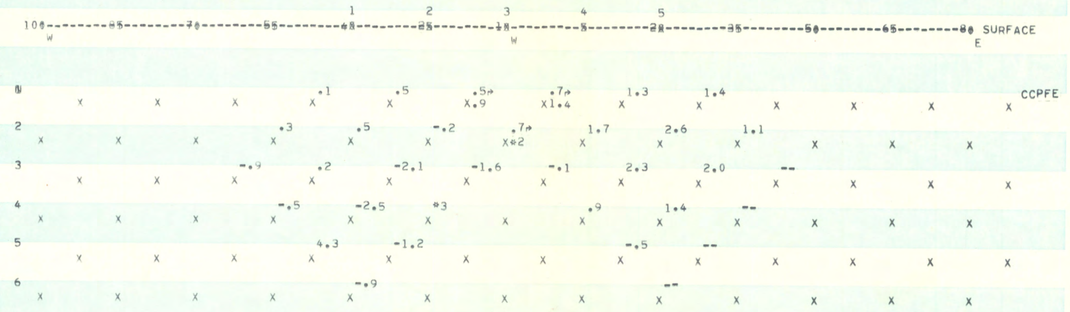
E-W | N 72°E

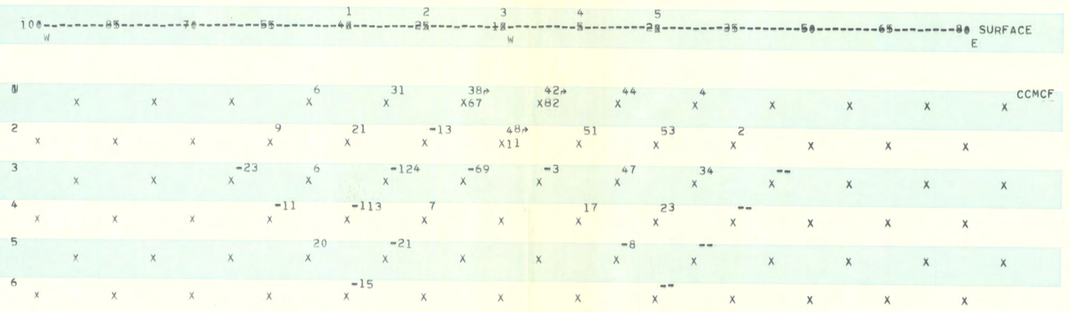
1.0 - 0.1ac











MK 4C

HEINRICHS GEOEX JOB LAKESHORE 69 LINE 10N SPREAD 1 LOOKING N 8/23-26/69 A= 1000 FEET 1.0 0.1

USE 10N 3.0-0.1 plot for ρ

1 2 3 4 5

90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

RHO/2PI

1	X	X	X18	X15	X18↗ 15	X17↗ 17	X15	X16	X	X	X	X	X
2	X	X	X30	X23	X18	X17↗ 18	X12	X14	X21	X	X	X	X
3	X	X	X52	X29	X24	X17	X14	X8.9	X19	X--	X	X	X
4	X	X	X	X45	X30	X26	X--	X7.2	X20	X--	X	X	X
5	X	X	X	X45	X32	X--	X	X27	X--	X	X	X	X
6	X	X	X	X	X56	X	X	X	X--	X	X	X	X

1 2 3 4 5

90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

PFE

1	X	X	X	X.3	X.9	X2.3↗ .9	X1.9↗ 1.1	X1.0	X1.0	X	X	X	X
2	X	X	X	X.7	X.4	X.2	X1.6↗ .8	X.7	X1.0	X1.6	X	X	X
3	X	X	X	X.5	X.1	X.9	X.9	X1.5	X.8	X1.2	X--	X	X	X
4	X	X	X	X-.0	X.4	X1.0	X	X1.3	X1.0	X--	X	X	X
5	X	X	X	X-.0	X.1	X	X	X.8	X--	X	X	X	X
6	X	X	X	X	X.6	X	X	X	X--	X	X	X	X

add 0.8?

1 2 3 4 5

90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

MCF

1	X	X	X	X19	X65	X131↗ 62	X114↗ 67	X68	X67	X	X	X	X
2	X	X	X	X23	X17	X14	X96↗ 48	X60	X73	X78	X	X	X
3	X	X	X10	X3	X38	X57	X107	X95	X62	X--	X	X	X
4	X	X	X	X-0	X15	X40	X	X187	X52	X--	X	X	X
5	X	X	X	X-0	X3	X	X	X31	X--	X	X	X	X
6	X	X	X	X	X11	X	X	X	X--	X	X	X	X

1 2 3 4 5

90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

CCPFE

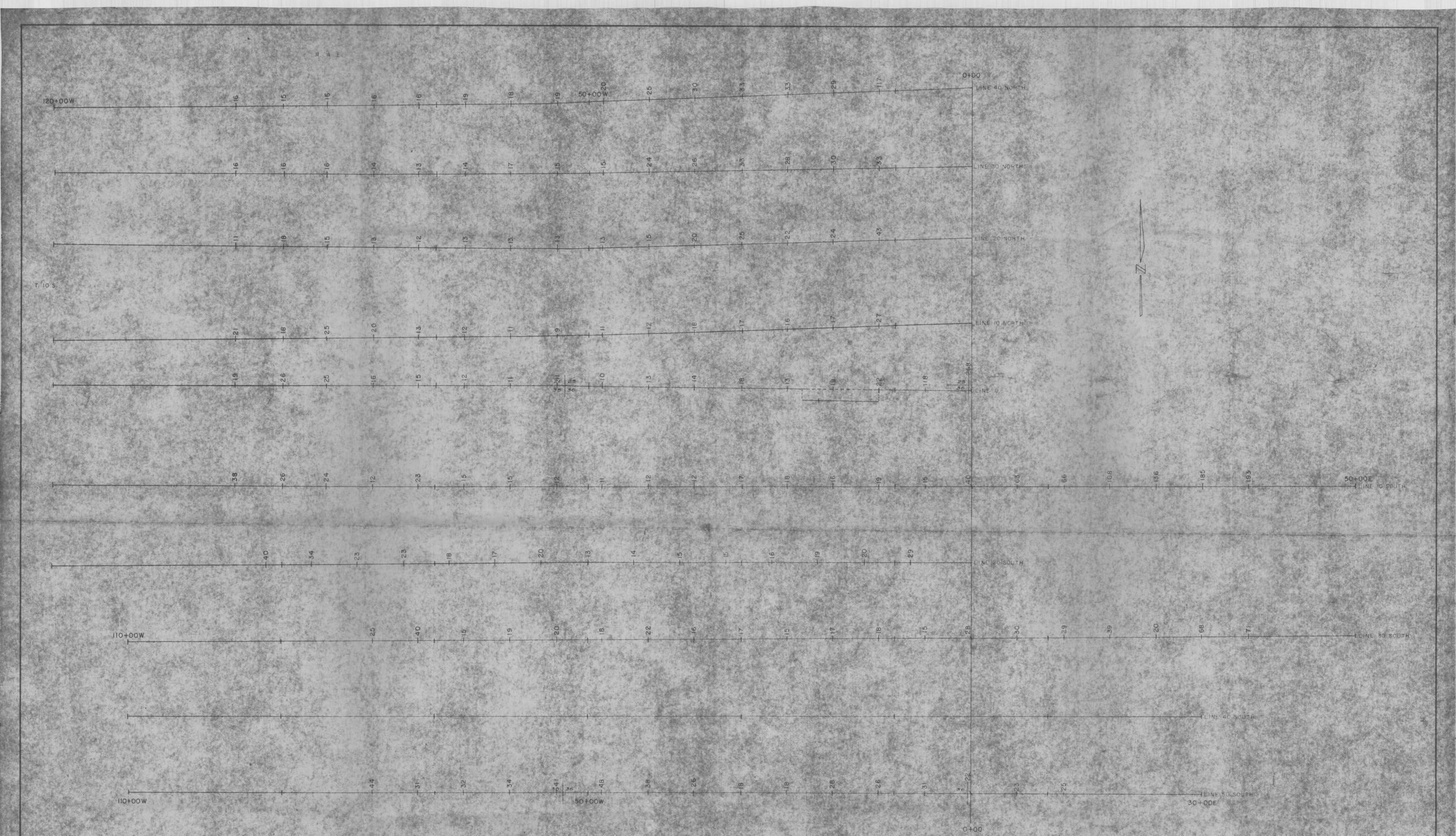
1	X	X	X	X.2	X.7	X2.1↗ .7	X1.8↗ .9	X.8	X.8	X	X	X	X
2	X	X	X	X.4	X-.0	X-.4	X1.0↗ .2	X-.3	X.1	X1.1	X	X	X
3	X	X	X.2	X-.7	X-.1	X-.6	X-.3	X-2.7	X-.1	X--	X	X	X
4	X	X	X	X-.8	X-.9	X-.5	X	X-6.7	X-1.2	X--	X	X	X
5	X	X	X	X-1.3	X-1.9	X	X	X-1.6	X--	X	X	X	X
6	X	X	X	X	X-.9	X	X	X	X--	X	X	X	X

1 2 3 4 5

90W 80 70 60 50 40 30W 20 10 0W/E 10 20 30E SURFACE

CCMCF

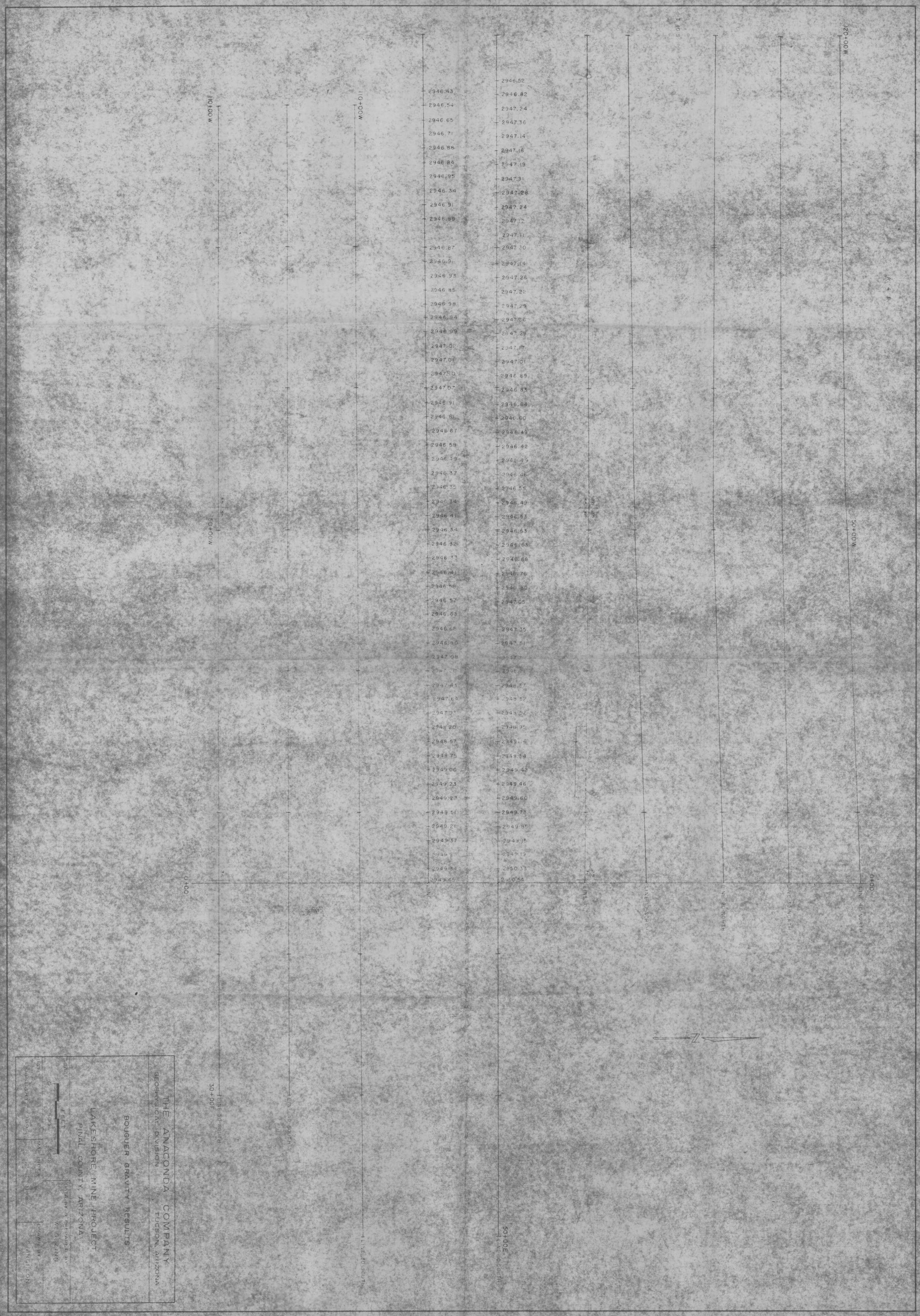
1	X	X	X	X10	X49	X120↗ 48	X103↗ 54	X54	X53	X	X	X	X
2	X	X	X	X13	X-2	X-23	X57↗ 11	X-23	X6	X54	X	X	X
3	X	X	X4	X-23	X-4	X-39	X-24	X-298	X-5	X--	X	X	X
4	X	X	X	X-17	X-29	X-21	X	X-929	X-59	X--	X	X	X
5	X	X	X	X-28	X-58	X	X	X-58	X--	X	X	X	X
6	X	X	X	X	X-16	X	X	X	X--	X	X	X	X



THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION RESULTS
RESISTIVITY DATA
SEARCH DEPTH 2400 FEET
PLOTTED AT MIDPOINT
LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA

SCALE	DATA BY & PREPARED BY
FEET 0 500 1000	W. G. ZINN
DATE	MAP INDEX
JANUARY, 1963	2-1-11-a
DRAWN BY: S. ANGELON	


THE ANACONDA COMPANY
GEOPHYSICAL DIVISION
TUCSON, ARIZONA
BOUGUER GRAVITY RESULTS
LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA
SCALE
FEET
0
500
1000
DATE
MAP INDEX
DRAWN BY
C. ANGELON
LINE 50 SOUTH
LINE 40 SOUTH
LINE 30 SOUTH
LINE 20 SOUTH
LINE 10 SOUTH
LINE 0
LINE 10 NORTH
LINE 20 NORTH
LINE 30 NORTH
LINE 40 NORTH
30+00E
50+00E
0+00
50+00W
110+00W
120+00W
2946.43
2946.54
2946.65
2946.71
2946.88
2946.84
2946.95
2946.34
2946.91
2946.89
2946.87
2946.91
2946.93
2946.85
2946.98
2946.94
2946.99
2947.02
2947.01
2947.10
2947.07
2946.91
2946.81
2946.67
2946.58
2946.49
2946.37
2946.35
2946.34
2946.41
2946.34
2946.32
2946.33
2946.41
2946.58
2946.57
2946.63
2946.68
2946.80
2947.08
2947.20
2947.43
2947.64
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2948.75
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2949.23
2949.23
2949.51
2949.21
2949.37
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2947.14
2947.26
2947.22
2947.29
2947.36
2947.29
2947.17
2947.01
2946.89
2946.83
2946.64
2946.60
2946.49
2946.42
2946.49
2946.46
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2946.49
2946.53
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2948.21
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2948.52
2948.52
2948.95
2949.16
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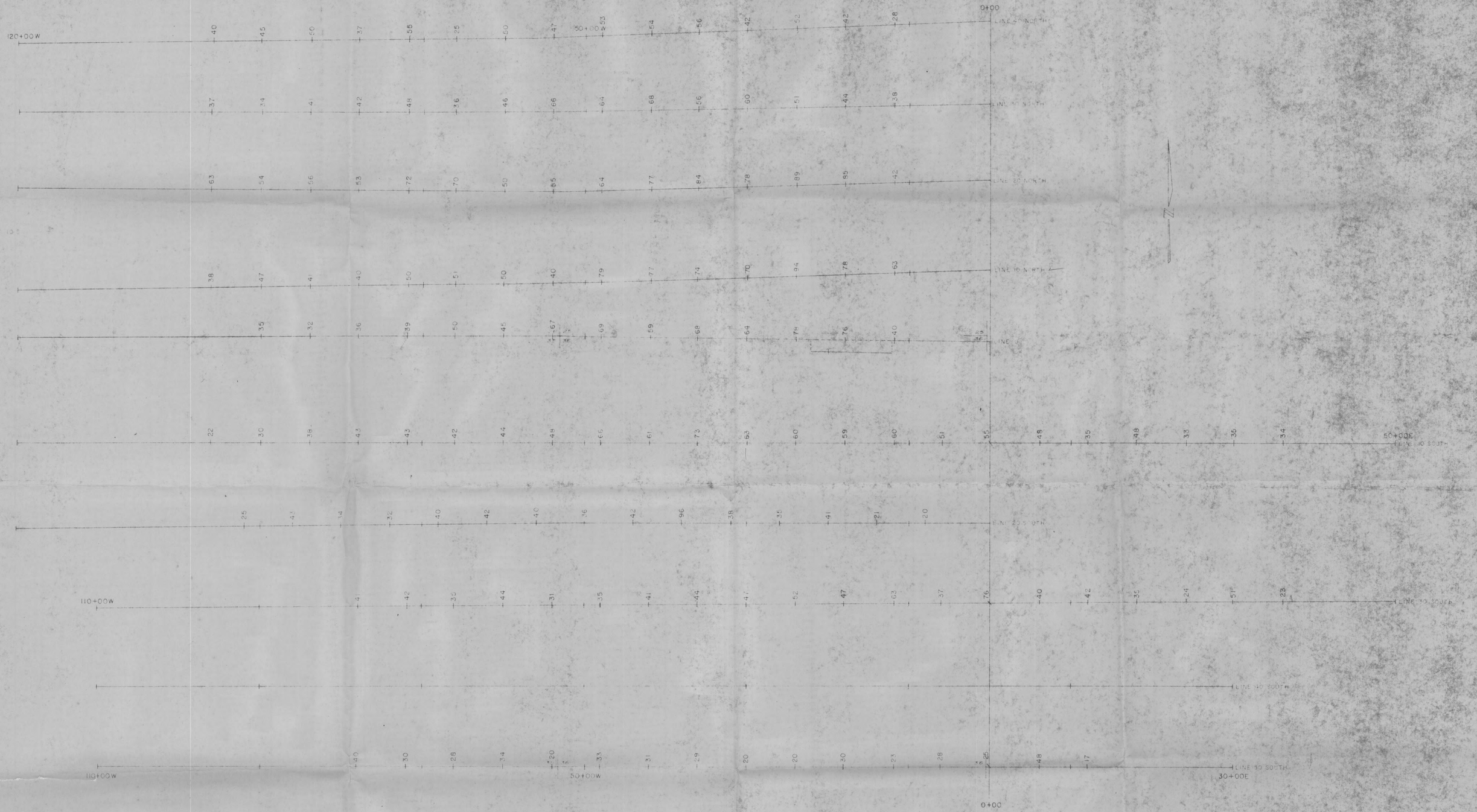
N

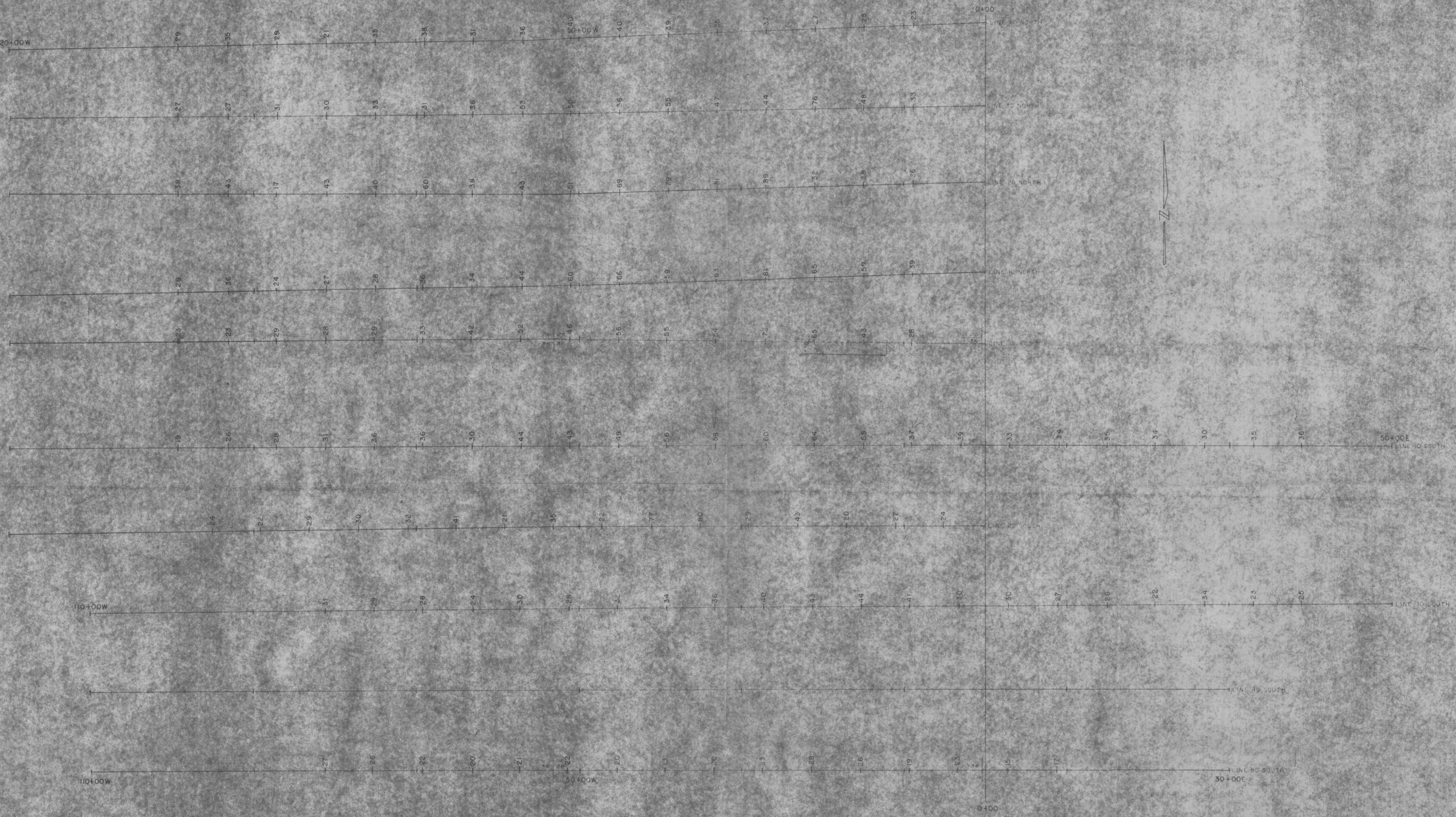


THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION RESULTS
PHASE ANGLE DATA
SEARCH DEPTH 2400 FEET
PLOTTED AT MIDPOINT

LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA

SCALE FEET 0 500 1000		DATA BY & PREPARED BY W. G. ZINN
DATE JANUARY, 1969	MAP INDEX 12-I-U-8	DRAWN BY S. ANGELON



THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION RESULTS
PHASE ANGLE DATA
SEARCH DEPTH 1800 FEET
PLOTTED AT MIDPOINT
LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA

SCALE	DATA BY & PREPARED BY
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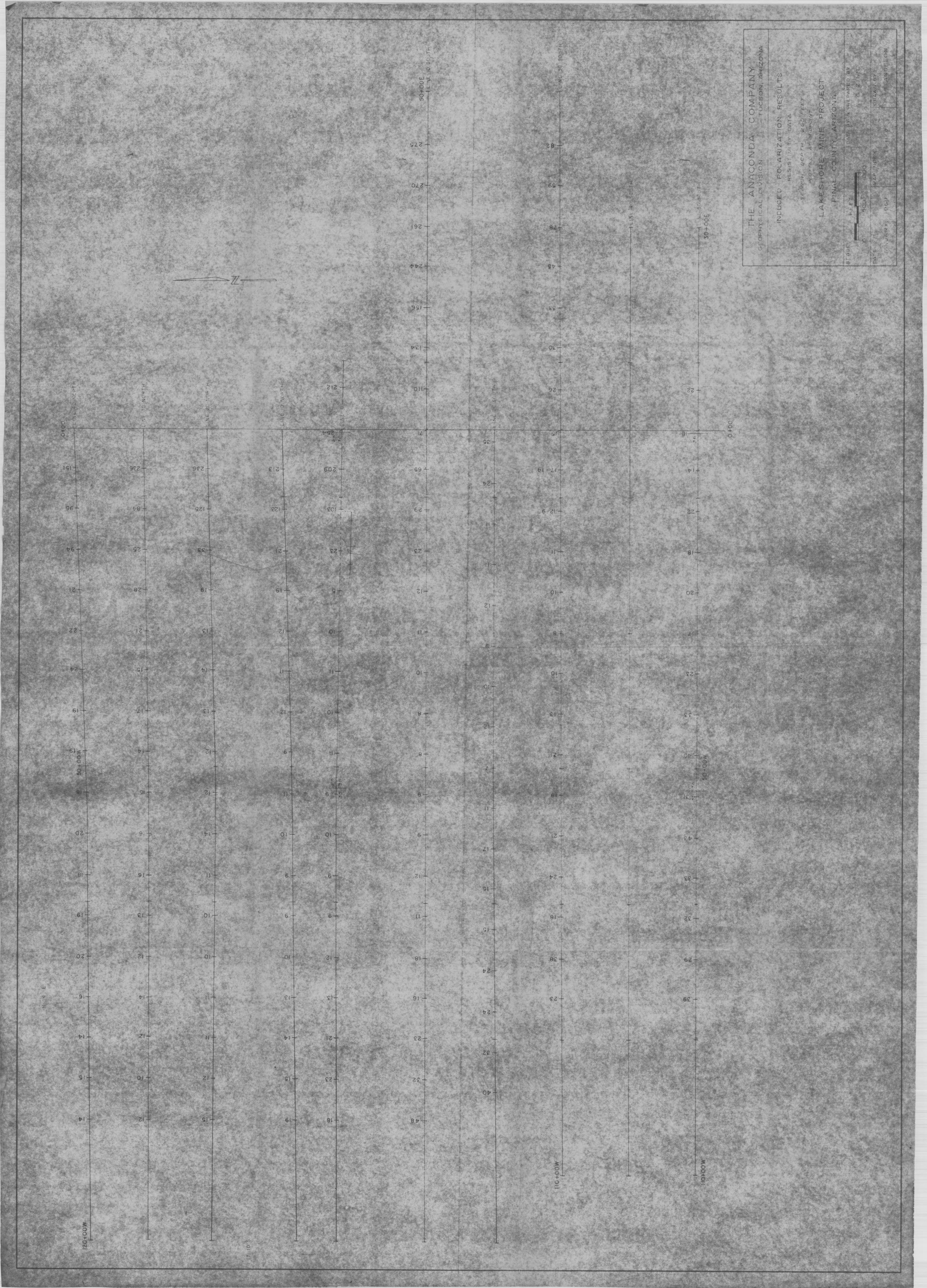
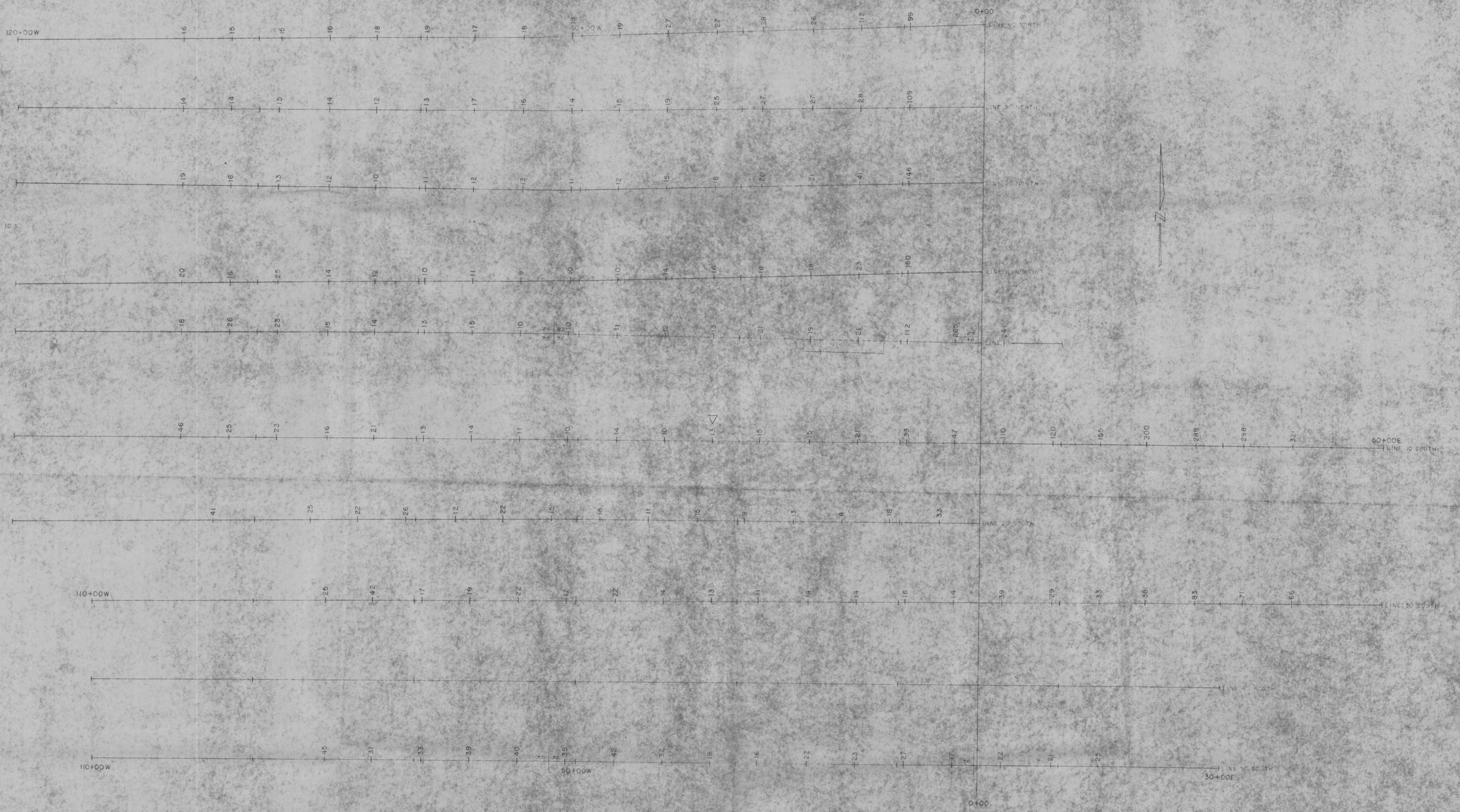
DATE: JANUARY, 1969	MAP INDEX: 12-I-11-a
	DRAWN BY: S. ANGELON


THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA
INDUCED POLARIZATION RESULTS
RESISTIVITY DATA
SEARCH DEPTH 200 FEET
PLOTTED AT MIDPOINT
LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA
SCALE FEET
0 500 1000
DATE JANUARY 1969
MAP INDEX
DATA BY & PREPARED BY
DRAWN BY
LINE 10 SOUTH
LINE 30 SOUTH
LINE 40 SOUTH
LINE 50 SOUTH
LINE 40 NORTH
LINE 30 NORTH
LINE 20 NORTH
LINE 10 NORTH
LINE 0
0+00
30+00E
50+00W
110+00W
120+00W
N

R. 4 E.

T. 10 S.

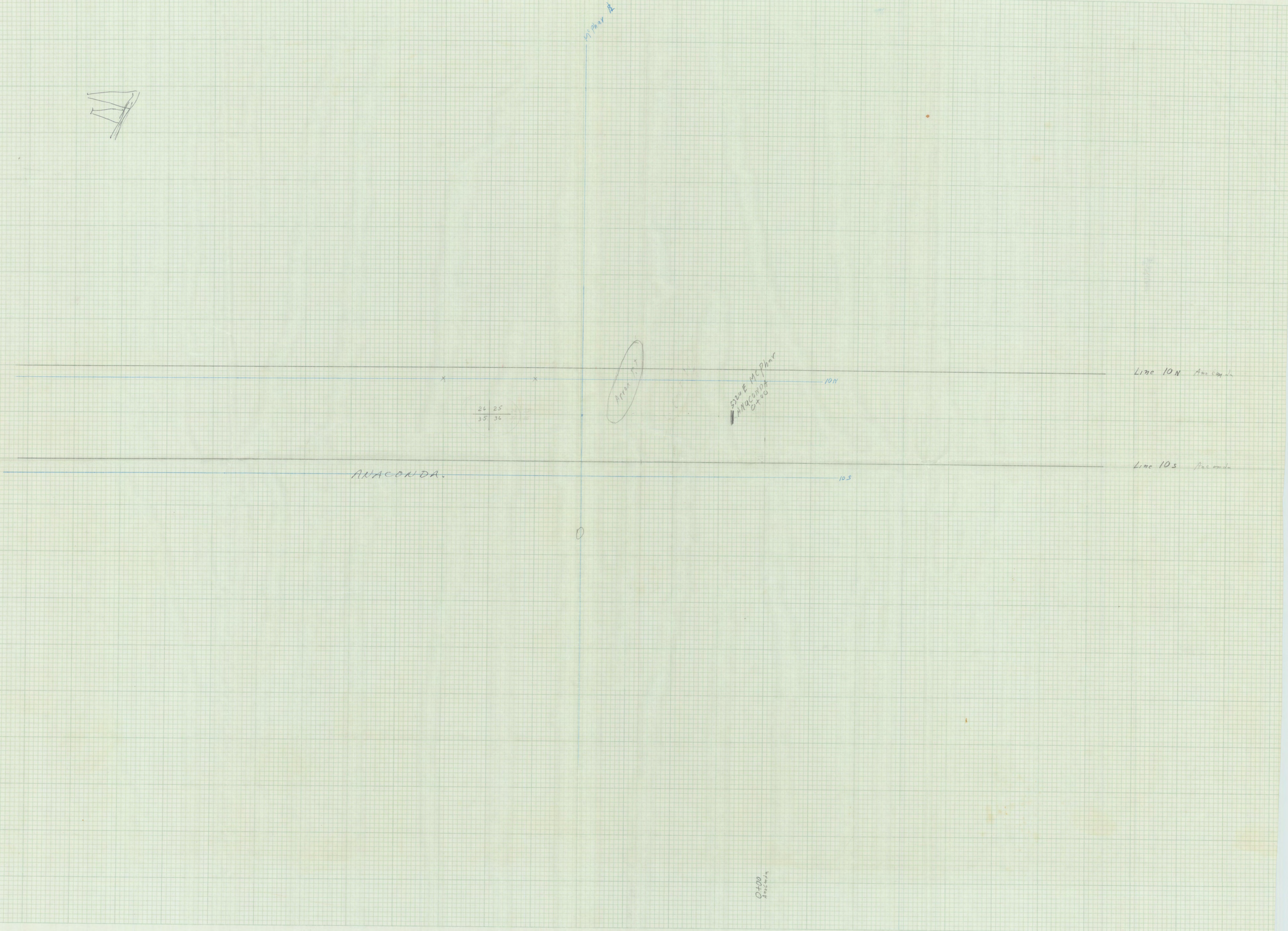


THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION RESULTS
RESISTIVITY DATA
SEARCH DEPTH 1800 FEET
PLOTTED AT MIDPOINT

LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA

SCALE: FEET 0 500 1000	DATA BY & PREPARED BY: R. G. ZINN
DATE: JANUARY, 1969	MAP INDEX: 12 - T - 11 - a
	DRAWN BY: S. ANGELON


McPhar
Line 10N
10N
Line 10S
10S
ANACONDA.
26 25
35 36
0+00

THE ANACONDA COMPANY
GEOPHYSICAL DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION RESULTS
PHASE ANGLE DATA
SEARCH DEPTH 1200 FEET
PLOTTED AT MIDPOINT

LAKESHORE MINE PROJECT
PINAL COUNTY, ARIZONA

SCALE: FEET 0 500 1000

DATA BY & PREPARED BY: W. G. ZINN

DATE: JANUARY, 1959

MAP INDEX: 12-T-11-B

DRAWN BY: S. ANGELON

American Mining Congress
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DISCOVERY AND INITIAL DEVELOPMENT OF THE LAKESHORE DEPOSIT IN ARIZONA*

by

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Vice President - Exploration
Hecla Mining Co., Wallace, Idaho

and

John R. Reynolds
Superintendent of Exploration - Mining Division
El Paso Natural Gas Co., El Paso, Texas

* Presented at the 1969 Mining Convention, American Mining Congress, San Francisco California, October 19-22.

Introduction

The Lakeshore property south of Casa Grande, Arizona received considerable attention by the industry following the announcement in early 1968 of the discovery of a major porphyry-type copper deposit by El Paso Natural Gas Company. In late 1968 several major mining companies examined the property with a view toward participation, and in early 1969 agreements were reached by El Paso and Hecla Mining Company under which Hecla would obtain a one-half interest in the property and become the operator.

The general geologic setting of the deposit is similar in many respects to that of other porphyry-type copper deposits in the southwest. In the present early stage of development, however, knowledge of the deposit and geology of the area is limited almost entirely to drill hole observations and correlation with meager outcrop information. Many geologic details require clarification which will be obtained as greater exposure is gained and further studies of the deposit are made.

This paper sketches the history of the property leading up to the discovery of the new deposit by El Paso in 1967, and describes the deposit and the geology as presently known.

The authors are indebted to members of El Paso and Hecla staffs for assistance in the preparation of the material and illustrations, and to the management of both companies for permission to present the paper.

Location and Property

The Lakeshore property is within the Papago Indian Reservation and lies principally in Sections 25, 26, 35, and 36, T. 10 S., R. 4 E., in the south part of Pinal County, Arizona. The deposit lies about two miles east of the paved highway connecting Casa Grande, 28 miles to the north, with Sells, The Papago Council headquarters, some 55 miles to the south

(Figure 1). The terrain is typical southwestern desert, and is formed upon a flatly sloping pediment surface which extends from the southwesterly flank of the Slate Mountains to north-trending Santa Rosa Wash, about three miles to the west.

The property consists of: (1) three patented lode mining claims covering 62 acres, known as the Treasure State Claims, (2) three patented and 19 unpatented lode mining claims covering 400 acres, known as the Drake Claims, (3) 3,717 acres held under mining leases, and (4) 6,325 acres held under a business lease from the Papago tribe.

History

Mining claims were first located on both the Treasure State and Drake Groups in the early 1880's and a modest amount of exploration and development was done on several outcrops of low grade oxidized copper mineralization. No commercial grade ore was found and the Treasure State Group was abandoned in 1884. It was relocated in 1905 and a few tons of ore were shipped. Several of the claims on both the Treasure State and Drake Groups were surveyed for patent, two in 1900, one in 1904, and three in 1913. During the period from 1914 to 1929 the Treasure State property was actively explored and developed. The reported production to 1929 was 280,000 pounds of copper.

In 1949 the U. S. Bureau of Mines drilled one diamond drill hole from underground and 5 surface churn drill holes to further explore the oxidized copper ore body. A description of the early development work and the results of sampling and drilling by the U. S. Bureau of Mines are described in U. S. Bureau of Mines RI-4706.

The various properties, now collectively known as the Lakeshore Mine, were then acquired by Transarizona Resources, Inc. which was incorporated on May 23, 1956 under the laws of the State of Arizona.

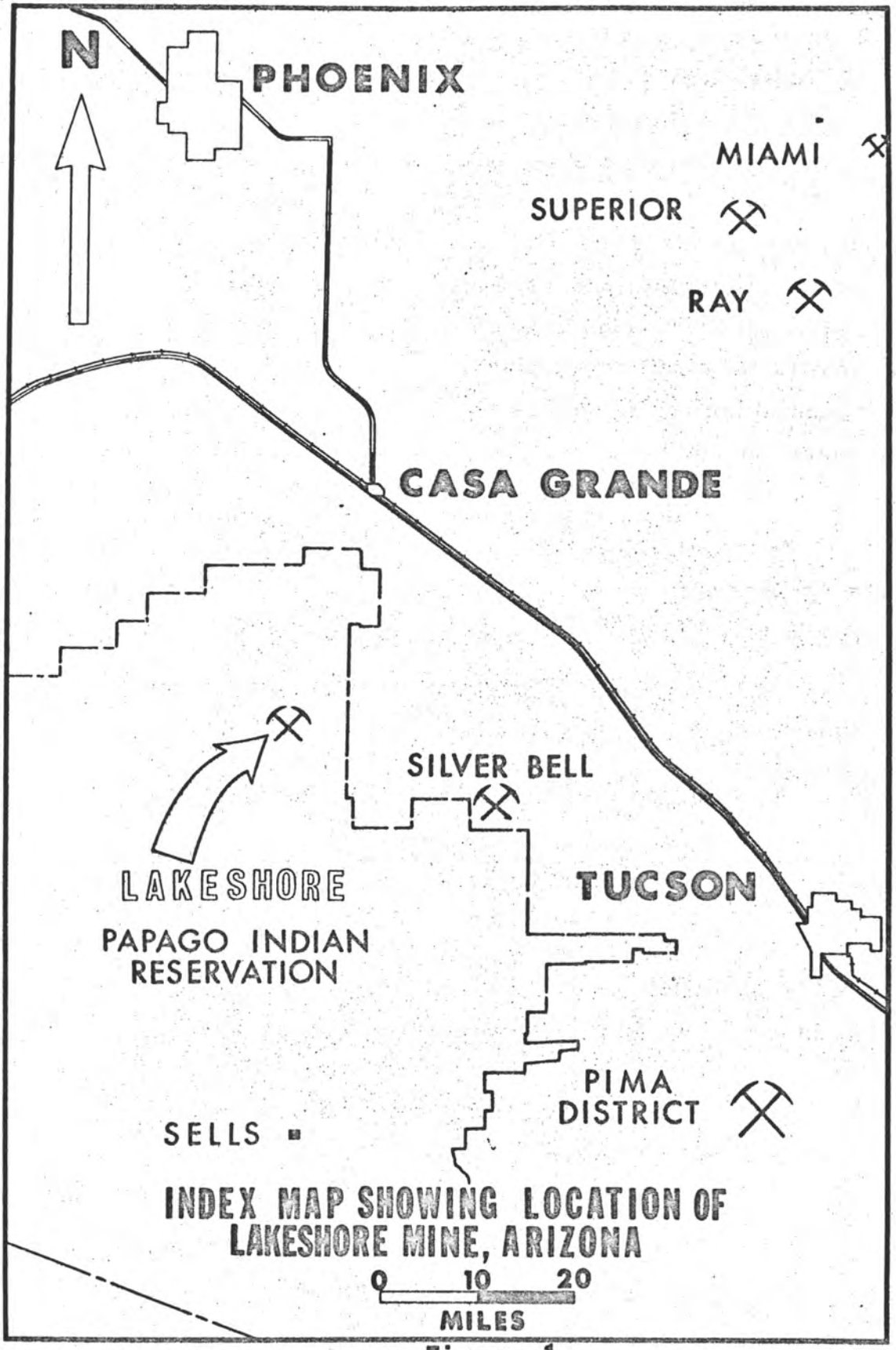

N
PHOENIX
MIAMI
SUPERIOR
RAY
CASA GRANDE
SILVER BELL
LAKESHORE
PAPAGO INDIAN RESERVATION
TUCSON
PIMA DISTRICT
SELLS
INDEX MAP SHOWING LOCATION OF LAKESHORE MINE, ARIZONA
0 10 20
MILES

Figure 1

From the date of its incorporation to October 1962, the principal efforts of Transarizona were directed to the exploration and development of a relatively small open-pit oxide copper ore body located on the Arizona claim of the Treasure State Group. In cooperation with the U. S. Bureau of Mines, Transarizona developed a copper segregation process for the beneficiation of oxide copper ores produced from the open pit, as these ores were in limy metasediments and hence not economically amenable to the customary acid leaching processes. The Lakeshore Plant was constructed to utilize the jointly developed process. Because of various technical difficulties, maximum capacity and efficiency have never been attained in the Lakeshore Plant. The segregation process is described in U. S. Bureau of Mines RI-5501.

