CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

June 28, 1967

Mf. Carew McFall
SEMINCO
3538 El Grande Drive
San Jose, California

Dear Mr. McFall:

Enclosed find an original and 2 copies of our report on the "Induced Polarization Survey, Mowry and Royal Areas, Santa Cruz County, Arizona".

Reproducibles will follow shoatly under separate cover along with the maps you lent us.

If we can be of any further assistance, please let us know.

Sincerely yours,

HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig
Senior Geophysicist

CSL:pm
Enclosures

1.025

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page 2

Project Seminco Line 1 NW½ Field date 6-13-67 Data page ____ Comp. date 6/16/67. Comp by A.P.F.

(A) Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		
(B) Receive	6-3NW	3-6NW →		6-9NW →			9-12NW →					
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I current amps	1.5 amps →											
(E) Vdc (avg) mv	186.1	189	49.3	441	69.4	27.1	810	173	40.9	18.9		
(F) DCcal	1.053 →											
(G) Kn x 10^{-3}	0.9	0.9	3.6	0.9	3.6	9.0	0.9	3.6	9.0	18		
(H) ρ dc=ExFxGx10^3/D	118	119	125	278	175	172	512	438	259	239		
(I) Vac Σ	181.5	184	48.0	425	68.0	26.5	776	165	39.8	18.6		
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.000 →											
(M) ρ dc/ρ ac=ExL/K												
(N) PFE=(M-1)(10^2)	2.5	2.8	2.8	3.7	2.1	2.3	4.4	4.8	2.8	1.6		
(O) MCF=(M-1)(10^5)/H	21	24	22.4	13.3	12.0	13.4	8.6	10.9	10.8	6.7		

Project ____ Line ____ Field date ____ Data page ____ Comp. date ____ Comp by ____

(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		CAL	CAL	
(B) Receive	12-15NW →				15-18NW →							
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	→									1.000	500	
(E) Vdc (avg)	112	40.7	14.6	7.71	60.6	26.5	10.8	6.08		94	47.9	
(F) DCcal	→								→	1.063	1.043	
(G) Kn x 10^{-3}	3.6	9.0	18	31.5	9.0	18	31.5	50.4			1.053 avg	
(H) ρ dc=ExFxGx10^3/D	283	257	184	171	383	335	239	215				
(I) Vac Σ	108	39.0	14.3	7.55	59.8	25.9	10.7	5.99		94	47.9	
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	→								→	1.000	1.000	
(M) ρ dc/ρ ac =ExL/K												
(N) PFE=(M-1)(10^2)	3.7	4.2	2.1	2.1	1.2	2.3	0.9	1.5				
(O) MCF=(M-1)(10^5)/H	13.1	16.3	11.4	12.3	3.58	6.87	3.77	6.98				

$$\text{DC Cal} = \frac{I_{DC\ cal}}{10\, V_{DC\ cal}}$$

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page 1

Project Seminco Line 1 SE ½ Field date 6-13-67 Data page ____ Comp. date 6/19/67. Comp by a.P.F.

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
(B) Receive	0-3 SE	3-6 SE →		600-900 SE →		→	900-1200			→		
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	1.5 →									→		
(E) Vdc (avg)	204	195	43.2	196	51.6	21.2	145	50.2	19.5	9.66		
(F) DCcal	1.002 →									→		
(G) Kn x 10^{-3}	0.9	0.9	3.6	0.9	3.6	9.0	0.9	3.6	9.0	18		
(H) ρdc=ExFxGx10^3/D	123	117	104	118	124	127	87.3	121	117	116		
(I) Vac Σ	198	191	42.1	190	50.0	20.5	142	48.9	19.2	9.4		
~~(J) AC noise x 2~~												
~~(K) Vac (corr) =$\sqrt{I^2 - J^2}$~~	1.000											
(L) AC-DC cal.	0.991 →									→		
(M) ρdc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	3.0	2.1	2.6	3.1	3.2	3.4	2.1	2.7	1.6	2.8		
(O) MCF=(M-1)(10^5)/H	24.39	17.9	25	26.5	25.8	26.8	24.1	22.3	13.7	24.1		

Project ____ Line ____ Field date ____ Data page ____ Comp. date ____ Comp by ____

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal	Cal	
(B) Receive	1200-1500 →			→	1500-1800 →			→		3-4	1-2	
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	1.5 →							→		1000	500	
(E) Vdc (avg)	55.0	31.9	15.2	8.81	39.6	28.2	14.4	8.64		99.8	49.9	
(F) DCcal	1.002 →							→				
(G) Kn x 10^{-3}	3.6	9.0	18	31.5	9.0	18	31.5	50.4				
(H) ρ dc=ExFxGx10^3/D	132	192	183	185	238	339	303	291				
(I) Vac Σ	52.6	30.8	14.6	8.37	36.6	26.4	13.7	8.3		98.8	49.5	
~~(J) AC noise x 2~~												
~~(K) Vac (corr) =$\sqrt{I^2 - J^2}$~~												
(L) AC-DC cal.	~~0.991~~ ~~1.00~~ 1.000 →							→				
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	4.6	3.6	4.1	5.3	8.2	6.8	5.1	4.1				
(O) MCF=(M-1)(10^5)/H	34.8	18.7	22.4	28.6	34.5	20	17	14				

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT SEMINCO
LINE 1 HALF NW SP. 1 DATE 6-13

PAGE

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	CAL
RECEIVE	120 →			→ 150				→ 200	2-3	4-5
RANGE	300	100	30	10	100	30	30	10	300	100
DC 1	109 115	401 414	146 146	784 763	610 605	265 265	108 105	620 602	94	48.0
DC 2	110 114	408 405	142 151	770 772	606 604	265 266	111 106	615 599	94	47.8
DC 3	111 113	410 403	145 147	782 769	607 603	264 265	112 105	630 591	94	48.0
DC 4	111 113	410 400	142 146	776 778	608 604		113 104	623 590	94	47.8
DC 5				803 723			110 105	615 603		
DC 6				780 756				640 588		
DC 7										
DC 8										
DC AVG.	112	40.7	14.6	7.71	60.6	26.5	10.8	6.08	94	47.9
AC 1	108	39.0	14.3	7.55	59.8	25.9	10.7	6.00	94	47.9
AC 2	107	39.0	14.2	7.55	59.7	25.9	10.6	5.98	94	47.9
AC AVG.	107.5	39.0	14.25	7.55	59.75	25.9	10.65	5.99	94	47.9
S.P.	-11.0 →			→	+21.2 →			→		
AC NOISE	.04 →			→	.05 →			→		
POT RES.										

12 V - 74
8
2.45

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT NW ½

LINE #1 HALF [illegible] SP. 1 DATE

PAGE

SEND →	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-300	300 -	600	600 -	900	→	900 -	1200	→	→
RANGE	10	→	→	→	→	→	→	→	→	→
VOLTAGE	360	220	360	140	220	360	140	140	220	360
CURRENT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	CAL
RECEIVE	1200-	1500	→	→	1500 -	1800	→	→	1A	500
RANGE	10	→	→	→	→	→	→	→		
VOLTAGE	140	140	220	360	140	140	220	360		
CURRENT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		

FREQUENCIES .05 3

SENDER NO. 14672S

OPERATOR M.F.

RECEIVER NO. 3641

OPERATOR B.F.

COMMENTS:

Field

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Seminco

LINE 1 HALF NW SP. 1 DATE 6-13

PAGE

SEND →	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0—30	——	—— 60	——	——	—— 90	——	——	——	—— 120
RANGE →	300	300	100	1000	100	30	1000	300	100	30
DC 1	188 185	190 189	492 495	442 442	694 696	270 271	803 805	170 176	410 406	190 187
DC 2	188 185	190 188	492 496	440 442	694 696	271 270	814 806	171 176	413 404	191 186
DC 3	186 185	190 188	490 496	440 442	690 696	271 269	814 806	170 177	414 403	189 189
DC 4									415 402	188 190
DC 5	377									187 191
DC 6										
DC 7										
DC 8										
DC AVG. →	186.1	189	49.3	441	69.4	27.1	810	173	40.9	18.9
AC 1	182	184	48.0	425	68.0	26.5	775	165	39.8	18.2
AC 2	181	184	48.0	425	68.0	26.5	776	165	39.8	18.2
AC AVG.	181.5	184	48.0	425	68.0	26.5	775.5	165	39.8	18.2
S.P.	+17.3	-7.1 →	→	+5.0 →	→	→	-11.1 →	→	→	→
AC NOISE	.04	.04 →	→	.04 →	→	→	.06 →	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE

PROJECT Seminco S.E ½

LINE #1 HALF [illegible] SP. 1 DATE

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-300	300	→600	600	→900	→	900	→1200	→	→
RANGE	10	→	→	→	→	→	→	→	→	→
VOLTAGE	140	180	140	265	180	140	380	260	180	140
CURRENT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	CAL
RECEIVE	1200	-1500	→	→	1500	-1800	→	→	1A	500
RANGE	10	→	→	→	→	→	→	→	→	
VOLTAGE	380	260	180	140	370	260	180	140		
CURRENT	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		

FREQUENCIES .05 3

SENDER NO. 146725

OPERATOR M.J.

RECEIVER NO. 3641

OPERATOR B.J.

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Seminco

LINE 1 HALF SE SP. 1 DATE 6-13

PAGE

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-30	———	——— 60	———	———	——— 90	———	———	———	——— 120
RANGE	300	300	100	300	100	30	300	100	30	30
DC 1	206 204	196 194	435 428	196 196	520 510	214 210	145 145	502 502	197 194	97 94
DC 2	204 205	196 193	436 428	196 196	320 518	214 210	145 145	502 500	195 195	98 95
DC 3	203 204	195 194	435 430		521 510	214 210		502 500	198 194	100 95
DC 4									197 193	98 92
DC 5										102 93
DC 6										
DC 7										
DC 8										
DC AVG.	204	195	43.2	196	51.6	21.2	145	50.2	19.5	9.66
AC 1	198	191	42.1	190	50.0	20.5	142	48.9	19.2	9.4
AC 2	198	191	42.1	190	50.0	20.5	142	48.9	19.2	9.4
AC AVG.	198	191	42.1	190	50.0	20.5	142	48.9	19.2	9.4
S.P.	-12.7	+7.7	→	-2.5	→	→	+2.7	→	→	→
AC NOISE	±.64	.04	→	±.06	→	→	±.64	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

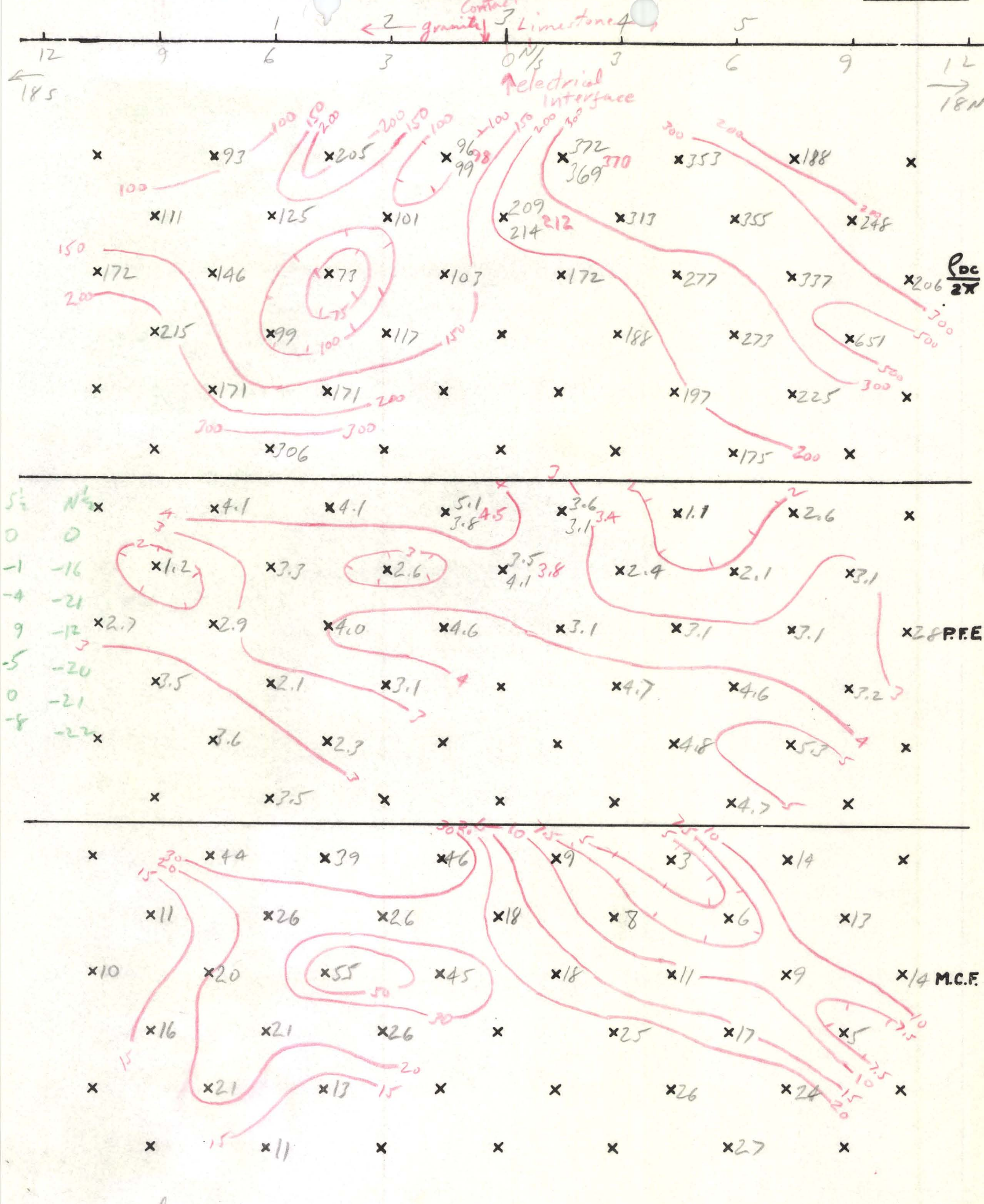
PROJECT SEMINCO

LINE 1 HALF SE SP. 1 DATE 1-27

PAGE

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	CAL
RECEIVE	120 ———	———	———	——— 150	———	———	———	——— 180	3-4	1-2
RANGE	100	100	30	10	100	30	30	30	100	100
DC 1	557 542	323 318	154 147	842 810	389 402	276 292	150 138	90 87	100	49.9
DC 2	557 542	323 313	151 153	858 903	398 390	280 290	145 143	87 86	99.5	49.8
DC 3	559 544	324 314	153 150	812 930	396 387	289 271	149 146	87 96	100	49.9
DC 4		320 318	157 148	837 980	402 401	284 277	146 140	80 82	99.5	49.9
DC 5		321 316	156 147	873 922	391 403	276 278	146 142	85 86		49.8
DC 6				877 941						49.9
DC 7				823 915						
DC 8				827 918						
DC AVG.	55.0	31.9	15.2	8.81	39.6	28.2	14.4	8.64	99.8	
AC 1	52.6	30.8	14.6	8.37	36.6	26.4	13.7	8.3	98.8	49.5
AC 2	52.6	30.8	14.6	8.37	36.6	26.4	13.6	8.3	98.8	49.5
AC AVG.										
S.P.	+ -0.1 ———	———	———	——→	- +10.2 ———	———	———	——→		
AC NOISE	.06 ———	———	———	——→	.09 ———	———	———	——→		
POT RES.										

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING S67°W



AREA Royal — Seminco LINE 4 a = 300 ' SCALE: 1" = 300 DATE: June '67

5½

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page______

Project Seminco Line 2 Field date 6-14 Data page ________ Comp. date 6-17 . Comp by JPM

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5		
(B) Receive	0-3	3-6	→	6-9	→	→	9-12	→	→	→		
(C) n separation												
(D) I	1000	→	→	→	→	→	→	→	→	→		
(E) Vdc (avg)	345	456.8	54.4	86.4	14.4	3.5	67.7	23.9	5.30	1.77		
(F) DCcal	1.012	→	→	→	→	→	→	→	→	→		
(G) Kn x 10^{-3}	.9	.9	3.6	.9	3.6	9	.9	3.6	9	18		
(H) ρ dc=ExFxGx10^3/D	314	416	198	79.	52	32	62	87	48	32		
(I) Vac Σ	342	451.5	52.9	84.4	14.25	3.33	66.15	23.3	5.165	1.65		
(J) AC noise x 2	.05	.04	→	.06	→	→	.05	→	→	→		
(K) Vac(corr) = $\sqrt{I^2 - J^2}$	1.000											
(L) AC-DC cal.	.992	→	→	→	→	→	→	→	→	→		
(M) ρ dc/ρ ac=ExL/K	+0.8											
(N) PFE=(M-1)(10^2)	0.1 0.9	0.3 1.1	2.0 2.8	1.5 2.3	0.2 1.3	4.3 5.1	1.5 2.3	1.7 2.5	1.8 2.6	6.4 7.2		
(O) MCF=(M-1)(10^5)/H	0 3	1 3	10 14	19 29	4 25	134 159	24 37	20 29	38 54	200 225		
	+18.9	-1.0 →		+17.9	→		+17.6	→	→	→		

Project____________ Line__________ Field date________ Data page________ Comp. date________ Comp by________

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		CAL		
(B) Receive	12-15	→	→	→	15-18	→	→	→		5		
(C) n separation												
(D) I	1000	→	→	→	→	→	→	→		500		
(E) Vdc (avg)	27.9	12.4 14	3.52	1.43	8.34	4.60	1.37			49.4		
(F) DCcal	1.012	→	→	→	→	→	→	→		1.012		
(G) Kn x 10^{-3}	3.6	9	18	31.5	9	18	31.5					
(H) ρ dc=ExFxGx10^3/D	102	113	64.1	46	76	84	44	31				
(I) Vac Σ	27.5	12.05	3.45	1.32	8.3	4.52	1.34	.57		49.0		
(J) AC noise x 2	.06	→	→	→	.06	→	→	→				
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	.992	→	→	→	→	→	→	→				
(M) ρ dc/ρ ac =ExL/K		1.6 2.4	2.0	8.3	0.5	1.7	2.2					
(N) PFE=(M-1)(10^2)	0.6 1.4	~~2.1~~	1.2	7.5	~~0.9~~	0.9	1.4					
(O) MCF=(M-1)(10^5)/H	6 14	~~19~~ 21	19 31	16 34	-12 7	11 20	32 50					
	-18.5	14 →			+10.1	→	→					

N ½

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page______

Project Samunco Line 2 Field date 6-14 Data page ______ Comp. date 6-16 . Comp by SPM

(A) Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		
(B) Receive												
(C) n separation												
(D) I	1.0 →									→		
(E) Vdc (avg)	43.9	331	54.9	199.6	67.7	16.0	187.7	35.3	16.53	5.15		
(F) DCcal	.995 →									→		
(G) Kn x 10^{-3}	.9	.9	3.6	.9	3.6	9	.9	3.6	9	18		
(H) ρ dc=ExFxGx10^3/D	384	297	197	179	242	143	168	127	148	92		
(I) Vac Σ	433	324	53.6	195	65.5	15.4	185	34.7	16.1	4.93		
(J) AC noise ~~x 2~~	.04	.03 →		.05 →			.05 →					
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.0 →									→		
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	1.4	2.1	2.6	2.4	3.4	3.9	1.4	1.8	2.6	4.4		
(O) MCF=(M-1)(10^5)/H	4	7	13	13	14	27	8	14	18	48		

+28.6 -7.8 → +9.2 → -1.0 →

Project______ Line______ Field date______ Data page______ Comp. date______ Comp by______

(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		CAL		
(B) Receive												
(C) n separation												
(D) I	1.0 →									→		
(E) Vdc (avg)	38.6	11.28	8.51	3.43	19.55	6.34	5.45	2.29	~~50.~~	50.2		
(F) DCcal	.995 →									→		
(G) Kn x 10^{-3}	3.6	9	18	31.5	9	18	31.5	50.4				
(H) ρ dc=ExFxGx10^3/D	138	101	153	108	175	114	171	115				
(I) Vac Σ	38.0	11.0	8.15	3.25	19.05	6.17	5.16	2.15		50.2		
(J) AC noise x 2	.05 →			→	.05 →			→				
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.0 →									→		
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	1.6	2.5	4.4	5.6	2.6	2.8	5.7	6.5				
(O) MCF=(M-1)(10^5)/H	12	25	29	52	15	25	33	57				

-14.2 → +18.5 →

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE 4

PROJECT ______

LINE #2 HALF S½ SP. 1 DATE ______

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-300	300 —	600	600 —	900 —	→	900 —	1200	—	→
RANGE	10	—								→
VOLTAGE	190	400	190	500	400	190	210	500	400	190
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A	1A	
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	1200 —	1500	—	→	1500 —	1800	—	→	.500	
RANGE	10	—						→		
VOLTAGE	210	500	400	190	210	500	400	190		
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A		

FREQUENCIES .05 3

SENDER NO. 146725

OPERATOR M.F.

RECEIVER NO. 3641

OPERATOR B. F.

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Seminco

LINE 2 HALF 5 SP. 1 DATE 6-14

PAGE 3

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0 — 30	———	60	———	———	— 90	———	———	———	— 120
RANGE	1000	1000	100	100	30	10	100	30	10	3
DC 1	344 346	458 458	542 547	872 858	144 145	340 345	677 680	237 240	530 535	174 184
DC 2	344 346	456 456	543 546	862 866	145 144	367 348	675 677	237 240	518 540	168 176
DC 3	344 346	456 457	541 546	864 866	144 144		674 677	237 240	526 532	165 158
DC 4				864 863			674 677		523 534	205 193
DC 5										170 176
DC 6										163 182
DC 7										158 197
DC 8										159 207
DC AVG.	345	456.8	54.4	86.4	14.4	3.5	67.7	23.9	5.30	1.77
AC 1	342	453	53.0	84.4	14.3	3.34	66.3	23.3	5.17	1.65
AC 2	342	450	52.8	84.4	14.2	3.32	66.0	23.3	5.16	1.65
AC AVG.	342	451.5	52.9	84.4	14.25	3.33	66.15	23.3	5.165	1.65
S.P.	+18.9	-1.0	——→	+17.9	———	——→	+17.6	———	———	——→
AC NOISE	.05	.04	——→	.06	———	——→	.05	———	———	——→
POT RES.				NOTE						

FENCE AT 9[illegible]0'

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT SEMINCO

LINE 2 HALF 5 SP. 1 DATE 6-14

PAGE 4

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	120 ———	———	———	——— 15°	———	———	———	——— 180	3-4	
RANGE	100	30	10	3	30	10	3	1	49.3	
DC 1	279 279	126 121	340 367	147 150	85 80	458 462	136 139		49.5	
DC 2	279 279	125 124	344 358	128 145	85 81	456 464	138 136		49.3	
DC 3		123 124	345 356		86 81	454 465	144 128		49.5	
DC 4		122 124	847 354	2	87 79					
DC 5			353 353	MUCH						
DC 6				DRIFT						
DC 7										
DC 8										
DC AVG.	27.9	12.~~4~~ 24	3.52	1.43	8.34	4.60	1.37		49.4	
AC 1	27.5	12.1	3.45	1.32	8.3	4.52	1.34	~~.570~~	49.0	
AC 2	27.5	12.0	3.45	1.32	8.3	4.52	1.34		49.0	
AC AVG.	27.5	12.05	3.45	1.32	8.3	4.52	1.34		49.0	
S.P.	-18.5 ———	———	———	——→	+10.1 ———	———	———	——→		
AC NOISE	.06 ———	———	———	——→	.06 ———	———	———	——→		
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE 3

PROJECT ____________ LINE #2 HALF N½ SP. 1 DATE ______

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-300	300 -	600	600 -	900	→	900 -	1200	→	→
RANGE	10	→	→	→	→	→	→	→	→	→
VOLTAGE	220	500	220	400	500	220	200	400	500	220
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
RECEIVE	1200 -	1500	→	→	1500 -	1800	→	→	500	
RANGE	10	→	→	→	→	→	→	→		
VOLTAGE	200	400	500	220	200	400	500	220		
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A		

FREQUENCIES .05 3

SENDER NO. 146725

OPERATOR M. F.

RECEIVER NO. 3641

OPERATOR B. F.

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES INT 20.8

PROJECT Seminco

LINE 2 HALF NW SP. 1 DATE 6-14

PAGE 1

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-30	———	——— 60	———	———	——— 90	———	———	———	——— 120
RANGE	1000	1000	100	300	100	30	300	100	30	10
DC 1	431 445	332 330	551 546	199 201	674 682	161 159	189 187	356 349	166 165	506 528
DC 2	440 437	335 328	551 545	198 201	668 683	162 158	189 187	356 350	165 165	525 503
DC 3	440 437	333 330	557 543	198 201	676 676	162 157	188 186	359 348	165 167	503 508
DC 4					676 677					505 523
DC 5										512 533
DC 6										512 516
DC 7										
DC 8										
DC AVG.	43.9	331	54.9	199.6	67.7	16.0	187.7	35.3	16.53	5.15
AC 1	433	324	53.6	195	65.5	15.4	185	34.7	16.1	4.93
AC 2	433	324	53.6	195	65.5	15.4	185	34.7	16.1	4.93
AC AVG.										
S.P.	+28.6	-7.8 →	→	+9.2 →	→	→	-1.0	& DRIFTING →	→	→
AC NOISE	.04	.03 →	→	.05 →	→	→	.05 →	→	→	→
POT RES.										

FENCE HT 650'

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PAGE 2

PROJECT SEMINCO
LINE 2 HALF N SP. 1 DATE 6-14

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
RECEIVE	120			150				180	2-3	
RANGE	100	30	10	10	30	10	10	3		
DC 1	397 398	114 111	860 850	335 354	196 194	646 632	544 558	221 231	502	
DC 2	390 384	114 113	853 841	330 353	198 195	657 620	538 560	224 228	502	
DC 3	390 383	113 112	852 858	343 342	200 191	652 604	527 548	225 231	502	
DC 4			843 860	343 341	195 196	630 622	530 555	218 244	502	
DC 5			837 864		196 194	652 627	545 550	215 232		
DC 6								226 247		
DC 7										
DC 8										
DC AVG.	38.6	11.28	8.51	3.43	19.55	6.34	5.45	2.29	50.2	
AC 1	38.0	11.0	8.15	3.26	19.1	6.17	5.16	2.15	50.2	
AC 2	38.0	11.0	8.15	3.24	19.2	6.17	5.16	2.15	50.2	
AC AVG.	38.0	11.0	8.15	3.25	19.05	6.17	5.16	2.15	50.2	
S.P.	-14.2 →				+18.5 →					
AC NOISE	.05 →				.06 →					
POT RES.										

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page______

Project SEMINCO Line #3 S½ Field date 6-15 Data page________ Comp. date 6-16. Comp by BOB

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
(B) Receive	0 — 30		— 60			— 90				— 120	3-4	
(C) n separation	1	1	2	1	2	3	1	2	3	4	100	
(D) I	2 A									→	500	
(E) Vdc (avg)	330	220	138	141	34.7	38.9	194	44.2	16.3	24.1	49.3	
(F) DCcal	1.014										1.014	
(G) Kn x 10^{-3}	.9	.9	3.6	.9	3.6	9.0	.9	3.6	9.0	18.0		
(H) ρ dc=ExFxGx10^3/D	151	100	252	64	63	178	89	81	74	220		
(I) Vac Σ	314	215.5	132	139	34.4	37.5	191.5	43.8	16.25	23.3	49.4	
(J) AC noise x 2												
(K) Vac(corr) =$\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.002										1.002	
(M) ρ dc/ρ ac=ExL/K												
(N) PFE=(M-1)(10^2)	5.3	2.3	4.8	1.6	1.1	3.9	1.5	1.1	0.5	3.6		
(O) MCF=(M-1)(10^5)/H	35	23	19	25	17	22	17	12	6	16		

Project______________ Line__________ Field date________ Data page________ Comp. date________ Comp by________

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5				
(B) Receive	120			— 150				180				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	2 A							→				
(E) Vdc (avg)	59.45	20.5	8.22	14.3	29.0	11.46	5.22	10.2				
(F) DCcal								→				
(G) Kn x 10^{-3}	3.6	9.0	18.0	31.5	9.0	18.0	31.5	50.4				
(H) ρ dc=ExFxGx10^3/D	109	92	75	228	132	105	83	261				
(I) Vac Σ	58.3	19.9	8.19	13.9	28.45	11.35	5.19	9.8				
(J) AC noise x 2												
(K) Vac (corr) =$\sqrt{I^2 - J^2}$												
(L) AC-DC cal.								→				
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	2.2	1.5	0.6	4.6	2.1	1.2	0.8	4.3				
(O) MCF=(M-1)(10^5)/H	20	16	8	20	16	11	10	16				

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page______

Project Seminco Line #3 N½ Field date 6-15 Data page________ Comp. date 6-16. Comp by Bob

(A) Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
(B) Receive	0—30		60			90				120	2-3	2-3
(C) n separation	1	1	2	1	2	3	1	2	3	4	100	300
(D) I	1	1	1	1	1	1	2	2	2	2	500	1000
(E) Vdc (avg)	108.5	168.3	70.9	31.9	8.9	5.84	875.2	14.2	6.9	5.76	50.15	98.5
(F) DCcal	1.006										.997	1.015
(G) Kn x 10^{-3}	.9	.9	3.6	.9	3.6	9.0	.9	3.6	9.0	18.0	(1.006 avg)	
(H) ρ dc=ExFxGx10^3/D	98	152	257	29	32	53	396	26	31	52		
(I) Vac Σ	106.5	160.3	67.5	30.1	8.5	5.735	870	13.6	6.82	5.61	50.3	
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.004										1.003	1.005
(M) ρ dc/ρ ac=ExL/K											1.004 avg	
(N) PFE=(M-1)(10^2)	2.3	5.3	5.5	6.4	5.1	2.2	1.0	4.8	2.2	3.1		
(O) MCF=(M-1)(10^5)/H	23	35	21	221	159	42	3	185	71	60		

Project______________ Line__________ Field date________ Data page________ Comp. date________ Comp by________

(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2				
(B) Receive	120			150				180				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	2A							→				
(E) Vdc (avg)	562	17.3	10.7	9.5	149.6	7.51	5.50	5.32				
(F) DCcal								→				
(G) Kn x 10^{-3}	3.6	9.0	18.0	31.5	9.0	18.0	31.5	50.4				
(H) ρ dc=ExFxGx10^3/D	1018	78	97	151	678	68	87	135				
(I) Vac Σ	555	16.7	10.5	9.35	147	7.29	5.39	5.175				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.								→				
(M) ρ dc/ρ ac =ExL/K												
(N) PFE=(M-1)(10^2)	1.7	4.0	2.3	2.0	2.2	3.4	2.5	3.2				
(O) MCF=(M-1)(10^5)/H	2	51	24	13	3	50	29	24				

$\sin A$

$\frac{a^2+b^2}{c^2} = \frac{c^2}{c^2} = 1$

PAGE 4

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT SEMINCO
LINE 3 HALF 5 SP. 1 DATE 6-15

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	120 —			150 —				180	3-4	
RANGE	100	30	10	30	100	30	10	30	100	
DC 1	599 590	201 202	824 820	142 143	294 286	114 115	520 526	101 103	49.3	
DC 2	599 590	202 202	824 822	144 141	295 285	115 115	516 532	102 103	49.3	
DC 3	599 590	200 202	824 817	144 142	292 290	114 115	522 520	102 103	49.3	
DC 4			823 825				522 520		49.3	
DC 5			828 816							
DC 6										
DC 7										
DC 8										
DC AVG.	594.5	201.5	8.22	14.3	29.0	11.46	5.22	10.2	49.3	
AC 1	58.4	19.9	8.20	13.7	28.5	11.4	5.17	9.8	49.4	
AC 2	58.2	19.9	8.18	13.7	28.4	11.3	5.17	9.8	49.4	
AC AVG.	58.3	19.9	8.19	13.7	28.45	11.35	5.17	9.8	49.4	
S.P.	+13.5 →				−14.0 →					
AC NOISE	.04 →				.04 →					
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT SEMINCO
LINE 3 HALF 5 SP. 1 DATE 6-15

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-30	—	— 60	—	—	— 90	—	—	—	— 120
RANGE	1000	300	300	300	100	100	300	100	30	30
DC 1	330 330	226 220	138 138	141 141	345 350	385 394	194 194	440 444	164 162	242 240
DC 2	330 330	220 220	138 138	141 141	344 350	385 395	194 194	438 445	164 161	241 240
DC 3					344 350	384 396		441 443	164 160	241 239
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	330	220	138	141	34.7	38.9	194	44.2	16.3	24.1
AC 1	314	215	132	139	34.4	37.5	191	43.8	16.3	23.3
AC 2	314	216	132	139	34.4	37.5	192	43.8	16.2	23.3
AC AVG.	314	215.5	132	139	34.4	37.5	191.5	43.8	16.25	23.3
S.P.	-9.2	+2.1 →	→	-3.6 →	→	→	-7.4 →	→	→	→
AC NOISE	.04	.04 →	→	.04 →	→	→	.04 →	→	→	→
POT RES.										

