CONTACT INFORMATION
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Arizona Geological Survey
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Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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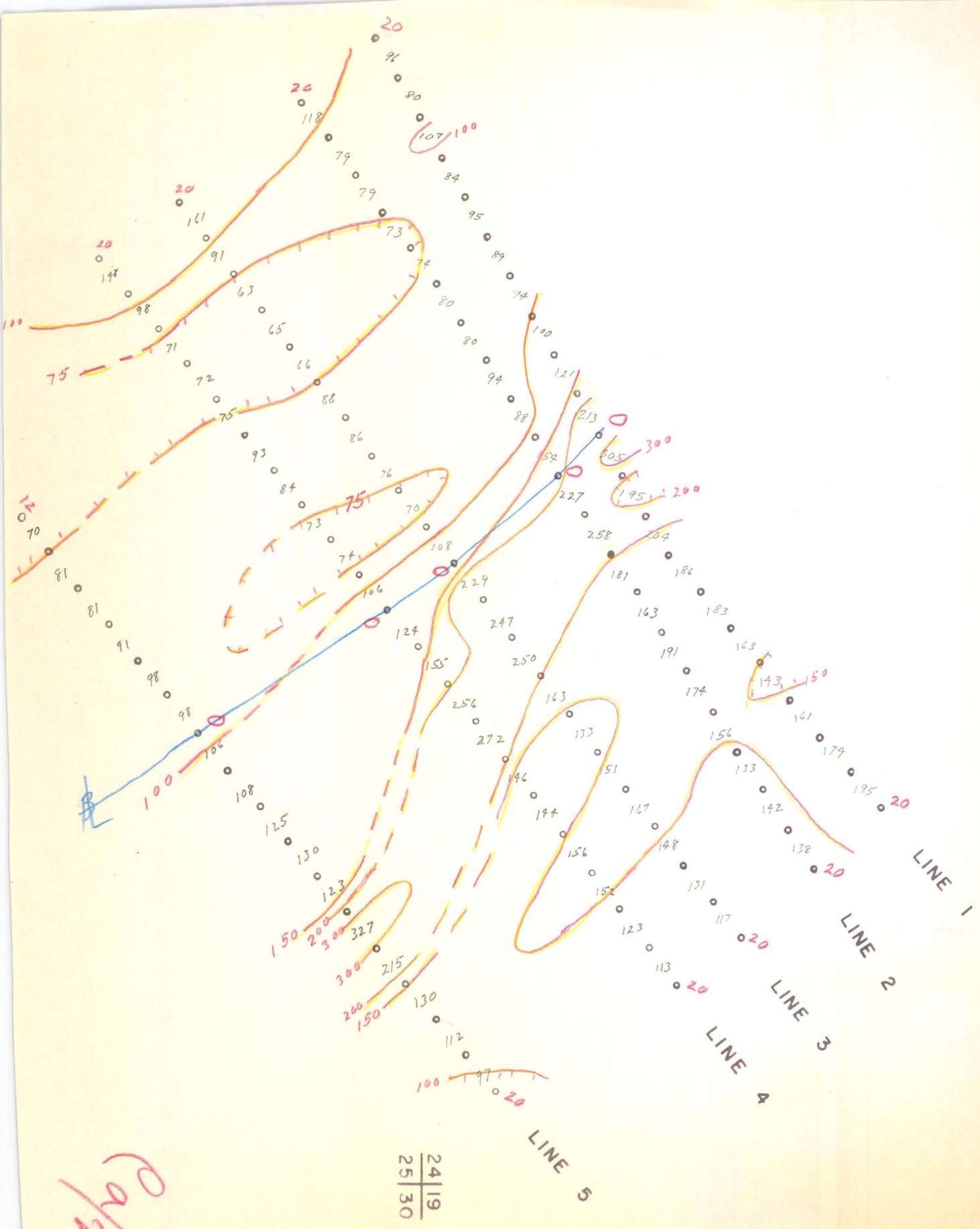
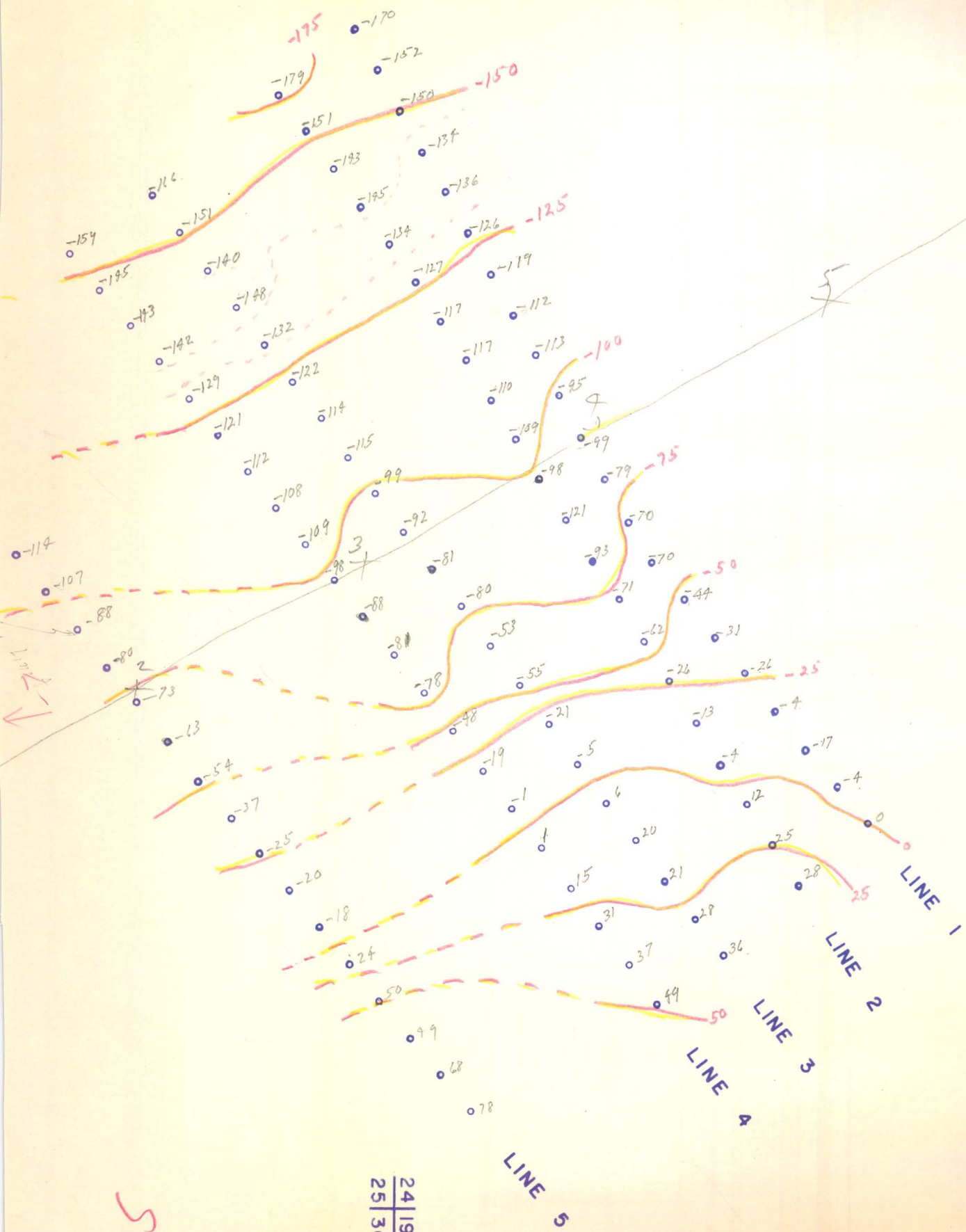


9/27


LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
-175
-150
-125
-100
-75
-50
-25
0
25
50
24 | 19
25 | 30

58

April 30, 1969

Dragoon Report for Heinrichs Geoexploration Company

On the surface, the geologic formations strike west-northwest and dip steeply to the northeast. Drill hole information leads us to believe that the beds dip from 60°-80° to the northeast and possibly are overturned locally.

Included in this report are:

- Claim locations
- Aeromagnetic data
- Ground magnetic date
- Drill hole locations
- Generalized drill hole logs

HEINRICHS GEOEX
GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

REC'D MAY 2 1969

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

Hole# 14 Alpha # 4

0-219	alluvium
219-604	quartzite
604	end of hole

No sulphides

Hole # 15 Alpha # 4

0-180	alluvium
180-190	quartzite
190-270	alternating garneties and tactites
270-340	tactite
340-420	garnetite
420	end of hole

Fault gouge at 199

No Sulphides

Hole # 22 Alpha # 4

0-170	alluvium
170-290	garnetite
290-390	quartzite
390-610	garnetite
610-775	brecciated garnetite
775	end of hole

Fault gouge at 290, 530, 570, 645, 730

No Sulphides

Hole # 24 Alpha # 4

0-170	alluvium
170-230	quartzite
230-270	tactite
270-370	quartzite
370	end of hole

Fault gouge at 250, 260, 270, 335
No Sulphides

Hole # 6 Alpha # 5

0-210	alluvium
210-770	quartzite
770-821	granite
821	end of hole

Minor sulphides in quartz veins at 315-320, 505, 511-513, 686, 696

Hole 13 Alpha # 5

0-160	alluvium
160-333	quartzite
333	end of hole

No sulphides

Hole # 16 Alpha # 5

0-220	alluvium
220-290	tactite breccia
290	end of hole

No Sulphides

Hole 17 Alpha # 5

0-205	alluvium
205-335	alternating beds of garnetite, tactite, and quartzite
335-370	tactite
370-490	alternating beds of garnetite, tactite, and quartzite
490	end of hole

No Sulphides

Hole 20 Alpha #5

0-228 alluvium
228-690 garnetite
690-890 garnetite breccia
890-900 quartzite
900-1015 granite

Fault gouge at 355, 430, 450, 805, 890

No Sulphides

Hole # 21 Alpha # 5

0-175 alluvium
175-515 quartzite
515-705 granite

Trace sulphides at 381-386

Hole # 23 Alpha # 5

0-180 alluvium
180- 300 quartzite
300-330 tactite
330-430 garnetite
430-930 alternating garnetite, limestone, and quartzite
930-1630 limestone breccia, fragments of limestone, quartzite, and shales
1630-1740 quartzite
1740-1750 granite
1750 end of hole

Sulphides at 874, 882-883, 893 to end of hole. Higher concentrations of sulphides

at 958 -966,
1001-1010, 1024-1026, 1052-1054, 1085-1088
1224-1226
1348-1358, 1366-1368
1483-1568, 1571-1574
1601-1607, 1614-1616

Hole 25 Southeast of Hole 23. Hole 25 still in progress

0-170 alluvium
170-196 garneite
196-575 quartzite
575-632 tactite
632 ---1450 limestone breccia. Top portion more garnetite, lower portions more quartzitic.

Native coppor at approximately 1300 until at least 1450, found sporatically
Sulphides at approximately 1200 to at least 1450.
Core is not logged

Hole 18

0-343 alluvium
343-450 limestone breccia
450 end of hole
No sulphides

Hole 12 Alpha # 3

0-1110 limestone
1110-1174 quartzite
1174-1236 granite
1236 end of hole

Sulphides at 955-1005, 1127-1174

Hole # 19

0-245 alluvium
245-400 Chloritic Schist
No Sulphides

Hole 1 Alpha #31

0-163 limestone

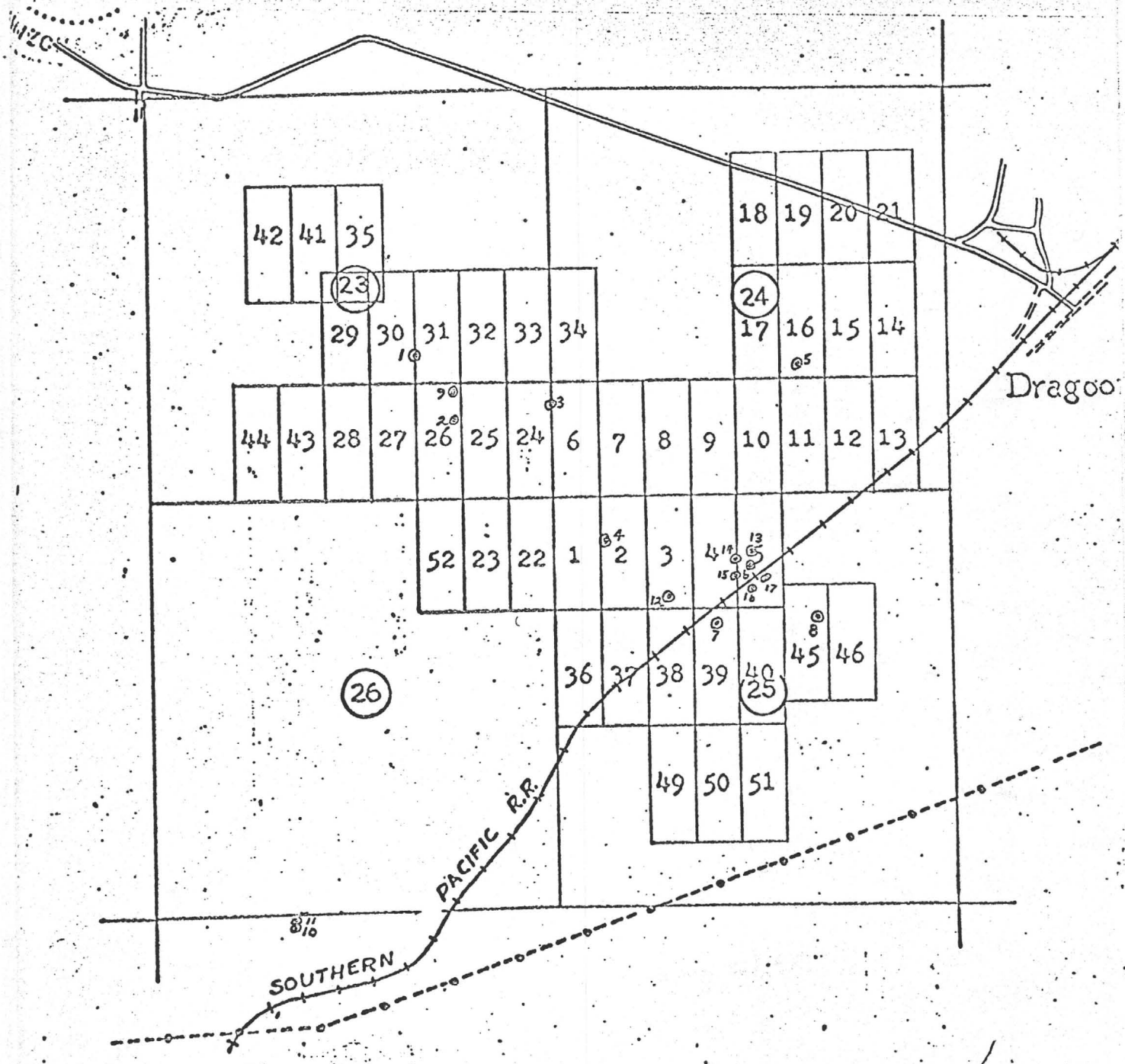
No Sulphides

Hole 3 Alpha 6

0-94 alluvium
94-164 limestone

No sulphides

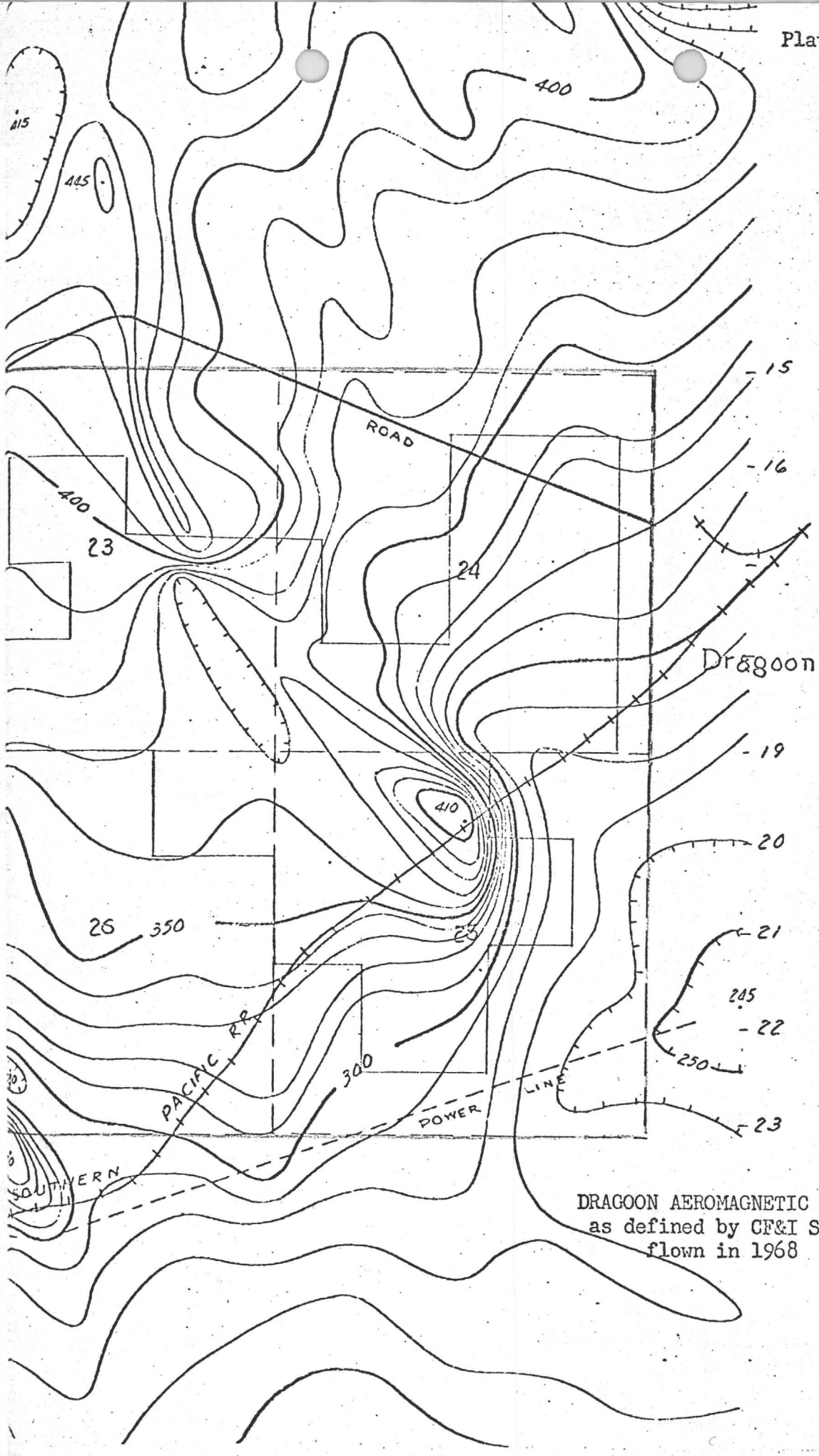
Joe Kantor



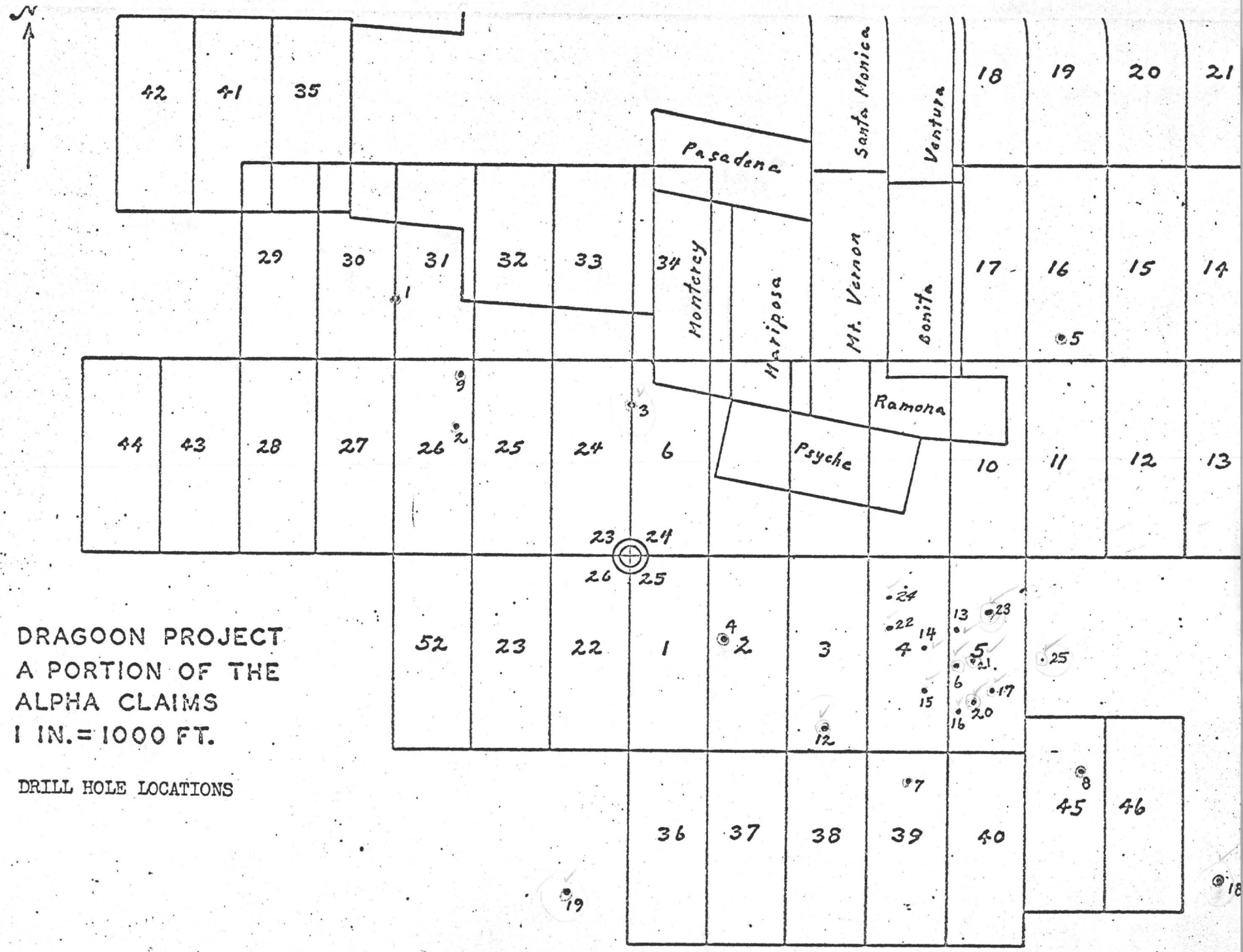
CF&I STEEL CORPORATION
ALPHA LODE CLAIMS
Cochise Mining District
Cochise County, Arizona
Sections 23,24,25&26
T16S, R22E

Date: February 5, 1968
Scale: 1" = 2000'

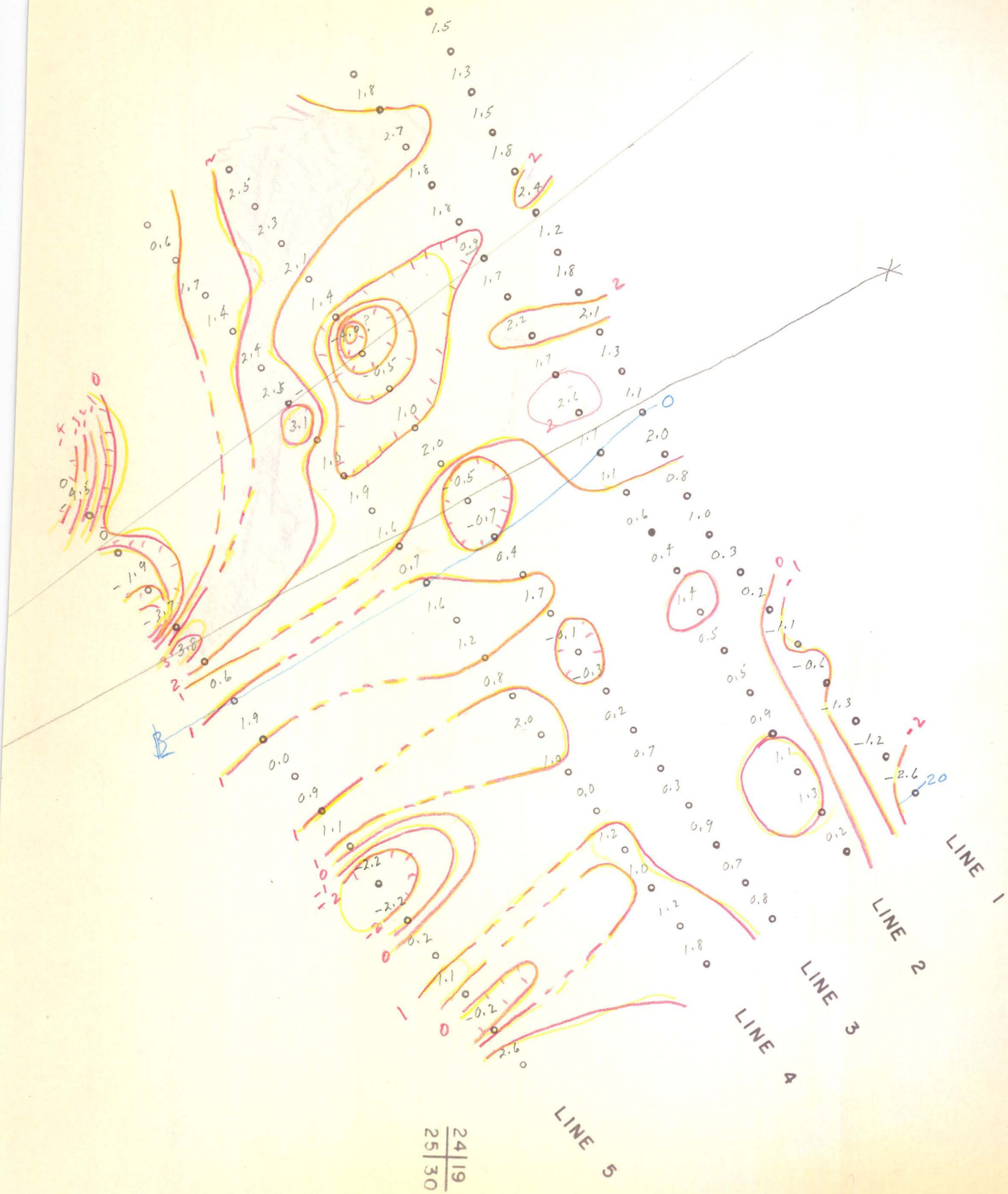
Plate V



DRAGOON AEROMAGNETIC ANOMALY
as defined by CF&I Survey
flown in 1968


N
42
41
35
29
30
31
32
33
34
Pasadena
Santa Monica
Ventura
18
19
20
21
Monterey
Mariposa
Mt. Vernon
Bonita
17
16
15
14
44
43
28
27
26
25
24
6
Psyche
Ramona
10
11
12
13
23
24
26
25
52
23
22
1
2
3
4
5
36
37
38
39
40
45
46
DRAGOON PROJECT
A PORTION OF THE
ALPHA CLAIMS
1 IN.= 1000 FT.
DRILL HOLE LOCATIONS

LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
24 | 19
25 | 30
MCF



PFE

Ab 376-69

NE	Line 1	Line 2	Line 3	Line 4
20	0	28.3 → 28.3 +	36.3	NE 49.0
18	-3.6	24.6	27.6	37.3
16	-16.8	11.6	20.8	30.7
14	-3.8	-3.9	20.2	+15.0
12	-26.3	-13.4	+5.9	+0.5
10	-30.9	-25.5	-4.5	-0.7
8	-43.5	-61.7	-20.8	-19.2
6	-69.5	-70.5	-55.0	-47.7
4	-70.3	-95.3	-53.3	-77.9
2	-79.6	-121	-79.5	-80.8
0	-98.8	-97.7	-80.5	-88.3
2	-95.1	-108.5	-92.2	-98.3
4	-113.2	-110.0	-99.4	-108.8
6	-111.9	-116.9	-115.3	-107.7
8	-119.4	-117.4	-114	-112.2
10	-126.1	-127.0	-122.2	-121.0
12	-136.0	-134.4	-132.3	-129.2
14	-133.9	-144.6	-147.9	-141.8
16	-150.3	-143.4	-140.3	-143.6
18	-151.6	-151.2	-151.0	-145.2
20	-170.3 → -159.1 →	-179.0 ↑	-166.0 → -164.1 →	-159.2
SW				SW

157.1
73
-78.1

Line 5 NE

20	0	+78	2	-151.1	= -73
18	-10.2	68	4	-157.5	-80
16	-29.5	49	6	166.4	-88
14	-27.9	50	8	-184.7	-107
12	-53.7	24	10	-191.8	-114
10	-96.2	-18	12	-192.7	-115
8	-97.6	-20	SW		
6	-103.2	-25			
4	-114.8	-37			
2	-131.6	-54			
0	-190.5	-63			

HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA, 85703. P.O. BOX 5671. PHONE: (AREA CODE 602) 623-0578

March 3, 1969

Mr. Jim Brooks
C. F. & I. Steel Corporation
P. O. Box 1522
Scottsdale, Arizona 85252

Re: I.P. Survey in the Dragoon Area, Cochise County, Arizona

Dear Mr. Brooks:

As you requested in your discussion with Mr. Walter Heinrichs and me last Tuesday in our office we offer the following quotes and recommendations on additional induced polarization coverage over your Dragoon Area property, Cochise County, Arizona.