In October 1962, Transarizona was forced into receivership and due to lack of financial resources was unable to make certain plant modifications which were required to correct some of the technical difficulties.

The company remained in receivership until 1966, during which time all operations were suspended. Funds necessary to meet the lease obligations of the various properties held by Transarizona were advanced by the court-appointed receiver during the receivership period.

During the period 1962 to 1966, Transarizona contacted many of the major mining companies and tried to interest them in the properties. Several companies scheduled examinations and some investigations were carried through the geophysical and reconnaissance drilling stages. El Paso Natural Gas Company first examined the property in September 1962, and in June 1963 secured permission to conduct a modest drilling program to verify the results of previous drilling. During this time El Paso also made certain modifications to the segregation plant and operated it for a short period on an experimental basis.

In October 1966, Narragansett Wire Co., Pawtucket, Rhode Island (a wholly-owned subsidiary of El Paso Natural Gas Company since October

1967), acquired the outstanding common stock of Transarizona, settled the creditors' claims, and cured the receivership status of Transarizona.

In November 1966, El Paso Natural Gas Company acquired a 50 percent interest in all the properties of Transarizona Resources, Inc. and entered into an operating agreement naming El Paso as operator. Under this arrangement El Paso undertook modification and expansion of the segregation plant and commenced open-pit production from the small oxide ore body. Along with this operation El Paso undertook a program of geological and geophysical investigations followed by extensive exploratory drilling of the adjacent lands held under Indian leases. This program resulted in the discovery of the major copper deposit which lies at greater depth and to the west of the original near-surface ore body.

Geology

The Lakeshore property lies within the boundaries of the Papago Indian Reservation, a tract encompassing 4300 square miles in southern Arizona. McClymonds (1959) and Heindl (1960) of the U. S. Geological Survey, have described the geology of the Reservation in three short papers, with emphasis on the Vekol area, which lies ten to fifteen miles northwest of Lakeshore, and on the Slate Mountains, in the vicinity of Lakeshore.

Precambrian Pinal schist is the oldest exposed formation in the area of the Lakeshore property and it forms the north-trending central mass of the Slate Mountains. Unconformably overlying the Pinal schist, the Late Precambrian Apache Series of Pioneer Shale, Dripping Spring quartzite, and Mescal limestone are found at the northern end of the Slates, about 5 miles north of Lakeshore. Here the Pioneer Shale (lowermost of the Apache Series) is 425 feet thick, the Dripping Spring quartzite is 1085 feet thick, and the Mescal limestone is 200 feet thick. Diabase sills split the units at many places.

Paleozoic formations described by McClymonds as present in the Vekol and Slate Mountains include the Troy quartzite, the Cambrian Abrigo, Devonian Martin, Mississippian Escabrosa, and Pennsylvanian Horquilla formations. In view of more recent studies, what has been called the Troy quartzite in this area is more likely the Bolsa quartzite.

The Abrigo, in the northern part of the Slate Mountains, is 520 feet thick, consisting of interbedded mudstone, quartzite, and dolomite. Lying disconformably upon the Abrigo, the Martin formation is 235 feet thick, and is composed of muddy dolomite interbedded with siltstone and quartzite. Above the Martin, about 150 feet of Escabrosa limestone occur in the northern area, while southeast of the mountains and nearer the Lakeshore property, the Escabrosa is nearly 400 feet thick. The Escabrosa formation is separated from the overlying Horquilla limestone, of which only the lowermost 380 feet are exposed, by a mudstone-chert conglomerate which indicates an intervening erosional interval.

The Cretaceous-Early Tertiary interval in southern Arizona was a period of recurrent volcanism and continental deposition, resulting in thick piles of clastic and volcanic conglomerates and agglomerates. There are few, if any, surface exposures of volcanic rocks in the main part of the Slate mountains, but a few such exposures are present in the Lakeshore area and drilling has shown the presence of a great thickness - up to 2000 feet - of andesite and andesite breccia in the immediate mine area. The andesitic volcanics are thought to be Cretaceous in age and unconformably overlie the Paleozoic and Upper Precambrian formations. Overlying the Cretaceous andesite is a variable but thick sequence of Tertiary fanglomerate and younger Tertiary volcanics and conglomerates.

In the Lakeshore area (Figure 2) a stock of quartz diorite and related porphyritic rocks has intruded the Pinal schist and younger formations up to and including the Cretaceous andesite.

The quartz diorite crops out over an area of about 2 square miles on the westerly slope of the Slate Mountains. The margins of the stock, in contact with Pinal schist, are well exposed on the slope of the mountains, but along the southerly and westerly side, at the base of the slope, the contact of the diorite with older rocks is largely obscured by desert wash and alluvium. A wide zone of complex faulting, trending along the southerly and westerly margins of the stock, further obscures the relationship between the quartz diorite and the Late Precambrian and Paleozoic rocks.

Within this faulted zone, outcrops of Paleozoic limestone occur in the easterly part of the property, while further west and near the present Lakeshore pit, outcrops of schist, diabase, quartzite, and metamorphosed limestone of probable Precambrian age are found. The oxide ore mined from the small Lakeshore pit and treated by the segregation process occurs within this sequence of metasediments.

Bordering the Paleozoic sediments and Late Precambrian metasediments, and in fault contact with them wherever seen, are sparse outcrops of quartzitic conglomerate and andesite which are regarded as Cretaceous in age. In the area south of the quartz diorite stock, the Cretaceous rocks are largely quartzites and conglomerates. In the area west of the present pit operation, Cretaceous rocks are predominantly andesite and andesite breccia. Drilling has shown that the andesitic rocks reach as much as 2000 feet in thickness in the westerly part of the deposit.

Fanglomerate, consisting of boulders, cobbles, and fragments of quartz diorite, porphyry, andesite, and metasediments, unconformably overlies the Cretaceous andesite. Commencing near the present Lakeshore pit, the fanglomerate thickens toward the west, reaching 1100 feet in thickness over the western part of the deposit. The fanglomerate is considered to be Middle Tertiary in age, and continental in type and origin.

A thin veneer of alluvial sand and gravel covers much of the area south and west of the quartz diorite stock, and outcrops of the bordering

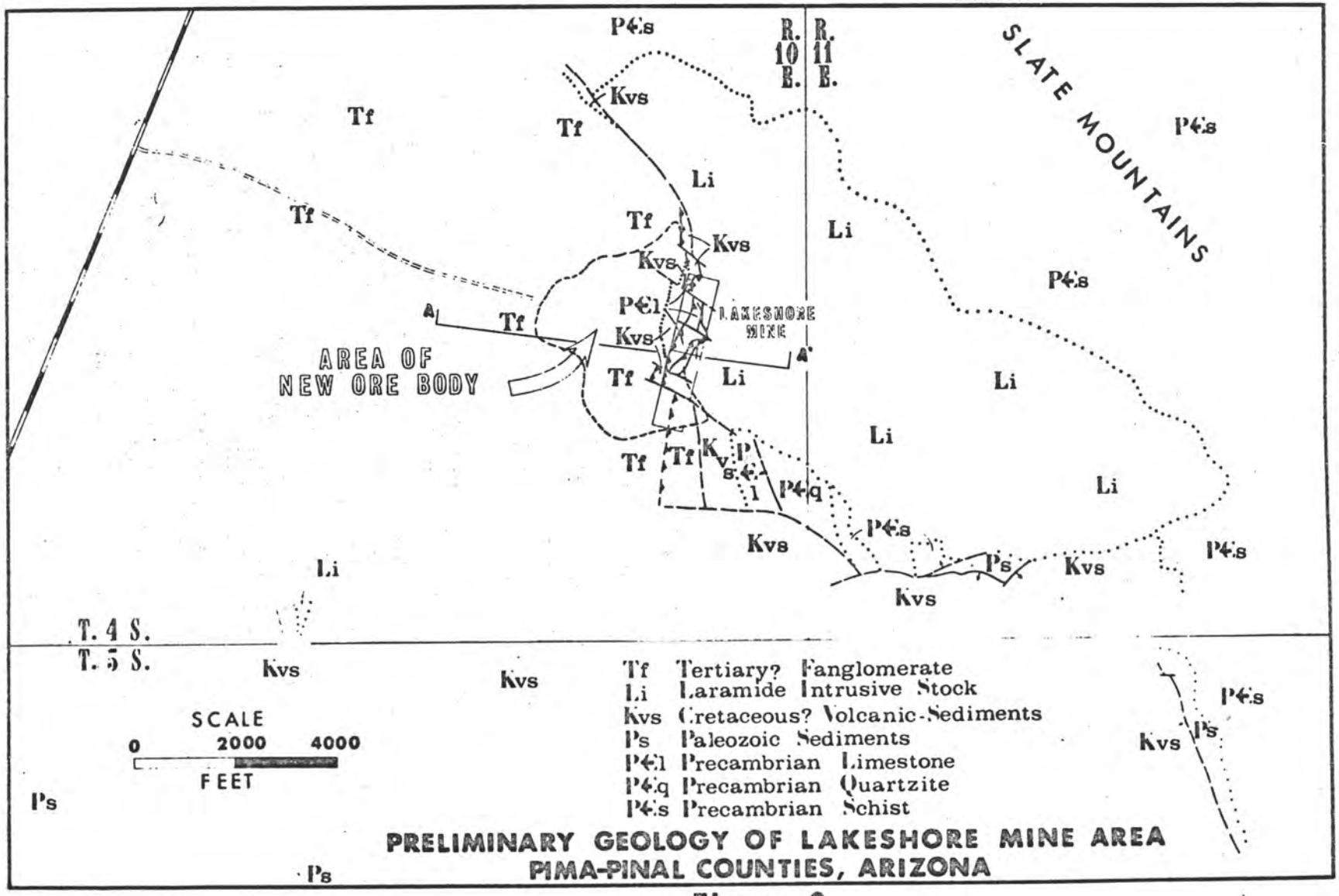

R. 10 E.
R. 11 E.
SLATE MOUNTAINS
LAKESHORE MINE
AREA OF NEW ORE BODY
A
A'
T. 4 S.
T. 5 S.
SCALE
0 2000 4000
FEET
Tf Tertiary? Fanglomerate
Li Laramide Intrusive Stock
Kvs Cretaceous? Volcanic-Sediments
Ps Paleozoic Sediments
P€l Precambrian Limestone
P€q Precambrian Quartzite
P€s Precambrian Schist
PRELIMINARY GEOLOGY OF LAKESHORE MINE AREA
PIMA-PINAL COUNTIES, ARIZONA

Figure 2

formations are sparse. The geology shown in Figure 2 is largely interpreted from drill hole data. This is illustrated in Geologic Section A-A' (Figure 3).

Figure 3 is a vertical section through the Lakeshore deposit, looking northerly. Metasediments and tactite ore, with overlying mineralized andesite, are present in the small pit at the upper right. The term "tactite ore" refers to a metasomatically replaced zone, usually occurring in the upper calcareous portion of the metasediments, which contains a concentration of copper and iron minerals in a calc-silicate gangue. In some parts of the pit area, quartz diorite occurs above and in fault contact with the underlying andesite and metasediments in an evident thrust relationship. In the area of the pit not obscured by the overthrust quartz diorite, the andesite-metasediment sequence is bounded on the east by a steeply dipping normal fault. Quartz diorite is present east of the fault. This fault marks the easterly limit of not only the small pit ore body but the major deposit as well.

Vertical drill holes in the area of the pit, as P-28A, pass through the metasediments and near-surface mineralized zone, cross through a fault, and, after cutting about 700 feet of mineralized andesite, again encounter the metasediments and tactite ore. The tactite zone, which includes a number of diabase sills, is underlain by the quartz diorite.

In the central part of the deposit, drill holes, after cutting 20 to 50 feet of alluvium, encounter fanglomerate and then pass through the andesite, the metasediments and tactite ore, and into quartz diorite. The formations strike northerly and dip westerly at about 25°, and are encountered in drilling at progressively greater depths to the west.

A fine to medium grained porphyry varying from quartz diorite to quartz monzonite intrudes the metasediments and andesite. Its relationship to the quartz diorite stock is not clearly established as yet. It may well be a late facies of the quartz diorite intrusive. The main mass of

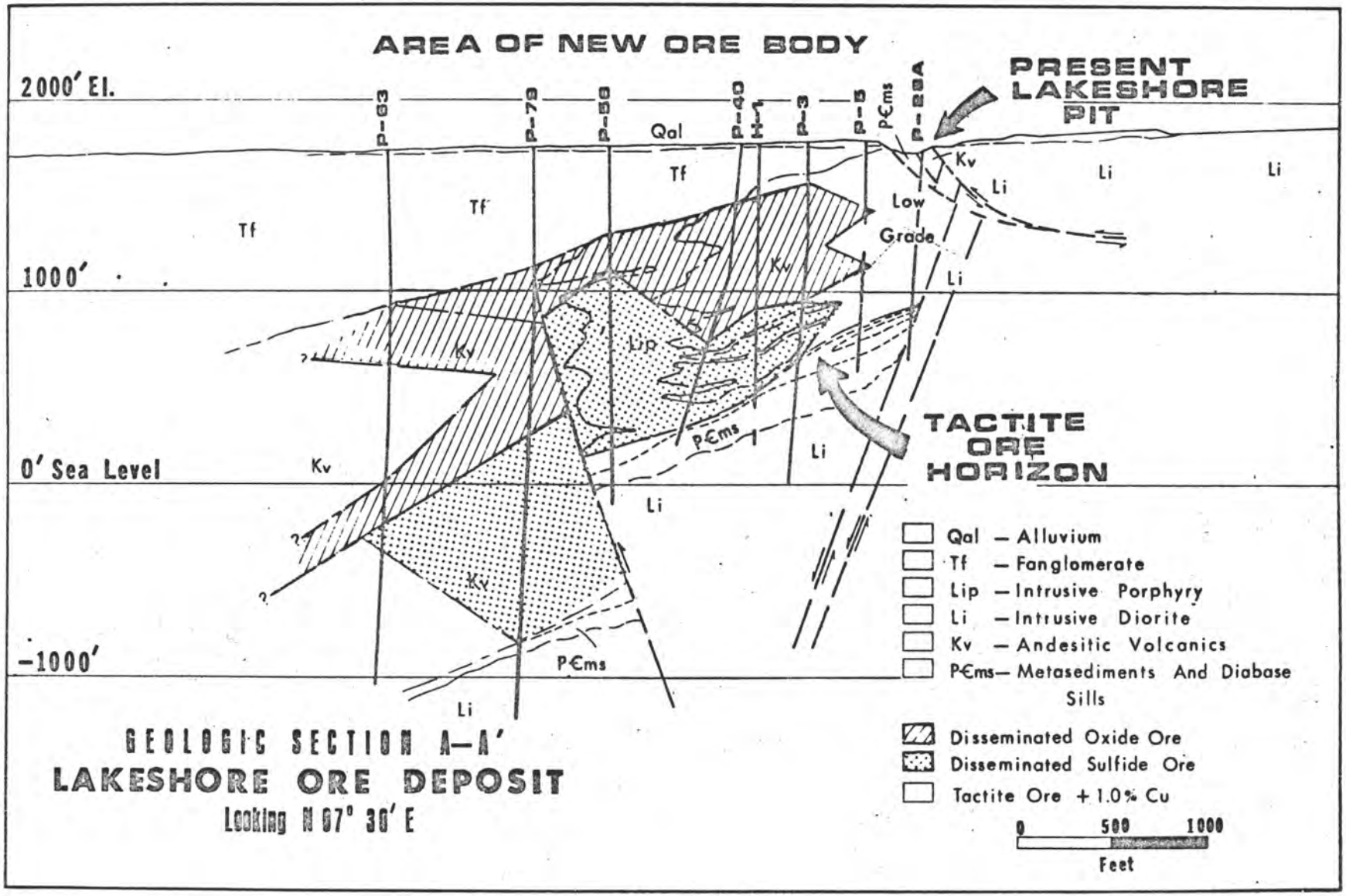

AREA OF NEW ORE BODY
PRESENT LAKESHORE PIT
2000' El.
1000'
0' Sea Level
-1000'
P-63
P-78
P-58
P-40
H-1
P-3
P-15
P€ms
P-28A
Qal
Tf
Kv
Li
Lip
Low Grade
TACTITE ORE HORIZON
P€ms
Qal — Alluvium
Tf — Fanglomerate
Lip — Intrusive Porphyry
Li — Intrusive Diorite
Kv — Andesitic Volcanics
P€ms — Metasediments And Diabase Sills
Disseminated Oxide Ore
Disseminated Sulfide Ore
Tactite Ore + 1.0% Cu
0
500
1000
Feet
GEOLOGIC SECTION A—A'
LAKESHORE ORE DEPOSIT
Looking N 07° 30' E

Figure 3

porphyry is located in the north central part of the deposit where it occurs as an irregular body with fingers extending upward and easterly toward the surface.

Drill holes in the westerly part of the drilled area encounter a thickness of andesitic rocks nearly twice that found in the central part of the deposit. Beneath as much as 2000 feet of andesite, the metasediments and underlying intrusive have been found in three drill holes. The metasediments in this area are about 700 feet lower in elevation than those in the central part, and the bottom of the oxidized zone is similarly displaced. A post-oxidation, high-angle reverse fault is inferred to separate the westerly part of the deposit from the central part.

The andesites, porphyry, metasediments, diabase, and upper part of the underlying intrusive have been extensively shattered throughout the Lakeshore ore zone and are moderately to strongly altered. Moderate fracturing has been developed in the fanglomerate.

Principal host rocks for the copper mineralization are the andesite, porphyry, and the metasediment-diabase sequence. The upper part of the underlying intrusive sometimes contains disseminated sulfide above 0.4% copper in grade, but more often is only weakly mineralized or barren. Weak copper mineralization is also present as exotic occurrences in the fanglomerate.

The copper mineralization is younger than the intrusive porphyry, but is thought to be closely associated with it. The quartz diorite stock has been dated by the potassium-argon method as Laramide in age, and the porphyry and copper mineralization probably were emplaced as later phases of the same magmatic interval.

Chalcopyrite and pyrite are the principal sulfide minerals in the primary zone. These minerals were extensively disseminated throughout the shattered porphyry and andesite, and were localized, in

association with massive magnetite, as a metasomatic replacement of the upper 20 to 150 feet of the calcareous metasediments. This replacement zone is that referred to as the tactite ore horizon.

In the central part of the deposit, oxidation extends irregularly to a depth of about 800 feet, while in the western part, oxide minerals extend as deep as 2000 feet. Chrysacolla is the principal copper mineral in the oxide zone. Other secondary copper minerals present in significant amounts are covellite, brochantite, tenorite and cuprite. Some of the copper in the oxidized zone is intimately associated with iron oxides.

Secondary enrichment is not extensive in the easterly and central parts of the deposit. Grades of the disseminated oxide and disseminated sulfide zones are approximately equal, and the blanket enrichment typical of many porphyry copper deposits is not present. However, extensive thicknesses of chalcocite resulting from supergene enrichment are present in the northwesterly part of the deposit.

The extent and relationship of the three types of mineralization, disseminated oxide, disseminated sulfide, and replacement, or tactite ore, are illustrated in Section A-A' (Figure 3).

Drilling and Reserves

The Lakeshore deposit has been explored by a total of 77 drill-holes, shown in Figure 4. The holes are located within an area about 3000 feet by 4000 feet in extent, and are spaced, for the most part, from 350 to 400 feet apart. They range from 700 to 3200 feet in depth. The total footage drilled to date is approximately 127,000 feet. The drilling shows the location of the major deposit in relation to the near-surface ore body exposed in the present small pit. The deposit has not been completely delineated, and five diamond drills and one rotary drill are presently in operation.

Reserves estimated in February 1969 totalled 472 million tons averaging 0.75% copper. This figure includes approximately 241 million tons of disseminated sulfide averaging 0.7% copper, 207 million tons of disseminated oxide averaging 0.71% copper, and 23.6 million tons of tactite sulfide ore averaging 1.69% copper. Minor amounts of molybdenum, gold, and silver are present in the sulfide ores. No revisions of the reserve estimate, based on drilling since February 1969, have been made.

Development and Mining Plan

The tonnage and grade of the Lakeshore deposit compare favorably with that of other major porphyry-type copper deposits in the southwestern United States. Because of its large size and "layered" characteristics, the deposit will lend itself to an extraction plan which integrates mechanized underground mining techniques with modern open-pit mining methods. The higher-grade sulfide ore in the tactite zone underlying the deposit will be developed and mined in the early stages of the operation. A modified room-and-pillar mining method utilizing mechanized equipment is planned for the tactite zone. A twin decline on a 15° slope will provide entry to the ore body, and, equipped with conveyors, will be the main ore handling facility for the tactite ore and also later for the deeper, open-pit, disseminated sulfide material. The length of the decline to a point beneath the central part of the deposit will be about 7500 feet.

During early development and preparation for mining the tactite-sulfide zone, bulk samples of various parts of the disseminated oxide and sulfide zones will be obtained for further metallurgical testing. Based upon favorable results of this testing, the oxide material will be mined by conventional open-pit methods, and at a later stage of pit operation the disseminated sulfide, which underlies the oxide zone, will also be mined by open pit. This deeper pit material will be crushed and delivered to the plant via the conveyor system in the decline.

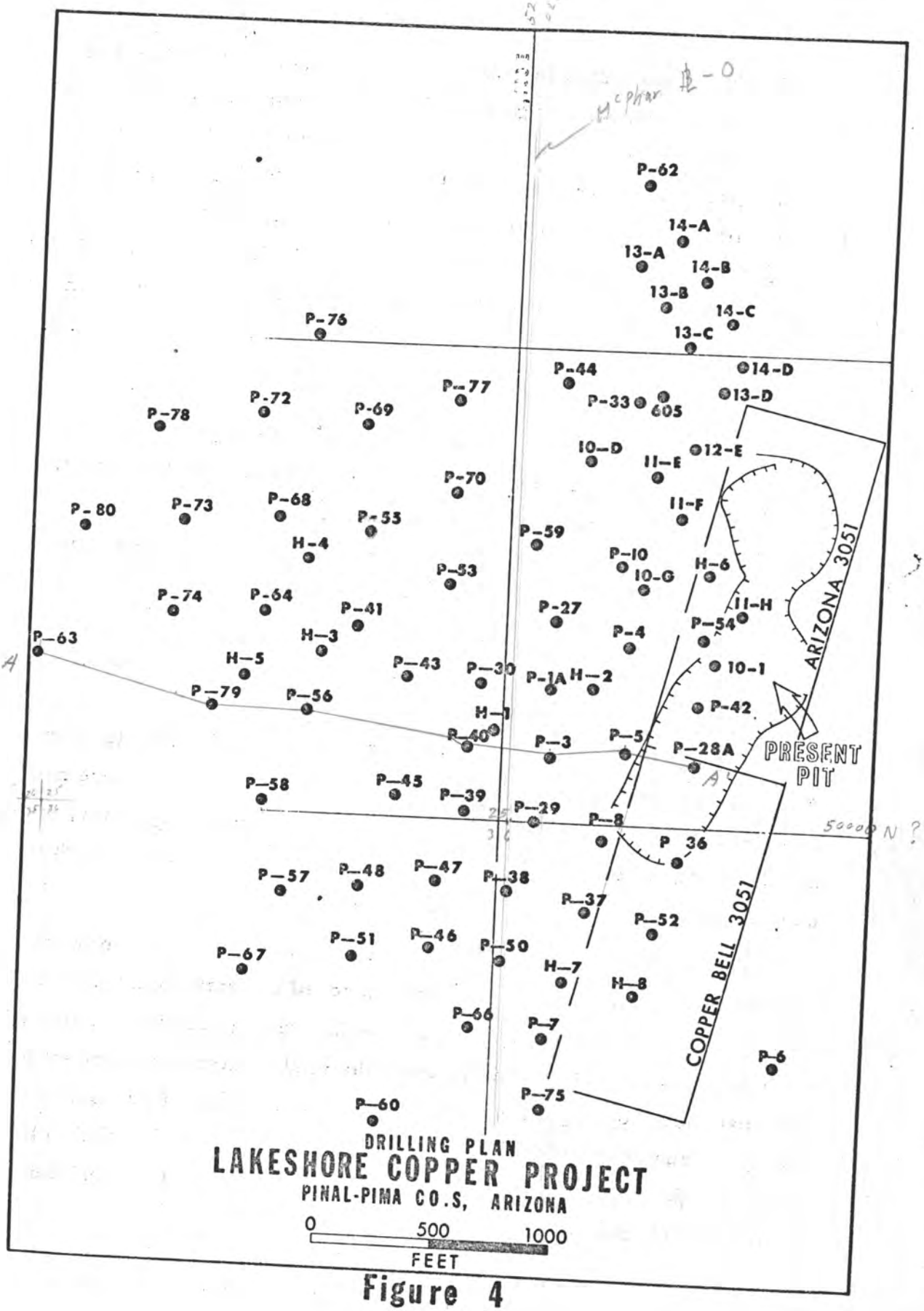

P-62
14-A
13-A
14-B
13-B
14-C
13-C
P-76
P-44
14-D
P-77
13-D
P-72
P-33
605
P-78
P-69
10-D
12-E
11-E
P-70
P-80
P-73
P-68
11-F
P-55
P-59
H-4
P-10
H-6
P-53
10-G
P-74
P-64
P-41
P-27
11-H
P-54
P-63
H-3
P-4
H-5
P-43
P-30
P-1A
H-2
10-1
P-79
P-56
P-42
H-1
P-40
P-3
P-5
P-28A
P-58
P-45
P-39
P-29
P-8
P-36
P-57
P-48
P-47
P-38
P-37
P-52
P-51
P-46
P-50
P-67
H-7
H-8
P-66
P-7
P-6
P-75
P-60
ARIZONA 3051
PRESENT PIT
COPPER BELL 3051
A
A
DRILLING PLAN
LAKESHORE COPPER PROJECT
PINAL-PIMA CO.S, ARIZONA
0
500
1000
FEET

Figure 4

Engineering studies and mine planning are underway and extensive metallurgical test work has been started. Underground development work should start soon.

Walt 12/15/69
Don C DBC

Make 2 copies

El Paso Natural Gas Company

El Paso, Texas 79999

November 28, 1969

HEINRICHS GEOEX
GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

RECD DEC 4 1969

BOX 5671 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Mr. E. Grover Heinrichs
Vice President
Heinrichs Geoexploration Company
P. O. Box 5671
Tucson, Arizona 85703

Dear Mr. Heinrichs:

In answer to your request I am enclosing a copy of the paper on exploration at Lakeshore that I prepared for the annual meeting of the New Mexico Mining Association which was held in El Paso on November 16 - 19, 1969.

Thank you.

Sincerely,

C/ Claude E. Barron

Claude E. Barron
Senior Mining Geologist
Mining Division

CEB:mp

EXPLORATION AT LAKESHORE MINE

Pinal County, Arizona

Claude E. Barron

Senior Mining Geologist

El Paso Natural Gas Company

EXPLORATION AT LAKESHORE MINE

Pinal County, Arizona

By

Claude E. Barron
Senior Mining Geologist
El Paso Natural Gas Company

ABSTRACT

As the result of a general reconnaissance of the Slate Mountain area, an interpretation of the geology was made that assumed (1) the oxide tactite ore body in the Lakeshore Pit had been overturned by tilting to the northwest, (2) that these metasediments would be in place underlying the andesite west of the pit and would trend generally northwest parallel to the trend of the Slate Mountains, and (3) that the strong northwest and north-south fault and fracture system which was exposed in the pit would offer channels for migrating mineralized solutions permitting the deposition of sulphides at depth.

A proposed correlation of this interpretation with Induced Polarization anomalies involved an area that extended to the south and northwest of the Lakeshore Pit. This area was recommended for deep drilling to test the weak I. P. anomalies for sulphide mineralization.

Contour maps based on assay and geological data from gyroscopically surveyed drill holes offered control for delineation and computer evaluation of the discovered ore body.

INTRODUCTION

The Lakeshore mineral deposit crops out on the southwest piedmont of the Slate Mountains in Section 25, T10S, R4E, Pinal County, Arizona. This location is in the Papago Indian Reservation, approximately 30 miles south of Casa Grande, Arizona.

In the Basin and Range Province of southwest Arizona, the Slate Mountains form an arcing outcrop that trends from northwest to north, and reaches an elevation of 3330 feet at Prieta Peak near the center of the range. The Lakeshore Mine, about 2 miles south of Prieta Peak, is at an elevation of approximately 1800 feet. Vegetation in the valley is of the desert variety, capable of surviving in the hot summer temperature and the few inches of annual precipitation.

PREVIOUS WORK

Rocks in the Slate Mountains were described in an unpublished thesis by Hogue (1) in 1940. The Lakeshore copper deposits were investigated by the U. S. Bureau of Mines (2) in 1950. Precambrian and Paleozoic sedimentary rocks of the area were described by McClymonds (3) in 1959. Geologic maps prepared by the Arizona Bureau of Mines (4) in 1960 show rocks in the Slate Mountain area range in age from Precambrian to Quaternary. Sedimentary rocks of the northern Slate Mountains have been described in detail in an unpublished thesis by Hammer (5) in 1961. Other work describing surface geology and sub-surface data obtained from shallow drilling is contained in several unpublished reports made by consultants for Transarizona.

HISTORY

The mineral outcrop, consisting primarily of copper silicates and iron oxides, was located by Trout and Atchison in the early 1880's. Abandoned in 1884, the property was relocated by B. S. Wilson in 1905. In 1914 Wilson sold the property to Frank M. and Charles Leonard.

The Leonards, who developed the ore body on three levels while working through a 225 foot vertical shaft, leased the property in 1917. This lease was terminated in 1919. The next noteworthy work to be conducted was an examination of the property by the U. S. Bureau of Mines in 1942 which initiated an investigation that started in 1948 and concluded with a report in 1950.

In November 1955, the three patented claims of the Lakeshore property and the Drake claims, consisting of three patented and 19 unpatented claims, were obtained by George Freeman under a lease-option agreement from Treasure State Mining Company. In 1956, a 580 acre lease surrounding these claims was obtained from the Bureau of Indian Affairs by Dwight McClure and George Freeman. In 1960 the Bureau of Indian Affairs approved an assignment of the lease to Transarizona Resources Inc.

El Paso Natural Gas Company's interest in the property was initiated by an invitation to examine the property in September 1962. At that time, the writer made an examination of the mine and plant. Transarizona had developed the mine as a small open pit. Exploration drilling on a closely-spaced drill pattern indicated $\pm$ 1.5 million tons of $\pm$ 1.75% copper oxide. Level maps and cross-sections prepared from the drill data indicated the mineral deposit formed a V-shaped trough that plunged to the southwest, and was controlled by faults.

The Plant had been designed for a copper segregation process that was followed by flotation.

As a result of the examination, a recommendation for a more complete evaluation of the property was made but the request was not approved. However, in June 1963, a limited amount of drilling was conducted in the open pit and a feasibility study of the segregation process was made.

In August 1966, under the direction of the Mining Division of El Paso Natural Gas Company, an induced Polarization survey was conducted on the Lakeshore property by McPhar Geophysical Limited and, at the same time, the writer began a general geological survey of the area.

In September 1966 a core drilling program was initiated to investigate the I. P. anomalies that were discovered on the property.

In February 1969, El Paso Natural Gas Company announced an agreement with Hecla Mining Company for development of a major new copper discovery made by the Mining Division on the Lakeshore property.

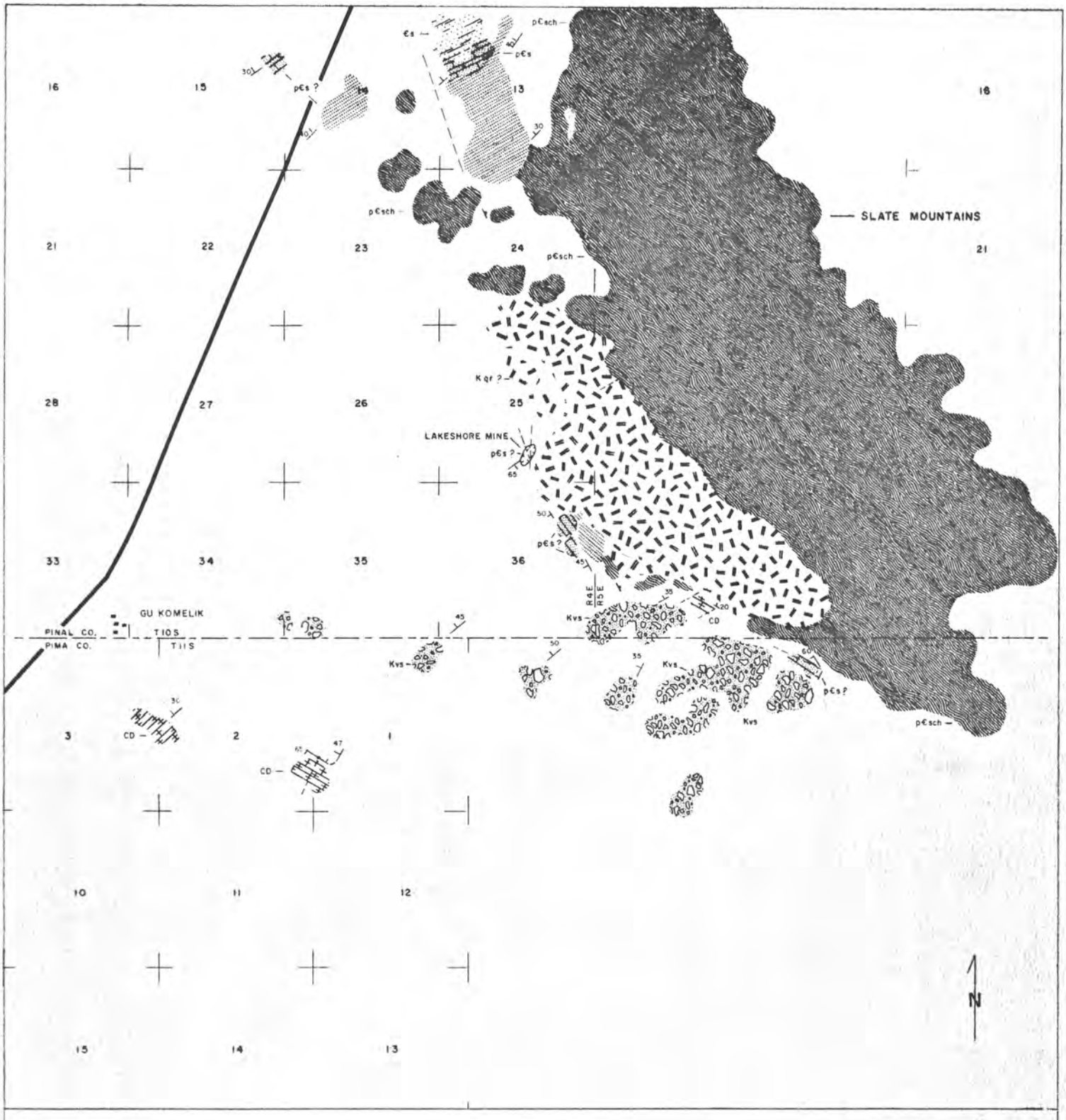
GENERAL GEOLOGY

Reconnaissance of the Slate Mountain Area

The Slate Mountains (Fig. 1), composed primarily of the Pinal Schist formation of Precambrian age (4), strike N $\pm$ 45W and dip $\pm$ 50° NE. Near the center of the mountains, an elongated mass of quartz diorite has intruded the schist. This intrusive mass tends to parallel the foliation of the schist and was identified as being Precambrian in age (4). However, recent work by P. E. Damon and R. L. Mauger (6) has dated this intrusive by the potassium-argon process as Laramide (Cretaceous-Tertiary). Along the northeast slopes of the mountains, the schist dips under the alluvium and fanglomerates at the edge of the valley.

At the north end of the Slate Mountains, the Pioneer Shale, the Dripping Springs Quartzite, and the Mescal Limestone of the Precambrian Apache Group (4) strike N $\pm$ 40° E and dip $\pm$ 45° NW. These northwest dipping metasediments overlie the northwest trending Pinal Schist with angular unconformity. Overlying the Apache Group is the Abrigo Limestone and Troy Quartzite of Early Cambrian age (4) and the limestone, quartzite and shales of Devonian and Carboniferous age (4). Along the southwest slope of the Slate Mountains and to the southeast, outcrops of these formations generally dip to the southwest and strike parallel with the trend of the mountains.

Around the southwest periphery of the Slate Mountains and protruding through the valley fill, are outlying hills of Devonian and Carboniferous limestone, Cretaceous volcanic and sedimentary rocks and Tertiary andesite and breccia (4). The Devonian



0 4000
SCALE IN FEET

- QUATERNARY ALLUVIUM
- CRETACEOUS SEDIMENTARY AND VOLCANIC ROCKS
- CRETACEOUS? GRANITE (QUARTZ DIORITE)
- CARBONIFEROUS AND DEVONIAN LIMESTONE
- CAMBRIAN BOLSA QUARTZITE
- YOUNGER PRECAMBRIAN MESCAL LIMESTONE
- YOUNGER PRECAMBRIAN DRIPPING SPRINGS QUARTZITE AND PIONEER SHALE
- OLDER PRECAMBRIAN PINAL SCHIST

- 45 ATTITUDE OF BEDS
- FOLIATION
- FAULT OR SHEAR ZONE
- OPEN PIT
- SECTION CORNER

GENERALIZED GEOLOGIC MAP OF THE SLATE MOUNTAIN AREA PINAL CO., ARIZONA

MODIFIED FROM GEOLOGIC MAP OF PINAL CO., ARIZONA BY THE ARIZONA BUREAU OF MINES, 1959

BASE MAP FROM U.S.G.S. TOPOGRAPHIC MAP

C.E.B. 9-11-69

Fig. 1

and Carboniferous limestone and dolomite have been folded along an apparent northwest trending axis and then tilted to the northwest. In the area southwest of the Lakeshore mine, the breccia and the underlying Cretaceous volcanic and sedimentary rock strikes N $\pm$ 50° E and dips $\pm$ 45° NW.

Small faults have apparently displaced sedimentary bedding and igneous and sedimentary contacts in these outlying hills. However, any evidence of large faults has been covered by the alluvium. The poles of the measured attitudes of joints and fractures, plotted on a stereographic projection, indicates a preferred orientation of N 30° E with 45° SE dip, N 40° E with 45° NW dip, and N 65° E with 66° SE dip.

Geology of the Lakeshore Pit

At the Lakeshore Mine, a small open pit was excavated by Transarizona (Fig. 2). Near the center of the pit, mineralized banded tactite overlaid by a fine-grained quartzite, striking N $\pm$ 50 E and dipping $\pm$ 60° SE, was exposed. These metasediments terminate on the east side of the pit where they are in contact with diorite along a very strong oblique slip dip fault that strikes NW and dips 65° SW. Merging with this fault is a strong north-south fault that dips 74° W.

Along the west wall of the pit, altered and fractured andesite occurs on the footwall of an andesite and metasediment contact which shows slickensides. This contact, striking N $\pm$ 40° E and dipping $\pm$ 50° SE, forms the footwall of the oxide ore body.

OC-5 U.S.B.M. DRILL HOLE

ALLUVIUM

ANDESITE

GRANITE (QUARTZ DIORITE)

METASEDIMENTS (TACTITE)

BANDED METASEDIMENTS

ATITUDE OF METASEDIMENTS

FOLIATION

FAULT

GENERAL GEOLOGY
OF THE
LAKESHORE PIT

SEPTEMBER 1966

SCALE 1" = 100' C.E.B.

Fig. 2

At the north end of the pit, a fine-grained, banded quartzite, striking N $\pm$ 10° W with vertical dip, has been exposed in contact with the diorite on the footwall side of the NW striking fault zone.

The south end of the pit has been cut through highly altered and fractured andesite with foliation striking N $\pm$ 30° E and dipping $\pm$ 45° SE. This andesite overlays the metasedimentary rock and forms the hanging wall of the oxide ore body.

Drill hole data from close space drilling, conducted by Transarizona, indicated that the northeast end of the ore body had been offset to the northwest on the footwall side of the NW striking fault zone.

Drilling conducted by the U. S. Bureau of Mines (2) in 1948 had encountered quartzite underlying andesite at 460 feet in hole C-2, and at 270 feet in hole C-4. In hole C-5, from 455 feet to 545 feet, copper oxides were encountered in a section described by the Bureau as a shear zone (Fig. 3).

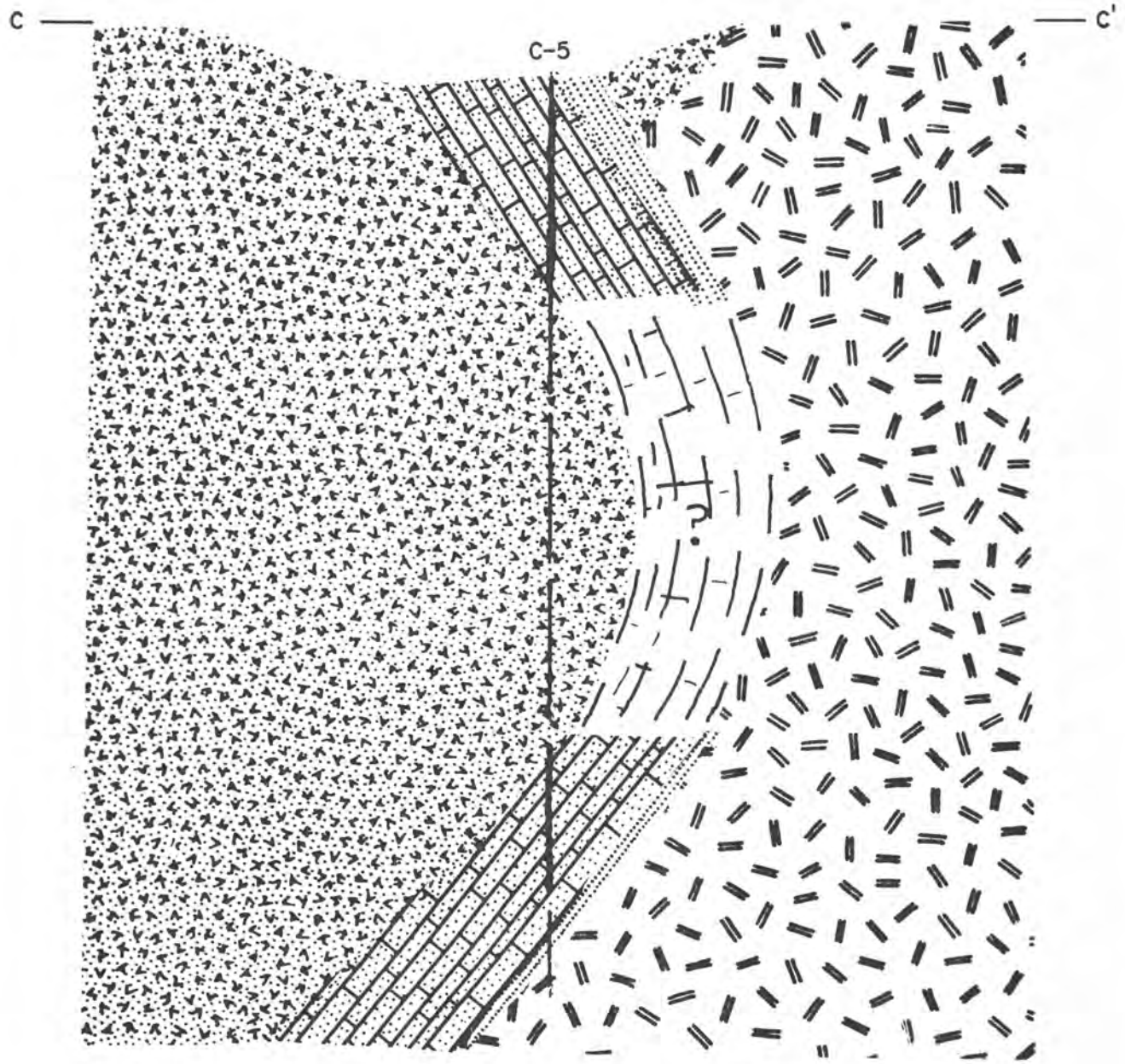
GEOPHYSICAL SURVEY

Induced Polarization Survey

During August and September of 1966, a combined resistivity and induced polarization survey was conducted on the mineral lease and the claims southwest of the Slate Mountains (Fig. 4).