PAGE 2

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT SEMINCU

LINE 3 HALF N SP. 1 DATE 6-15

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	CAL
RECEIVE	120 ———	———	———	150 ———	———	———	———	180	2-3	2-3
RANGE	1000	30	30	30	300	10	10	10	50.2	300
DC 1	561 563	172 174	108 105	95 95	149 151	738 774	550 550	520 533	50.1	98
DC 2	559 564	173 173	109 105	96 94	148 151	745 750	550 547	537 537	50.2	99
DC 3	559 564	175 171	110 104	97 93	148 151	750 756	545 552	~~524 538~~	50.1	98
DC 4						760 740	556 553	524 542		99
DC 5						764 735		520 538	100	
DC 6								520 542		
DC 7										
DC 8										
DC AVG.	562	17.3	10.7	9.5	149.6	7.51	5.50	5.32	50.15	98.5
AC 1	555	16.7	10.5	94	147	7.28	5.40	5.18	50.3	99
AC 2	555	16.7	10.5	93	147	7.30	5.38	5.17	50.3	99
AC AVG.	555	16.7	10.5	93.5	147	7.29	5.39	5.175	50.3	99
S.P.	-13.4 ———	———	———	——→	+6.1 ———	———	———	——→		
AC NOISE	.03 ———	———	———	——→	.04 ———	———	———	——→		
POT RES.			NOTE							

FENCE AT 1600 ft'.

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Seminco

LINE 3 HALF N SP. 1 DATE 6-15

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 — 30	———	——— 50	———	———	——— 90	———	———	———	——— 120
RANGE	300	300	100	100	30	10	1000	30	10	10
DC 1	108 109	169 168	706 713	316 330	89 88	602 541	876 875	140 145	710 675	570 582
DC 2	108 109	169 168	704 712	324 310	84 94	584 586	875 875	135 150	720 664	566 588
DC 3	108 107	168 168	704 714	335 307	86 92	576 604	875 875	141 143	704 686	556 593
DC 4				323 307		646 518		139 144	704 675	550 603
DC 5						603 556				564 583
DC 6						588 602				
DC 7										
DC 8										
DC AVG.	108.5	168.3	70.9	31.9	8.9	5.84	875.2	14.2	6.94	5.76
AC 1	107	161	67.5	30.1	8.5	5.73	870	13.6	6.82	5.61
AC 2	106	160	67.5	30.1	8.5	5.74	870	13.6	6.82	5.61
AC AVG.	106.5	160.5	67.5	30.1	8.5	5.735	870	13.6	6.82	5.61
S.P.	-30.0	+29.5	→	-9.9	→	→	-5.4	→	→	→
AC NOISE	.03	.06	→	.04	→	→	.03	→	→	→
POT RES.										

PAGE 5

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT Seminco

LINE #3 HALF D½ SP. 1 DATE

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-300	300	- 600	600 -	900	→	900	- 1200		→
RANGE	10	→								→
VOLTAGE	120	100	120	100	100	120	400	180	210	240
CURRENT	1A	1A	1A	1A	1A	1A	2A	2A	2A	2A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	CAL
RECEIVE	1200	- 1500		→	1500	- 1800		→	500	1A
RANGE	10	→							→	
VOLTAGE	400	180	200	240	400	180	200	240		
CURRENT	2A	2A	2A	2A	2A	2A	2A	2A		

FREQUENCIES .05 3

SENDER NO. 146725

OPERATOR M. F.

RECEIVER NO. 3641

OPERATOR B. F.

COMMENTS: ALL GAUGES DEVIATE WITH AC DC PULCE

PAGE 6

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT SEMINCO

LINE #3 HALF S½ SP. 1 DATE

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-300	300	- 600	600	- 900	——→	900	- 1200	——	——→
RANGE	10	———	———	———	———	———	———	———	———	——→
VOLTAGE	390	180	390	200	180	390	240	200	180	390
CURRENT	2A	2A	2A	2A	2A	2A	2A	2A	2A	2A
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	1200	- 1500	———	——→	1500	- 1800	———	——→	500	
RANGE	10	———	———	———	———	———	———	——→		
VOLTAGE	240	200	180	390	240	200	180	390		
CURRENT	2A	2A	2A	2A	2A	2A	2A	2A		

FREQUENCIES .05 3

SENDER NO. 14672S

OPERATOR M. F.

RECEIVER NO. 3641

OPERATOR B. F.

COMMENTS:

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page______

Project *Seminco* Line *4-11½* Field date *6-15* Data page______ Comp. date *6-19*. Comp by *Bob*

(A) Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
(B) Receive	0 — 30		60			90				120	2-3	
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	1 A →									→		
(E) Vdc (avg)	103	400	56.1	380	84.1	18.5	201.7	95.5	29.8	10.1	48.4	
(F) DCcal	1.033 →									→		
(G) Kn x 10-3	.9	.9	3.6	.9	3.6	9.0	.9	3.6	9.0	18		
(H) ρ dc=ExFxGx10³/D	96	372	209	353	313	172	188	355	277	188		
(I) Vac Σ	98	386	54.2	376	82.15	17.95	196.5	93.5	28.9	9.65	48.5	
(J) AC noise x 2												
(K) Vac(corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.00 →									→		
(M) ρ dc/ρ ac=ExL/K												
(N) PFE=(M-1)(10²)	5.1	3.6	3.5	1.1	2.4	3.1	2.6	2.1	3.1	4.7		
(O) MCF=(M-1)(10⁵)/H	53	9.7	17	3.1	7.7	18	14	5.9	11	25		

Project______ Line______ Field date______ Data page______ Comp. date______ Comp by______

(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2				
(B) Receive	120			150				180				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	1 A →							→				
(E) Vdc (avg)	66.7	36.3	14.7	6.06	22.2	35.0	6.91	3.37				
(F) DCcal	1.033 →							→				
(G) Kn x 10-3	3.6	9.0	18	31.5	9.0	18	31.5	50.4				
(H) ρ dc=ExFxGx10³/D	248	337	273	197	206	651	225	175				
(I) Vac Σ	64.7	35.2	14.05	5.78	21.6	33.9	6.56	3.22				
(J) AC noise x 2												
(K) Vac (corr) = $\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.00 →							→				
(M) ρ dc/ρ ac =ExL/K												
(N) PFE=(M-1)(10²)	3.1	3.1	4.6	4.8	2.8	3.2	5.3	4.7				
(O) MCF=(M-1)(10⁵)/H	13	9.2	17	26	14	4.9	24	27				

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page ______

Project SEMINCO Line 4-S½ Field date 6-16 Data page [illegible] Comp. date 6-19 . Comp by BOB

(A) Send	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
(B) Receive	0 — 30		60			90				120	3-4	
(C) n separation	1	1	2	1	2	3	1	2	3	4		
(D) I	1 A	→								→		
(E) Vdc (avg)	404	108	58.7	115	27.7	11.3	102	34.2	8.01	6.40	49.3	
(F) DCcal	1.014	→								→		
(G) Kn x 10^{-3}	.9	.9	3.6	.9	3.6	9.0	.9	3.6	9.0	18		
(H) ρ dc=ExFxGx10^3/D	369	99	214	105	101	103	93	125	73	117		
(I) Vac Σ	392	104	56.4	110.5	27.0	10.8	98	33.1	7.70	6.21	49	
(J) AC noise x 2												
(K) Vac(corr) =$\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.00	→								→		
(M) ρ dc/ρ ac=ExL/K												
(N) PFE=(M-1)(10^2)	3.1	3.8	4.1	4.1	2.6	4.6	4.1	3.3	4.0	3.1		
(O) MCF=(M-1)(10^5)/H	8.4	38	19	39	26	45	44	26	55	26		

Project ______ Line ______ Field date ______ Data page ______ Comp. date ______ Comp by ______

(A) Send	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5				
(B) Receive	120			150				180				
(C) n separation	2	3	4	5	3	4	5	6				
(D) I	1A	→						→				
(E) Vdc (avg)	30.35	16.05	5.45	5.35	18.9	11.8	5.35	5.99				
(F) DCcal	1.014	→						→				
(G) Kn x 10^{-3}	3.6	9.0	18	31.5	9.0	18	31.5	50.4				
(H) ρ dc=ExFxGx10^3/D	111	146	99	171	172	215	171	306				
(I) Vac Σ	30	15.6	5.34	5.23	18.4	11.4	5.165	5.785				
(J) AC noise x 2												
(K) Vac (corr) =$\sqrt{I^2 - J^2}$												
(L) AC-DC cal.	1.00	→						→				
(M) ρ dc/ρ ac =ExL/K												
(N) PFE=(M-1)(10^2)	1.2	2.9	2.1	2.3	2.7	3.5	3.6	3.5				
(O) MCF=(M-1)(10^5)/H	11	20	21	13	10	16	21	11				

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE 7

PROJECT ______ LINE 4 HALF N½ SP. 1 DATE ______

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-300	300 —	600	600 —	900	→	900 —	1200	→	→
RANGE	10	→	→	→	→	→	→	→	→	→
VOLTAGE	620	320	620	550	340	620	640	550	320	620
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A	1A	1A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	ENC	
RECEIVE	1200 —	1500	→	→	1500 —	1800	→	→	500	
RANGE	10	→	→	→	→	→	→	→		
VOLTAGE	640	550	340	620	640	550	340	620		
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A		

FREQUENCIES .05 3

SENDER NO. 146725

OPERATOR M.F.

RECEIVER NO. 3641

OPERATOR B.F.

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT Seminco
LINE 4 HALF N SP. 1 DATE 6-15

PAGE 1

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-30	——	60	——	——	90	——	——	——	120
RANGE	300	1000	100	1000	100	30	300	300	100	30
DC 1	102 104	400 400	560 565	380 380	844 840	184 186	203 201	96 95	299 298	102 100
DC 2	108 104	400 400	556 565	380 380	850 828	183 185	202 201	96 95	299 297	102 100
DC 3			557 567		842 839	184 185	202 201	96 95	299 297	102 100
DC 4					842 838					
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.	103	400	56.1	380	84.1	18.5	201.7	95.5	29.8	10.1
AC 1	98	387	54.2	376	82.3	18.0	197	94	29.0	9.7
AC 2	98	385	54.2	376	82.0	17.9	196	93	28.8	9.6
AC AVG.	98	386	54.2	376	82.15	17.95	196.5	93.5	28.9	9.65
S.P.	-16.4	-4.5 →	→	+8.7 →	→	→	-8.3 →	→	→	→
AC NOISE	.06	.05 →	→	.05 →	→	→	.06 →	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE 2

PROJECT SEMINCO

LINE 4 HALF N SP. ____ DATE 6-15

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2	CAL	
RECEIVE	120 ———	———	———	——— 150	———	———	———	——— 180	2-3	
RANGE	100	100	30	10	30	100	10	10	100	
DC 1	664 668	~~340~~ ~~360~~	144 150	602 613	220 225	348 353	688 696	346 325	48.5	
DC 2	664 670	362 366	144 151	598 618	220 225	346 353	687 686	337 341	48.3	
DC 3	660 673	360 365	143 152	607 602	223 221	346 353	~~[illegible]~~	343 325	48.5	
DC 4	~~360~~	360 366	145 147	604 608			697 680	347 330	48.3	
DC 5			146 147	600 610			712 672	337 334		
DC 6							703 668			
DC 7										
DC 8										
DC AVG.	66.7	36.3	14.7	6.06	22.2	35.0	6.91	3.37	48.4	
AC 1	64.8	35.3	14.1	5.78	21.7	34.0	6.56	3.22	48.5	
AC 2	64.6	35.1	14.0	5.78	21.5	33.8	6.56	3.22	48.5	
AC AVG.	64.7	35.2	14.05	5.78	21.6	33.9	6.56	3.22	48.5	
S.P.	-1.2 ———	———	———	———→	-1.0 ———	———	———	———→		
AC NOISE	.05 ———	———	———	———→	.06 ———	———	———	———→		
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE 8

PROJECT ________

LINE #4 HALF S½ SP. 1 DATE ____

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-300	300 -	600	600 -	900	→	900 -	1200		→
RANGE	10									→
VOLTAGE	650	560	660	330	570	660	540	325	560	660
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A	1A	

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	1200 -	1500		→	1500 -	1800		→	500	
RANGE	10							→		
VOLTAGE	560	325	560	650	560	325	560	650		
CURRENT	1A	1A	1A	1A	1A	1A	1A	1A		

FREQUENCIES .05 3

SENDER NO. 14672 S

OPERATOR M. F.

RECEIVER NO. 3641

OPERATOR B. F.

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT Seminco

LINE 4 HALF S SP. 1 DATE 6-16

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-30	—	60	—	—	90	—	—	—	120
RANGE	1000	300	100	300	30	30	300	100	10	10
DC 1	404 404	108 108	584 596	115 115	278 276	114 113	102 102	342 342	802 797	644 636
DC 2	404 404	108 108	580 590	115 115	278 276	114 111	102 102	342 342	812 797	640 640
DC 3			586 585		278 276	115 110			800 800	637 638
DC 4						113 112				640 640
DC 5						114 111				
DC 6										
DC 7										
DC 8										
DC AVG.	404	108	58.7	115	27.7	11.3	102	342	8.01	6.40
AC 1	392	104	56.4	111	27.0	10.8	98	33.2	7.70	6.21
AC 2	392	104	56.4	110	27.0	10.8	98	33.0	7.70	6.21
AC AVG.	392	104	56.4	110.5	27.0	10.8	98	33.1	7.70	6.21
S.P.	-1.2	-3.1 →	→	+12.8 →	→	→	-13.5	→	→	→
AC NOISE	.04	.03 →	→	.03 →	→	→	.04	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT: SEMINCO
PAGE: 4
LINE: 4 HALF: S SP.: 1 DATE: 6-16

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5	CAL	
RECEIVE	120 ———	———	———	——— 130	———	———	———	——— 180	3-4	
RANGE	100	30	10	10	30	30	10	10	100	
DC 1	300 307	160 161	545 547	544 524	188 190	116 120	523 544	618	49.3	
DC 2	300 307	159 164	543 546	540 533	187 190	119 116	533 540	600 601	49.2	
DC 3	300 307	161 160	549 540	540 526	186 190	119 116	533 535	592 604	49.3	
DC 4			552 541	530 539	186 191	119 116	537 533	590 612	49.3	
DC 5								602 597		
DC 6								595 600		
DC 7										
DC 8										
DC AVG.	30.35	16.05	5.45	5.35	18.9	11.8	5.35	5.99	49.3	
AC 1	30.0	15.6	5.34	5.23	18.4	11.4	5.17	5.79	49.0	
AC 2	30.0	15.6	5.34	5.23	18.4	11.4	5.16	5.78	49.0	
AC AVG.	30	15.6	5.34	5.23	18.4	11.4	5.165	5.785	49	
S.P.	+5.1 ———	———	———	———>	-8.1 ———	———	———	———>		
AC NOISE	.05 ———	———	———	———>	.03 ———	———	———	———>		
POT RES.										

SEMINCO
INCORPORATED
SCIENTIFIC EXPLORATION AND MINING COMPANY

P. O. Box 2297
Nogales, Ariz. 85621
June 19, 1967

Mr. Chris Ludwig
Heinrichs Geoexploration Company
808 West Grant Road
Tucson, Arizona

Dear Mr. Ludwig:

The I. P. Survey made by the Heinrichs crew last week went very smoothly. It was a pleasure to work with Bob and Mike. Enclosed are a cross-section of the Mowry Mine from U.S.G.S. Bulletin 582 where we crossed it with Line #3 (the first pits north of center were about on the Mowry fault) and a map showing the critical part of Line #4 at Duquesne. The north part of the latter line was in limestone, with the exception of some granite at the north end, and the south part was in granite. I have sketched the granite-limestone contact on in red.

I will plan to call you later this week and make an appointment to come to your office and talk overthe results of the survey, if that will be all right. I'll pick up these diagrams and the transparency of the Mowry map at that time.

Yours truly,

C. Carew McFall

C. Carew McFall
General Manager

Dog

SEMINCO
~~INCORPORATED~~
SCIENTIFIC EXPLORATION AND MINING COMPANY

P. O. Box 2297
Nogales, Ariz
June 8, 1967

JUN 1967
GEOEX

Heinrichs Geoexploration Company
808 West Grant Road
Tucson, Arizona   Attn: Walter Heinrichs, Jr.

Dear Sir:

Enclosed is a Seminco check for $875. This check together with one for $125 for the magnetometer rent will cover the cost of the I. P. survey of portions of the Mowry Mine area and Duquesne area which we discussed today by phone.

Yours truly,

C. Carew McFall

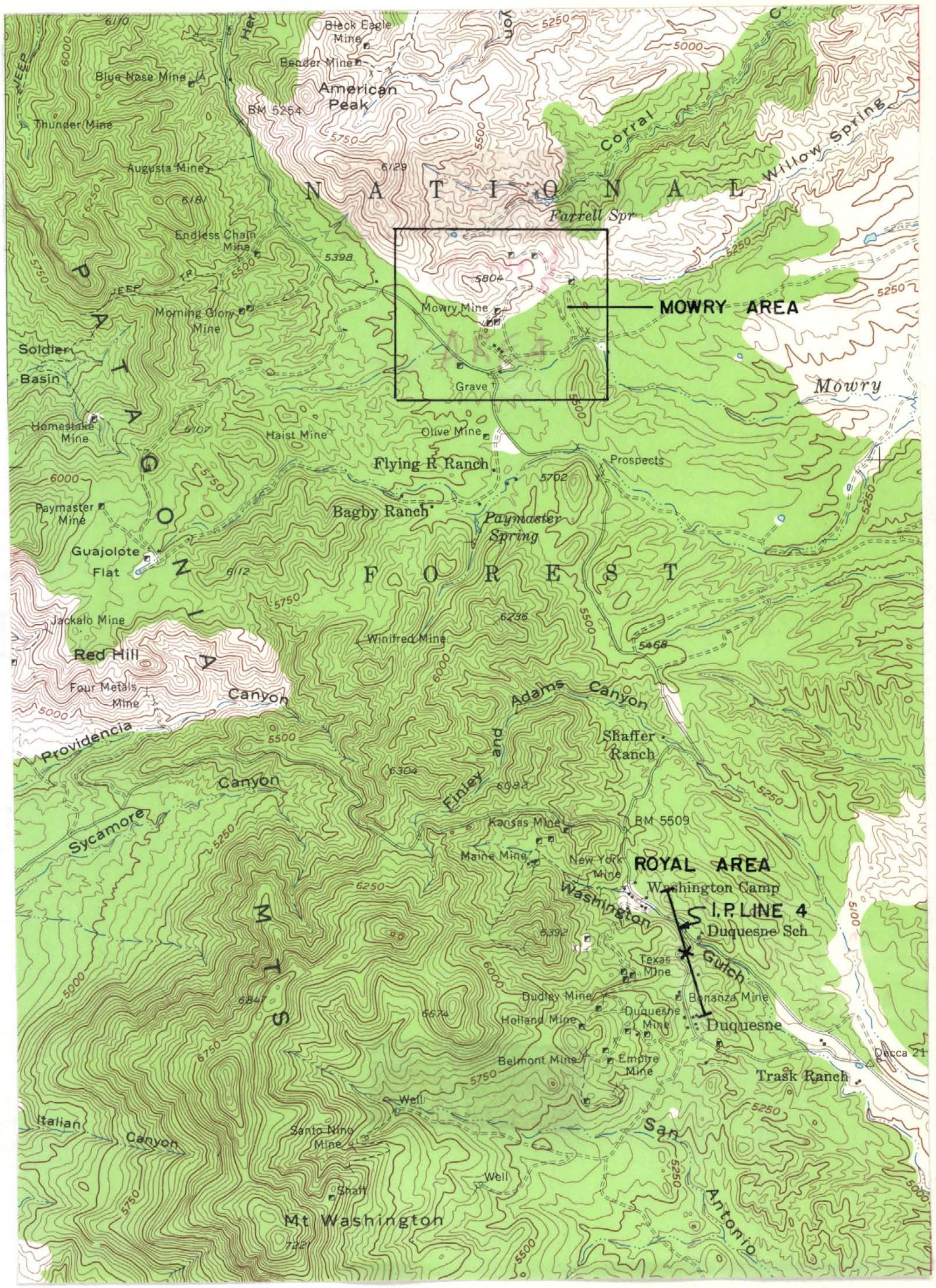
C. Carew McFall
General Manager

Chris Cdl
Paul ???

3538 El Grande Drive, San Jose, California 95132, Tel: 408 251-7340, Cable: Seminco, Sanjose, Calif.

GENERAL LOCATION OF

ROYAL & MOWRY AREAS
SANTA CRUZ COUNTY, ARIZONA



N

SCALE 1:62,500

LOCHIEL, ARIZ.
N3115—W11030/15
1958
AMS 3846 I—SERIES V798

INDUCED POLARIZATION SURVEY

PHASE II

MOWRY MINE VICINITY

SANTA CRUZ COUNTY, ARIZONA

for

SEMINCO

September 1967

HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5671, Tucson, Arizona 85703

TABLE OF CONTENTS

INTRODUCTION

At the request of Mr. Carew McFall of SEMINCO, San Jose, California, Heinrichs Geoexploration Company of Tucson, Arizona conducted and completed Phase II of an induced polarization survey in the Mowry Area, Santa Cruz County, Arizona during the interim August 21 to September 22, 1967.

A total of sixteen new spreads were surveyed comprising fifteen lines. Total new surface coverage is 66,500 ft, of which 40,750 ft. is "subsurface" plotted data. Station spacings used were 150, 300, 400, 500 and 1,000 ft. depending on the detail desired. For the details of location, see the Location and Interpretation Plan.

The data were obtained with the dual frequency induced polarization system utilizing sending frequencies of 0.05 and 3.0 H_z (cps). The electrode configuration used was the conventional collinear dipole-dipole array. See "Basis of I. P. Method" attached herewith for details of basic procedures used.

The purpose of this Phase II survey was to detail several anomalous areas found on Phase I work plus running additional reconnaissance. This work resulted in our recommending several drill holes to determine whether the polarizable zones found are economic or have potentially economic significance.

Data are presented on Sectional Data Sheets, one for each line, with resistivity, percent frequency effect (PFE), and metallic conduction factor (MCF), contoured in section, and self potential (SP), in profile form. An Induced Polarization Location and Interpretation Plan showing results of the Phase I and Phase II work in plan is also included. Again, for additional specifics on theory, presentation and interpretation, see the "Basis of the Induced Polarization Method" attached.

GEOEX personnel involved in this field work were H. K. Henson, R. Fedelchak and R. Palmer; geophysical crew chiefs and S. Cruze, J. King and M. Fraker were technical assistants. SEMINCO supplied helpers as needed. Interpretation and report by the Tucson staff under the supervision of Mr. Chris S. Ludwig, Senior Geophysicist.

INTERPRETATION
CONCLUSIONS AND RECOMMENDATIONS

Five lines of 500 ft. dipoles (2-1, 2-4, 2-5, 2-12 and 2-14) were surveyed in the vicinity of the shale-limestone contact. This work shows a quite uniform conductive polarizable zone, definitely associated with and probably on the shale-limestone contact rather than being north of the contact as the Phase I work indicated.

This polarizable zone comes nearest to the surface on Lines 2-4, 2-5 and generally deepens on Lines 2-1, 2-12 and 2-14, respectively, indicating a southeast plunge on the anomalous body.

A drill hole is recommended on Line 2-4 to test this zone, preferably at around 500 ft. in depth. Assuming a vertical to 80° SW dip on the "vein", a 750 ft. long 60° hole N 60° E collared approximately 380 ft. S 60° W from the contact is suggested and if maintained perfectly straight, should intersect roughly 500 ft. down dip. If the dip is actually northeast instead of southwest, a symmetrically opposite drill hole may be preferable. Based on the 84° SW dip indicated in the shallow test hole, a vertical hole about 52 ft. S 60° W of the vein should intersect roughly 500 ft. down dip. However, slight variations in dip could produce large variations in depth of intersection or possibly miss the "vein" entirely, as well as factors such as hole deviation in the direction most normal to the mean equivalent bedding.

A 200 or 300 ft. shaft in the vicinity of 2NE, Line 2-5, shows some pyrite on the dump and possibly widening or increase in concentration of this pyrite zone is responsible for the I.P. anomaly. However, there may be a favorable bed in the limestone replaced with more economically interesting polarizable mineralization. We believe this anomaly, considering the district's history and production, to be worth at least one deep check or test hole.

On Line 2-2 from station 4SW to 8SW and on Line 2-3 from 10S to 25S, is a weak and very weak anomaly, respectively and on the same NW-SE trend as the moderate anomaly on the 500 ft. dipole spacing lines to the NW. Quite likely these weaker anomalies are caused by mineralization in the same fault zones as the moderate anomaly. A shaft correlates with the anomaly on Line 2-2.

Further along Line 2-2, between 10NE and 18NE, is a very weak anomaly, likely correlating with the Mowry mineralization laterally to the SE. Another very weak anomaly occurs between 24NE and 34NE, decreasing in strength with the depth and probably not significant although it is supported by a very weak anomaly between 2S and 2N on Line 2-9.

Also on Line 2-9 is a very weak anomalous zone from 8S to 12S, probably related to the "Sand Area" anomalism just east.

Line 2-3 was surveyed across the Mowry Mine on a 1,000 ft. spacing to attempt to locate any large sulfide body below the gabbro "sill". None was definitely seen, although a very slight increase in PFE was seen with depth, probably due to inductive coupling interference rather than sulfide effects.

Line 1, Phase I was extended an additional spread to the south to test a weak anomaly indicated on the end of the line. This anomaly was found to lie between 13.5S and 18S with a very weak fringe mostly to the south.

Since the anomaly source appeared quite shallow on the 300 ft. dipole line (1), the 150 ft. dipole lines were surveyed on a 200 ft. line spacing for more detail. This detail work consists of Line 2-6, 2-7, 2-8, 2-10, 2-11 and 2-13 and disclosed an irregularly shaped weak anomaly.

The main trend of the anomalous zone is ENE-WSW and appears to warp around the quartzite hill to the south. Line 2-11 terminates the anomalism to the east except for a very weak questionable zone near 3NW that may be external effects from material to the west.

Line 2-10 shows a well defined PFE anomaly, particularly near center, but having poor MCF and limited depth extent. The top of the anomaly could be within 30 ft. of the surface and probably bottoms within 100 ft. of the surface.

Line 2-7 shows a fairly well defined MCF high near the center of the spread and having good depth extent and moderate strength. A 150 ft. vertical drill hole is recommended at ONW/SE and should intersect polarizable material within 50 ft. of the surface. Another 150 ft. drill hole is suggested on a PFE high near Station 4.5NW. Again, polarizable material should be close to surface.

Line 2-6 shows a very complex pattern of anomalism similar in strength to that on Lines 2-7 and 2-10. Line 2-8 shows a weak but well shaped anomaly near center and apparently related to the quartz monzonite-quartzite contact, the quartzite being more resistant. Line 2-13 is very similar to Line 2-8 with the anomalism centered near Station 1.5NW.

As to content and type of polarizable material covering the "sand area" anomaly; if mostly sulfide, about 0.5% to 1.5% total sulfide by volume is indicated. If manganese is the cause, a somewhat higher percentage would be needed. However, there is a complication in that a fractured quartzite may be the host rock. If the polarizable material occurs in the fractures, as is typical for both manganese oxides and sulfides, a considerably smaller percentage could cause the anomalism because of the insulating unfractured quartzite preferentially shunting the current through the conductive fractures. This weights the observed polarization in favor of the fracture mineralization, giving a higher response than normal. Clay alteration is a possibility, but not likely a cause of the anomalism.

Self potential response on all lines is typical minor background variation with the exception of a 70 millivolt low at Station 20NE Line 2-14. This low could represent a zone of near surface sulfide mineralization and should be inspected on the ground. Since no I.P. response correlates with this low, the sulfide amount is apt to be minor or a relatively thin zone.

If any of the polarizable zones prove interesting after initial drilling, additional I.P. could be used to find their total extent. Most of the anomalous zones seen on this survey are open ended at least in one direction.

To gain the maximum use of the drilling results, it is recommended that we be kept informed and selected samples be sent to us for laboratory verification of intersecting the polarizable zones.

Respectfully submitted,
HEINRICHS GEOEXPLORATION CO.

Chris S. Ludwig

Chris S. Ludwig, Senior Geophysicist.