We recommend that a standard dipole-dipole array I.P. spread on a 1,000 foot dipole spacing (for increased penetration and greater linear coverage than that provided by the previous 750 foot dipole work) be run parallel to Line 1 and centered about 1,000 feet S 40 E of Station 7.5 NE Line 1. Depending on the results of this spread, additional parallel coverage may be required further to the southeast until the sulfide zone is terminated. Orientation and dipole lengths of such work should be varied to best fit prior results.

An additional 1,000 foot spaced spread run approximately normal to the other lines and along and centered on the zone of interest would also help to resolve the structure and details of mineralization in this area of very complex geology.

We recommend a three man crew equipped with standard duty gear and one vehicle to execute this survey. The charges for this are $250.00 per day plus expenses. The charged expenses consist of $15.00 per day plus $0.15 per mile per vehicle plus living expenses and directly related supplies and communications. Final compilation, interpretation and report is $150.00 per Tucson staff day.

Assuming that three lines will be run, it is estimated that the total job including report will cost about $2,000.00 and would involve about four field days. Added coverage to the southeast, should that be desired, we estimate will cost approximately $500.00 per profile mile.

It is also recommended that consideration be given to running an induced polarization gradient array detail survey over and near the known sulfide zone. This could possibly resolve the sulfide mineralized zone and resistivity related geology to a considerably greater degree of detail than the more reconnaissance dipole-dipole work.

Four additional field days should suffice to obtain the detailed gradient array data and would be charged at the same daily rate and would used the same crew as the dipole-dipole I.P. survey. This would cost an estimated additional $1,600.00 including report for a total job cost of about $3,600.00 if the combined survey is executed.

The above daily rates are prorated on a ten hour field day basis including travel time. 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.

Others of our technical staff are involved as needed and/or are supplied as requested and mutually agreed upon.

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.

Payments due on presentation. Billings may be submitted periodically with final statement after completion of final report.

Our crew availability in the immediate future would be within one or two weeks upon notification to proceed.

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.

Yours very truly,

HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Sr. Geophysicist

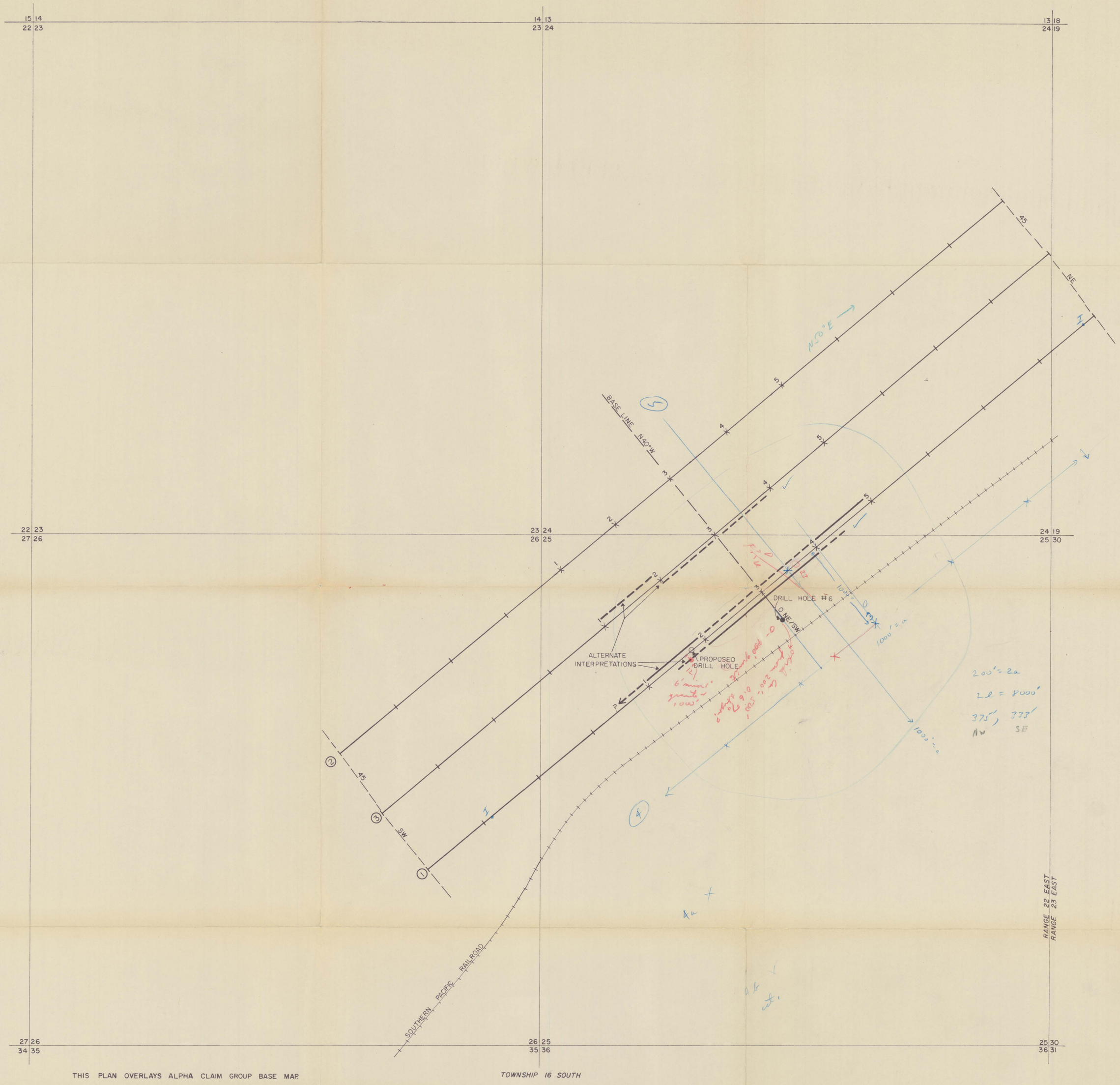
ACCEPTED BY: _____

TITLE: _____

DATE: _____

CSL/rc

Enclosure 1cc



THIS PLAN OVERLAYS ALPHA CLAIM GROUP BASE MAP.

TOWNSHIP 16 SOUTH

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

I.P. LINE NO. → 2

STATIONS — ELECTRODES

N

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

INDUCED POLARIZATION LOCATION
AND INTERPRETATION PLAN
DRAGOON AREA
COCHISE COUNTY, ARIZONA

FOR

C F & I STEEL CORPORATION

SCALE 1"=500' | DRAWN BY BLG | DATE MARCH 1968

CF&I STEEL CORPORATION

ALPHA LODE CLAIMS

Cochise Mining District — Cochise County, Arizona

Sections 23, 24, 25, & 26 — Township 16 South Range 22 East

Scale: 1" = 500' — Date: February 5, 1968

Job 376

◎ ..... Section Corner (Found)

○ ..... Section Corner

— — ..... Subdivision Line

∘ ..... Claim Corner Post

× ..... Discovery

CF&I Steel Corp.
Pueblo, Colorado
FEB 23 1968
MAILED
ENGINEERING DEPARTMENT

6 @ 25' SW 1500' IP Line ① I=4.5 amp

PAGE 1

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376-69
LINE 1 HALF NE SP. ____ DATE 4/14/69

SEND	1.50									
RECEIVE	18-20 NE	16-18	14-16	12-14	10-12	8-10	6-8	4-6	2-4	0-2
RANGE	100	100	100	100	100	100	100	240 100	100	100
DC 1	382	~~318~~	259	214	222	239	218	229	220	335
DC 2	386	320	259	220	219	223	243	242	208	320
DC 3	379	314	257	211	221	242	232	223	221	328
DC 4	384	321	260	218	220	221	208	243	207	318
DC 5	360	310	259	210	220	241	245	221	221	330
DC 6		323	262			221	199		207	
DC 7						241	252			
DC 8							188			
DC AVG.	38.0	31.66	25.91	21.53	22.0	23.133	22.41	23.35	21.41	32.46
AC 1	37.8	31.1	25.3	21.0	21.6	22.2	21.6	22.4	20.6	30.8
AC 2	37.7	30.9	25.5	20.9	21.4	22.2	21.6	22.3	20.5	30.8
AC AVG.										
S.P.	-3.6	-13.2	+13.0	-22.5	-4.6	-12.6	-26.0	-0.8	-9.3	-19.2
AC NOISE	.290	.08 .318	.350	.374	.418	.445	.468	.491	.513	.529
POT RES.	195	179	161	143	163	183	186	204	195	305

Pg 2 FE	1.1	1.3	2.1	1.8	1.2	2.4	1.8	1.5	1.3	1.5
MCF	5	11	21	19	13	25	21	17	16	16

35.5555

$\rho/2\pi = \frac{l^2}{2a} \frac{\Delta V}{I} (G_{xy})$ 16 @ 25' SW & 3 NW corner

$l = 4000$
$a = 100$
$I = 4.5$

2 PAGE

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 1 HALF SW SP. ____ DATE 4/14/69

SEND	2:55									
RECEIVE	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
RANGE	100	30	30	30	10	30	30	30	30	30
DC 1	223	126	106	102	920	103	97	125	103	126
DC 2	222	127	101	93	980	106	94	128	96	130
DC 3	223	124	106	107	945	102	97	127	103	125
DC 4	222	130	101	88	938	108	94	127	95	130
DC 5		121	106	107	932	100	97	127	104	125
DC 6		132		87	963	110			95	131
DC 7					943					
DC 8					945					
DC AVG.	222.5	126.2	10.35	9.79	9.45	10.45	9.55	12.7	9.95	12.75
AC 1	21.3	12.1	9.80	9.30	9.05	9.90	9.10	12.1	9.50	12.2
AC 2	21.1	12.0	9.80	9.30	9.00	9.85	9.05	12.1	9.50	12.1
AC AVG.										
S.P.	+3.7	-18.7	+1.3	-7.5	-6.7	-9.9	+2.1	-16.3	-1.4	-18.7
AC NOISE	.538	.543	.543	.540	.529	.511	.495	.472	.450	.425
POT RES.	213	121	100	94	89	95	84	107	80	96

$\log^1_{pFE}$	-2.6	-1.2	-1.3	-0.6	-1.1	+0.2	0.3	1.0	0.8	2.0
MCF	-13	-7	-8	-4	-7	1	2	1	4	7

SW End

Line 1

+11.2 } 200'

-19.9 } 195'

Line 2

$\frac{l^2}{2aI} = 16.0$

10 @ 2.3 NE Con
12' NE of

$l = 4000$
$a = 100$
$I = 5000$

PAGE 3

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376-69
LINE 2 HALF SW SP. ____ DATE 4/14/69

SEND	4:05									
RECEIVE	20-18 SW	16-18	14-16	12-14	10-12	8-10	6-8	4-6	2-4	0-2
RANGE	30	30	30	30	30	30	30	30	30	30
DC 1	203	126	115	98	100	103	93	114	105	184
DC 2	199	119	114	102	96	95	99	112	105	184
DC 3	203	129	116	97	98	106	95	115	105	184
DC 4	199	118	113	101	96	93	100	111	104	194
DC 5	203	128	117	96	98	110	94	114	105	
DC 6		118		102	96	88	100			
DC 7						112				
DC 8						87				
DC AVG.	20.1	12.32	11.47	9.92	9.7	9.986	9.69	11.25	10.5	18.4
AC 1	19.1	11.6	10.9	9.45	9.30	9.50	9.15	10.7	9.90	17.5
AC 2	19.1	11.6	10.9	9.40	9.30	9.50	9.20	10.7	9.90	17.5
AC AVG.										
S.P.	+27.8	+7.8	-1.2	+10.2	+7.4	+9.6	+0.5	+6.9	+1.5	+10.8
Gm AC NOISE	.368	.400	.430	.458	.479	.500	.514	.523	.525	.523
ρ POT RES.	118	79	79	73	74	80	80	94	88	154

Pg 4 PFE	1.1	0.6	0.4	1.4	0.5	0.5	0.9	1.1	1.3	0.2
MCE	5	2	2	8	3	3	6	8	9	1

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376
LINE 2 HALF NE SP. ____ DATE 4/14/67

SEND	5:00									
RECEIVE	0-2 NE	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
RANGE	30	100	30	30	30	30	30	30	30	100
DC 1	276	322	218	224	278	276	265	250	301	338
DC 2	274	324	218	223	275	267	267	255	303	323
DC 3	276	320	219	226	284	280	262	245	295	340
DC 4	275	325	218	219	268	260	272	260	309	321
DC 5	276	318		226	290	287	260	241		341
DC 6		327				257	273			321
DC 7										
DC 8										
DC AVG.	27.55	32.23	21.8	22.33	27.78	27.21	26.6	25.14	30.1	33.09
AC 1	26.4	31.0	21.0	21.3	26.7	26.2	25.5	24.0	28.8	32.0
AC 2	26.3	31.0	21.0	21.3	26.8	26.2	25.5	24.1	28.7	31.9
AC AVG.										
S.P.	-23.3	+27.7	+22.8	+8.8	+36.2	+12.1	+9.5	+15.5	+13.0	+3.7
AC NOISE	.515	.500	.520	.455	.430	.400	.368	.332	.295	.260
POT RES.	227	258	181	163	191	174	156	133	142	138

Cal.

Range 300

200

199

200

199

$I = 5$ amp

Dc Cal = 1.0025

Ac Cal .96741

A.C.

193.

193.

Dg 3	PFE	1.8	2.7	1.8	1.8	0.9	1.7	2.2	1.7	2.6	1.7
	VICF	15	34	23	25	12	21	28	18	30	11

$\frac{l^2}{2aI}$ cal = 16.121 I = 5 amp = 5000 R cal = 1.007 l = 4000 a = 100

PAGE 1

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 3 HALF NE SP. ____ DATE 4/15/69

SEND										
RECEIVE	18-20	NE 16-18	14-16	12-14	10-12	8-10	6-8	4-6	2-4	0-2
RANGE	100	30	30	298 30	30	30	30.	100	100	100
DC 1	302	294	288	296	249	203	238	335	322	288
DC 2	300	287	286	297	247	198	228	341	317	283
DC 3	301	297	294	293	247	205	237	332	322	291
DC 4	300	284	286	296	247	197	225	340	318	287
DC 5		298	293	293	247	207	233	333	323	290
DC 6						198	226		319	290
DC 7 P/60	117	131	148	167	151	133	163	250	247	209
DC 8 M/E	7	5	6	2	5	2	-2	-1	7	2
DC AVG.	30.07	29.10	28.91	29.55	24.73	20.15	23.10	33.68	32.01	28.80
AC 1	28.9	28.0	27.7	28.5	24.2	19.5	22.3	32.6	30.4	27.7
AC 2	28.8	27.9	27.7	28.5	24.0	19.4	22.5	32.6	30.5	27.8
AC AVG.	28.85	27.95	27.70	28.50	24.10	19.45	22.40	32.60	30.45	27.75
S.P.	-8.7	-6.8	-0.6	-14.3	-10.4	-16.3	-34.2	+1.7	-26.2	-1.0
~~AC NOISE~~	.8	.7	.9	.3	-.7	.2	-.3	-.1	1.7	.4
POT RES.	.241	.279	.318	.350	.380	.411	.438	.461	.479	.493

Cal.
Range 300
199
198
199
198
198.5

NE end
Line 2
↓
Line 3

S.P.
0.0
+8.0

DC cal = 1.00755

Ac/Dc = .96725 ✓

192.
192.
192

Cg2	PFE	-0.7	-0.5	2.0	1.0	-0.5	-4.0	1.4	2.1	2.3	2.5
	MCF	-6	-7	26	11	-6	-60?	22	33	25	15

D.O @ 125' NW all SW Con

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 3 HALF SW SP. ____ DATE 4/15/69

PAGE 2

SEND										
RECEIVE	0-2 SW	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
RANGE	30	30	10	30	115 30	30	30	30	30	100
DC 1	137	82	940	118	121	92	98	105	162	327
DC 2	132	93	950	117	114	88	99	104	161	320
DC 3	136	81	960	118	121	89	100	106	165	324
DC 4	131	92	940	118	115	99	97	100	168	318
DC 5	137	81	975		122	101	100	112	169	327
DC 6		94	925			102	96	99	160	318
DC 7		82					100	110	173	
DC 8									156	
DC AVG.	13.4	8.716	9.515	11.8	11.79	9.48	9.85	10.48	16.5	32.23
AC 1	13.1	8.50	9.00	11.3	11.1	9.50	9.40	9.90	15.6	30.3
AC 2	13.0	8.45	9.05	11.3	11.3	9.60	9.40	9.95	15.6	30.5
AC AVG.										
S.P.	-11.7	-7.2	-15.9	+1.3	-8.2	-10.1	-15.6	+7.6	-11.0	-15.1
G(x) AC NOISE	.500	.498	.494	.471	.462	.434	.409	.375	.341	.310
ρ_a POT RES.	108	70	76	86	88	66	65	63	91	161

$\frac{\ell^2}{2aI}$ cal = 16.121

4 @ Drill Hole

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 4 HALF SW SP. ____ DATE 4/15/69

SEND										
RECEIVE	18-20 SW	16-18	14-16	12-14	10-12	8-10	6-8	4-6	2-4	0-2
RANGE	30	30	30	30	30	30	30	30	30	30
DC 1	296	174	117	109	108	123	108	90	92	133
DC 2	287	174	115	109	106	128	112	95	91	134
DC 3	295	174	120	109	107	119	107	88	94	131
DC 4	288		111		106	132	111	96	89	135
DC 5	294		122		106	118	109	85	95	131
DC 6			111			135				
DC 7										
~~DC~~ 8 C_a	148	98	71	72	75	93	84	73	74	106
DC AVG.	29.13	17.4	11.64	10.90	10.65	12.52	10.96	9.163	9.188	13.30
AC 1	28.1	16.6	11.1	10.3	10.1	11.8	10.5	8.70	8.75	12.75
AC 2	27.9	16.5	11.1	10.3	10.0	11.7	10.5	8.70	8.75	12.8
AC AVG.	28.0	16.55	11.10	10.30	10.05	11.75	10.50	8.70	8.75	12.78
S.P.	+14.0	+1.6	+1.8	+12.6	+8.2	+8.8	+4.5	−1.1	+10.5	+10.0
~~AC~~ NOISE	.6	1.7	1.4	2.4	2.5	3.1	1.0	1.9	1.6	.7
POT RES.	.315	350	.377	.411	438	462	.478	.492	.500	498

Pg 4										
gFE	1.6	1.2	0.8	2.0	1.0	0.0	1.2	1.0	1.2	1.8
MCF	13	8	3	7	7	0	8	7	10	16

SW end

Line 3

+2.3

+4.9

Line 4

3@ α11 S. End Center

PAGE 4

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 4 HALF NE SP. ____ DATE 4/15/69

SEND										
RECEIVE	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
RANGE	30	30	100	100	30	30	30	30	30	30
DC 1	156	201	342	375	218	222	275	290	259	279
DC 2	156	195	342	386	212	233	268	291	261	281
DC 3	155	203	342	373	222	222	275	288	258	281
DC 4	158	194		383	209	237	265	293	271	280
DC 5	150	205		374	223	220	275	287	257	280
DC 6	161	194		384	207	241	264	295	273	
DC 7										
DC 8										
DC AVG.	15.55	19.89	34.2	37.9	21.57	22.87	27.05	29.03	26.26	28.04
AC 1	14.8	19.0	32.8	36.0	20.6	22.1	25.9	27.8	25.1	26.7
AC 2	14.8	19.0	32.8	35.9	20.7	22.1	25.8	27.8	25.1	26.6
AC AVG.										
S.P.	+7.5	+2.9	+30.2	+28.5	+18.5	+1.2	+14.5	+15.7	+6.6	+11.7
P AC NOISE	.124	155	256	272	144	144	156	152	123	113
G(x4) POT RES.	.496	.484	.469	.445	.420	.391	.360	.325	.291	.251

$I = 5$ amp

NICF 1/3 | 4 17 20 33 33 33 12 24 22 7

$\frac{l^2}{2aI}(a) = 18.81243$

$I = 4.5$ amp

$l = 4000$
$a = 100$
$I = 4500$

PAGE 1

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376-69
LINE 5 HALF NE SP. ____ DATE 4/16/69

SEND										
RECEIVE	18-20NE	16-18	14-16	12-14	10-12	8-10	6-8	4-6	2-4	0-2
RANGE	30	30	30	30	100	30	30	30	30	30
DC 1	152	161	170	263	372	137	132	126	110	103
DC 2	149	157	170	270	383	139	134	127	100	106
DC 3	151	161	170	259	365	129	135	125	113	99
DC 4	160	157	170	265	385	138	127	126	99	108
DC 5	150			256	363	125	139	125	115	98
DC 6	156			266	390	137	128		99	108
DC 7	147					129				
DC 8	155					140				
DC AVG.	15.18	15.9	17.0	26.29	37.54	13.36	13.30	12.59	10.63	10.33
AC 1	14.4	15.4	16.3	25.5	37.2	13.2	12.7	12.1	10.3	9.80
AC 2	14.3	15.5	16.3	25.4	37.2	13.3	12.8	12.1	10.3	9.85
AC AVG.										
S.P.	-10.2	-19.3	+1.6	-25.8	-42.5	-1.4	-5.6	-11.6	-16.8	-8.9
AC NOISE	.343	.375	.408	.435	.463	.490	.519	.529	.542	.548
POT RES.	97	112	130	215	327	123	130	125	108	106

69 2 PFE	+0.6	3.8	-3.7	-1.9	0.0	-4.5
	6	39	-41	-23	0	-69

6 @ 10' NE of 0.0 I.P. Line 4 NE/SW

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

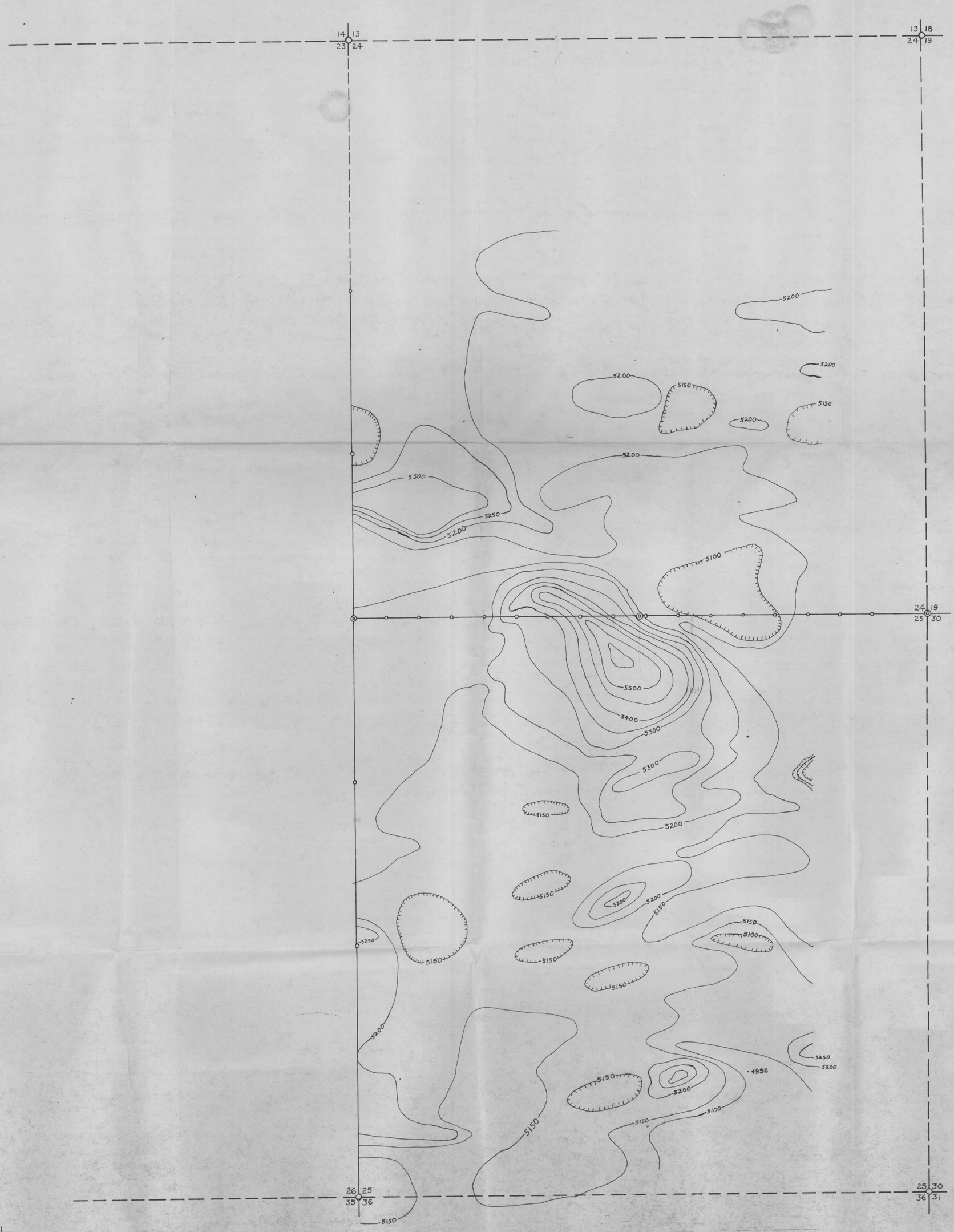
PROJECT 376-69

LINE 5 HALF SW SP. ____ DATE 4/16/69

PAGE 2

SEND										
RECEIVE	0-2 SW	2-4	4-6	6-8	8-10	10-12	12-14	Cal.		
RANGE	30	10	30	10	10	10		300		
DC 1	94	90	92	810	853	745		187		
DC 2	95	93	87	808	840	760		191		
DC 3	93	93	91	818	860	755		187		
DC 4	99	97	88	810	838	770		191	Dc	Cal = 1.058
DC 5	93	95	91	825	858	765		187		
DC 6	98	99		813		765				
DC 7		95		830		780			Ac/Dc	= .96957
DC 8		100								
DC AVG.	9.52	9.53	8.94	8.157	8.48	7.63		189		
AC 1	9.20	8.90	9.00	8.02	8.21	7.65		183.		
AC 2	9.15	8.90	9.00	8.15	8.23	7.85		183.5		
AC AVG.										
S.P.	-10.6	-6.4	-8.9	-18.3	-7.1	-0.9				
AC NOISE	.550	.547	.540	.525	.505	.488				G(xy)
POT RES.	98	98	91	81	81	70				Ca