A dipole-dipole electrode configuration, with 500 foot electrode spread length, was used to apply current and measure potential along parallel north-south lines, with $\pm$ 1200 foot east-west separations. Alternating current of 0.3 and 5 cycles per second were used to determine the I. P. effect. In addition to the north-south survey, an east-west survey, using shorter electrode spread lengths, was made over the Lakeshore fault system.

Fig. 3



CROSS-SECTION C-C'
LOOKING N 55 E
SCALE 1" = 100'

INTERPRETATION, BY THE WRITER, OF THE MINERALIZATION ENCOUNTERED BY THE U.S.B.M. IN CHURN DRILL HOLE No. C-5

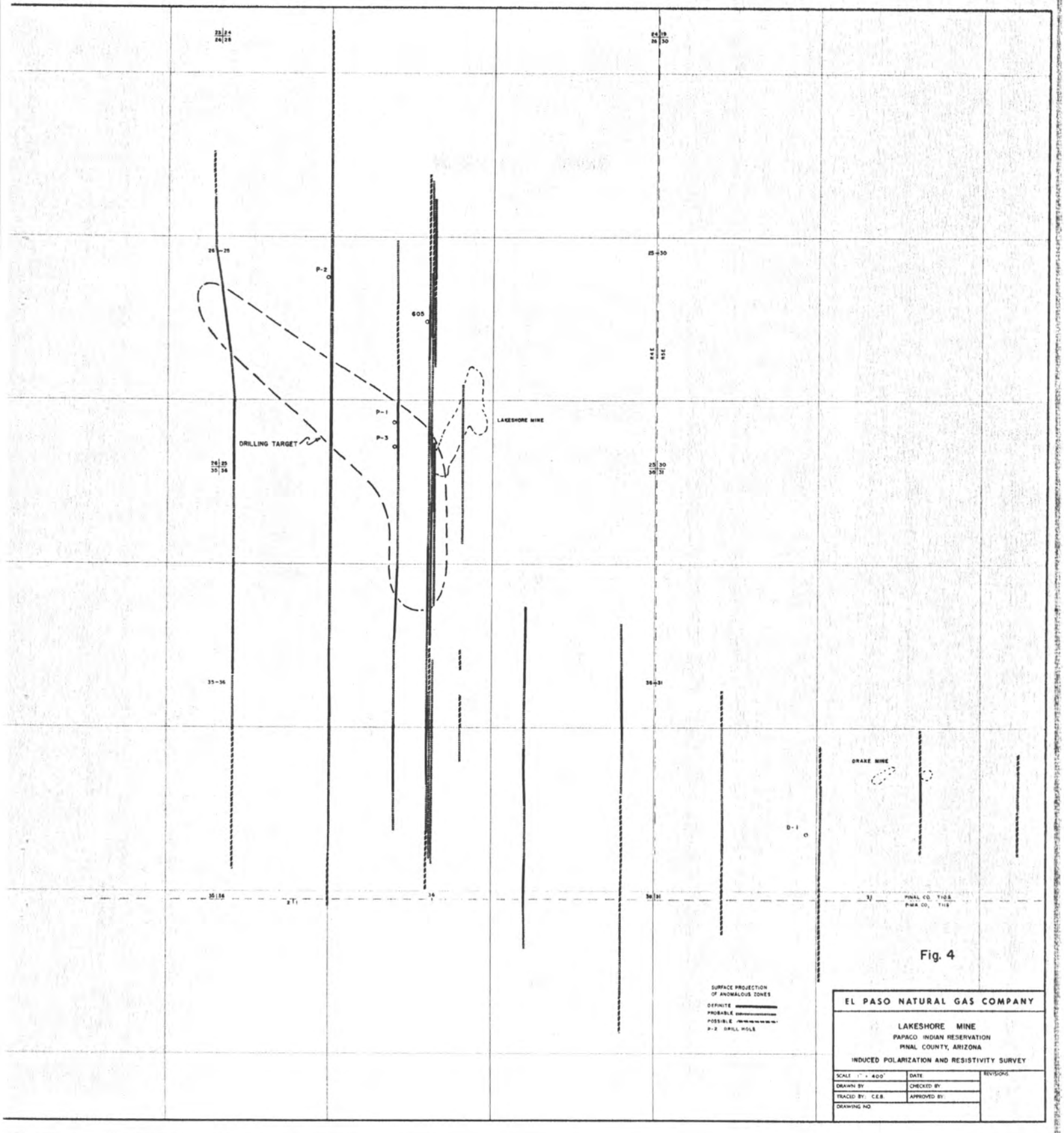


Fig. 4

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA

INDUCED POLARIZATION AND RESISTIVITY SURVEY

SCALE 1" = 400'	DATE	REVISIONS
DRAWN BY	CHECKED BY	
TRACED BY C.E.B.	APPROVED BY	
DRAWING NO.		

Testing I. P. Anomalies

Several I. P. anomalies were recorded along the north-south survey lines. To test the anomalies, core drilling began at locations D-1 and 605 (Fig. 4). Core hole D-1 was located in the area of a reported anomaly ± 1200 feet southwest of the Drake oxide pit. This test hole was cored for 500 feet through andesite breccia without encountering sulphide mineralization and then abandoned. Hole 605 was an old rotary drill hole which had been terminated in a weakly mineralized porphyry at a drill depth of ± 288 feet. This location was on an I. P. anomaly ± 750 feet north of the Lakeshore pit. Core drilling began at 288 feet and copper oxide mineralization was encountered along fractures in an altered biotite porphyry and in and near the contacts of the biotite porphyry and sections of altered andesite of varying thickness. This hole was anandoned at 790 feet because of drilling conditions without encountering sulphide mineralization.

With the completion of D-1 and 605, the testing of two additional I. P. anomalies began at locations P-1 and P-2 (Fig. 4). Drill hole P-2 was located on an I. P. anomaly ± 1500 feet northwest of hole 605. Core drilling was conducted through 800 feet of fanglomerate without encountering oxide or sulphide mineralization, and the hole was abandoned. The fanglomerate consisted of angular to sub-angular fragments of sedimentary and volcanic rock that was weakly cemented but did not display the prominent high-angle slickenside fracture system that had been encountered in hole 605.

At Hole P-1, located on an I. P. anomaly ± 700 feet west of the Lakeshore pit, low grade copper oxide mineralization was encountered in a fractured and altered andesite and andesite breccia. These andesites had been intruded by a few thin sill-like masses of biotite porphyry. At a drill depth of 750 feet where the drill was still in oxides, a re-evaluation of the I. P. data and a review of the geology was made.

INTERPRETATION OF GEOLOGY

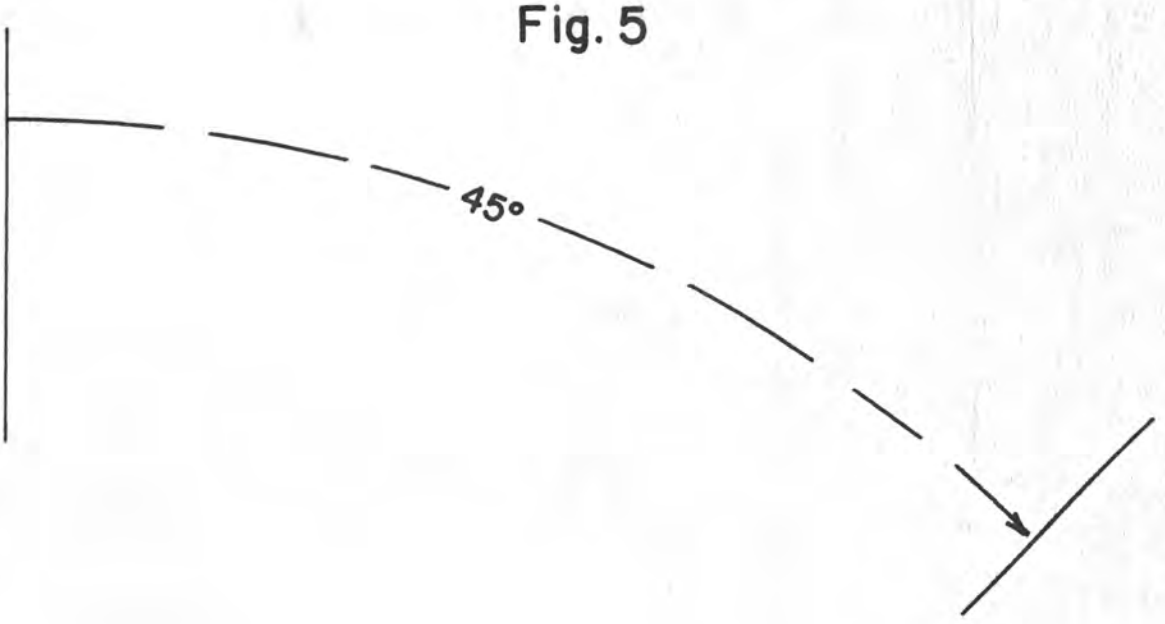
In an attempt to correlate surface geology with subsurface data obtained from core holes, the writer assumed:

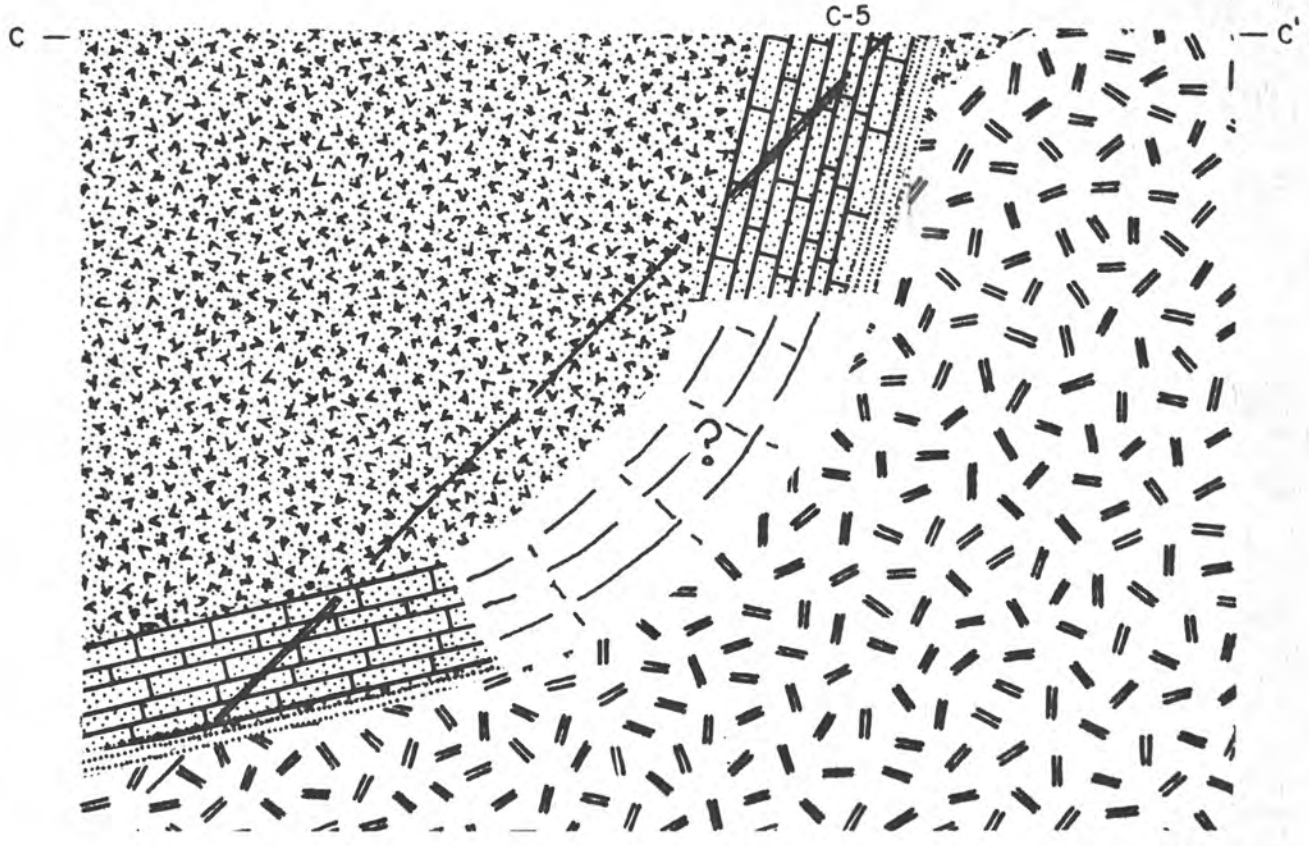
(1) The andesite and breccia encountered in drill hole P-1 are extrusive and the biotite porphyry encountered in hole 605 and P-1 is younger than the andesite and younger than the biotite hornblende porphyry that has intruded the Pinal Schist to the east;

(2) The high angle slickenside fracture system encountered in hole P-1 and 605 is parallel to the fault and fracture system observed in the Lakeshore pit;

(3) The present attitude of the Cretaceous volcanic and sedimentary rocks cropping out southwest of the Slate Mountains represents the youngest structural trend in the area, and that this trend, striking N ± 50° E and dipping ± 45° NW, has been superimposed on the older structural system in the area;

Fig. 5





CROSS-SECTION C-C'

LOOKING N 55 E

SCALE 1" = 100'

ASSUMED ATITUDE OF THE METASEDIMENTS
PRIOR TO TILTING TO THE NORTHWEST

(4) If the metasediments cropping out outcropping in the Lakeshore pit were rotated about a horizontal axis trending N 50° E to a pre-45° tilt attitude, the metasediments would then be dipping steeply to the northwest and be overlaid by the andesite (Fig. 5).

(5) The mineralization, encountered by the U. S. Bureau of Mines (2) in churn drill hole C-5 at a drill depth of 455 feet to 545 feet, is the continuation down dip of the mineralized metasediments and these metasediments would continue to the northwest to underlie the andesite (Fig. 3).

In summation then, this interpretation requires that the metasediments extend down dip from the oxide outcrop and lie under the andesite to the northwest. The trend of the metasediments is controlled by the northwest trend of the Slate Mountains, the strong northwest and north-south fault and fracture system, and the intrusive. Movement of mineralized solutions were controlled by this physical environment and sulphide mineralization should be encountered at depth.

RECOMMENDED DRILLING TARGET

To try to correlate this interpretation with the indicated I. P. anomalies, the plotted anomalies extending to the south of the Lakeshore pit and the anomalies in echelon to the northwest of the pit were encircled. This enclosed an area $\pm$ 1000 feet wide extending from near the center of Section 36 north to Section 25, then northwest to the west line of Section 25 (Fig. 4). This area offered the best possible correlation of projected geology and plotted I. P. anomalies. The enclosed area was recommended as the drilling target for the Lakeshore project.

DISCOVERY OF SULPHIDE MINERALIZATION

Following the review of I. P. and geological data, the decision was made to continue drilling P-1 and preparations were made to drill an offset hole 300 feet south of hole 605. However, before a drill could be moved to this location, sulphide copper mineralization was encountered in P-1 at a depth of ± 850 feet in andesite and andesite breccia. The prepared drill location south of hole 605 was abandoned and a drill was moved to location P-3, 300 feet south of P-1. Drilling at P-1 continued to a depth of ± 1100 feet where it was abandoned because of drilling conditions.

On location P-3, drilling conditions were the same as those encountered in hole P-1. Fractured and altered andesite and andesite breccia was difficult to drill but core recovery was consistently high. Mineralization consisted of low grade copper oxide and silicate plus hematite, calcite, and gypsum occurring along fracture planes. Silification seems to be the dominate type of alteration. Andesite and breccia continued to a drill depth of 1080 feet where the drill penetrated a thick section of sericite and then entered highly altered limestone or dolomite. These altered carbonate rocks continued to a drill depth of 1147 feet.

At 1147 feet, massive magnetite with pyrite and chalcopyrite in banded tactite was encountered. This marked the discovery of sulphide mineralization in metasediments west of the Lakeshore pit. The mineralization continued for 90 feet and had an average assay value of 1.75% copper.

DELINEATION OF MINERALIZATION

Drilling and Recording of Data

With the encounter of sulphide mineralization in metasediments, an accelerated drilling program began. Rotary drilling was used to penetrate the andesites and breccias. When the rotary hole was completed to a pre-determined depth, casing was set and a wire line diamond drill was then moved onto the prepared location. NX size tools (2-1/8 inch core diameter) were used until drill depth or drilling conditions required the hole diameter to be reduced; then BX size tools (1-5/8 inch core diameter) were used. Average recovery of core was over 90%.

From the recovered core, the following data and observations were recorded and sketched on the logs: rock type, alterations, mineralization, amount of fracturing, angle of fracturing and pitch of the slickensides, fault breccia and gouge, and contacts of major rock type changes.

When core holes were completed, they were surveyed for drift and inclination with a multiple-shot gyroscopic survey instrument. Degree of inclination and bearing of drift were recorded on 100 foot intervals and at major contacts.

With this drill hole survey data, the assay and geological data could be plotted in both vertical and horizontal positions with a high degree of accuracy (Fig. 6).

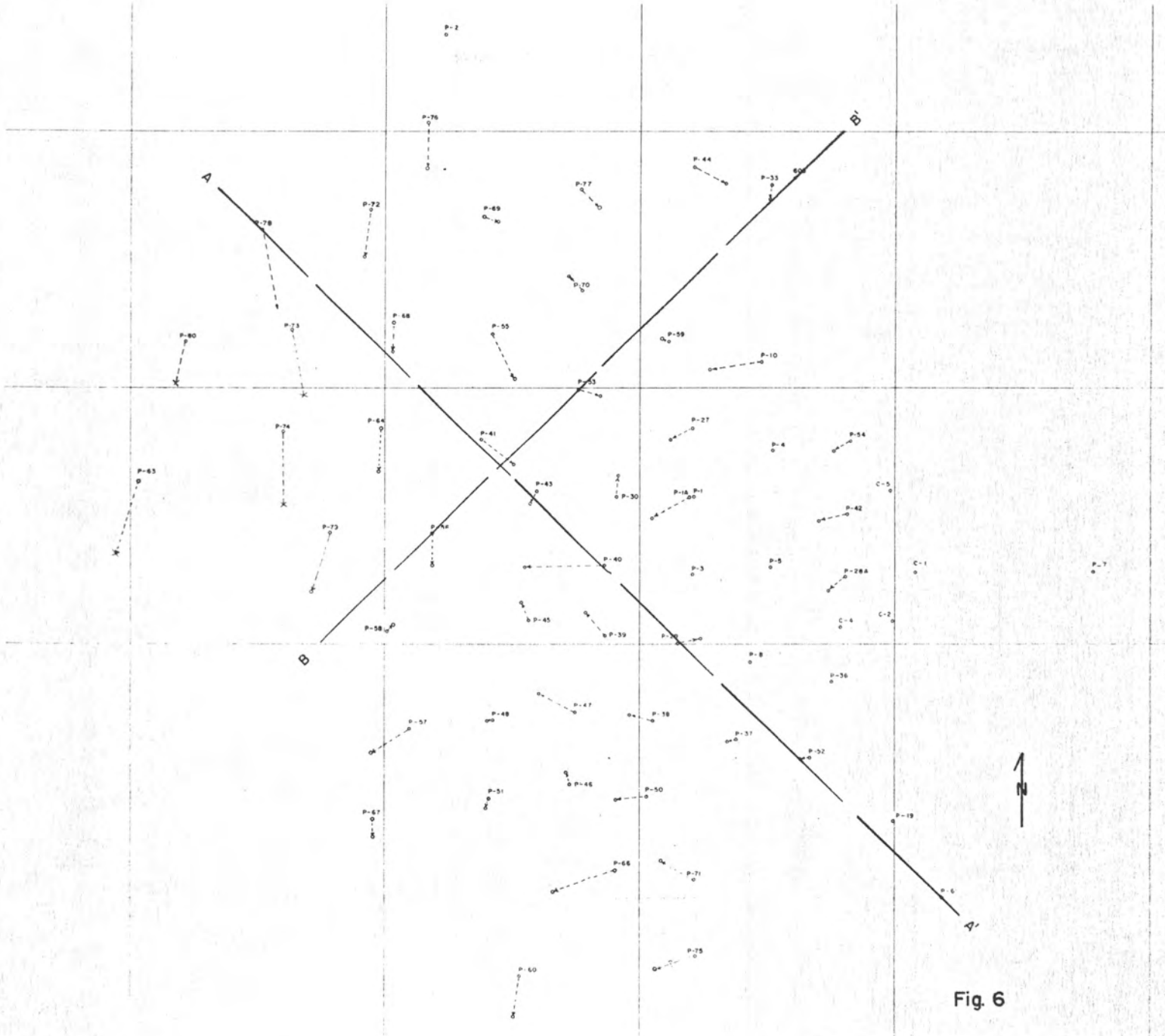


Fig. 6

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA MAGNETIC AND GYROSCOPIC DRIFT SURVEY		
SCALE: 1" = 200'	DATE: 2/19/69	REVISIONS
DRAWN BY: C.E.B.	CHECKED BY:	
TRACED BY:	APPROVED BY:	
DRAWING NO.		

Subsurface Mapping

To maintain control of drilling and indicate attitude and limits of assay and geological data, the following subsurface contour maps were prepared:

(1) The andesite-tactite contact

(2) The tactite-quartzite contact

(3) The quartzite-diorite contact

(4) The top and bottom of mineralization within the tactite

(5) The upper contact of the mineralized biotite porphyry

(6) The top and the lower drilling cut off of sulphide

(7) The top and bottom of oxide

(8) Base of the fanglomerate

With the above contoured data, isopach maps were drawn indicating direction and thickness of high grade oxides, sulphides, tactite, and mineralization within the tactite.

With the same contour maps, cross-sections could be drawn in any direction without regard to drift or alignment of core holes.

Interpretation of Subsurface Data

From the subsurface data, the following interpretations were made:

(1) The contours of the andesite-tactite contact form a subsurface that strikes $\pm$ north and dips $\pm$ 30° W (Fig. 7).

(2) The contours at the tactite-quartzite contact form a subsurface that strikes N $\pm$ 20° W and dips $\pm$ 20° SW, then turns to the northeast and dips to the northwest (Fig. 8). The curving contours

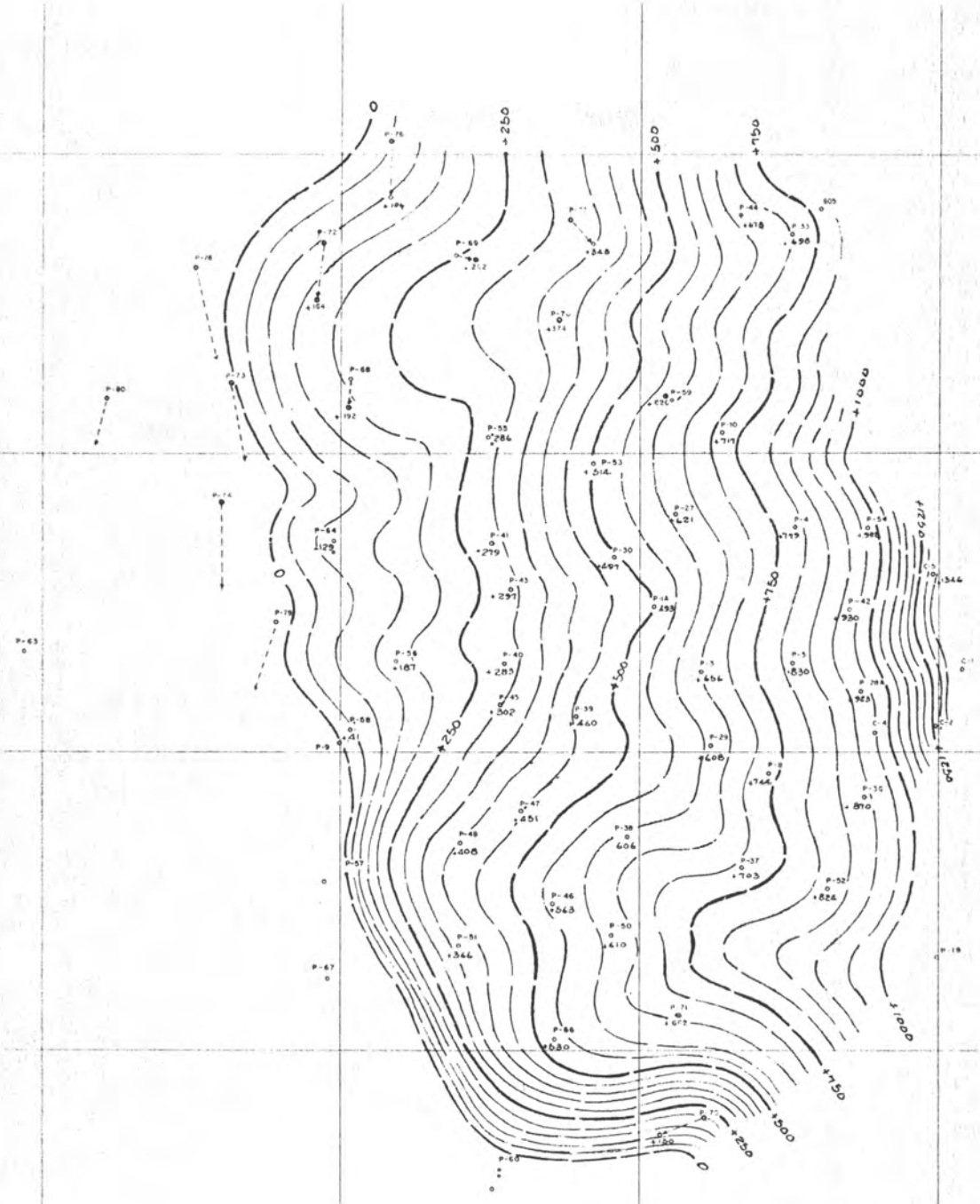


Fig. 7

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA CONTOURS ON TOP OF TACTITE CONTOUR INTERVAL 50 FEET		
SCALE 1" = 200'	DATE: 2/18/69	REVISIONS
DRAWN BY: C.E.B.	CHECKED BY:	
TRACED BY:	APPROVED BY:	
DRAWING NO. GEOLOGY BY: C.E. BARRON		

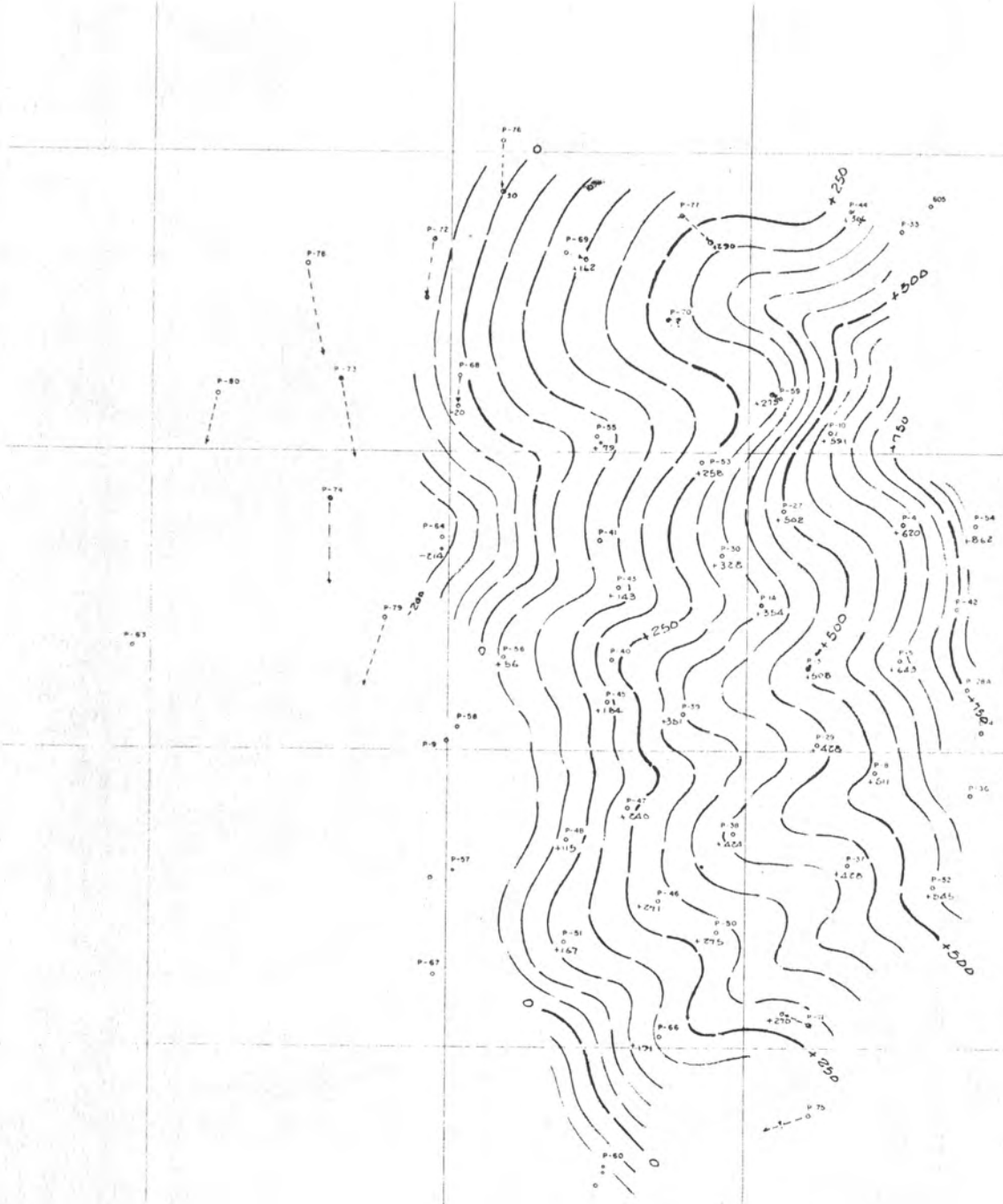


Fig. 8

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA CONTOURS ON TOP OF QUARTZITE CONTOUR INTERVAL 50 FEET		
SCALE: 1" = 200'	DATE: 2/19/69	REVISIONS
DRAWN BY: C E B	CHECKED BY:	
TRACED BY:	APPROVED BY:	
DRAWING NO.		
GEOLOGY BY: C E BARRON		

form a weakly nosing subsurface structure that plunges to the southwest. As the overlying andesite-tactite contact approaches this plunging structure, a thinning of the tactite occurs along a northeast trend and wedge-like thicknesses of tactite occur to the northwest and southeast of this zone of thinning. This thickening and thinning is best illustrated by an isopach of the tactite (Fig. 15).

(3) The more consistent thickness of mineralization, within the tactite, occurs in the wedge-like thickness southeast of the zone of thinning. Contours on the top and bottom of this mineralized thickness conform with the N 20 W strike and 20° SW dip of the underlying quartzite. The line of intersection of this mineralization with the overlying andesite trends NE and plunges SW, and terminates this thickness of mineralization in the zone of thinning. To the south and southeast of the zone of thinning, an increasing thickness of massive garnet and epidote occurs over the mineralization, and the mineralized horizon is divided into an upper and lower mineral thickness by an interbedded, fine-grained quartzite. Underlying this sulphide mineralization, a black and gray banded tactite is in contact with the underlying quartzite. This sequence of metasediments, which has been intruded by diabase and biotite porphyry, continues to the south and southeast until it has apparently been displaced by a major fault that trends N $\pm$ 20 W.

(4) To the east the metasediments are in contact with the diorite. Contours on this contact form a north trending subsurface that dips ± 60° W (Fig. 9).

(5) To the west the metasediments have been intruded by the biotite porphyry along a northeast trending contact zone. Along this contact zone the intrusive forms sills of irregular masses that occur in both the metasediments and the andesite. Better grade mineralization occurs along this zone of multiple sills (Fig. 16).

(6) Northwest of this contact zone the stock-like intrusive forms a more homogenous emplacement within the andesite but continues to form sills within the metasediments. Further to the northwest, the intrusive again forms a contact zone of multiple sills within the andesite (Fig. 16).

(7) Contours on top of the oxidized intrusive trend N 55 E and form a ± 40° slope along the northwest side (Fig. 10). On the southeast side the contours indicate a much steeper slope, and to the southwest, the intrusive apparently has been displaced in this horizon by a high angle normal fault that strikes ± N 20 W. Limits of the intrusive have not been determined to the north and northeast.

(8) Contours on top of the oxide mineralization form an irregular horizon in the subsurface west of the Lakeshore pit; then this horizon forms a northwestern dip and passes through the top of the mineralized intrusive. As the oxide zone passes through the

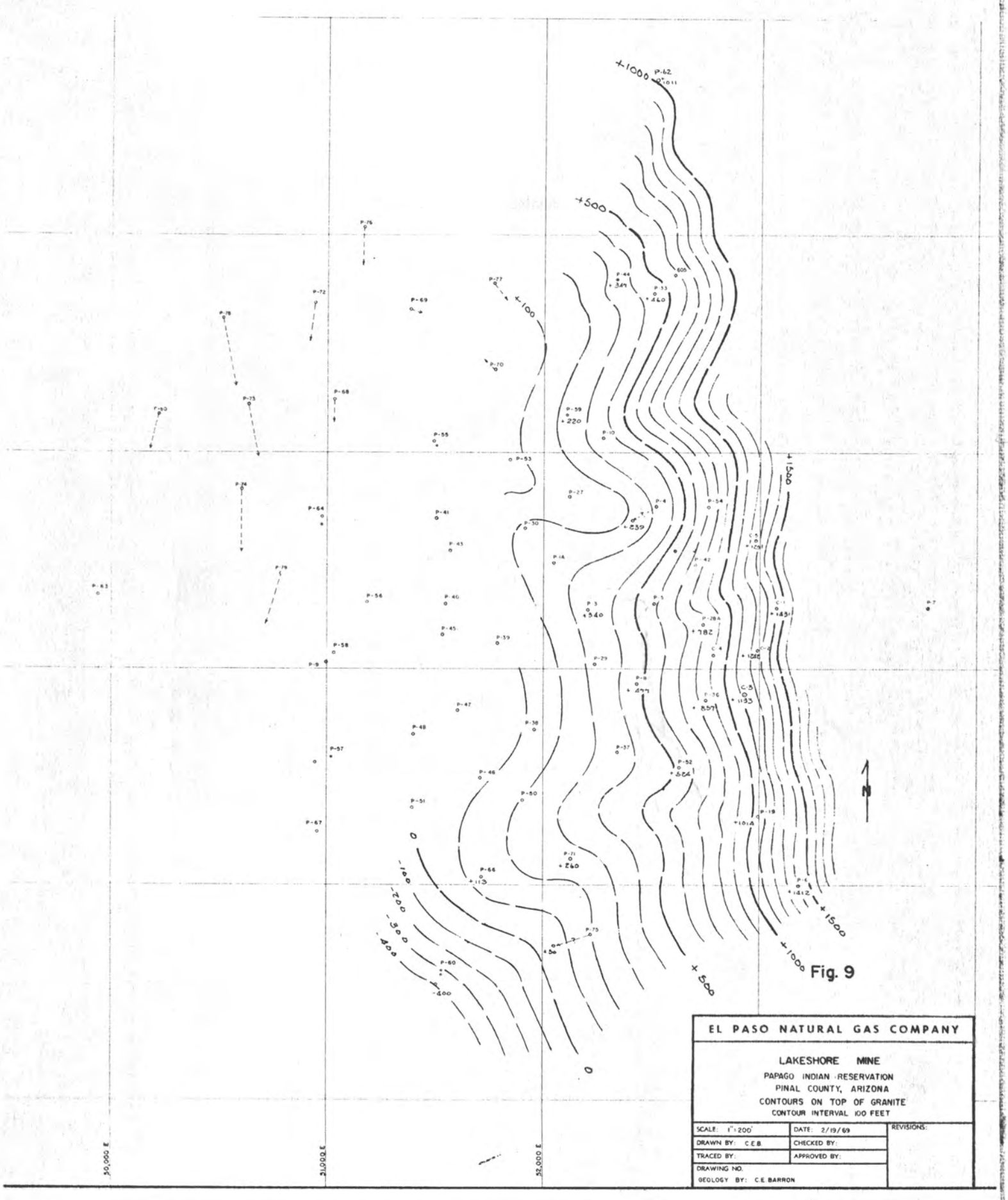


Fig. 9

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS ON TOP OF GRANITE
CONTOUR INTERVAL 100 FEET

SCALE: 1" = 200'	DATE: 2/19/69	REVISIONS:
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GEOLOGY BY: C.E. BARRON		

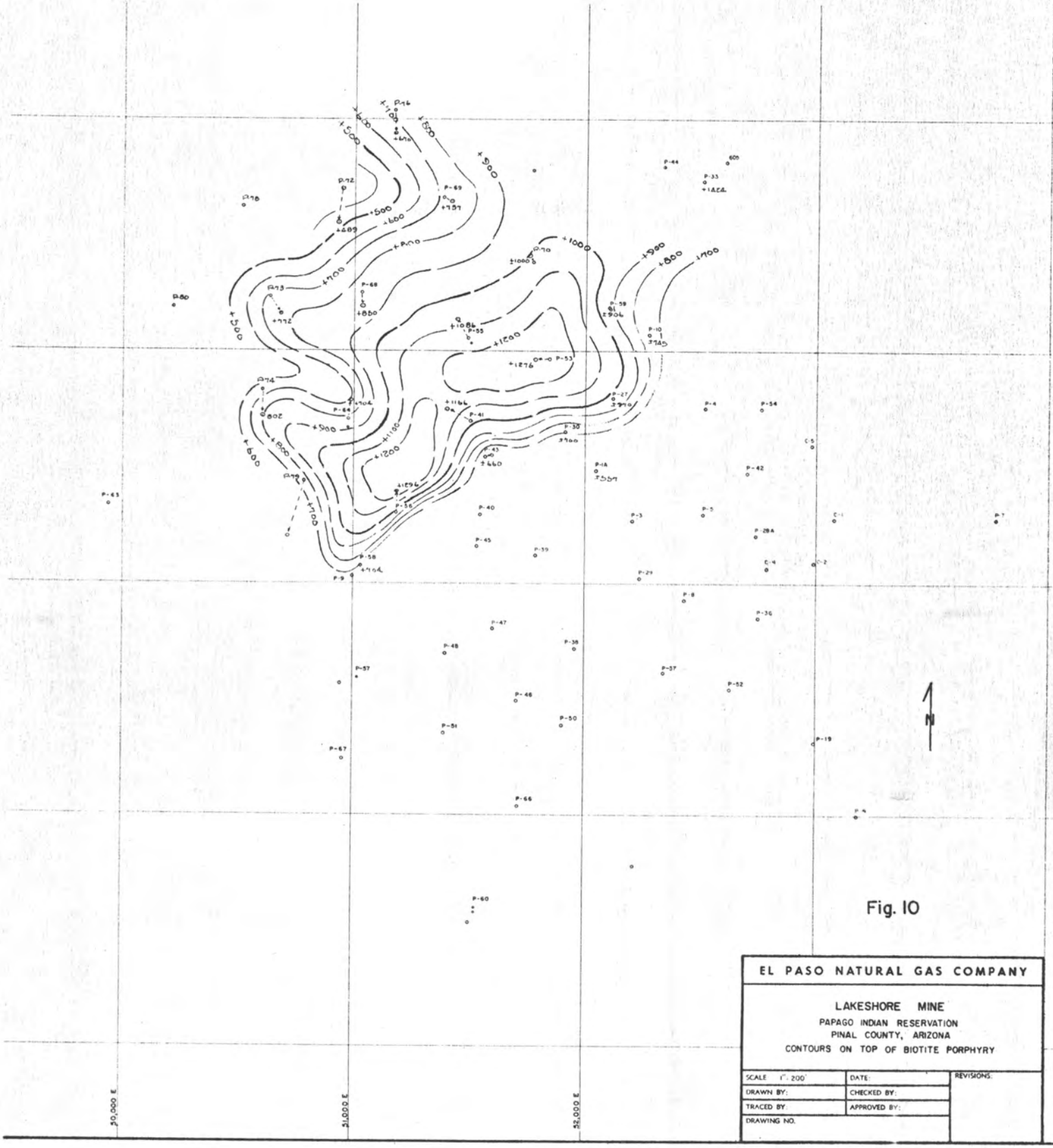

Fig. 10

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA CONTOURS ON TOP OF BIOTITE PORPHYRY		
SCALE 1" : 200'	DATE:	REVISIONS:
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DRAWING NO.		

upper part of the intrusive, a ± 100 foot thick blanket of ± 1.5% copper oxide mineralization occurs at the base of the oxides. This mineralization trends to the northeast along the top of the intrusive and dips to the northwest. As the dip of the oxide mineralization increases to the northwest, the high grade oxide mineralization thins and a zone of chalcocite has formed an enriched upper thickness of sulphide mineralization (Fig. 11).

(9) Contours at the top of sulphide mineralization form a low trough that plunges to the southwest along the southeast flank of the biotite porphyry intrusive. This oxide-sulphide transition horizon then climbs to its highest elevation within the top of the intrusive and forms a northeast trend that dips to the NW. To the southwest the contours turn sharply to the northwest or southeast and form a N ± 20° W trending horizon that dips ± 70° SW (Fig. 12).

(10) The isopach of the sulphides indicates a wedge-like thickness of mineralization. The thin edge, ± 300 feet thick, occurs along the northeast trending contact zone of the intrusive and the metasediments. To the northwest of this contact zone and along the apparent fault zone, the mineralized zone thickens to over 1000 feet. Some core holes in this zone have an average assay value of .85% copper for 1000 feet of recovered core. The limits of mineralization to the northwest and north of this area have not been determined (Fig. 14).