Approved: W E Heinrichs
Walter E. Heinrichs, Jr.
President

October 14, 1967
P.O. Box 5671
Tucson, Arizona 85703

I.P. SURVEY, MOWRY & ROYAL
AREA, SANTA CRUZ CO., ARIZONA

For: SEMINCO, June 1967

INDUCED POLARIZATION SURVEY

MOWRY AND ROYAL AREAS, SANTA CRUZ COUNTY, ARIZONA

For

SEMINCO

June 1967

By

Heinrichs Geoexploration Company
P. O. Box 5671   Tucson, Arizona   85703
Phone: 623-0578   Area Code: 602

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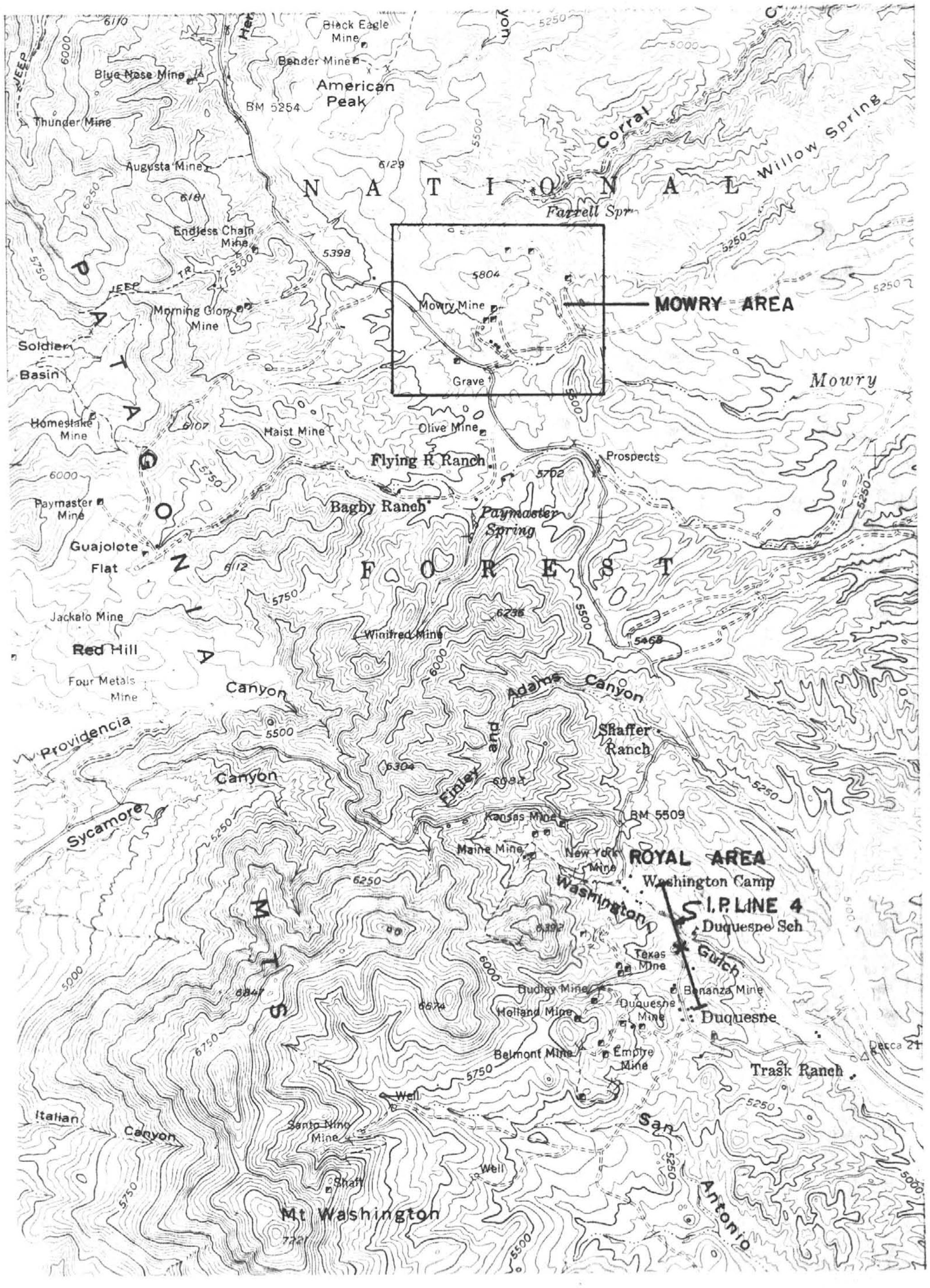
GENERAL LOCATION OF

ROYAL & MOWRY AREAS
SANTA CRUZ COUNTY, ARIZONA



QUADRANGLE LOCATION

SCALE 1:62,500

HEINRICHS GEOEX
GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

LOCHIEL, ARIZ.
N3115—W11030/15
1958
AMS 3846 I–SERIES V798

INTRODUCTION

At the request of Mr. Carew McFall of SEMINCO, San Jose, California, Heinrichs Geoexploration Company of Tucson, Arizona, conducted and completed a preliminary reconnaissance induced polarization survey over parts of the Mowry and Royal Areas, Santa Cruz County, Arizona, during the interim June 13 to June 16, 1967.

A total of four lines were surveyed, three in the Mowry Area and one in the Royal, (Duquesne), Area, giving a total surface coverage of 14,400 feet of which 8,400 is "subsurface" plotted data. All four lines were run with a 300 foot dipole spacing and oriented NNW-SSE. For details of location for the Mowry lines, see the Induced Polarization Location and Interpretation Plan. For the Royal Area, see the General Location.

The data were obtained with the dual frequency induced polarization technique utilizing the collinear dipole-dipole electrode configuration. Sending frequencies used were 0.05 and 3.0 hertz (cps).

The purpose of this survey was to help evaluate several electromagnetic anomalies obtained by SEMINCO in terms of sulfide distribution and concentration within the zone from about 90 feet to 400 feet below surface in the vicinity of the induced polarization lines. Geologically, these lines are in potentially economic areas. A calibration-correlation line was run across the past producer, Mowry Mine, (Line 3).

Data are presented on Sectional Data Sheets, one for each line, with resistivity, percent frequency effects (PFE), and metallic conduction factor (MCF) contoured in section, and self potential (SP) in profile form. Major geologic features have also been shown on the sections for correlation. For the Mowry Area, the interpretation has been indicated on the plan as well as on the sections. See the Basis of Induced Polarization Method appended to this report for additional details on theory, presentation, and interpretation.

Geoex personnel involved in the field work were Robert Fedelchak, Geophysical Crew Chief; and Michael Fraker, Technical Assistant. Mr. McFall assisted as the third man on the crew and his assistance was greatly appreciated. Interpretation, compilation, computation, and report were by the Tucson Geoex staff under the supervision of Chris S. Ludwig, Senior Geophysicist.

CONCLUSIONS, RECOMMENDATIONS, AND INTERPRETATION

MOWRY AREA

Line 3 was centered about 300 feet south of the Mowry Fault and oriented approximately N9W-S9E and crosses the old Mowry stopes. A rather strong, very definite induced polarization anomaly was found between station 3N and 6N indicating a steeply dipping tabular body less than 150 feet thick and thinning, (or lessening in polarizable content), with depth. Top of the polarizable body is within likely 100 feet of the surface. This interpretation fits the Mowry ore body which is probably the source of anomalism - the manganese and iron oxides along with galena left in the stopes and diffused into the nearby county rock giving the electrical polarization.

This anomaly is associated with a pronounced resistivity low likely caused by the conductive minerals and more porous and broken material in the ore zone. Also a minor self potential low correlates with the induced polarization anomaly suggesting small amounts of oxidizing sulfides within several hundred feet of the surface.

An alternate, but less probable, interpretation to this anomaly is that it could be caused by a yet undiscovered polarizable body just north of the known deposit. To test this possibility, a shorter spaced, say 100 foot dipole, induced polarization line would be needed to resolve and distinguish between the two possible zones.

The resistivities show the limestones to the north to be the most resistive and the quartz monzonite to the south intermediate and the ore zone the least resistive, in fact, the ore zone would likely give an electromagnetic anomaly with most techniques.

Line 1 is centered about 2,200 feet ENE down strike from Line 3 on the Mowry Fault, (contact), and oriented N21W-S21E. The limestone-quartz monzonite contact shows as a rather gradational resistivity change and with no associated conductive and anomalous zone as over the Mowry. However, near and between stations 6N and 9N, the limestone has slightly higher than typical background polarization effects perhaps caused by minor mineralization.

The only significant anomalism on Line 1 is on the south end of the line well into the quartz monzonite. This anomalism is weak, but could be of possible interest particularly if there is associated encouraging geology. If so, we would recommend extending the line further south to better delineate the body and then prospect along its strike, if it has a preferred orientation.

Self potentials show only background variations along the line, which is also indicative of a lack of near surface sulfides. The resistivity shows no conductive zone near center to explain the SEMINCO electromagnetic anomaly. This could perhaps be due to the E.M. conductor being very near surface or very narrow - or both - and therefore not responsive on our 300 foot dipole spacing.

Line 2 is centered about 2,800 feet northwesterly of the center of Line 3 and oriented N9W-S9E. The shale-limestone contact is near 4.5S and shows as a strong electrical interface with the shale more conductive, particularly near the contact, (likely caused by the more altered shale adjacent to the contact).

This conductive zone is very weakly anomalous near surface and is probably due to the minor mineralization noted there.

Approximately between stations 0N/S and 3N, at a depth of around 300 to 350 feet below surface, a moderately strong anomaly was located. This anomaly is near the limit of depth detectability and therefore a detailed interpretation is difficult. However, it is possible that the source of anomalism is on or near the limestone-shale contact, providing the contact dips northerly and not too steeply. If the contact does not dip gently enough to the north, the anomaly source is probably entirely within the limestone. Regardless, this is an interesting and potentially economic anomaly and should be persued further.

We recommend additional induced polarization on perhaps a 500 foot spacing to gain better depth penetration and centered on Station 3N, Line 2, and oriented the same way. Parallel lines should be run about 750 feet either side of the first line to determine strike direction and extent as well as possibly a stronger or nearer surface portion of the anomaly. Drill targets could then be selected with confidence and a minimum of expenditure to gain intersection with the polarizing body.

This polarizing body at depth on Line 2 could be caused by similar material as was seen at Mowry, (because of similar response and the same host rock), or perhaps by an unoxidized sulfide body. Either possibility is of potential interest.

Self potentials show a minor low at ON/S which could be of minor interest and may reflect near surface mineralization related to the deeper induced polarization source.

ROYAL AREA

Line 4 was centered at the SEMINCO shaft and oriented about N23W-S23E. The limestone-granite contact shows a resistivity interface with the granite more conductive.

No definite response directly related to the SEMINCO shaft mineralization was seen, although the zone from about ON/S to 9S shows very weak polarization effects within one hundred feet of the surface in the granite. The lack of a directly associated response over the SEMINCO shaft is likely due to the narrowness and limited extent of the body, (about 5 feet wide), relative to the 300 foot electrode spacing used.

Below the near surface granite anomaly, the polarization effects again increase and in a zone apparently dipping northerly or perhaps diverging from the line. In the latter case, mineralization along the granite-limestone contact to the east is implied.

The anomalous response is quite weak. Additional work would only be worthwhile to further prospect the limestone contact in the hope that the very weak effects are lateral effects from stronger anomalism near or on the contact. Lines normal to the contact are recommended, in this case, and should be continued on the 300 foot spacing if the depth of processing from about 90 to 400 feet is still desired. No self potential anomalism was seen on this line.

Otherwise, we believe the area warrants a more regional or reconnaissance approach with broader spaced and deeper induced polarization. Such work is recommended, provided sufficient property rights or options can be acquired. The district certainly has some excellent unexplored potential.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig
Senior Geophysicist

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 19
ARIZONA, U.S.A.

APPROVED:

Walter E. Heinrichs, Jr.
President & General Manager

June 27, 1967
Tucson, Arizona

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BASIS OF THE INDUCED POLARIZATION METHOD

The induced polarization method is based on the electrical properties exhibited by electronic or metallic conductors imbedded in an ionic or electrolytic conducting matrix. These properties are noticed in that the potential across a block of this dual conduction mode material will increase with time, approaching a constant value, when a constant current is made to flow through the block. This phenomenon occurs because at the boundaries between the two conductor types, electrolytic ions have to give up or take on electrons thereby requiring an additional force (overvoltage) over that which would be needed with only one mode of conduction; showing up as a building of potential across the block with time as more ions are backed up. This potential approaches a constant value when an equilibrium is established between the ions backed up at the boundaries and the flow across the boundaries. Therefore from the preceeding discussion, it is seen that the gross effect is quite similar to the charging of a leaky capacitor and for most applications, it is proper to use this mode as a guide. These capacitive-like properties are normally measured by three different techniques.

In the time domain (pulse) method, a steady direct current is imposed across the block for a few seconds and abruptly terminated so that the capacitive-like decay (discharge) curve can be measured or recorded. Usually, the voltage decay curve is integrated with respect to time to give the area under the decay curve in units of volt-seconds. The more area determined, the more capacitance or polarization the block exhibits.

In the frequency domain method, the percentage difference between the impedance (AC resistance) offered to a lower and a higher frequency is measured. A capacitor offers a lower impedance to a higher frequency than it does to a lower frequency, therefore the percentage difference between the impedances will increase with increased polarization.

A third technique is to measure the phase angle or delay between an introduced current wave-form and the received voltage wave across the block. This phase delay also increases as polarization increases.

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GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

Almost all metallic lustered sulfides such as for example; pyrite, chalcopyrite, chalcocite, bornite and molybdenite are electronic conductors and the rocks and ground water, with which they permeate or are permeated, are ionic conductors, therefore if an electric current is made to flow through a sulfide deposit, it will polarize and can be detected by the three methods described above.

This induced polarization property is not entirely unique with sulfides since magnetite, graphite and some clays will exhibit it; however, with sufficient geological and geophysical data, effects due to sulfides can generally be interpreted apart from non-sulfide anomalism. The type of sulfide however, say pyrite, as distinct from chalcopyrite, cannot yet be distinguished with present induced polarization techniques since all types give quite similar types of problems.

The I. P. technique was developed primarily for porphyry type deposits and is perhaps the only reliable means of detecting hidden disseminated sulfides. However, the I. P. method works just as well or perhaps better on semi-massive to massive sulfides, contrary to some of the earlier thinking, for it gives increased response with increased volume percentage of sulfide.

FIELD TECHNIQUES AND INTERPRETATION

For routine exploration, we prefer and use the dual frequency system because of its greater simplicity of instrumentation, operation and greater accuracy as well as simplicity of interpretation. However, all three methods give basically the same results and the choice is either a matter of opinion or highly technical reasons and therefore should be left to the individual application and the geophysicist's discretion.

The two frequencies we most commonly use are 0.05 and 3.0 cycles per second, respectively or so called "D.C." and "A.C." modes. Other frequencies are available with our equipment and are occasionally used when desired. The usual frequency range used is from about 0.01 cps. to 10 cps. The lower frequency limit is due to naturally existing time varying Telluric (earth) currents and electrode polarization. The upper limit is determined by electro-magnetic coupling effects which increase rapidly with increasing frequency.

In our standard reconnaissance field practice, five equally spaced co-linear current electrodes are placed in the ground by burying aluminum foil in pits wetted with brine. Observations are made in accordance with a symmetrical dipole-dipole configuration where the distance between the receiver or potential electrodes is kept equal to the distance between adjacent electrode pairs. Generally the receiving dipole is separated by one to six dipole units ("n" separation) from the sending dipole. Figures 1 and 2 indicate this configuration and resulting data plotting positions. A precisely controlled square wave current is sent through a sending dipole at 0.05 and 3.0 cycles per second from which, at the receiving dipole, a "D.C." and an "A.C." voltage are measured, respectively. By knowing the geometry involved (the dipole length or spacing and the separation distance between the two receiving-sending dipole pairs), along with the two voltages, an apparent "D.C." and an "A.C." resistivity can be calculated. From these apparent resistivities, their percentage difference is determined, thus giving the Percent Frequency Effect (PFE). A third quantity proportional to PFE and inversely proportional to "D.C." resistivity, called Metallic Conduction Factor (MCF) is computed in order to somewhat normalize PFE for variations in ground conductivity purely as a technical interpretational aid. Formulas for these various quantities are given on Figure 3.

Selection of electrode spacings is determined by the objectives to be reached in a given survey. This spacing will range from very small (50 feet or less) for very detailed and shallow surveys, up to 1,000 feet, or occasionally more, for broad and deep reconnaissance work. Other factors involved in the selection of spacing are concerned with the anticipated physical geometry of any possibly existing mineral occurrence. This includes consideration of such size, shape and position factors as expected depth of burial to the top of the deposit, the dimensions of the deposit itself, its orientation, strike and dip, etc., as well as its expected electrical properties.

In general, the greater the dipole spacing and "n" separation, the greater the depth penetration and the less the resolution. A rule of thumb used in practice is that, with a good contrast of electrical properties, using the symmetrical - co-linear dipole-dipole system, and having data from 1 through 6 in "n" separations, two times the dipole length is the maximum depth of detectable penetration, and 0.2 times the dipole length is about the minimum depth of detectable penetration for a body having two or three of its dimensions large in relation to the dipole spacing. However, a body having two or three of its dimensions less than the dipole spacing, and buried more than one spacing probably will not be detectable. A zone, regardless of orientation, having a dimension less than 0.1 the dipole spacing will not likely be detectable. Also, zones differing by less than about 30% in electrical conductivity will not be very easily resolved by resistivity measurements, but may still be detected if a polarization contrast exists.

To illustrate the above in more concrete terms, consider a dipole spacing of 1,000 feet for the following: An overburden of more than 2,000 feet would likely not allow enough current penetration into bedrock to detect even a large and highly mineralized zone in the bedrock. Also, a sulfide zone lying completely within 200 feet of the surface generally would not be detected. A spherical or elongated cylindrical body whose top is more than about 1,000 feet below surface and whose diameter is much less than 1,000 feet would be just out of the range of detectability. A Dike-like or sill-like zone whose width is less than 100 feet probably would not be detected regardless of how it lies relative to the spread.

So far, only the maximum and minimum limits of detection and resolution relative to the various geological and geometrical configurations have been discussed, thus omitting optimum conditions. Generally, we attempt to make the dipole spacing one to two times the expected depth to the target in order to obtain a good electrical response. Of course, where it is suspected that the zone has a good depth extent, say two or more dipole spacings, as is typical of most porphyry type copper deposits, a spacing considerably more than two times the expected depth to sub-outcrop can be used to obtain broader and more rapid coverage, as long as we do not exceed the zone's width. Because of these factors, we usually use 500 to 1,000 foot dipole spacings in prospecting for porphyry-type deposits.

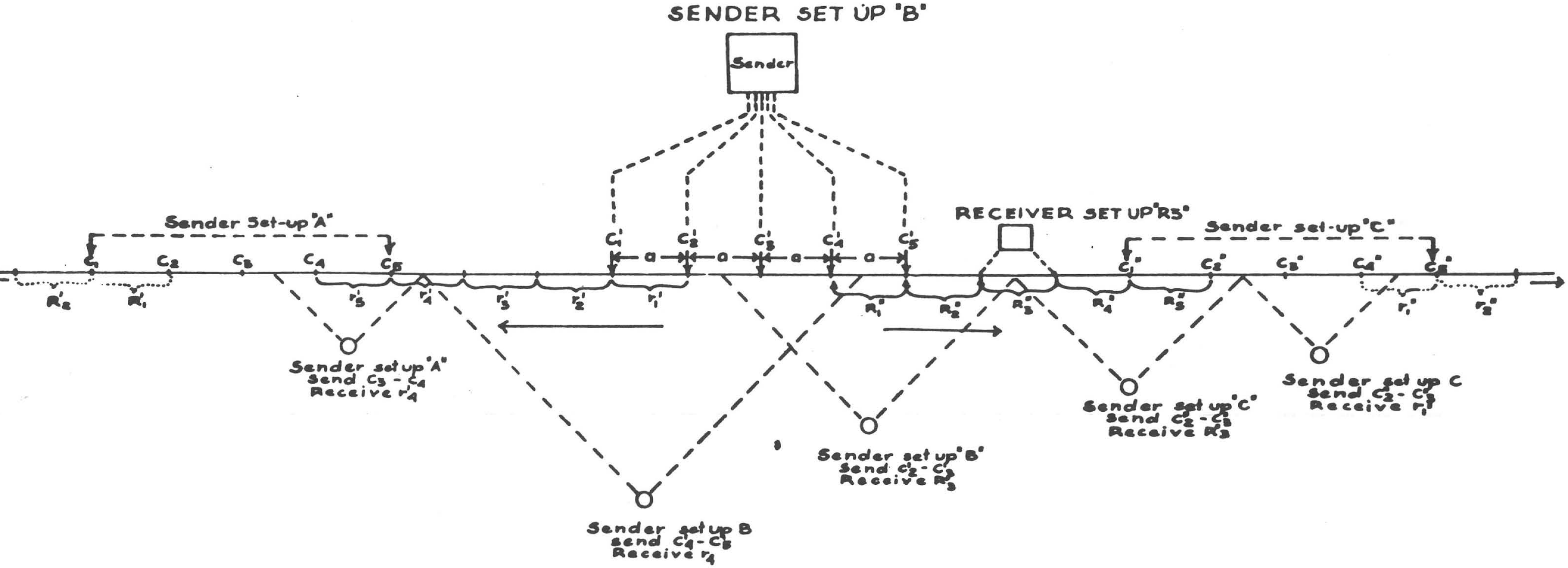
The field data are interpreted after plotting the PFE, MCF and resistivity as in Figures 1 and 2. These values are then contoured, the resistivity and metallic conduction factor logarithmically (because of the usual large variations in magnitude) and the percent frequency effect on a constant interval. This two dimensional method of plotting gives an additional leverage over the standard profile methods in that easily recognizable patterns are associated with various subsurface geometrical configurations and that lateral variations can be separated from vertical effects.

It should be realized that there is no definite relation between the vertical scale on these plots and actual subsurface depth. The data point values are a complexly weighted average of the electrical contrast distribution in the vicinity of the sending-receiving dipole pair and contain depth as well as lateral information. About all that can be said is that by increasing the dipole length and the dipole separation ("n" separation) more volume of ground is being affected and therefore more depth penetration.

There are cases where the depth to a subsurface feature can be determined fairly precisely as in the two horizontal layer situation. The field data is compared with theoretical type curves for various resistivity contrasts between the top and bottom layer and various thickness of the top layer until a close match is found. This enables the depth to the bottom layer in the field to be determined as well as the true resistivity of both layers. A major limitation to this interpretational technique is that only a few simple geometric cases related to a relatively few number of layers have been theoretically developed. However, extremely valuable information can still be derived in alluvial and lake bed applications for depth to bedrock and ground water purposes, etc.

In interpreting PFE's, values of 0 to 4 percent are usually considered background, 4 to 8% marginally anomalous and 8 to 40 plus definitely anomalous, but they must be considered in light of the associated resistivity. Very low resistivities give an increased background frequency effect due to an electromagnetic inductive coupling interference phenomenon that must be corrected for. The MCF tends to correct any high resistivity increased background frequency effects but tends to amplify the electro-magnetic frequency effects making a correction imperative.

Figure 1



Schematic diagram illustrating the method of obtaining and plotting Dipole-Dipole I. P. data. Diagram shows three separate current electrode spreads along a traverse line. In normal procedure, there are three dipole separations between current electrode spreads. The receiver setups are moved outwards from the ends of each current electrode spread usually until three dipole spacings separate the potential electrode setup from the near end of the spread. Current is "sent" to each possible pair of electrodes for each receiver setup. For instance, in Sender setup "B" when the receiver is receiving at R_1 only C_3' - C_2' and C_2' - C_1' can be "sent" so that data at 1 and 2 dipole separations is obtained respectively. When the receiver is at R_5'; C_5' - C_4', C_4' - C_3', C_3' - C_2', and C_1' - C_2' are sent and data is obtained for 3, 4, 5 and 6 dipole separations respectively. Each sender setup provides 33 data points.

Figure 2

(Data obtained from the three setups of Figure 1)

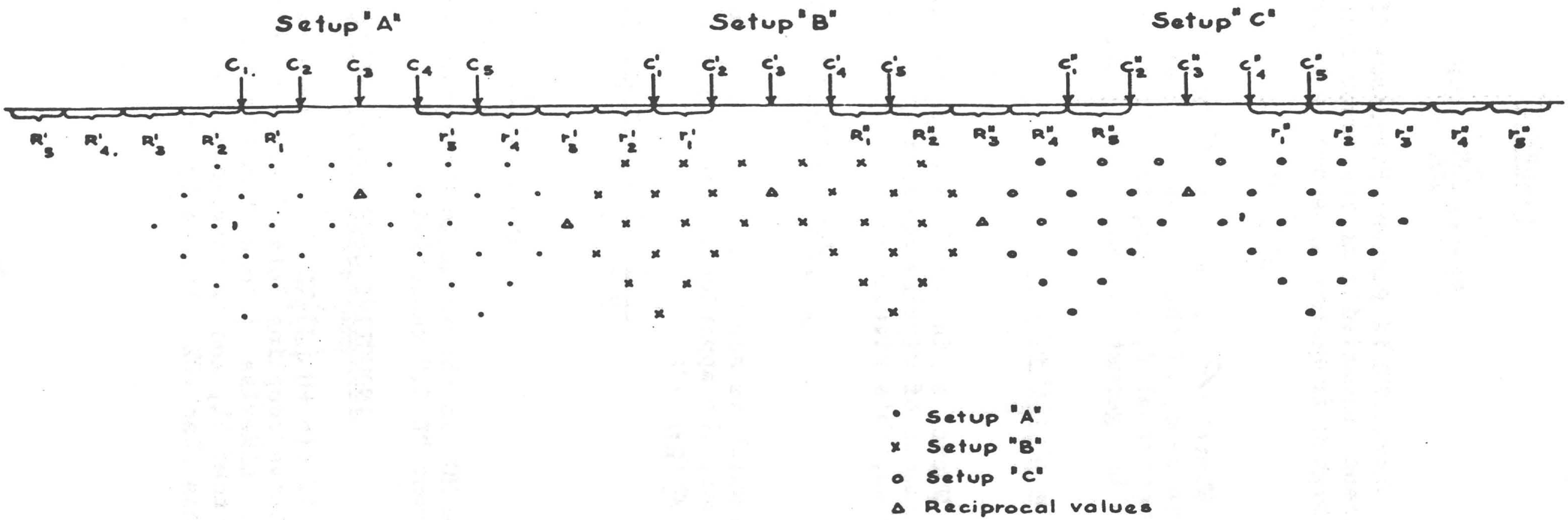


FIGURE 3

$$PFE = \left(\frac{\rho_{dc}}{\rho_{ac}} - 1\right) 100$$

Where PFE is Percent Frequency Effect, ρ dc is the apparent resistivity at the lower frequency and ρ ac is the higher frequency apparent resistivity.

$$\rho = \frac{2\pi V}{I} Kn$$

Where ρ is either ρ dc or ρ ac depending on frequency of the current I which is measured in amperes. The potential V, arising from I, is measured in volts. K_n is the geometric factor given by:

$$Kn = \frac{an(n+1)(n+2)}{2}$$

(Only for dipole-dipole arrays)

Where a is the dipole spacing in feet and n is the number of dipoles separating the sending and receiving dipoles, this gives, for apparent resistivity:

$$\rho = \frac{2\pi V}{I} \left(\frac{an(n+1)(n+2)}{2}\right)$$

from which we see that ρ is in units of ohm-feet. However, the apparent resistivity usually plotted is $\rho/2\pi$ or:

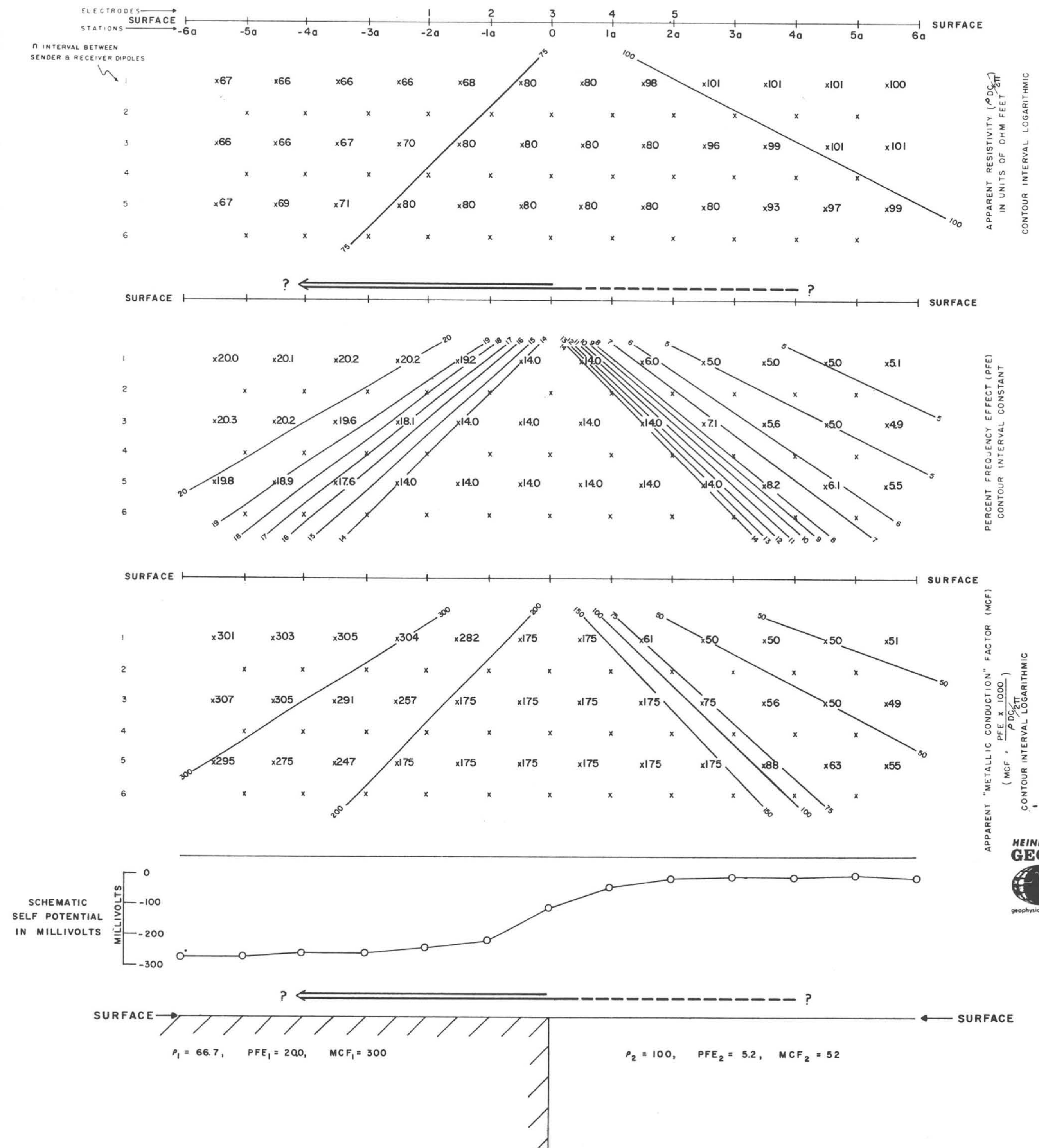
$$\frac{\rho}{2\pi} = \frac{V}{I} Kn = \frac{V}{I} \left(\frac{an(n+1)(n+2)}{2}\right)$$

$$MCF = \frac{PFE}{\rho dc/2\pi} \times 1000$$

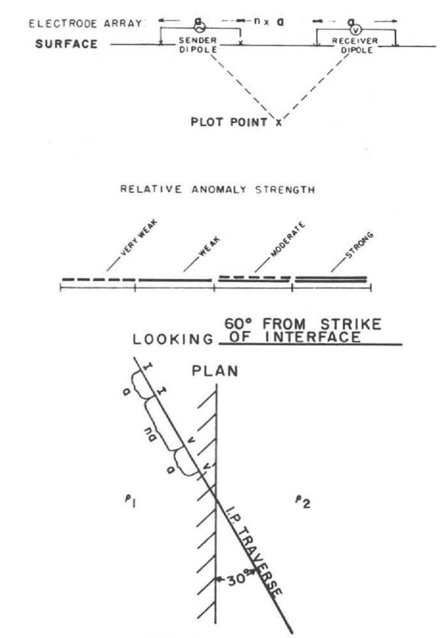
Where MCF is the Metallic Conduction Factor and $\rho dc/2\pi$ is apparent "D.C." resistivity.

INDUCTIVE COUPLING INTERFERENCE

If $a(n+1)\sqrt{\frac{f}{\rho/2\pi}}$ is less than 1000 then the inductive coupling false frequency effect will be less than 2.5%. Likewise if less than 1500 the false effect will be less than 5%, and if less than 2000, the false effect will be less than 10%. Frequency f is in cycles per second.