Pg 1	PFE	2.6	-0.2	1.1	0.2	-2.2	-2.2	1.1	0.9	0.0	1.9
	MCF	27	-2	8	1	-7	-18	8	7	0	18



CF&I STEEL CORPORATION

MAGNETIC MAP OF DRAGOON AREA

Cochise Mining District Cochise County, Arizona

Contour Interval - 50 γ Askania GFZ

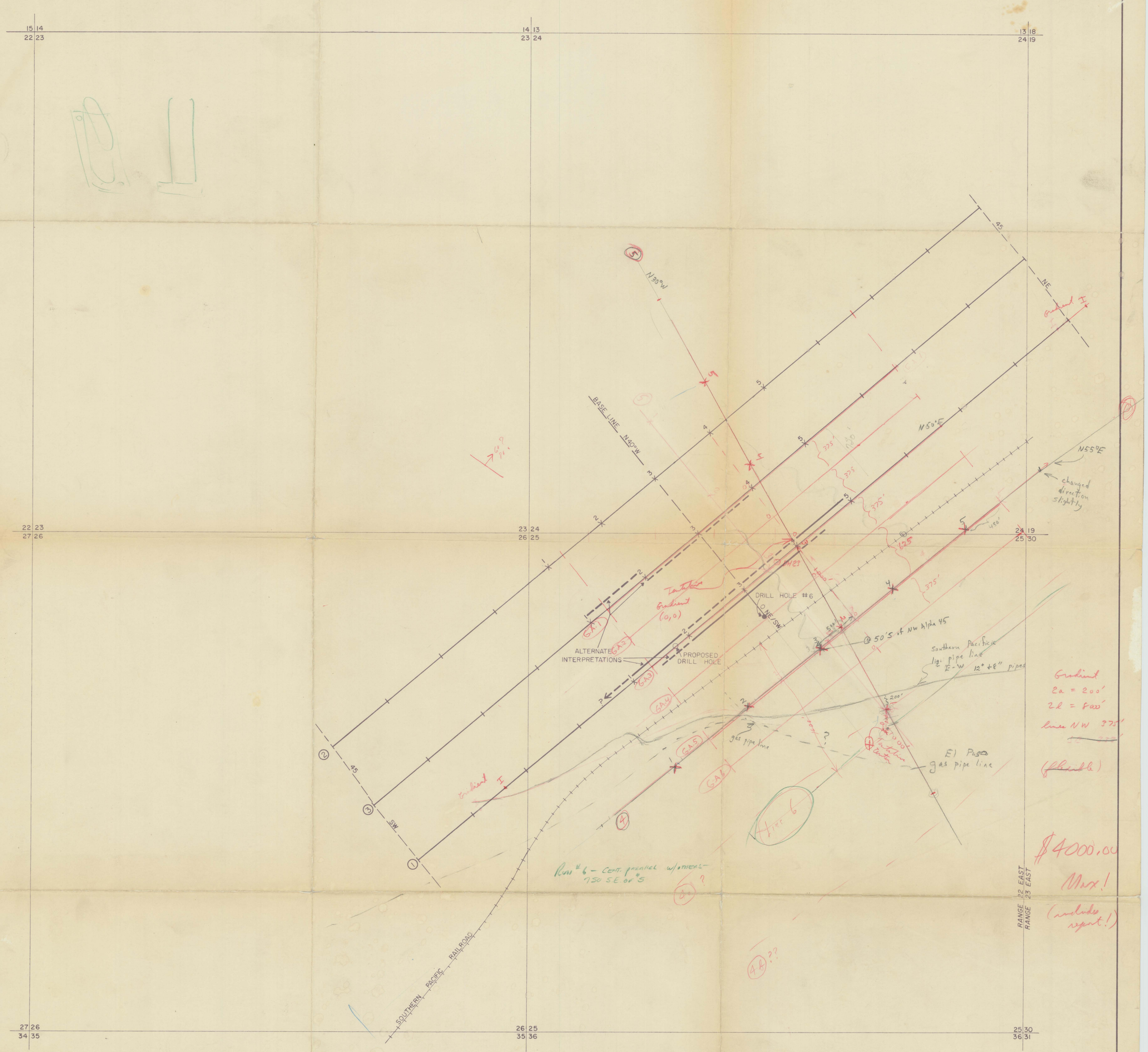
Scale: 1" = 500' Date: March 31, 1969

◎ Section Corner (Found)

○ Section Corner

— — Subdivision Line

∘ Claim Corner Post


BASE LINE N40°W
N50°E
N55°E
changed direction slightly
45
NE
SW
N30°W
DRILL HOLE #6
ALTERNATE INTERPRETATIONS
PROPOSED DRILL HOLE
@ 50'S of NW Alpha 45
Southern Pacific lig. pipe line E-W 12" + 8" pipes
gas pipe line
El Paso gas pipe line
SOUTHERN PACIFIC RAILROAD
RANGE 22 EAST
RANGE 23 EAST
Run #6 – Cent. parallel w/others – 750 SE of #5
Gradient (0,0)
Gradient 2a = 200'
2l = 800'
lines NW 375'
(flexible)
$4000.00 Max! (include report!)
THIS PLAN OVERLAYS ALPHA CLAIM GROUP BASE MAP.
TOWNSHIP 16 SOUTH
N
RELATIVE ANOMALY STRENGTH
VERY WEAK
WEAK
MODERATE
STRONG
I.P. LINE NO.
STATIONS
ELECTRODES
HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578
Cable: GEOEX, Tucson
geophysical engineers
vancouver
sydney
INDUCED POLARIZATION LOCATION AND INTERPRETATION PLAN
DRAGOON AREA
COCHISE COUNTY, ARIZONA
FOR
C F & I STEEL CORPORATION
SCALE 1" = 500'
DRAWN BY BLG
DATE MARCH 1968
File 376-69

JOB 326-69 LINE 4 SPREAD 1

LOOKING N 40° W DATE 4/8/69 A= 1000'

CENTER 0,0 / NE / NW LABEL SW / NE FREQ. 1.0 & 0.05

COUPLING Yes.

18 Apr 69
RC

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 287-69

LINE 4 HALF SW SP. 1 DATE 4/8/69

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-10	10-20	→	20-30	→	→	30-40	→	→	→
RANGE	300	300	100	100	30	10	300	30	10	10
DC 1	191	196	820	782	174	530	144	182	860	635
DC 2	189	204	814	775	169	575	139	175	880	665
DC 3	191	196	822	785	177	530	143	180	880	655
DC 4	189	204	810	776	169	600	139	170	885	665
DC 5	191	196	821	783	177	580	142	182	860	650
DC 6			813		169	540	139	170	890	655
DC 7						580			860	615
DC 8						540			885	650
DC AVG.	380	400	1633	1559	346	1117	282	353	1751	1299
AC 1	182.	195.	77.5	74.5	16.1	4.35	136.	16.5	8.10	5.98
AC 2	181.	194.5	77.5	74.5	16.1	4.38	136.	16.5	8.12	6.00
AC AVG.	363	389.5	155.0	149.0	32.2	8.73	272.	33.0	16.22	11.98
S.P.	-73.8	-133.5		+97.0	→	→	-2.9	→	→	→
AC NOISE	.15	.15	→	.15	→	→	.10	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 287-69

LINE 4 HALF SW SP. 1 DATE 4/8/69

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal.
RECEIVE	40-50	→	→	→	50-60	→	→	→		
RANGE	100	10	10	10	30	10	10	10		300
DC 1	235	640	579	610	97	375	445	555		207
DC 2	265	645	598	635	96	300	430	570		207
DC 3	235	650	565	630	97	375	465	555		207
DC 4	264	660	605	640	96	295	410	555		207
DC 5	235	640	560	610	97	385	465	550		207
DC 6	262	655	575	620	96	300	430	580		
DC 7		640	570	640		380	460	530		
DC 8			575	630			430	590		
DC AVG.	499	1297	1157	1260	193	678	885	1116		414
AC 1	23.9	5.97	5.43	5.99	9.20	3.15	4.23	5.36		205.5
AC 2	23.9	6.00	5.43	6.00	9.00	3.12	4.22	5.33		205.5
AC AVG.	47.8	11.97	10.86	11.99	18.20	6.27	8.45	10.69		411.0
S.P.	-19.6	→	→	→	-7.5	→	→	→		
AC NOISE	.15	→	→	→	.15	→	→	→		
POT RES.										

buried
gas line
30 SW
20 SW
100'

PAGE

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT 376-69

LINE 4 HALF SW SP. 1 DATE 4/8

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	5-4	4-5
RECEIVE	0-10	10-20	—	20-30	—	—	30-40	—	—	—
RANGE										
VOLTAGE	2500	2800	2500	2600	280	2500	4500	3600	280	2,500
CURRENT	3.0A	3.0A	3.0A	2.0A	3.0A	3.0A	2.0A	2.0A	3.0A	3.0
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		4/1
RECEIVE	40-50	—	—	—	50-60	—	—	—		1-2
RANGE										
VOLTAGE	4500	3600	2800	2500	4500	3000	2800	2500		2,500
CURRENT	2.0A	2.0A	3.0A	3.0A	2.0A	2.0A	3.0A	3.0A		2.0A

FREQUENCIES .05 1.0

SENDER NO.

OPERATOR 25

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 4 HALF NE SP. 1 DATE 4/9/69

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-10 NE	10-20 →		20-30 →			30-40 →			
RANGE	300	300	100	300	30	30	300	30	30	10
DC 1	135	128	559	125	253	170	155	269	85	760
DC 2	135	127	533	122.5	256	175	154	264	77	755
DC 3	135	127	565	125	246	168	155	269	84	750
DC 4	135	127	535	122.5	264	173	154	264	79	780
DC 5			567	125	236	165		269	86	720
DC 6			540		273	177		264	73	795
DC 7			560						88	720
DC 8										780
DC AVG.	270	254	1099	248	506	342	309	533	162	1510
AC 1	129.	120.	51.2	118.	24.6	16.8	148.	25.5	8.0	7.45
AC 2	129.	120.	51.3	118.	24.6	16.8	148.	25.4	8.00	7.43
AC AVG.	258.	240.	102.5	236.	49.2	33.6	296.	50.9	16.0	14.88
S.P.	+45.5	+94.9 →		+85.0			+15.8			
AC NOISE	.15	.12 →		.10			.10			
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 376-69

LINE 4 HALF NE SP. 1 DATE 4/9/69

PAGE 2

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal.
RECEIVE	40-50	→	→	→	50-60	→	→	→		
RANGE	100	30	10	10	30	10	3	3		300
DC 1	280	86	350	355	126	450	220	195		212
DC 2	297	93	360	370	127	430	210	250		212
DC 3	281	96	360	340	125	460	185	205		212
DC 4	297	80	340	400	128	420	250	265		212
DC 5	280	85	350	300	124	460	160	180		
DC 6	296	75	330	370		420	260	260		
DC 7	278	86	340	340			220	190		
DC 8				400			195, 220	250		
DC AVG.	577	172	695	719	253	882	418	449		424
AC 1	27.8	8.0	3.32	3.45	12.1	4.24	2.05	2.18		206.5
AC 2	27.7	8.0	3.35	3.48	12.2	4.22	2.06	2.19		207
AC AVG.	55.5	16.0	6.67	6.93	24.3	8.46	4.11	4.37		413.5
S.P.	-25.2	→	→	→	-36.4	→	→	→		
AC NOISE	.13	→	→	→	.12	→	→	→		
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT 376-69

LINE 4 HALF NE SP. 1 DATE 4/9/69

PAGE 1

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-10NE	10-20 →		20-30 →						
RANGE										
VOLTAGE	435V	320V	435V	275V	320V	435V	245	275V	320	435V
CURRENT	2.0A	2.0A	2.0A	3.0A	2.0A	2.0A	3.0A	3.0A	2.0A	2.0A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
RECEIVE										3-4
RANGE										
VOLTAGE	245	275V	320	435V	245V	275V	320V	435V		180V
CURRENT	3.0A	3.0A	2.0A	2.0A	3.0A	3.0A	2.0A	2.0A		2.0A

FREQUENCIES 0.5 1.0

SENDER NO. 9662-5 25

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 4 SPREAD 1 LOOKING N40W 4/8/69 A=1000 FEET, FREQUENCIES .05 AND 1.0

3.000	3.000	3.000	2.000	3.000	3.000	2.000	2.000	3.000	3.000	I	2.000	2.000	3.000	3.000	2.000	2.000	3.000	3.000	2.000	
191	196	820	782	174	530	144	182	860	635	DC	235	640	579	610	97	375	445	555	207	LEFT
189	204	814	775	169	575	139	175	880	665		265	645	598	635	96	300	430	570	207	SIDE
191		822	785	177	530	143	180	880	655		235	650	565	630	97	375	465	555		
189		810	776	169	600	139	170	885	665		264	660	605	640	96	295	410	555		
191		821	783	177	/	142	182	860	650		235	640	560	610	97	385	465	550		
		813		169	580	139	170	890	655		262	655	575	/	96	300	430	/		
					540			860	615			640	570	620		380	460	580		
					580			885	650				575	640			430	530		
					540									630				590		
1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18		
380	400	1634	1557	343	1105	283	357	1740	1300	DC	500	1285	1177	1245	193	675	875	1125	414	
380		1636	1560	346	1105	282	355	1760	1320	SUMS	500	1295	1163	1265	193	675	895	1125		
380		1632	1561	346	1130	282	350	1765	1320		499	1310	1170	1270	193	670	875	1110		
380		1631	1559	346	1120	281	352	1745	1315		499	1300	1165	1250	193	680	875	1105		
		1634		346	1120	281	352	1750	1305		497	1295	1135	1260	193	685	895	1110		
					1120			1750	1270			1295	1145	1270		680	890	1120		
								1745	1265				1145				890			
0.0	0.0	.0	-.1	-.7	-1.0	.4	1.1	-.6	.1	DC	.2	-.9	1.7	-1.2	0.0	-.4	-1.1	.8	0.0	
0.0		.2	.0	.2	-1.0	.1	.5	.5	1.6	DEVS	.2	-.1	.5	.4	0.0	-.4	1.1	.8		
0.0		-.1	.1	.2	1.2	.1	-.9	.8	1.6		0.0	1.0	1.1	.8	0.0	-1.1	-1.1	-.5		
0.0		-.1	-.0	.2	.3	-.3	-.3	-.3	1.2		0.0	.3	.7	-.8	0.0	.4	-1.1	-1.0		
		.0		.2	.3	-.3	-.3	-.0	.4		-.4	-.1	-1.9	0.0	0.0	1.1	1.1	-.5		
					.3			-.0	-2.3			-.1	-1.0	.8		.4	.6	.4		
								-.3	-2.6				-1.0				.6			
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
190.0	200.0	81.67	77.96	17.27	5.683	140.9	17.66	8.754	6.496	DCA	24.95	6.483	5.786	6.300	9.650	3.388	4.425	5.579	207.0	
182.0	195.0	77.50	74.50	16.10	5.350	136.0	16.50	8.100	5.980	AC1	23.90	5.970	5.430	5.990	9.200	3.150	4.230	5.360	205.5	
181.0	194.5	77.50	74.50	16.10	5.380	136.0	16.50	8.120	6.000	AC2	23.90	6.000	5.430	6.000	9.000	3.120	4.220	5.330	205.5	
181.5	194.7	77.50	74.50	16.10	4.365	136.0	16.50	8.110	5.990	ACA	23.90	5.985	5.430	5.995	9.100	3.135	4.225	5.345	205.5	
183.6	193.2	315.6	113.0	66.74	53.95	204.2	102.4	84.58	125.5	RHO	144.6	93.96	111.8	213.0	139.9	98.19	149.6	301.9	.966	DC CAL
3.9	2.0	4.6	3.9	6.5	27.0	2.9	6.3	7.2	7.7	PFE	3.6	7.5	5.8	4.3	5.3	7.3	4.0	3.6	.993	AC CAL
21	10	15	34	97	500	14	61	85	61	MCF	25	80	52	20	38	74	27	12		
2.000	2.000	2.000	3.000	2.000	2.000	3.000	3.000	2.000	2.000	I	3.000	3.000	2.000	2.000	3.000	3.000	2.000	2.000	2.000	
135	128	559	125	253	170	155	269	85	760	DC	280	86	350	355	126	450	220	195	212	RIGHT
135	127	533	123	256	175	154	264	77	755		297	93	360	370	127	430	210	250	212	SIDE
	127	565	125	246	168		269	84	750		281	96	360	340	125	460	185	205		
	127	535	122	264	173		264	79	780		297	80	340	400	128	420	250	265		
		567	125	236	165			86	720		280	85	350	300	124	460	160	180		
		540		273	177			73	795		296	75	330	390		420	260	260		
		560						88	720		278	86	340	340			/	190		

									780						400			220	250
																		195	
																		220	

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
270	255	1092	248	509	345	309	533	162	1515	DC	577	179	710	725	253	880	430	445	424
	254	1098	248	502	343		533	161	1505	SUMS	578	189	720	710	252	890	395	455	
	254	1100	247	510	341		533	163	1530		578	176	700	740	253	880	435	470	
		1102	247	500	338			165	1500		577	165	690	700	252	880	410	445	
		1107		509	342			159	1515		576	160	680	690		880	420	440	
		1100						161	1515		574	161	670	730			415	450	
									1500					740			415	440	

0.0	.3	-.7	.2	.6	.9	0.0	0.0	.1	.2	DC	.1	4.3	2.2	.8	.2	-.2	3.1	-1.0	0.0
	-.1	-.2	.2	-.8	.4		0.0	-.5	-.4	DEVS	.2	10.1	3.6	-1.3	-.2	.9	-5.3	1.3	
	-.1	.0	-.2	.8	-.2		0.0	.7	1.2		.2	2.5	.7	2.9	.2	-.2	4.3	4.6	
		.2	-.2	-1.2	-1.1			2.0	-.8		.1	-3.9	-.7	-2.7	-.2	-.2	-1.7	-1.0	
		.7		.6	.1			-1.8	.2		-.1	-6.8	-2.2	-4.1		-.2	.7	-2.1	
		.0						-.5	.2		-.5	-6.2	-3.6	1.5			-.5	.2	
									-.8					2.9			-.5	-2.1	

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6	
135.0	127.2	54.99	123.7	25.30	17.09	154.5	26.65	8.092	7.557	DCA	28.83	8.583	3.475	3.596	12.62	4.410	2.086	2.246	212.0
129.0	120.0	51.20	118.0	24.60	16.80	148.0	25.50	8.000	7.450	AC1	27.80	8.000	3.320	3.450	12.10	4.240	2.050	2.180	206.5
129.0	120.0	51.30	118.0	24.60	16.80	148.0	25.40	8.000	7.430	AC2	27.70	8.000	3.350	3.480	12.20	4.220	2.060	2.190	207.0
129.0	120.0	51.25	118.0	24.60	16.80	148.0	25.45	8.000	7.440	ACA	27.75	8.000	3.335	3.465	12.15	4.230	2.055	2.185	206.7
191.0	180.0	311.3	116.7	143.2	241.8	145.8	100.6	114.5	213.9	RHO	108.8	80.97	98.35	178.1	119.1	83.21	103.3	178.0	.943 DC CAL
2.1	3.3	4.6	2.3	.3	-.8	1.8	2.1	-1.4	-.9	PFE	1.3	4.6	1.6	1.2	1.3	1.7	-1.0	.3	.975 AC CAL
11	19	15	19	2	-3	12	21	-12	-4	MCF	12	57	16	7	11	20	-10	1	

↑

?

JOB 376-69 LINE 5 SPREAD 1

LOOKING S60°W DATE 4/10/69 A= 1000'

CENTER 0,0 ~~SE/NW~~ LABEL SE/NW FREQ. 1.0 + 0.05

COUPLING Yes

18 Apr 68

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376-69
LINE 5 HALF SE SP. 1 DATE 4/10/6

PAGE 3

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-10	10-20 →		20-30 →			30-40 →			
RANGE	100	100	30	100	30	10	100	30	10	100
DC 1	630	815	188	770	147	580	667	243	660	290
DC 2	637	819	189	760	158	550	662	235	680	295
DC 3	629	818	188	770	156	580	668	243	660	298
DC 4	638	820	189	760	149	545	662	235	690	290
DC 5	629	817	187	770	156	560	666	245	655	298
DC 6			189		151	535	663	234	690	287
DC 7					156	560			660	292
DC 8									690	
DC AVG.	126.7	163.7	37.7	153.0	30.6	11.13	132.9	47.8	13.46	5.86
AC 1	61.8	76.8	17.8	74.5	14.3	5.22	65.5	23.2	6.25	2.75
AC 2	61.7	77.0	17.9	74.4	14.3	5.23	65.6	23.3	6.28	2.75
AC AVG.	123.5	153.8	35.7	148.9	28.6	10.45	131.1	46.5	12.53	5.50
S.P.	+24.8	+20.8 →		+25.0 →			-1.8 →			
AC NOISE	.08	.08 →		.08 →			.08 →			
POT RES.										

30 SE @
α 46 SE Cor.

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 326-69
LINE 5 HALF SE SP. 1 DATE 4/10/69

PAGE 4

SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal.
RECEIVE	40-50	→			50-60	→				
RANGE	30	30	10	3	30	10	3	3		
DC 1	251	108	340	160 145	108	530	190	90		300
DC 2	244	105	341	180 200	100	530	170	92		105
DC 3	248	107	343	150 120	108	523	185	110		105
DC 4	245	107	339	200 210	100	528	175	75		105
DC 5	246	105	343	135 130	108	527	182	120		105
DC 6		108	338	205	100	527	187	70		
DC 7				135			175	125		
DC 8				220				65		
DC AVG.	483	213	682	3.47	20.8	10.55	3.61	1.91		210
AC 1	24.1	10.2	3.14	1.57	10.1	5.00	1.67	.86		102.5
AC 2	24.2	10.2	3.14	1.58	10.1	5.01	1.68	.88		102.5
AC AVG.	48.3	20.4	6.28	3.15	20.2	10.01	3.35	1.74		205.0
S.P.	+3.4	→			-10.2	→				
AC NOISE	.12	→			.10	→				
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT 287-69

LINE 5 HALF SE SP. 1 DATE

PAGE

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE										
RANGE										
VOLTAGE	4100	3800	4100	2100	3800	4100	2900	2100	3800	4100
CURRENT	1.0A	1.0A	1.0A	2.0A	1.0A	1.0A	2.0A	2.0A	2.0A	1.0A
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		Cal
RECEIVE										3-4
RANGE										
VOLTAGE	2900	2100	3800	4100	2900	2100	3800	4100		3800
CURRENT	2.0A	2.0A	1.0A	1.0A	2.0A	2.0A	1.0A	1.0A		1.0A

FREQUENCIES .25 1.0

SENDER NO. 9602-5

OPERATOR 25

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 376-69
LINE 5 HALF NW SP. 1 DATE 4/10/69

PAGE 1

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-10	10-20	→	20-30	→	→	30-40	→	→	→
RANGE	300	300	100	100	100	30	300	100	30	30
DC 1	153	124	363	770	278	135	225	368	219	125
DC 2	155	125	358	766	280	132	229	358	221	126
DC 3	152	124	365	770	280	136	225	368	219	125
DC 4	155	125	356	767	280	130	229	357	222	126
DC 5	153		368	768		137	225	367	218	125
DC 6								357	223	126
DC 7										
DC 8										
DC AVG.	307.	249.	722	1536	56.0	26.7	454.	72.5	44.0	25.1
AC 1	144.5	121.	34.2	75.3	27.2	12.8	224.	35.6	21.6	12.1
AC 2	144	120.5	34.1	75.4	27.4	12.8	223.	35.8	21.5	12.1
AC AVG.	282.5	241.5	68.3	150.7	54.6	25.6	447.	71.4	43.1	24.2
S.P.	-21.4	+1.3	→	-7.5	→	→	-44.1			
AC NOISE	.16	.16	→	.10	→	→	.22	→	→	→
POT RES.										

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 326-69
LINE 5 HALF NW SP. 1 DATE

PAGE 2

SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		Cal
RECEIVE	40-50	→		→	50-60	→	→	→		
RANGE	30	10	10	10	30	10	10	10		300
DC 1	260	778	675	442	120	587	624	422		209
DC 2	254	799	670	443	118	583	597	425		209
DC 3	264	777	682	445	122	590	627	422		209
DC 4	253	810	666	440	117	563	618	428		209
DC 5	264	754	682	446	122	600	599	421		
DC 6	253	835	662	440	118	572	620	430		
DC 7		795	680				597			
DC 8		783	670							
DC AVG.	51.7	15.79	13.47	8.86	23.9	11.66	12.20	8.49		418.
AC 1	25.2	7.75	6.63	4.32	11.6	5.67	5.95	4.08		205
AC 2	25.2	7.76	6.63	4.31	11.6	5.70	5.95	4.10		205
AC AVG.	50.4	15.51	13.26	8.63	23.2	11.37	11.90	8.18		410
S.P.	-29.2	→	→	→	-24.7					
AC NOISE	.16	→	→	→	.22	→	→	→		
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT 287-69

LINE 5 HALF NW SP. 1 DATE

PAGE

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	2-4	2-3	1-2
RECEIVE										
RANGE										
VOLTAGE	4100V	3300	410	4000V	3200	4100	4300V	4000	3300	4100
CURRENT	2.0A	2.0A	2.0A	1.0A	2.0A	2.0A	1.0A	1.0A	2.0A	2.0A
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		[illegible]
RECEIVE										2-3
RANGE										
VOLTAGE	4300	4000	3300	4100	4300	4000	3200	4100		3300
CURRENT	1.0A	1.0A	2.0A	2.0A	1.0A	1.0A	2.0A	2.0A		2.0A

FREQUENCIES .05 1.0

SENDER NO. 9662-5

OPERATOR 25

RECEIVER NO.