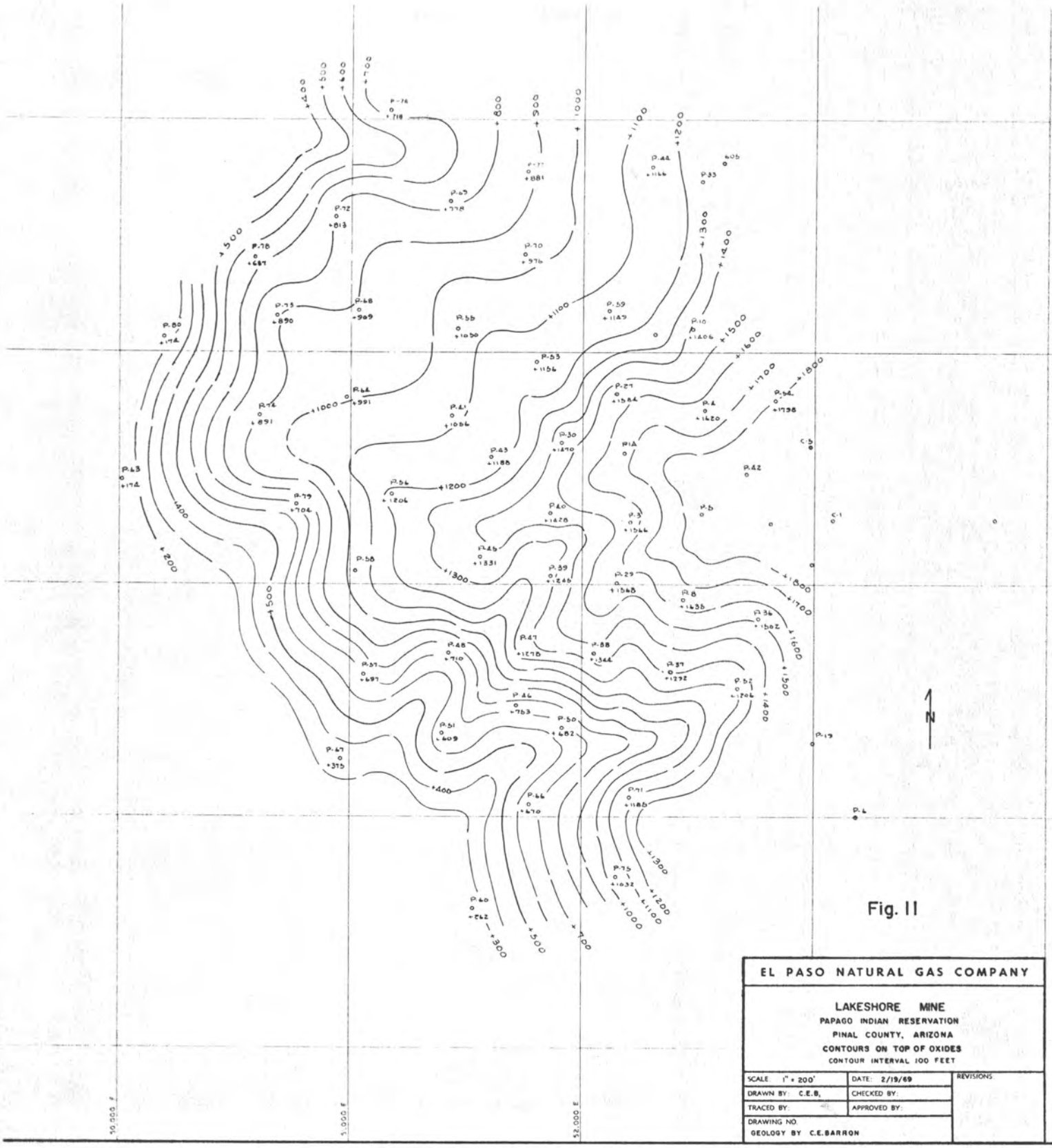

Fig. 11

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA CONTOURS ON TOP OF OXIDES CONTOUR INTERVAL 100 FEET		
SCALE: 1" = 200'	DATE: 2/19/69	REVISIONS
DRAWN BY: C.E.B.	CHECKED BY:	
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Fig. 12

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE

PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA

CONTOURS ON TOP OF SULPHIDES
CONTOUR INTERVAL 100 FEET

SCALE: 1" = 200'	DATE: 2/19/69	REVISIONS:
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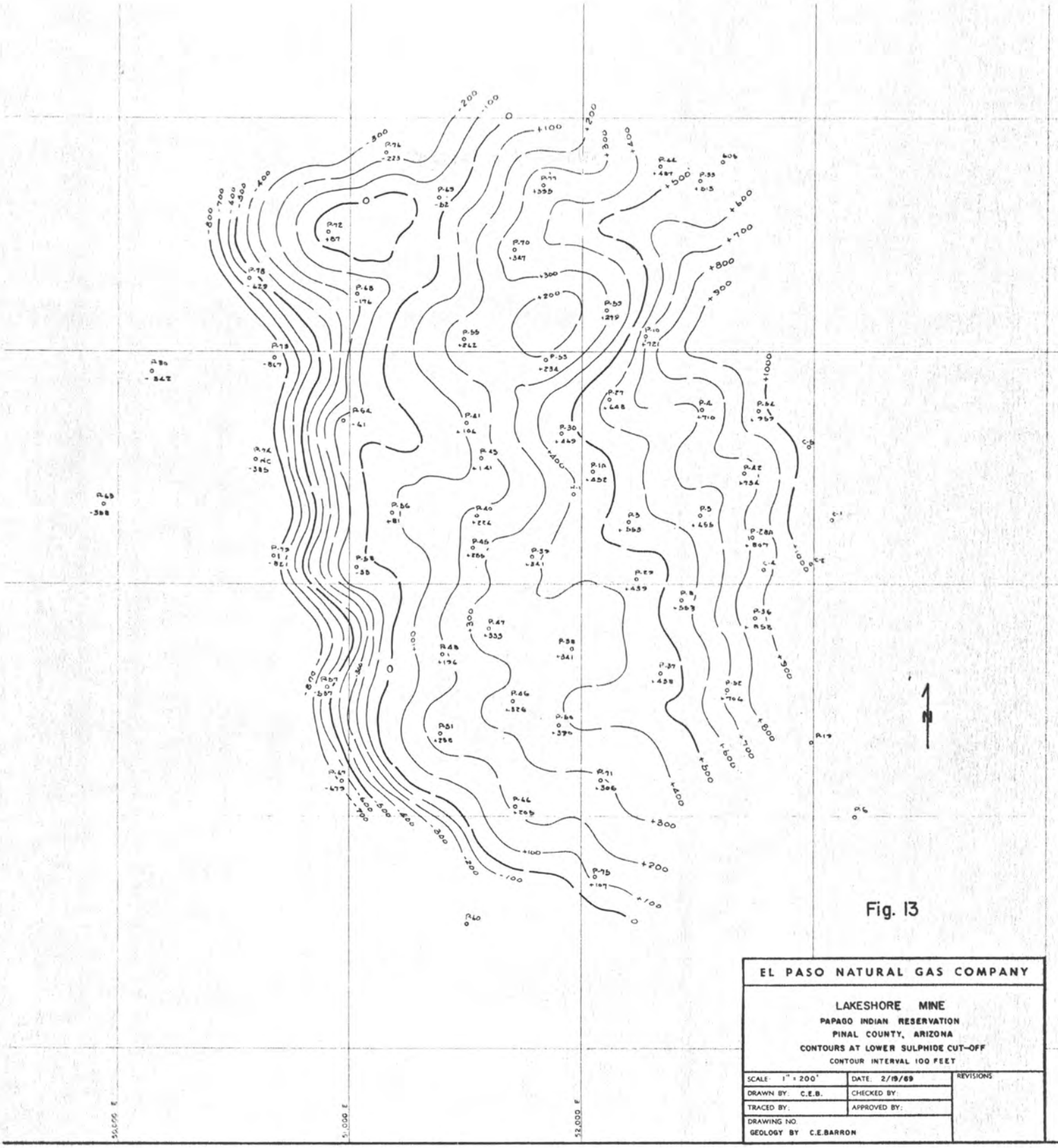
GEOLOGY BY: C.E.BARRON		


EL PASO NATURAL GAS COMPANY
LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS AT LOWER SULPHIDE CUT-OFF
CONTOUR INTERVAL 100 FEET
SCALE: 1" = 200'
DATE: 2/19/69
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GEOLOGY BY C.E.BARRON
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Fig. 13

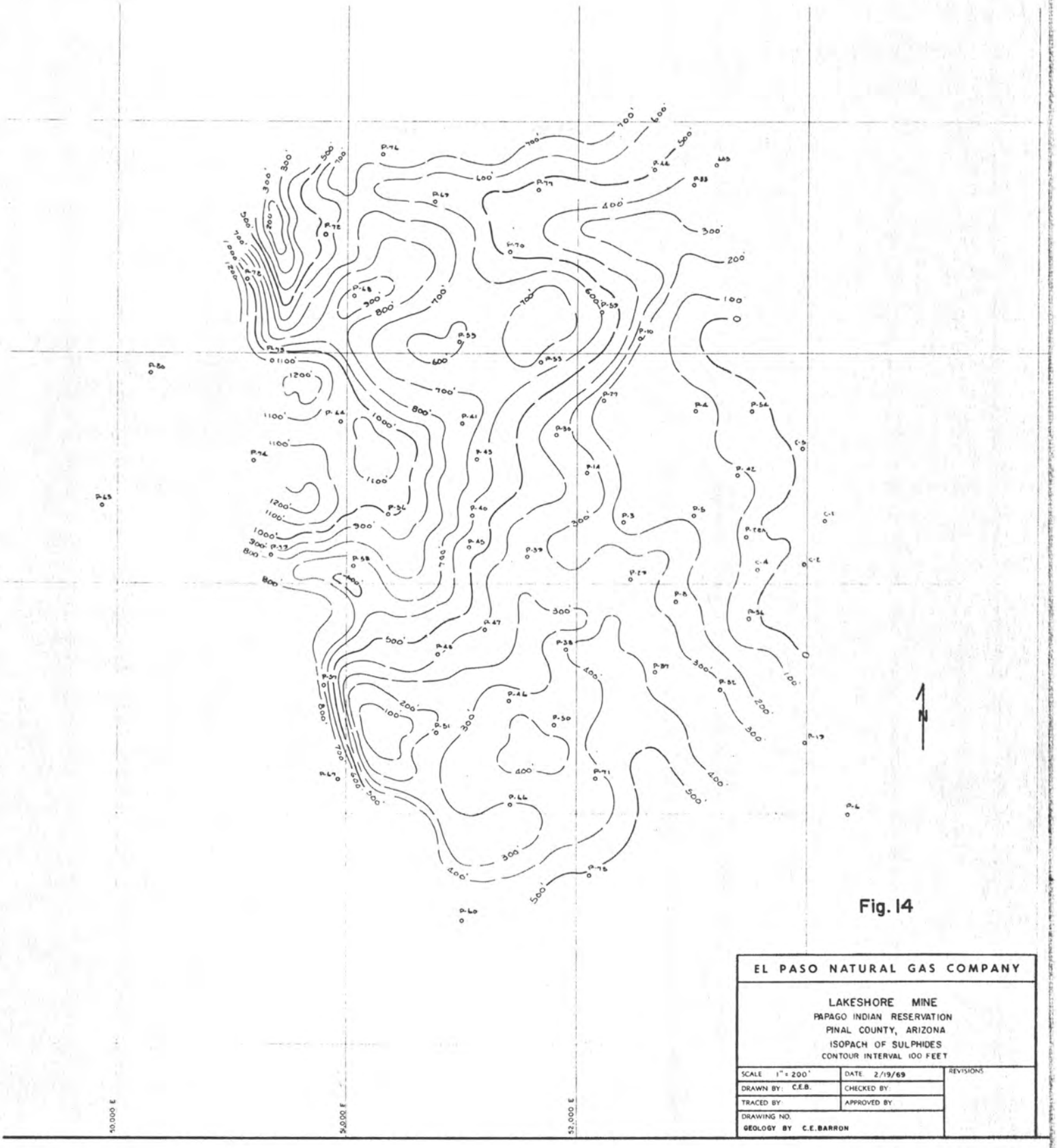

Fig. 14

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA ISOPACH OF SULPHIDES CONTOUR INTERVAL 100 FEET		
SCALE 1" = 200'	DATE 2/19/69	REVISIONS
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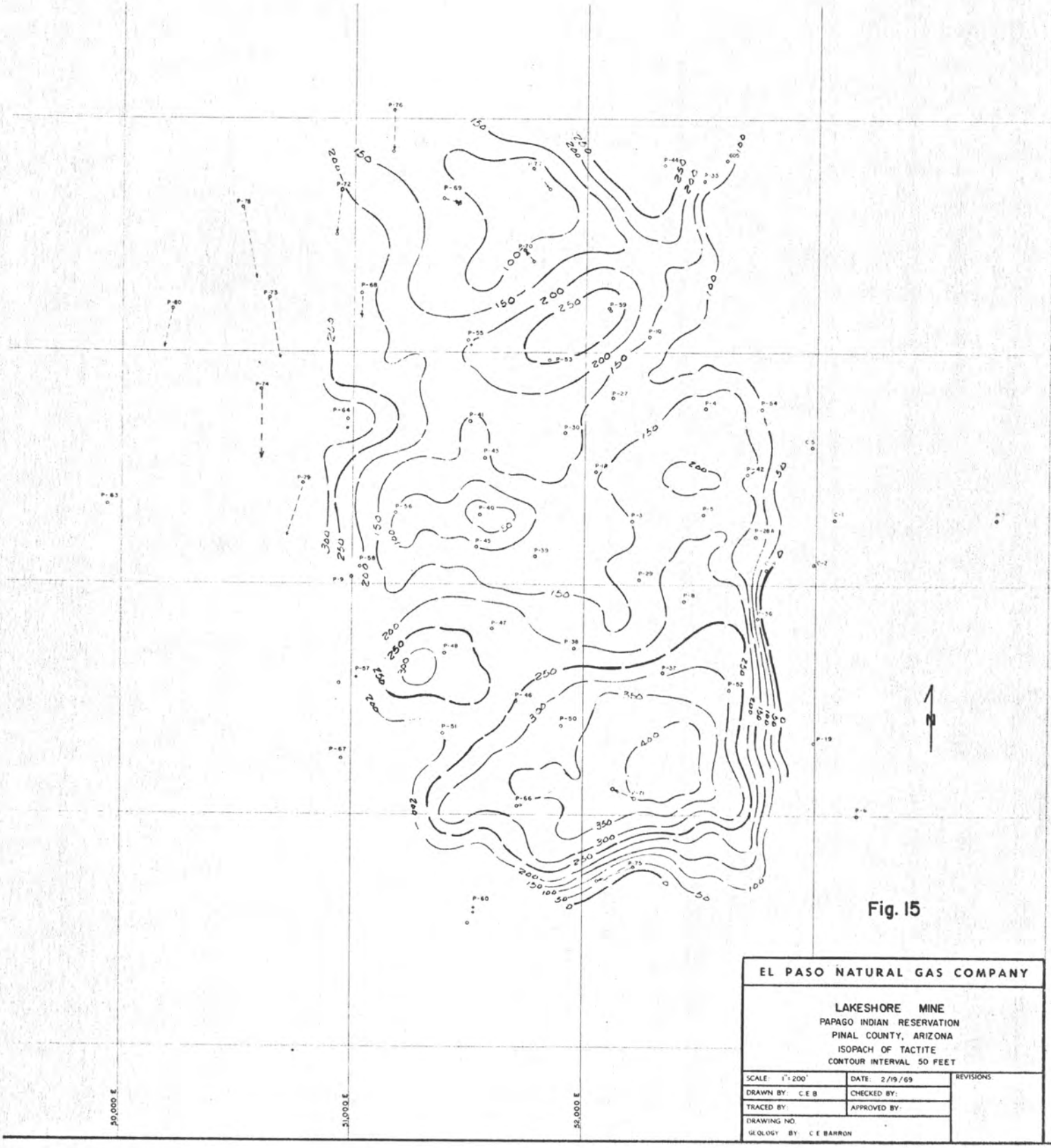

Fig. 15

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA ISOPACH OF TACTITE CONTOUR INTERVAL 50 FEET		
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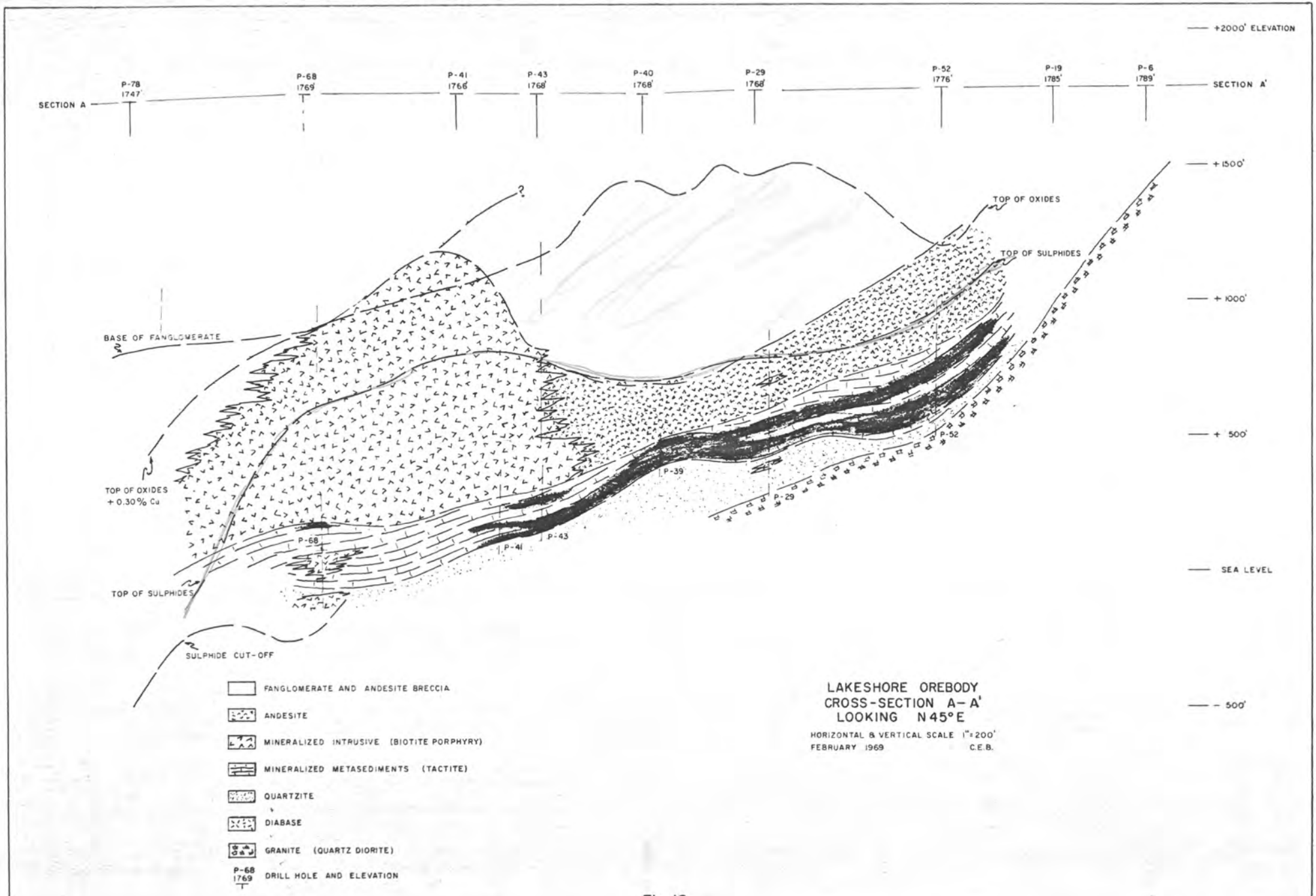
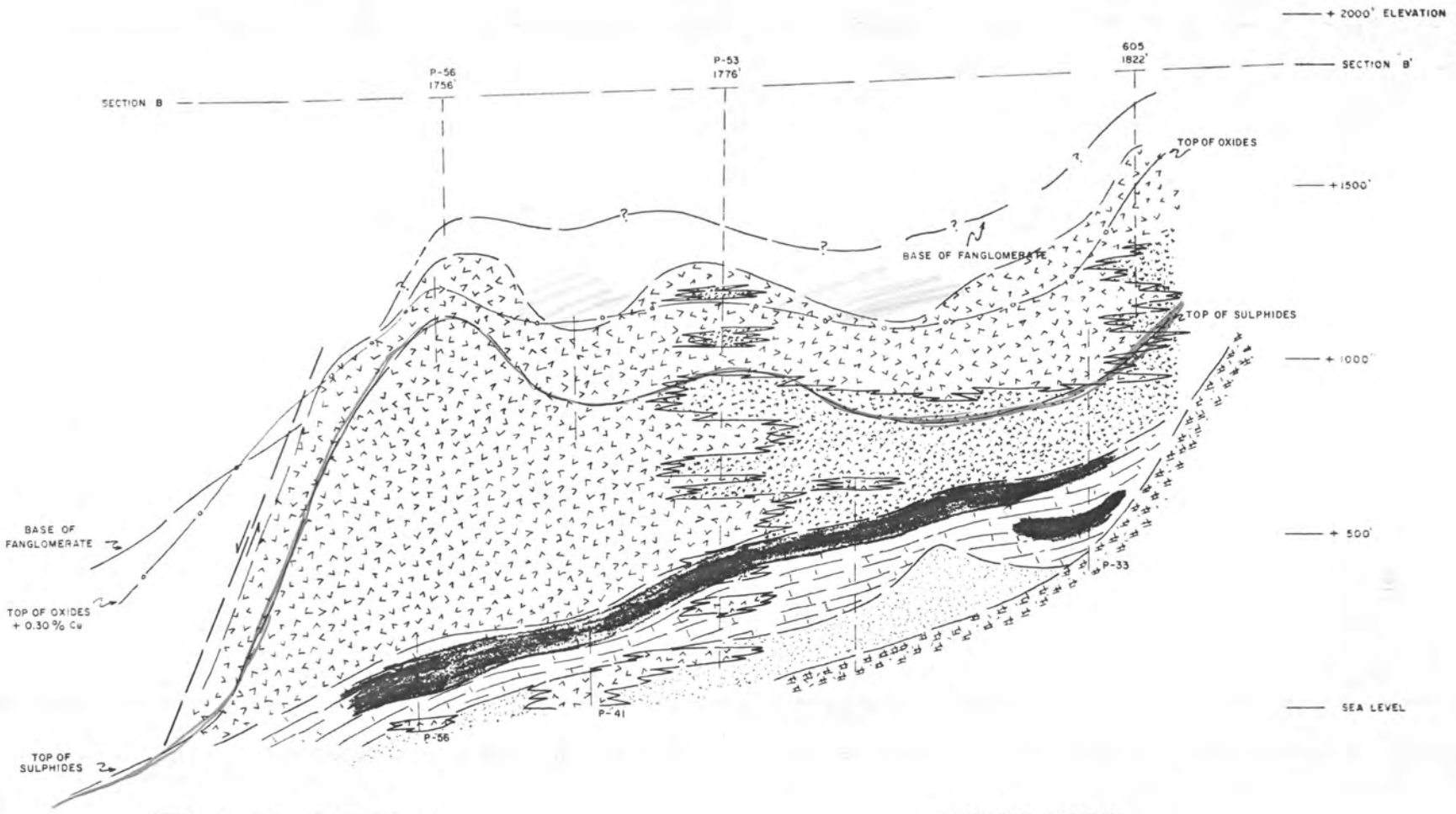

+2000' ELEVATION
SECTION A
P-78 1747'
P-68 1769'
P-41 1766'
P-43 1768'
P-40 1768'
P-29 1768'
P-52 1776'
P-19 1785'
P-6 1789'
SECTION A'
+1500'
+1000'
+500'
SEA LEVEL
-500'
TOP OF OXIDES
TOP OF SULPHIDES
BASE OF FANGLOMERATE
TOP OF OXIDES + 0.30% Cu
SULPHIDE CUT-OFF
P-52
P-39
P-29
P-43
P-41
P-68
FANGLOMERATE AND ANDESITE BRECCIA
ANDESITE
MINERALIZED INTRUSIVE (BIOTITE PORPHYRY)
MINERALIZED METASEDIMENTS (TACTITE)
QUARTZITE
DIABASE
GRANITE (QUARTZ DIORITE)
P-68 1769 DRILL HOLE AND ELEVATION
LAKESHORE OREBODY
CROSS-SECTION A-A'
LOOKING N45°E
HORIZONTAL & VERTICAL SCALE 1"=200'
FEBRUARY 1969 C.E.B.

Fig. 16



LAKESHORE OREBODY
CROSS-SECTION B - B'
LOOKING N 45° W

HORIZONTAL & VERTICAL SCALE 1" = 200'
FEBRUARY 1969 C.E.B.

Fig. 17

(11) Overlying the highly fractured and altered andesite, biotite porphyry and tactite is a relatively unfractured, weakly cemented fanglomerate that thickens from ± 100 feet at the edge of the valley to ± 1500 feet around the southwest end of the biotite porphyry and is apparently in contact with the altered and oxidized top of this intrusive.

In summation, the geological data indicates the occurrence of mineralization at Lakeshore to be the result of the emplacement of a weakly mineralized biotite porphyry. This stock-like mass formed a multiple sill contact with eroded and deformed metasediments and the overlying andesites and breccia. The processes of contact metamorphism formed tactite or skarn in the metasediments and a higher grade of sulphide mineralization was deposited in the more favorable carbonates. Post-mineral faulting and fracturing formed channels for erosion, leaching, and enrichment of mineralization. This mineral deposit was tilted to the northwest and underwent a second period of erosion and oxidization. This oxidized and fractured surface was then buried by the present overlying fanglomerate (Fig. 17).

COMPUTER EVALUATION

During March and April of 1968, a computer evaluation of the assay and geological data from 23 core holes was performed by an independent consultant (7). This evaluation provided the following information:

(1) Ore reserves, tonnage and grade of the sulphide and oxide mineralization for various cut-off grades and thicknesses;

(2) Level plans at various vertical intervals showing contours of sulphide copper values;

(3) Vertical cross-sections of the sulphide copper values;

(4) A confidence interval analysis to determine future drilling requirements; and

(5) A financial analysis based on ore reserves of varying cut off grades, and the following parameters - mining cost and mining methods, concentrator capacity and recovery, metal prices, capital requirements and financing, royalty, sales agreements, and taxation.

In May 1968, ore reserves based on assay and geological data from 23 holes was reported as follows:

1. Tactite reserves, based on a cut-off grade of 0.75% copper, were 13.7 million tons with an average grade of 1.84% copper.
2. Porphyry reserves including tactite, based on a cut-off grade of 0.50% copper, were 59 million tons with an average grade of 0.99% copper.

During September 1968, the assay and geological data was again submitted to an independent consultant (8) for computer evaluation. The following reserves were reported:

1. Porphyry reserves based on mineralization with a thickness greater than 200 feet and a cut-off grade of 0.50% copper were 86 million tons with an average grade of 0.81% copper. This included tactite material lying under the porphyry.

2. Tactite reserves, outside the porphyry area and with a cut-off grade of 1.00% copper, were 10 million tons with an average grade of 1.73% copper.

In November 1968, with the data from 42 core holes, the following up-dated ore reserves, classified as a total of proved and probable, were reported:

1. Porphyry reserves based on mineralization with a thickness greater than 200 feet and a cut-off grade of 0.50% copper, were 132.0 million tons with an average grade of 0.81% copper. This included 9 million tons of tactite material lying under the porphyry.
2. Tactite reserves, outside the porphyry area and with a cut-off grade of 1.00% copper, were 10 million tons with an average grade of 1.73% copper.
3. Oxide reserves, based on a cut-off grade of 0.50% copper, were 85 million tons with an average grade of 0.81% copper.

On February 7, 1969, with data from 51 core holes, the following ore reserves classified as a total of proved and probable, were reported:

1. Porphyry reserves, based on a cut-off grade of 0.40% copper, were 241 million tons with an average grade of 0.70% copper.
2. Tactite reserves, based on a cut-off grade of 1.00% copper, were 24 million tons with an average grade of 1.69% copper.
3. Oxide reserves, based on a cut-off grade of 0.40% copper, were 207 million tons with an average grade of 0.71% copper.

CONCLUSION

In the opinion of the writer, the discovery of sulphide mineralization at Lakeshore was the result of a successful interpretation of combined geologic and geophysical data. The rotation of the mineralized metasediments to an assumed pre-tilt attitude gave a reason for projecting these metasediments to the northwest. The I. P. anomalies were correlated with this assumed northwest projection.

At the end of this phase of the exploration program, the majority of mineralized core holes have been collared within or near the limits of the proposed drilling target (Fig. 18). The interpretation that assumed overturning of metasediments by tilting to the northwest has been strengthened by three core holes which were collared in the oxide ore body and again entered mineralized metasediments at depth after penetrating the andesites. The discovery of the mineralized tactite led to the discovery of sulphide mineralization in the biotite porphyry intrusive and a "porphyry copper" deposit.

The gyroscopic drift survey of drill holes accurately located the subsurface position of the assay and geologic data that was obtained from the diamond drill cores, and gave the necessary vertical and horizontal control for the preparation of subsurface maps and cross sections and for computer evaluation of the mineral deposit.

Computer evaluation proved to be an efficient and rapid method of obtaining and updating grade and tonnage estimates during the exploration program.

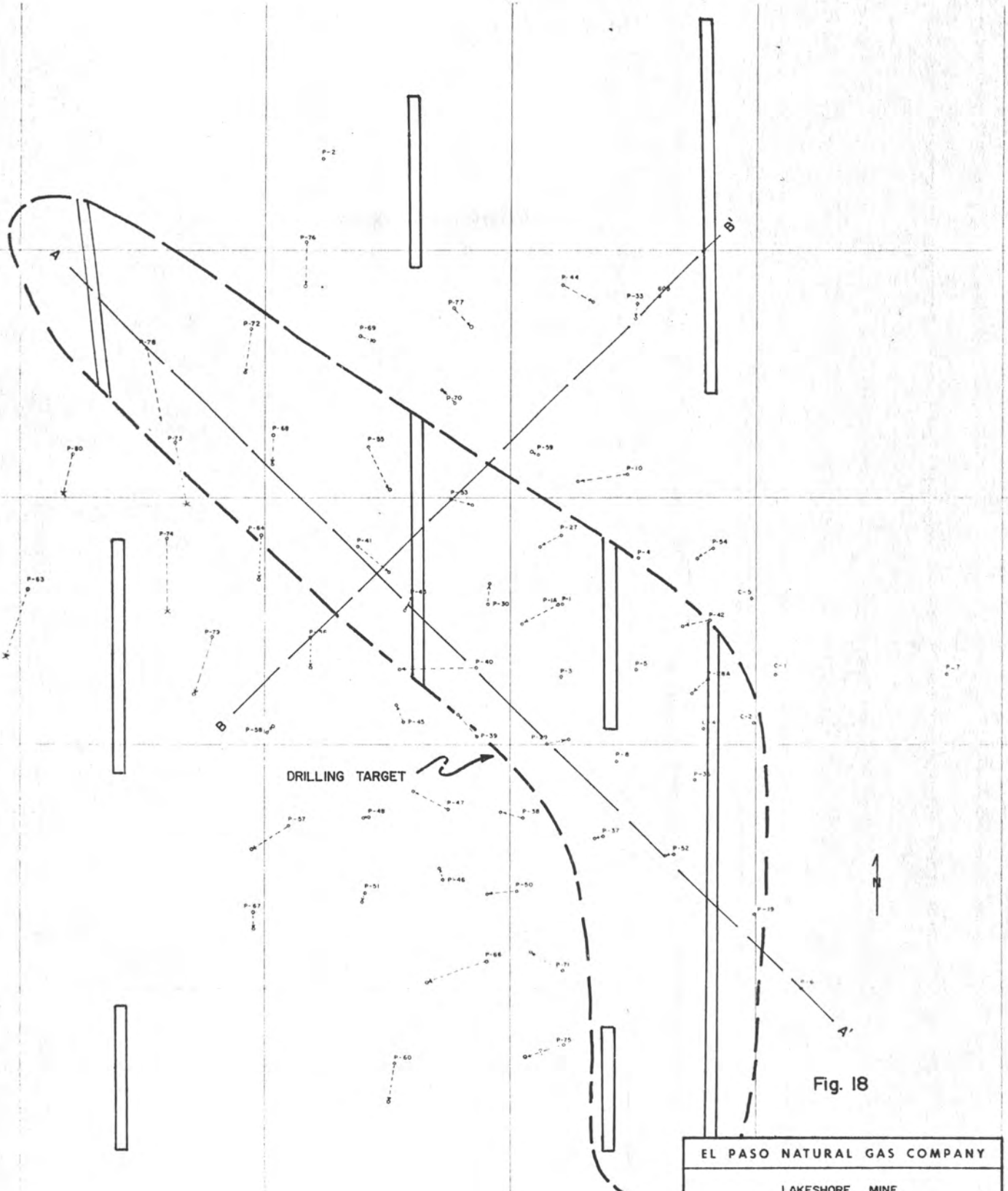


Fig. 18

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
MAGNETIC AND GYROSCOPIC DRIFT SURVEY

SCALE 1"=200'	DATE 2/19/69	REVISIONS
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ACKNOWLEDGMENTS

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(7) Richard F. Hewlett and Associates, Computer Applications Consultants, Tucson, Arizona.

(8) Systems Development Division of Computech Research, Ltd., Tucson, Arizona.

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A GEOPHYSICAL CASE HISTORY OF THE LAKESHORE OREBODY

Note 500' area to 5n! ??

by

Philip G. Hallof,

and

Emil Winniski.

Presented at the S.E.G. Annual Meeting
New Orleans, Louisiana, November 1970

McPHAR GEOPHYSICS LIMITED
139 BOND AVENUE, DON MILLS, ONTARIO, CANADA

ABSTRACT

The Lakeshore Orebody occurs in Pinal County, Arizona about 30 miles south of Casa Grande. In February 1969, when the latest figures were published, the ore reserves were reported at 241 million tons of disseminated sulphide ore (0.7% Cu) and 24 million tons of concentrated metallic ore (1.69% Cu).

The first hole intersected primary ore (magnetite, pyrite, chalcopyrite) in the metasediments (tactite) at a depth of 1147 feet in early 1967. The successful conclusion of this exploration program by El Paso Natural Gas Company is an excellent example of an integrated exploration approach. The application of regional geological planning, geophysical methods and detailed geological reasoning resulted in the discovery of a major copper orebody.

Due to the depth of the ore zone, and the less than massive character of the ore, the only geophysical technique that was useful in the direct detection of the ore mineralization was the induced polarization method. Variable frequency induced polarization measurements, made using the dipole-dipole electrode configuration and electrode intervals from 300' to 1,000', successfully indicated the presence of the metallic mineralization at depth, and gave some indication of its extent.

Comparisons of the induced polarization data and the appropriate geological sections give information concerning the usefulness of the method.

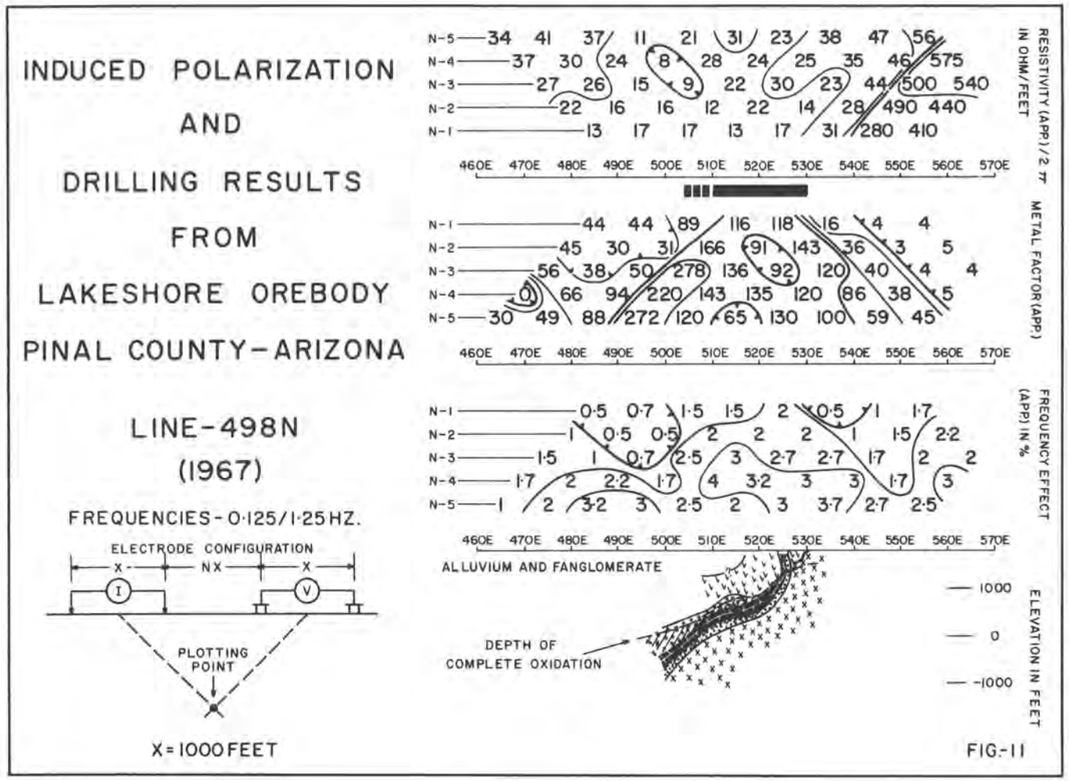
Natural Gas Co. was accomplished by the application of integrated exploration techniques. All of the available geological and geophysical data was considered; not just once, but repeatedly. The success of the program was due in large part to the patient re-evaluation of geophysical and geological data by the Geologic Staff of El Paso Natural Gas Co.

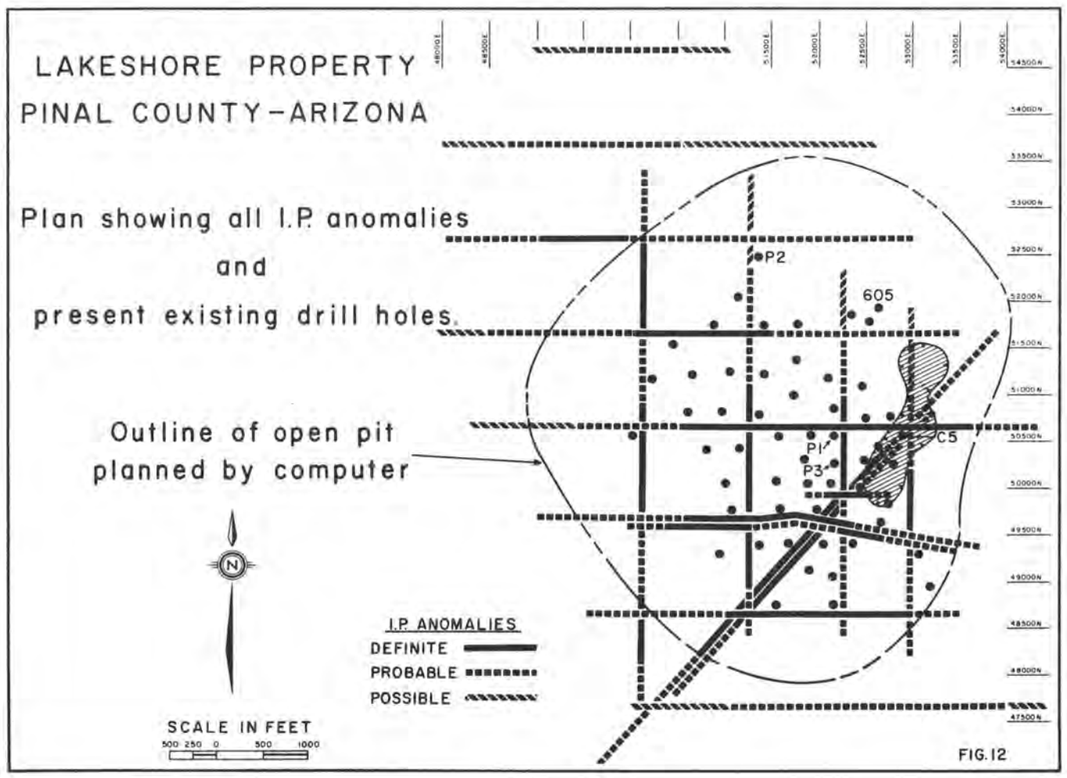
Our thanks are due to the Management of El Paso Natural Gas Co. for permission to publish the data presented. We are greatly indebted to Mr. John R. Reynolds, Manager of Exploration, and Claude E. Barron, Senior Geologist, of El Paso Natural Gas Co. for their help in the preparation of the geological aspects of the paper. Mr. H.E. Harper of Hecla Mining Co., who are Managers of the current development at Lakeshore, was kind enough to review the paper and gave permission for its presentation.

References

1) Barron, Claude E. " Exploration at the Lakeshore Mine".
Presented at the Annual Meeting of the New Mexico Mining Association November 1969.

2) Harper, H.E. and Reynolds, J.R. "The Lakeshore Copper Deposit".
Presented at the 1969 Mining Congress, San Francisco, California October 1969.





Introduction

On February 7,1969 an announcement was made by El Paso Natural Gas Co. that the latest calculations for the Lakeshore Orebody gave 241 million tons of disseminated sulphide ore averaging 0.70% copper and 24 million tons of concentrated (tactite) metallic ore containing 1.69% copper. This was the latest announcement that has been made. The orebody is currently being developed jointly by El Paso Natural Gas Co. and Hecla Mining Co.

The discovery of this major copper deposit by the Mineral Division of El Paso Natural Gas Co. was the result of a well planned, integrated exploration program. The application of regional geological studies, modern geophysical techniques and detailed geological reasoning all contributed to the success of the program.

The Lakeshore Orebody lies under the southwest pediment of the Slate Mountains in Section 25, T10S, R4E, Pinal County, Arizona. (Fig. 1). This location is in the Papago Indian Reservation, about 30 miles south of Casa Grande, Arizona and 70 miles northwest of Tucson. The surface elevation in this area is about 1,800 feet.

Interest in the area dates back to the early 1880's. The mineralized outcrop consisted primarily of copper silicates and iron oxides. Between 1917 and 1919, a shaft was sunk to a depth of 225 feet. An excellent history of the Lakeshore Property is given in the paper by Harper and Reynolds (1969).