EXPLANATION



VERTICAL INTERFACE

SECTIONAL DATA SHEET

LINE NO. ——

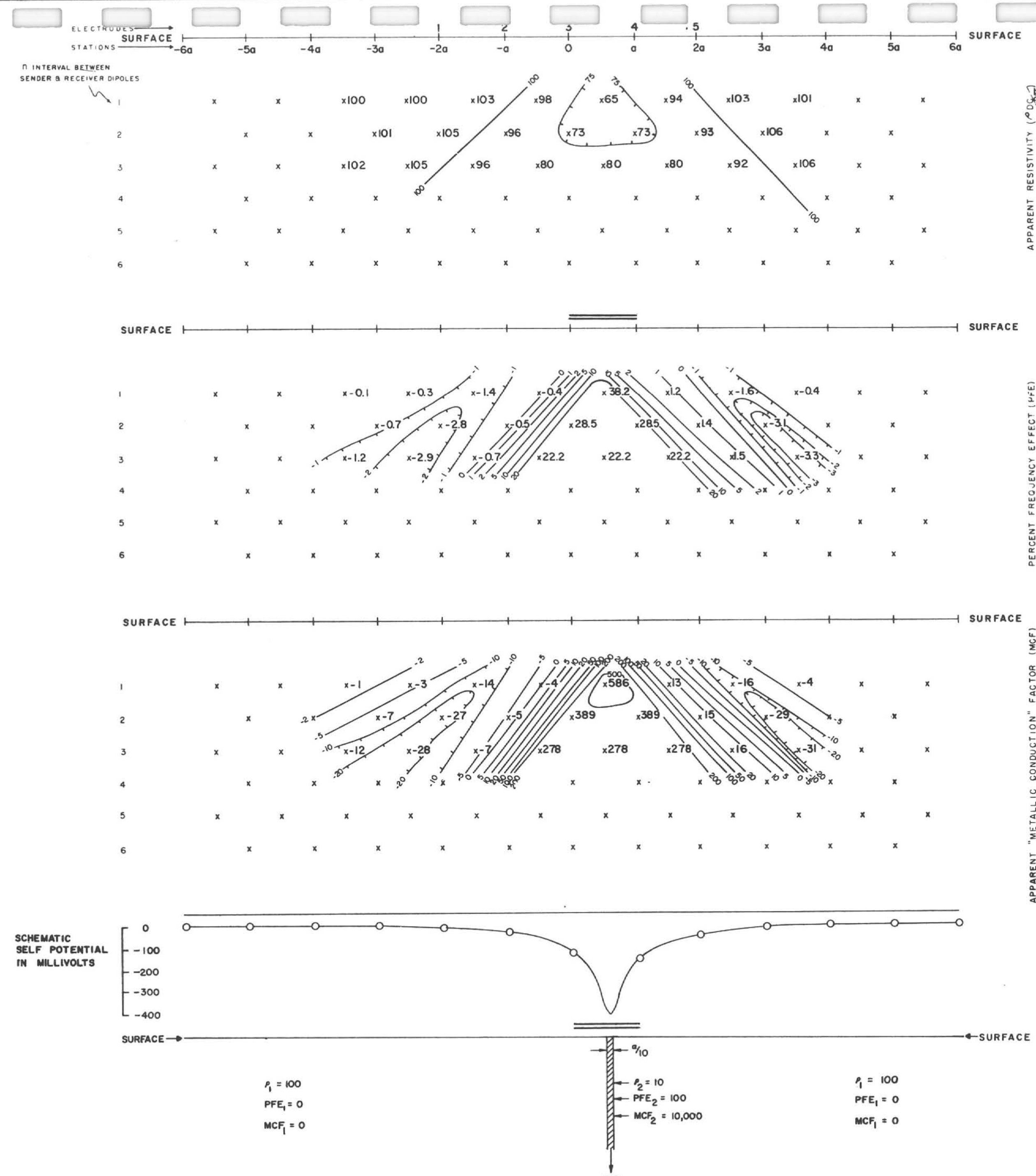
INDUCED POLARIZATION TRAVERSE

SCALE: 1" = a DATE: ——

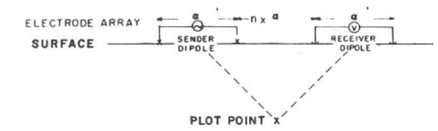
FOR ——

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney
geophysical engineers

THEORETICAL INDUCED POLARIZATION TRAVERSE ACROSS A VERTICAL INTERFACE AT 30° – DIPOLE-DIPOLE ELECTRODE ARRAY.



EXPLANATION



RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

LOOKING NORMAL TO STRIKE

VERTICAL

TABULAR BODY

SECTIONAL DATA SHEET

LINE NO. ——

INDUCED POLARIZATION TRAVERSE

SCALE: 1" = a　　DATE: ——

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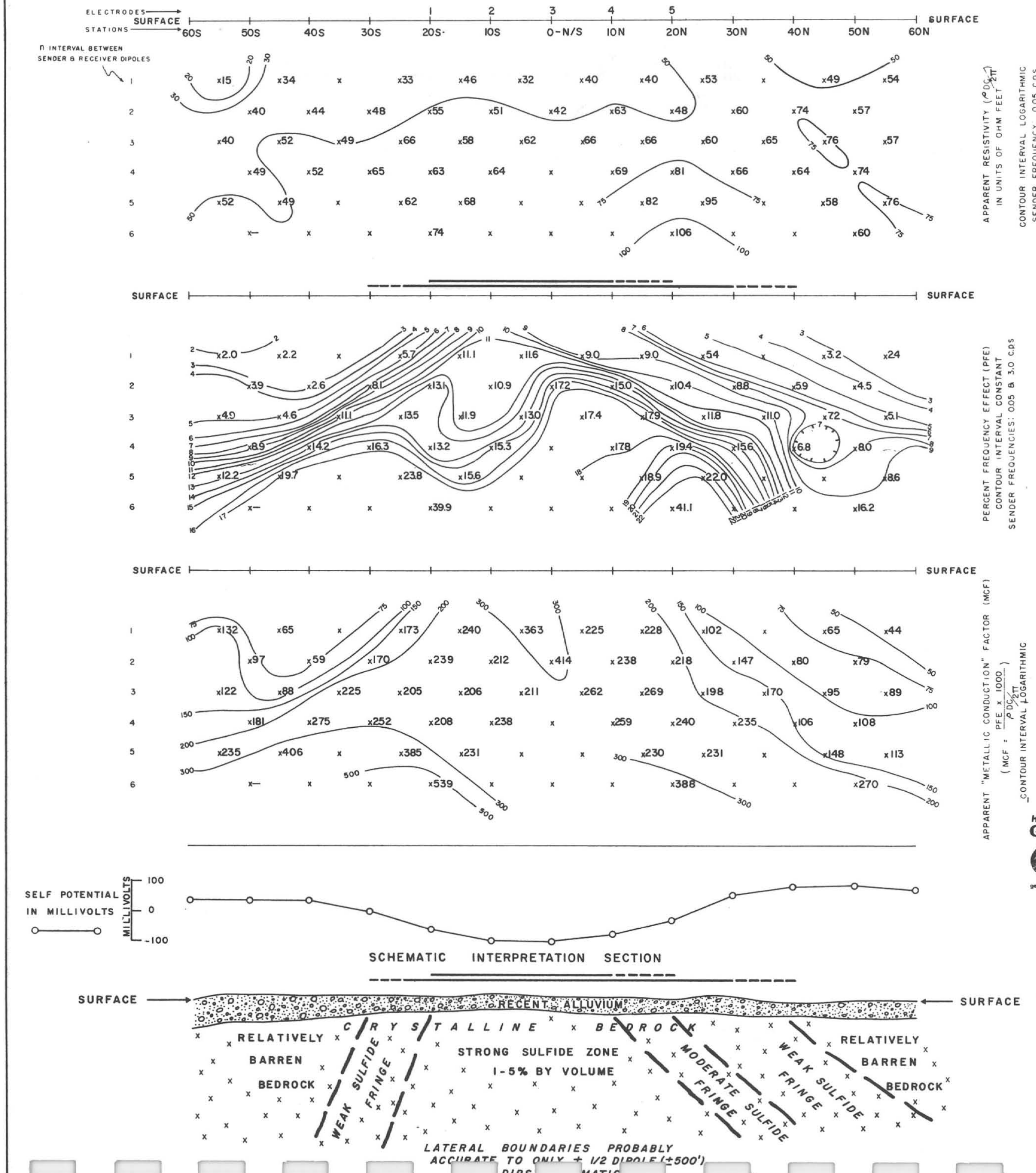
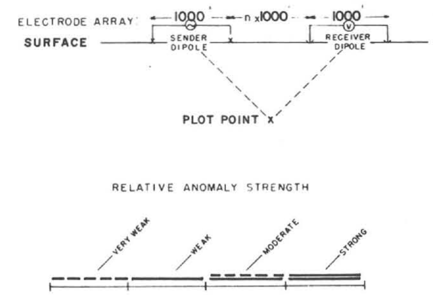
THEORETICAL DIPOLE-DIPOLE INDUCED POLARIZATION RESPONSE OVER A CONDUCTIVE VERTICAL TABULAR SULFIDE BODY CROSSED NORMAL TO THE STRIKE [HAVING A THICKNESS OF 1/10 THE ELECTRODE SPACING (a), A RESISTIVITY CONTRAST OF 10:1, A BACKGROUND RESISTIVITY (ρ_1) OF 100, A BACKGROUND PFE_1 OF 0, AND A PFE_2 OF 100 IN THE SULFIDE ZONE]



EXPLANATION



LOOKING WEST

PIMA MINING DISTRICT
PIMA COUNTY, ARIZONA

SECTIONAL DATA SHEET

LINE NO. —

INDUCED POLARIZATION TRAVERSE

SCALE: 1" = 1000' DATE: —

FOR ________

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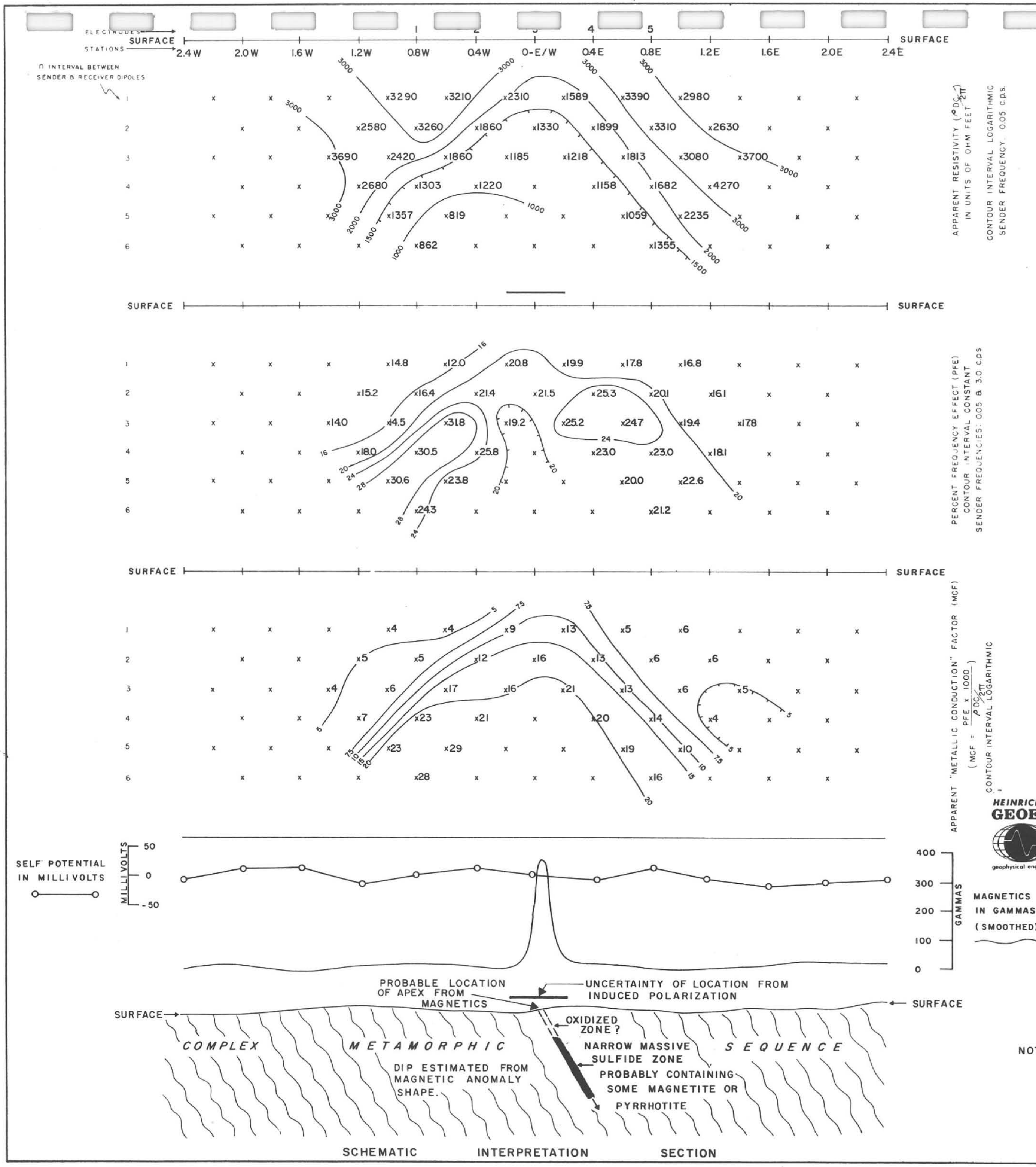
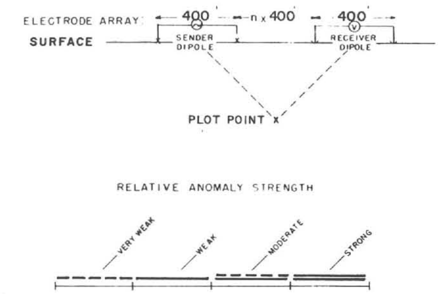
sydney
geophysical engineers

ACTUAL FIELD EXAMPLE OF INDUCED POLARIZATION TRAVERSE OVER DISSEMINATED PORPHYRY TYPE SULFIDE MINERALIZATION



EXPLANATION



LOOKING NORTH

MASSIVE SULFIDE VEIN

APPALACHIAN SULFIDE DISTRICT

SECTIONAL DATA SHEET

LINE NO. —

INDUCED POLARIZATION TRAVERSE

SCALE: 1" = 400'   DATE: —

FOR ________

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geophysical engineers

ACTUAL FIELD EXAMPLE OF COMBINED INDUCED POLARIZATION, RESISTIVITY, MAGNETIC AND SELF POTENTIAL SURVEY ACROSS A NARROW-STEEPLY DIPPING MASSIVE SULFIDE VEIN.

NOTE: INDUCED POLARIZATION ANOMALY ONLY INDICATES A STEEP BUT UNKNOWN DIP. DEPTH TO SULFIDES PROBABLY BETWEEN 200 AND 400 FEET BASED ON ROUNDED APPEARANCE OF INDUCED POLARIZATION ANOMALY AND LACK OF SELF POTENTIAL RESPONSE.

I.P. SURVEY, MOWRY & ROYAL
AREA, SANTA CRUZ CO., ARIZONA

For: SEMINCO, June 1967

INDUCED POLARIZATION SURVEY

MOWRY AND ROYAL AREAS, SANTA CRUZ COUNTY, ARIZONA

For

SEMINCO

June 1967

By

Heinrichs Geoexploration Company
P. O. Box 5671 Tucson, Arizona 85703
Phone: 623-0578 Area Code: 602

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INTRODUCTION

At the request of Mr. Carew McFall of SEMINCO, San Jose, California, Heinrichs Geoexploration Company of Tucson, Arizona, conducted and completed a preliminary reconnaissance induced polarization survey over parts of the Mowry and Royal Areas, Santa Cruz County, Arizona, during the interim June 13 to June 16, 1967.

A total of four lines were surveyed, three in the Mowry Area and one in the Royal, (Duquesne), Area, giving a total surface coverage of 144,000 feet of which 84,000 is "subsurface" plotted data. All four lines were run with a 300 foot dipole spacing and oriented NNW-SSE. For details of location for the Mowry lines, see the Induced Polarization Location and Interpretation Plan. For the Royal Area, see the General Location.

The data were obtained with the dual frequency induced polarization technique utilizing the collinear dipole-dipole electrode configuration. Sending frequencies used were 0.05 and 3.0 hertz (cps).

The purpose of this survey was to help evaluate several electromagnetic anomalies obtained by SEMINCO in terms of sulfide distribution and concentration within the zone from about 90 feet to 400 feet below surface in the vicinity of the induced polarization lines. Geologically, these lines are in potentially economic areas. A calibration-correlation line was run across the past producer, Mowry Mine, (Line 3).

Data are presented on Sectional Data Sheets, one for each line, with resistivity, percent frequency effects (PFE), and metallic conduction factor (MCF) contoured in section, and self potential (SP) in profile form. Major geologic features have also been shown on the sections for correlation. For the Mowry Area, the interpretation has been indicated on the plan as well as on the sections. See the Basis of Induced Polarization Method appended to this report for additional details on theory, presentation, and interpretation.

Geoex personnel involved in the field work were Robert Fedelchak, Geophysical Crew Chief; and Michael Fraker, Technical Assistant. Mr. McFall assisted as the third man on the crew and his assistance was greatly appreciated. Interpretation, compilation, computation, and report were by the Tucson Geoex staff under the supervision of Chris S. Ludwig, Senior Geophysicist.

CONCLUSIONS, RECOMMENDATIONS, AND INTERPRETATION

MOWRY AREA

Line 3 was centered about 300 feet south of the Mowry Fault and oriented approximately N9W-S9E and crosses the old Mowry stopes. A rather strong, very definite induced polarization anomaly was found between station 3N and 6N indicating a steeply dipping tabular body less than 150 feet thick and thinning, (or lessening in polarizable content), with depth. Top of the polarizable body is within likely 100 feet of the surface. This interpretation fits the Mowry ore body which is probably the source of anomalism - the manganese and iron oxides along with galena left in the stopes and diffused into the nearby county rock giving the electrical polarization.

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This conductive zone is very weakly anomalous near surface and is probably due to the minor mineralization noted there.

Approximately between stations 0N/S and 3N, at a depth of around 300 to 350 feet below surface, a moderately strong anomaly was located. This anomaly is near the limit of depth detectability and therefore a detailed interpretation is difficult. However, it is possible that the source of anomalism is on or near the limestone-shale contact, providing the contact dips northerly and not too steeply. If the contact does not dip gently enough to the north, the anomaly source is probably entirely within the limestone. Regardless, this is an interesting and potentially economic anomaly and should be persued further.

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ROYAL AREA

Line 4 was centered at the SEMINCO shaft and oriented about N23W-S23E. The limestone-granite contact shows a resistivity interface with the granite more conductive.

No definite response directly related to the SEMINCO shaft mineralization was seen, although the zone from about ON/S to 9S shows very weak polarization effects within one hundred feet of the surface in the granite. The lack of a directly associated response over the SEMINCO shaft is likely due to the narrowness and limited extent of the body, (about 5 feet wide), relative to the 300 foot electrode spacing used.

Below the near surface granite anomaly, the polarization effects again increase and in a zone apparently dipping northerly or perhaps diverging from the line. In the latter case, mineralization along the granite-limestone contact to the east is implied.

The anomalous response is quite weak. Additional work would only be worthwhile to further prospect the limestone contact in the hope that the very weak effects are lateral effects from stronger anomalism near or on the contact. Lines normal to the contact are recommended, in this case, and should be continued on the 300 foot spacing if the depth of processing from about 90 to 400 feet is still desired. No self potential anomalism was seen on this line.

Otherwise, we believe the area warrants a more regional or reconnaissance approach with broader spaced and deeper induced polarization. Such work is recommended, provided sufficient property rights or options can be acquired. The district certainly has some excellent unexplored potential.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig
Senior Geophysicist

APPROVED:

Walter E. Heinrichs, Jr.
President & General Manager

Registered Professional Engineer
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 19
ARIZONA, U. S. A.

SEMINCO

SCIENTIFIC EXPLORATION AND MINING COMPANY

P. O. Box 2297
Nogales, Ariz. 85621
August 15, 1967

Mr. Chris Ludwig
Senior Geophysicist
Heinrichs Geoexploration Company
P. O. Box 5671
Tucson, Arizona 85703

Dear Chris:

I sent the map showing planned I. P. lines for Phase II of work at the Mowry to U. S. Smelting, keeping only a tracing. As I can not seem to locate the tracing, I have put on the enclosed map the lines as I remember them. The alternate for line 2-4, shown in ordinary pencil may be better in that it goes over the Olive Mine shaft and near a shaft north of the Mowry Mine.

I will try to call you Friday morning to discuss further lines 2-1, 2-2, and 2-3. Perhaps a combination of I. P. and magnetometer work will give us a more precise drill site for this anomaly picked up in Phase I (our Nellie Prospect).

Yours truly,

C. Carew McFall

C. Carew McFall
General Manager

3538 El Grande Drive, San Jose, California 95132, Tel: 408 251-7340, Cable: Seminco, Sanjose, Calif.

August 10, 1967

Mr. Carew McFall
Scientific Exploration & Mining Company
P. O. Box 2297
Nogales, Arizona 85621

Re: Proposed I.P. Surveys
Patagonia Area, Santa
Cruz County, Arizona

Dear Carew:

Confirming recent conversations with Walt, we herewith propose for our mutual understanding and agreement as follows:

Beginning on or about August 21, 1967, Geoex will furnish one two man I.P. crew and equipment as requested by you.

Charges will be at the rate of $200.00 per two man crew day for estimated 11 days; total job cost will be approximately $3,600.00. Vehicle charges will be $12.00 per day plus $0.12 per mile per vehicle and one vehicle will be used. Directly related supplies, communications, living and other directly incidental charges at our cost. Final compilation, interpretation and report is $125.00 per Tucson staff day.

Mobilization and demobilization, travel, excessive weather delay and standby charges are one-half the daily rate. Breakdown of our equipment in excess of one hour per day will be made up or not charged.

All property permits, brushing and trespassing-liability and related costs incurred on behalf of client assumed by client. Charges for extra equipment and personnel employed if mutually desired, are extra.

Geoex will save client harmless from all Workmen's Compensation, public liability and property damage liability incurred by Geoex employees.

Preliminary reports or copies of rough field plotting sheets will be available as work progresses.

An advance of $1,500.00 will be required to mobilize the crew, and payments are due on presentation. Billings may be submitted periodically with final statement after completion of final report.

Indication of your understanding and approval of the above by executing as provided below on the attached copy of this letter and returning it to us, will be most appreciated.

Sincerely yours,

HEINRICHS GEOEXPLORATION COMPANY

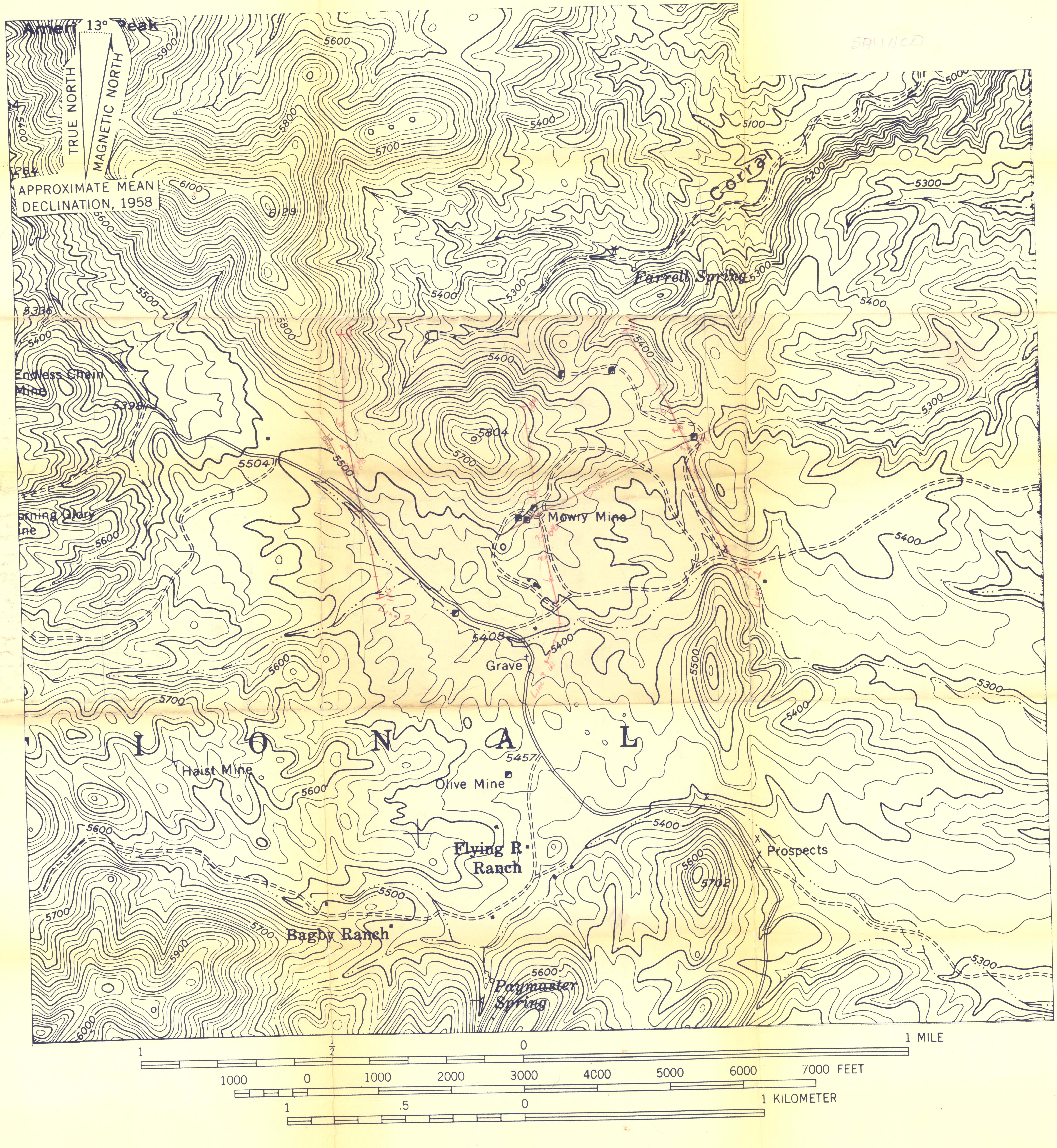
E. Grover Heinrichs
Vice President

Date:____________________

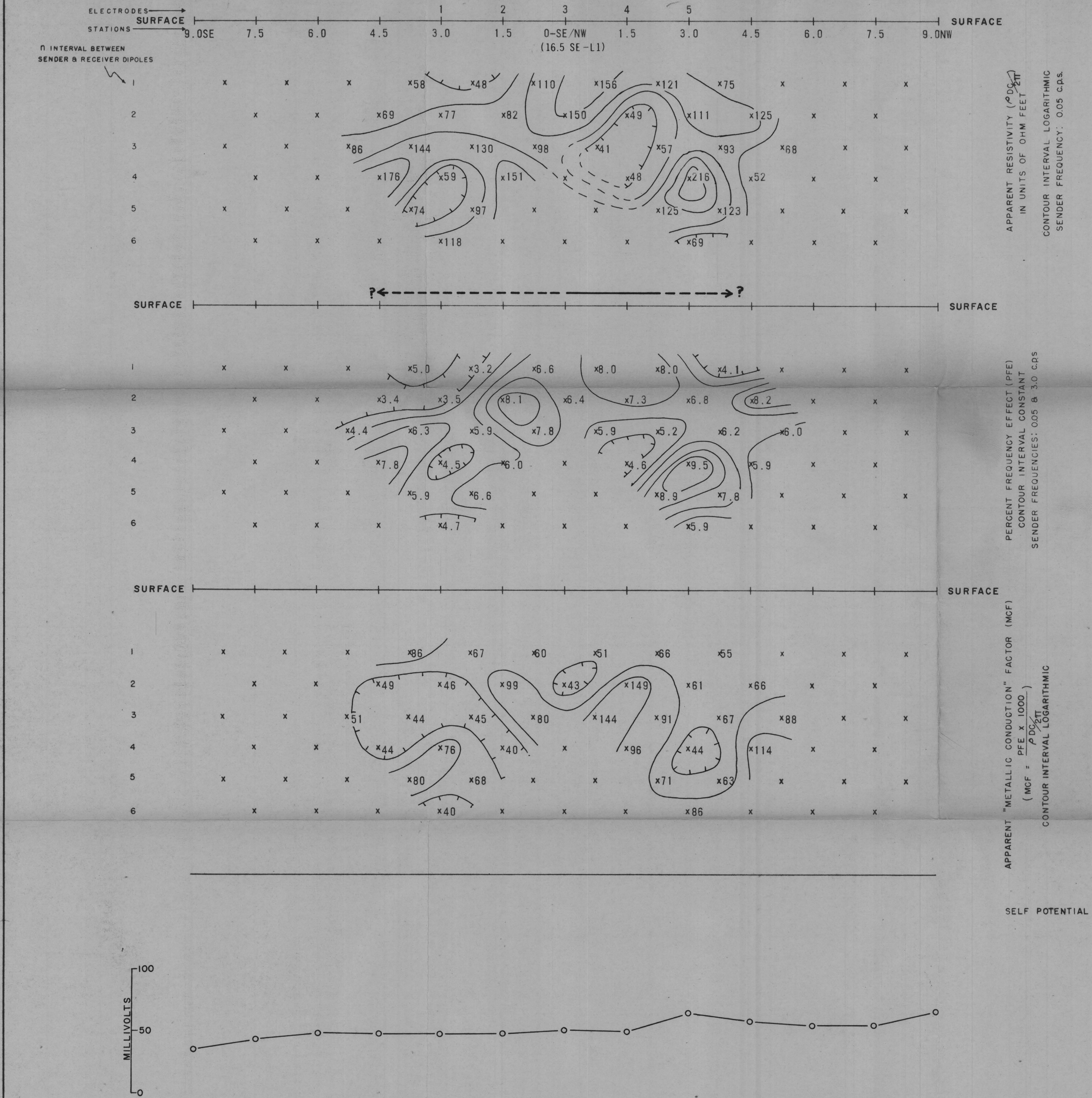
Accepted by:______________

Title:____________________

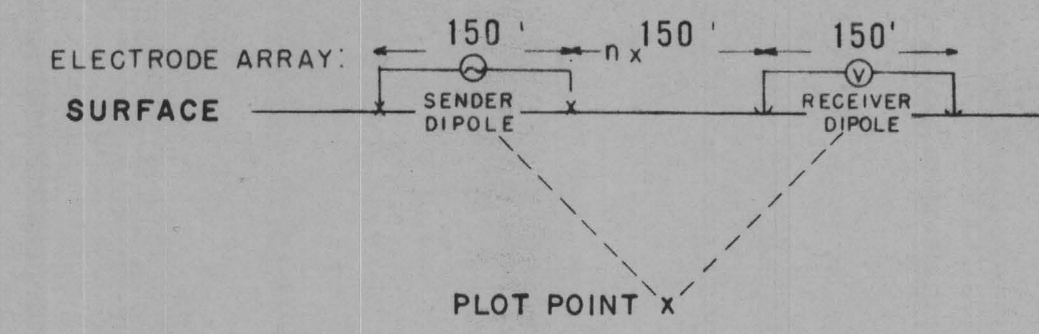
EGH:jc
cc: Extra enclosure



13°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1958
Corral
Farrell Spring
Endless Chain Mine
Mowry Mine
Grave
I O N A L
Haist Mine
Olive Mine
Flying R Ranch
Prospects
Bagby Ranch
Paymaster Spring
5600
5700
5800
5900
6000
6100
6129
5400
5300
5200
5100
5000
5500
5804
5504
5408
5457
5702
1 MILE
7000 FEET
1 KILOMETER



EXPLANATION



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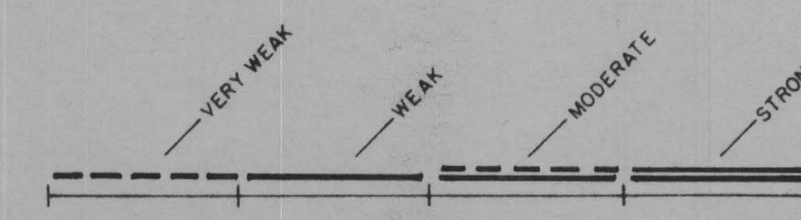