OPERATOR

COMMENTS:

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 5 SPREAD 1 LOOKING N60S 4/10/69 A=1000 FEET, FREQUENCIES .05 AND 1.0

1.000	1.000	1.000	2.000	1.000	1.000	2.000	2.000	1.0 2.000	1.0 2.000	I	2.000	2.000	1.000	1.000	2.000	2.000	1.000	1.000	1.000	
630	815	188	770	147	580	667	243	660	290	DC	251	108	340	160	108	530	190	90	105	LEFT
637	819	189	760	158	550	662	235	680	295		244	105	341	180	100	530	170	92	105	SIDE
629	818	188		/	580	668	243	660	298		248	107	343	150		523	185	110		
638	820	189		156	545	662	235	690	290		245	107	339	200		528	175	75		
629	817	187		149	560	666	245	655	298		246	105	343	135		527	182	120		
		189		156	535	663	234	690	287			108	338	205		527	187	70		
				151	560			660	292					135			175	125		
				156				690						220				65		
														/						
														145						
														200						
														120						
														210						
														130						

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
1267	1634	377	1530	305	1130	1329	478	1340	585	DC	495	213	681	340	208	1060	360	182	210
1266	1637	377		305	1130	1330	478	1340	593	SUMS	492	212	684	330		1053	355	202	
1267	1638	377		305	1125	1330	478	1350	588		493	214	682	350		1051	360	185	
1267	1637	376		307	1105	1328	480	1345	588		491	212	682	335		1055	357	195	
		376		307	1095	1329	479	1345	585			213	681	340		1054	369	190	
					1095			1350	579					340			362	195	
								1350						355				190	
														345					
														320					
														330					
														340					

.0	-.2	.1	0.0	-.3	1.5	-.0	-.1	-.4	-.2	DC	.5	.1	-.1	.4	0.0	.5	-.1	-4.9	0.0
-.1	.0	.1		-.3	1.5	.1	-.1	-.4	1.1	DEVS	-.2	-.4	.3	-2.6		-.2	-1.5	5.6	
.0	.1	.1		-.3	1.0	.1	-.1	.3	.3		.1	.6	0.0	3.4		-.3	-.1	-3.3	
.0	.0	-.2		.4	-.7	-.1	.3	-.1	.3		-.4	-.4	0.0	-1.1		.0	-1.0	1.9	
		-.2		.4	-1.6	-.0	.1	-.1	-.2			.1	-.1	.4		-.1	2.4	-.7	
					-1.6			.3	-1.3					.4			.4	1.9	
								.3						4.8				-.7	
														1.9					
														-5.5					
														-2.6					
														.4					

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6	
63.34	81.82	18.83	76.50	15.29	5.567	66.46	23.93	6.729	2.932	DCA	24.64	10.64	3.410	1.693	10.40	5.273	1.802	.956	105.0
61.80	76.80	17.80	74.50	14.30	5.220	65.50	23.20	6.250	2.750	AC1	24.10	10.20	3.140	1.570	10.10	5.000	1.670	.860	102.5
61.70	77.00	17.90	74.40	14.30	5.230	65.60	23.30	6.280	2.750	AC2	24.20	10.20	3.140	1.580	10.10	5.010	1.680	.880	102.5
61.75	76.90	17.85	74.45	14.30	5.225	65.55	23.25	6.265	2.750	ACA	24.15	10.20	3.140	1.575	10.10	5.005	1.675	.870	102.5
181.0	233.8	215.2	109.3	174.7	159.0	94.94	136.7	96.12 (172)	83.76 #67	RHO	140.8	152.0	194.9	169.3	148.6	150.7	180.2	153.0	.952 DC CAL
.1	3.9	3.0	.3	4.4	4.0	-1.0	.5	4.8	4.1	PFE	-.4	1.8	6.0	4.9	.5	2.8	5.0	7.3	.976 AC CAL
1	17	14	3	25	25	-11	3	50	49	MCF	-3	12	31	29	3	19	28	48	

2.000	2.000	2.000	1.000	2.000	2.000	1.000	1.000	2.000	2.000	I	1.000	1.000	2.000	2.000	1.000	1.000	2.000	2.000	2.000	
153	124	363	770	278	135	225	368	219	125	DC	260	778	675	442	121	587	624	422	209	RIGHT
155	125	358	766	280	132	229	358	221	126		254	799	670	443	118	583	597	425	209	SIDE
152		365	770	280	136	225	368	219	125		264	777	682	445	122	590	627	422		
155		356	767	280	130	229	357	222	126		253	810	666	440	117	563	/	428		
153		368	768		137	225	367	218	125		264	754	682	446	122	600	618	421		
							357	223	126		253	835	662	440	118	572	599	430		
												/	680				620			
												795	670				597			
												783								

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
308	249	721	1536	558	267	454	726	440	251	DC	514	1577	1345	885	239	1170	1221	847	418
307		723	1536	560	268	454	726	440	251	SUMS	518	1576	1352	888	240	1173	1224	847	
307		721	1537	560	266	454	725	441	251		517	1587	1348	885	239	1153	1217	850	
308		724	1535		267	454	724	440	251		517	1564	1348	886	239	1163	1219	849	
							724	441	251		517	1589	1344	886	240	1172	1217	851	
												1578	1342						
													1350						

.2	0.0	-.2	0.0	-.2	0.0	0.0	.1	-.1	0.0	DC	-.5	-.1	-.1	-.1	-.2	.3	.1	-.2	0.0
-.2		.1	0.0	.1	.4	0.0	.1	-.1	0.0	DEVS	.3	-.2	.4	.2	.3	.6	.4	-.2	
-.2		-.2	.1	.1	-.4	0.0	0.0	.1	0.0		.1	.5	.1	-.1	-.2	-1.1	-.2	.1	
.2		.2	-.1		0.0	0.0	-.1	-.1	0.0		.1	-.9	.1	0.0	-.2	-.3	-.0	.0	
							-.1	.1	0.0		.1	.7	-.2	0.0	.3	.5	-.2	.3	
												-.0	-.4						
													.2						

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6	
153.7	124.5	36.11	76.80	27.97	13.35	227.0	36.25	22.02	12.55	DCA	25.83	7.892	6.735	4.430	11.97	5.831	6.098	4.244	209.0
144.5	121.0	34.20	75.30	27.20	12.80	224.0	35.60	21.60	12.10	AC1	25.20	7.750	6.630	4.320	11.60	5.670	5.950	4.080	205.0
144.0	120.5	34.10	75.40	27.40	12.80	223.0	35.80	21.50	12.10	AC2	25.20	7.760	6.630	4.310	11.60	5.700	5.950	4.100	205.0
144.2	120.7	34.15	75.35	27.30	12.80	223.5	35.70	21.55	12.10	ACA	25.20	7.755	6.630	4.315	11.60	5.685	5.950	4.090	205.0
220.7	178.7	207.3	220.5	160.6	191.6	651.7	416.3	316.1	360.3	RHO	296.6	226.6	193.3	222.6	343.6	334.8	306.4	341.1	.957 DC CAL
4.5	1.1	3.7	-.0	.5	2.3	-.4	-.4	.2	1.7	PFE	.5	-.2	-.4	.7	1.2	.6	.5	1.8	.981 AC CAL
21	6	18	-0	3	12	-1	-1	1	5	MCF	2	-1	-2	3	4	2	2	5	

JOB 376 LINE 6 SPREAD 1

LOOKING NW DATE May 7, 69 A= 1000

CENTER 0 LABEL SW / NE FREQ 1.0 and 0.1

COUPLING YES

8 May 69
RC

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT DRAGOON

LINE 6 HALF 5 SP. 1 DATE 5/7/69

SEND	4-5	3-4	4-5	2-3	3-4	4-5	1-2	2-3	3-4	4-5
RECEIVE	0-1000	1 —	2	2 —	—	3	3 —	—	—	4
RANGE	.3	.3	.1	.3	.1	.1	.3	.3	.1	.03
DC 1	176	145	63.0	256	66.6	34.7	212	109	36.1	21.2
DC 2	173	145	62.0	256	66.9	33.8	212	117	33.9	20.6
DC 3	176	145	62.8	258	66.6	34.7	214	106	36.1	20.9
DC 4	173	145	61.9	256	66.9	33.8	211	119	33.7	20.8
DC 5			62.8				214	106	36.5	20.7
DC 6			62.0				211	120	33.0	20.9
DC 7			62.8					106	37.6	20.6
DC 8			62.0					122	32.9	21.1
DC AVG.										
AC 1	178	148	63.1	259	66.0	34.4	217	114	34.7	20.6
AC 2	178	148	63.1	259	66.0	34.2	217	114	34.7	20.6
AC AVG.										
S.P.	-87.7	-53.5		-21.1			-83.2			
AC NOISE	.14	.13		.12			.16			
POT RES.										

NOTE- Poorly grounded RANGE FENCE CROSSES LINE AT ≈ 30°
130' N. OF ELEC. #1

ANOTHER, SAME KIND & ANGLE ≈ 350' S. OF #1

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT HORIZON
LINE 6 HALF 5 SP. 1 DATE 5/6/65

SEND	1-2	2-3		3-4	4-5		1-2	2-3	3-4	4-5		CAL 1	
RECEIVE	4				5		5			6		2-3	
RANGE	.1	.1		.03	.03		.1	.03	.03	.01			
DC 1	61.9	43.8	40.0	16.4	11.5	11.8	32.4	26.8	11.3	8.40	8.80	207	
DC 2	68.5	44.1	49.7	17.2	10.2	9.8	32.7	25.8	11.5	8.86	8.44	208	
DC 3	60.7	44.0	39.7	15.7	12.6	12.5	32.4	26.0	11.3	8.39	8.18	207	
DC 4	69.2	46.5	50.6	17.4	9.9	9.6	32.6	26.8	11.2	8.81	9.00	208	
DC 5	59.9	42.1	39.0	15.8	12.8	13.2	32.5	26.3	11.2	8.02	8.31		
DC 6	71.8	47.9	51.0	17.3	8.8	8.4	32.2	26.3	11.7	8.98	8.70		
DC 7	58.7	41.6	38.2	15.5	13.6	14.0	32.7	26.2	10.8	8.28	8.31		
DC 8	72.6	48.2	51.4	17.7	9.0	8.0	32.5	26.5	11.2	8.62	8.42		
DC AVG.													
AC 1	65.4	45.1		16.4	11.0		33.1	25.7	11.0	8.36		213	
AC 2	65.3	45.1		16.5	11.0		32.9	25.7	11.0	8.37		213	
AC AVG.													
S.P.	-14.1						-24.3						
AC NOISE	.18						.19						
POT RES.													

NOTE - Poorly grouded range fences cross line 6 at ≈ 90°, ≈ 200' N. & 200' S. of Station # 5000' - Large power line also crosses line at ≈ 45°, ≈ 700' S of St # 5000'

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PAGE 1

PROJECT DRAGON 376

LINE 6 HALF S 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	0-10	10-20	→	20-30	→	→	30-40	→	→	→
RANGE										
VOLTAGE	90v	130v	90v	130v	130v	90v	130v	130v	110v	130v
CURRENT	6.0A	5.0A	6.0A	6.0A	5.0A	6.0A	5.0A	6.0A	5.0A	6.0A
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4	4-5		OAL
RECEIVE	40-50	→	→	→	50-60	→	→	→		2-3
RANGE										
VOLTAGE	130v	130v	110	85v	130v	110v	85v	85v		160v
CURRENT	5.0A	6.0A	5.0	6.0A	5.0A	6.0A	5.0A	6.0A		2.0A

FREQUENCIES 1.0 0.1

SENDER NO. MK3

OPERATOR

RECEIVER NO.

OPERATOR

COMMENTS: Multiply Voltage times 4

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT DRAGOON
LINE 6 HALF N SP. 1 DATE 5/6/69

PAGE 30K4

SEND	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2
RECEIVE	0-1	1 —	— 2	2 —	—	— 3	3 —	—	—	— 4
RANGE	.3	.3	.1	.3	.1	.03	.3	.1	.1	.03
DC 1	143	187	48.2	110	72.1	25.0	115	36.5	28.2	12.6
DC 2	143	163	56.9	113	69.7	25.1	115	37.2	30.0	10.2
DC 3	143	187	48.3	110	72.4	24.2	116	36.4	28.2	12.0
DC 4	143	163	56.7	113	69.1	25.4	114	39.2	29.9	10.3
DC 5			47.8		72.3	24.4	117	37.0	28.4	12.3
DC 6			56.6		69.0	25.7	114	38.7	29.9	10.0
DC 7			48.3		73.0	24.3	116	37.0	28.6	12.7
DC 8			57.1		68.2	25.7	114	38.8	29.8	9.2
DC AVG.										
AC 1	143	178	52.4	113	70.9	24.8	114	37.5	29.0	11.1
AC 2	143	178	52.4	113	70.9	24.8	114	37.5	29.0	11.1
AC AVG.										
S.P.	+99.0	+161		+230			-140.3			
AC NOISE	.25	.19		.20						.25
POT RES.										

NOTE - #4 ELECTRODE UNDER PHONE WIRE W/ GROUNDED POLE

LINE PASSES UNDER POWER LINE AT ≈ 90° ≈ 700 ft

OF ELEC #1

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT DRAGOON
LINE 6 HALF N SP. 1 DATE 5/6/65

SEND	4-5	3-4	2-3	1-2		4-5	3-4		2-3	1-2		CAL 1	
RECEIVE	4			5		5				6		ZAMP.	
RANGE	.1	.03	.03	.01		.03	.01		.01	.01		3-4	
DC 1	34.2	20.1	11.7	6.21	5.97	18.1	8.72	9.61	8.20	8.07	3.52	3.60	207
DC 2	35.8	21.9	13.5	6.22	6.50	18.6	8.18	8.81	7.61	8.00	2.98	3.01	207
DC 3	34.5	20.3	11.6	6.03	5.73	18.5	9.18	9.78	8.22	8.02	3.40	3.39	207
DC 4	35.6	21.8	13.4	6.28	6.51	18.8	7.91	8.68	7.98	8.38	2.99	3.06	207
DC 5	34.7	20.5	11.4	6.19	5.58	18.2	9.97		8.01	7.58	3.58	3.52	
DC 6	35.0	21.6	13.6	6.11	6.48	18.9	7.30		7.98	8.29	3.07	2.61	
DC 7	35.6	20.4	11.3	6.01	5.92	18.2	9.82		8.03	7.62	3.77	3.72	
DC 8	35.1	21.7	13.7	6.21	6.17	18.5	7.24		7.91	8.17	2.75	2.62	
DC AVG.													
AC 1	34.6	20.6	12.2	5.90		18.2	8.37		7.70		3.13		207
AC 2	34.5	20.6	12.2	5.90		18.2	8.37		7.71		3.13		207
AC AVG.													
S.P.	-78.3					-118.9							
AC NOISE				.14								.11	
POT RES.													

NOTE - GROUNDED STEEL FENCE AT ∡ 70° ≈ 50' N. OF STATION # 5600' - POWER LINE ∡ SAME ANGLE, ≈ 500' N. OF SAME STATION

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT 376-69
LINE 6 HALF N 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	0-10	10 →	20	20 →		30	30 →			40
RANGE										
VOLTAGE	130V	140	130V	120	140	130	90V	120	140	130
CURRENT	5Amp	6Amp	5A	5Amp	6Amp	5A	6A	5A	6Am	5Amp
SEND	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2		CAL
RECEIVE	40 →			50	50 →			60		3-4
RANGE										
VOLTAGE	90V	120	120	130	90	120	140	130		120V
CURRENT	6A	5A	5A	5A	6A	5A	6A	5A		2Amp

FREQUENCIES 1.0 0.1
SENDER NO. MK 3
OPERATOR
RECEIVER NO.
OPERATOR

COMMENTS:

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 6 SPREAD 1 LOOKING NW 5/7/69 A=1000 FEET, FREQUENCIES .10 AND 1.0

6.000	5.000	6.000	6.000	5.000	6.000	5.000	6.000	5.000	6.000	I	5.000	6.000	5.000	6.000	5.000	6.000	5.000	6.000	2.000	
176	145	630	258	666	347	212	109	361	212	DC	619	438	164	115	324	268	113	840	207	LEFT
173	145	620	256	669	338	212	117	339	206		685	441	172	102	327	258	115	886	208	SIDE
		628				214	106	361	209		607	440	157	126	324	260	113	839		
		619				211	119	337	208		692	465	174	99	326	268	112	881		
		628				214	106	365	207		599	421	158	128	325	263	112	802		
		620				211	120	330	209		718	479	173	88	322	263	117	898		
		628					106	370	206		587	416	155	136	327	262	108	828		
		620					122	329	211		726	482	177	90	325	265	112	862		
												400		118				880		
												497		98				844		
												397		125				818		
												506		96				900		
												390		132				831		
												510		84				870		
												382		140				831		
												514		80				842		

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
349	290	1250	514	1335	685	424	226	700	418	DC	1304	879	336	217	651	526	228	1726	415
		1248				426	223	700	415	SUMS	1292	881	329	228	651	518	228	1725	
		1247				425	225	698	417		1299	905	331	225	650	528	225	1720	
		1247				425	225	702	415		1291	886	332	227	651	531	224	1683	
		1248				425	226	695	416		1317	900	331	216	647	526	229	1700	
		1248					226	700	415		1305	895	328	224	649	525	225	1726	
		1248					228	699	417		1313	898	332	226	652	527	220	1690	
												882		208				1742	
												897		216				1724	
												894		223				1662	
												903		221				1718	
												896		228				1731	
												900		216				1701	
												892		224				1701	
												896		220				1673	

0.0	0.0	.2	0.0	0.0	0.0	-.2	.2	.1	.4	DC	.1	-1.6	1.4	-1.9	.1	.0	1.1	1.0	0.0
		0.0				.2	-1.1	.1	-.3	DEVS	-.8	-1.4	-.7	3.0	.1	-1.5	1.1	1.0	
		-.1				0.0	-.3	-.2	.2		-.3	1.3	-.1	1.7	-.0	.4	-.3	.7	
		-.1				0.0	-.3	.4	-.3		-.9	-.9	.2	2.6	.1	1.0	-.7	-1.5	
		0.0				0.0	.2	-.6	-.0		1.1	.7	-.1	-2.4	-.5	.0	1.5	-.5	
		0.0					.2	.1	-.3		.2	.2	-1.0	1.2	-.2	-.2	-.3	1.0	
		0.0					1.1	-.0	.2		.8	.5	.2	2.1	.3	.2	-2.5	-1.1	
												-1.3		-6.0				2.0	
												.4		-2.4				.9	
												.0		.8				-2.7	
												1.1		-.1				.6	
												.3		3.0				1.3	
												.7		-2.4				-.4	
												-.2		1.2				-.4	
												.3		-.6				-2.1	

1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6	
174.5	145.0	62.40	257.0	66.75	34.25	212.5	112.8	34.96	20.81	DCA	65.15	44.68	16.56	11.06	32.51	26.29	11.28	8.541	207.5

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178.0	148.0	63.10	259.0	66.00	34.40	217.0	114.0	34.70	20.60	AC1	65.40	45.10	16.40	11.00	33.10	25.70	11.00	8.360	213.0	
178.0	148.0	63.10	259.0	66.00	34.20	217.0	114.0	34.70	20.60	AC2	65.30	45.10	16.50	11.00	32.90	25.70	11.00	8.370	213.0	
178.0	148.0	63.10	259.0	66.00	34.30	217.0	114.0	34.70	20.60	ACA	65.35	45.10	16.45	11.00	33.00	25.70	11.00	8.365	213.0	
84.10	83.86	120.3	123.9	154.4	165.1	122.9	217.4	202.2	200.6	RHO	150.7	215.3	191.6	186.6	188.0	253.4	228.3	230.5	.964	DC CAL
.6	.6	1.5	1.9	3.8	2.5	.5	1.6	3.4	3.7	PFE	2.3	1.7	3.4	3.2	1.1	5.0	5.3	4.8	1.027	AC CAL
8	7	13	15	25	15	4	7	17	18	MCF	16	8	18	17	6	20	23	21		

5.000	6.000	5.000	5.000	6.000	5.000	6.000	5.000	6.000	5.000	I	6.000	5.000	5.000	5.000	6.000	5.000	6.000	5.000	2.000	
143	187	482	110	721	250	115	365	282	126	DC	342	201	117	621	181	872	820	352	207	RIGHT
143	163	569	116	697	251	115	392	300	102		358	219	135	622	186	818	761	298	207	SIDE
		483		724	242	116	366	282	120		345	203	116	603	185	918	822	340		
		567		691	254	114	392	299	103		359	218	134	628	188	791	798	299		
		478		723	244	117	370	284	123		347	205	114	619	182	997	801	358		
		566		690	257	114	387	299	100		350	216	136	611	189	730	798	307		
		483		730	243	116	370	286	127		350	204	113	601	182	982	803	377		
		571		682	257	114	388	298	92		351	217	137	621	185	724	791	275		
														592		961	807	360		
														650		881	800	301		
														573		978	802	339		
														651		868	838	306		
														558			758	352		
														648			829	261		
														592			762	372		
														617			817	262		

1	2	3	4	5	6	7	8	9	10	PT.	11	12	13	14	15	16	17	18	
286	350	1051	226	1418	501	230	757	582	228	DC	700	420	252	1243	367	1690	1581	650	414
		1052		1421	493	231	458756	582	222	SUMS	703	422	251	1225	371	1736	1583	638	
		1050		1415	496	230	458756	581	223		704	421	250	1231	373	1709	1620	639	
		1045		1414	498	231	762	583	226		706	423	248	1247	370	1788	1599	657	
		1044		1413	501	231	757	583	223		697	421	250	1230	371	1727	1599	665	
		1049		1420	500	230	757	585	227		700	420	249	1212	371	1712	1601	684	
		1054		1412	500	230	758	584	219		701	421	250	1222	367	1706	1594	652	
														1213		1685	1598	635	
														1242		1842	1607	661	
														1223		1859	1602	640	
														1224		1846	1640	645	
														1209			1596	658	
														1206			1587	613	
														1240			1591	633	
														1209			1579	634	

0.0	0.0	.2	0.0	.1	.5	-.2	12.6	-.1	1.8	DC	-.2	-.3	.8	1.5	-.8	-3.7	-1.1	.5	0.0
		.3		.3	-1.1	.2	-31.9	-.1	-.9	DEVS	.2	.2	.4	-.0	.3	-1.1	-1.0	-1.4	
		.1		-.1	-.5	-.2	-31.9	-.3	-.4		.3	-.0	0.0	.5	.8	-2.6	1.3	-1.2	
		-.4		-.2	-.1	.2	13.3	.0	.9		.6	.4	-.8	1.8	0.0	1.9	.0	1.6	
		-.5		-.2	.5	.2	12.6	.0	-.4		-.7	-.0	0.0	.4	.3	-1.6	.0	2.8	
		-.0		.3	.3	-.2	12.6	.4	1.3		-.2	-.3	-.4	-1.1	.3	-2.4	.2	5.7	
		.4		-.3	.3	-.2	12.7	.2	-2.2		-.1	-.0	0.0	-.3	-.8	-2.8	-.3	.8	
														-1.0		-4.0	-.0	-1.8	
														1.4		5.0	.5	2.2	
														-.2		6.0	.2	-1.1	
														-.1		5.2	2.6	-.3	
														-1.3			-.2	1.7	
														-1.6			-.7	-5.2	

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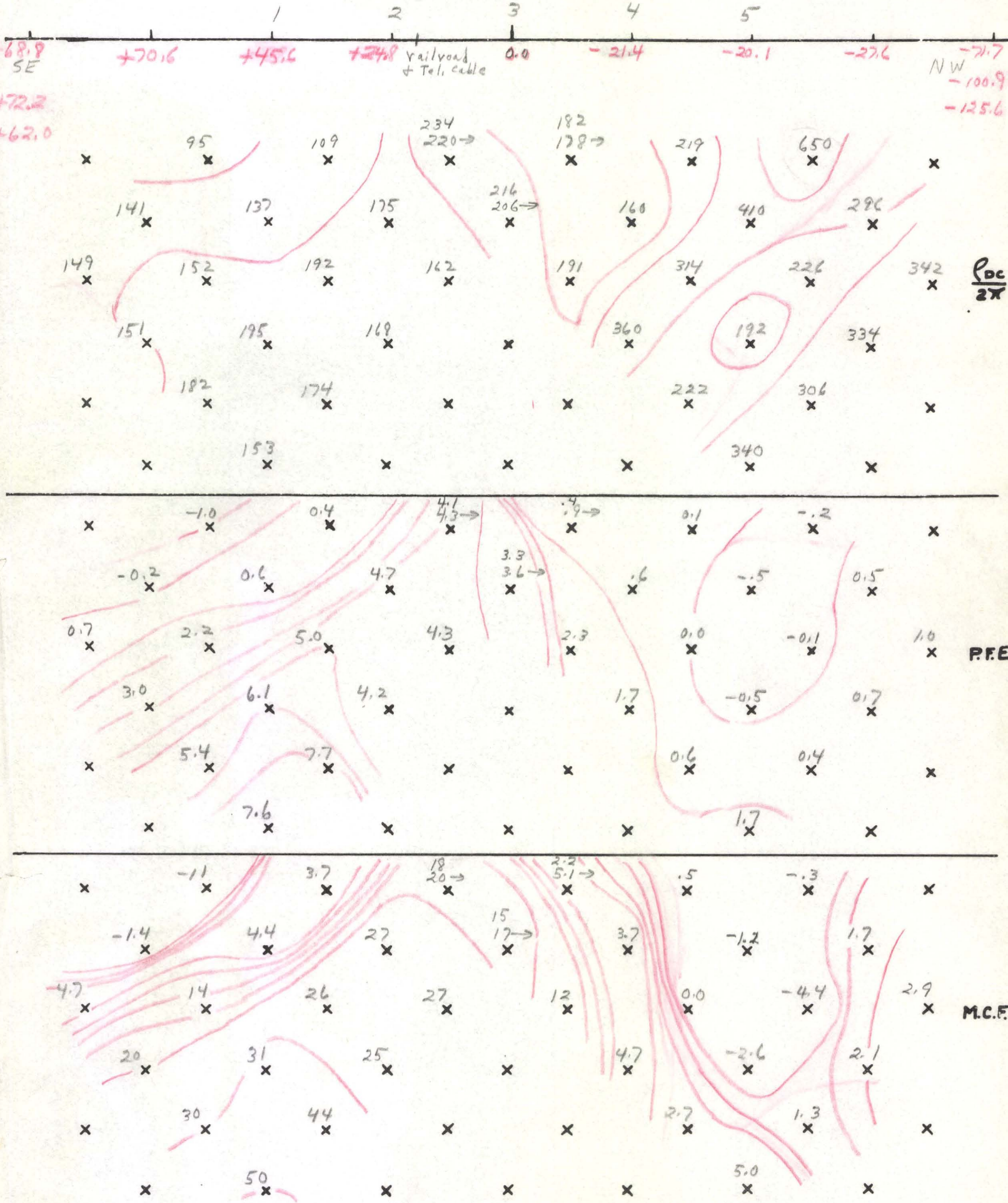
												1.2			-.5	-2.2				
												-1.3			-1.2	-2.0				
1	1	2	1	2	3	1	2	3	4	N	2	3	4	5	3	4	5	6		
143.0	175.0	52.46	113.0	70.81	24.92	115.2	~~33.62~~ 39.8	29.14	11.20	DCA	35.08	21.06	12.50	6.125	18.50	8.773	7.992	3.235	207.0	
143.0	178.0	52.40	113.0	70.90	24.80	114.0	37.50	29.00	11.10	AC1	34.60	20.60	12.20	5.900	18.20	8.370	7.700	3.130	207.0	
143.0	178.0	52.40	113.0	70.90	24.80	114.0	37.50	29.00	11.10	AC2	34.50	20.60	12.20	5.900	18.20	8.370	7.710	3.130	207.0	
143.0	178.0	52.40	113.0	70.90	24.80	114.0	37.50	29.00	11.10	ACA	34.55	20.60	12.20	5.900	18.20	8.370	7.705	3.130	207.0	
82.90	84.54	121.7	65.51	136.8	144.5	55.66	~~77.96~~ 87.5	140.8	129.9	RHO	67.78	122.1	144.9	124.3	89.37	101.7	135.1	105.0	.966	DC CAL
0.0	-1.7	.1	0.0	-.1	.5	1.1	~~+10.3~~ 0.9	.5	.9	PFE	1.5	2.2	2.5	3.8	1.6	4.8	3.7	3.3	1.000	AC CAL
0	-20	1	0	-1	3	19	~~-133~~ 10	3	7	MCF	23	18	17	31	18	47	28	32		

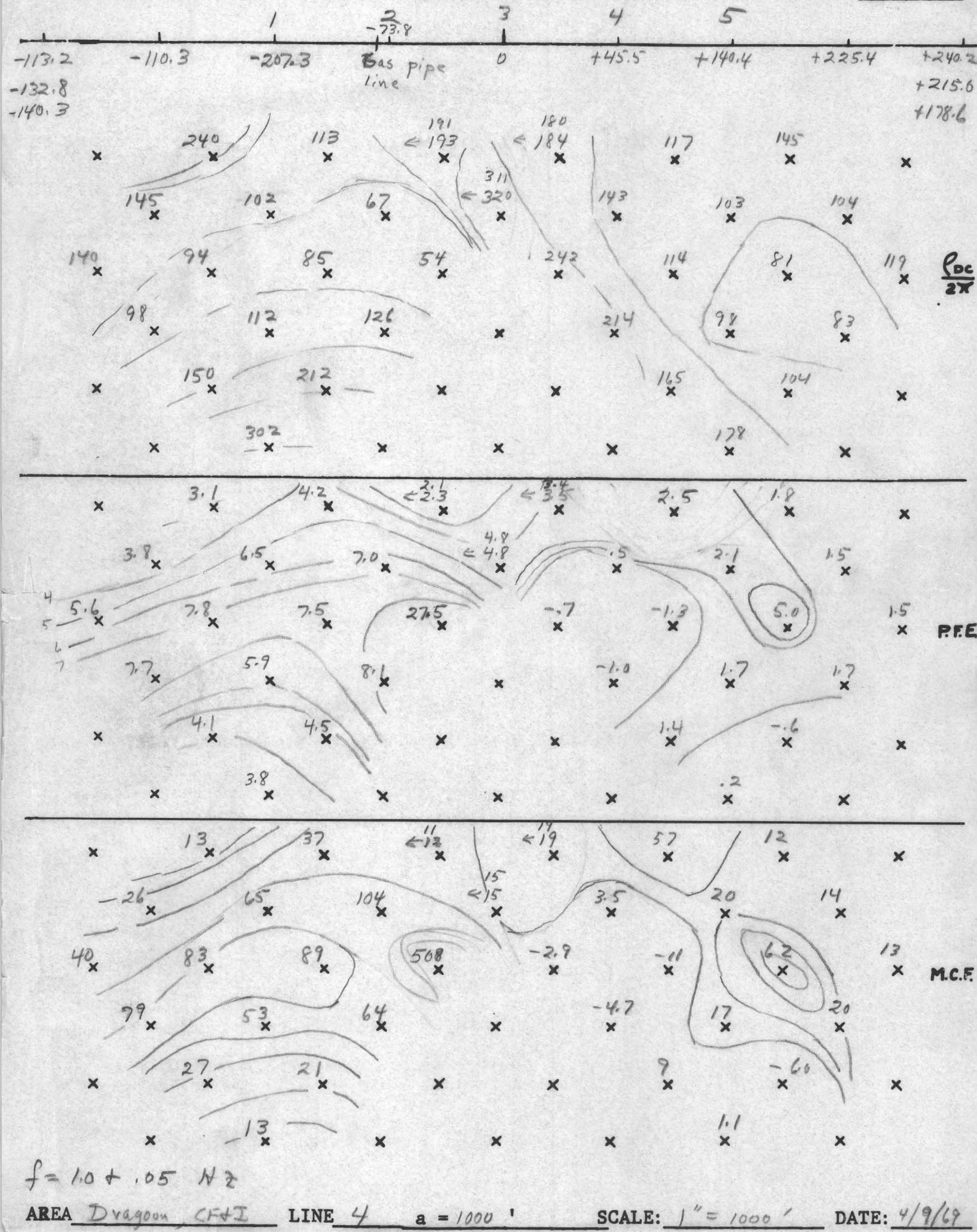
HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING S60° W



f = 1.0 ± .05 Hz.