El Paso Natural Gas Co. first examined the area in 1962, but the mineral rights to the Lakeshore Property were not acquired until mid-1966. Investigations were begun into processes to recover the copper in the copper silicates exposed in the old Lakeshore Pit. At the same time, regional exploration was initiated. After preliminary geologic studies, a reconnaissance induced polarization survey was completed by McPhar

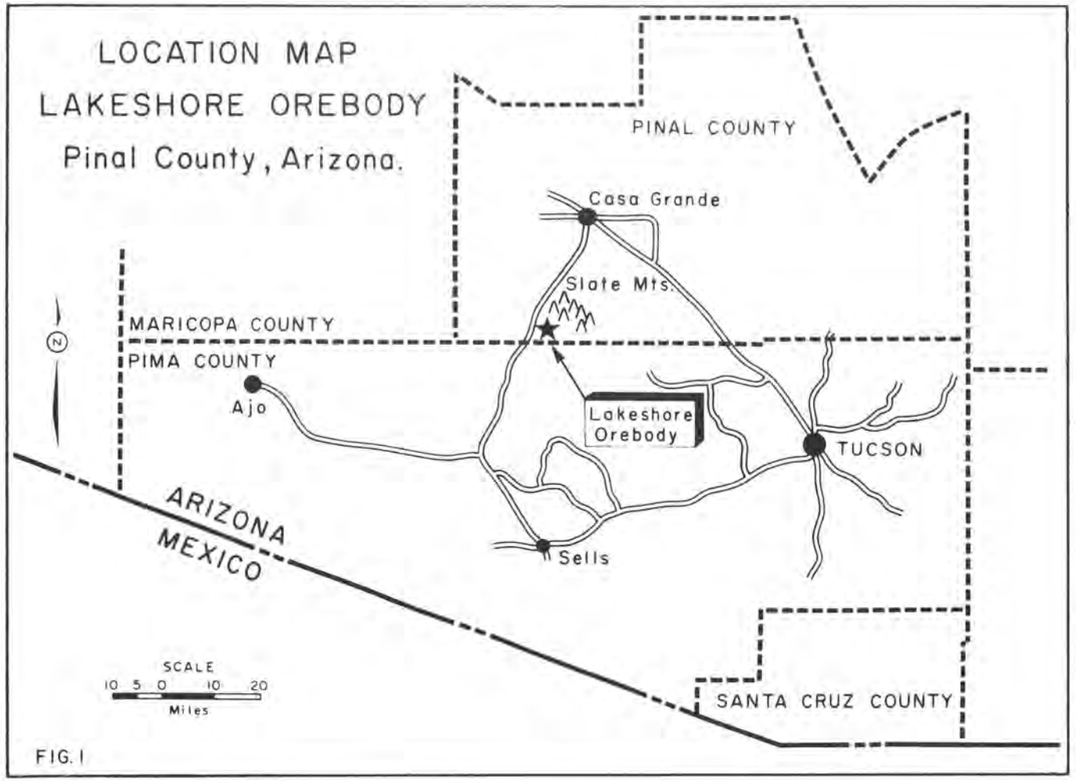


FIG. 1

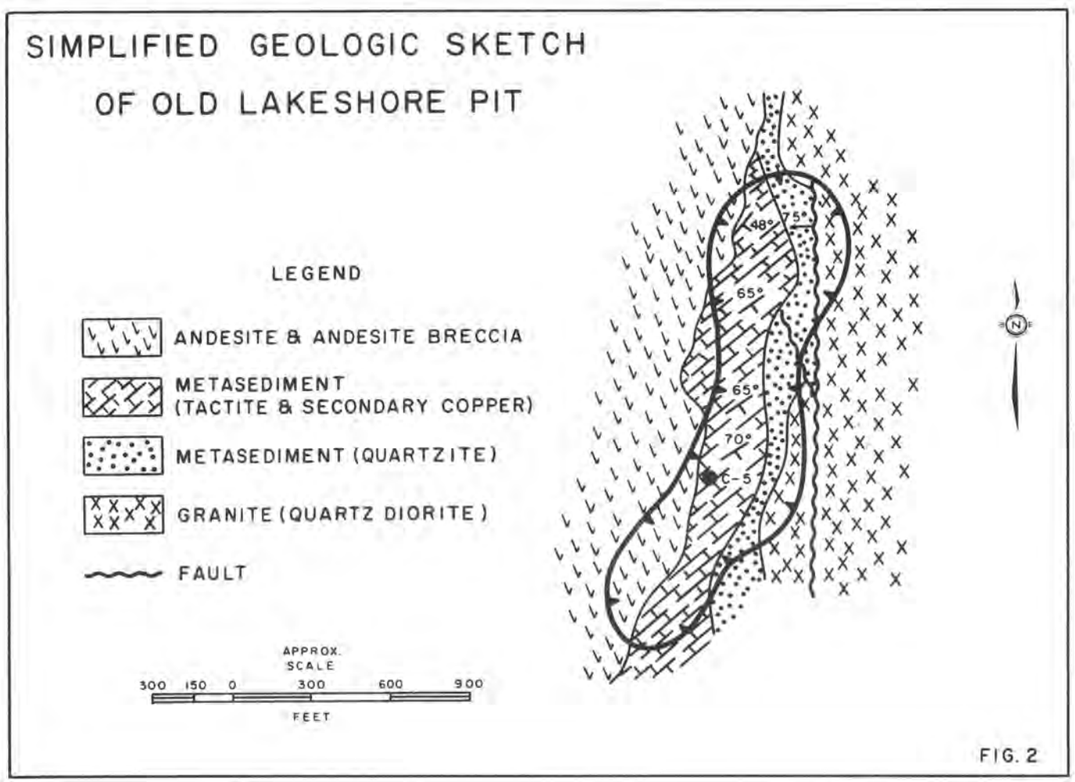


FIG. 2

shown on Figure 11. The IP anomaly centred at 520E correlates with the centre of the Lakeshore Orebody. The apparent frequency effect values and the apparent Metal Factor values are definitely anomalous. With 1000' electrode intervals, it is probable that the IP anomaly is due to the entire volume of metallic mineralization rather than just the near-vertical, up-dip end of the tactite zone that gave rise to anomalies when shorter electrode intervals were used.

Conclusions

The variable frequency IP results described above were chosen to demonstrate the role played by geophysics in the discovery and evaluation of the major copper deposit at the Lakeshore Property. The IP measurements at Lakeshore were made at irregular intervals over a period of three years. Some of the results contributed to the eventual discovery of the ore; in other cases the results were misleading. Now that more complete geological data is available, it is, of course, possible to explain all of the effects measured.

On Figure 12, we have shown all of the anomalies interpreted during the various IP surveys at Lakeshore. Also shown are all of the drill holes completed prior to November 1969. The line surrounding all of the IP anomalies is the surface outline of a sample open pit prepared as the result of one, of several, computer analyses of the drill hole data. The correlation is quite specific.

Acknowledgements

The authors feel that there is a lesson for all exploration people in the history of the discovery of the Lakeshore Orebody. The successful conclusion of the Exploration Program by the Mineral Division of El Paso

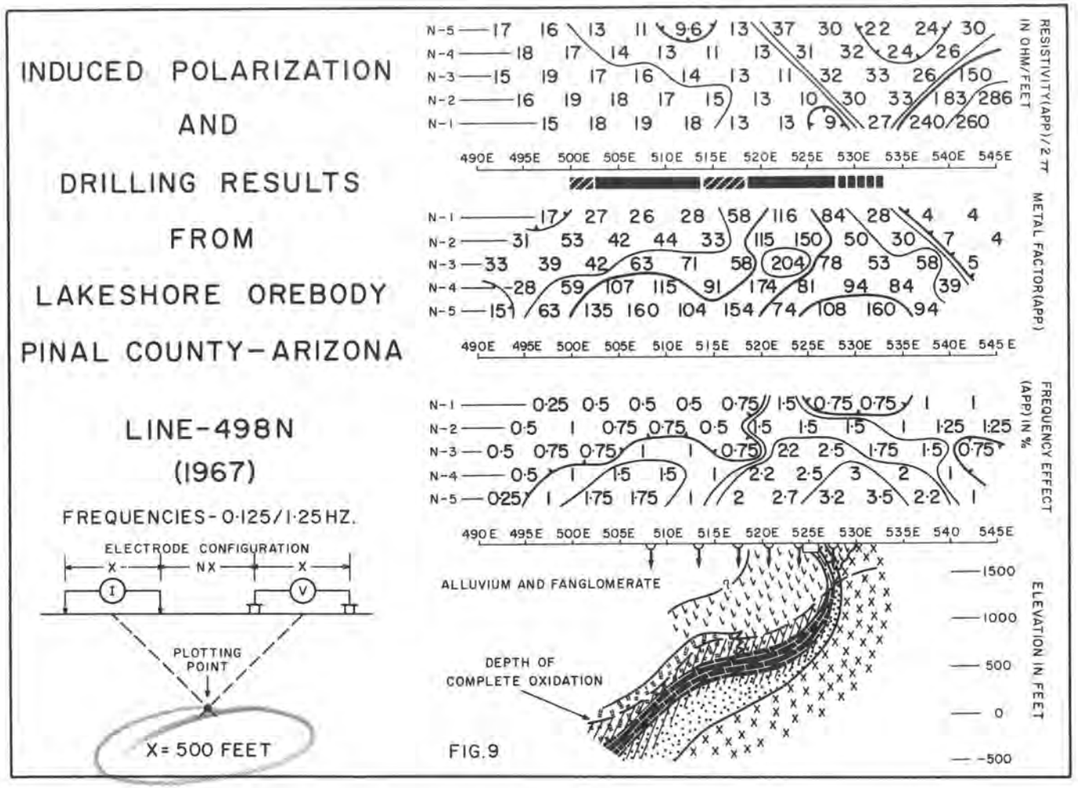


FIG.9

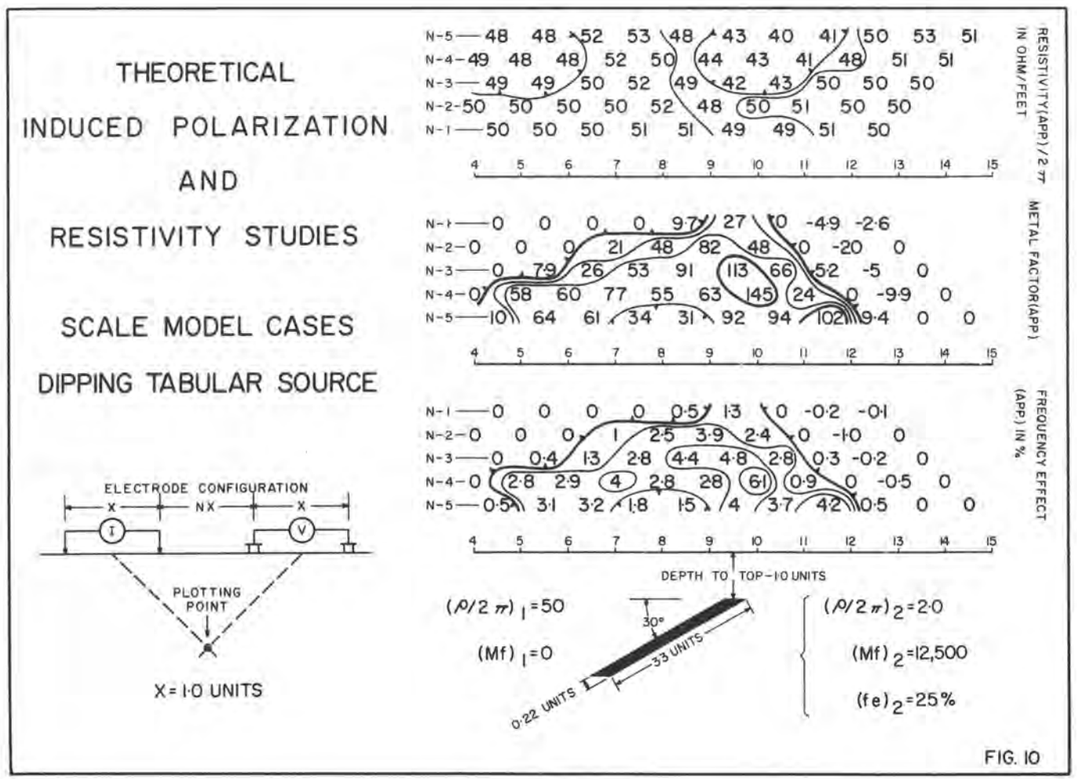


FIG. 10

Geophysics Inc. in August - September 1966. The IP survey was planned to locate any zones of metallic mineralization that might be associated with the surface zone.

Geology

The general geology of the area is described briefly by Harper and Reynolds (1969). A complete geologic description is given by Barron (1969). The mass of the Slate Mountains (about 2.0 miles northeast of the Lakeshore Property) is primarily Precambrian Pinal Schist. Near the centre of the mountains, an elongated body of Laramide age quartz-diorite (granite) has intruded the schist. Around the southwest edge of the Slate Mountains, and outcropping through the valley fill, are outlying hills of Devonian and Carboniferous limestone, Cretaceous volcanic and sedimentary rocks and Tertiary andesite and andesite breccia.

At the Lakeshore Property, the geology has been exposed in the old Lakeshore Pit. (Fig. 2). In the centre of the pit, mineralized, banded tactite (metasediment) overlaid by a fine-grained quartzite, striking N50E and dipping 60°SE, is exposed. These metasediments are terminated on the east side of the pit by a very strong fault that strikes northwest and dips 65°SW.

Along the west wall of the pit, altered and fractured andesite occurs on the footwall of an andesite and metasediment contact. This contact, striking N40°E and dipping 50°SE, forms the footwall of the oxide orebody in the wedge-shaped block of metasediment (tactite).

The drilling recently completed at the Lakeshore Property has obviously added a great deal to information about the subsurface geology. The simplified geological section shown in Figure 3 shows the main features, as presently known. The correlations from the drill hole sections have resulted in a completely unexpected picture !

Hole C-5 is one of several churn drill holes completed in 1948 by the U.S. Bureau of Mines. The hole penetrated the oxide mineralization in the pit and then entered fractured andesite. At a depth of 455 feet, the hole penetrated 90 feet of secondary copper mineralization. A proper interpretation of these results in 1966-67, gave added importance to IP anomalies, at depth, to the west.

The picture in Fig. 3 is much simplified. For instance, the tactite is not completely mineralized and the concentrated mineralization (magnetite, pyrite, chalcopyrite) extends into the surrounding rock units at some points. The overturned position of the oxidized tactite at the surface is shown as a result of simple folding; in fact, complex faulting may be a part of the structure !

The biotite porphyry (quartz monzonite) intrusive which contains much of the disseminated mineralization intrudes the Cretaceous andesitic breccia and the late Precambrian metasediments. It was not known to reach the surface in the vicinity of the Lakeshore Property, at the time of this exploration program.

The andesites, porphyry, metasediments and the upper portions of the underlying intrusive have been extensively shattered and are moderately to strongly altered. The principal host rocks are the andesite, porphyry and the tactite. Chalcopyrite and pyrite are the principal sulphide minerals. They are disseminated throughout the shattered porphyry and andesite; they are present in greater concentration with the near-massive magnetite in the metasomatic replacement in the tactite.

The copper mineralization is younger than the intrusive porphyry, but may be associated with it. The granite (quartz-diorite) stock has been dated as Laramide in age; the porphyry, and the copper mineralization, are probably related to later phases of the same magmatic period. The complete picture is that of a typical southwestern U.S., "porphyry copper" deposit that reaches the present surface at only one, very small, outcrop area.

definite anomaly, at depth, centred at 525E. The anomalous pattern suggests a near-vertical, tabular source that has a width less than the electrode interval (300').

The results on Line 500N show clearly that if the Lakeshore Orebody is to be detected using 200' or 300' electrode intervals, it is necessary to use the dipole-dipole configuration and make accurate measurements for n = 4 and n = 5.

d) Line 498N (X = 500' and X = 1000')

As mentioned above, the deep IP anomaly at Lakeshore was confirmed using east-west lines and larger electrode intervals after the first drilling had not intersected significant sulphide mineralization to depths of 700 to 800 feet. Measurements using X = 500' and X = 1000' were made on Line 498N. This line is close enough to Line 500N, that the data can be considered to be from the same survey line.

The measurements with 500' electrode intervals can be seen on Figure 9. The most distinctive resistivity feature is the high resistivity level east of 530E to 535E. There is only a very slight resistivity low associated with the orebody.

The IP anomaly is quite definite when 500' electrode intervals are used. The apparent frequency effect values and the apparent Metal Factor values are both definitely anomalous. The largest effects are measured for n = 4 and n = 5.

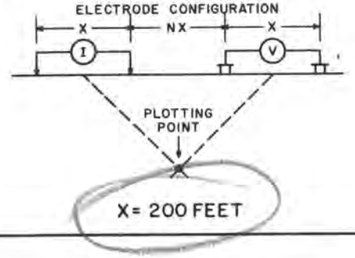
The anomalous pattern suggests an asymmetric source and the pattern is complex. The source of the IP effects could be approximated by a tabular source dipping to the west. The theoretical scale modelling results shown in Figure 10 show a typical pattern for a source dipping at 30°. The pattern is not unlike that measured over the Lakeshore Orebody using 500' electrode intervals.

The results of measurements with X = 1000' on Line 498N are

INDUCED POLARIZATION AND DRILLING RESULTS FROM LAKESHORE OREBODY PINAL COUNTY – ARIZONA

LINE – 500N (1966)

FREQUENCIES – 0·05/1·25 HZ.



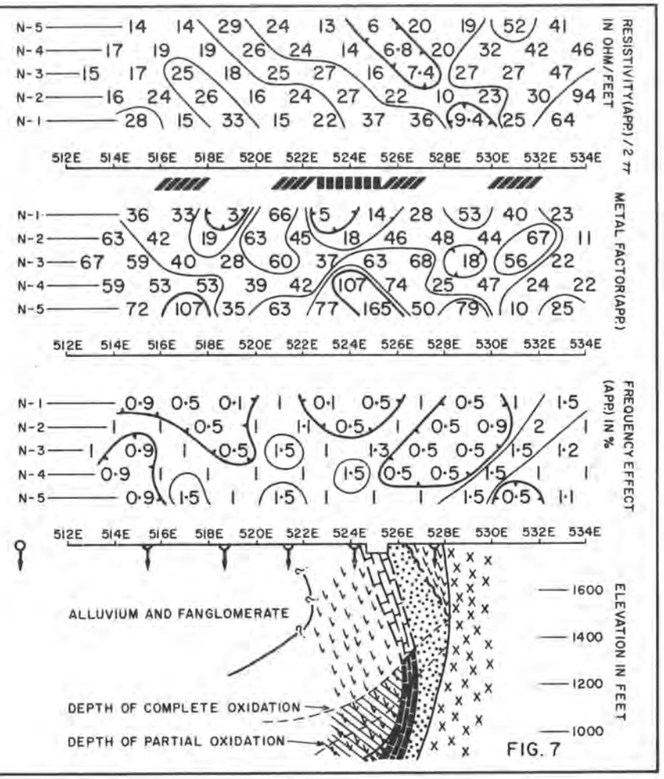


FIG. 7

GENERALIZED GEOLOGIC SECTION – LINE 507 N. LAKESHORE OREBODY – PINAL COUNTY, ARIZONA.

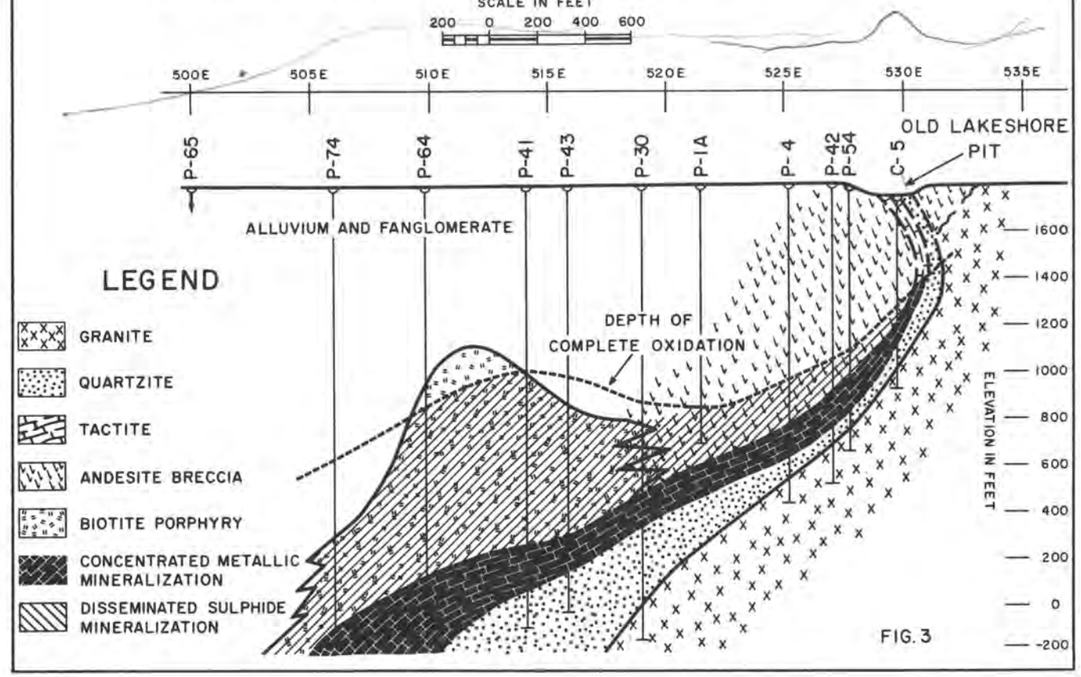
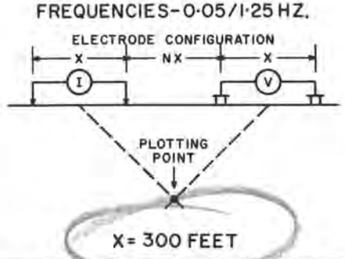


FIG. 3

INDUCED POLARIZATION AND DRILLING RESULTS FROM LAKESHORE OREBODY PINAL COUNTY – ARIZONA

LINE – 500N (1966)

FREQUENCIES – 0·05/1·25 HZ.



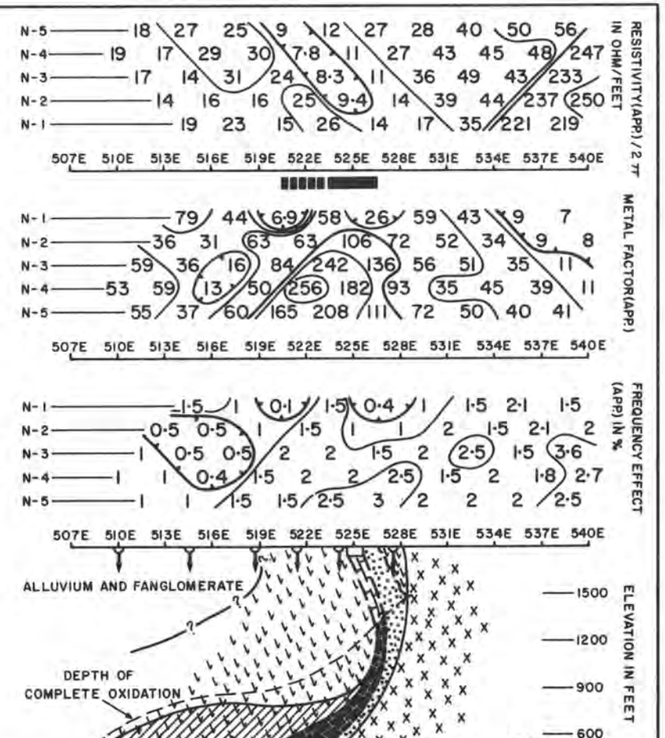


FIG. 8

LAKESHORE PROPERTY PINAL COUNTY – ARIZONA

Plan map showing position of survey lines and drill holes discussed.

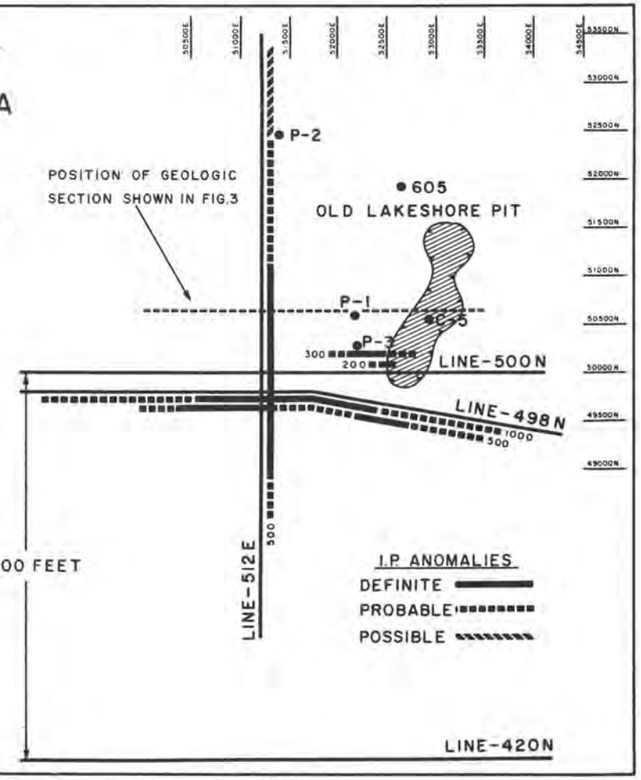


FIG. 4

Drilling Sequence For First Holes

The reconnaissance IP survey completed in August - September 1966 was made on north-south lines, at approximately one-quarter mile intervals. The dipole-dipole electrode configuration was used, with X = 500'. A few east-west lines were surveyed over the old Lakeshore Pit mineralization using X = 200' and X = 300'. The reconnaissance results indicated a moderate magnitude anomaly, at depth, to the west of the known mineralization in the old Lakeshore Pit. The depth to the top of the source was interpreted to be 1.0 - 2.0 electrode intervals (i.e. 500' to 1,000').

In Figure 4 we have shown the drill holes and surveyed lines that will be discussed. The first drilling done after the IP survey, was a deepening of Hole #605. This old rotary hole lay at the edge of the anomalous zone. It had been stopped at 288 feet in a porphyry, weakly mineralized with secondary copper minerals. Core drilling was completed to 790 feet, before the hole was lost due to poor drilling conditions. Fractured and altered porphyry and andesite breccia were encountered, with secondary copper minerals. No sulphide mineralization was encountered.

At this point, Hole P-1 and Hole P-2 were begun at widely separated points within the IP anomaly. Hole P-2 was drilled through 800 feet of cemented fanglomerate and abandoned due to poor conditions. No oxide or sulphide mineralization was encountered. Hole P-1 was continued to a depth of 750 feet in fractured and altered andesite and andesite breccia; a few, sill-like, masses of biotite porphyry were encountered. At 750 feet the hole was still in weak copper oxide mineralization. At this point in time, drilling was discontinued while all of the geological and geophysical data was re-evaluated.

Laboratory measurements were made on core samples of all of the rock types encountered. The samples were of relatively low resistivity (25 - 250) due to porosity from fracturing, alteration, etc.; a few of the frequency effects measured were 1.0% to 1.25% (using 0.31 - 5.0 cps),

This is the most definite anomaly located on the reconnaissance survey, probably because of the decrease in the depth to the top, at this point.

c) Line 500N (X = 200' and X = 300')

At the end of the reconnaissance survey in 1966, a few east-west lines were surveyed in the vicinity of the old Lakeshore Pit. For this work X = 200', n = 1,2,3,4,5 were used. The data shown on Figure 7 is from Line 500N. This line passes over the south end of the old Lakeshore Pit.

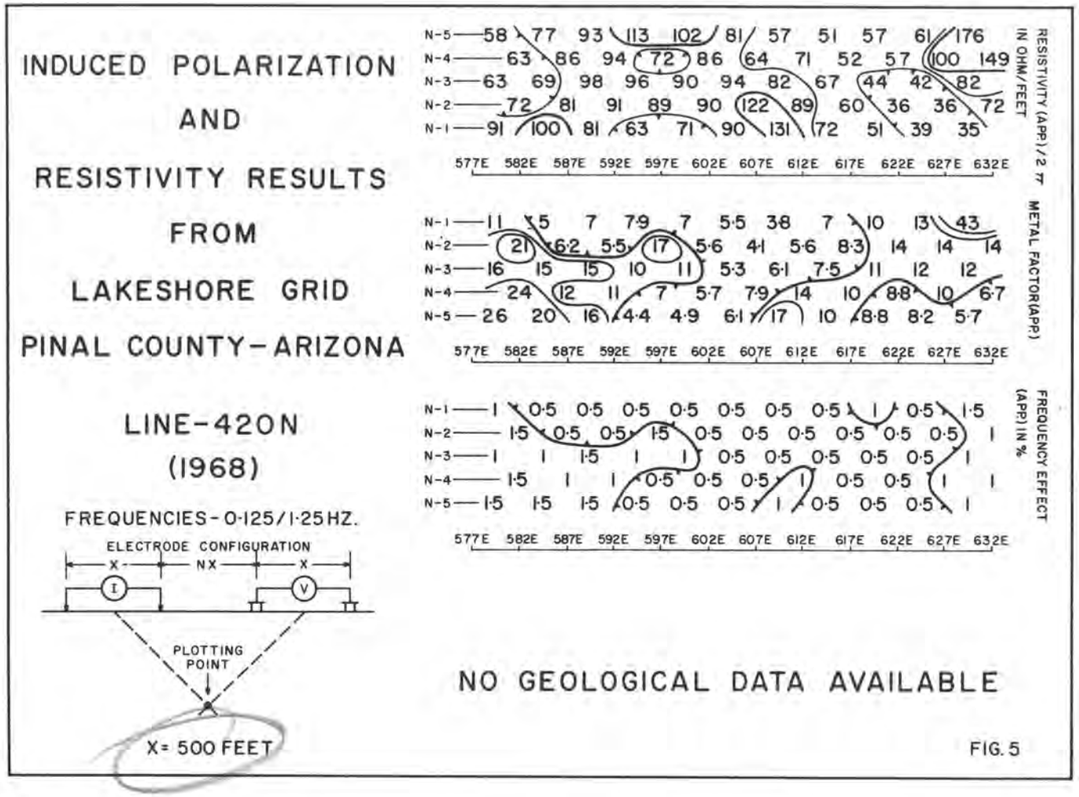
No anomalous frequency effects were measured. The apparent Metal Factor results show a weak anomaly, at considerable depth, centred at 524E. As shown by the geological section, constructed using later drill holes, this deep anomaly correlates with the up-dip edge of the metallic mineralization, beneath the depth of oxidation.

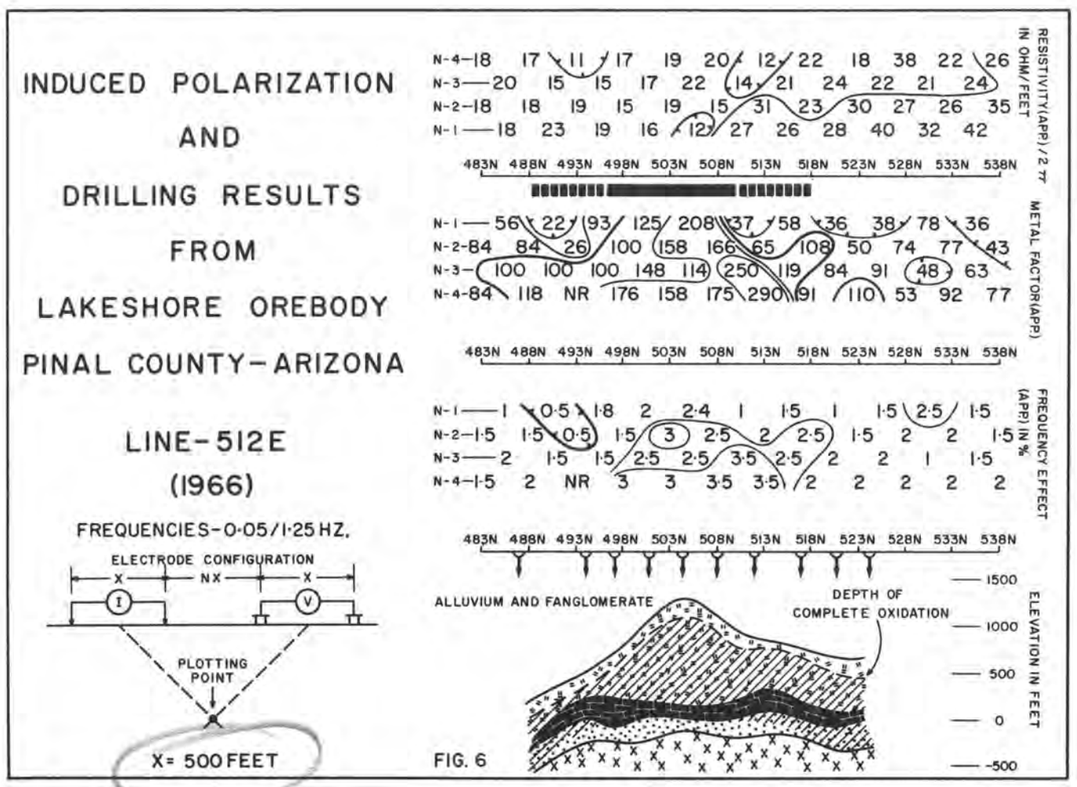
Definite information about the depth of oxidation is sparse. However, the available data suggests that no fresh sulphide mineralization could be present above a depth of 400' to 500'. There would certainly be some interval of partial oxidation, in which some metallic minerals might be present. The metallic mineralization present is at the extreme limit of the depth at which X = 200' measurements would be expected to detect it.

Because of the great depth of the anomaly detected using X = 200', the measurements on Line 500N were repeated using X = 300'. (Figure 8). The 50% increase in electrode interval gave rise to a much more definite anomaly.

The resistivity pattern centred between 531E and 534E is a typical pattern indicating a near-vertical contact between high resistivity rocks to the east and lower resistivity rocks to the west. There is a slight resistivity low associated with the anomaly.

There is a slight increase in the apparent frequency effects for n = 4,5 but the increase is less than the increased frequency effects to the east in the high resistivity rocks. The Metal Factor parameter shows a





but most were less than 1.0%. These true IP effects were not large enough in magnitude to be the source of the apparent effects previously measured. The anomaly was then confirmed using 500' electrode intervals on a few east-west lines.

At the same time a complete review of all of the geological information available was being completed by the Mineral Division of El Paso Natural Gas Co. This work was done by Claude E. Barron, Senior Mining Geologist, under the supervision of John R. Reynolds, Chief Geologist of the Minerals Division.

The major result of this review was the decision that the last structural event effecting the Lakeshore geology has been a 45° rotation about a horizontal axis trending N50°E. The interpretation was made that before this event the mineralized metasediments outcropping in the old Lakeshore Pit had been dipping steeply to the northwest, and overlain by the andesite and andesite breccia. This interpretation was confirmed by the two intersections of secondary copper mineralization in the old churn drill hole, Hole C-5; it also suggested that the mineralized tactite should be, at depth, in the area of the deep IP anomaly.

With the review completed, the possible importance of the IP anomalies was confirmed. It was decided to continue Hole P-1, in an attempt to intersect metallic mineralization that could be the source of the IP effects. At 850 feet, the hole encountered weak copper sulphide mineralization in the andesite breccia. Hole P-1 was lost at about 1,100 feet, due to poor drilling conditions.

Meanwhile, Hole P-3 had been started about 300' south of Hole P-1. The fractured and altered andesite and andesite breccia were difficult to drill; however, careful drilling gave consistently high core recovery. Some secondary copper mineralization was encountered, but little or no sulphides ! The hole passed from altered volcanics to altered sediments (limestone and dolomite) at 1,080 feet. At 1,147 feet the hole penetrated 90 feet of mineralized, banded tactite with massive magnetite, pyrite, and chalcopyrite. The interval

assayed 1.75% copper.

This intersection (in mid-1967) marked the discovery of sulphide mineralization in the metasediments (tactite). The drilling program was accelerated, and in early 1968 an announcement was made that a major copper deposit had been discovered.

Geophysical Results

The only geophysical technique used in the direct detection of the metallic mineralization at Lakeshore was the induced polarization method. Ground and airborne magnetic data does exist for the area, but this data has not been released for publication here. The surface magnetic results show a weak anomaly associated with the mineralized tactite in the old Lakeshore Pit; these effects are interpreted to be due to small quantities of remnant magnetite in the weathered zone. There are variable, and sometimes large, concentrations of magnetite in the andesites. The surface expressions from these features effectively mask any interpretable anomaly from the approximately flat-lying magnetite zone in the tactite at depth.

Before Hecla Mining Co. joined El Paso Natural Gas Co. in the development of the Lakeshore Orebody, several other major mining companies reviewed the drilling and geophysical data. As part of their review, several of these companies carried out induced polarization surveys over the mineralized zone. These IP measurements were made in both the frequency domain and the time domain, with many different electrode configurations. If these measurements were made with the proper electrode interval, and electrode configuration, they usually confirmed the IP anomaly at depth. None of this data has been released for inclusion in this paper.

The variable frequency induced polarization surveys completed by McPhar Geophysics Inc., for El Paso Natural Gas Co., were done using the dipole-dipole electrode configuration. We will present enough of the

data here to confirm the usefulness of the method in detecting and delimiting the Lakeshore Orebody.

a) Line 420N (Background)

The results shown on Figure 5 are from a portion of Line 420N, which passes approximately two miles south of the centre of the ore zone. These results were chosen to show typical background levels on the pediment, southwest of the Slate Mountains. The resistivity level is moderate and the apparent frequency effects are variable, but low in magnitude.

b) Line 512E (Discovery Line)

The results shown on Figure 6 are part of the original 1966 reconnaissance survey done on north-south lines, about one-quarter mile apart. The survey was done using 500' electrode intervals and 0.05 - 1.25 cps.

There is almost no resistivity expression of the anomaly. The apparent frequency effect and apparent Metal Factor results both show a definite anomaly centred at 503N. There is some depth indicated to the source, but the depth to the top was not interpreted to be much more than one electrode interval (i.e. 500' - 600').

The geological section shown at the bottom of Figure 6 is drawn to the same vertical and horizontal scale as the IP data plots. The locations of the holes that have been drilled since 1966 are also shown. The rock-type symbols used are those identified in Figure 2 and Figure 3. The geologic section shows that the IP anomaly correlates with the shallowest portion of the mineralized porphyry. At about 503N on Line 512E, the disseminated mineralization is about 600' to 700' nearer the surface than it is for several thousand feet in all directions.

Under Line 512E, the more concentrated metallic mineralization in the tactite is at a depth of 1,800 feet. This mineralization would not be expected to influence the measurements using 500' electrode intervals.

DATA COMPARISON AND TEST INDUCED POLARIZATION SURVEY

OF A FEW SELECTED LINES

OVER THE

LAKESHORE DEPOSIT
PINAL COUNTY, ARIZONA

November 1969 - February 1970

BY

HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5671, TUCSON, ARIZONA

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SIX (6) I.P. Sectional Data Sheets showing apparent resistivity and polarization factors.

LINE 10 N a = 500 feet

LINE 10 N a = 1000 feet (with McPhar and Anaconda Data comparisons)

LINE 10 N a = 1500 feet

LINE 10 S a = 500 feet

LINE 10 S a = 1000 feet (with McPhar and Anaconda Data comparisons)

LINE 10 S a = 1500 feet

PLAN MAP

INTRODUCTION

At the request of Heinrichs GEOEXploration Company, permission was given by Mr. John R. Reynolds, Superintendent of Exploration, Mining Division, El Paso Natural Gas Company and Mr. Herbert Harper, Vice President of Exploration, Hecla Mining Company, to run a few test I.P. profiles over the recently discovered Lakeshore Deposit.

The Primary objective was to test, over known conditions, some new GEOEX I.P. equipment - in particular the new prototype GEOEX Mark 4C I.P. receiver. It was also desired to confirm practical detectibility of the Lakeshore type of deposition by the I.P. method in more independent and quantitative terms and to compare available results obtained by El Paso - Hecla and others before production activity made such test work impractical. New information obtained and the older data furnished, are presented herewith on standard GEOEX sectional data sheets and composited so as to most readily illustrate the differences and similarities in observed readings and in the more positive geologic correlations obtained.

SUMMARY

In summary, we re-affirm conclusions made in our report to El Paso dated June 16, 1967. The five hundred foot dipole-dipole electrode configuration dual frequency data indicates little regarding the presence of any significant sulfide mass. Deeper penetrating, 1,000 foot dipole data does indicate weak, but definite response showing the existence and position of the main sulfide mass. However, overall, the 1,000 foot dipole response is such that, under unknown and slightly different electrical properties and/or geometrical parameters, a deposit of this nature could be missed. Such unpredictable (weak and indefinite) response with 1,000 foot dipoles, suggests confining their future use to extensions from the more-shallow and well known portions of the area. Otherwise, considerably "deeper penetrating" work (i.e. 1,500 ft. length dipoles or greater) will be necessary to completely evaluate the adjacent vicinity. To produce maximum worthwhile information at minimum cost, this will require the best in equipment, procedures and interpretation.

Our interpretation of anomaly positions apparently agrees more with Anaconda than with McPhar, but significance of this, if any, needs more correlation information and analysis.

CONCLUSIONS

The most completely diagnostic I.P. anomalism obtained so far, is that done by GEOEX using 1500 foot dipole spreads. Although the apparent 500 foot dipole anomalism does in part correlate in plan with the ore body, this may be only geographically coincidental. Careful study shows its real cause is small, near surface and lacking in depth continuity. Therefore it is probably due to the fanglomerate and/or something within it such as a clayey zone. The 1000 foot dipole work apparently integrates these near surface effects into the background frequency effects and the response from the true sulfide body at depth is just barely discernable.

The Anaconda phase angle data cannot be exactly compared point by point with the McPhar and GEOEX frequency data. This is due to differences in location and electrode array, as well as difference in measuring technique. Nevertheless, it is evident that the phase angle plots indicate a deep lying sulfide body located in essentially the position indicated by drill results. Time permitting the significance of the other Anaconda data might be evaluated with further work. Anaconda did not state absolute units used in their plots, but they probably represent minutes of phase angle for their apparent polarization factor and ohm feet for their apparent resistivity.

It is our opinion that the Anaconda phase angle data, though detecting deeply, sacrifices resolving power due to the type of electrode array used, whereas the dipole-dipole arrangement used by McPhar and GEOEX, permits more accurate placement of drill holes and gives better overall representation of the gross shape and depth of the target. In dipole-dipole work the choice in this case between 1000 foot and 1500 foot dipoles is clearly in favor of the 1500 foot dipoles, since the depth to the top of the known orebody diffuses the pattern of anomalous response and thereby reduces the effective lateral interpretation resolution of the 1000 foot dipole data to roughly plus or minus one dipole (i.e. $\pm$ 1000 feet); whereas 1500 foot dipole data gives a more sharply defined plotted anomaly pattern having interpretable lateral resolution of $\pm$ 750 feet.

Resolution and detection of a "drillable" target is the prime factor in selecting the proper method and electrode spacing to be utilized in I.P. prospecting. Usually costs dictate that this must be done on an optimum and combined basis.

Adverse conditions encountered at the time GEOEX ran 1,000 ft. dipoles on Line 10 N, prevented full comparison with McPhar and Anaconda at this position. The rest of the data, however, indicate that results would ordinarily be very similar with identical electrode configurations and power.

RECOMMENDATIONS

Any future I.P. work near the present Lakeshore operations, searching for similar ore bodies, should employ the dipole-dipole electrode array utilizing at least in part 1500 foot dipole lengths. This is particularly indicated to the west of present coverage.

To the north, the existing McPhar data may be compromised by an electrically grounded 4" gas line, but also shows significant anomalism well east of the pipeline. When working in the vicinity of the pipeline I.P. lines should be parallel to and at least 750 feet away from the pipe. Moreover, none of the existing anomalism should be left open ended.