LOOKING SOUTHWESTERLY

Extra

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-6

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

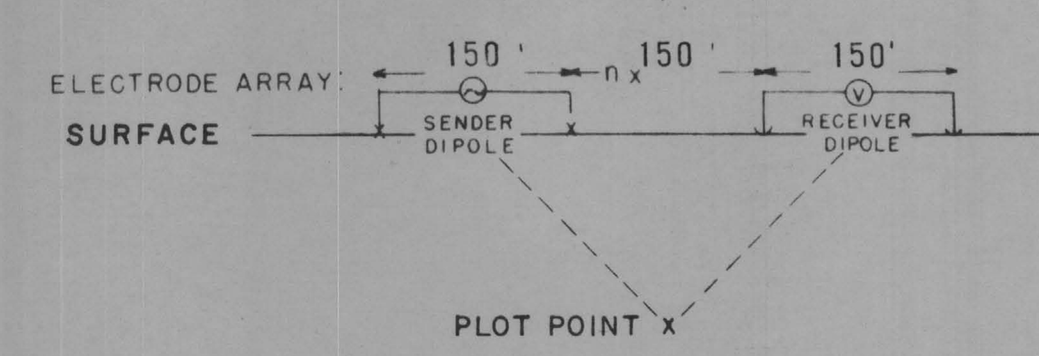
SCALE: 1" = 150' DATE: AUG 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney
geophysical engineers

EXPLANATION



RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

LOOKING SOUTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-6

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: AUG 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
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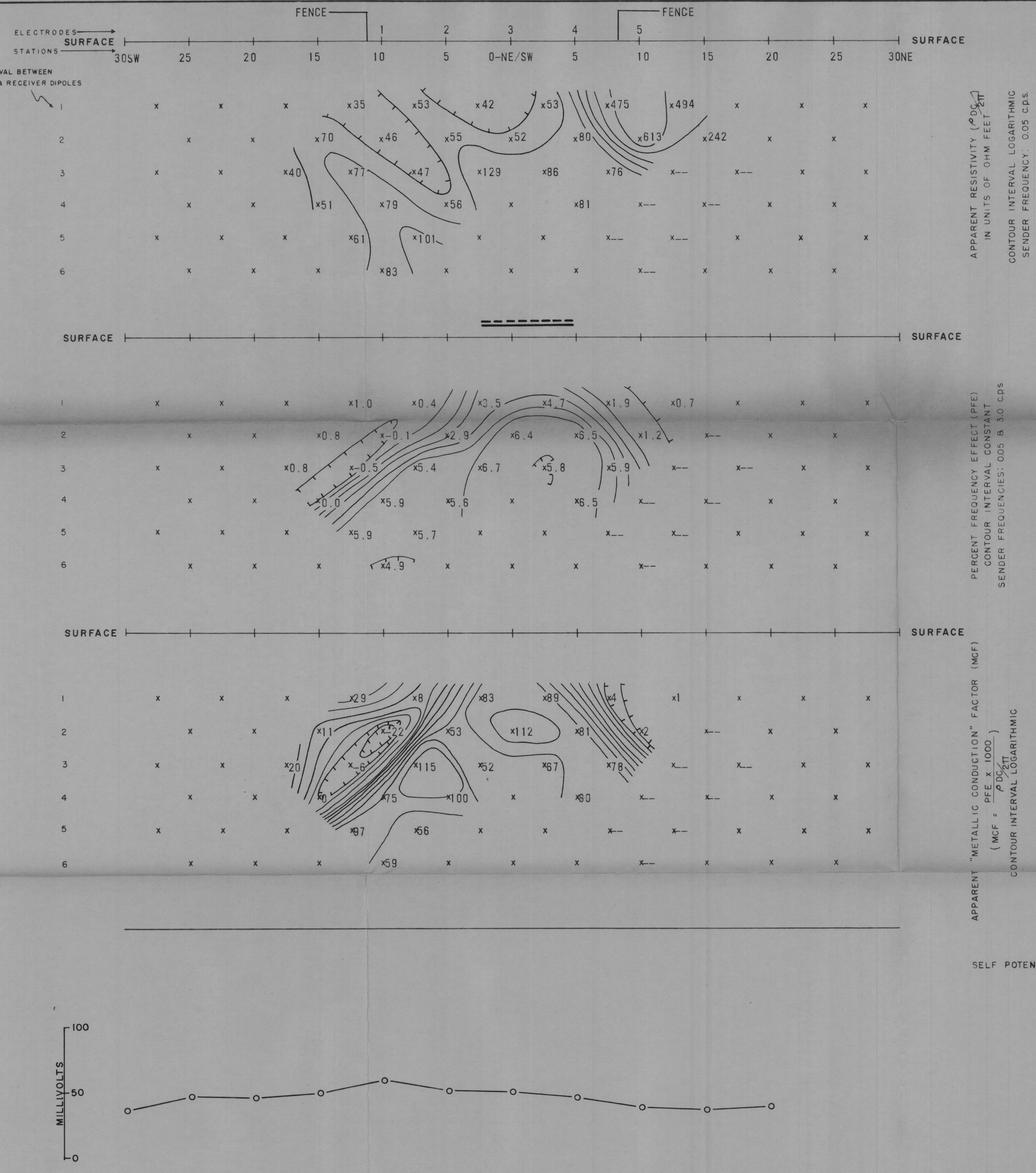

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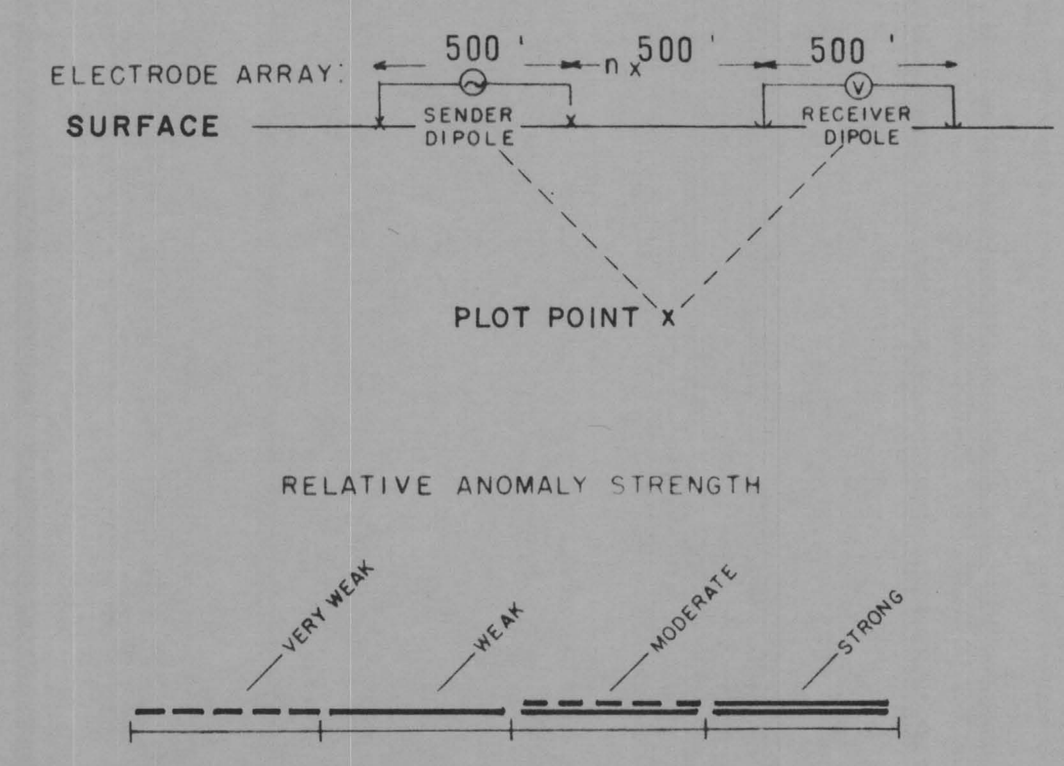

LOOKING NORTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-5

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 500' DATE: AUG 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
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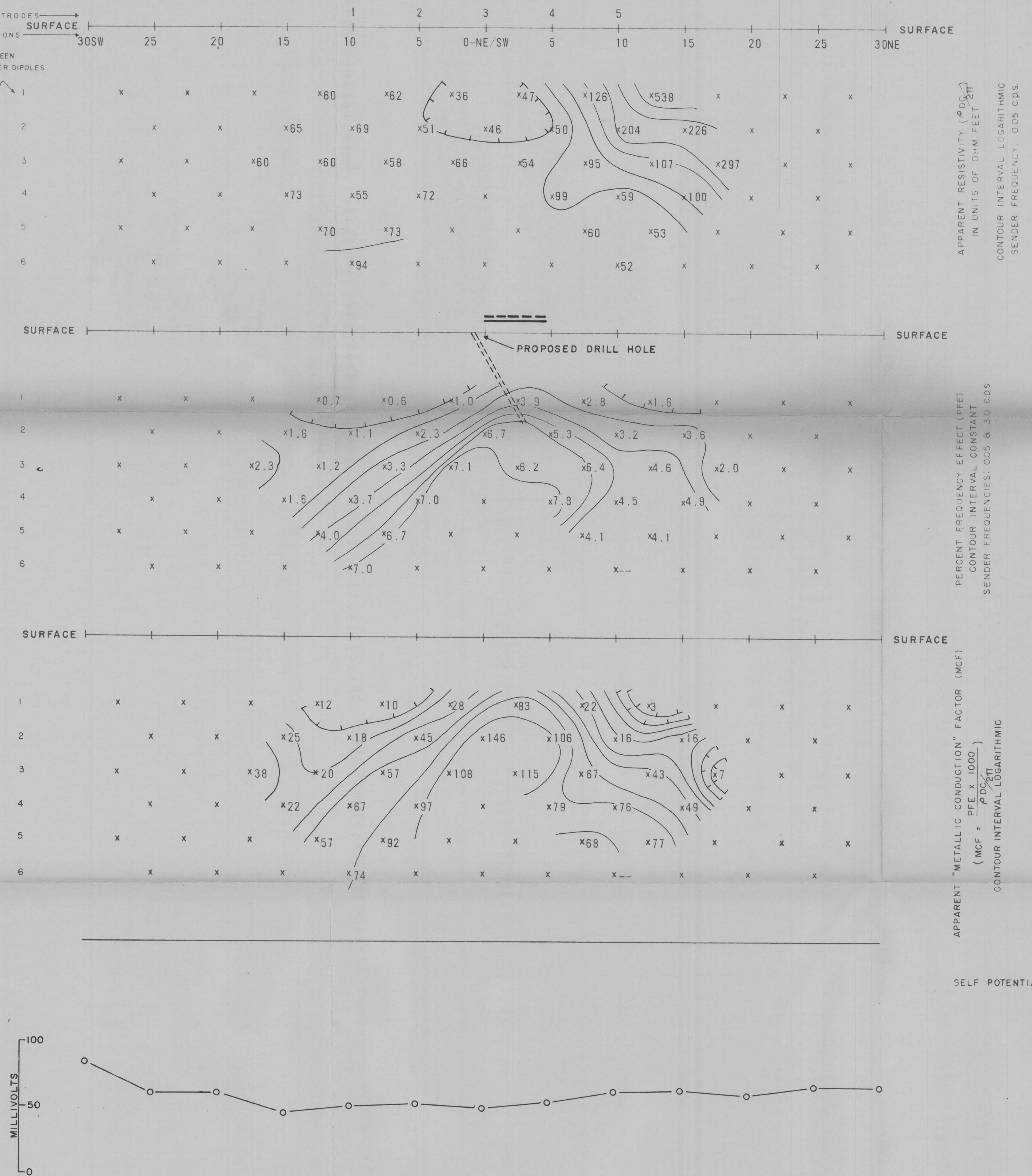
geophysical engineers



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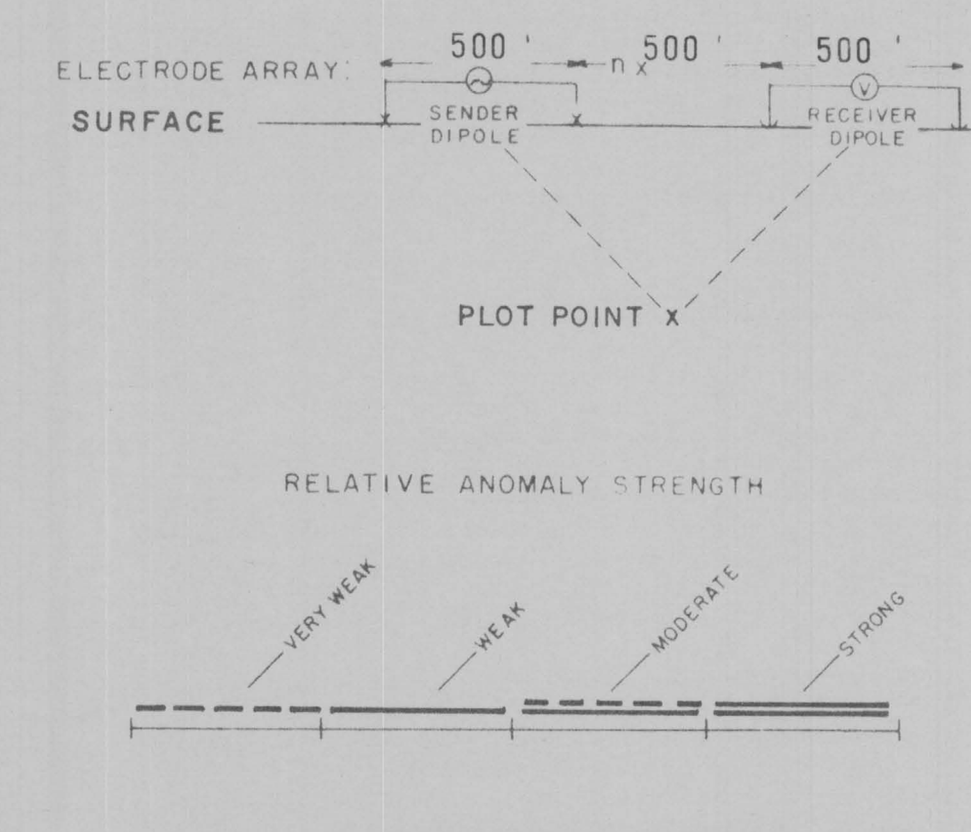

LOOKING NORTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET
LINE NO. 2-4
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 500' DATE: AUG 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
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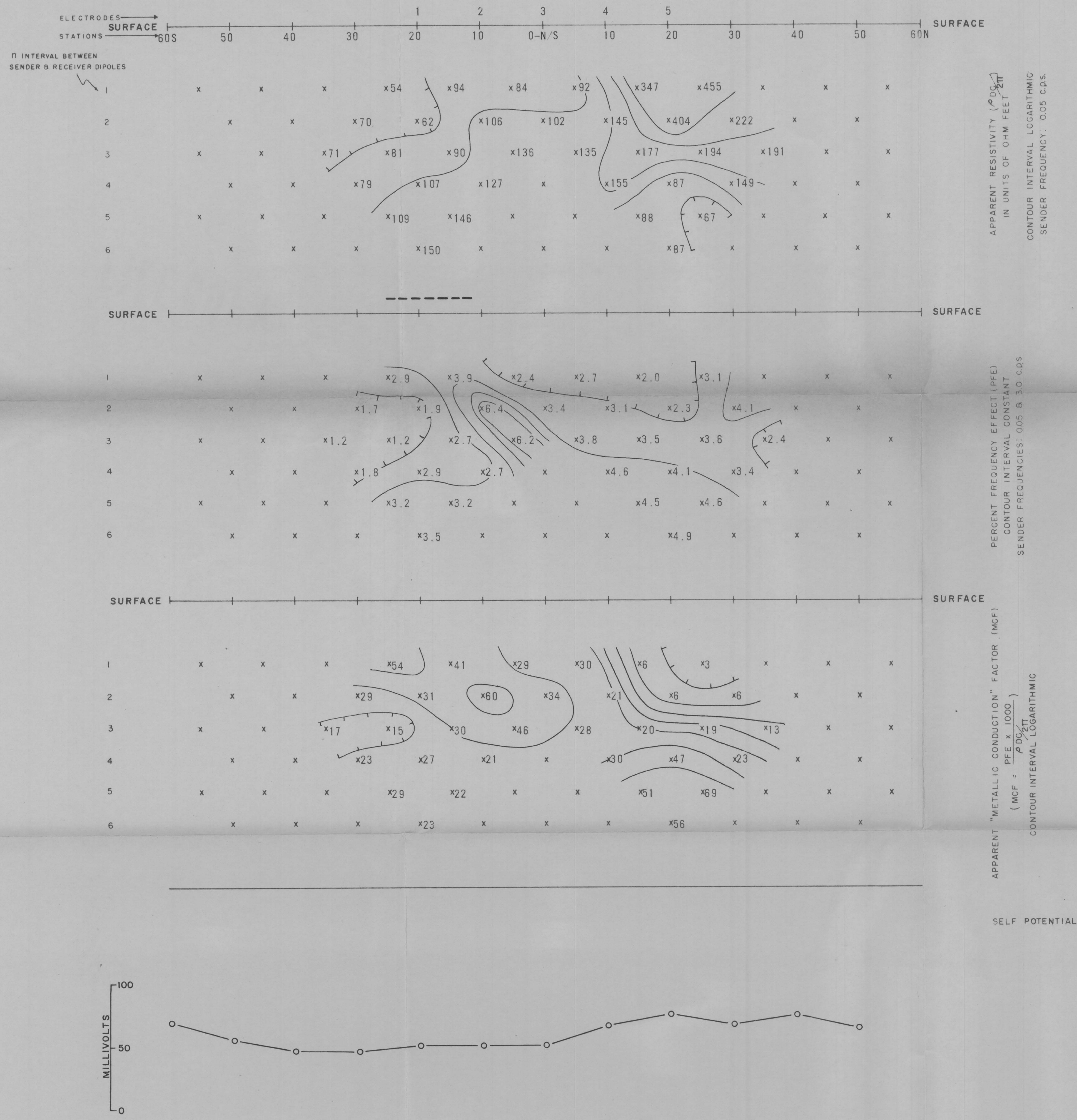
sydney



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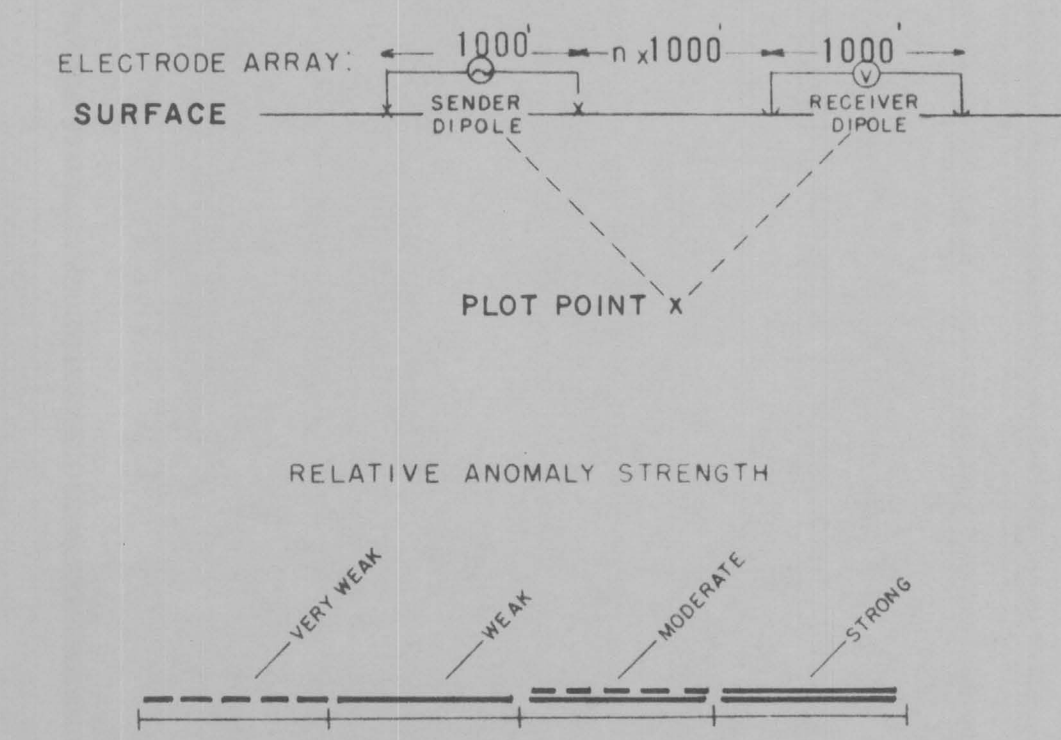

LOOKING N 84° W

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-3

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 1000' DATE: AUG 1967

FOR

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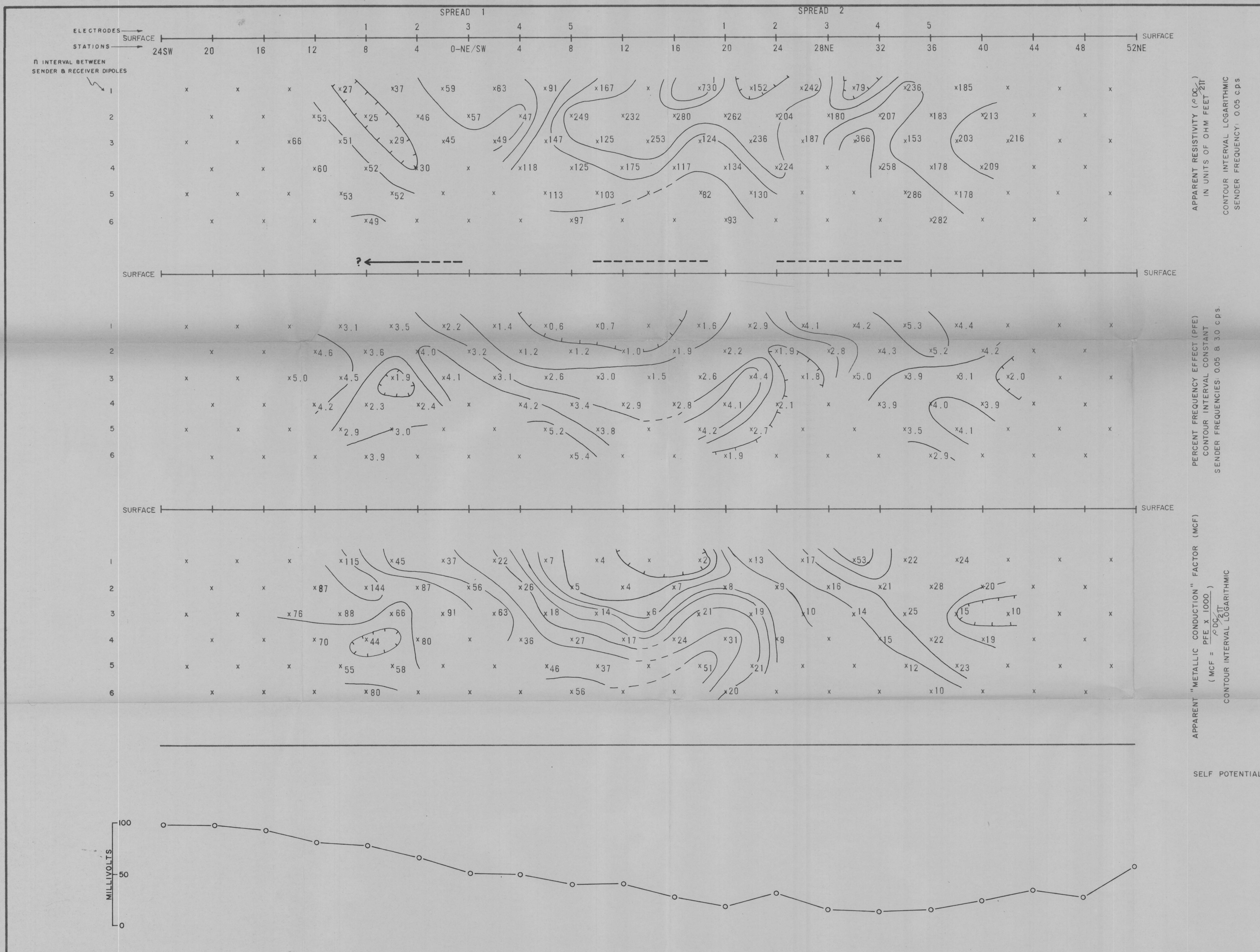
sydney



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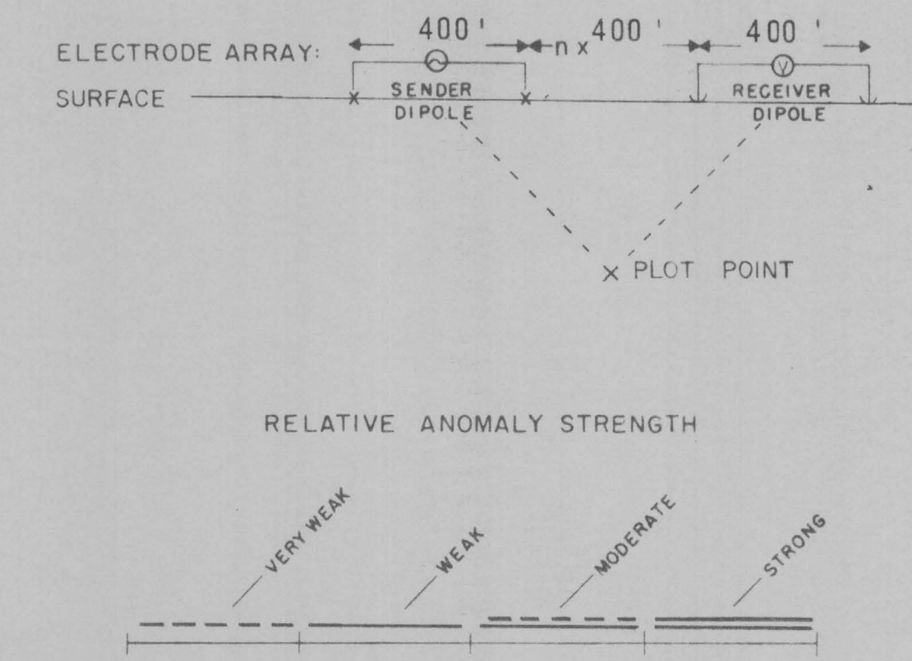

LOOKING NORTHWESTERLY

FILE COPY

GEOEX

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-2

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 400'   DATE: AUG 1967

FOR

SEMINCO

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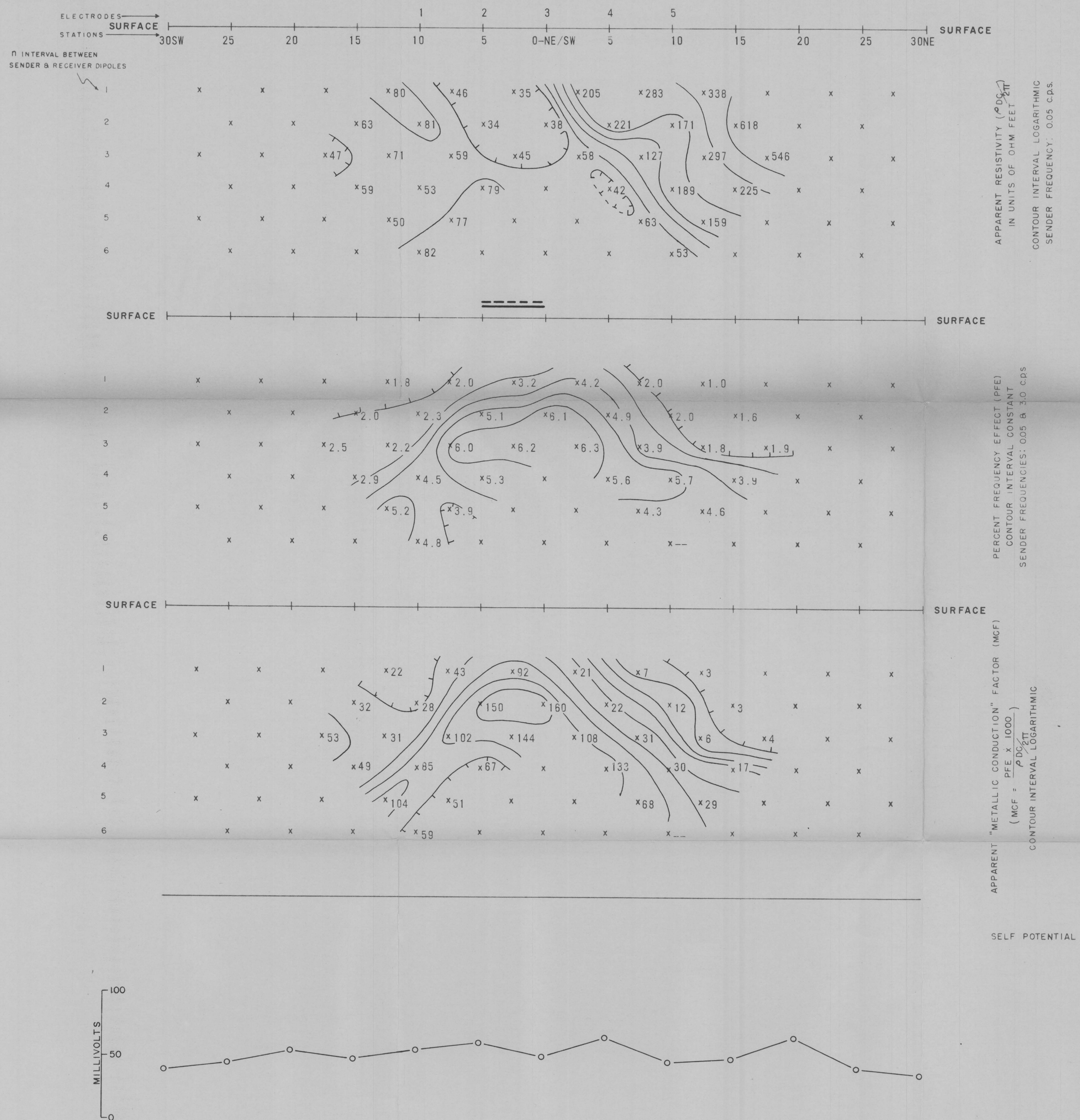
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578   Cable: GEOEX, Tucson
vancouver sydney
geophysical engineers



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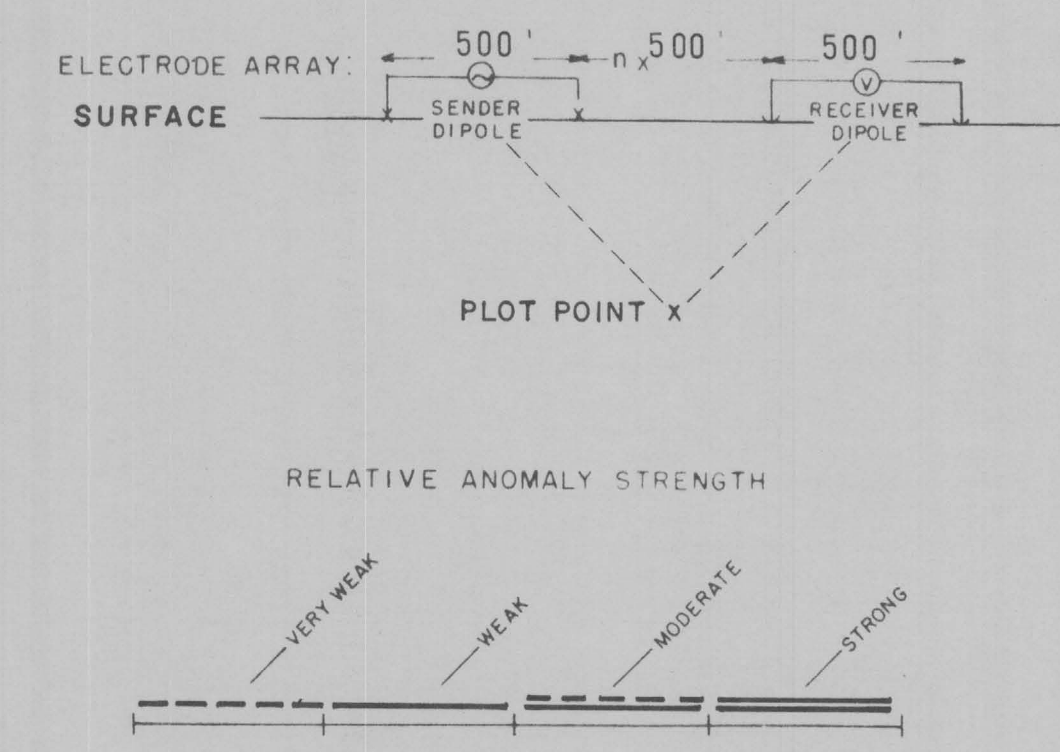