AREA Dragoon, C.F.&I. LINE 5 a = 1000' SCALE: 1" = 1000' DATE: 4/10/69

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N40°W



f = 1.0 + .05 Nz

AREA Dragoon CF&I LINE 4 a = 1000' SCALE: 1" = 1000' DATE: 4/9/69

HEINRICHS GEOEXPLORATION COMPANY

INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project 376-69 Line 5/NW Field date 4/10/69 Data page_____ Comp. date 4/10/69. Comp by NOR

(A) Send												
(B) Receive												
(C) n separation												
(D) I	2.0	2.0	2.0	1.0	2.0	2.0	1.0	1.0	2.0	2.0		
(E) Vdc (avg)	307.	249.	72.2	153.6	56.0	26.7	454.	72.5	44.0	25.1		
(F) DCcal												
(G) Kn x 10^{-3}	3	3	12	3	12	30	3	12	30	60		
(H) ρ dc=ExFxGx10^3/D	220	178	206	219	160	191	650	410	314	360		
(I) Vac Σ	288.5	241.5	68.3	150.7	54.6	25.6	447.	71.4	43.1	24.2		
(J) AC noise x 2												
(K) Vac(corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	4.3	.9	3.6	0.1	.6	2.3	-.2	-.5	0.0	1.7		
(O) MCF=(M-1)(10^5)/H	20	5.1	17	.46	3.7	12	-.31	-1.2	0.0	4.7		

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send											Cal.	
(B) Receive												
(C) n separation												
(D) I	1.0	1.0	2.0	2.0	1.0	1.0	2.0	2.0			2.0	
(E) Vdc (avg)	51.7	15.79	13.47	8.86	23.9	11.66	12.20	8.49			418.	
(F) DCcal											.478	
(G) Kn x 10^{-3}	12	30	60	105	30	60	105	168				
(H) ρ dc=ExFxGx10^3/D	296	226	192	222	342	334	306	340				
(I) Vac Σ	50.4	15.51	13.26	8.63	23.2	11.37	11.90	8.18			410	
(J) AC noise x 2												
(K) Vac (corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.											.980	
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	0.5	-0.1	-0.5	0.6	1.0	0.7	0.4	1.7				
(O) MCF=(M-1)(10^5)/H	1.7	-.44	-2.6	2.7	2.9	2.1	1.3	5.0				

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

Project 326-69 Line 5/SE Field date 4/10/69 Data page_____ Comp. date_____. Comp by WOR

(A) Send												
(B) Receive												
(C) n separation												
(D) I	1.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0		
(E) Vdc (avg)	126.7	163.7	37.7	153.0	30.6	11.13	132.9	47.8	13.46	5.86		
(F) DCcal												
(G) Kn x 10^{-3}	3	3	12	3	12	30	3	12	30	60		
(H) ρ dc=ExFxGx10^3/D	182	234	216	109	175	162	95	137	192	168		
(I) Vac Σ	123.5	153.8	35.7	148.9	28.6	10.45	131.1	46.5	12.53	5.50		
(J) AC noise x 2												
(K) Vac(corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	.4	4.1	3.3	0.4	4.7	4.3	-1.0	0.6	5.0	4.2		
(O) MCF=(M-1)(10^5)/H	2.2	17.5	15.3	3.69	27	27	-10.5	4.4	26	25		

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

(A) Send											Cal.	
(B) Receive												
(C) n separation												
(D) I	2.0	2.0	1.0	1.0	2.0	2.0	1.0	1.0			1.0	
(E) Vdc (avg)	49.3	21.3	6.82	3.47	20.8	10.55	3.61	1.91			210	
(F) DCcal											.477	
(G) Kn x 10^{-3}	12	30	60	105	30	60	105	168				
(H) ρ dc=ExFxGx10^3/D	141	152	195	174	149	151	182	153				
(I) Vac Σ	48.3	20.4	6.28	3.15	20.2	10.01	3.35	1.74			205	
(J) AC noise x 2												
(K) Vac (corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.											.977	
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	-0.2	2.2	6.1	7.7	0.7	3.0	5.4	7.6				
(O) MCF=(M-1)(10^5)/H	-1.4	14	31	44	4.7	20	30	50				

HEINRICHS GEOEXPLORATION COMPANY
INDUCED POLARIZATION SURVEY COMPUTATION SHEET

Page_____

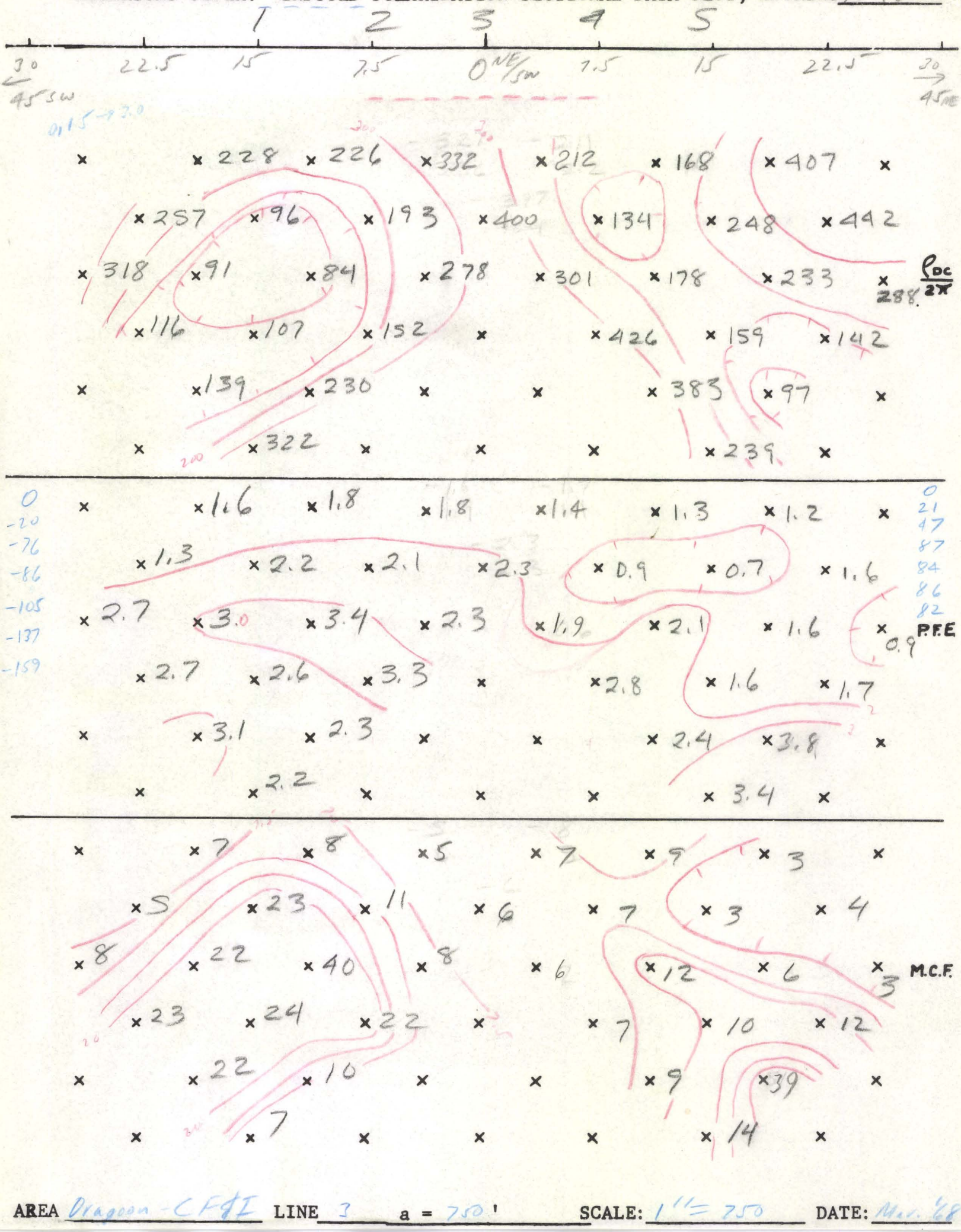
Project 326-69 Line 4/NE Field date_____ Data page_____ Comp. date_____. Comp by WHR

(A) Send	1-2	2-3	1-2	3-4	2-3	1-2	4-5	3-4	2-3	1-2		
(B) Receive	0-10	10-20 →		20-30 →			30-40 →					
(C) n separation												
(D) I	2.0	2.0	2.0	3.0	2.0	2.0	3.0	3.0	2.0	2.0		
(E) Vdc (avg)	270	254	109.9	248	50.6	34.2	309.	533	16.2	15.10		
(F) DCcal												
(G) Kn x 10^{-3}	3	3	12	3	12	30	3	12	30	60		
(H) ρ dc=ExFxGx10^3/D	191	180	311	117	143	242	145	103	114	214		
(I) Vac Σ	258.	240.	102.5	236.	49.2	33.6	296.	50.9	16.0	14.88		
(J) AC noise x 2												
(K) Vac(corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.												
(M) ρ dc/ρac=ExL/K												
(N) PFE=(M-1)(10^2)	2.1	3.4	4.8	2.5	.5	-.7	1.8	2.1	-1.3	-1.0		
(O) MCF=(M-1)(10^5)/H	11	19	15	57	3.5	-2.9	12	20	-11	-4.7		

Project_____ Line_____ Field date_____ Data page_____ Comp. date_____ Comp by_____

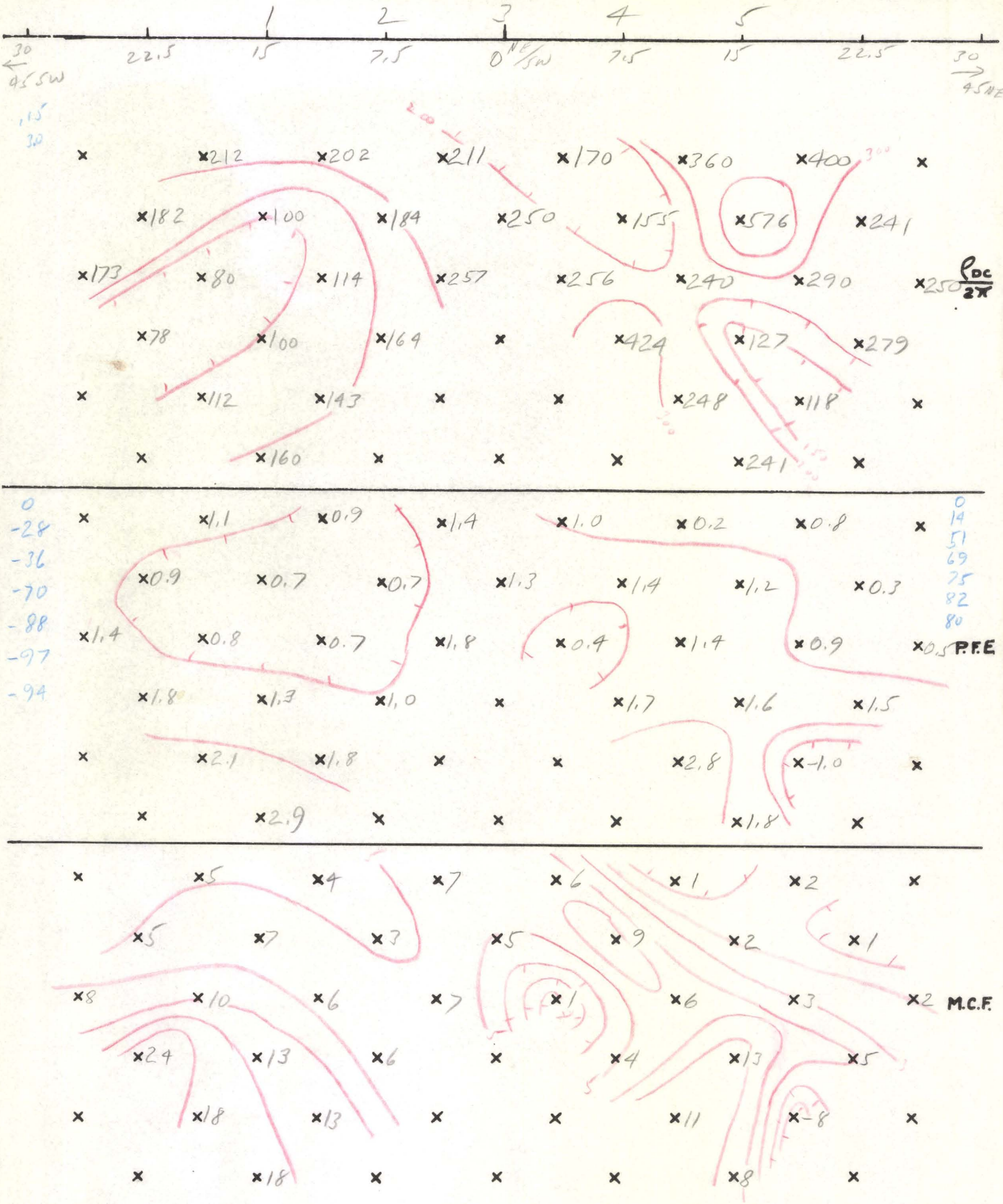
(A) Send	4-5	3-4	2-3	1-2	4-5	3-4	2-3	1-2			Cal	
(B) Receive	40-50 →				50-60 →							
(C) n separation												
(D) I	3.0	3.0	2.0	2.0	3.0	3.0	2.0	2.0			2.0	
(E) Vdc (avg)	57.7	122	6.95	7.19	25.3	8.82	4.18	4.49			424.	
(F) DCcal											.472	
(G) Kn x 10^{-3}	12	30	60	105	30	60	105	168				
(H) ρ dc=ExFxGx10^3/D	104	81	98	165	119	83	104	178				
(I) Vac Σ	55.5	16.0	6.67	6.93	24.3	8.46	4.11	4.37			413.5	
(J) AC noise x 2												
(K) Vac (corr) $=\sqrt{I^2 - J^2}$												
(L) AC-DC cal.											.975	
(M) ρdc/ρac =ExL/K												
(N) PFE=(M-1)(10^2)	1.5	5.0	1.7	1.4	1.5	1.7	-.6	.2				
(O) MCF=(M-1)(10^5)/H	14	62	17	9	13	20	-6	1.1				

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N40W



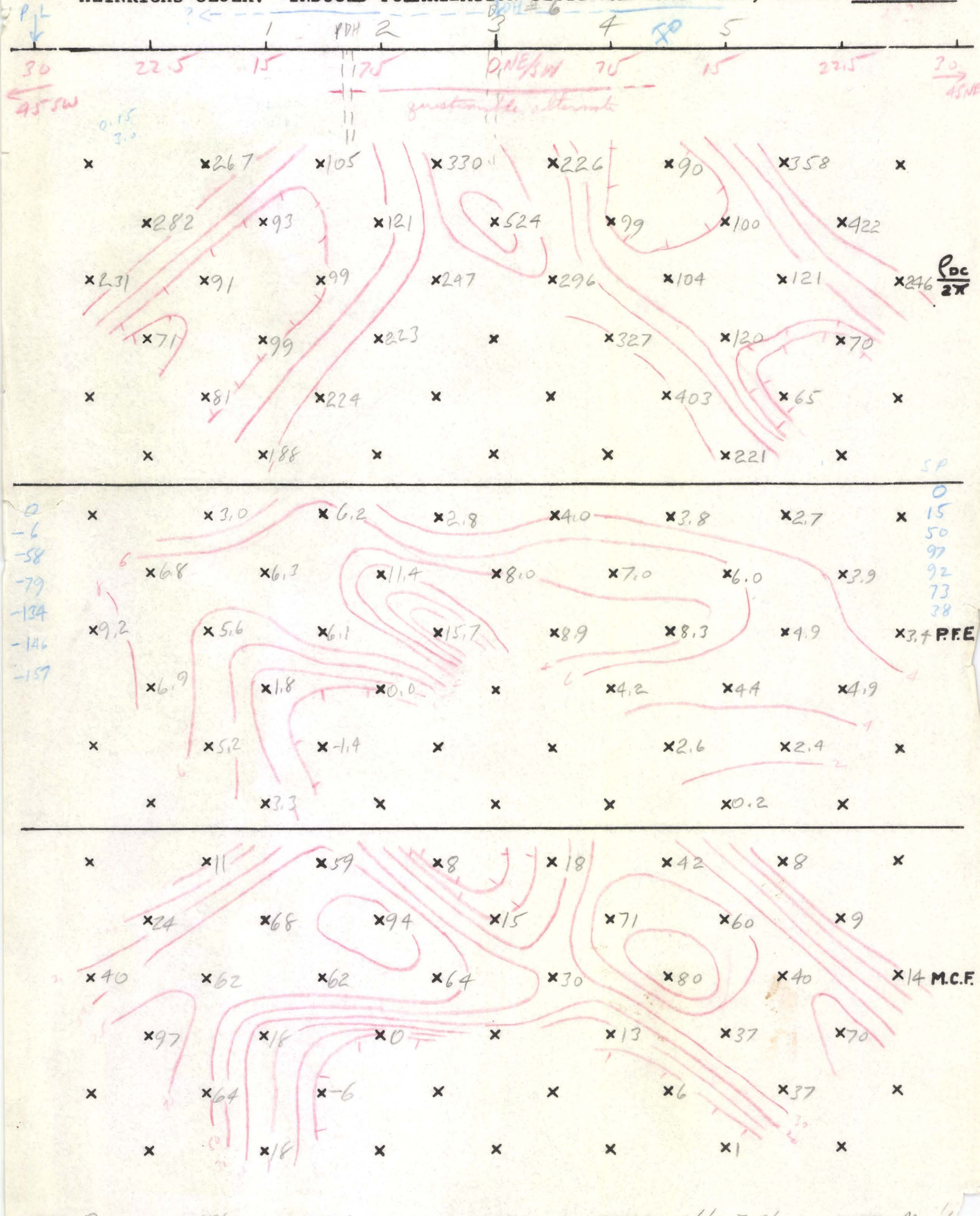
AREA Dragoon - CF&I LINE 3 a = 750' SCALE: 1" = 750 DATE: Nov. '68

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N40 W



AREA Dragoon-CF#1 LINE 2 a = 750' SCALE: 1" = 750' DATE: Mar. 68

HEINRICHS GEOEX. INDUCED POLARIZATION SECTIONAL DATA PLOT, LOOKING N40°W



AREA Dragoon - GEI LINE 1 a = 750 ' SCALE: 1" = 750' DATE: Mar. 6

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 6 SPREAD 1 LOOKING NW 5/7/69 A=1000 FEET, FREQUENCIES .10 AND 1.0

G fonce G fonce PL G fonce PL

1 2 3 4 5

60SW 50 40 30 20 10 0SW/NE 10 20 30 40 50 60NE SURFACE

RHO/2PI

N														
1	X	X	X	X123	X124	X83 ~~84~~	X85 ~~84~~	X66	X56	X	X	X	X	
2	X	X	X	X151	X217	X154	X122 ~~120~~	X137	X78	X68	X	X	X	
3	X	X	X188	X215	X202	X165	X144	X141	X122	X89	X	X	X	
4	X	X	X	X253	X192	X201	X	X130	X145	X102	X	X	X	
5	X	X	X	X228	X187	X	X	X124	X135	X	X	X	X	
6	X	X	X	X	X230	X	X	X	X105	X	X	X	X	

121 88

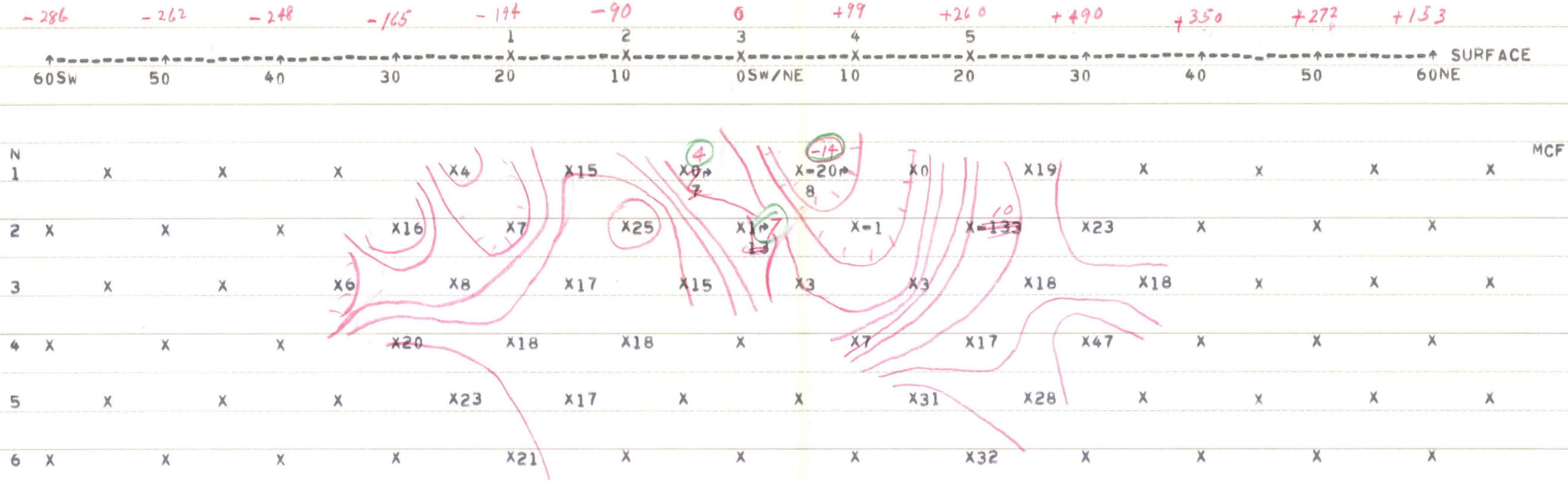
1 2 3 4 5

60SW 50 40 30 20 10 0SW/NE 10 20 30 40 50 60NE SURFACE

PFE

N														
1	X	X	X	X.5	X1.9	X0 ~~0~~ ~~.6~~	X ~~-1.7~~ ~~.6~~	X0.0	X1.1	X	X	X	X	
2	X	X	X	X2.3	X1.6	X3.8	X ~~.1~~ ~~1.5~~	X-.1	X ~~-10.3~~	X1.5	X	X	X	
3	X	X	X1.1	X1.7	X3.4	X2.5	X.5	X.5	X2.2	X1.6	X	X	X	
4	X	X	X	X5.0	X3.4	X3.7	X	X.9	X2.5	X4.8	X	X	X	
5	X	X	X	X5.3	X3.2	X	X	X3.8	X3.7	X	X	X	X	
6	X	X	X	X	X4.8	X	X	X	X3.3	X	X	X	X	

0.3 -1.2 0.8 0.9


-286 -262 -248 -165 -194 -90 0 +99 +260 +490 +350 +272 +153
1 2 3 4 5
SURFACE
60SW 50 40 30 20 10 0SW/NE 10 20 30 40 50 60NE
N
MCF
1 X X X X4 X15 X0 X-20 X0 X19 X X X X
2 X X X X16 X7 X25 X1 X-1 X-133 X23 X X X
3 X X X6 X8 X17 X15 X3 X3 X18 X18 X X X
4 X X X X20 X18 X18 X X7 X17 X47 X X X
5 X X X X23 X17 X X X31 X28 X X X X
6 X X X X X21 X X X X32 X X X X

CF + I Dragoon Ariz.