ACKNOWLEDGMENT

We wish to thank El Paso and Hecla for allowing this test work and to their personnel for their cooperation, and assistance in helping us get it done, and their patient indulgence in awaiting the final results.

Respectfully submitted:

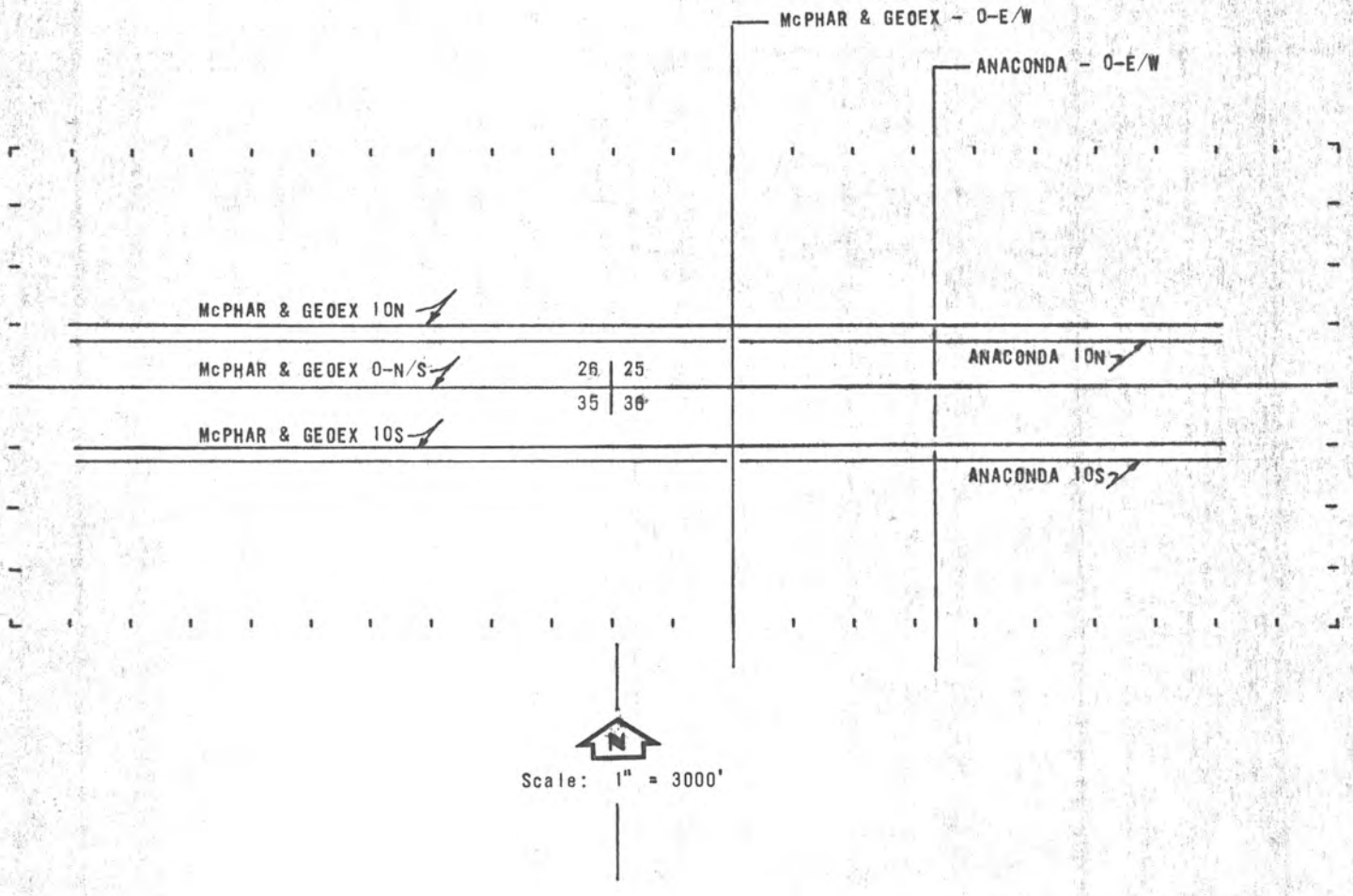
HEINRICHS GEOEXPLORATION COMPANY

Paul A. Head
Geophysicist

Chris S. Ludwig
Senior Geophysicist

LOCATION PLAN
of
INDUCED POLARIZATION SURVEYS

LAKESHORE AREA



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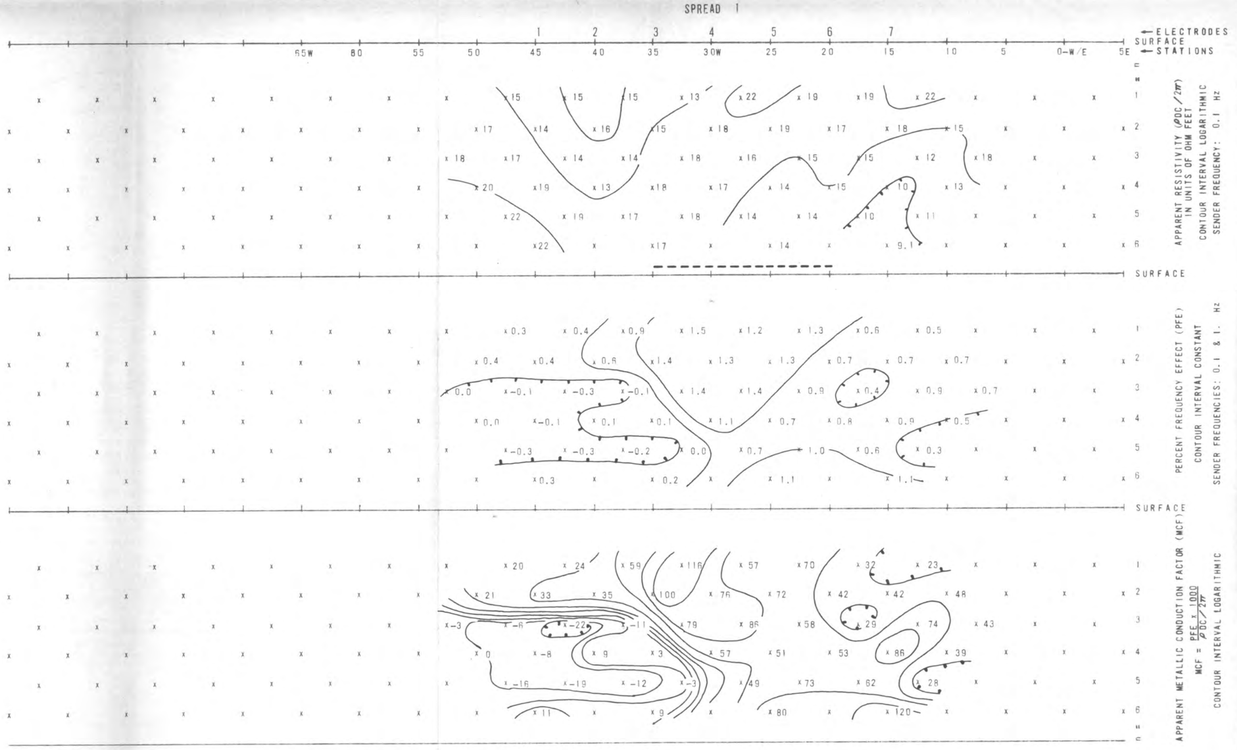
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney
geophysical engineers



LINE NO.
ION
SPREAD(S)
1

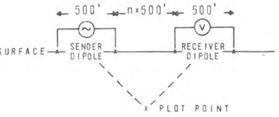
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET
for

HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA

LAKESHORE
LOOKING
NORTH

DATE

AUG 1969

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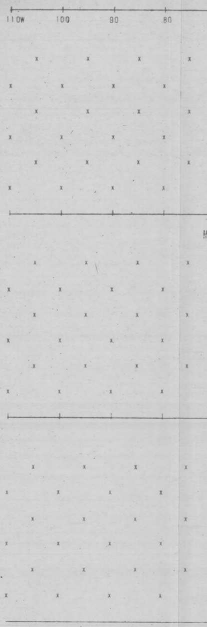
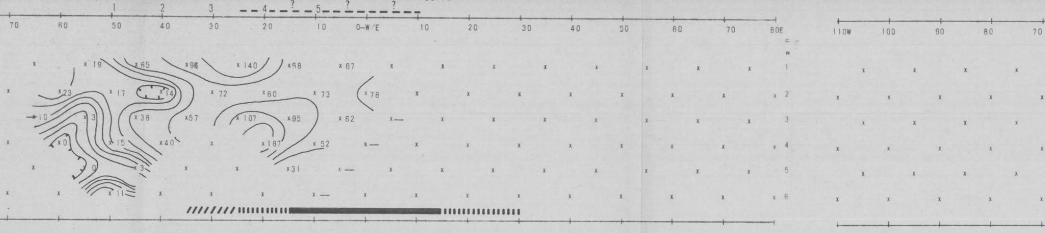
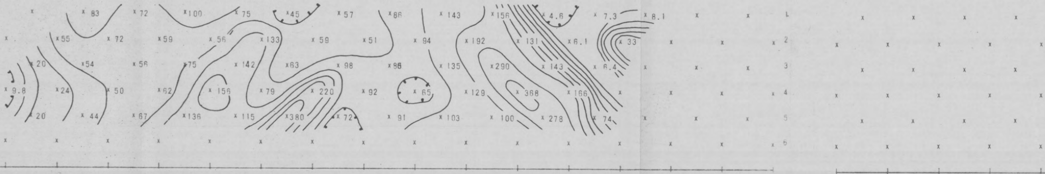
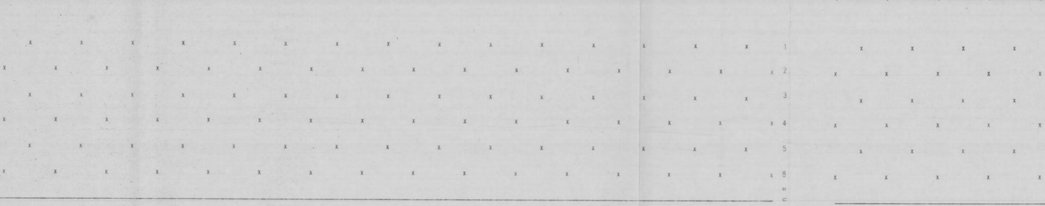

110W
100
90
80

Conduction Factor (MCF): MCF = $\frac{\quad}{\rho_{DC}/2\pi}$ Contour interval logarithmic



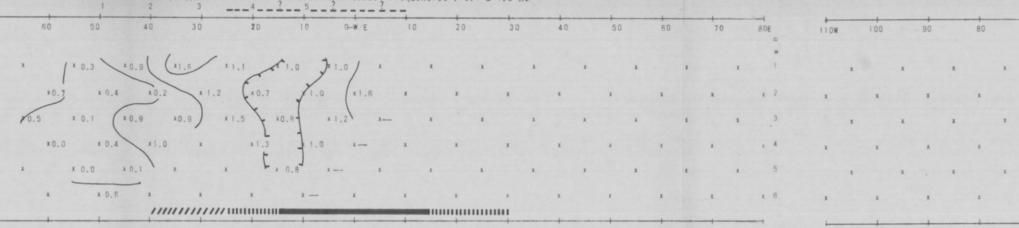
McPHAR GEOPHYSICS - Apparent Metallic Conduction Factor (MCF): MCF = $\frac{PFE \times 1000}{\rho_{DC}/2\pi}$ Contour interval logarithmic





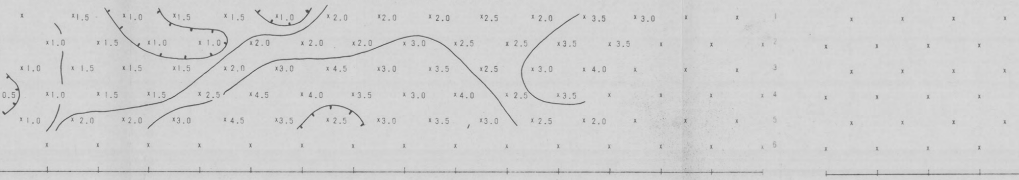
HEINRICHS GEOEXPLORATION COMPANY

PERCENT FREQUENCY EFFECT (PFE): Contour interval constant. Sender frequencies : 0.1 & 1.0 Hz



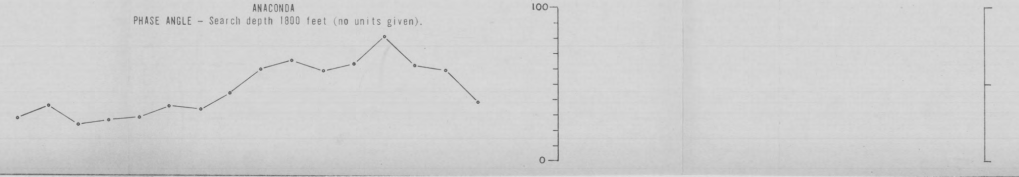
McPHAR GEOPHYSICS

PERCENT FREQUENCY EFFECT (PFE): Contour interval constant. Sender frequencies: 1.25 & .125 Hz.



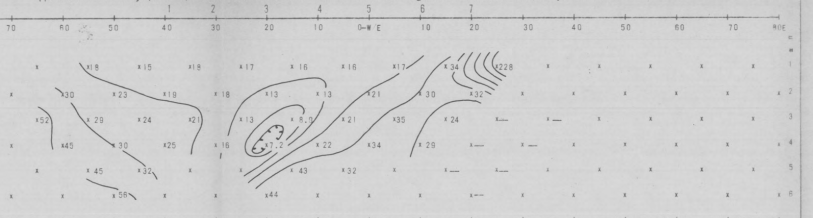
ANACONDA

PHASE ANGLE – Search depth 1800 feet (no units given).



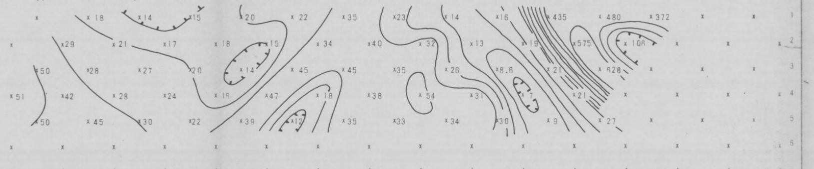
HEINRICHS GEOEXPLORATION COMPANY

Apparent Resistivity ($\rho DC/2\pi$) in units of ohm feet. Contour interval logarithmic. Sender frequency: 0.1 Hz.



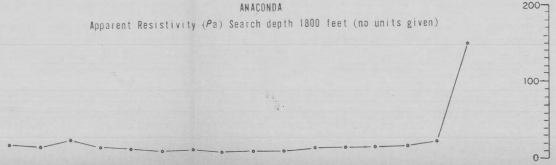
McPHAR GEOPHYSICS

Apparent Resistivity ($\rho DC/2\pi$) in units of ohm feet. Contour interval logarithmic. Sender frequency: .125 Hz.



ANACONDA

Apparent Resistivity (ρa) Search depth 1800 feet (no units given)

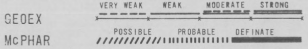


COMPARISON
of
INDUCED POLARIZATION TRAVERSES
SECTIONAL DATA SHEET

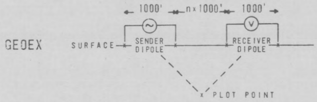
LINE NO.
10N

HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH


GEOEX
VERY WEAK
WEAK
MODERATE
STRONG
McPHAR
POSSIBLE
PROBABLE
DEFINATE

DIPOLE DIPOLE ELECTRODE ARRAY


GEOEX
1000'
n x 1000'
1000'
SURFACE
SENDER DIPOLE
RECEIVER DIPOLE
PLOT POINT

AREA
LAKESHORE
LOOKING
NORTH
DATE
FEB 5, 1970
JUNE 1968

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

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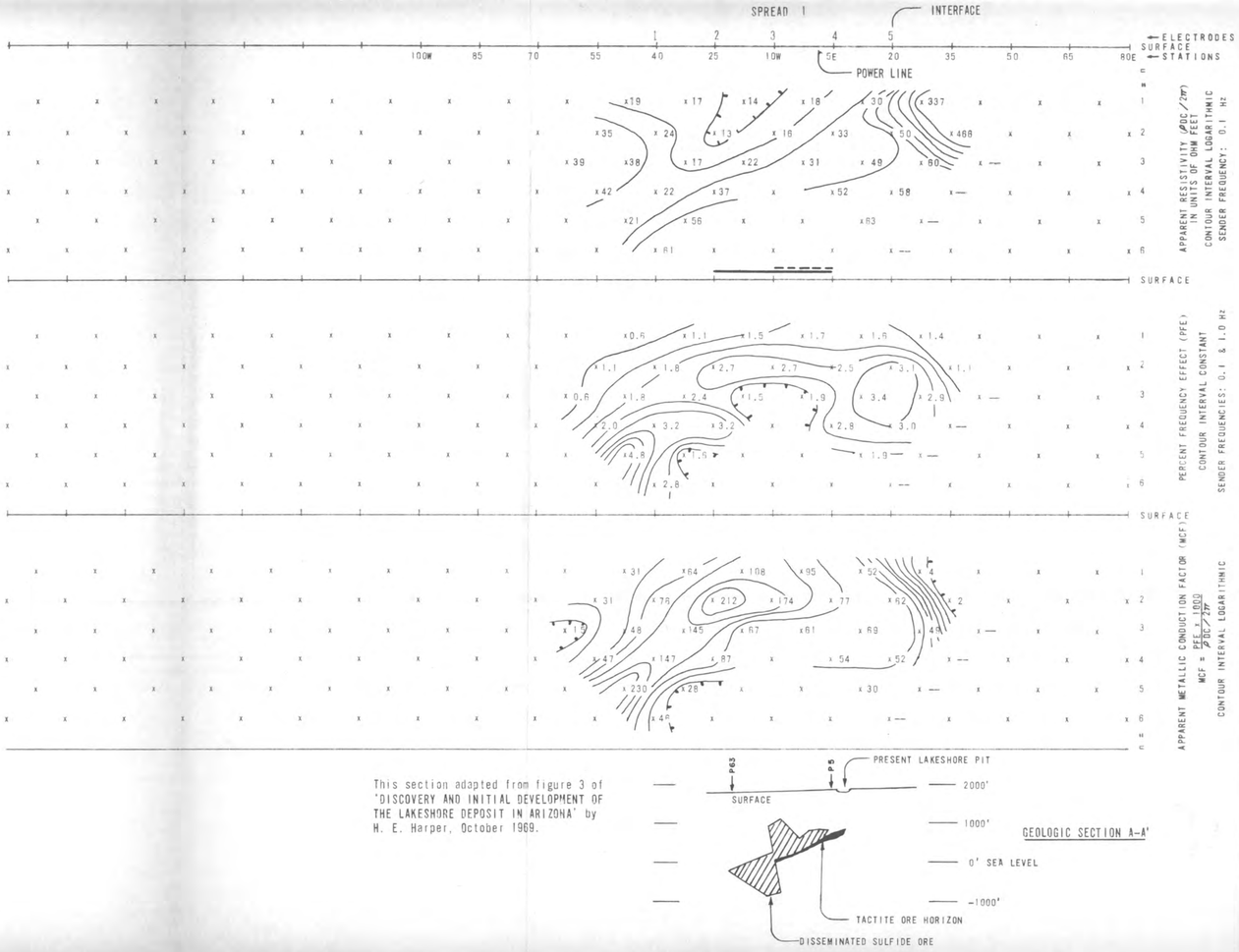


This section adapted from figure 3 of 'DISCOVERY AND INITIAL DEVELOPMENT OF THE LAKESHORE DEPOSIT IN ARIZONA' by H. E. Harper, October 1969.

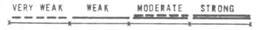
GEOLOGIC SECTION A-A'

LINE NO.
10N
SPREAD(S)
1

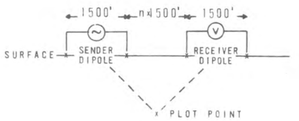
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET
for

HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA

LAKESHORE

LOOKING
WEST HALF - - NORTH
EAST HALF - N 18 W

DATE

NOV 1969

HEINRICHS
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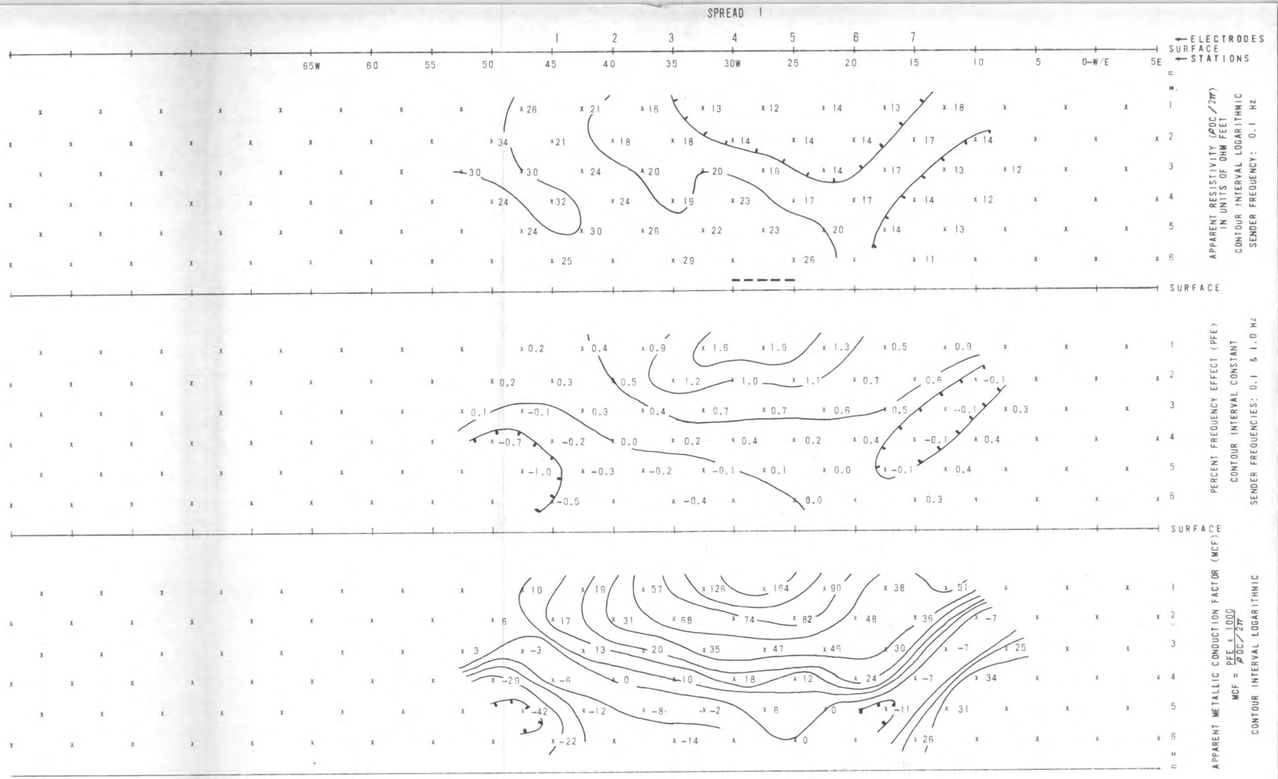
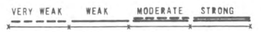


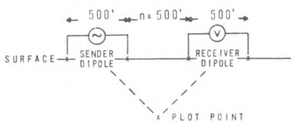
LINE NO.
10S
SPREAD(S)
1

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
LAKESHORE

LOOKING
NORTH

DATE
AUG 1969

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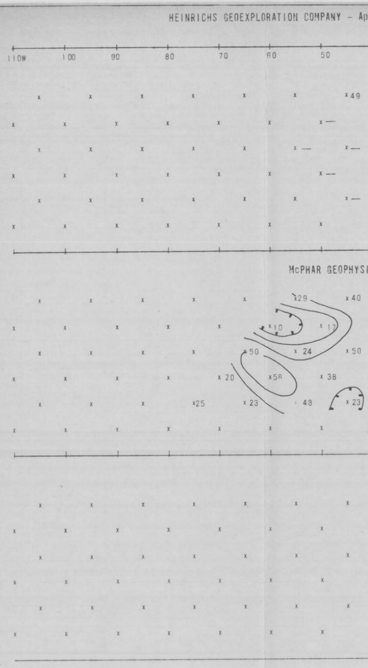
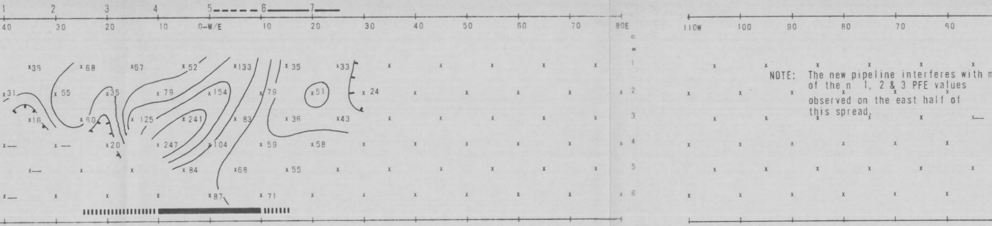

HEINRICHS GEOEXPLORATION COMPANY - Ap
110W
100
90
80
70
60
50
49
McPHAR GEOPHYSI
29
40
10
17
50
24
50
20
56
38
25
23
48
23

parent Metallic Conduction Factor (MCF): MCF = $\frac{PFE \times 1000}{\rho_{DC}/2\pi}$ Contour Interval logarithmic

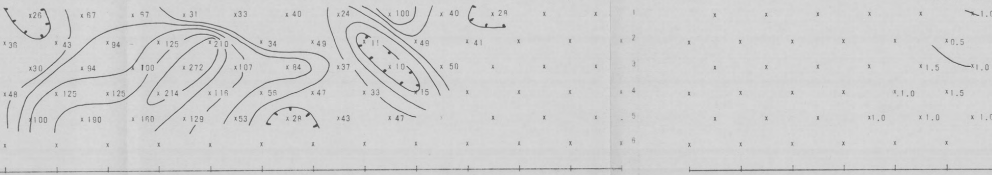
PERCENT FREQU

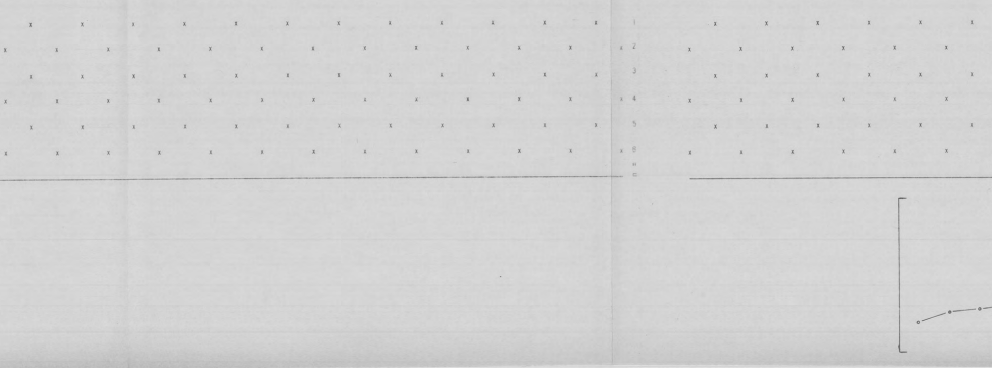


NOTE: The new pipeline interferes with m
of the n 1, 2 & 3 PFE values
observed on the east half of
this spread.

CS - Apparent Metalic Conduction Factor (MCF): MCF = $\frac{PFE \times 1000}{\rho_{DC}\ 2\pi}$ Contour interval logarithmic

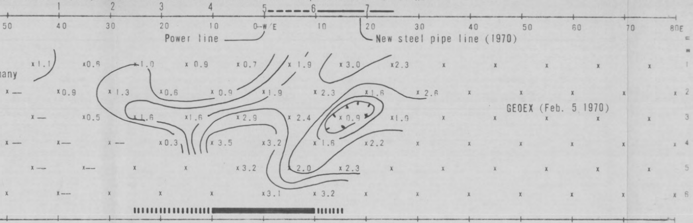
PERCENT FREQU



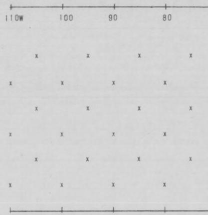


HEINRICHS GEOEXPLORATION COMPANY

JENCY EFFECT (PFE): Contour interval constant. Sender frequencies: 0.1 & 1.0 Hz

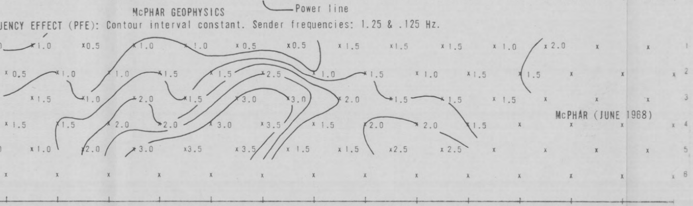


Apparent Resistivity (ρ

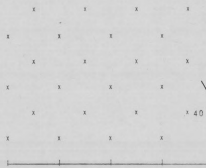


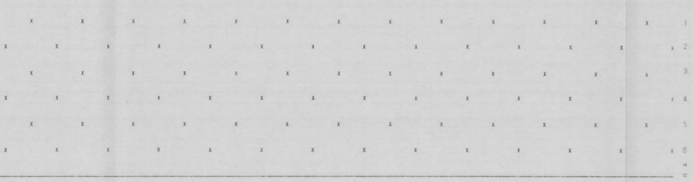
McPHAR GEOPHYSICS

UENCY EFFECT (PFE): Contour interval constant. Sender frequencies: 1.25 & .125 Hz.



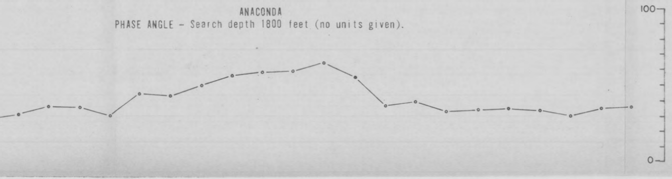
Apparent Resistivity (ρ





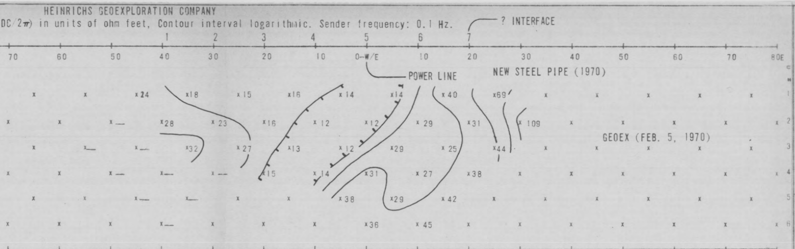
ANACONDA

PHASE ANGLE - Search depth 1800 feet (no units given).



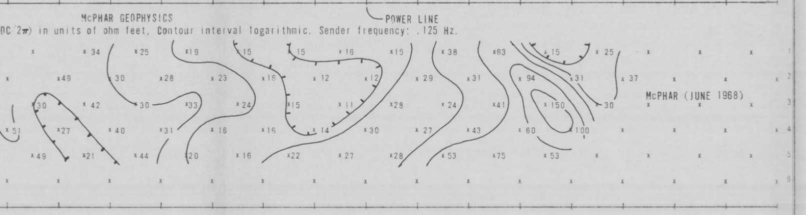
HEINRICHS GEOEXPLORATION COMPANY

DC/2π) in units of ohm feet, Contour interval logarithmic. Sender frequency: 0.1 Hz.



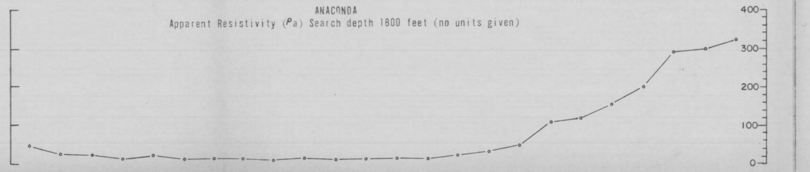
McPHAR GEOPHYSICS

DC/2π) in units of ohm feet, Contour interval logarithmic. Sender frequency: .125 Hz.



ANACONDA

Apparent Resistivity (ρa) Search depth 1800 feet (no units given)



COMPARISON
of
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET

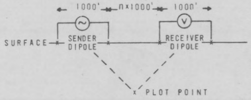
LINE NO.
10S

HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH

	VERY WEAK	WEAK	MODERATE	STRONG
GEOEX	- - - -	——	═ ═ ═	══
	POSSIBLE	PROBABLE	DEFINATE	
McPHAR	//////////	▮▮▮▮▮▮▮▮	■■■■	

DIPOLE DIPOLE ELECTRODE ARRAY


1000'
n×1000'
1000'
SURFACE
SENDER DIPOLE
RECEIVER DIPOLE
PLOT POINT

AREA
LAKESHORE
LOOKING
NORTH
DATE
FEB. 5, 1970
JUNE 1968

HEINRICHS
GEOEXPLORATION COMPANY
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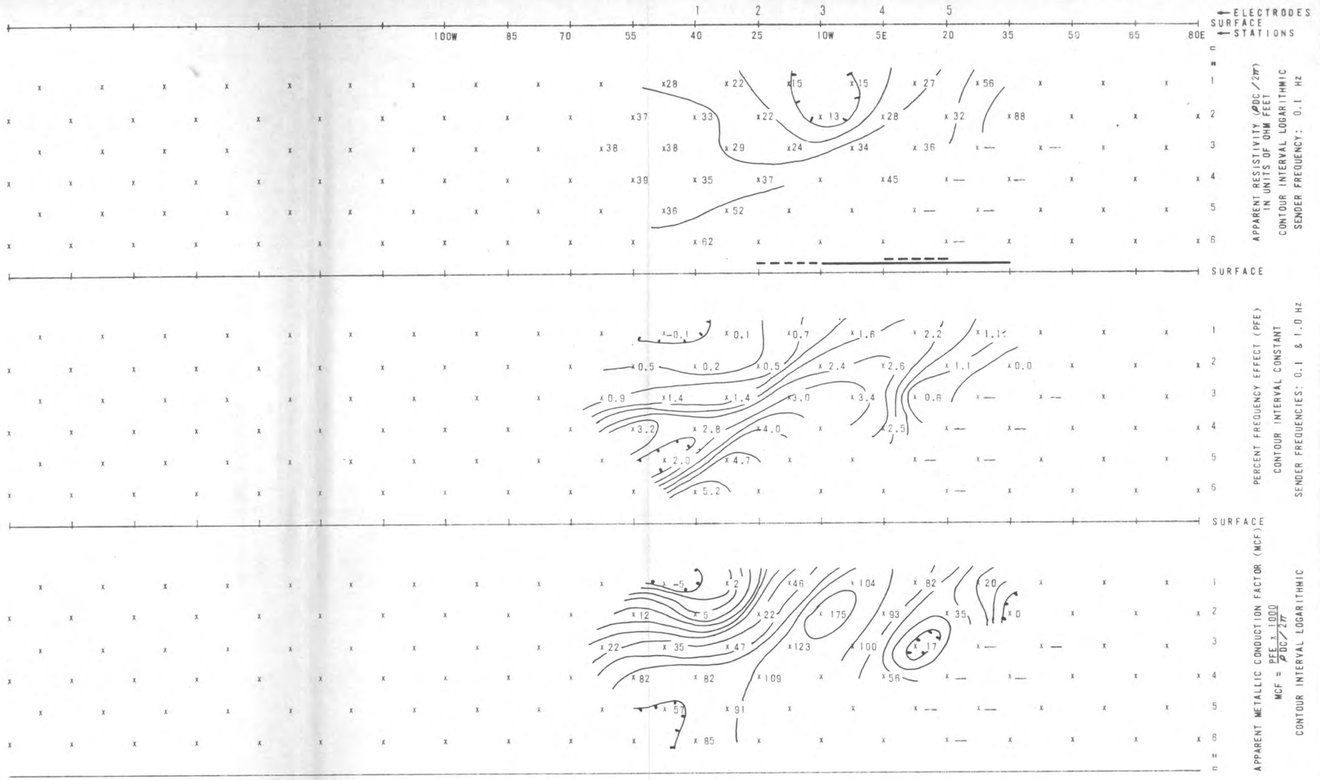
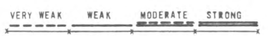


LINE NO.
10S
SPREAD(S)
1

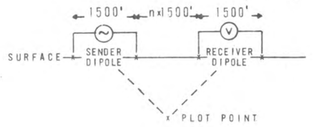
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET
for

HEINRICHS GEOEXPLORATION COMPANY

RELATIVE ANOMALY STRENGTH



DIPOLE DIPOLE ELECTRODE ARRAY



AREA
LAKESHORE

LOOKING
NORTH

DATE
NOV 1969

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Hecla Stockholders To Consider Proposed Development Of Lakeshore Properties

Plans by Hecla Mining Company of Wallace, Idaho to enter into an operating agreement with El Paso Natural Gas Company for development of a 500-million-ton copper orebody on the Lakeshore Properties on the Papago Reservation south of Casa Grande will hang in the balance when the annual meeting of Hecla stockholders gets under way May 29th in Spokane, Washington.

All but one of the members of the Hecla board of directors voted in favor of the proposal—but that one director controls a sizeable amount of Hecla stock and has indicated an all-out fight, including legal action, to block it. He is H. F. Magnuson, vice president of Golconda Mining Corporation, which controls 691,900 shares of Hecla's 4,945,575 shares currently outstanding. Magnuson said "the proposed transaction may result in decreased earnings per-share for Hecla for the next five years."

Hecla management, led by Chairman L. J. Randall and President W. H. Love, has countered by securing proxies and pledges to secure what it says are enough votes to carry the issue. They also explained that under the company's charter, the proposal, if approved unanimously by the board of directors, need not be taken to shareholders for a vote. To achieve this, the company has proposed a slate of directors that would not include Magnuson.

Love said he believed Golconda's position to be "unfortunate" because the proposal is "an excellent deal for Hecla."

Under terms of the agreement, Hecla would:

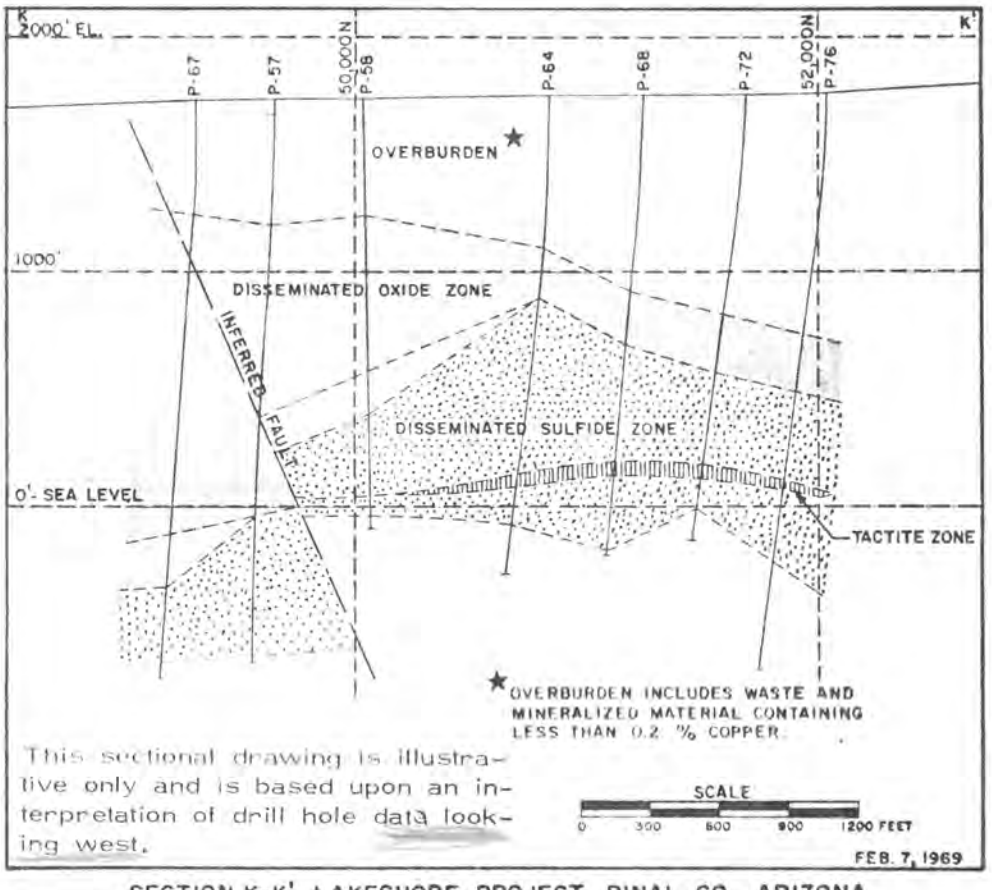
1. Acquire substantially all of the assets of Transarizona Resources, Inc., which consist of an undivided one-half interest in certain patented and unpatented mining claims and mineral leases together with an undivided one-half interest in a milling plant, all known as the Lakeshore Properties, for one million shares of the authorized but unissued capital stock of Hecla Mining Company.

2. Acquire the remaining undivided one-half interest in the Lakeshore milling plant owned by El Paso Natural Gas Company for $1,500,000 cash.

3. Enter into an operating agreement with El Paso under which Hecla would be designated as operator of the Lakeshore Properties, in which El Paso owns the remaining undivided one-half interest. Hecla would provide all financing and it and El Paso would split the net profits 50-50.

Under terms of a preliminary agreement, Hecla has until August 11th to close the transaction with El Paso, although the deadline may be extended by mutual agreement.

PATRONIZE PAY DIRT ADVERTISERS



SECTION K-K', LAKESHORE PROJECT, PINAL CO., ARIZONA

Special Report Gives Details Of Half-Billion-Ton Deposit

Considerable additional details concerning discovery of the half-billion-ton Lakeshore deposit of low grade copper ore on the Papago Indian Reservation about 30 miles south of Casa Grande have been revealed in a special report to stockholders of Hecla Mining Company prior to the annual meeting of stockholders May 29th. (See accompanying story).

We quote pertinent portions of the special report as follows:

Lakeshore Deposit

The Company's planned operations relate to the Lakeshore copper deposit. It consists of three zones of mineralization, the uppermost being designated as the Disseminated Oxide Zone, the second being the Disseminated Sulfide Zone and the lowest being the Tactite Zone.

The Lakeshore copper deposit has been explored to February 7, 1969 by 53 drill holes consisting of a total of 42,000 feet of rotary and 49,000 feet of diamond drilling.

The drilling program has resulted in the following disclosures:

1. The Disseminated Oxide Zone is found from the surface to depths of more than 1,000 feet at an average depth of about 500 feet, and with an average thickness of about 550 feet in andesite and porphyry rocks. Mining of this zone would require copper recovery by the leaching method.

2. The Disseminated Sulfide Zone is found immediately below the oxide zone, with an average thickness of about 500 feet, and is also contained in andesite and porphyry rocks. Mining of this zone would require ore treatment by conventional milling operations.