LOOKING NORTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-1

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 500' DATE: AUG 1967

FOR

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GEOEXPLORATION COMPANY
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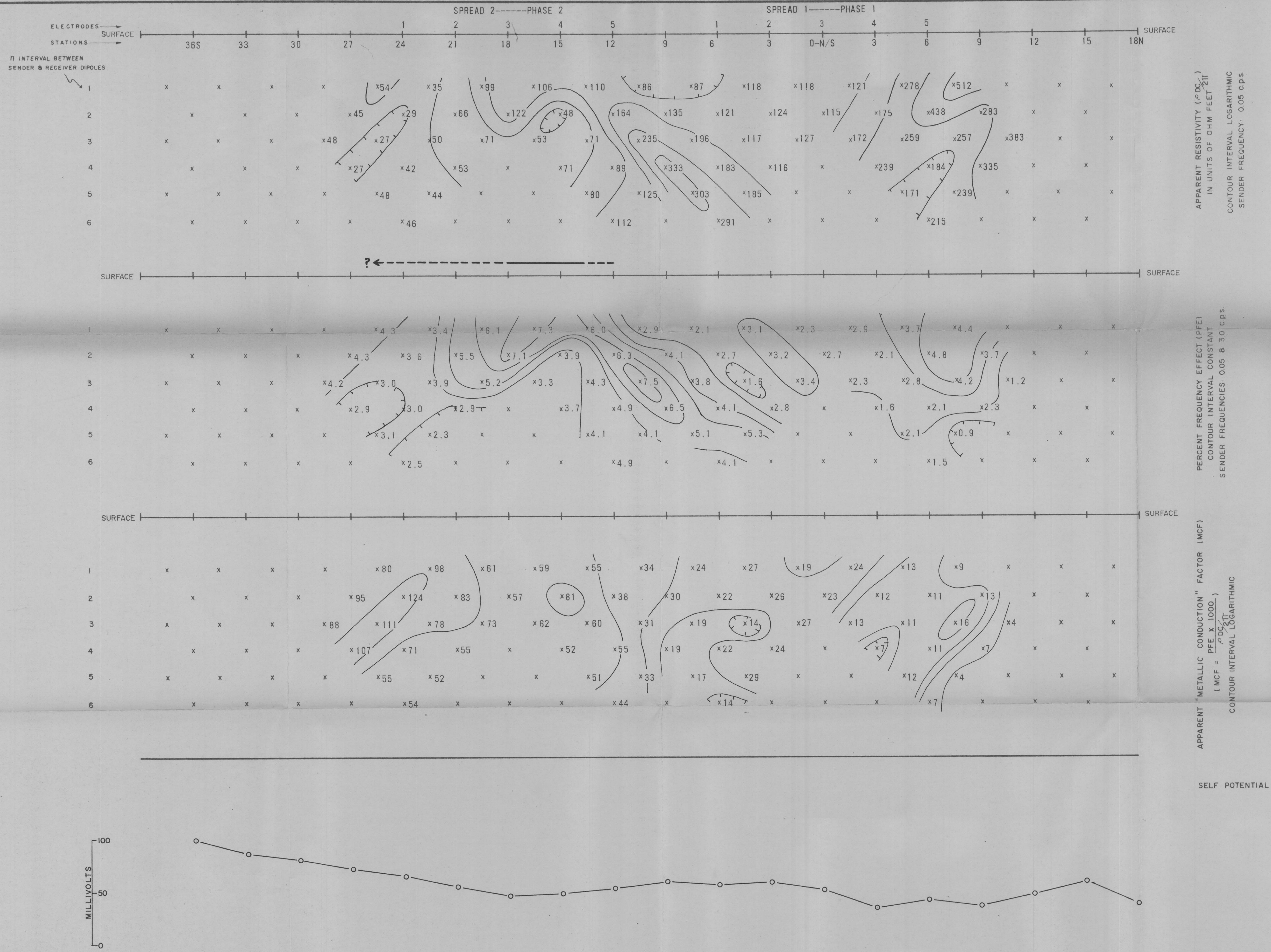
sydney



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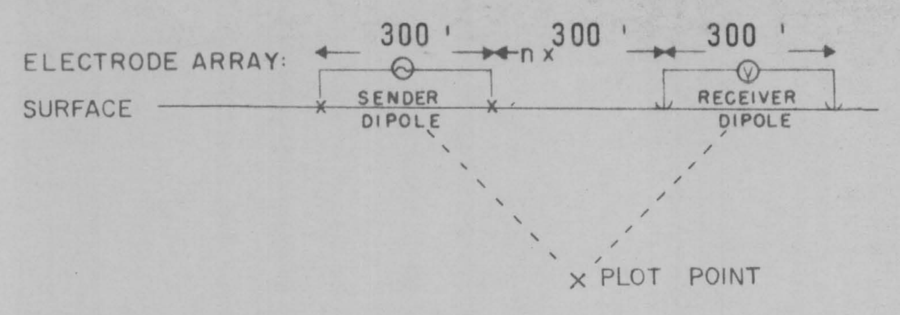

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

LOOKING S 69° W

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET
LINE NO. 1 (PHASE 1 & 2)
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 300'   DATE: JUN & AUG 1967

FOR

SEMINCO

HEINRICHS GEOEXPLORATION COMPANY
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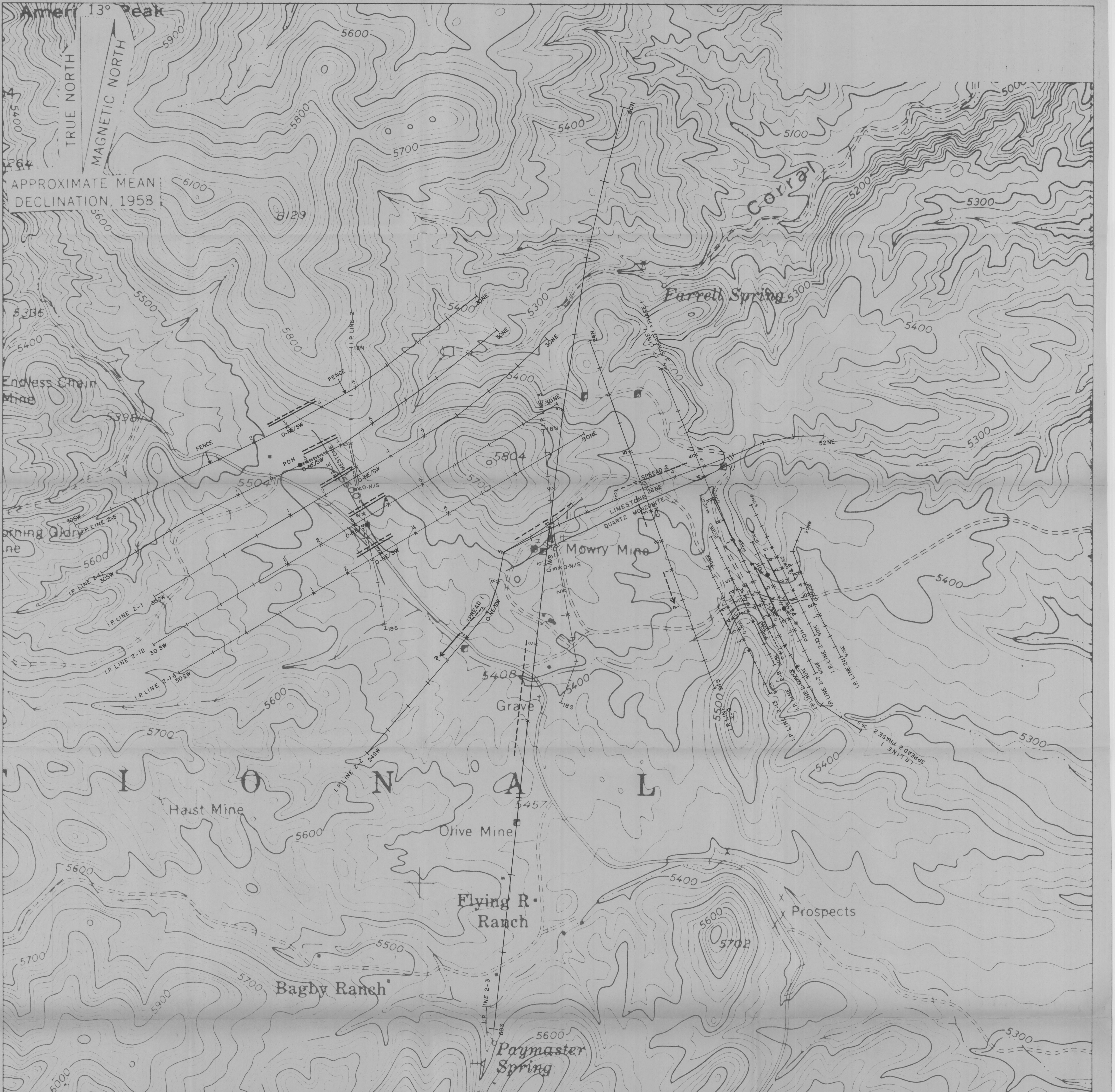
vancouver sydney
geophysical engineers



1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

RELATIVE ANOMALY STRENGTH

VERY WEAK · WEAK · MODERATE · STRONG

STATIONS · INTERFACE · ELECTRODES · I.P. LINE

● PDH = PROPOSED DRILL HOLE

I.P. LINE 2-1 = PHASE 2 LINE 1

FILE COPY

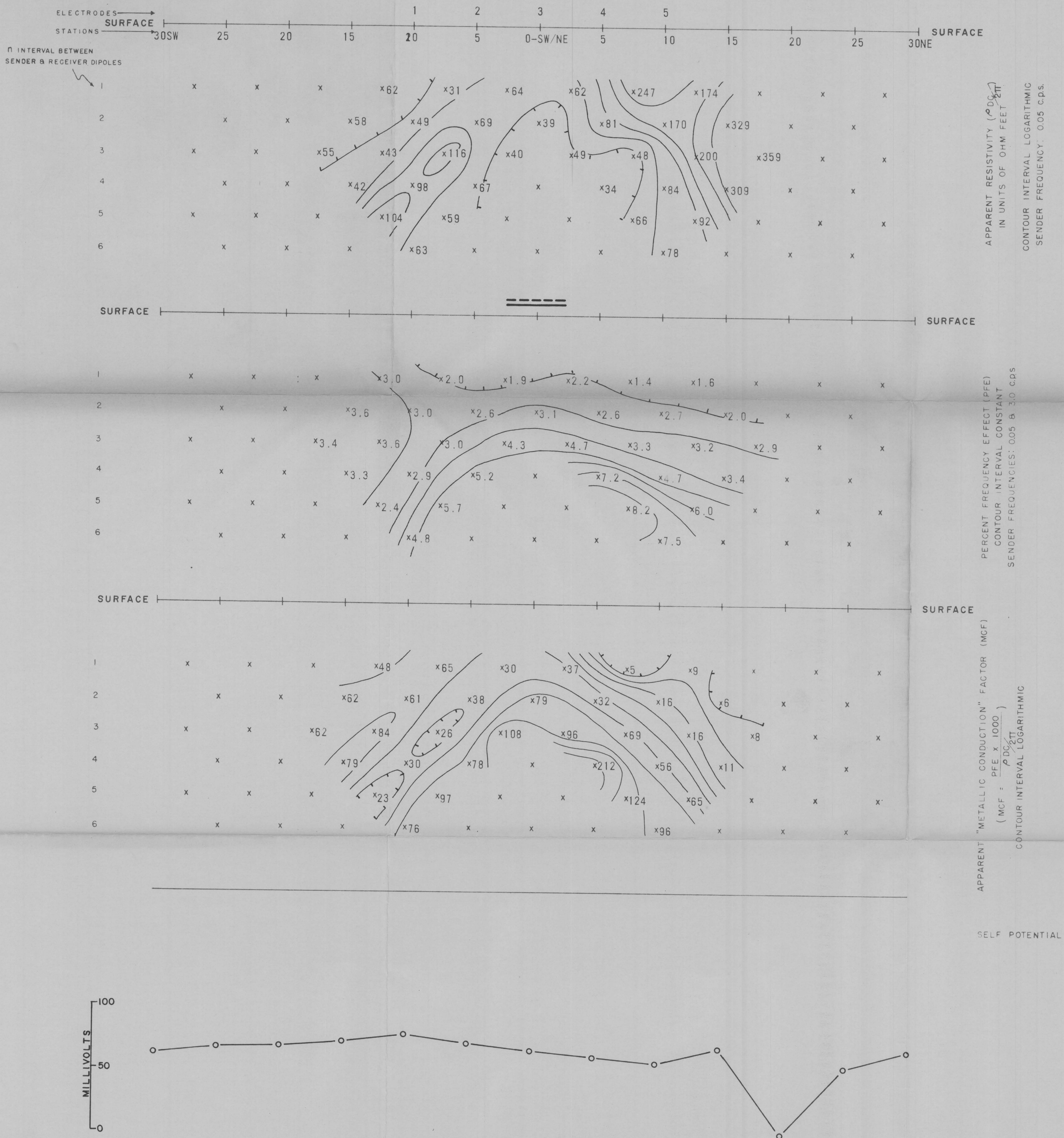
HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA 85703
Phone: 602/623-0578 Cable GEOEX, Tucson
vancouver sydney
geophysical engineers

INDUCED POLARIZATION LOCATION AND INTERPRETATION PLAN
MOWRY AREA
SANTA CRUZ COUNTY, ARIZONA
PHASE 1 & 2

FOR

SEMINCO

SCALE 1" = 500'	DRAWN BY J.C.D.	DATE OCT. 1967



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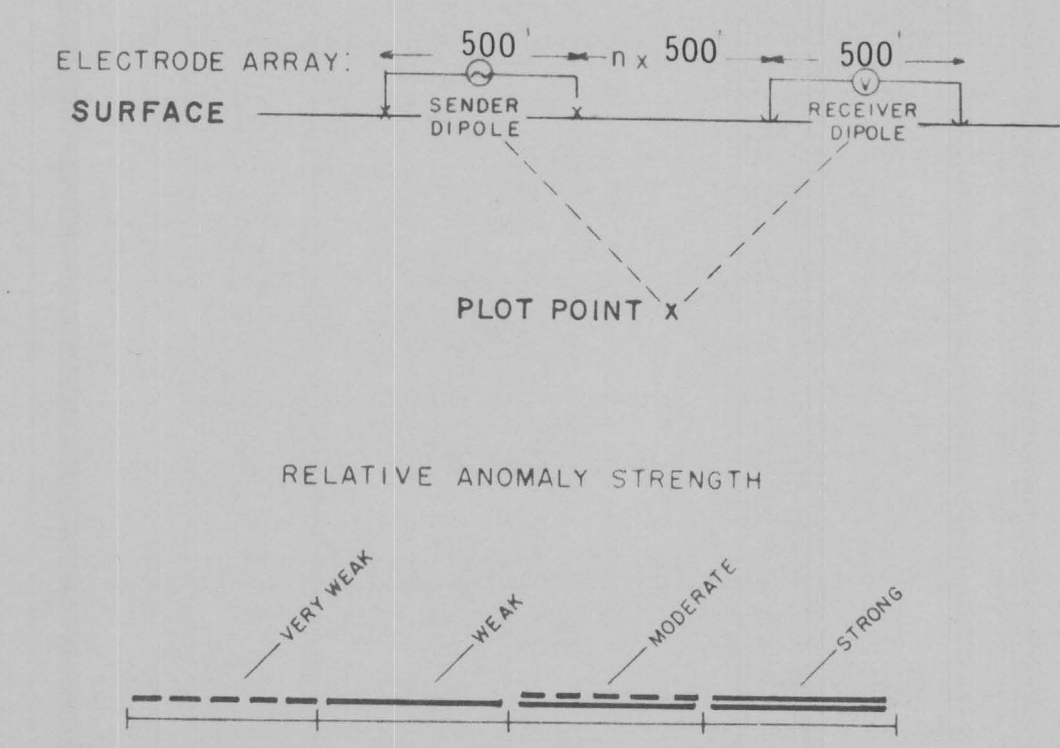

LOOKING NORTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-14

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 500 DATE: SEP 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOFX, Tucson
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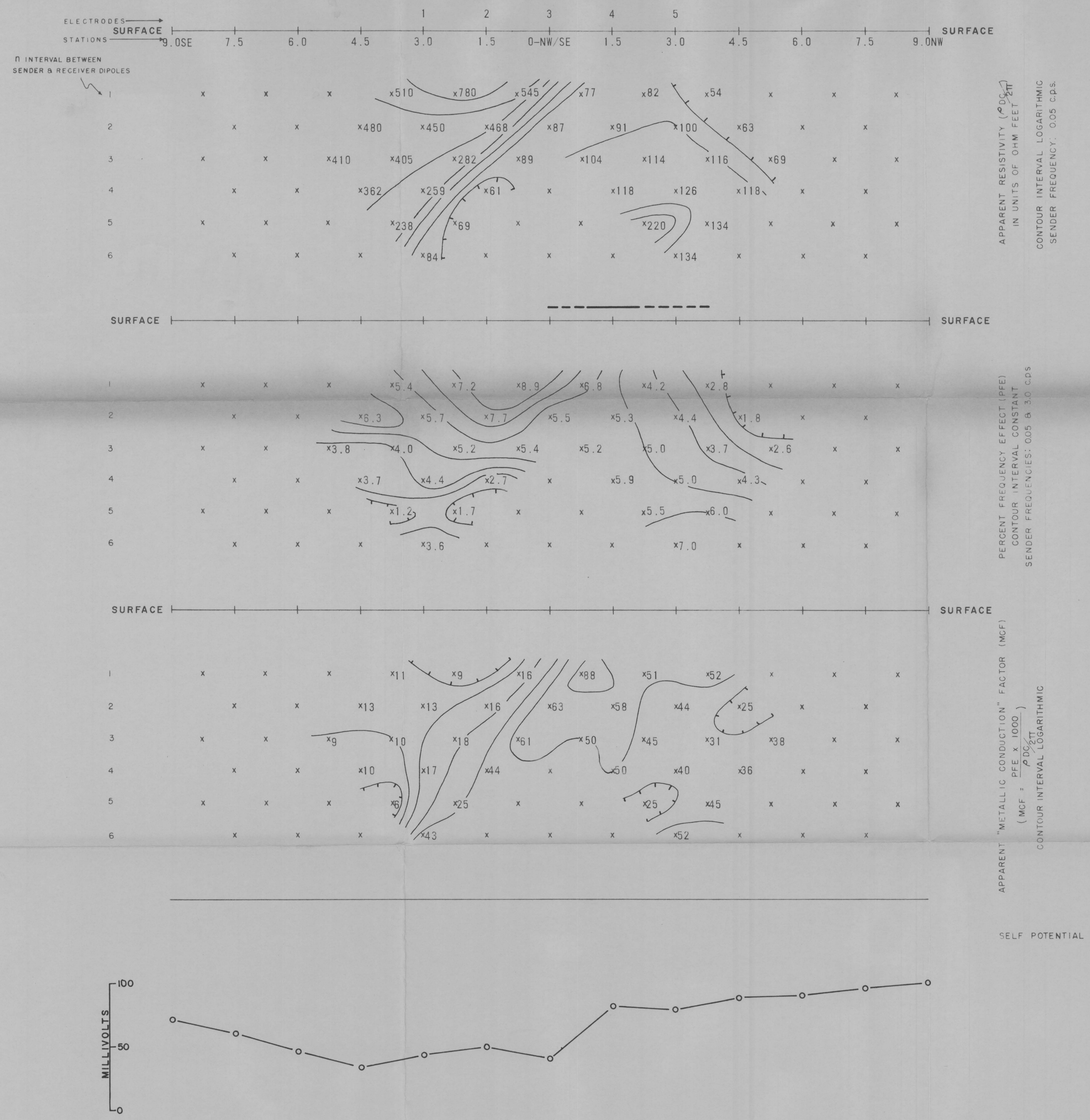
sydney
geophysical engineers



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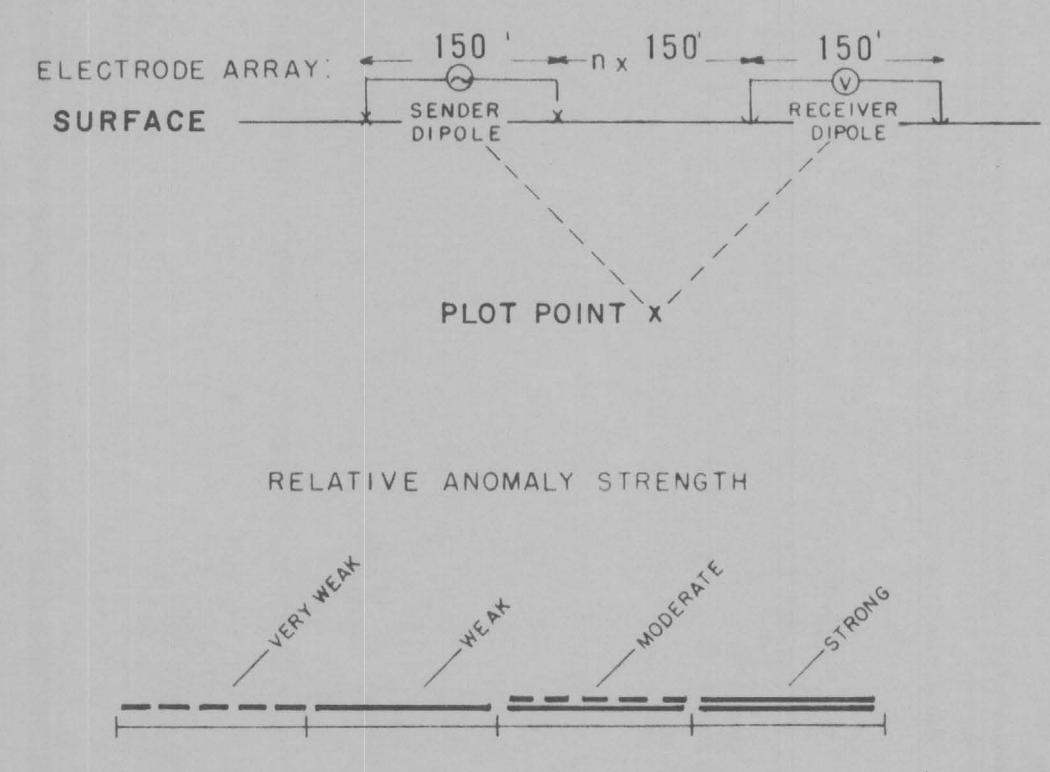

LOOKING SOUTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-13

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: SEP 1967

FOR

SEMINCO

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GEOEXPLORATION COMPANY
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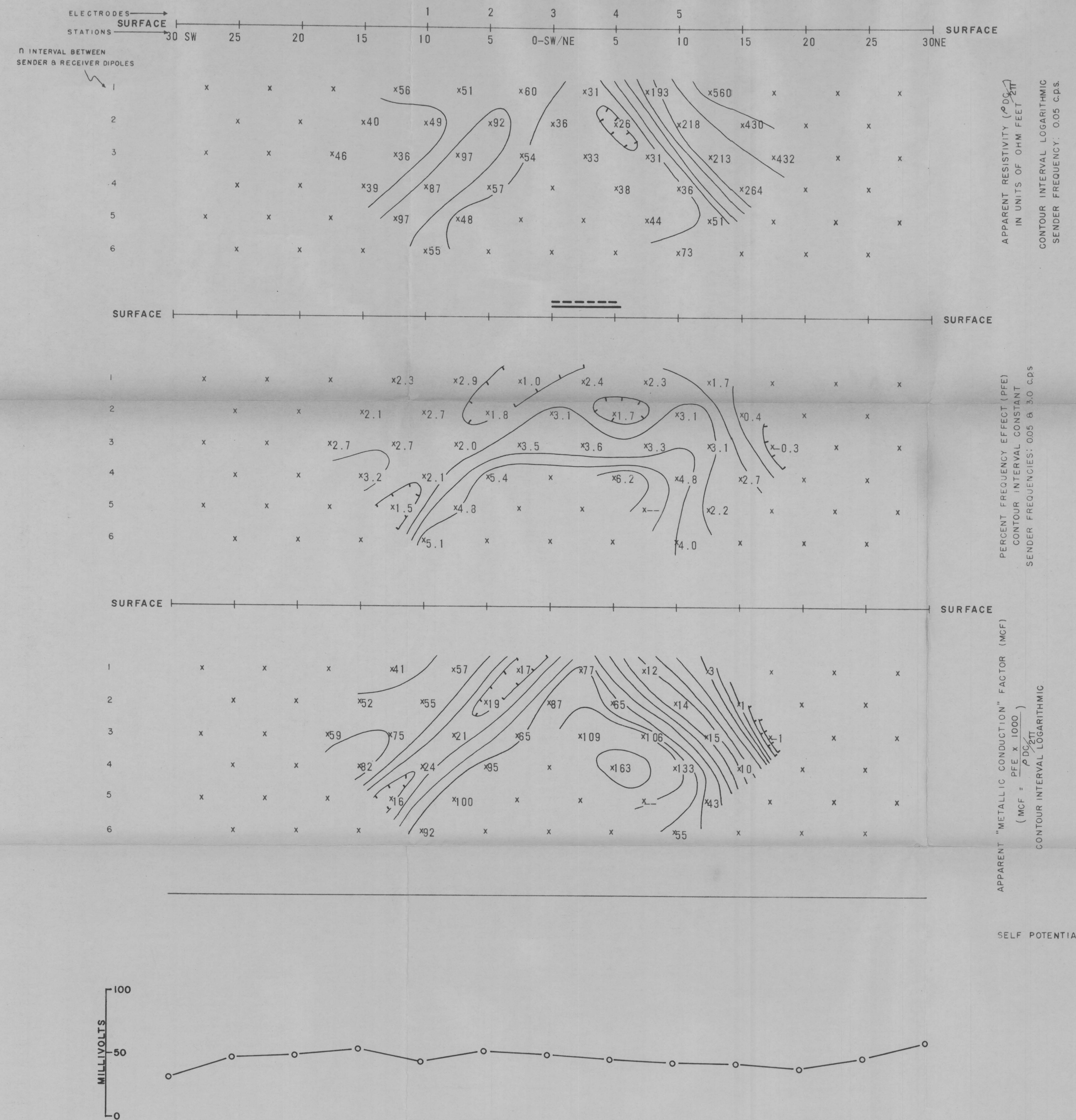

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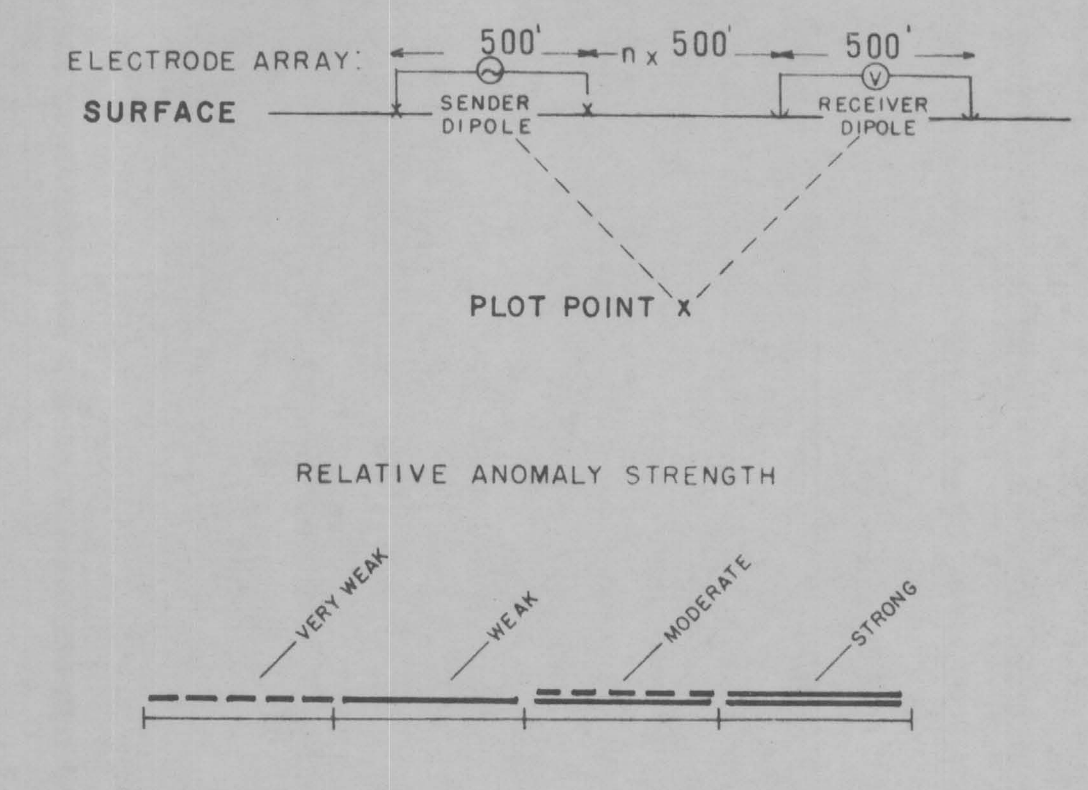


LOOKING NORTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-12

INDUCED POLARIZATION TRAVERSE

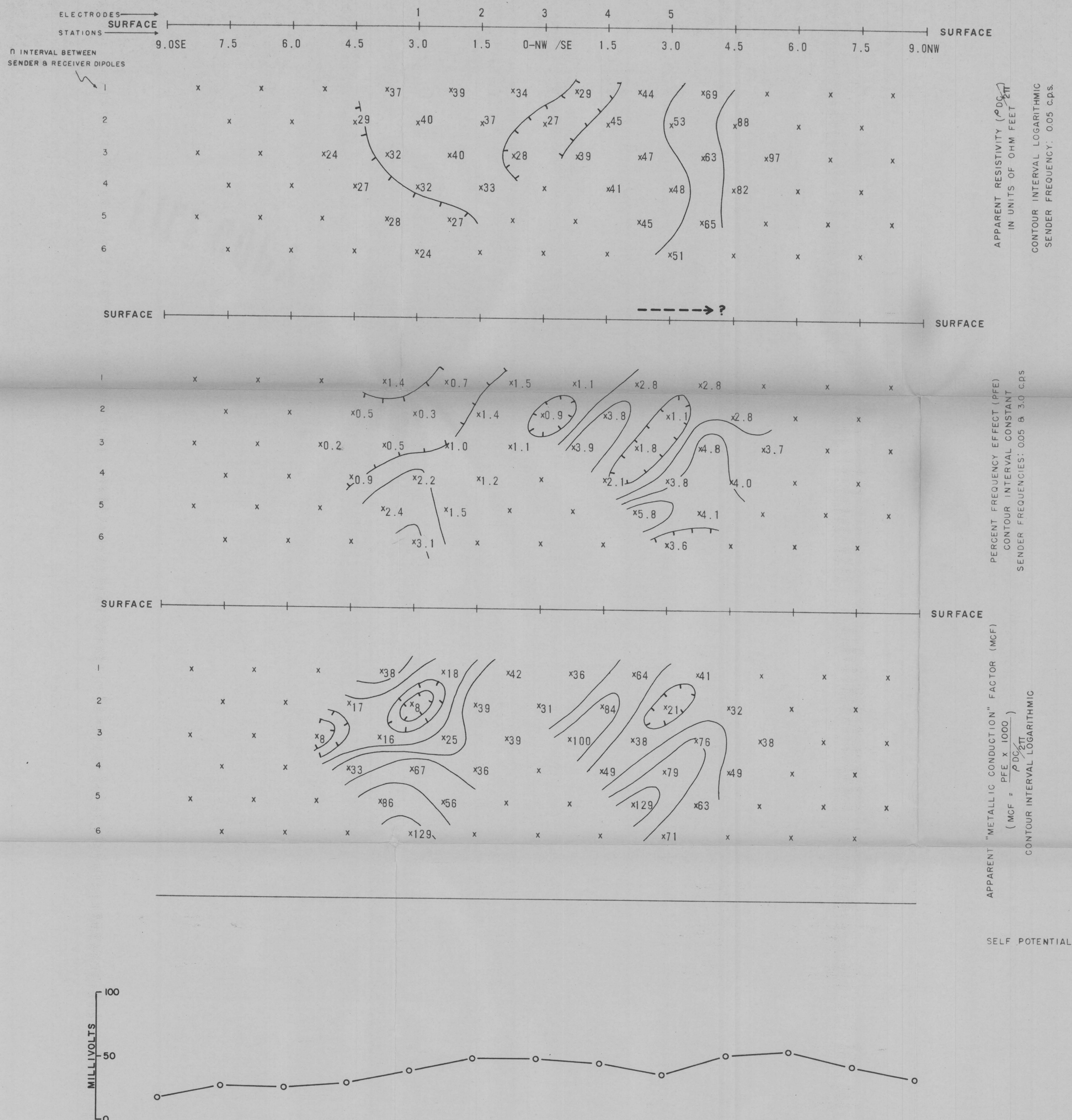
HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 500' DATE: SEP 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney
geophysical engineers