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 5 SPREAD 1 LOOKING N60S (S W) 4/10/69 A=1000 FEET, FREQUENCIES .05 AND 1.0

	60SE	50	40	30	20	10	0SE/NW	10	20	30	40	50	60NW
					1	2	3	4	5				SURFACE

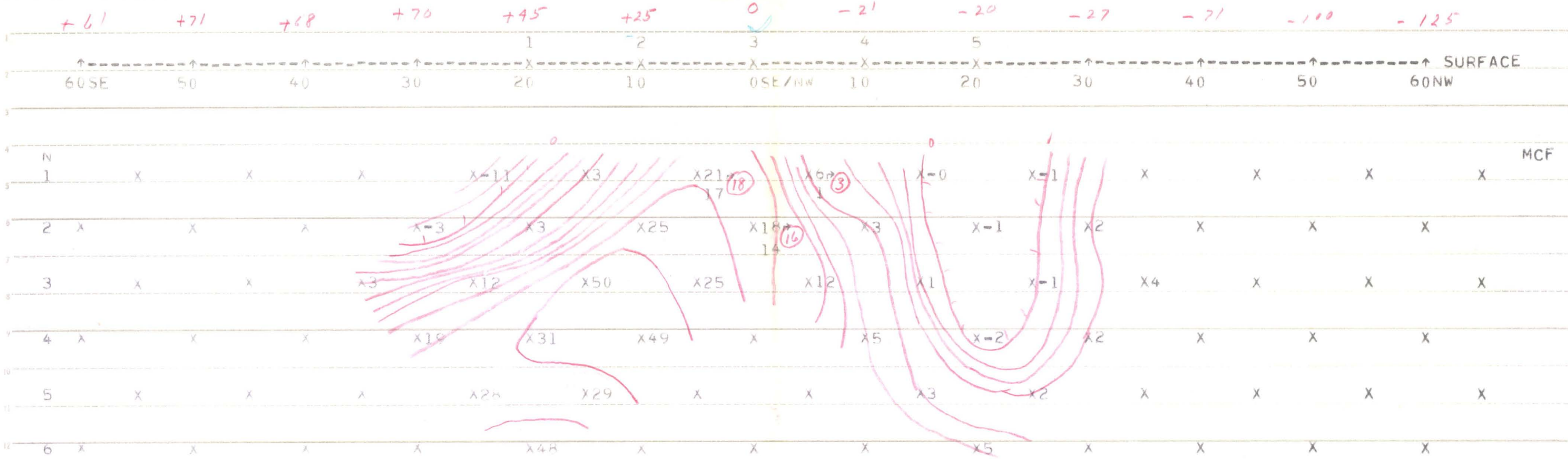
RHO/2PI

N														
1	X	X	X	X95	X109	X221 234 (227)	X179 181 (180)	X220	X652	X	X	X	X
2	X	X	X	X141	X137	X175	X207 215 (211)	X161	X416	X297	X	X	X
3	X	X	X149	X152	X~~18~~ 192	X159	X192	X316	X227	X344	X	X	X
4	X	X	X	X151	X195	X~~27~~ 167	X	X360	X193	X335	X	X	X
5	X	X	X	X180	X169	X	X	X223	X306	X	X	X	X
6	X	X	X	X	X153	X	X	X	X341	X	X	X	X

	60SE	50	40	30	20	10	0SE/NW	10	20	30	40	50	60NW
					1	2	3	4	5				SURFACE

PFE

N														
1	X	X	X	X-1.0	X.3	X4.5 3.9 (4.2)	X1.1 .1 (0.6)	X-.0	X-.4	X	X	X	X
2	X	X	X	X-.4	X.5	X4.4	X3.7 3.0 (3.4)	X.5	X-.4	X.5	X	X	X
3	X	X	X.5	X1.8	X4.8	X4.0	X2.3	X.2	X-.2	X1.2	X	X	X
4	X	X	X	X2.8	X6.0	X4.1	X	X1.7	X-.4	X.6	X	X	X
5	X	X	X	X5.0	X4.9	X	X	X.7	X.5	X	X	X	X
6	X	X	X	X	X7.3	X	X	X	X1.8	X	X	X	X

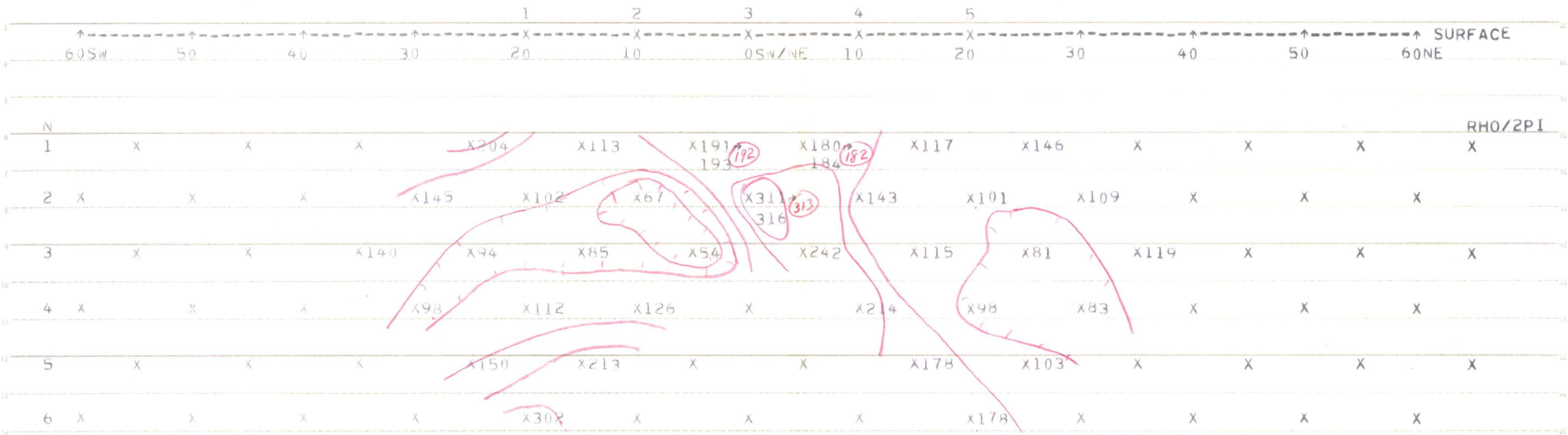


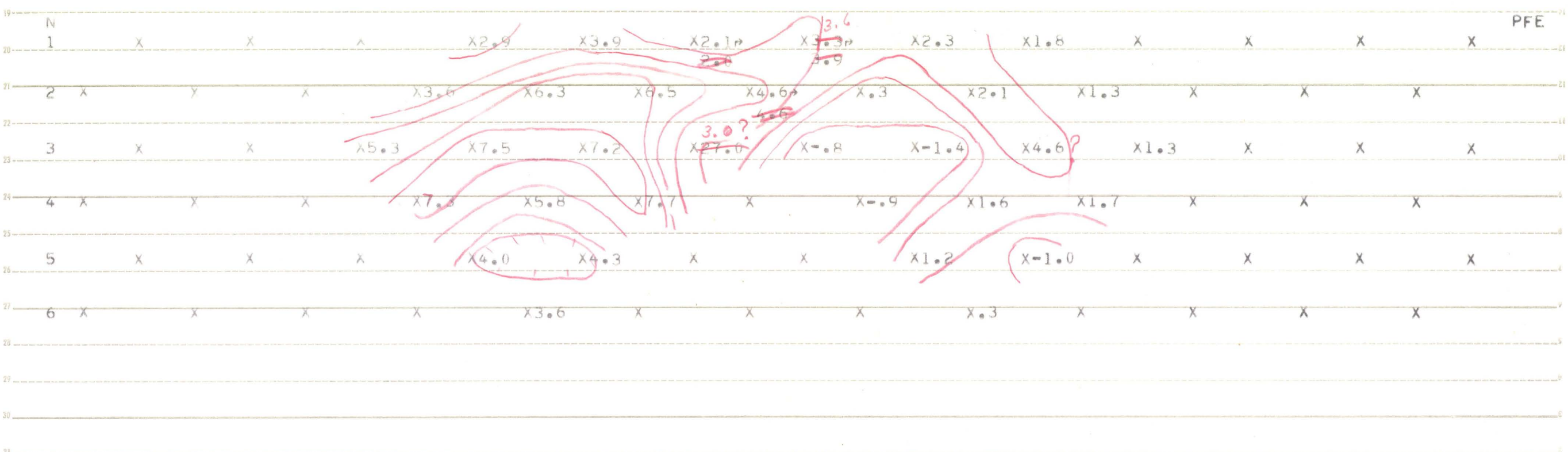
BCD INPUT *ENDFILE*INPUT
ERROR NUMBER 0065 DETECTED BY INPUTC AT ADDRESS 030503
CALLED FROM IPDATA AT 006464

ERROR SUMMARY

ERROR	TIMES
0065	0001

HEINRICHS GEOEX (MAR 69) JOB 376-69 LINE 4 SPREAD 1 LOOKING N40W 4/8/69 A=1000 FEET, FREQUENCIES .05 AND 1.0





	-142	-134	-114	-111	-208	-74	0	+46	+141	+226	+242	+217	+181
					1	2	3	4	5				
	60SW	50	40	30	20	10	0SW/NE	10	20	30	40	50	60NE

SURFACE

MCF

N															
1		X		X		X	X14	X34	X11	X19	X19	X12	X	X	X	X
2	X		X		X	X25	X61	X97	X15	X2	X21	X12	X	X	X	
3		X		X	X38	X80	X85	X500	X-3	X-12	X57	X11	X	X	X	
4	X		X		X	X74	X52	X61	X	X-4	X16	X20	X	X	X	
5		X		X		X27	X20	X	X	X7	X-10	X	X	X	X	
6	X		X		X	X	X12	X	X	X	X1	X	X	X	X	

I.P. and Resistivity Survey

Dragoon Area

Cochise County, Arizona

C.F.&I. Steel Corporation
Job #376069

INDUCED POLARIZATION AND RESISTIVITY SURVEY

OF PART OF THE

DRAGOON AREA

COCHISE COUNTY, ARIZONA

For

C. F. & I. Steel Corporation

May 1969

By

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

Job # 376-19

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1 Gradient Array Induced Polarization Location and Interpretation Plan, Self Potential Contours

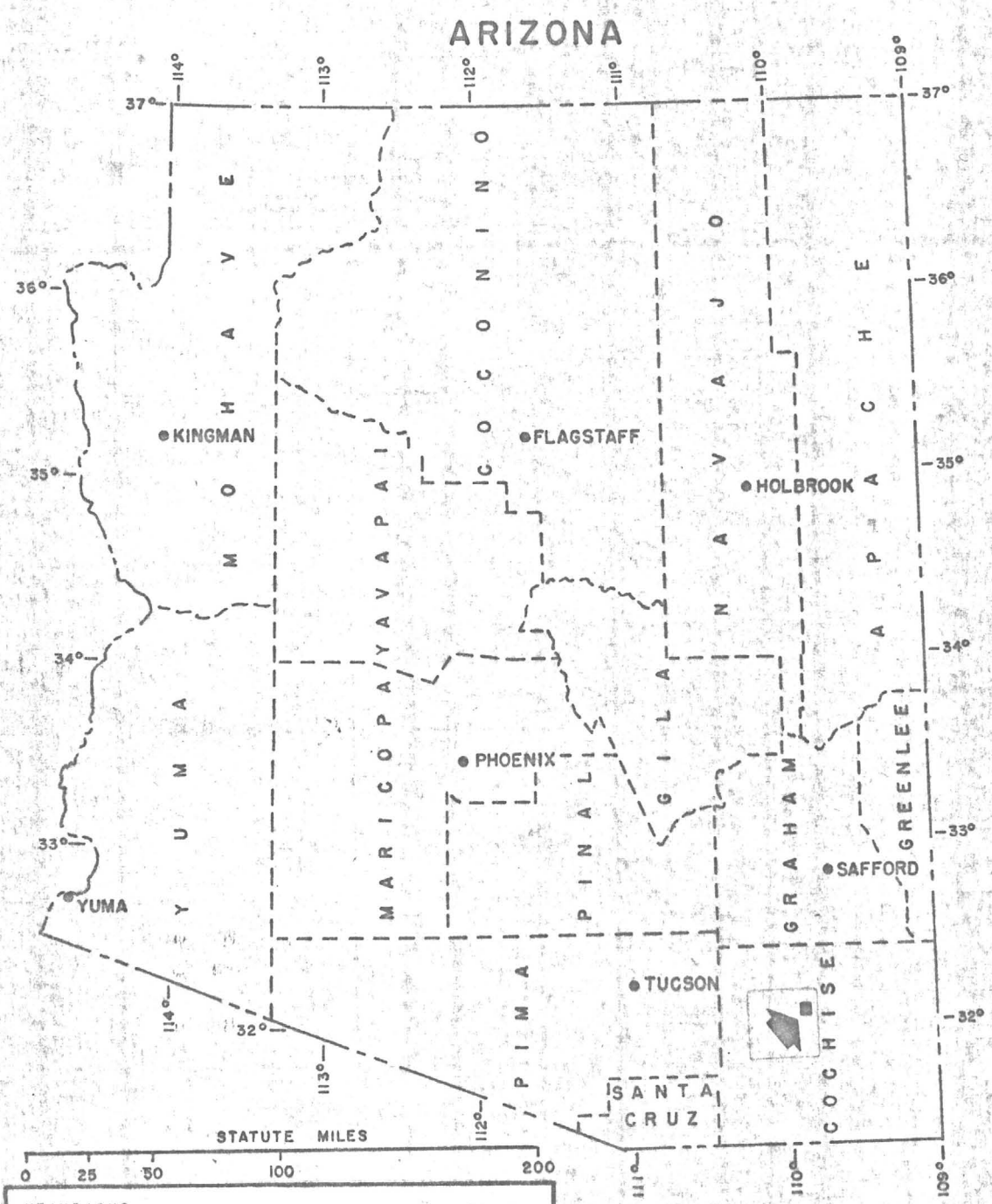
1 Gradient Array Induced Polarization Location and Interpretation Plan, Percent Frequency Effect Contours

1 Gradient Array Induced Polarization Location and Interpretation Plan, Metallic Conduction Factor Contours

1 Gradient Array Induced Polarization Location and Interpretation Plan, Apparent Resistivity Contours

3 Sectional Data Sheets

GENERAL LOCATION OF DRAGOON AREA FOR C F & I STEEL CORPORATION



HEINRICHS
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GEOPHYSICAL ENGINEERS

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SYDNEY VANCOUVER

INTRODUCTION

At the request of Mr. Jim Brooks and on behalf of C. F. & I. Steel Corporation, Heinrichs Geoexploration Company completed an induced polarization survey in the Dragoon Area, Cochise County, Arizona. This particular project follows a previous survey Heinrichs Geoexploration Company completed in March 1968 and the start of a drilling program by C. F. & I. Steel Corporation which is still in progress. The I.P. field work was completed during the periods from April 8 to April 16, 1969 and from May 7 to May 8, 1969.

I. P. data were obtained with the dual frequency technique and employed two different electrode configurations. The conventional collinear dipole-dipole electrode array with an "a" spacing of 1,000 feet and sending frequencies of 1.0 Hz and 0.05 Hz was used on three lines, resulting in 36,000 feet of surface coverage and 21,000 feet of "subsurface" plotted data. In addition, five lines were run employing a gradient electrode array and using frequencies of 1.0 Hz and 0.05 Hz, with the current electrodes 8,000 feet apart and a receiving dipole spacing of 200 feet. The gradient profiles obtained, totaled 20,800 feet in length.

The dipole-dipole data are presented on sectional data sheets, one for each line showing resistivity ($\rho_a / 2\pi$), percent frequency effect (PFE) and metallic conduction factor (MCF), contoured in section, with self potential (SP) in profile form. An induced polarization location and interpratation plan is also presented to show the surface projected anomalism in relation to the land net. For further details of interpretation theory, see the "Basis of the Induced Polarization Method" appended to the report. In addition to this, the gradient data has been presented in contoured plan form, one for each of the four parameters; apparent resistivity ($\rho_a / 2\pi$), PFE, MCF, and S.P.

Collateral information concerning existing drill hole locations and magnetic anomalism are plotted, in approximate location from data obtained from C. F. & I. Steel Corporation, on the Induced Polarization Location and Interpretation Plan superimposed on the abstracted results of the 1968 and 1969 I. P. surveys.

The purpose of the dipole-dipole survey was to extend the known I. P. anomalism and perhaps better define its depth limits. The gradient survey is intended to detail the known I. P.

I. P. anomalies and if possible to eliminate the ambiguous interpretation of the 1968 survey.

The Geoex field personnel on this job were Mr. William Rasmussen, crew chief; Mr. Blain Gaul and Mr. Steve Miller were technical assistants. Mr. Chris Ludwig and Mr. Paul Head are responsible for this report and overall project planning assisted by the Geoex staff in Tucson.

CONCLUSIONS AND RECOMMENDATIONS

To summarize correlation of data now on hand, the more important features of the geophysical surveys have been abstracted and presented graphically on the Induced Polarization Location and Interpretation Plan. In addition, alternate interpretations given on the 1968 Geoex survey have been reassessed and the presently preferred solutions re-plotted.

Horquilla limestone, as shown in U.S.G.S. Professional Paper No. 416, correlates very nicely with the dipole-dipole PFE anomalies and there are indications of a probable concealed extension of Horquilla to the southeast. These frequency effects are probably caused by localized concentrations of metallic lustered mineralization within the Horquilla, which are not ubiquitous throughout the entire formation. This is indicated by the lack of definite I. P. anomalism on Line 2 and by the presence of sulphides in the sedimentary portion of drill Hole #12. The presence of sulphides at about the 750 foot plus predicted depth in Hole #12, is considered to substantiate our earlier interpretation, although the amount of sulphide encountered so far is perhaps not quite sufficient to totally explain the strength of the anomaly. In order to test for the possibility of greater concentrations

of sulphides at depth, we recommend drilling a vertical hole located about 300 feet northeast of Hole #12 along Line 1, and programmed to at least 1,200 feet deep.

A C. F. & I. Steel Corporation Magnetic Map indicates a 250 gamma high which has been abstracted on our Plan Map along with the available drill hole locations. These magnetic effects are most probably due to magnetite in garnetite and tactite and less likely to be due to magnetite in the Horquilla limestone or the quartzite. It is also apparent that the second band of dipole-dipole anomalism is located at the east side of the magnetic anomaly and near the greater sulphide concentrations noted at Drill Holes #23 and #25. The gradient array frequency effects also tend to be the greatest along the edges of the magnetic anomaly. We predict that higher percentages of sulphides should be located in or near the contact zone between the Horquilla and the garnetite-tactite formations which lie to the northeast of the Horquilla as well as along the northeast edge of the garnetite-tactite formations themselves. To test this hypothesis we propose a vertical drill hole on Line 1 about 800 feet northeast of Drill Hole #12 and a vertical drill hole 300 feet east of Drill Hole #23. Proposed Drill Hole #4

is at 15 Southwest on Line 4. All four drill holes proposed should be no less than 1,200 feet deep to adequately test the geophysical work.

The Southern Pacific Railroad is a possible cause for the exceptional S.P. gradients noted in this area owing to electrical signals, etc. carried by the rails. Whether the cause be natural or artificial, may be an academic question. However, if it is a natural effect there could be an economically important cause nearby. We suggest that a reconnaissance S.P. survey be conducted to help identify the true cause of these effects.

Pipe lines in the area do not seem to have caused severe interference with either the dipole-dipole or gradient I. P. surveys and have not shown up in the S.P. data.

INTERPRETATION

DIPOLE-DIPOLE ARRAY

Line 4, Spread 1, a = 1,000 feet

Line 4 lies approximately 1,000 feet southeast and parallel to Line 1 from the 1968 survey. Line 4 is quite similar to Line 1 in its general aspects of symmetry and strength of polarization effects. The major difference is the rather distinct separation of I.P. anomalies on Line 4, which permits a choice to be made between the alternate interpretation on the 1968 survey. A weak anomaly is noted between 10 Southwest and 20 Southwest and has very weak fringes extending 500 feet on each side. Two pipe lines cross the line at about 12 Southwest or 13 Southwest and could account for at least part of this anomaly, however, correlation to Line 1 and to the Horquilla limestone outcrop strongly suggests a valid natural cause. This weak anomaly is due to a polarization source, probably at least 1,000 feet deep and is related to a relatively conductive zone noted in the resistivity plot. A second anomaly is centered at 10 Northeast and is possibly due to polarizing material within 500 feet of the surface.

The anomaly at 20 Southwest is somewhat characteristic of the anomaly expected from a thin, flat lying, polarizable body, probably less than one dipole thick and more than one dipole wide.

There is no self potential correlation to the I. P. effects, however, a very strong S.P. gradient, decreasing to the Southwest is present.

Line 6, Spread 1, a = 1,000 feet

This line is approximately 1,200 feet southeast and parallel to Line 4. The resistivity low and I. P. anomaly that have been traced southeast from Line 2 have essentially disappeared although there is still a very weak I. P. anomaly between 5 Southwest and 25 Southwest. Questionable, very weak frequency effects beginning at 30 Northeast and continuing Northeast off the survey are also observed.

The same highly unusual S.P. gradient effect noted on Line 4, and on the 1968 survey is present. The line also shows a reversal of this gradient at 30 Northeast, possibly indicating oxidizing sulphides to the northeast. This is supported by very weak questionable frequency effects at the extreme northeast end of Line 6.

Line 5, Spread 1, a = 1,000 feet

This line is oriented North 30° West, and centered at Station 7.5 Northeast on Line 1. The weak frequency effect anomaly noted on Line 6 is well defined and is the anomaly pattern expected from a relatively near surface, steeply dipping body. The weak anomaly noted on the older survey on Line 1 at about 10 Northeast tends to confirm the results of Line 6.

There is an S.P. gradient observed decreasing to the northeast which is seemingly unrelated to the I. P. anomalies.

GRADIENT ARRAY

The contoured S.P. data shows the same very strong gradient decreasing to the southwest as previously seen on all of the dipole-dipole lines. Zone of apparent high resistivity crosses the area bearing about North 60° West through Station 12 Northeast on Line 5 and a general area of low resistivity is noted over most of the southwest side of the surveyed grid.

A narrow, irregular PFE anomaly having an average value of about 2.5% running across the southwest end of the area was observed, possibly caused by the sulphides reported in drill holes numbered 6, 23, and 25. The corresponding MCF

anomalies are very weak and do not indicate much more than 0.5% total sulphides nor are they shaped well enough to permit accurate depth interpretation.

These gradient array I. P. anomalies lie on the southwest side and on the northeast side of the magnetic anomaly outlined by C. F. & I. Steel Corporation, possibly indicating sulphide or magnetite concentrations.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Paul A. Head

Paul A. Head
Geophysicist

Approved: W. E. Heinrichs, Jr.
Walter E. Heinrichs, Jr.
President & General Manager

Tucson, Arizona
21 May 1969

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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 embedded 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 those flowing 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 model as a guide. These capacitive-like properties are normally measured by one of three different field techniques.

In the time domain (pulse) method, a steady direct current is imposed in the ground for a few seconds and abruptly terminated so that the resulting capacitive-like voltage 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. This value is then normalized by the primary voltage measured while the steady current is on. The more area determined, the more capacitance or polarization the ground exhibits.

In the frequency domain (dual frequency) method, the percentage difference between the impedance (AC resistance) offered to a lower and 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. This phase delay also increases as polarization increases.

Almost all metallic lustered minerals, including most sulfides, for example: pyrite, chalcopyrite, chalcocite, bornite, and molybdenite are electrical conductors. The rocks and groundwater, with which they permeate or are permeated, are also ionic conductors; therefore, if an electrical current is made to flow through a sulfide deposit, it will polarize and often can be detected by the three methods described above.

The induced polarization property is not entirely unique with sulfides since magnetite, graphite (which are both metallic lustered) 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 response.

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 generally 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 particular application and the geophysicist's discretion.

The two frequencies we most commonly use are 0.05 and 3.0 cycles per second, or so called "D.C." and "A.C." modes respectively. 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 (natural earth) currents, and electrode polarization. The upper limit is determined by electromagnetic coupling effects which increase rapidly with increasing frequency.

In our standard reconnaissance field practice, five equally spaced collinear current electrodes are placed in the ground by burying aluminum foil in pits wetted with brine to insure good electrical contact. Observations are made using a symmetrical dipole-dipole electrode configuration where the distance (a) between adjacent receiver (potential) electrode pairs (or dipoles) is kept equal to the distance between adjacent sender (or current) 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 is 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 porportional to PFE and inversely porportional 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 page 5.

Selection of electrode spacings [(a) in Fig. 1] is determined by the objectives to be reached in a given survey. This spacing will range from very small (50 ft. or less) for very detailed and shallow surveys, up to 1,000 ft., or occasionally more, for broad, 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 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. An average rule of thumb, with a good contrast of electrical properties, using the symmetrical co-linear dipole-dipole system, and having data from 1 through 4 in "n" separations, is that two times the dipole length is the maximum 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 likely will not be detected. 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 ft. for the following: An overburden of more than 2,000 ft. 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 ft. of the surface generally would not be detected. A spherical or elongated cylindrical body whose diameter is much less than 1,000 ft. would be just out of the range of detectability. A dike-like or sill-like zone whose width is less than

100 ft. 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 or 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 three 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 width. Because of these factors, we usually use 500 to 1,000 ft. 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 in sections, 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 advantage 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. See the four appended examples of plotted field and theoretical sectional data sheets.

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 of this interpretational technique is that only a few simple geometric cases related to a relatively few numbers of layers have been theorectically developed. However, extremely valuable information can still be derived in alluvial and lake bed applications for depth to bedrock and groundwater purposes, etc.

In interpreting PFE's, values of 0 to 4% 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 effects, but tends to amplify the electromagnetic frequency effects making a correction imperative.

FORMULAS: $PFE = [\rho_{dc}/\rho_{ac} - 1]\ 100$

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.

$$\rho = 2\pi VK_n/I$$

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:

$$K_n = \tfrac{1}{2}an(n+1)(n+2) \quad \text{(Only for dipole-dipole arrays.)}$$

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:

$$\rho = [2\pi V/I][\tfrac{1}{2}an(n+1)(n+2)]$$

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

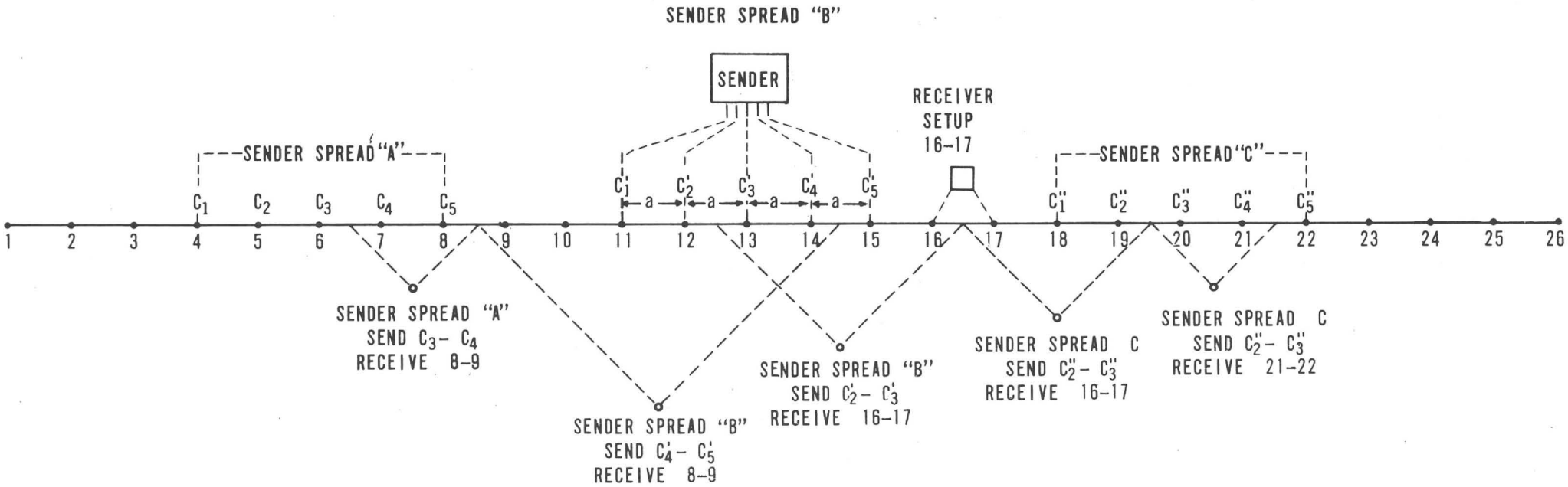
$$\rho/2\pi = VK_n/I = [V/I][\tfrac{1}{2}an\ (n+1)(n+2)]$$

$$MCF = 1000 \times PFE/[\rho_{dc}/2\pi]$$

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

References:
1. Wait, James R., "Overvoltage Research and Geophysical Applications", Pergamon Press, 1959.
2. "Mining Geophysics", Society of Exploration Geophysicists, Vol. I, Case Histories, October 1966.

Published by W. E. Heinrichs, Jr., et al., Engineering and Mining Journal, September 1967.

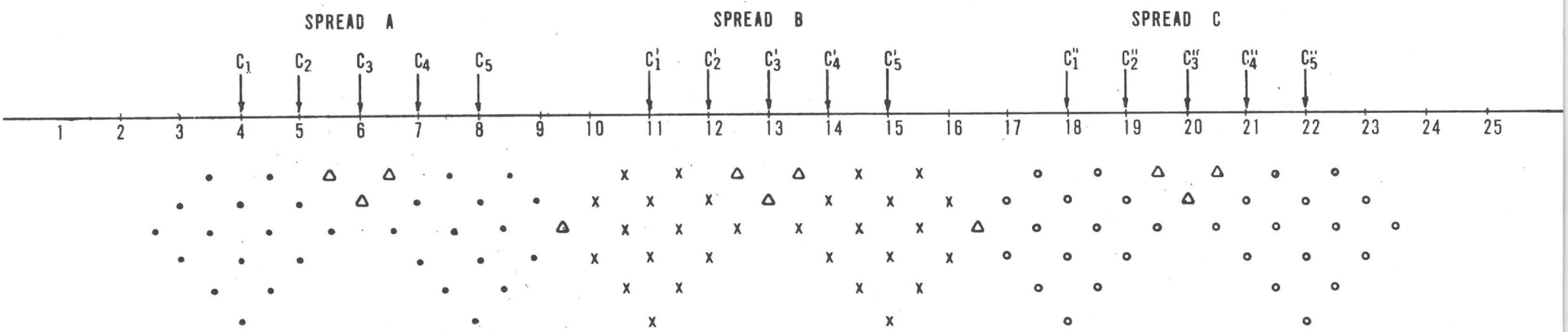


SCHEMATIC DIAGRAM ILLUSTRATING THE METHOD OF OBTAINING AND PLOTTING DIPOLE-DIPOLE I.P. DATA

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 Spread "B" when the receiver setup is between 14 and 15 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 setup between 16 and 17; 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 spread provides 33 data points.