3. The Tactite Zone of higher-grade copper sulfide content lies below a substantial portion of the sulfide mineralization referred to in (2) above, and occurs in altered sedimentary rocks. Its average thickness is 63 feet. Mining of this zone would require ore treatment by conventional milling operations.

Drilling is continuing on the property with five drill rigs in use, and the deposit is still "open" in the north and west direction.

The above mineralized deposits will be discussed in reverse order as follows:

Tactite Zone

Drilling to February 7, 1969 indicates 23,600,000 tons of tactite ore reserves averaging 1.69 percent copper, before making any allowance for an appreciable tonnage which would not be recovered by presently conceived underground mining plans. These reserves were delineated by drilling.

Initial plans call for sinking a vertical shaft near the center of the Lakeshore

(Continued Next Page)

Lakeshore . . .

mineralized deposit, from which openings will be driven into the tactite ore zone. It is estimated that approximately four years will be required to bring the tactite ore body into production.

The Disseminated Oxide and Disseminated Sulfide Zones

Drilling to February 7, 1969 gives the basis for estimating that the Disseminated Sulfide Zone contains 241,000,000 tons of disseminated sulfide mineralization averaging 0.70 percent copper. This zone is in turn overlain by the Disseminated Oxide Zone which is estimated to contain 207,000,000 tons of disseminated oxidized copper mineralization of an average grade of 0.71 percent copper. As stated above, the outer boundaries of these zones have not been delineated on the north or the west side. The above grades are based on assay for total copper content only, without segregated analysis for copper in oxide form and for copper in sulfide form.

Limited studies regarding treatment of the oxide mineralization have given encouraging results. Final determination of the feasibility of mining and treating the oxide copper mineralization awaits further testing on drillhole samples, and on bulk samples obtained from underground work which is planned in conjunction with the development of the tactite ore, as mentioned above.

If results of such further drilling and metallurgical analysis confirm that the Disseminated Oxide Zone can be mined at a profit, such zone and the underlying Disseminated Sulfide Zone will be mined by the open-pit method. Alternatively, the Disseminated Sulfide Zone and the Tactite Zone may be mined through underground operations by block-caving. The shaft to be sunk to mine the tactite ore, and other mine workings from it, will be used to sample and determine the economic mineability of the Disseminated Sulfide Zone. Deposits of this type generally lend themselves to economic mining operations.

General Operating Plan

Initial efforts will be concentrated on preparation of the Tactite Zone for production, accompanied by expenditures for work in the Disseminated Oxide and Sulfide Zones to obtain bulk samples from various parts of the deposit to allow further metallurgical testing, and other testing and analysis. Management is of the opinion that Hecla will be able to finance the development and the preproduction costs of the tactite ore body without outside financing.

If further study proves that the Disseminated Oxide Zone can be mined economically, a substantial expenditure, which would require outside financing, would be needed to provide for open-pit mining equipment, an enlarged surface plant, removal of overburden, and for a refinery and heap-leach plant and equipment to treat the oxidized ore. Hecla has reviewed the availability of such outside financing with Chase Manhattan Bank (National Association) and has supplied such bank with data as to Hecla's operating plan and the economics of such operating plan as they exist to date. Chase Manhattan Bank (National Association) has advised Hecla that such bank believes, based upon its initial verification of such data, that debt financing, if required, can reasonably be expected to be obtained from commercial banking sources.

Sample and metallurgical test data are adequate for a firm commitment to build a flotation concentrator for treatment of the Tactite Zone ore. A conventional sulfide flotation concentrator is planned with a capacity to process 8,000 tons of underground Tactite Zone ore per day (2,880,000 tons per year). The concentrator could be later expanded to treat ore from the Disseminated Sulfide Zone. Contingent upon final plans for oxidized ore treatment, this concentrator would include a pyrite flotation concentrate production circuit, the concentrate being used to produce sulfuric acid and sponge iron. It may also include a magnetic concentration circuit to produce a magnetite concentrate for use in the manufacture of sponge iron. Further studies are required to determine the most beneficial treatment of the copper concentrates, with particular attention to the manner in which the treatment will integrate with processing of the oxidized ore. At present, use of hydrometallurgical treatment of the sulfide concentrates appears most favorable.

With this approach, copper concentrates and pyrite concentrates would be roasted, with roaster gases used to manufacture sulfuric acid for subsequent utilization in leaching oxide ores, in a standard sulfuric acid package plant. The residue from roasting of the copper concentrate would be leached and copper recovered from solution by electrowinning. The leach residue and pyrite roast residue would be treated in a plant to manufacture sponge iron, which would be used in the precipitation plant in the oxide ore leach process.

The oxide ores would be vat-leached and/or heap-leached with established techniques, utilizing sulfuric acid as a solvent, followed by treatment in a conventional precipitation plant to produce cement copper. Based upon further studies and developments, plans relating to the foregoing may be modified as conditions warrant.

Plan For Participation

On February 11, 1969, your Board of Directors, with one dissenting vote, approved the execution and delivery of certain agreements (the "Agreements") providing for the acquisition by Hecla from El Paso and Transarizona of undivided one-half interest in the Lakeshore Properties (described more fully below), consisting of patented and unpatented lode mining claims and Papago Indian reservation mineral leases and related rights covering approximately 4,179 acres in Pinal County, Arizona. (See "Description of Lakeshore Properties".) Under the Agreements, Hecla would issue 1,000,000 shares of its Capital Stock to Transarizona, which would then become Hecla's largest shareholder with approximately one-sixth (or 16 2/3 percent) of Hecla's outstanding Capital Stock. Hecla would then have 5,957,575 outstanding shares instead of the presently outstanding 4,957,575 shares. It should be noted that Hecla, on several occasions in the past, has expanded its mining activities through the issuance of additional shares of its Capital Stock.

Management of Hecla believes that the acquisition will be in the best interests of Hecla shareholders for the reasons set forth in "Factors Considered in Execution of Agreements" below, and recommends that the shareholders of Hecla approve adoption of the Agreements.

The Agreements, which are three in number and are interdependent one upon the other, must be approved by the shareholders of Hecla or none shall become effective. The agreements provide for (i) the acquisition by Hecla of substantially all of the assets of Transarizona, free of liabilities, which assets consist of an undivided one-half interest in the Lakeshore Properties including an undivided one-half interest in a milling plant located thereon in exchange for 1,000,000 of the authorized but unissued shares of Capital Stock of Hecla; (ii) the acquisition by Hecla from El Paso of the remaining undivided one-half interest in the milling plant located on the Lakeshore Properties for $1,500,000 in cash; and (iii) an operating agreement with El Paso with respect to operations upon the jointly owned Lakeshore Properties.

The principal terms of the operating agreement provide, among other standard provisions, as follows:

(i) Hecla is designated as Operator and shall, beginning with the fifth calendar quarter of the agreement, make $250,000 quarterly minimum advance royalty payments to El Paso which Hecla is entitled to recoup out of El Paso's share of any "net profits."

(ii) Hecla shall provide all financing and have sole risk and responsibility for bringing the Lakeshore Properties to production and operation until such time as El Paso shall become a fully participating working interest owner.

(iii) El Paso and Hecla shall each be entitled to fifty percent (50 percent) of any "net profits" derived from operation of properties, subject to Hecla's right to recoup out of El Paso's share of net profits all minimum advance royalties and accrued interest. El Paso may elect for any accounting period to accelerate amortization of the preproduction costs referred to in paragraph (iv) below.

(iv) Hecla will establish mining accounts

(Continued Next Page)

Lakeshore . . .

(Continued from Previous Page)

to which all preproduction costs (excluding minimum advance royalty) shall be charged.

(v) "Net profits" are defined as gross income before income taxes less operating costs and less an annual charge of ten percent (10 percent) of preproduction costs over a period of ten (10) years and less any accumulated prior losses.

(vi) Interest shall be charged to El Paso at an annual rate of three and one-half percent (3½ percent) of 50 percent of the unamortized balance of preproduction costs and is payable out of El Paso's share of remaining net profits.

(vii) If and when payout occurs, El Paso shall become a fully participating working interest owner. At such time, Hecla's obligation to pay minimum advance royalty shall cease, and thereafter El Paso is obligated to advance the funds required to pay for its share of costs and expenses attributable to operation of the property. Payout shall occur when all preproduction costs have been recovered by Hecla.

(viii) El Paso or Hecla may assign its rights under the operating agreement to a parent or a subsidiary, but otherwise only upon consent of the other party, with such other party having right of first refusal.

(ix) El Paso and Hecla agree that El Paso, prior to payout, shall have first call on purchase of up to fifty percent (50 percent) of all copper mined and recovered at the then quoted producer price for domestic copper.

(x) Date of closing shall be as soon as practicable and not later than August 11, 1969. If not closed by such latter date, the Agreement will terminate unless extended by mutual agreement of the parties expressed in writing. In event the Agreement is terminated, the parties will take such action as may be required to return each of them to their respective positions preceding the date of the Agreement, it being understood that each party shall bear solely, without right of reimbursement from the other, any expense which it shall have incurred in connection with the Agreement.

Description of Properties

The Lakeshore Properties are located within the boundaries of the Papago Indian Reservation, Pinal County, Arizona, about 30 miles south of Casa Grande, Arizona. Undivided interests in these properties are owned 50 percent by El Paso and 50 percent by Transarizona and consist of (1) three patented lode mining claims covering 62 acres of land, known as the Treasure State Claims, covered by "Lease for Exploration Purposes and Option Agreement" dated November 14, 1955, as amended July 8, 1957, between Treasure State Mining Company and George Freeman, et al, (2) three patented and 19 unpatented lode mining claims covering 400 acres of land, known as the Drake Claims, (3) 3,717 acres of land located on the Papago Indian Reservation and covered by two "Mining Lease Indian Lands" between the Papago tribe and Transarizona (the "Papago Leases"), (4) an ore beneficiation plant utilizing a copper segregation process followed by conventional flotation treatment, and (5) a water permit authorizing the production of water from Papago lands required for operations upon land covered by the Papago Leases and the 25 mining claims.

The lease covering the Treasure State Claims provides for a purchase price of $400,000 to be paid out of minimum royalty and production royalty. As of February 28, 1969, $218,249 of the purchase price remained to be paid.

The Drake Claims are owned equally by El Paso and Transarizona, but under terms of the Papago Lease a royalty has been granted to the Papago tribe of 1 percent of net smelter return until a total tonnage of ore containing 50,750,000 pounds of copper has been mined from the Drake and Treasure State Claims, and thereafter, five percent of net smelter return. Additionally, El Paso and Transarizona are required to perform annual labor of $100 per claim per year upon each of the 19 unpatented lode mining claims.

A bonus of $140,000 was paid to the Papago tribe for the Papago Leases, which run from August 17, 1966 to August 17, 1976 and as long thereafter as minerals are produced in paying quantities. An annual rental of $1.00 per acre per year and a minimum royalty of $50,000 per year, which can be credited against the production royalty referred to below, is required to be paid to the Papago tribe as long as the Papago Leases are in effect. A production royalty of 10 percent of net smelter return is also required to be paid to the Papago tribe and is subject to (i) renegotiation when the mineral deposit has been quantitatively and qualitatively determined and (ii) renegotiation at the end of each five-year period based on market conditions. The leases also provide for annual exploration, development, mining and processing, and improvement obligations of $30 per acre during the first year, $40 per acre during the second year, $50 per acre during the third year and $100 per acre during the fourth and subsequent years.

Copper Days . . .

(Continued from Page Four)

ment, American Smelting and Refining Company; David C. Lincoln, president, Bagdad Copper Corporation; Lee L. Travis, president, Banner Mining Company; Henry T. Mudd, chairman of the board, Cyprus Mines Corporation; W. Page Morris, president, Duval Corporation; H. Myles Jacob, president, Inspiration Consolidated Copper Company; Ivor G. Pickering, general manager, Ray Mines Division, Kennecott Copper Corporation; T. G. Chilton, assistant to the president, Magma Copper Company; B. R. Coil, vice president and general manager, Miami Copper Company, division, Tennesee Corporation; John A. Lentz, vice president and general manager, Phelps Dodge Corporation; Paul W. Allen, president, Pima Mining Company.

A new feature of Tucson Copper Days this year was the Copper Cowboys Championship Rodeo, held the 19th and 20th at the Tucson Rodeo Grounds. More than 200 cowboys entered . . . basic requirement was that the cowboy, or member of his family, is employed by a mining company. Entrants came from throughout the state and New Mexico. A special copper trophy was presented to the company with the most winners . . . the trophy was from the Arizona Mining Association . . . and other prizes were awarded .

The Cowboys also sponsored a barbecue, with proceeds going to the Tucson Burn Center, Boys Club of Tucson and the Sportsmen Fund to Send-a-Kid-to-Camp.

Special tours of groups, particularly from grade school classrooms, were arranged throughout the week. For four Saturdays prior to the opening of Tucson Copper Days, the Arizona Mining Association hosted teachers tours . . . more than 1,000 Tucson-area teachers took advantage of the mine tours which included viewing various open pit operations south of Tucson, plus a deluxe luncheon at a mine site. This project encouraged participation by teachers once the downtown activities got under way and added to the general educational information.

Copper—colors—in cotton fashions were presented in style shows for the public on several days, with numerous unusual designs created especially for the occasion. The Copperettes, dressed in copper costumes designed by Cele Peterson, performed at the fashion shows and at numerous luncheon and dinner meetings during the week. More than two dozen talks on copper were given to civic and service clubs by mining experts.

Special arrangements were made to bring a group of artisans from Santa Clara del Cobre in Michoacan, Mexico, to Tucson for the week. The copper handcraftsmen brought their forges and other equipment and actually fabricated their wares right downtown. And all sold as quickly as the items could be made.

A special copper-dust painted headquarters was set up downtown and "manned" by the WAAIMES (Women's Auxiliary to the American Institute of Mechanical, Metallurgical and Petroleum Engineers).

Tucson Copper Days were held in 1966 and 1967, making this the third such event ever staged in Arizona . . . and probably anywhere else in the world. A cross-section of Tucson businessmen and mining personnel worked together for more than six months prior to each of the Copper Days held. Basic coordination was handled through Ade Abbott, executive director of the Tucson Trade Bureau, and Edward H. Peplow, Jr., executive secretary of the Arizona Mining Association.

REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY AT THE LAKESHORE MINE PINAL COUNTY, ARIZONA FOR EL PASO NATURAL GAS COMPANY

El Paso Natural Gas Company

El Paso, Texas 79999

October 15, 1969

Mr. Walter Heinrichs
Heinrichs Geoexploration Company
P. O. Box 5671
Tucson, Arizona 85703

Dear Walt:

Enclosed is a copy of "Report on the Induced Polarization and Resistivity Survey at the Lakeshore Mine Pinal County, Arizona". I would appreciate your returning it as soon as you have finished reading it.

Very truly yours,

John R. Reynolds
Supt. of Exploration
Mining Division

JRR:mp
Enclosure

October 17, 1969

Mr. John R. Reynolds
Supt. of Exploration
Mining Division
El Paso Natural Gas Co.
El Paso, Texas 79999

Dear Mr. Reynolds:

Thank you very much for allowing us to review the Induced Polarization report by McPhar. We have taken the liberty to record some of the data in order to be able to run comparison tests with our gear. I am sure this will enable us to better evaluate our findings. We certainly appreciate your willingness to let us look at the data.

We expect to present a preliminary analysis of all of our work at Lakeshore in the next few weeks.

Your report from McPhar is enclosed.

Sincerely yours,
Heinrichs GEOEXploration Co.

Paul A. Head, Geophysicist

PAH:jh

Enclosure: 1

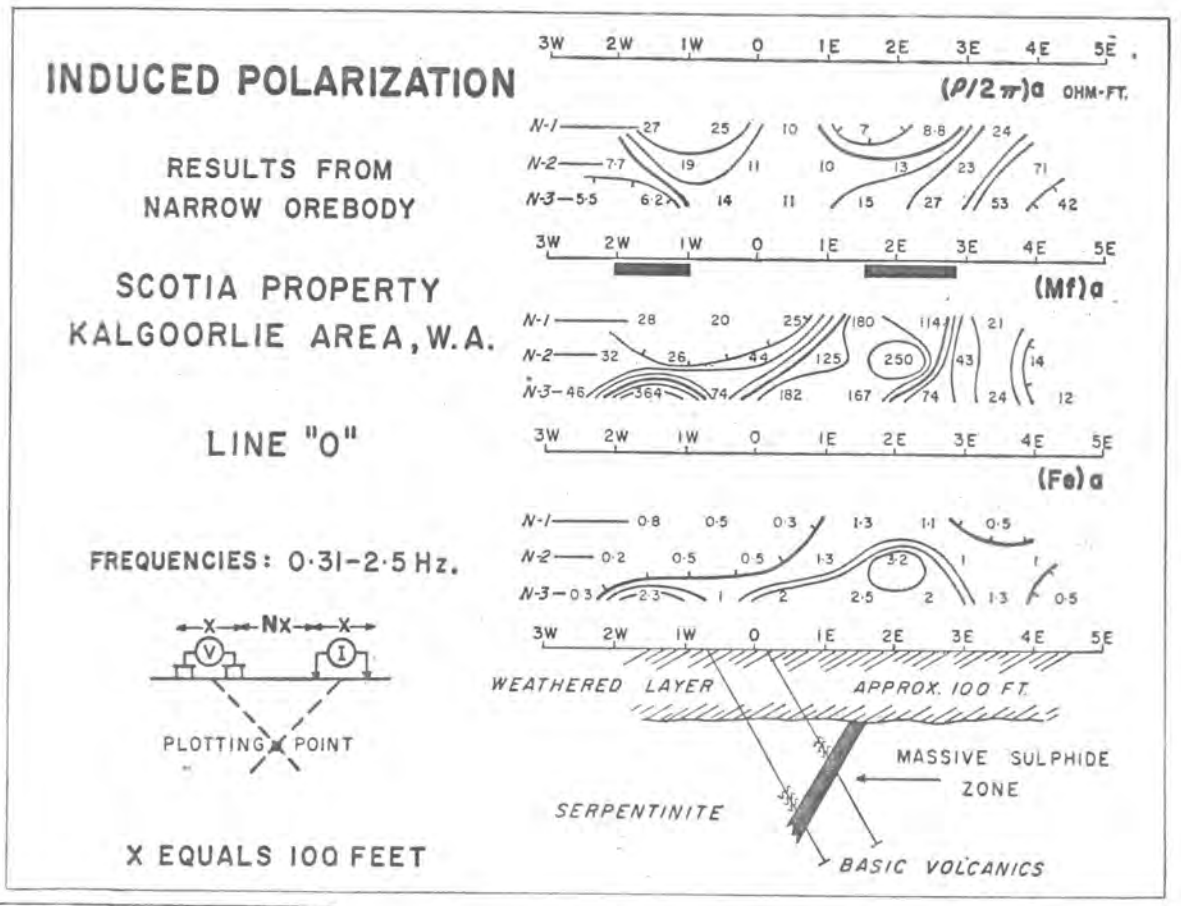
McPHAR

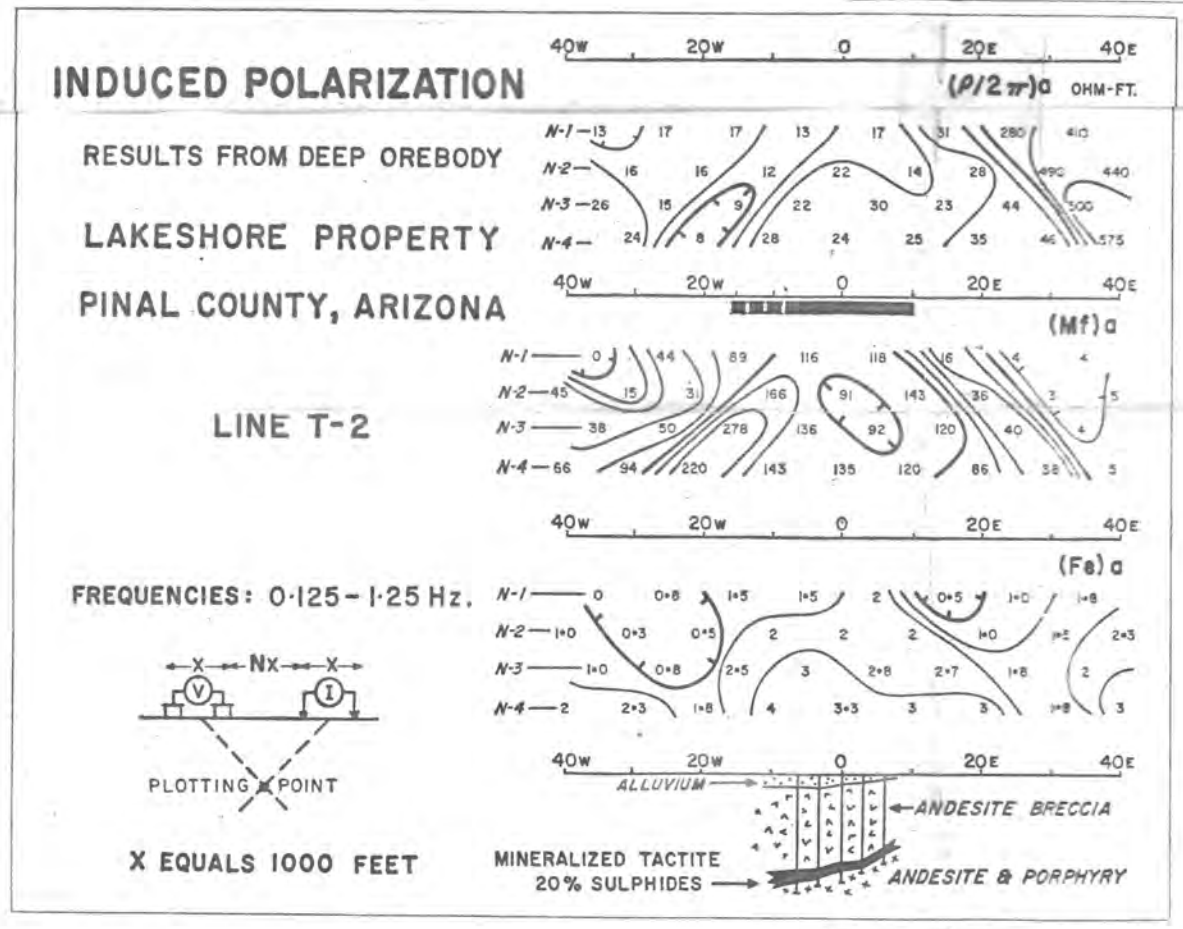
World-Wide Geophysical Contracting and Consulting Services

McPhar Geophysics is a world-wide organization offering the mineral exploration industry over twenty years' experience in contracting and consulting services, and instrument design and manufacturing capabilities.

Presently, there are more than sixty-five McPhar field crews operating on five continents — over fifty of these crews are using the variable frequency induced polarization technique advanced by McPhar Geophysics. The depth of experience in this method by McPhar is unequalled throughout the industry.

The vast experience of McPhar's Engineering Division has, throughout the years, assured our clients of accurate, reliable instrumentation for their ground and airborne geophysical exploration programmes.

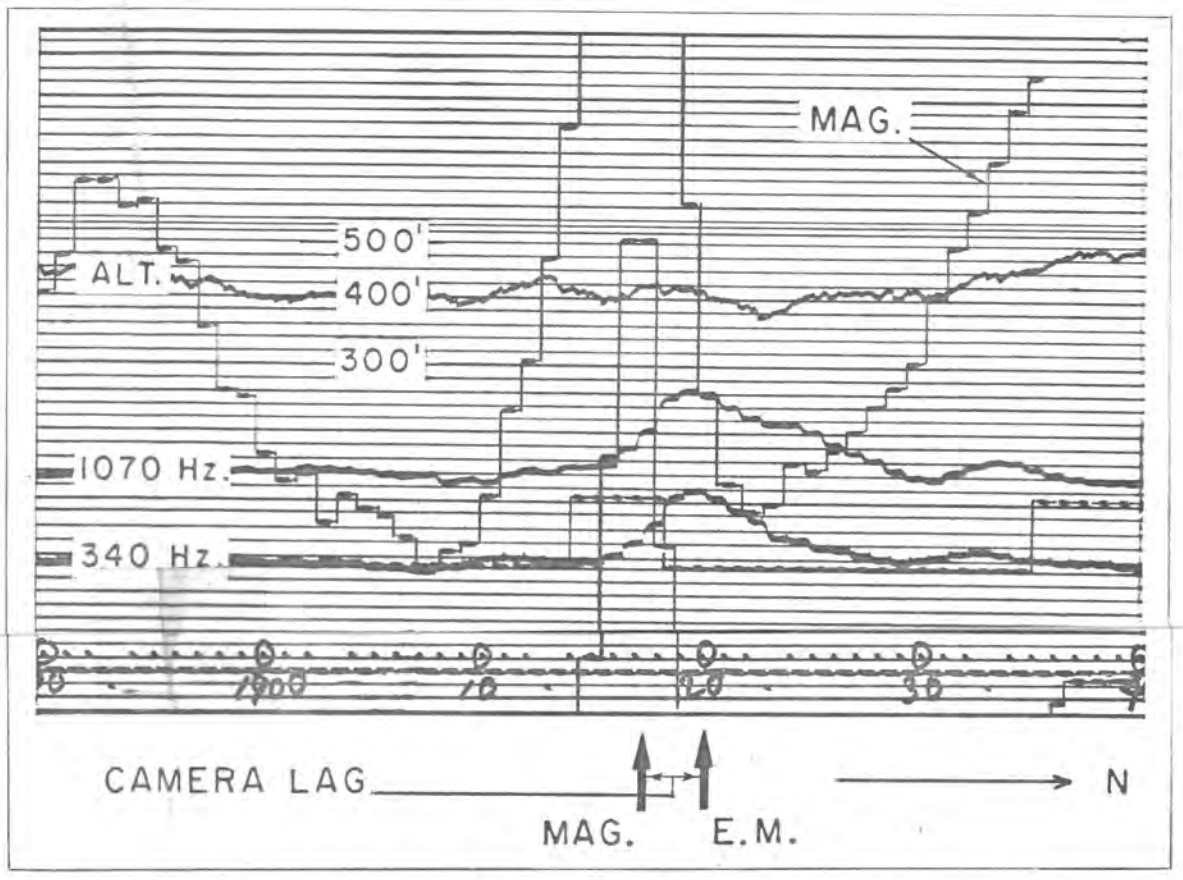




Our background and experience with the induced polarization method enabled us to tell our clients that they would have to use short electrode intervals to detect the narrow nickel ore bodies in West Australia (See Scotia Case History).

Previous experience in the area and theoretical considerations also permitted us to assure another client that the use of 1,000-foot electrode intervals would detect copper ore bodies at depths of 1,000-1,500-feet in the Southwestern Region of the United States. The drilling of one such deep anomaly at the Lakeshore Property in Arizona resulted in the discovery of one of the major copper deposits of North America (See Lakeshore Case History).

McPhar Geophysics was involved in the first development of an airborne E.M. system in Canada in 1948. A complete line of airborne instruments has been developed for installation in light aircraft, resulting in decreased line mile survey costs. The results, on the right, were obtained at a standard survey altitude of 425 feet over the recent Mattagami Lake Mines discovery near Sturgeon Lake, Ontario. The system employed included the McPhar F-400 Airborne E.M. Unit and a Proton Precession Magnetometer mounted in a Beaver aircraft. The data on the strip indicates an E.M. anomaly over the deposit with good conductivity, as obtained from the ratio of high and low frequency out-of-phase response. Correlating with the E.M. is a distinct magnetic high of 275 gammas.



McPHAR GEOPHYSICS

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Vancouver, B.C. • Mexico City, Mexico • Adelaide, Australia
Tuscon, Arizona

McPHAR GEOPHYSICS

REPORT ON THE

INDUCED POLARIZATION

AND RESISTIVITY SURVEY

AT THE

LAKESHORE MINE

PINAL COUNTY, ARIZONA

FOR

EL PASO NATURAL GAS COMPANY

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1. INTRODUCTION

A previous report dated May 16, 1968 describes the results of the Test Survey carried out to determine the usefulness of the IP method in locating the sulphide mineralization that has been located west of the zone of secondary copper mineralization at the Lakeshore Mine. Since the sulphide mineralization is at considerable depth, electrode intervals of 500 feet and 1,000 feet were used for this Test Survey.

As described in the report on the results of the Test Survey, the IP data clearly indicated the presence of the sulphide mineralization at depth. An extended survey to cover the area of interest was recommended, and this work has now been completed.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results are shown

on the following enclosed data plots. The results are plotted in the manner described in the notes preceding this report.

In order to be complete, the previous data from the test survey is also enclosed with this report.

Test Line T1	1,000 foot electrode intervals	Dwg. IP 5091-1
	500 foot electrode intervals	Dwg. IP 5091-2
Test Line T2 (Line 0+00)	1,000 foot electrode intervals	Dwg. IP 5091-3
	500 foot electrode intervals	Dwg. IP 5091-4
Line 50N	1,000 foot electrode intervals	Dwg. IP 5132-1
Line 40N	1,000 foot electrode intervals	Dwg. IP 5132-2
Line 30N	1,000 foot electrode intervals	Dwg. IP 5132-3
Line 20N	1,000 foot electrode intervals	Dwg. IP 5132-4
Line 10N	1,000 foot electrode intervals	Dwg. IP 5132-5
Line 10S	1,000 foot electrode intervals	Dwg. IP 5132-6
Line 20S	1,000 foot electrode intervals	Dwg. IP 5132-7
Line 30S	1,000 foot electrode intervals	Dwg. IP 5132-8
Line 40S	1,000 foot electrode intervals	Dwg. IP 5132-9
Line 50S	1,000 foot electrode intervals	Dwg. IP 5132-10

Enclosed with this report is Dwg. I. P. P. 4423, a plan map of the grid at a scale of 1"=500'. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as the data plots. These bars represent the surface pro-

jection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured.

Since the induced polarization measurement is essentially an averaging process, as are all potential methods, it is frequently difficult to exactly pinpoint the source of an anomaly. Certainly, no anomaly can be located with more accuracy than the spread length; i.e. when using 1,000' spreads the position of a narrow sulphide body can only be determined to lie between two stations 1,000' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the centre of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

3. DISCUSSION OF RESULTS

The results from Line T1 and Line T2 have been discussed previously. The zone of sulphide mineralization is clearly outlined. The 500 foot electrode interval measurements show the source at considerable depth; the measurements with 1,000 foot spreads show that the depth to the top is about one electrode interval.

The recent measurements on the adjacent lines seem to indicate the extension of the known zone of mineralization. However, the interpretation of the IP results is complicated by several factors. The

first is the rather complicated geologic picture that has been revealed by recent drilling. Drill holes only a few hundred feet apart show completely different subsurface geology. The faulting that must be postulated to explain these geologic variations can be expected to complicate the positioning of the zones of mineralization causing the IP anomalies.

The interpretation of the IP data is additionally complicated by the fact that there are two types of mineralization that are of potential economic importance. The mineralization in the relatively flat-lying tactite zone is fairly concentrated; the usual thickness of this zone is 50 feet to 125 feet. The copper content of the tactite zone is high enough to be of extreme interest! To the west and northwest, a very large volume of granite porphyry has been fractured and weakly mineralized. There is much less mineralization in this zone, and the copper content is less; however, it is still of economic interest.

IP anomalies would be expected from both of these types of mineralization. However, in places, the two zones are present together and it would not be possible to separate the anomalies. The considerable depth to the top of the mineralization also makes it difficult to locate the exact edges of mineralized zones or to separate two closely spaced zones.

Line 50N

This is the northernmost line surveyed. The apparent resistivity values are typical for the area. There are high resistivity values to the east in the direction of a fresh granite intrusive, and lower resistivity values to the west.

The IP results show a very weak anomaly centred at 35W to 15W. The resistivities are very low in this area and only small concentrations of metallic mineralization would be necessary to cause the effects measured. The depth to the top of the source is indicated to be less than one electrode interval (1,000').

Line 40N

The anomaly is slightly larger in magnitude on this line. The source is indicated to have less width and to be at greater depth. There are also weakly anomalous effects, at depth, at the eastern end of the line. However, it would be necessary to extend the measurements in order to evaluate the anomaly.

Line 30N

Here, the anomaly has a moderate magnitude. It extends from 30W to 10E and the mineralization is indicated to be somewhat more concentrated at the western edge of the zone.

Line 20N

The anomaly is quite definite on this line. The strongest portion of the anomaly is centred at 20W to 0+00. There is some depth indicated to the top of the source.

Line 10N

On this line the anomaly is very broad, and complex. However, the data correlates well with the anomaly previously located on Line T2.

To the east, the anomalous effects extend at least to 20E and perhaps to 30E. This is east of the open pit, and within the granite area. Further investigation would be warranted to check this anomaly.

Line 10S

This line is south of Line T2. The results show a single, moderate magnitude anomaly centred at the baseline. The source is indicated to have some width, and to be at depth.

Line 20S

The anomaly is somewhat weaker on this line. The source is still wide, but there is no suggestion of depth to the top of the source. This anomaly could be better evaluated using shorter electrode intervals.

Line 30S

There is a very broad, weak IP anomaly on this line that correlates with the effects measured on the lines to the north. However, the anomalous effects do not seem to be strong enough to warrant further work at this time.

Line 40S

The same weakly anomalous effects are present on this line. The anomaly at 0+00 to 20E was measured for n=1, and it could be better evaluated using shorter electrode intervals.

Line 50S

This is the southernmost line surveyed. The very weakly

anomalous IP effects measured were detected for the large values of (n). Either the source is at considerable depth, or the effects are due to the source to the north.

4. CONCLUSIONS AND RECOMMENDATIONS

The IP anomalies have been shown on the plan map Dwg. I.P.P. 4423; the anomalous zones can be compared with the drill holes. The IP results appear to indicate that the zones of mineralization extend beyond the drilled area.

The most recent drilling is taking place at the southwestern edge of the definite anomaly. In hole P-58, a considerable thickness of mineralized porphyry was intersected; the mineralization was first intersected at a relatively shallow depth in the hole. However, in hole P-57 and hole P-60, both drilled near the edge of the definite IP anomaly, the geologic portion is quite definite.

In these holes a thickness of more than 1000 feet was encountered of a badly oxidized, limonitic breecia or conglomerate. Samples of this rock give a moderately low resistivity but no IP effect, when laboratory measurements are made. Both of these holes have recently encountered fresh sulphide mineralization at depths greater than 1,500 feet. It is still too early to assess the geologic importance of this change in subsurface geology; a fault is probably present.

It is obvious from these recent drilling results that the geologic picture is complicated and that there may be several sulphide zones present.

Further drilling to fully evaluate the importance of the anomalous zones is necessary. In some portions of the area better locations may be obtained using 750 foot electrode intervals and lines 500 feet apart, and this may be warranted. On the basis of the present data, it would appear that a large area of mineralization remains to be tested.

MCPHAR GEOPHYSICS INCORPORATED,

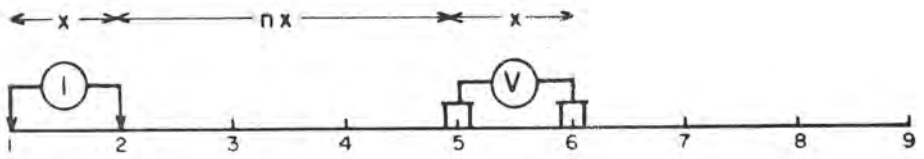
P. G. HALLOF

Philip G. Hallof,
Geophysicist.

Robert A. Bell,
Geologist.

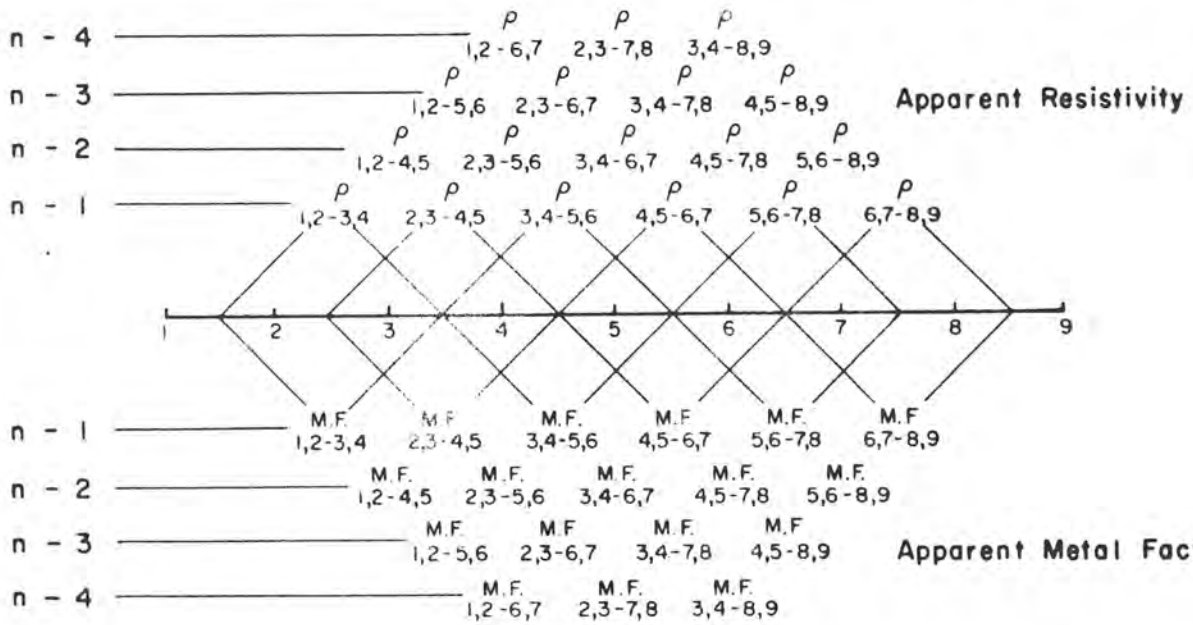
Dated: July 24, 1968.

METHOD USED IN PLOTTING DIPOLE-DIPOLE INDUCED POLARIZATION AND RESISTIVITY RESULTS



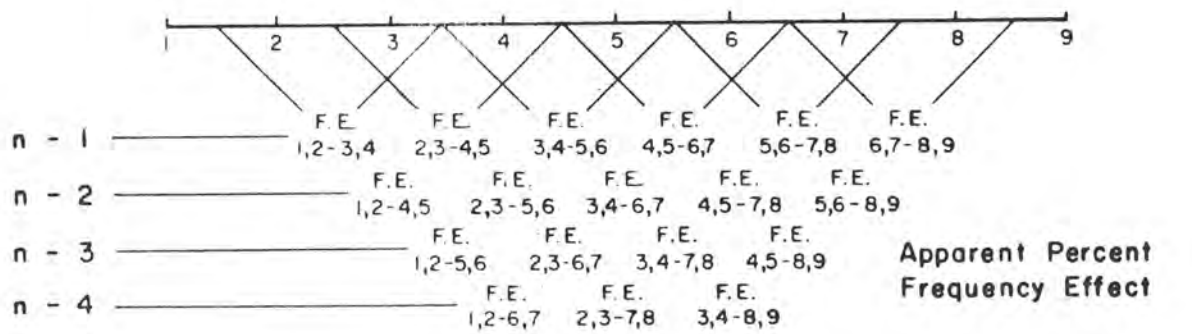
Stations on line

x = Electrode spread length
n = Electrode separation



Apparent Resistivity

Apparent Metal Factor



Apparent Percent Frequency Effect

Fig. A

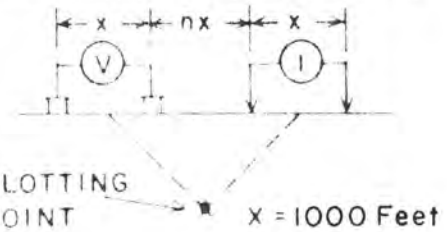
DWG. NO.-I.P.- 5091-1

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY ARIZONA

LINE NO.- T1

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE ——————

PROBABLE .....