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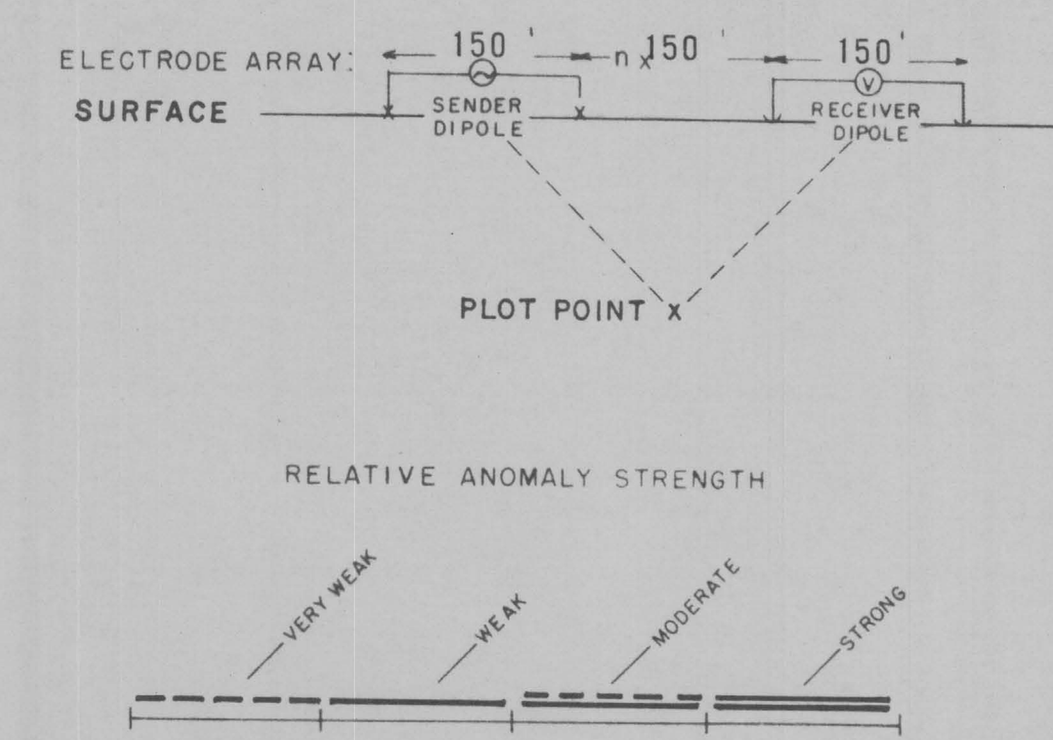

LOOKING SOUTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-11

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150'   DATE: SEP 1967

FOR

SEMINCO

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
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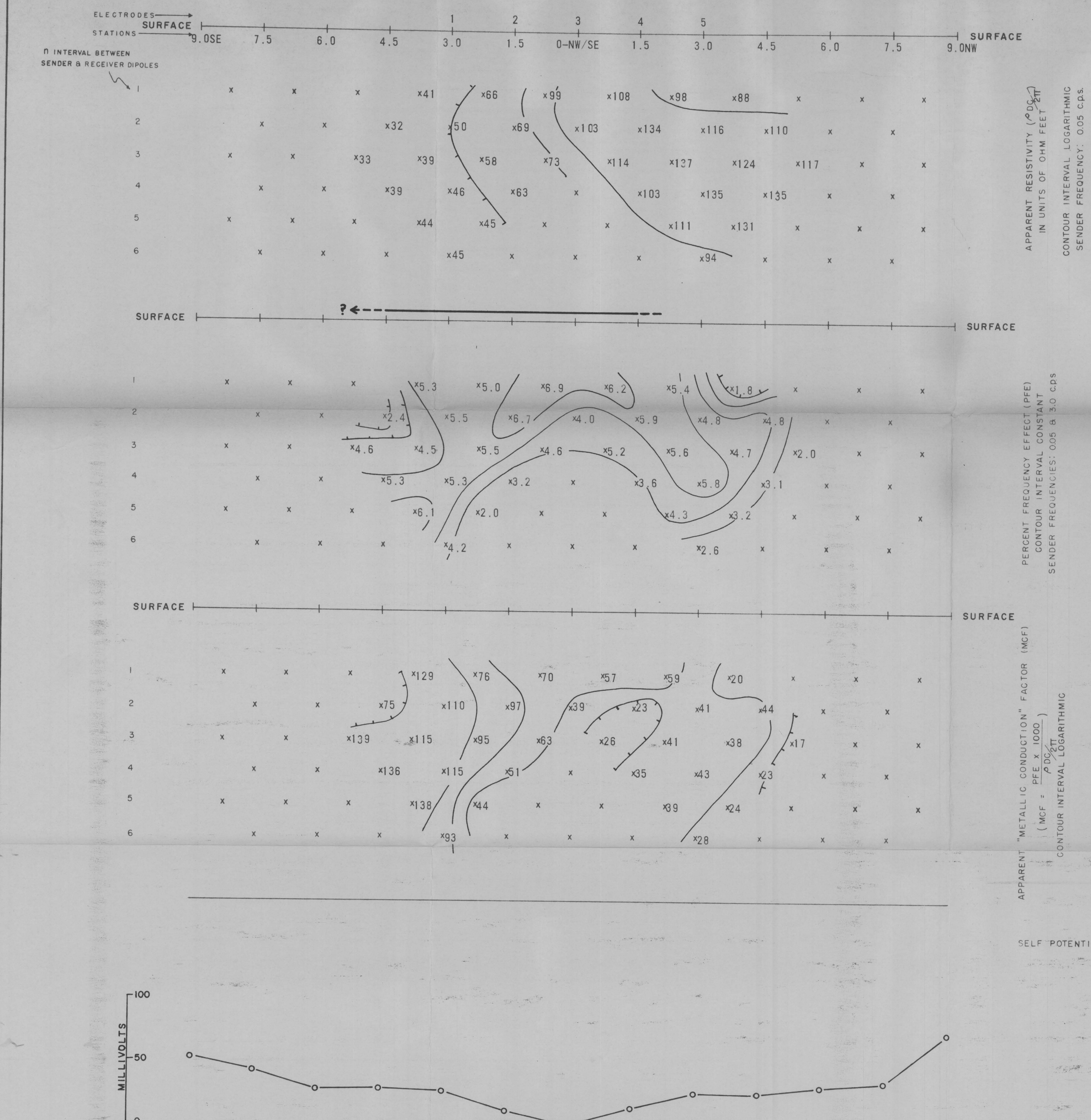
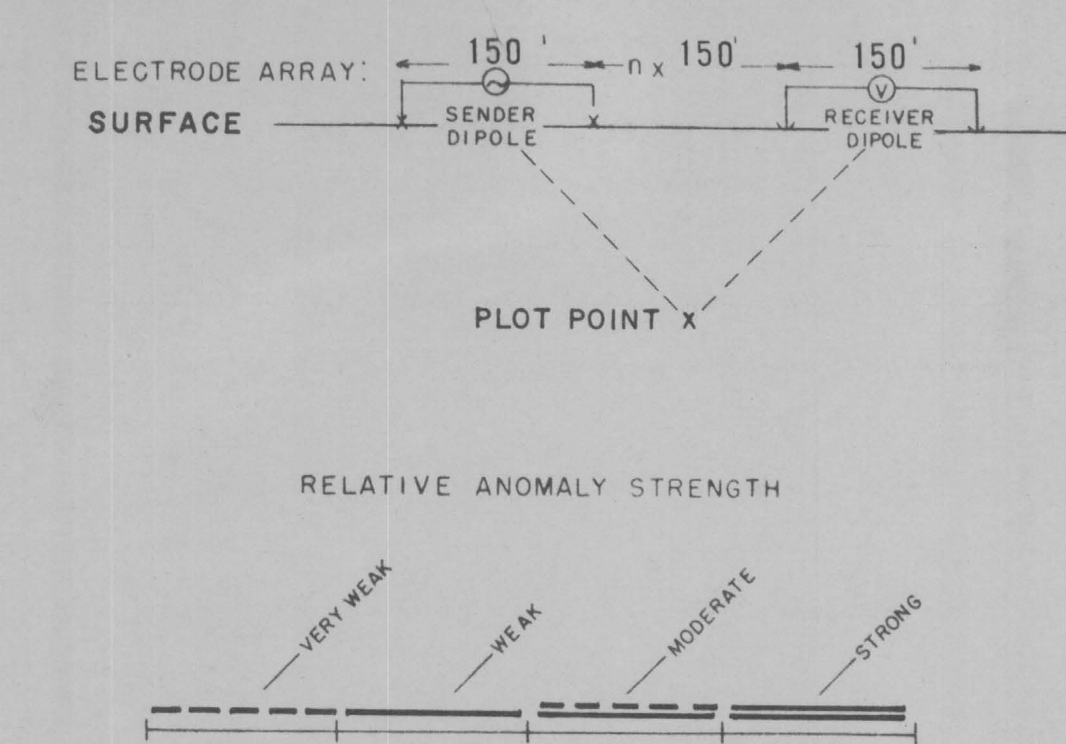
vancouver sydney
geophysical engineers



EXPLANATION



LOOKING SOUTHWESTERLY

GEOEX

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-10

INDUCED POLARIZATION TRAVERSE

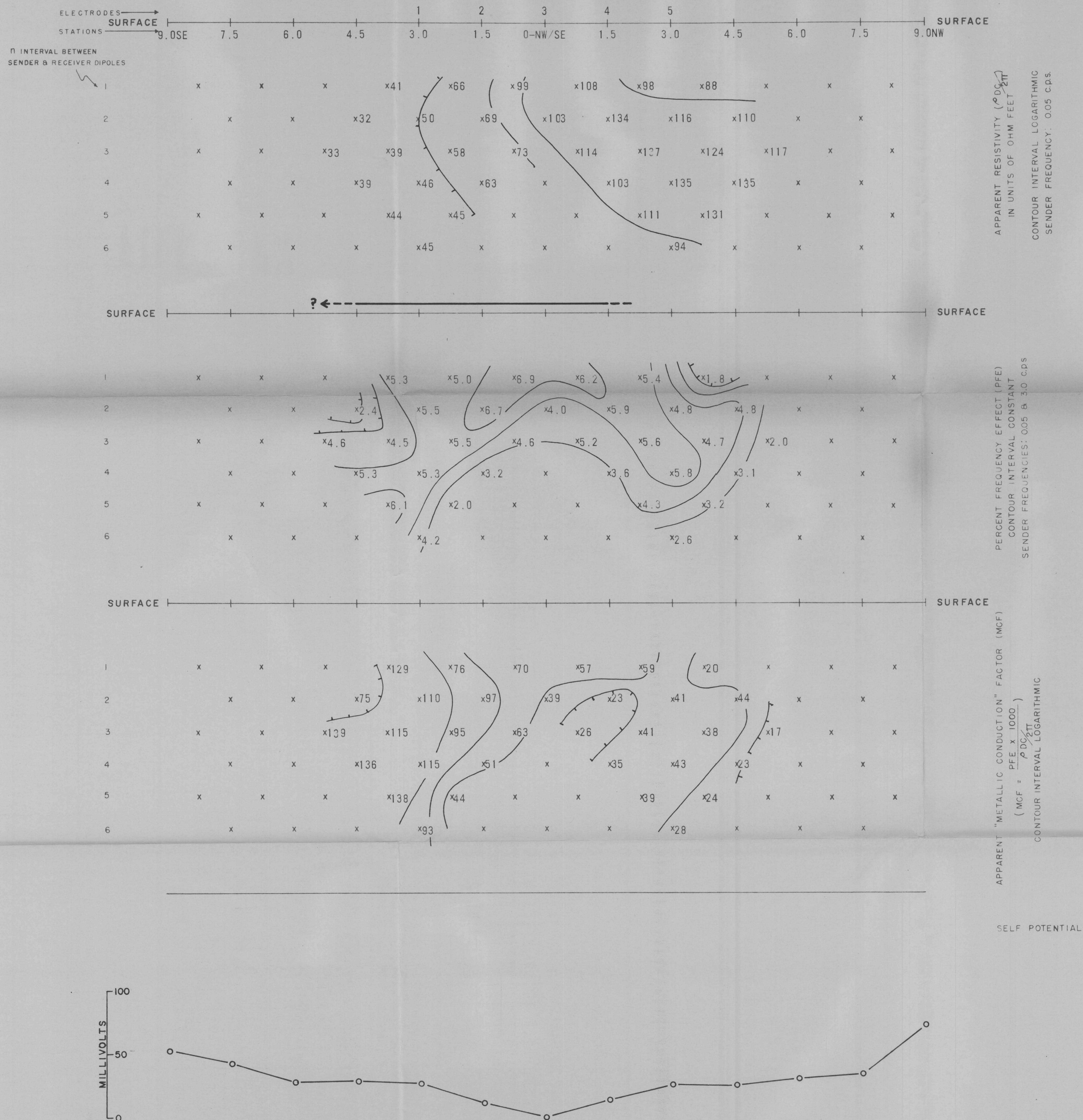
HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: SEP 1967

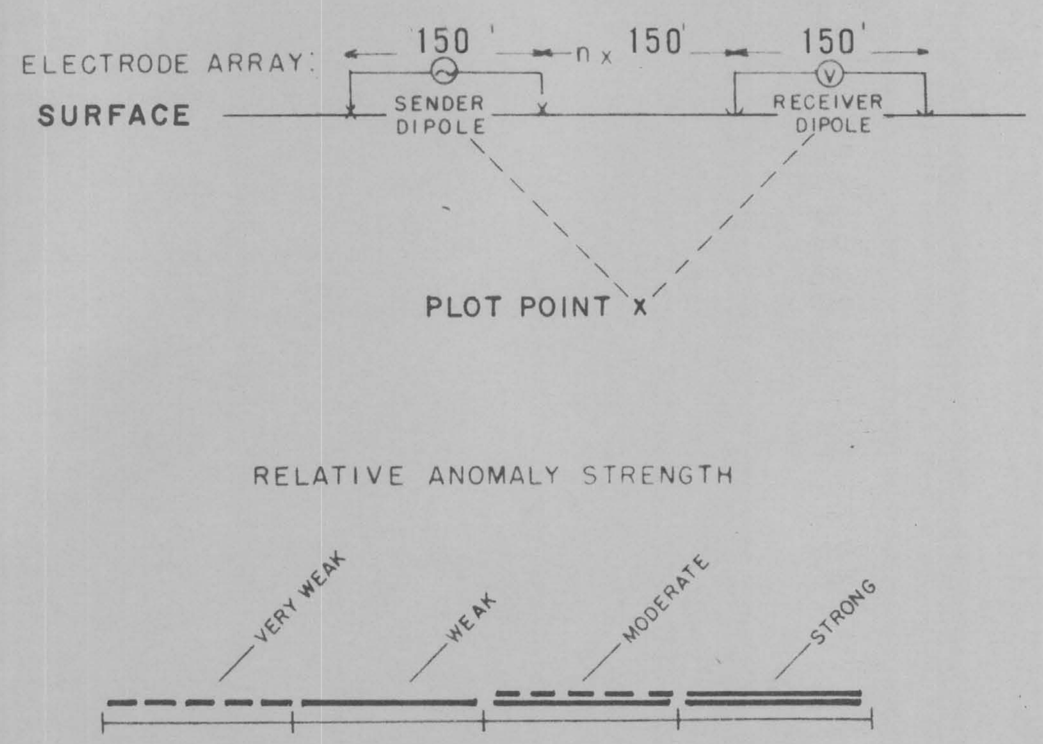
FOR

SEMINCO

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney



EXPLANATION



LOOKING SOUTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-10

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: SEP 1967

FOR

SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
vancouver
sydney
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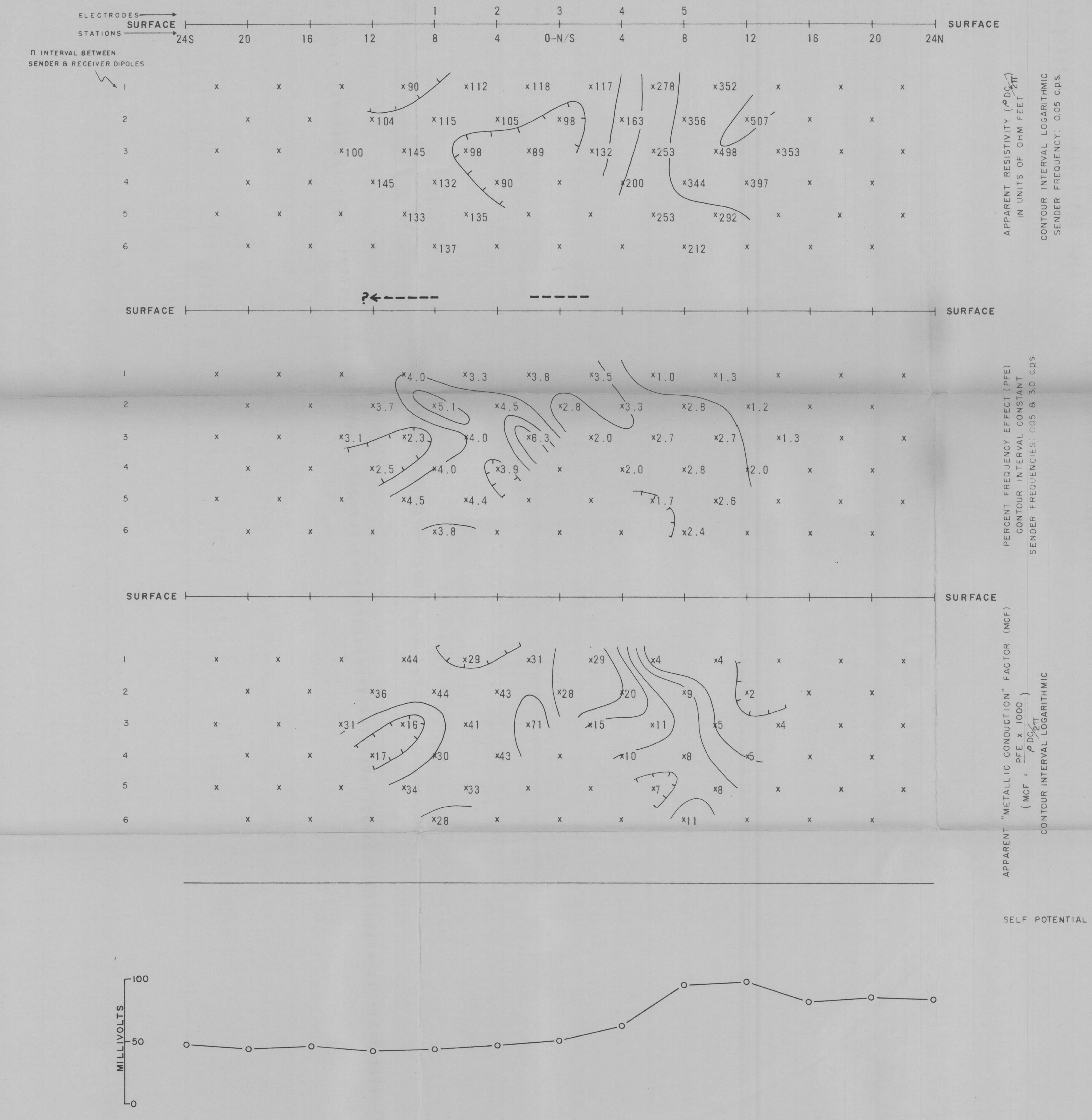
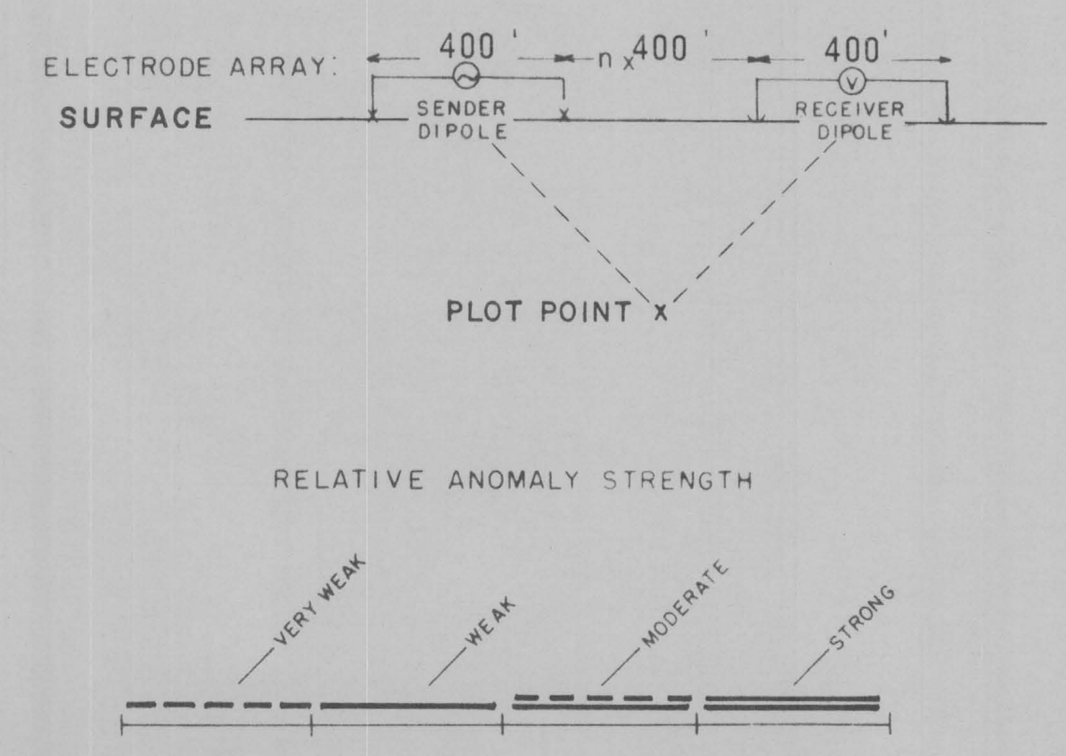


EXPLANATION



LOOKING S 70° W

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-9

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 400' DATE: AUG 1967

FOR

SEMINCO

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
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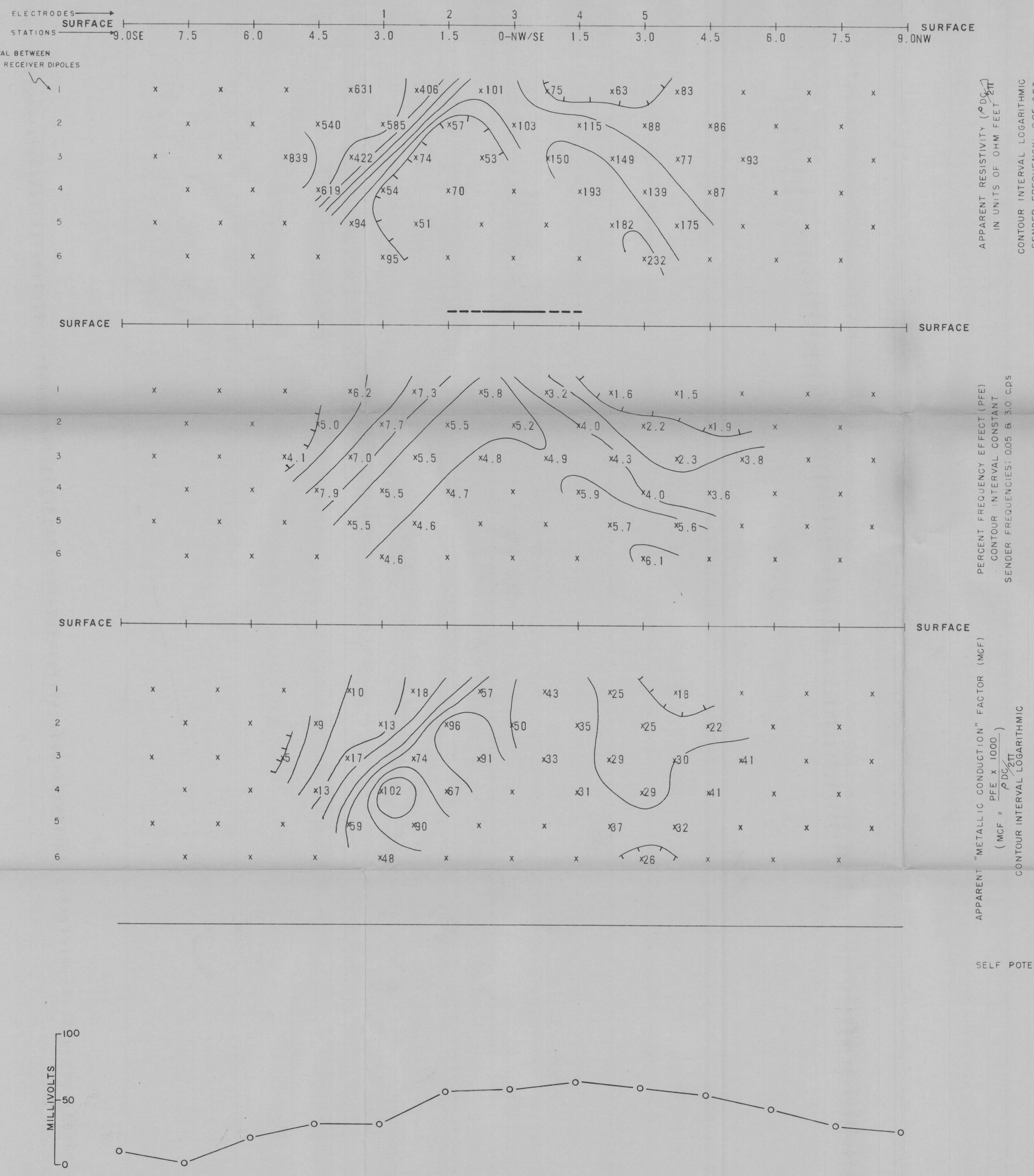
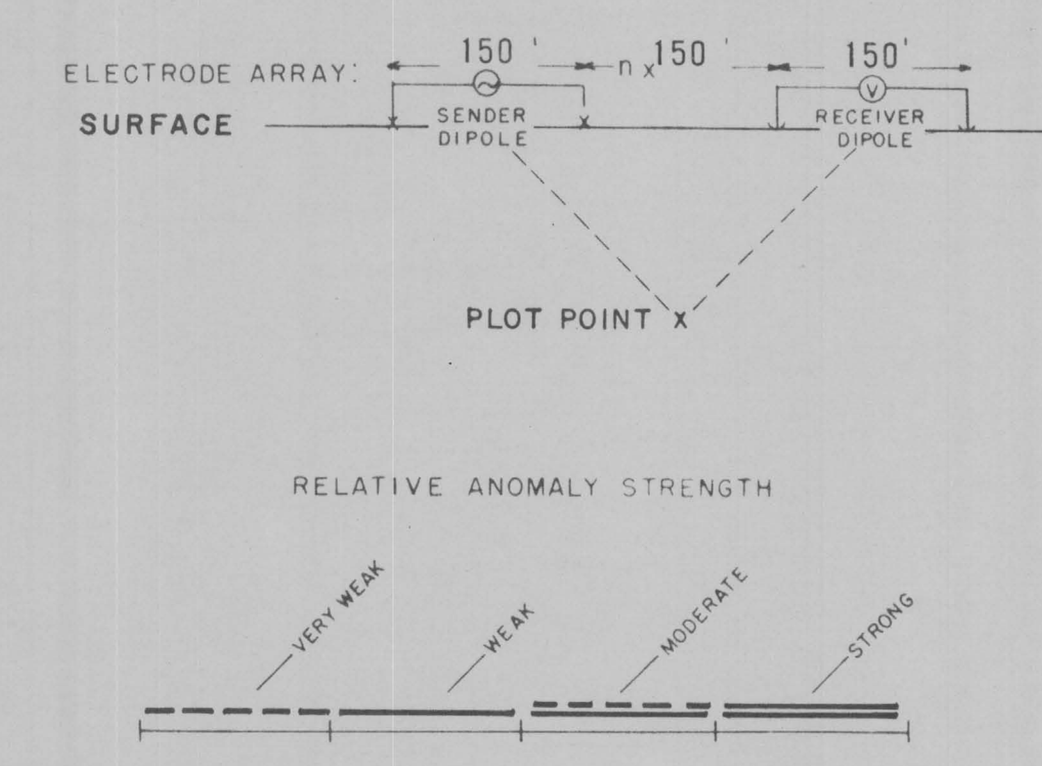