Fig. 1

(DATA POINTS OBTAINED FROM THE THREE SPREADS OF FIGURE 1)



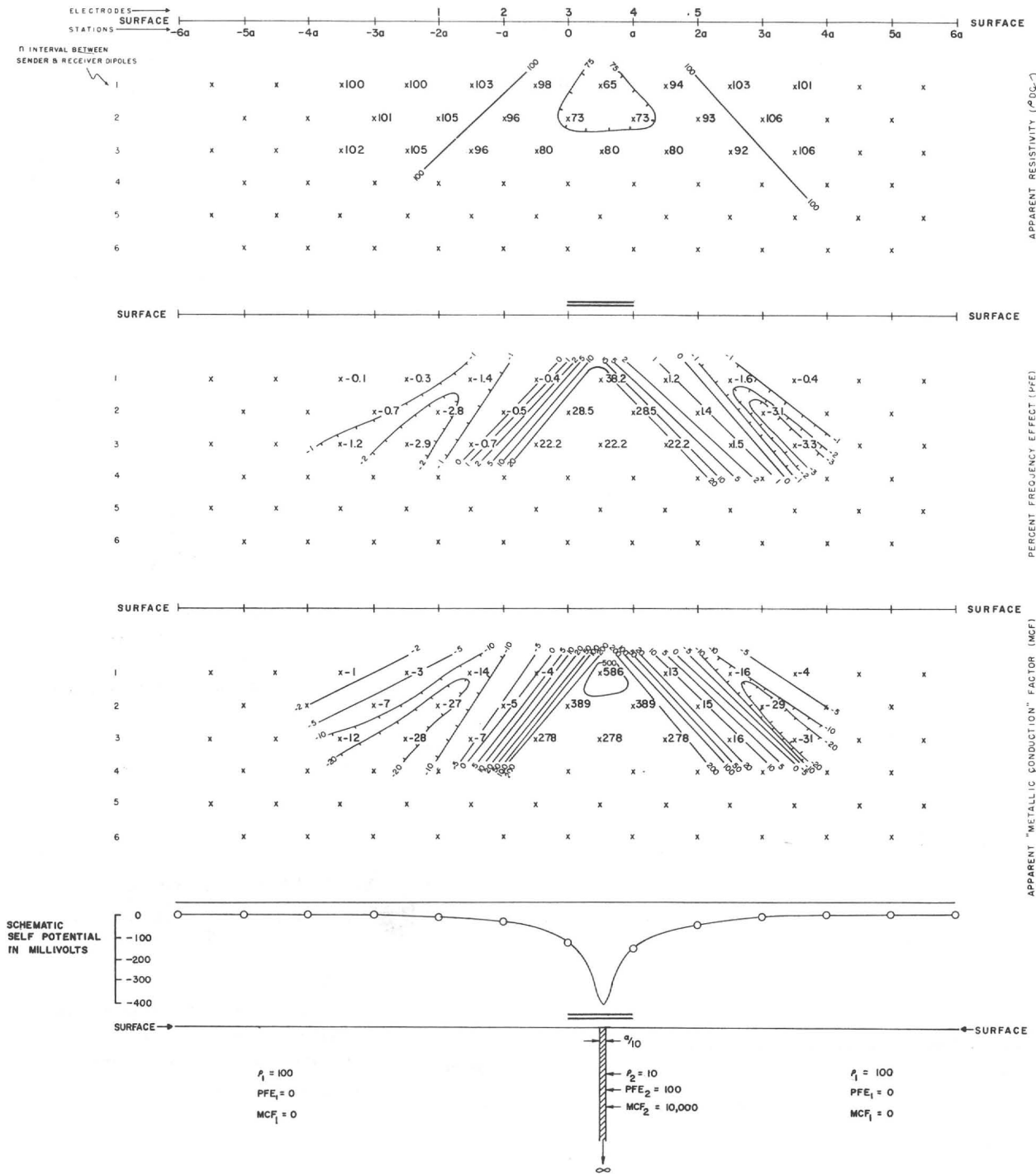
• SPREAD A

x SPREAD B

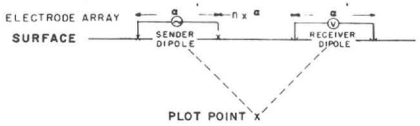
o SPREAD C

△ RECIPROCAL VALUES (TIE POINTS)

Fig. 2



EXPLANATION



RELATIVE ANOMALY STRENGTH

LOOKING NORMAL TO STRIKE

VERTICAL
TABULAR BODY

SECTIONAL DATA SHEET

LINE NO. ——

INDUCED POLARIZATION TRAVERSE

SCALE: 1" = a DATE: ——

FOR

——

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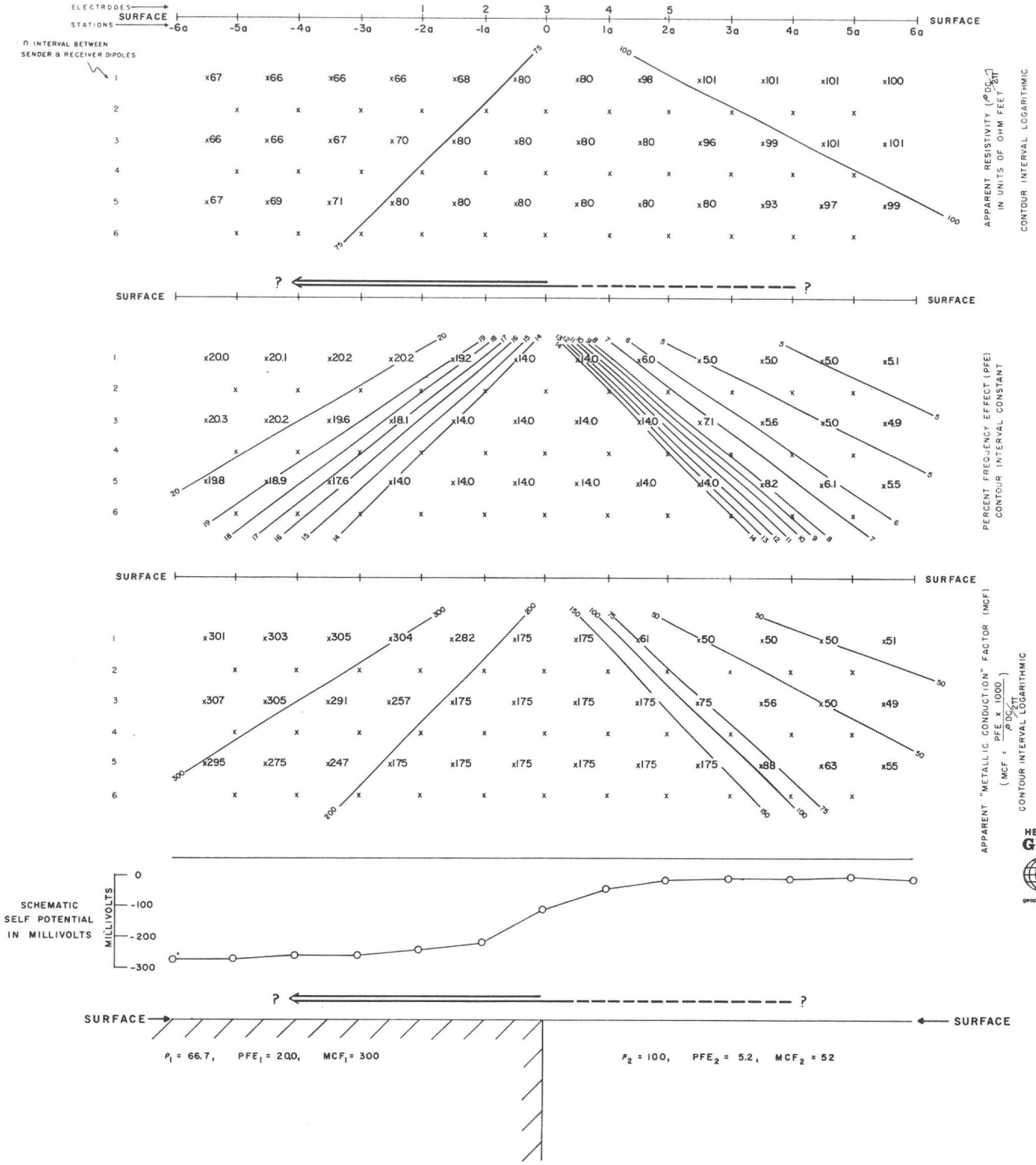
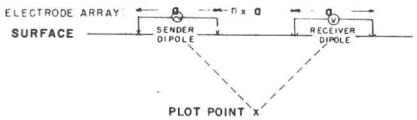
THEORETICAL DIPOLE-DIPOLE INDUCED POLARIZATION RESPONSE OVER A CONDUCTIVE VERTICAL TABULAR SULFIDE BODY CROSSED NORMAL TO THE STRIKE [HAVING A THICKNESS OF 1/10 THE ELECTRODE SPACING (a), A RESISTIVITY CONTRAST OF 10:1, A BACKGROUND RESISTIVITY (ρ_1) OF 100, A BACKGROUND PFE$_1$ OF 0, AND A PFE$_2$ OF 100 IN THE SULFIDE ZONE]



EXPLANATION



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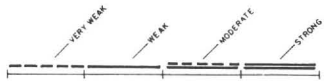
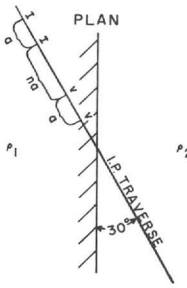


LOOKING 60° FROM STRIKE OF INTERFACE



VERTICAL INTERFACE

SECTIONAL DATA SHEET

LINE NO. ——

INDUCED POLARIZATION TRAVERSE

SCALE: 1" = a DATE: ——

FOR

——

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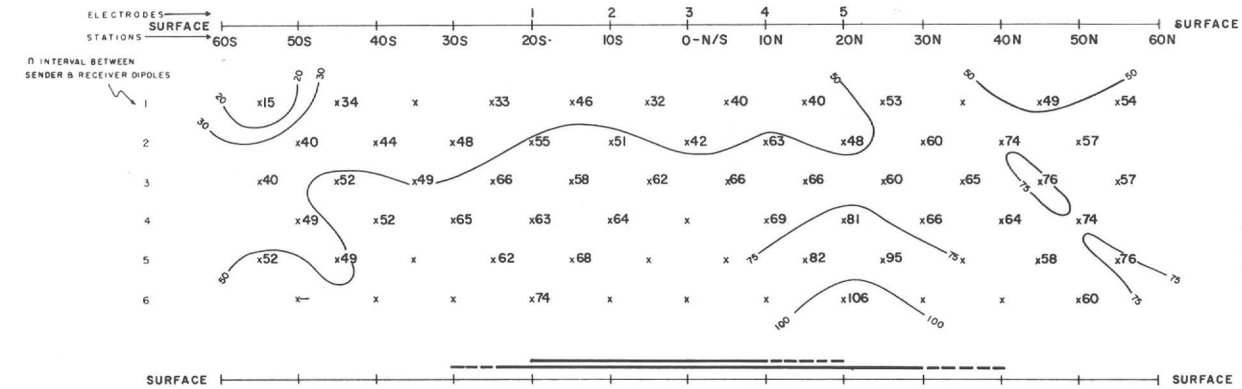
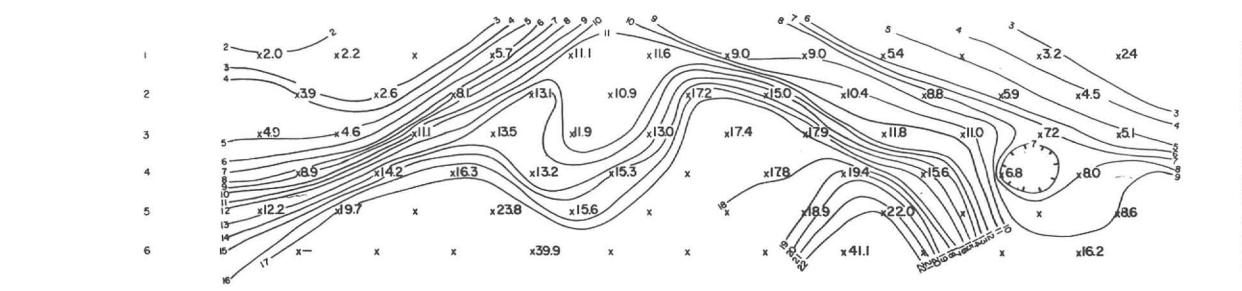
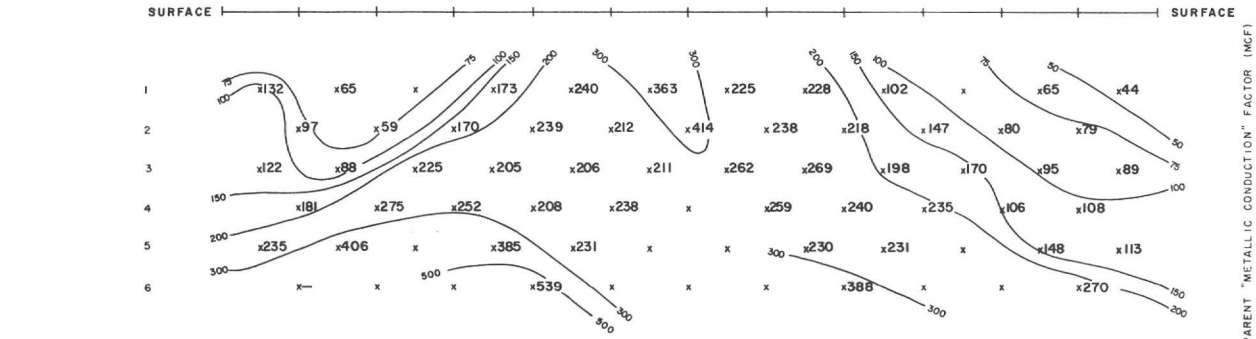
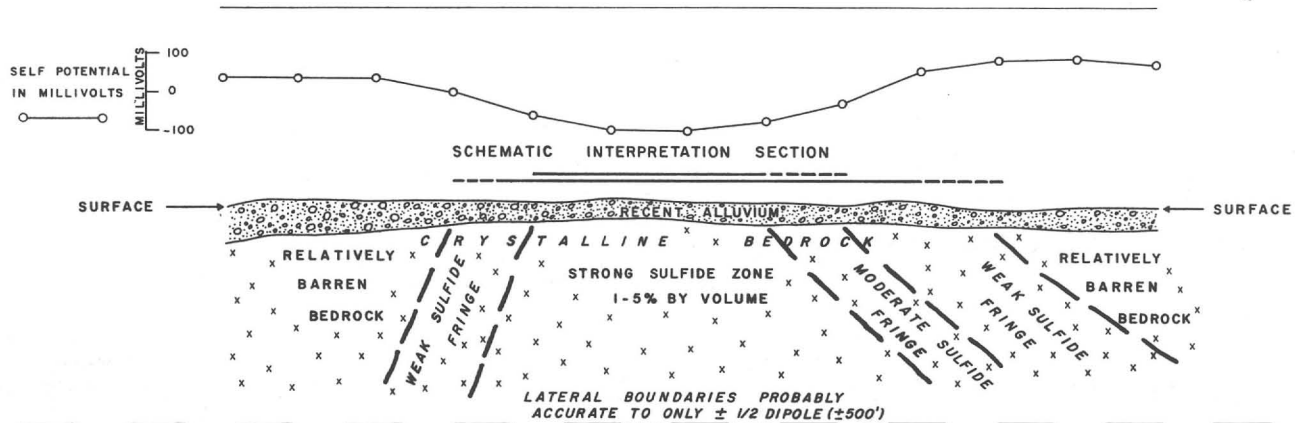
vancouver
sydney

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

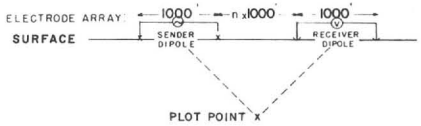




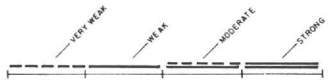




EXPLANATION



RELATIVE ANOMALY STRENGTH



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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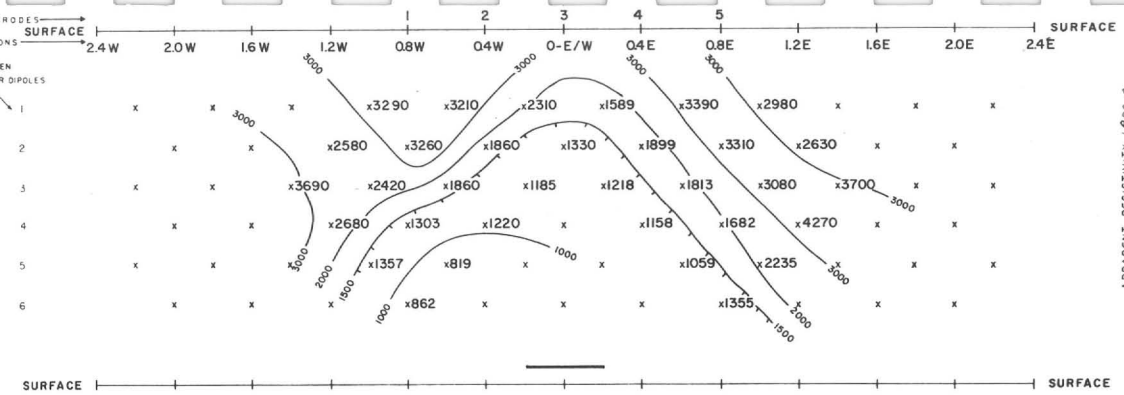
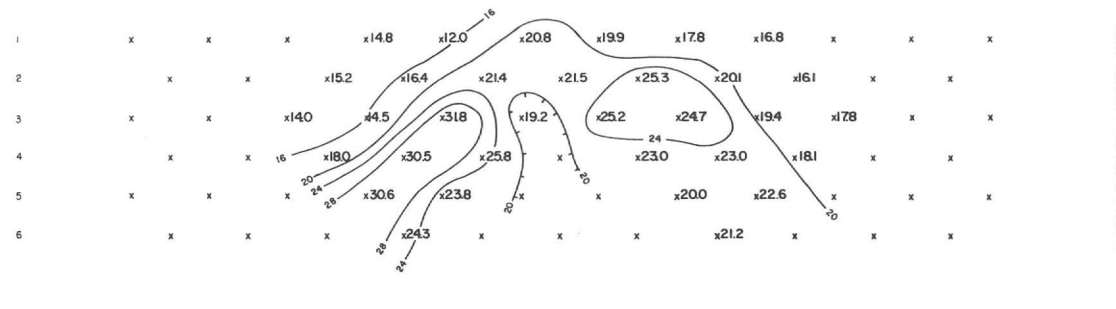
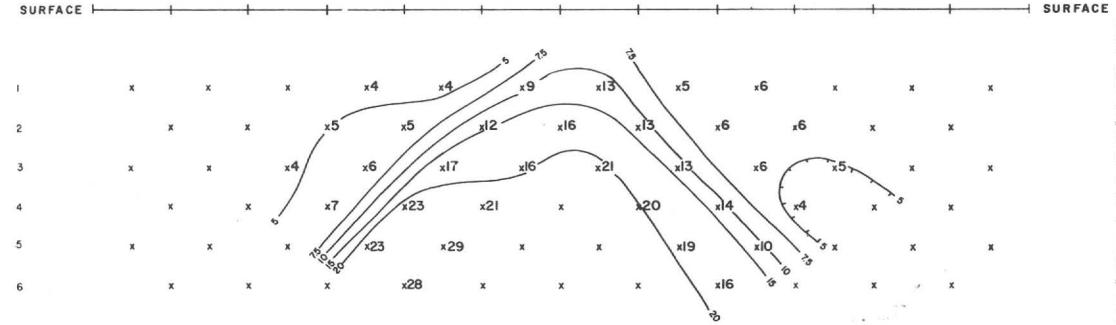
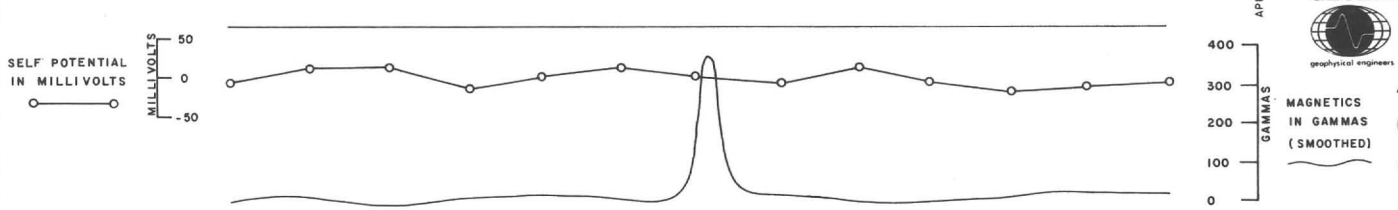
sydney

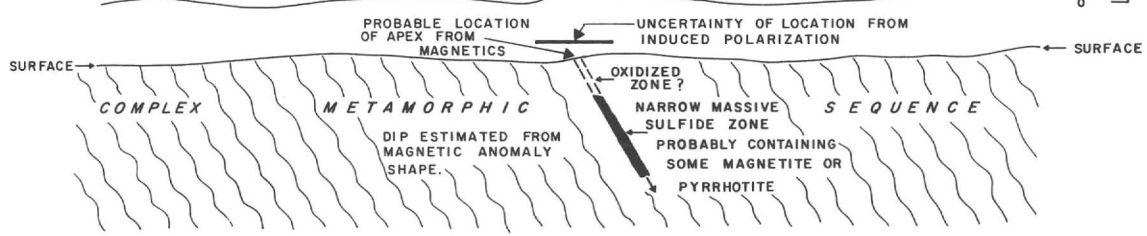
ACTUAL FIELD EXAMPLE OF INDUCED POLARIZATION TRAVERSE OVER DISSEMINATED PORPHYRY TYPE SULFIDE MINERALIZATION





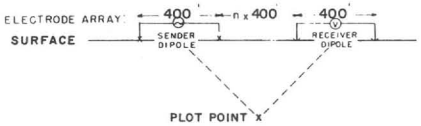




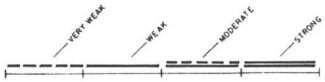


SCHEMATIC INTERPRETATION SECTION

EXPLANATION



RELATIVE ANOMALY STRENGTH



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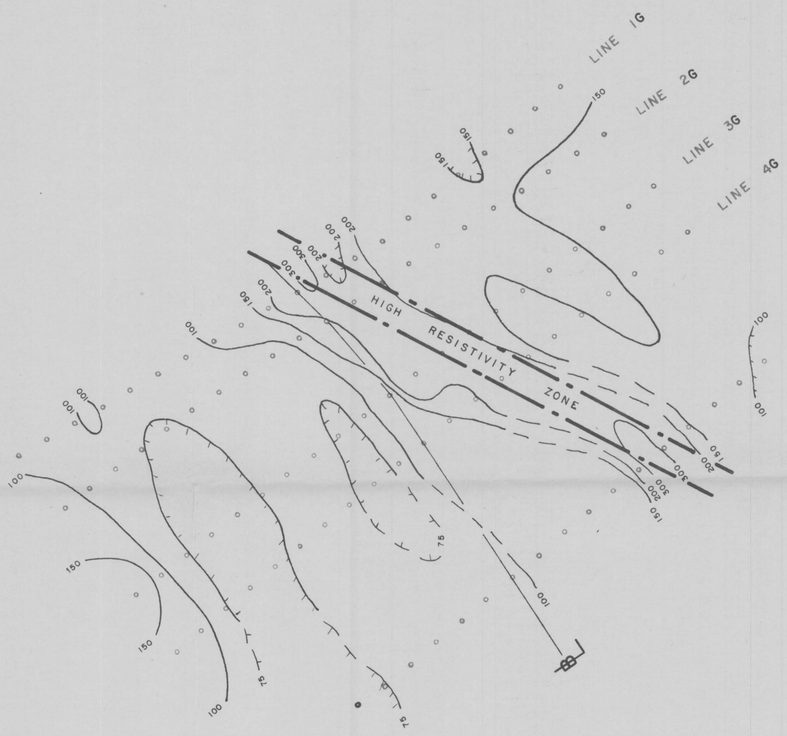
ACTUAL FIELD EXAMPLE OF COMBINED INDUCED POLARIZATION, RESISTIVITY, MAGNETIC AND SELF POTENTIAL SURVEY ACROSS A NARROW-STEEPLY DIPPING MASSIVE SULFIDE VEIN.

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.