POSSIBLE / / / / / / /

FREQUENCIES: 0·125 & 1·25 c.p.s

DATE SURVEYED APRIL/68

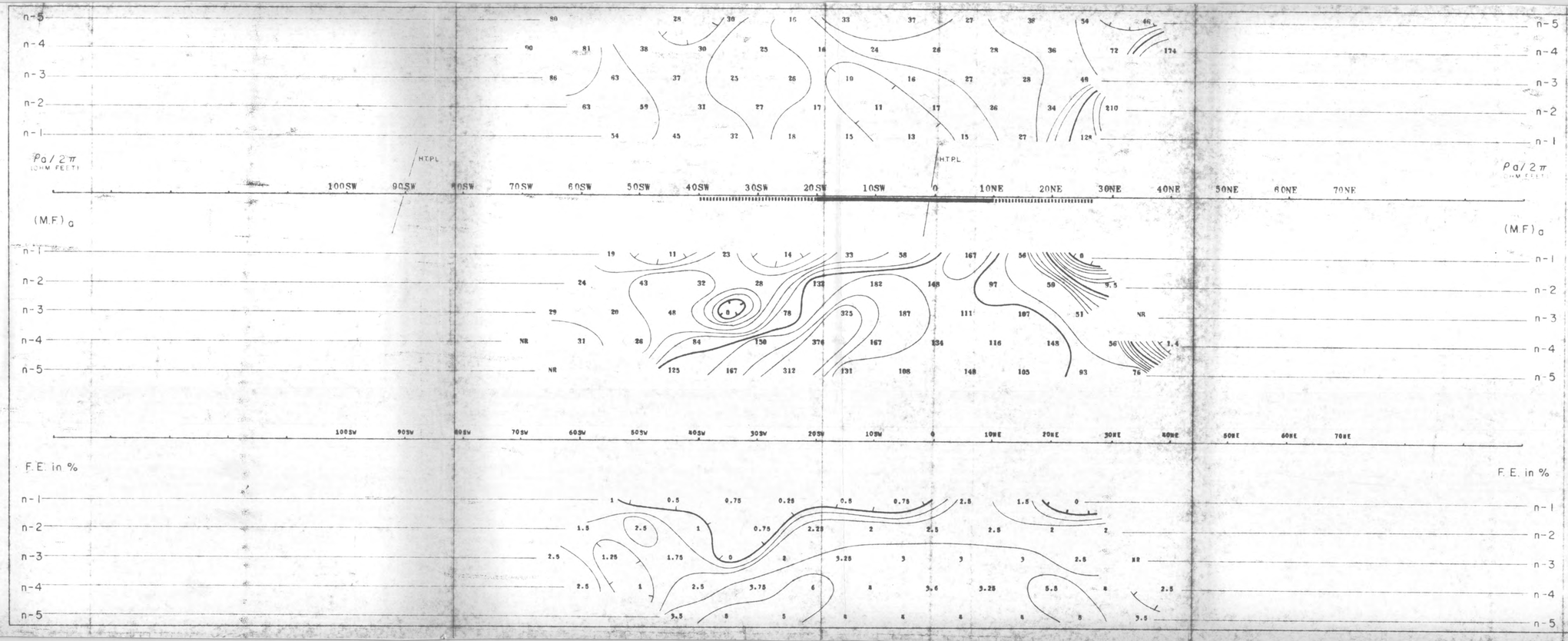
APPROVED: R. A. Bell

DATE May 16/68

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1·5-2-3-5-7·5-10

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



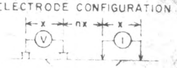
DWG. NO.-I.P.- 5091-1

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY ARIZONA

LINE NO.- T1

ELECTRODE CONFIGURATION



PLOTTING POINT * x = 1000 Feet

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.125 & 1.25 c.p.s

DATE SURVEYED APRIL/68

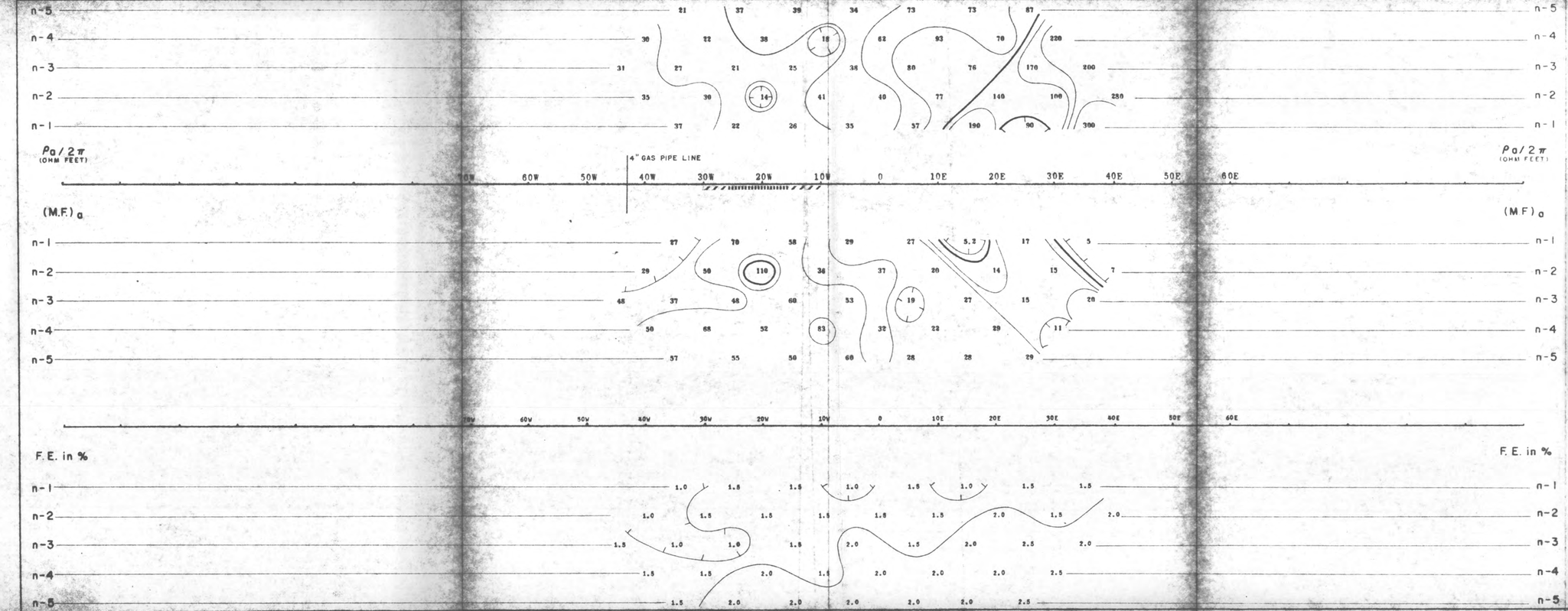
APPROVED

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

DATE

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



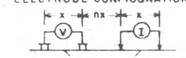
DWG NO - I P - 5132 - I

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO - 50 N

ELECTRODE CONFIGURATION



PLOTTING POINT x = 1000'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125 - 1.25 CPS

DATE SURVEYED JUNE 1968

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1 - 1.5 - 2 - 3 - 5 - 7.5 - 10

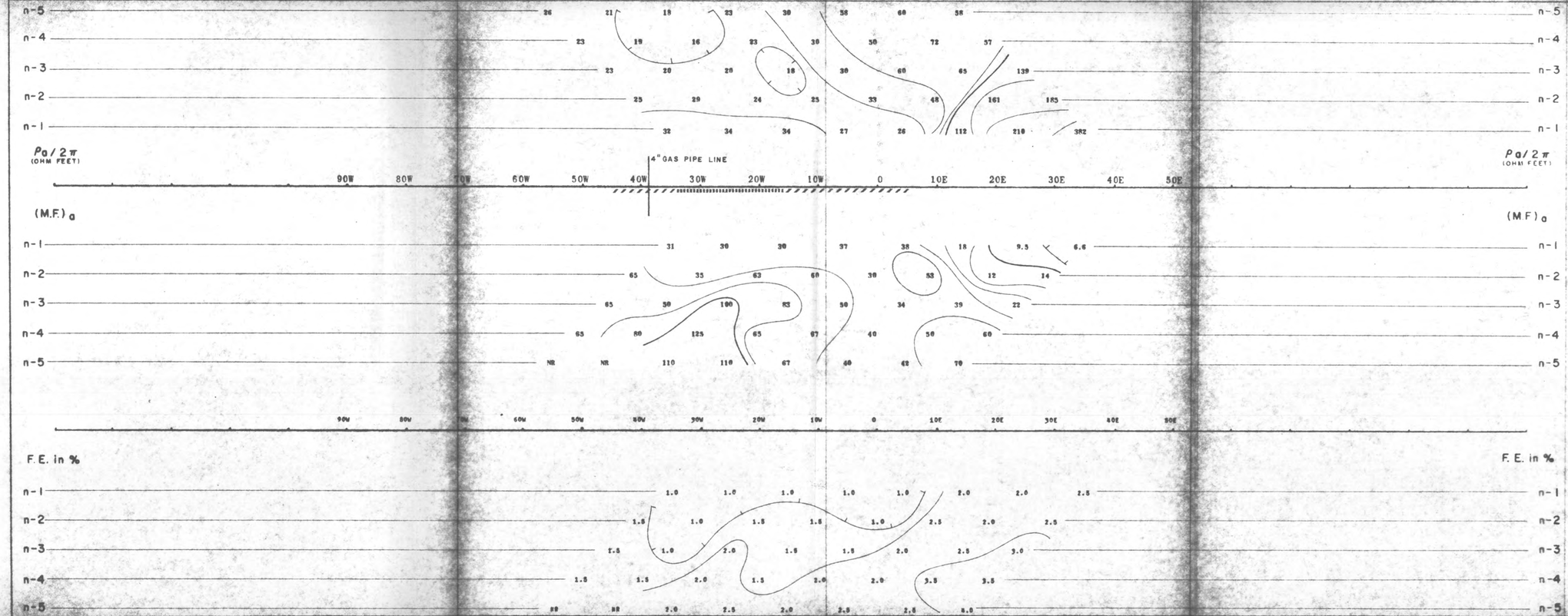
APPROVED

DATE July 10

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



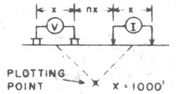
DWG NO.-IP-5132-2

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 40 N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED JUNE 1966

APPROVED

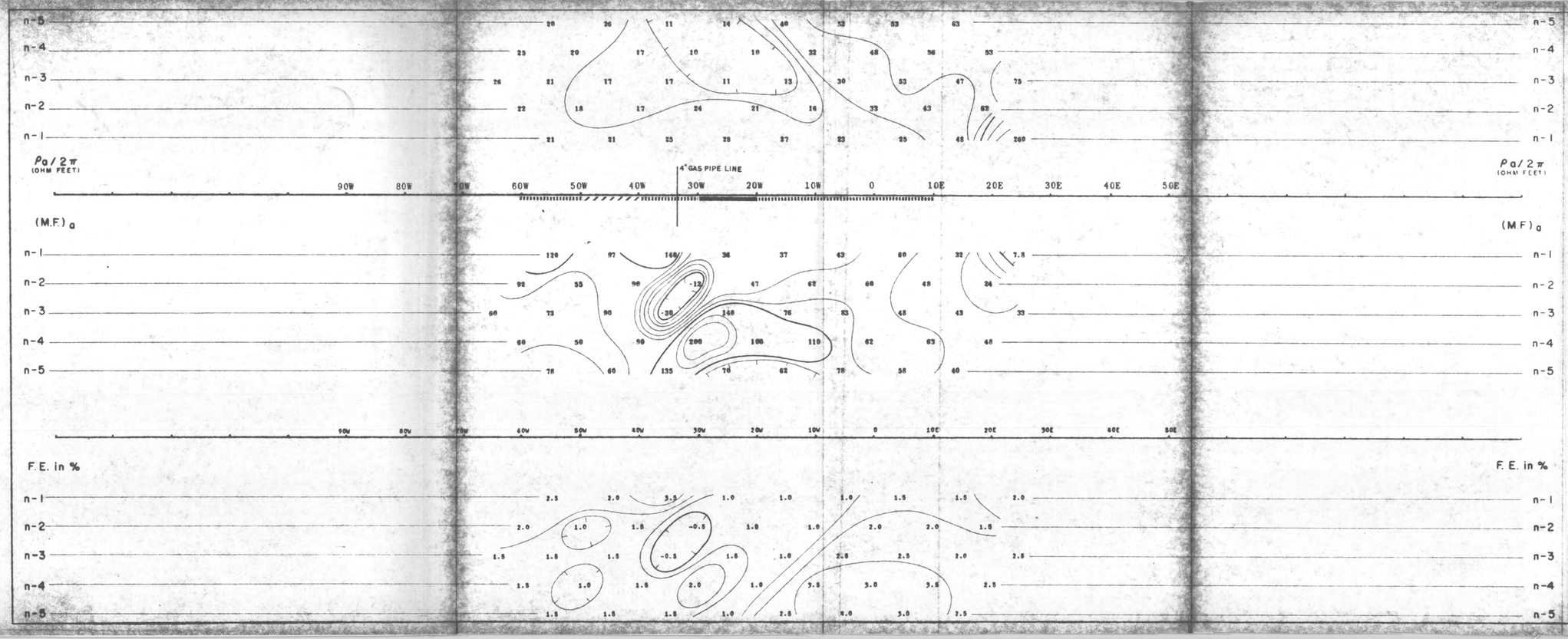
DATE

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



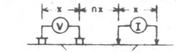
DWG NO.-I.P.-5132-3

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 30N

ELECTRODE CONFIGURATION



PLOTTING POINT x = 1000'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED JUNE 1968

NOTE: CONTOURS AT LOGARITHMIC INTERVALS
1-1.5-2-3-5-7.5-10

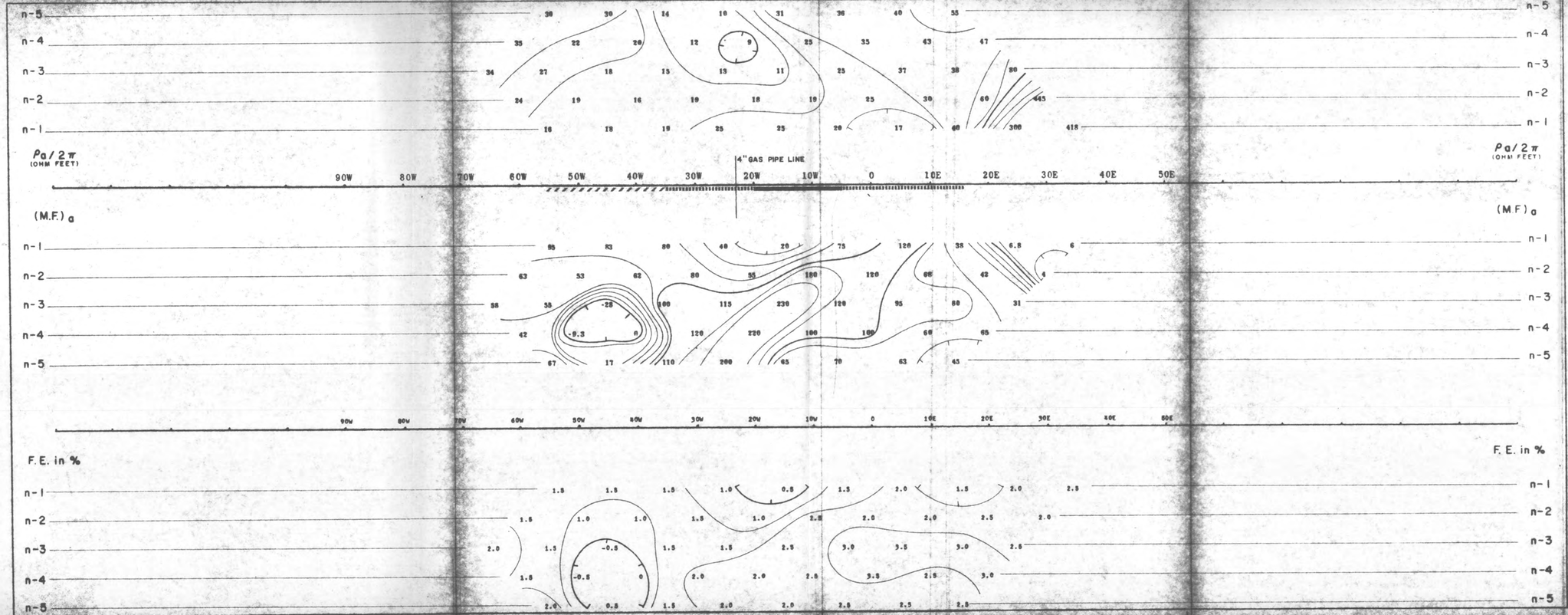
APPROVED

DATE July 10, 1968

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



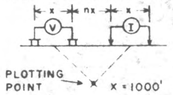
DWG NO.- I P - 5132-4

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 20 N

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES: 0.125-1.25 CPS

DATE SURVEYED: JUNE 1968

APPROVED

DATE

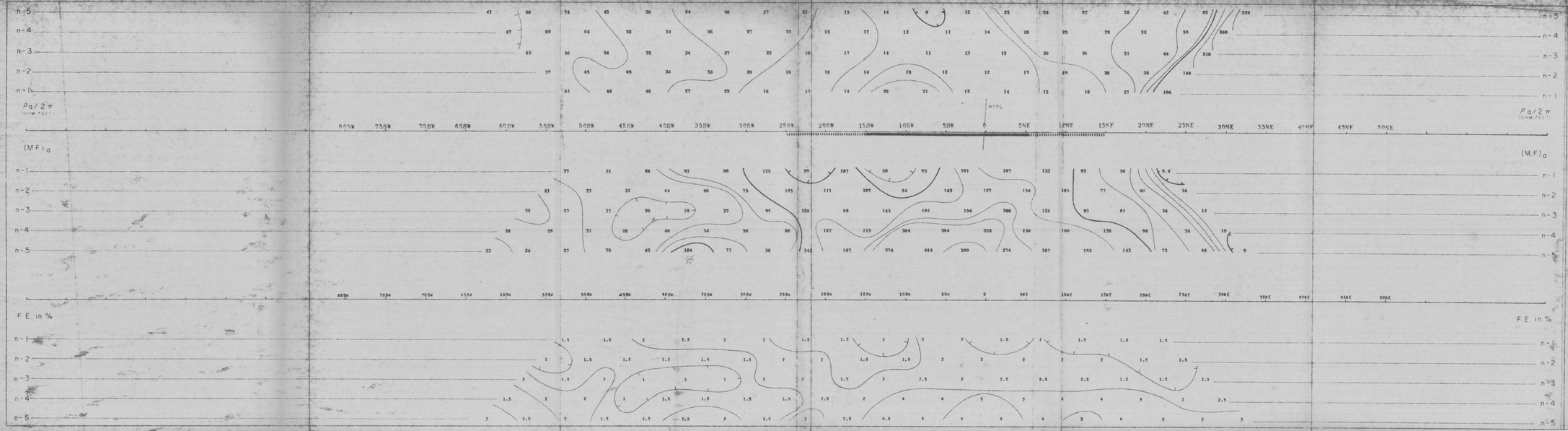
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

REGISTERED GEOLOGIST CERTIFICATE NO. 6786 ROBERT ALAN BELL ARIZONA, U.S.A.

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



DWG. NO.-T.P.- 5091-2

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY ARIZONA

LINE NO.- T1

ELECTRODE CONFIGURATION

PLOTTING POINT x = 500 Ft

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.10 & 1.25 c.p.s.

DATE SURVEYED APRIL/68

APPROVED

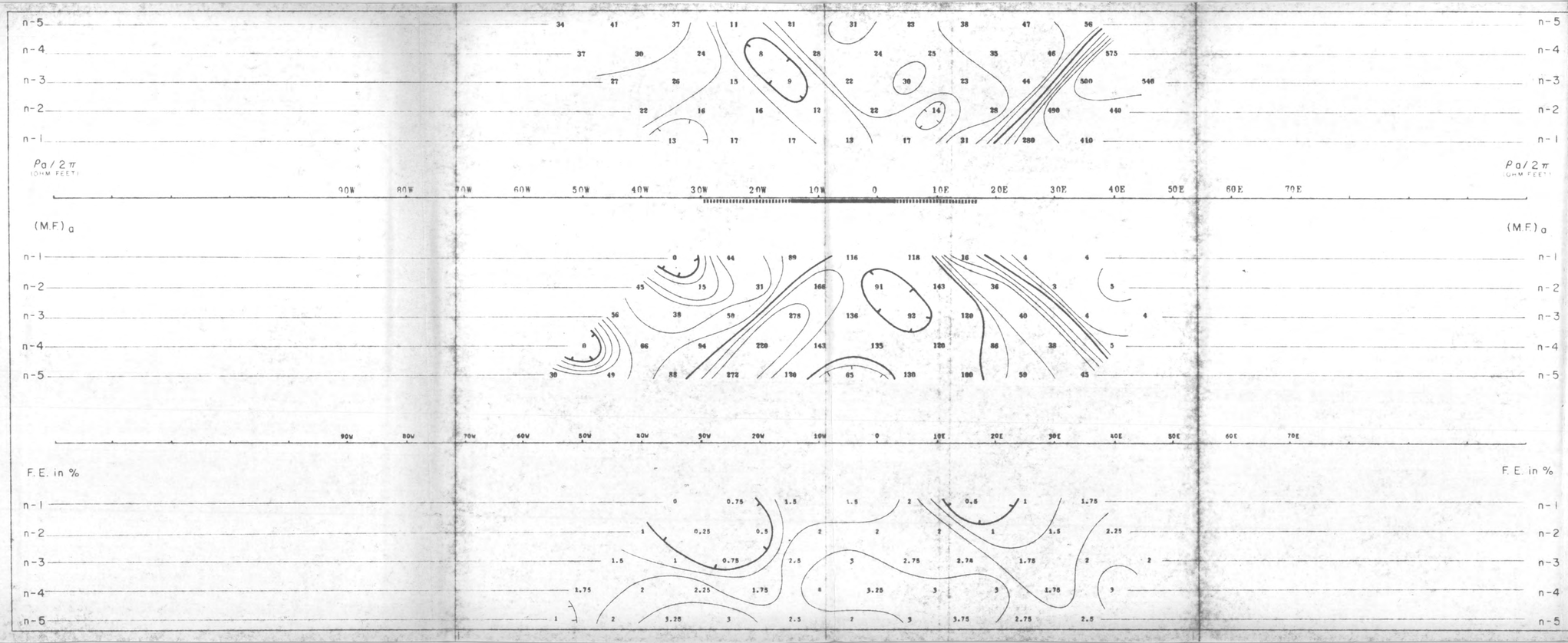
DATE

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

REGISTERED GEOLOGIST
SCIENTIFIC LAND
R. A. Bell
May 16/68
ARIZONA, U.S.A.

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



DWG. NO.-I.P.- 5091-3

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY ARIZONA

LINE NO.- T 2

ELECTRODE CONFIGURATION

PLOTTING POINT

X = 1000 Ft

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCIES 0·125 & 1·25 c.p.s.

DATE SURVEYED APRIL/68

APPROVED

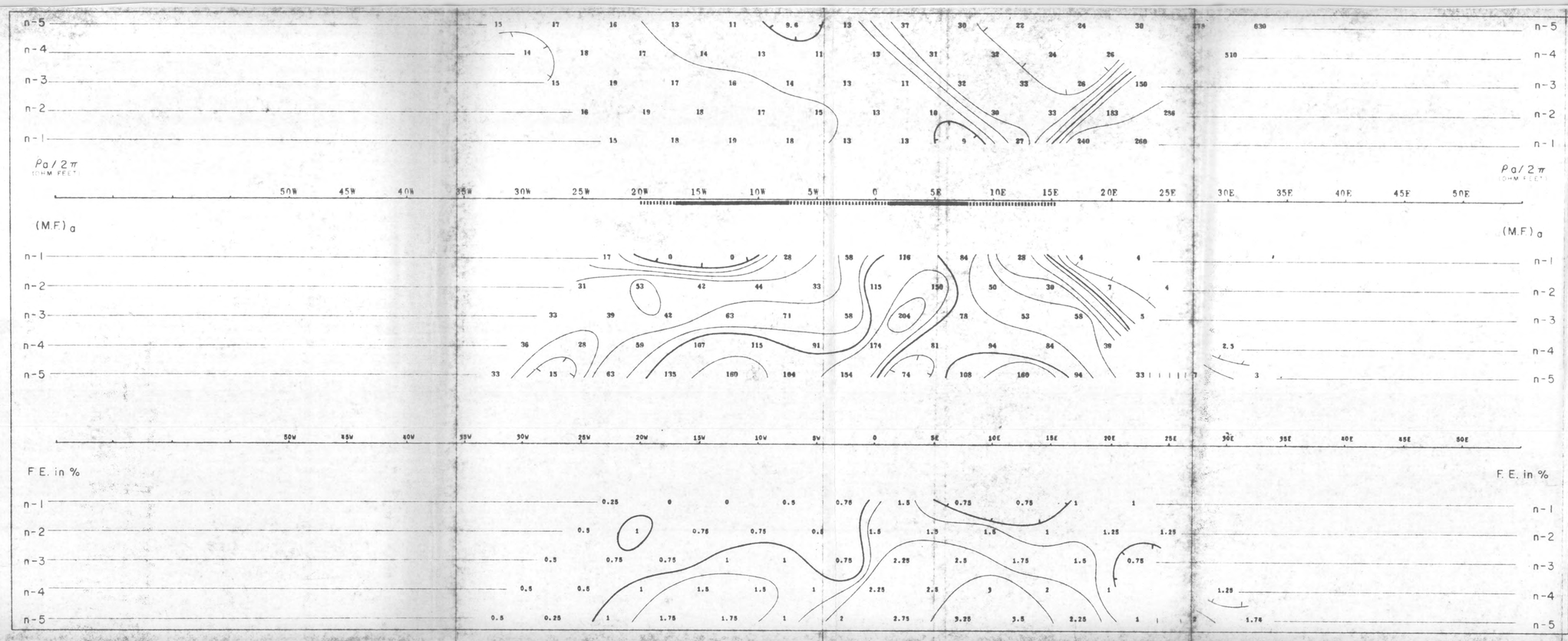
DATE

NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1·5-2-3-5-7·5-10

REGISTERED GEOLOGIST
CERTIFICATE NO. 465
PROBERT A. BELL
ARIZONA, U.S.A.

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



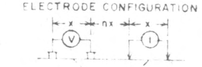
DWG. NO.-I.P.- 5091-4

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY ARIZONA

LINE NO.- T 2

ELECTRODE CONFIGURATION



PLOTTING POINT x = 500 Ft.

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0·125 & 1·25 c.p.s.

DATE SURVEYED APRIL/68

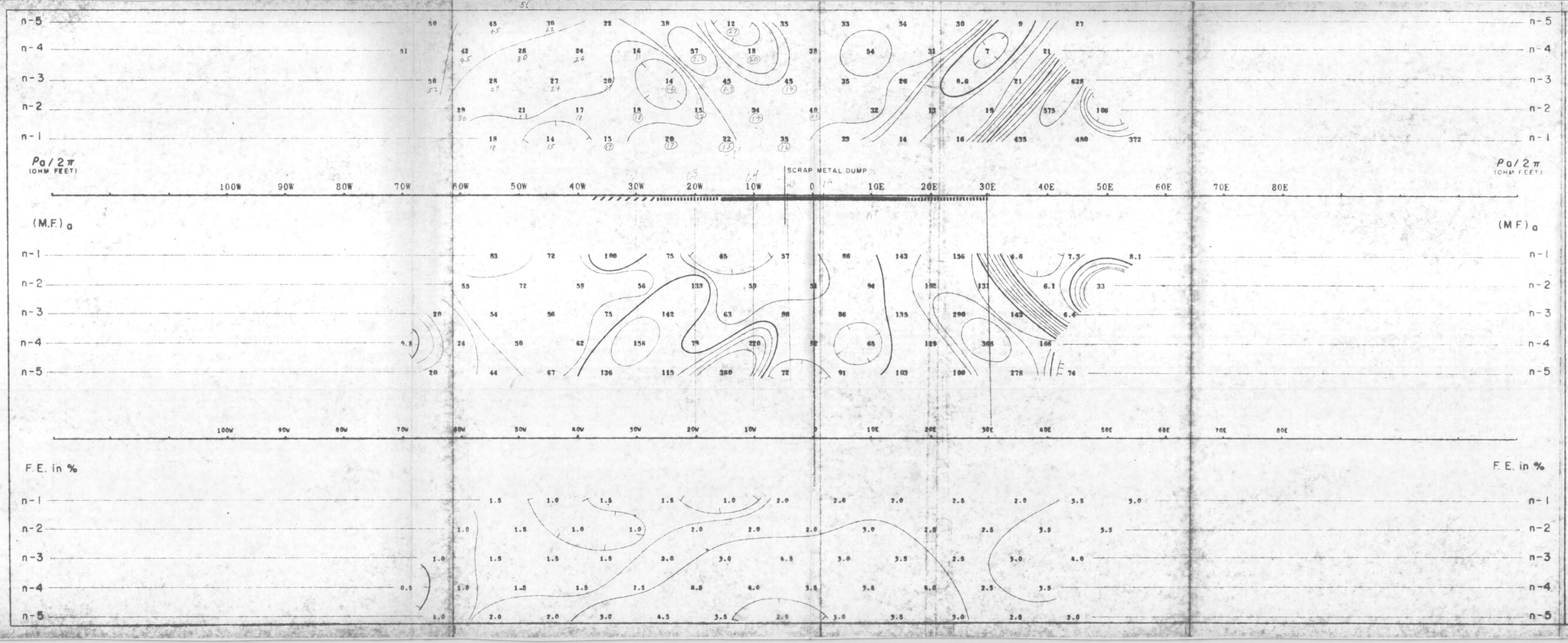
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1·5-2-3-5-7·5-10

APPROVED

DATE May 16/68

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



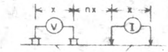
DWG NO - I P - 5132 - 5

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA

LINE NO - 10 N

ELECTRODE CONFIGURATION



PLOTTING POINT → x X = 1000'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED JUNE 1968

NOTE CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

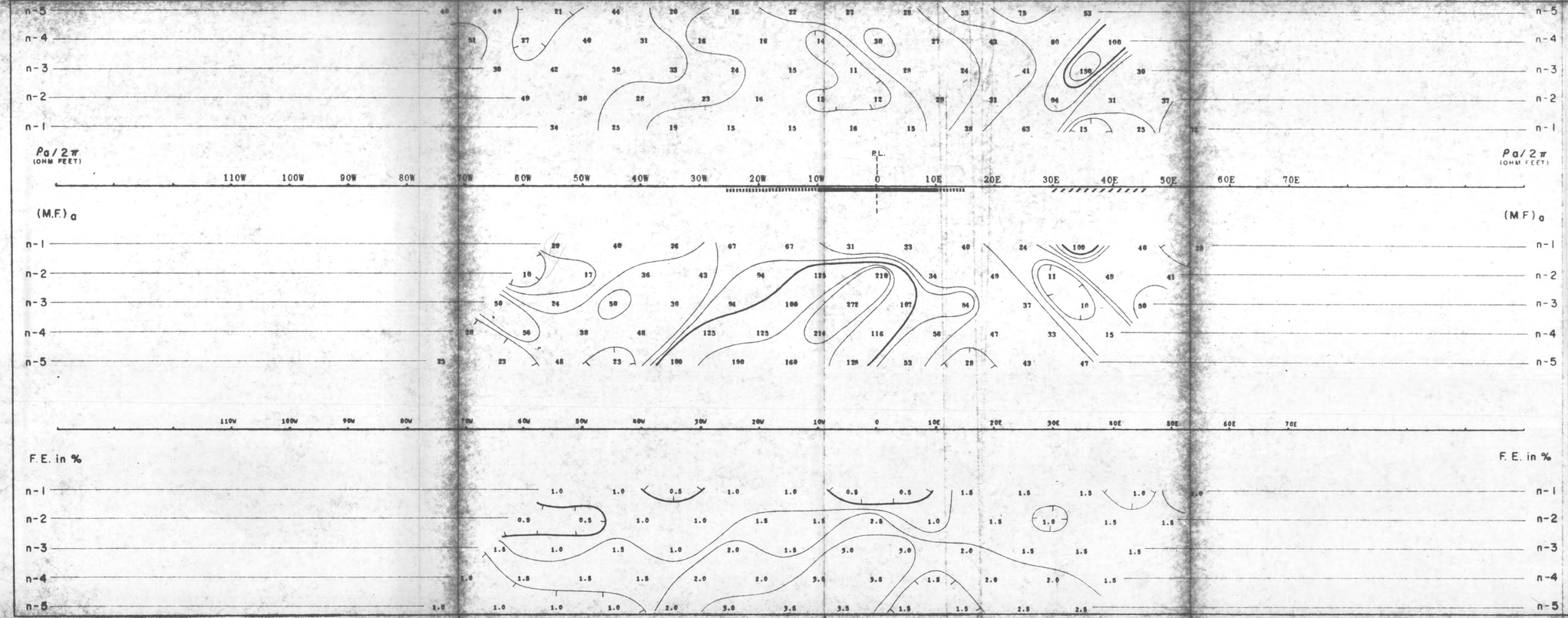
APPROVED

DATE July 10 68

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



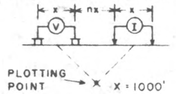
DWG NO - IP - 5132-6

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 10 S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED JUNE 1968

APPROVED

DATE July 10, 68

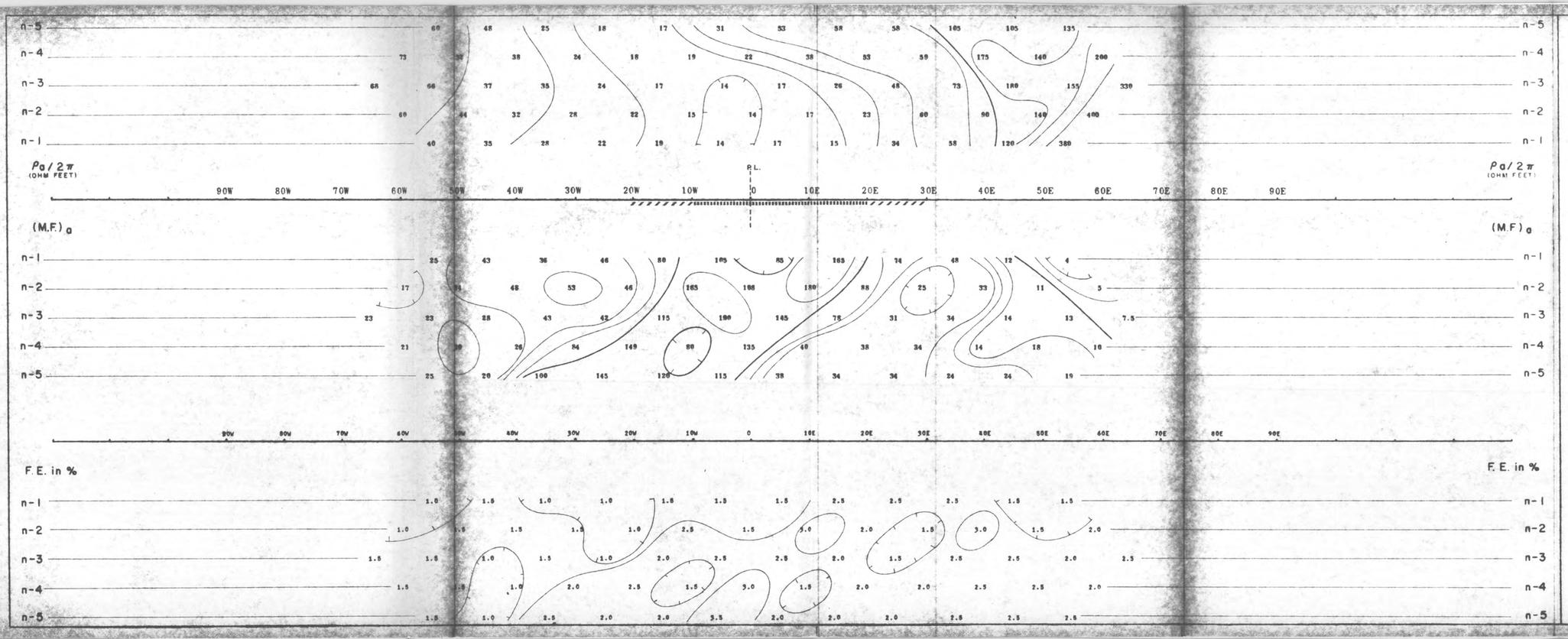
NOTE CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

REGISTERED GEOLOGIST CERTIFICATE No. 5780 ROBERT ALAN BELL ARIZONA, U.S.A.

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



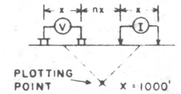
DWG NO - IP - 5132-7

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO - 20 S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED JUNE 1968

APPROVED

DATE

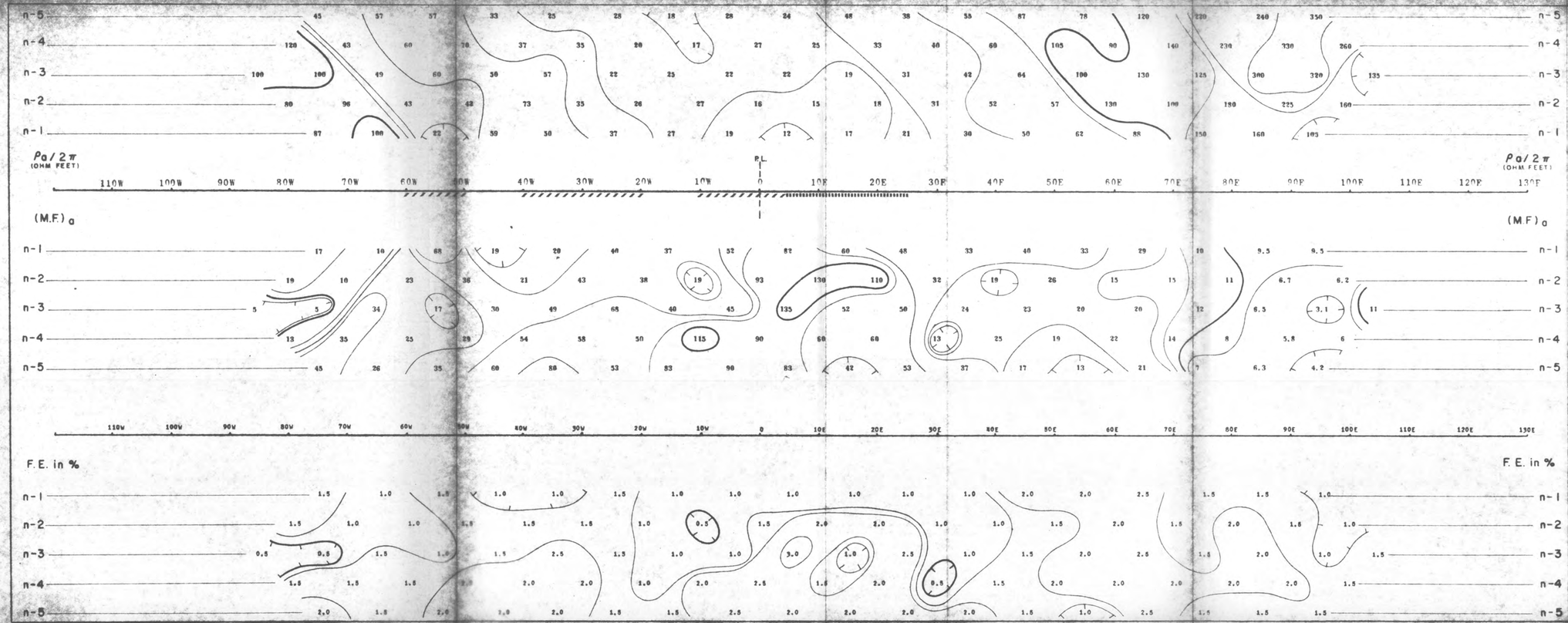
NOTE - CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

REGISTERED GEOLOGIST
CERTIFICATE NO. 5786
ROBERT ALAN BELL
ARIZONA, U.S.A.

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



DWG NO.-I P- 5132-8

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 30S

ELECTRODE CONFIGURATION

PLOTTING POINT x = 1000'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED: JUNE 1968

APPROVED

DATE

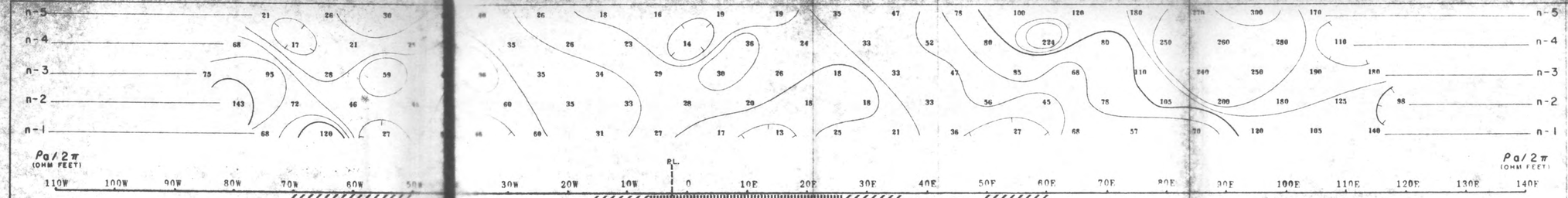
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

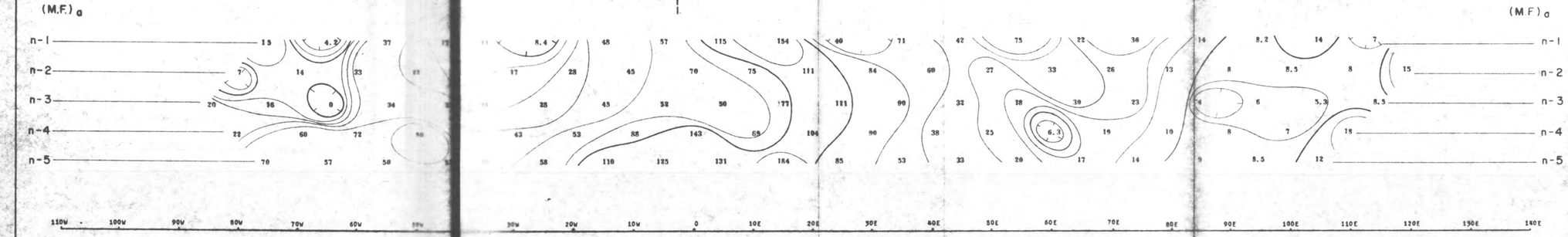
REGISTERED GEOLOGIST CERTIFICATE NO. 6788 ROBERT ALAN BELL ARIZONA, U.S.A.

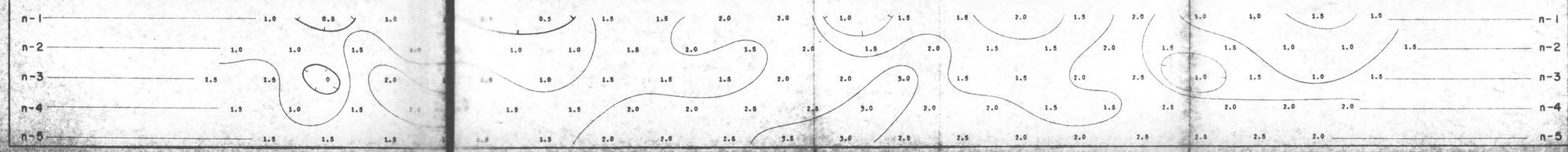
McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY







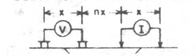
DWG NO - I P - 5132-9

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 40 S

ELECTRODE CONFIGURATION



PLOTTING POINT × x = 1000'

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES 0.125-1.25 CPS

DATE SURVEYED: JUNE 1968

APPROV

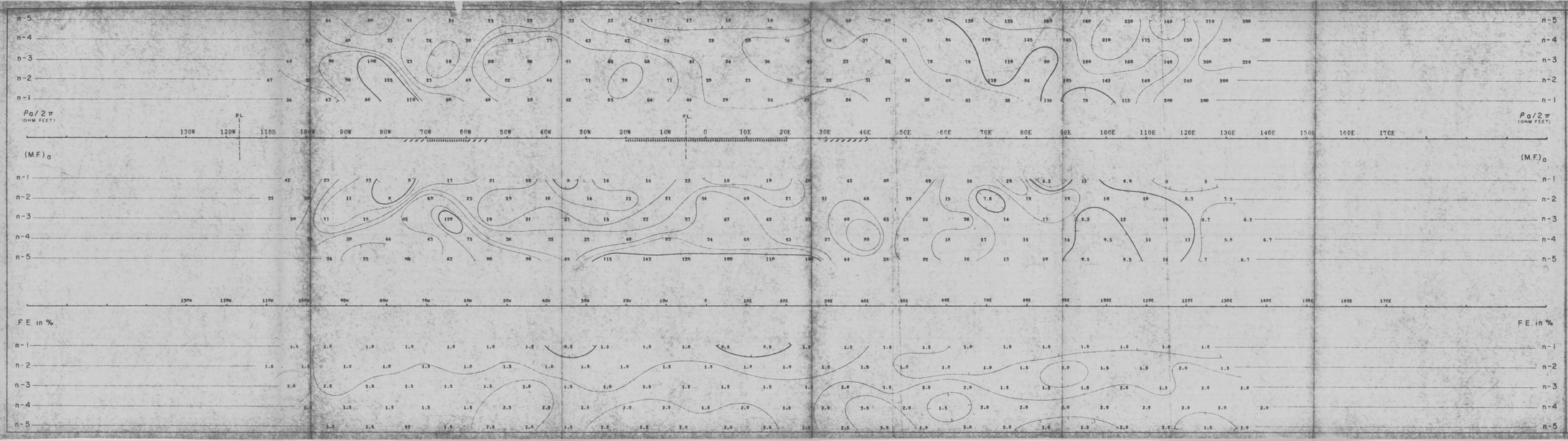
NOTE: CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

DATE: July 10, 68

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY



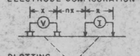
DWG. NO.-I.P.-5132-10

EL PASO NATURAL GAS CO.

LAKESHORE MINE, PINAL COUNTY, ARIZONA.

LINE NO.- 50 S

ELECTRODE CONFIGURATION



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

FREQUENCIES- 0.125-1.25 CPS

DATE SURVEYED- JUNE 1968

APPROVED-

DATE-

NOTE- CONTOURS AT LOGARITHMIC INTERVALS 1-1.5-2-3-5-7.5-10

McPHAR

McPHAR GEOPHYSICS

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Dwg. I.P.P. 4423