EXPLANATION



LOOKING SOUTHWESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-8

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: AUG 1967

FOR

SEMINCO

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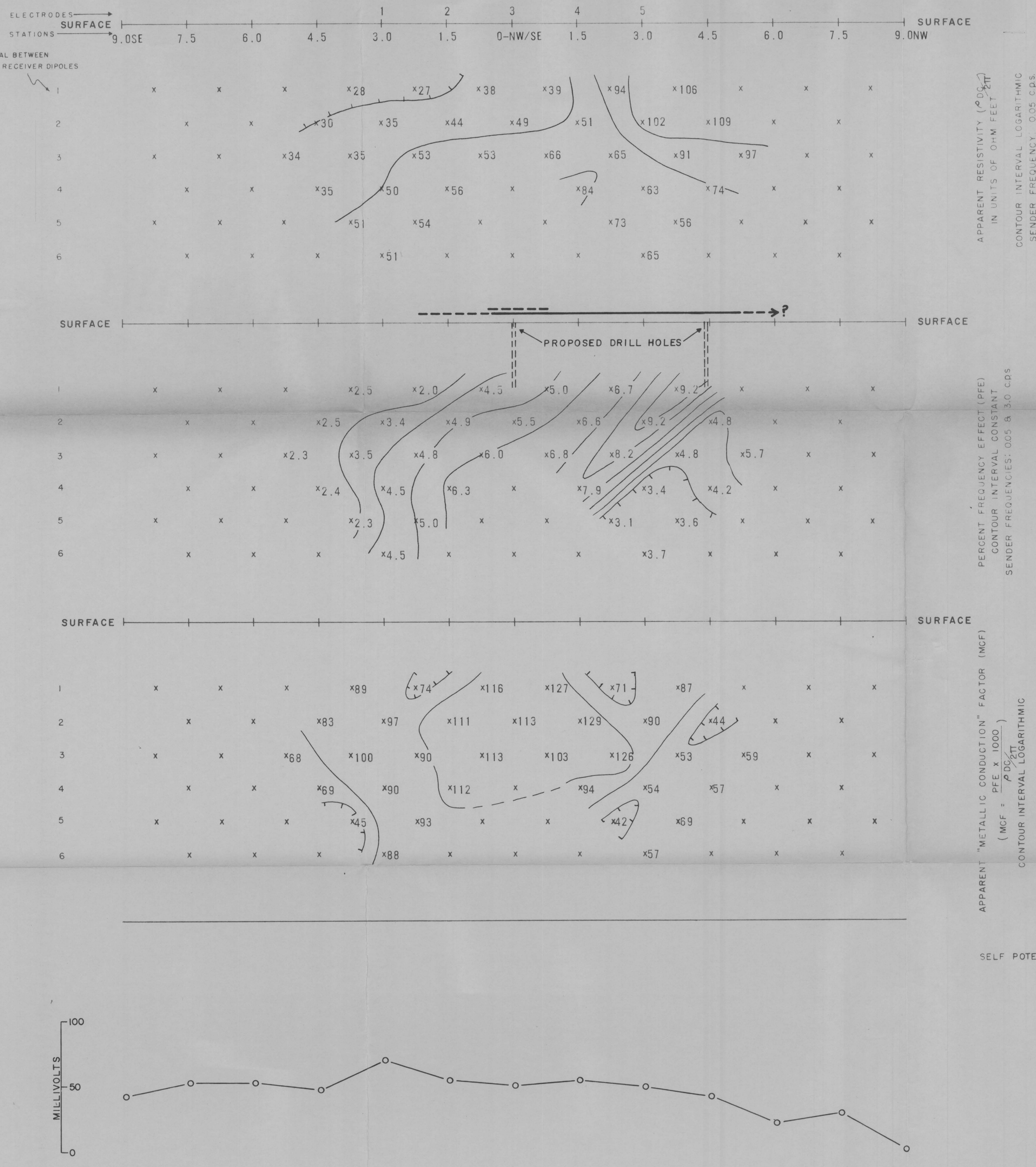
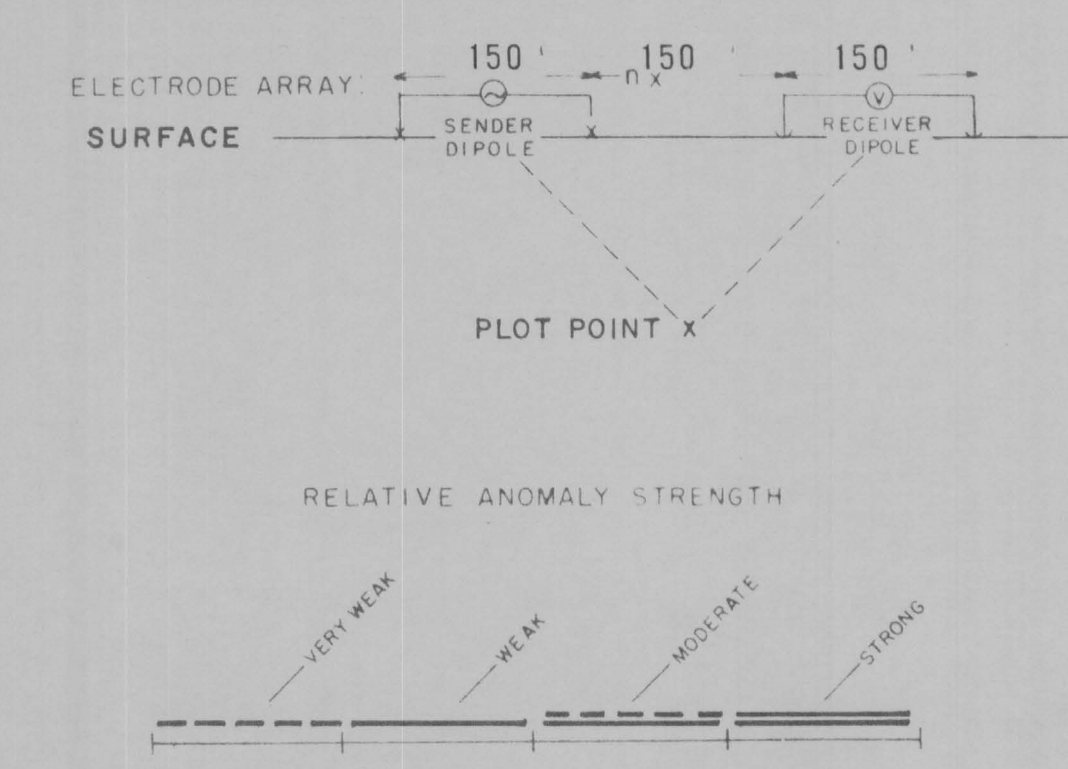
vancouver
sydney
geophysical engineers



EXPLANATION



LOOKING S-WESTERLY

FILE COPY

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2-7

INDUCED POLARIZATION TRAVERSE

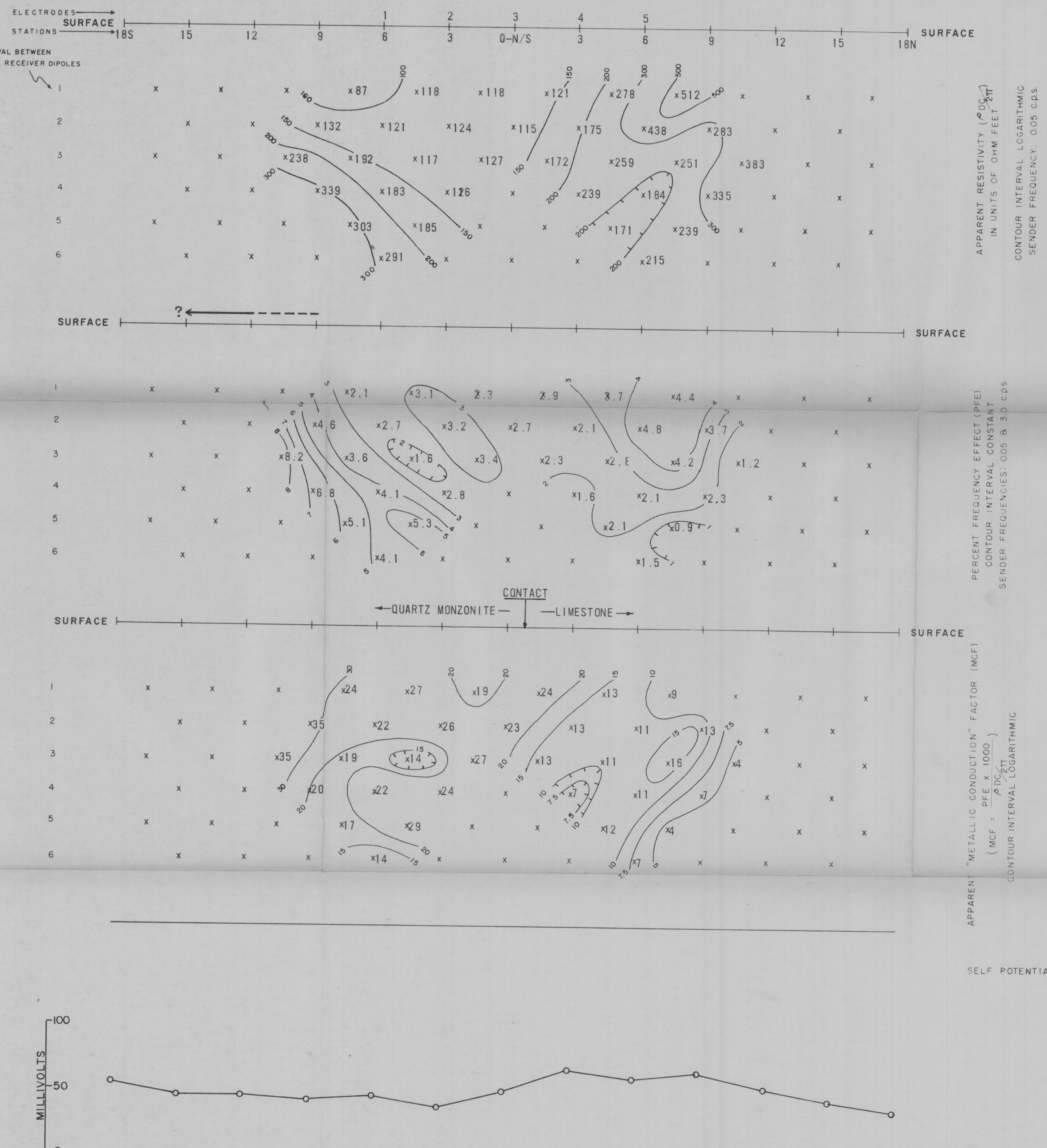
HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 150' DATE: AUG 1967

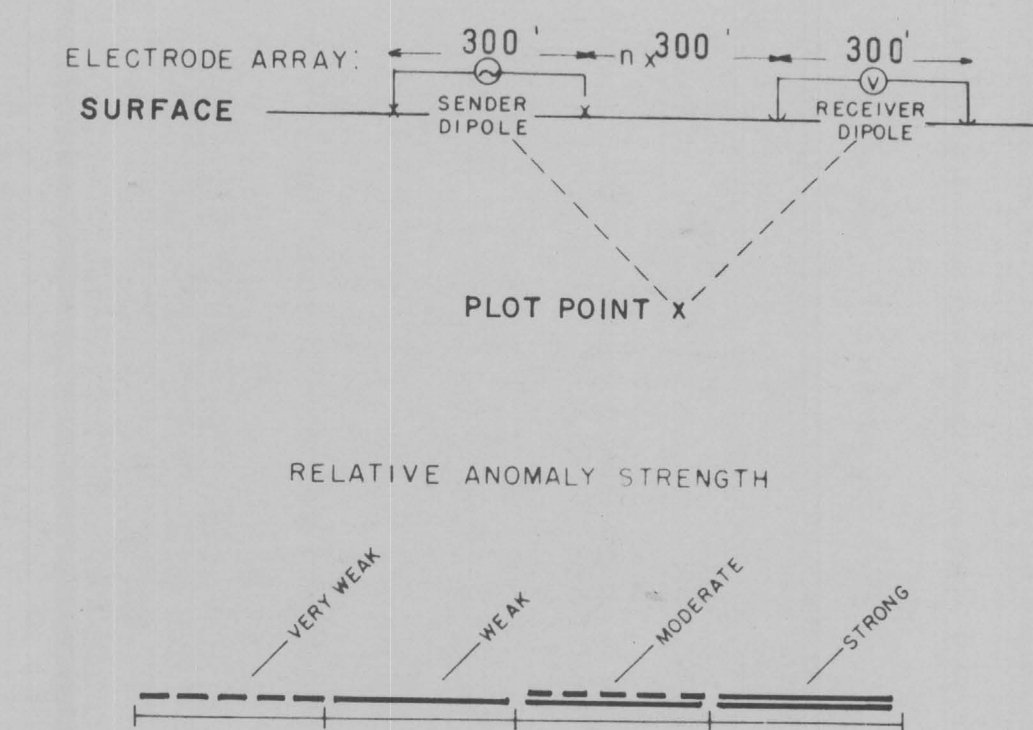
FOR

SEMINCO

HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney



EXPLANATION



LOOKING S 69° W

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 1

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 300' DATE: JUNE 1967

FOR

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vancouver
sydney
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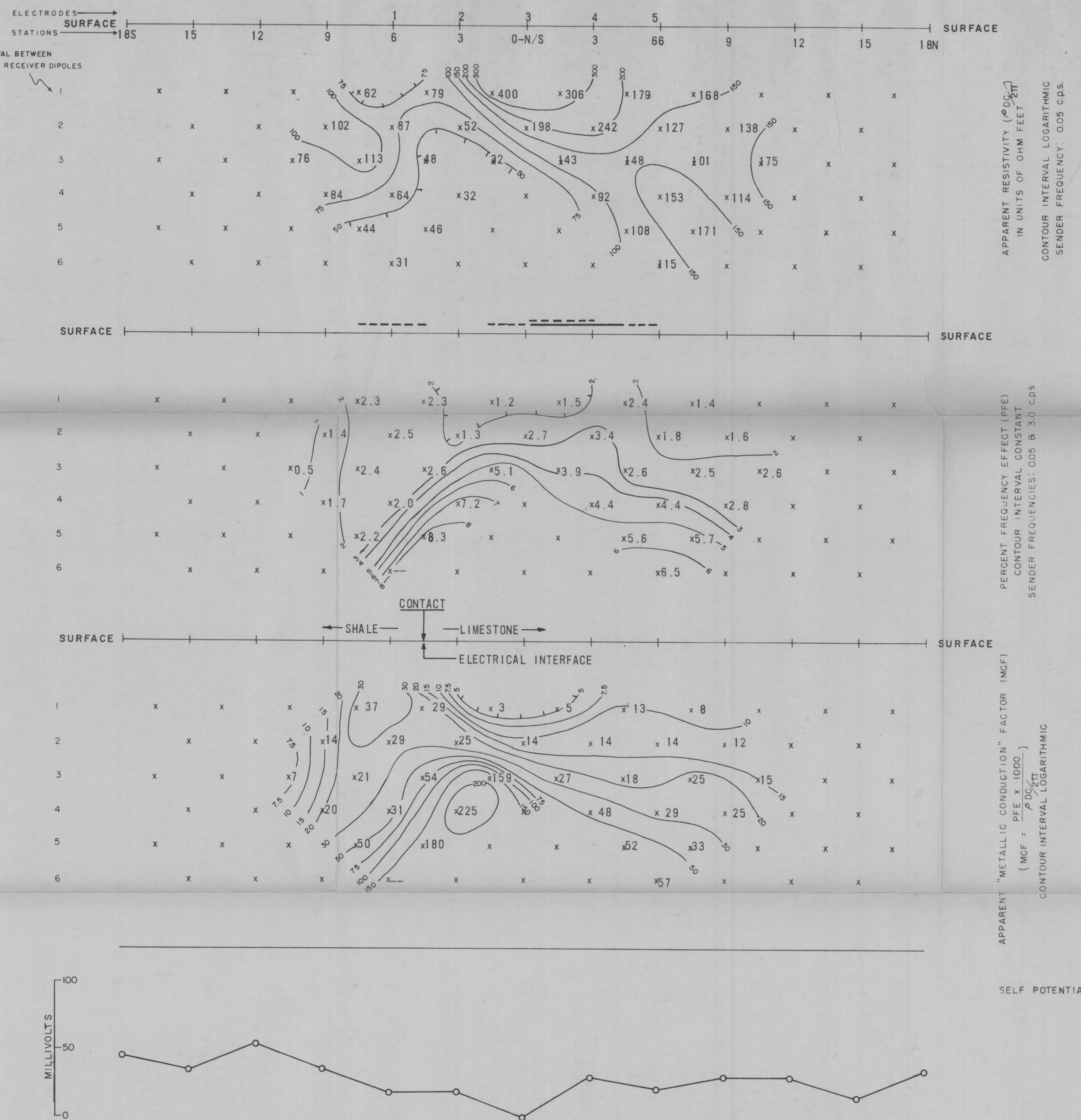
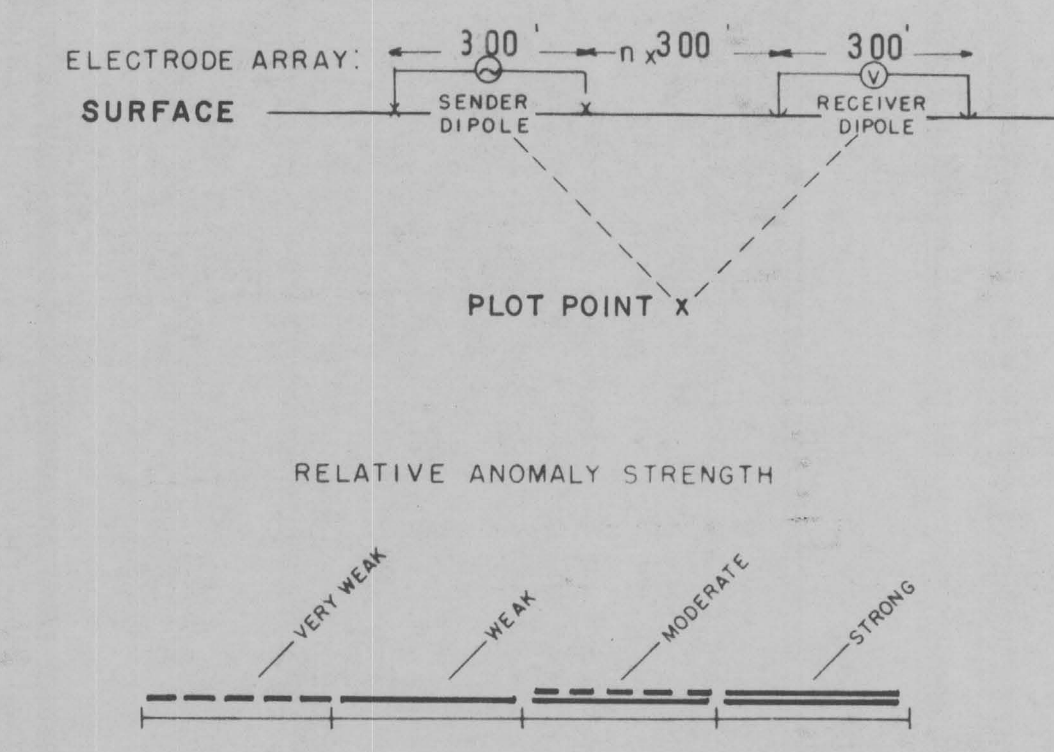


EXPLANATION



LOOKING S 81° W

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 2

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 300' DATE: JUNE 1967

FOR SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
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Phone: 602/623-0578 Cable: GEOEX, Tucson
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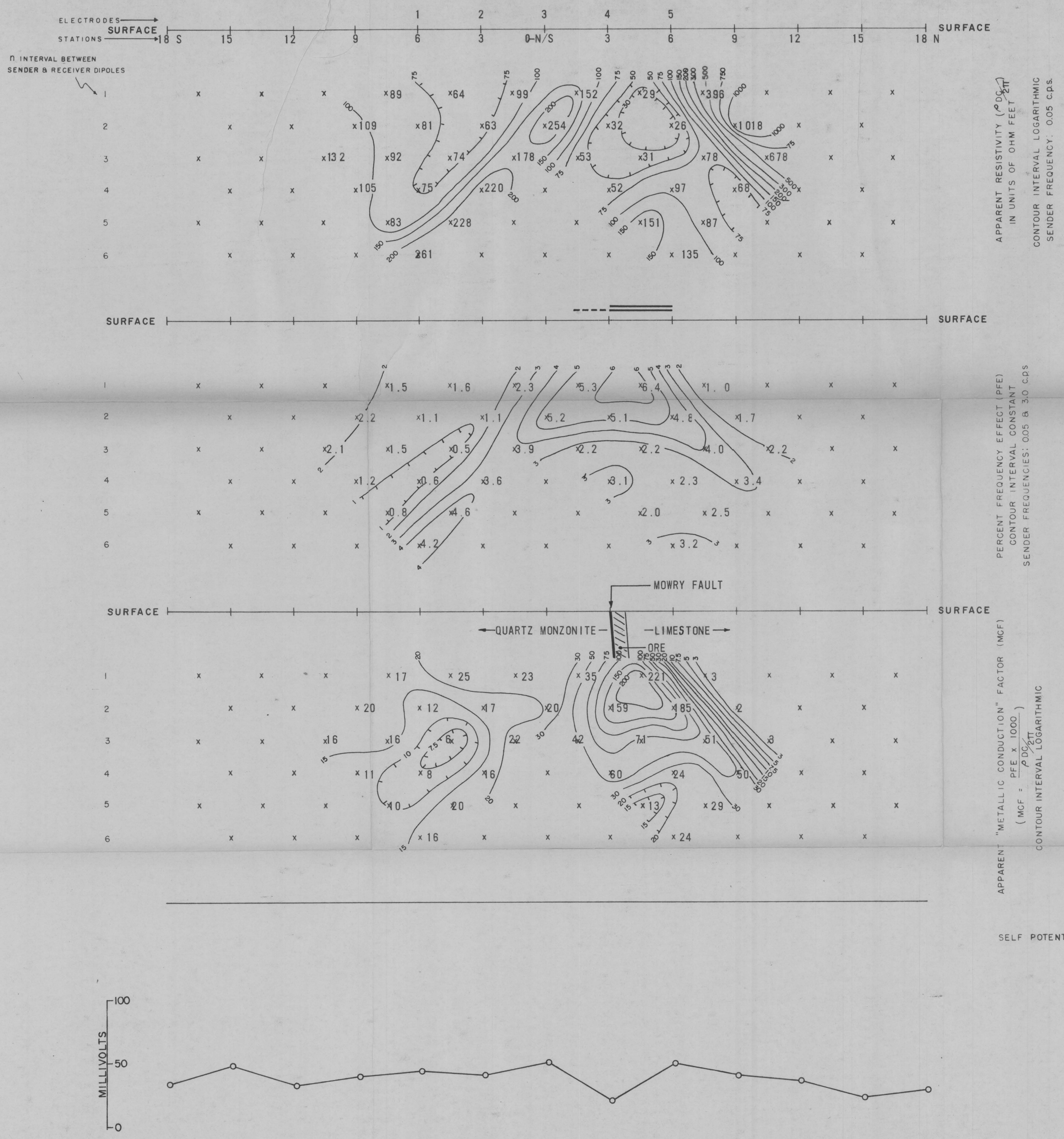
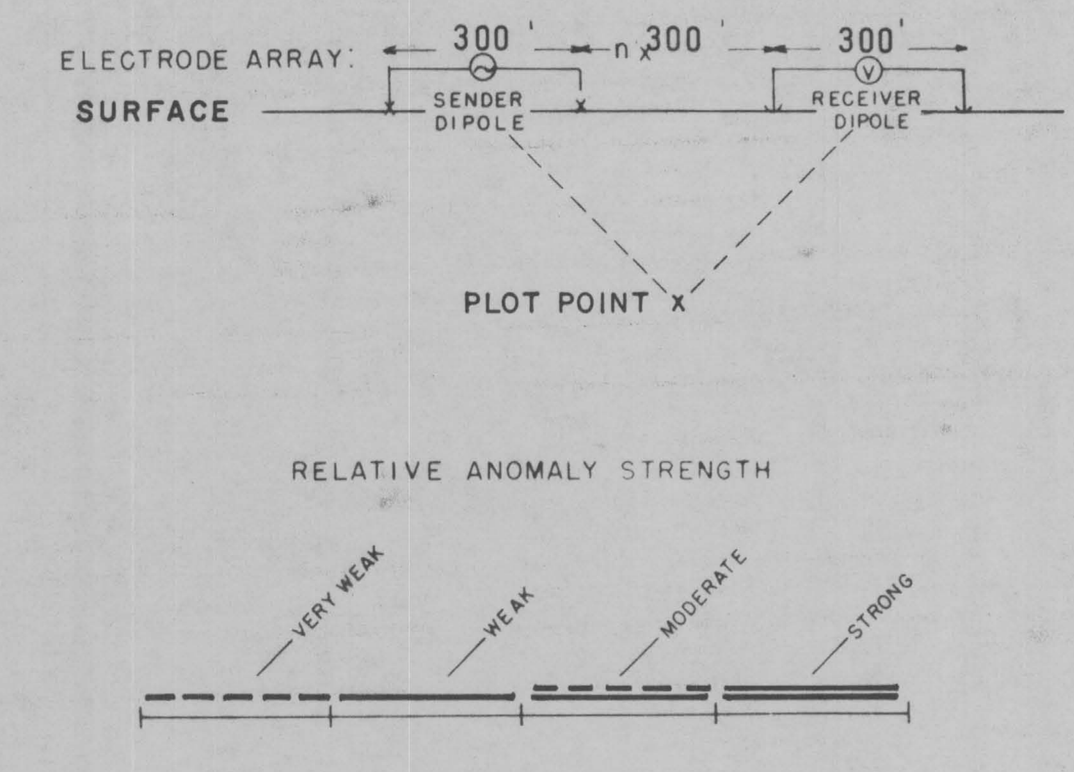


EXPLANATION



LOOKING S 81° W

MOWRY AREA

SECTIONAL DATA SHEET

LINE NO. 3

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 300' DATE: JUNE 1967

FOR

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GEOEXPLORATION COMPANY
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vancouver
sydney
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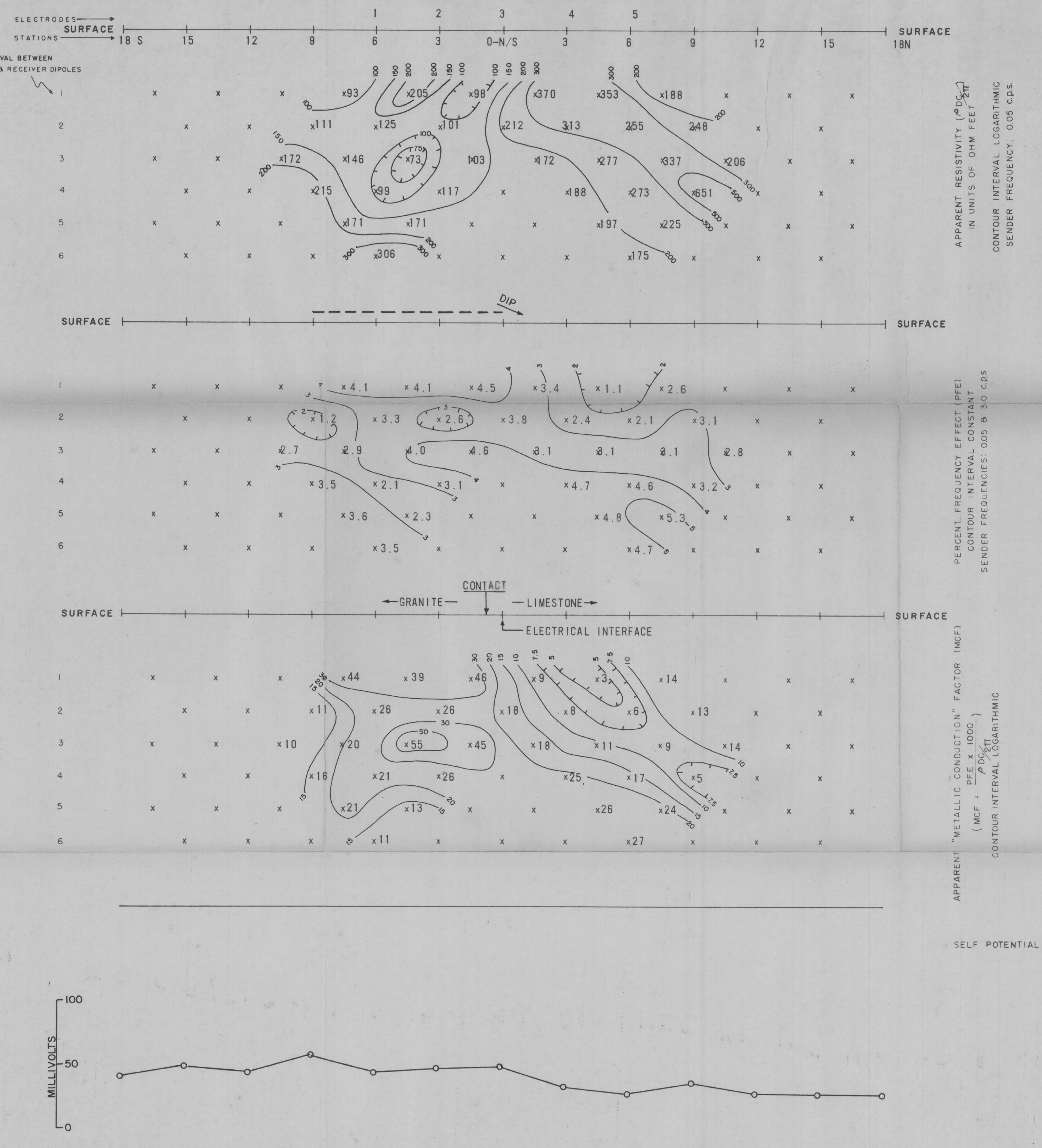
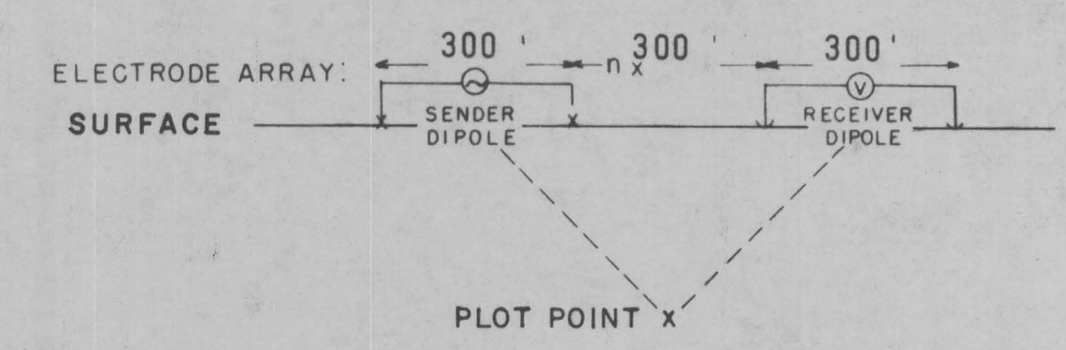
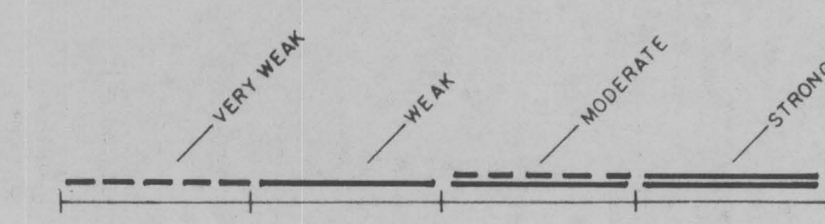


EXPLANATION



RELATIVE ANOMALY STRENGTH



LOOKING S 67° W

ROYAL AREA

SECTIONAL DATA SHEET
LINE NO. 4
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 300'   DATE: JUNE 1967

FOR
SEMINCO

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578   Cable: GEOEX, Tucson
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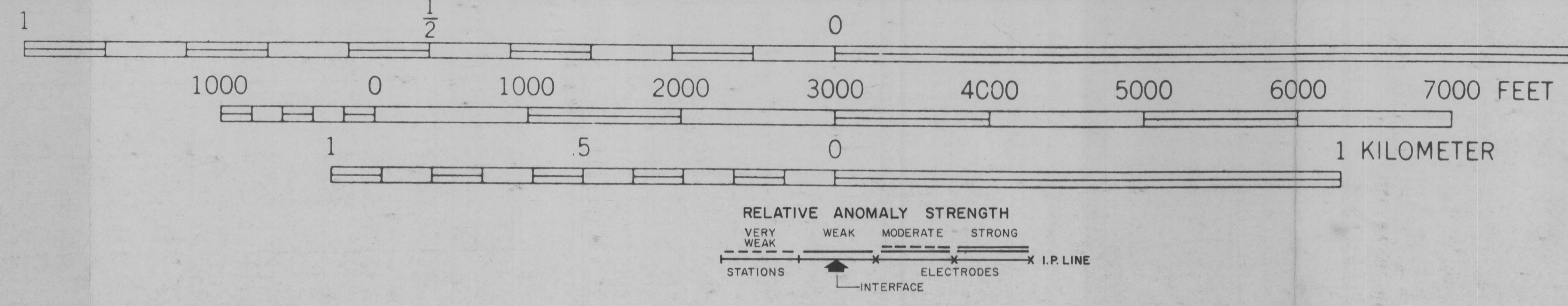

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INDUCED POLARIZATION LOCATION
AND INTERPRETATION PLAN
MOWRY AREA
SANTA CRUZ COUNTY, ARIZONA

FOR

SEMINCO

SCALE 1" = 500' | DRAWN BY J. C. D. | DATE JUNE 1967