14 | 13
23 | 24

13 | 18
24 | 19

I
X



23 | 24
26 | 25

24 | 19
25 | 30

I
X

RANGE 22 EAST
RANGE 23 EAST

26 | 25
35 | 36

25 | 30
36 | 31

TOWNSHIP 16 SOUTH

EXPLANATION

X I CURRENT ELECTRODE
O POTENTIAL ELECTRODE POSITION
LOGARITHMIC CONTOUR INTERVAL

N

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GRADIENT ARRAY INDUCED POLARIZATION
LOCATION & INTERPRETATION PLAN
APPARENT RESISTIVITY $[\rho a/2\pi]$ IN OHM FEET
DRAGOON AREA
COCHISE COUNTY, ARIZONA
FOR
C F & I STEEL CORPORATION

SCALE 1" = 500' | DRAWN BY JUDY PETRY | DATE APRIL 1969

14 | 13
23 | 24

13 | 18
24 | 19

23 | 24
26 | 25

24 | 19
25 | 30

RANGE 22 EAST
RANGE 23 EAST

26 | 25
35 | 36

25 | 30
36 | 31

TOWNSHIP 16 SOUTH

EXPLANATION

I CONTOUR INTERVAL 1.0 PFE
X CURRENT ELECTRODE
O POTENTIAL ELECTRODE

N

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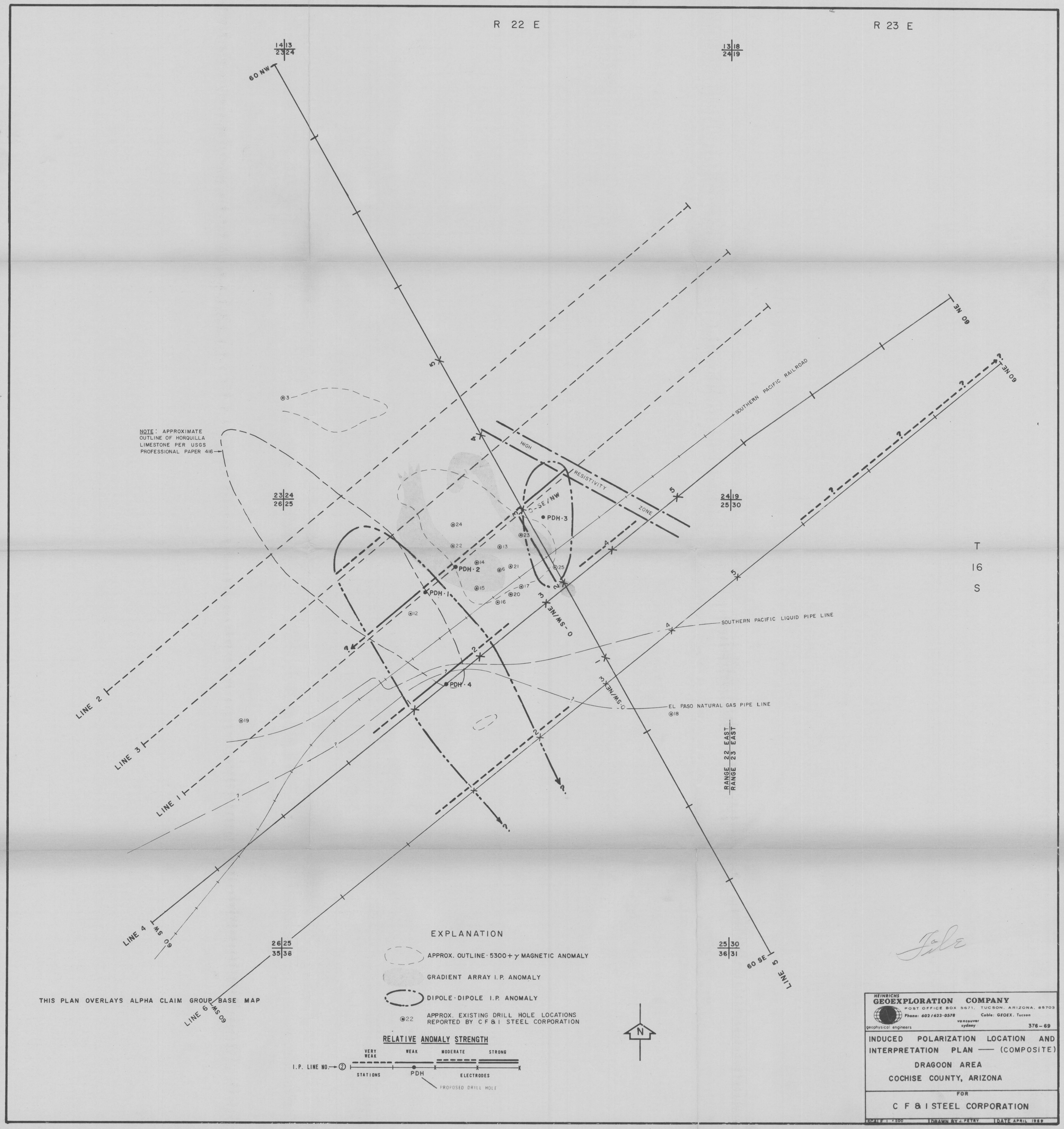
GRADIENT ARRAY INDUCED POLARIZATION
LOCATION & INTERPRETATION PLAN
PERCENT FREQUENCY EFFECT
DRAGOON AREA
COCHISE COUNTY, ARIZONA
FOR
C F & I STEEL CORPORATION

SCALE 1" = 500' | DRAWN BY JUDY PETRY | DATE APRIL 1969


R 22 E
R 23 E
T 16 S
14 13 / 23 24
13 18 / 24 19
23 24 / 26 25
24 19 / 25 30
26 25 / 35 36
25 30 / 36 31
60 NW
60 NE
35 09
60 SW
NOTE: APPROXIMATE OUTLINE OF HORQUILLA LIMESTONE PER USGS PROFESSIONAL PAPER 416
SOUTHERN PACIFIC RAILROAD
HIGH RESISTIVITY ZONE
MN/SE-C
O-SW/NE-C
PDH·1
PDH·2
PDH·3
PDH·4
SOUTHERN PACIFIC LIQUID PIPE LINE
EL PASO NATURAL GAS PIPE LINE
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
RANGE 22 EAST / RANGE 23 EAST
THIS PLAN OVERLAYS ALPHA CLAIM GROUP BASE MAP
EXPLANATION
APPROX. OUTLINE · 5300+γ MAGNETIC ANOMALY
GRADIENT ARRAY I.P. ANOMALY
DIPOLE-DIPOLE I.P. ANOMALY
APPROX. EXISTING DRILL HOLE LOCATIONS REPORTED BY C F & I STEEL CORPORATION
RELATIVE ANOMALY STRENGTH
VERY WEAK
WEAK
MODERATE
STRONG
I.P. LINE NO.
STATIONS
PDH
ELECTRODES
PROPOSED DRILL HOLE
N
HEINRICHS GEOEXPLORATION COMPANY
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INDUCED POLARIZATION LOCATION AND INTERPRETATION PLAN — (COMPOSITE)
DRAGOON AREA
COCHISE COUNTY, ARIZONA
FOR
C F & I STEEL CORPORATION
SCALE 1" = 500
DRAWN BY J. PETRY
DATE APRIL 1969

14 | 13
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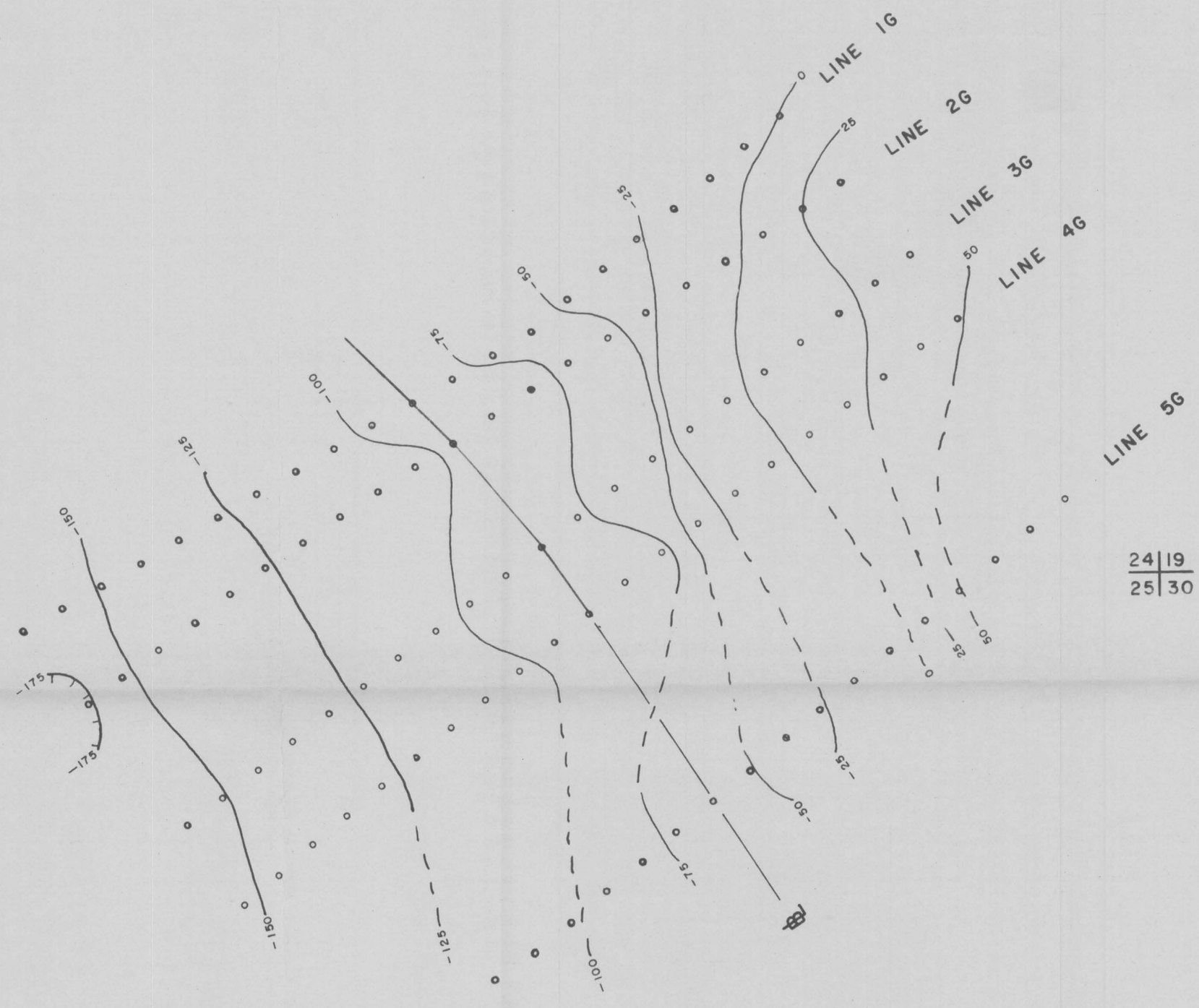

23 | 24
26 | 25

24 | 19
25 | 30

I
X

RANGE 22 EAST
RANGE 23 EAST

26 | 25
35 | 36

25 | 30
36 | 31

TOWNSHIP 16 SOUTH

EXPLANATION

CONTOUR INTERVAL 25 MILLIVOLTS

N

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GRADIENT ARRAY INDUCED POLARIZATION
LOCATION & INTERPRETATION PLAN
SELF POTENTIAL
DRAGOON AREA
COCHISE COUNTY, ARIZONA

FOR

C F & I STEEL CORPORATION

SCALE 1" = 500' | DRAWN BY JUDY PETRY | DATE APRIL 1969

14 | 13
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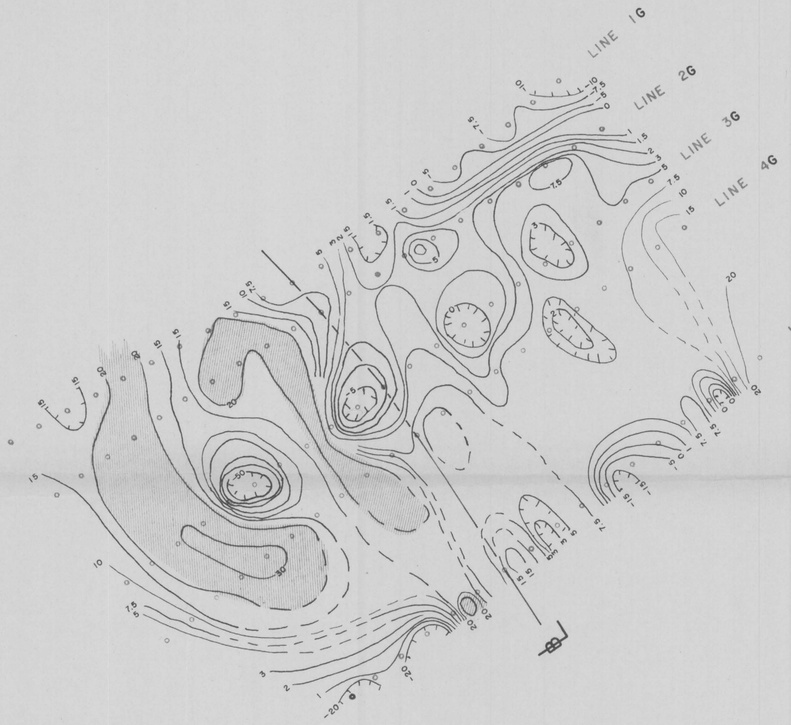

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I
X

RANGE 22 EAST
RANGE 23 EAST

26 | 25
35 | 36

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36 | 31

TOWNSHIP 16 SOUTH

EXPLANATION

LOGARITHMIC CONTOUR INTERVAL

N

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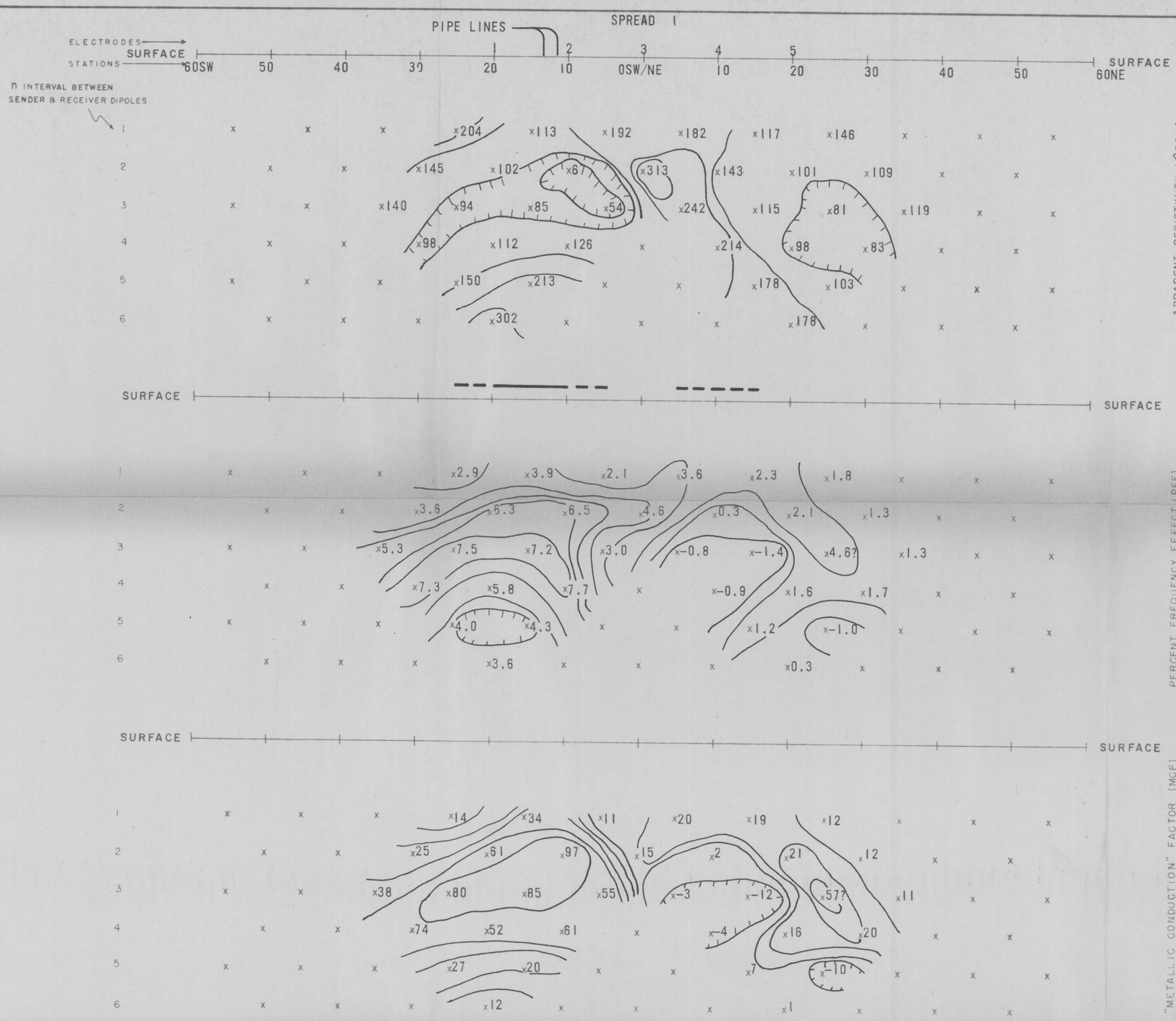
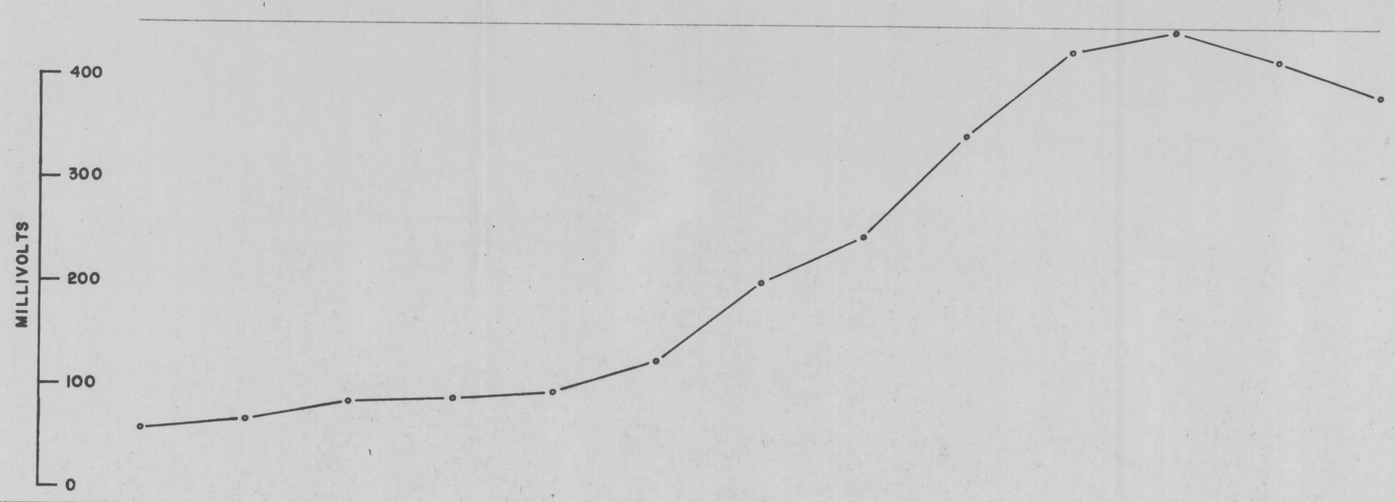
GRADIENT ARRAY INDUCED POLARIZATION
LOCATION & INTERPRETATION PLAN
METALIC CONDUCTION FACTOR
DRAGOON AREA
COCHISE COUNTY, ARIZONA

FOR

C F & I STEEL CORPORATION

SCALE 1" = 500' | DRAWN BY JUDY PETRY | DATE APRIL 1969





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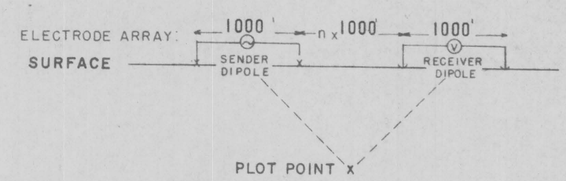
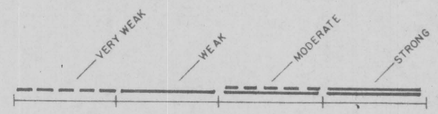


RELATIVE ANOMALY STRENGTH



LOOKING N 40° W

DRAGOON AREA

SECTIONAL DATA SHEET

LINE NO. 4 SPREAD 1

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 1000' DATE: APRIL 1969

FOR

C F & I STEEL CORPORATION

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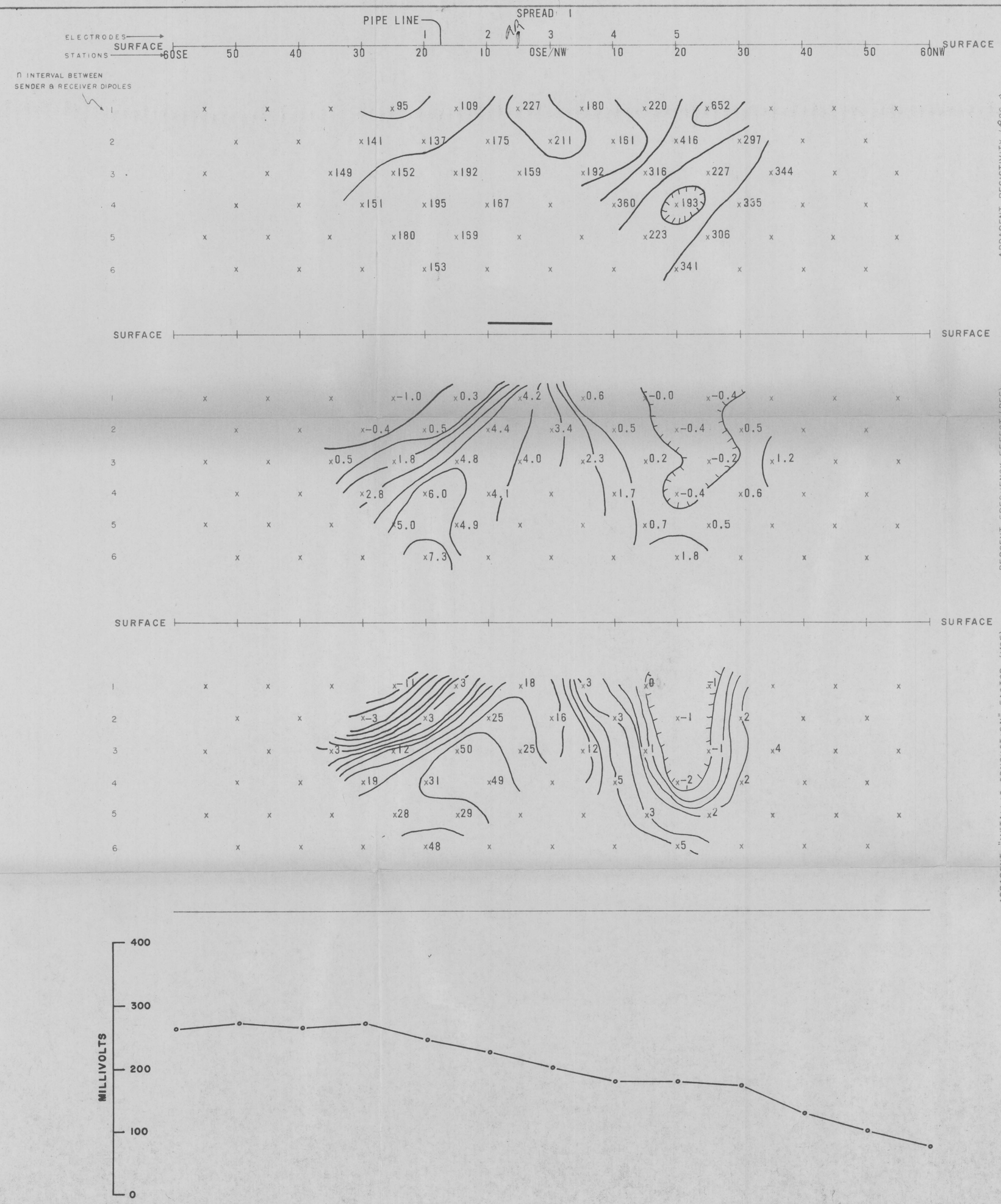

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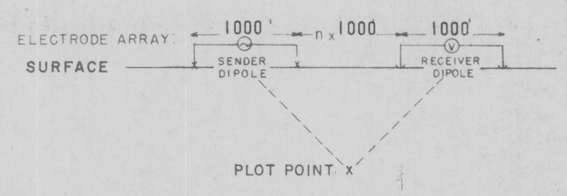
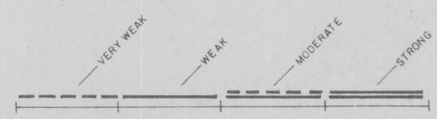


RELATIVE ANOMALY STRENGTH



LOOKING S 60° W

DRAGOON AREA

SECTIONAL DATA SHEET

LINE NO. 5 SPREAD 1

INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 1000' DATE: APRIL 1969

FOR

C F & I STEEL CORPORATION

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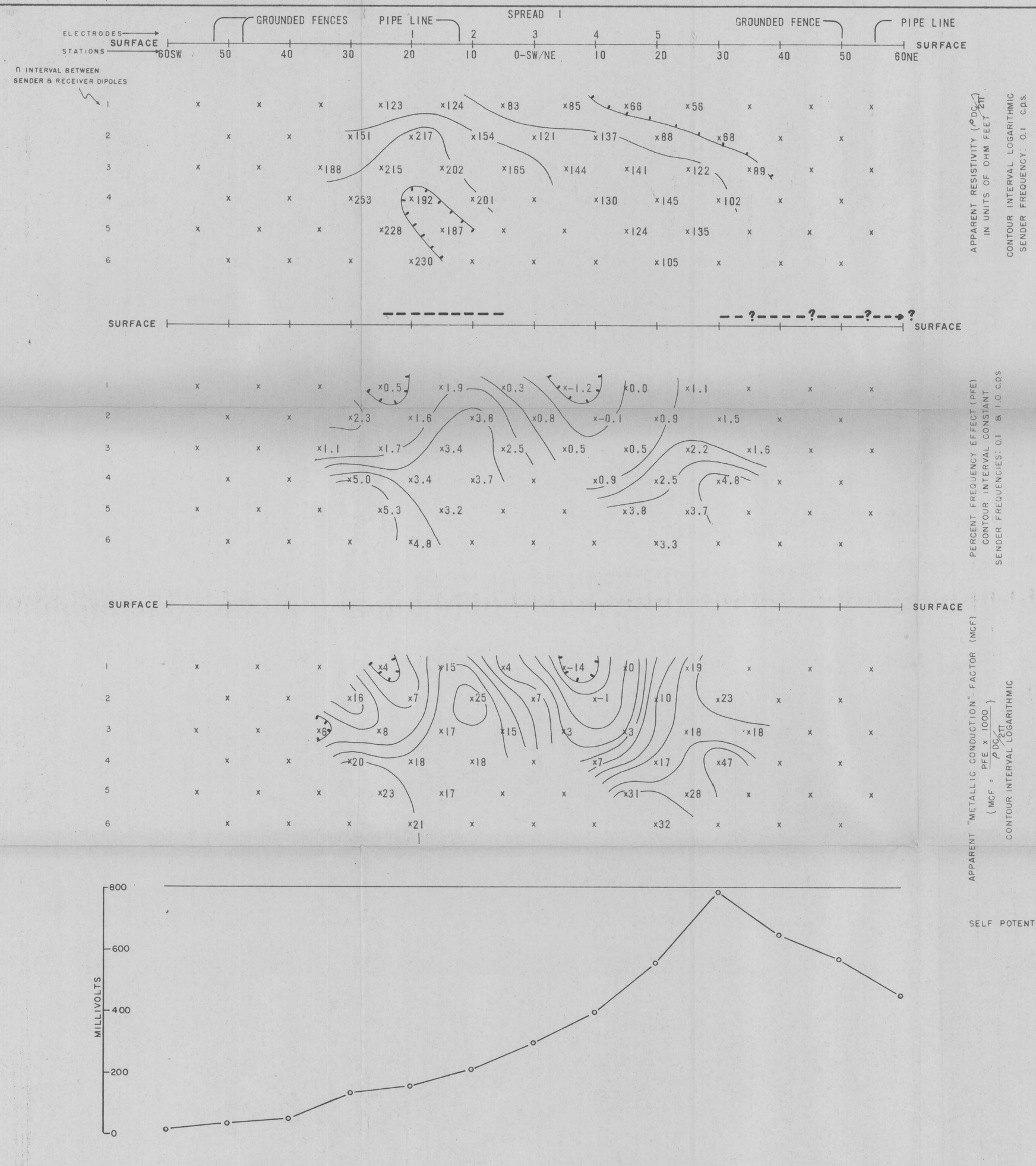
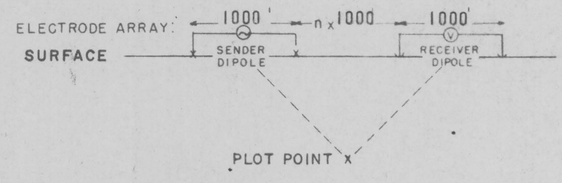


EXPLANATION



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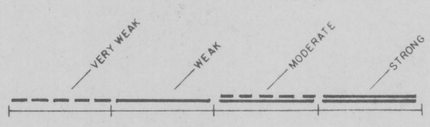

LOOKING NORTHWEST

DRAGOON AREA

SECTIONAL DATA SHEET
LINE NO. 6 (SPREAD I)
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 1000' DATE: MAY 1969

FOR

C. F. & I. STEEL CORPORATION

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GEOEXPLORATION COMPANY
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Job 245

INDUCED POLARIZATION SURVEY
DRAGOON AREA
COCHISE COUNTY, ARIZONA
For
C. F. &. I.Steel Corporation

March 1968

INDUCED POLARIZATION SURVEY

DRAGOON AREA

COCHISE COUNTY, ARIZONA

For

C. F. & I. Steel Corporation

March 1968

By

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

TABLE OF CONTENTS

	PAGE
GENERAL LOCATION	
INTRODUCTION	1
CONCLUSIONS, RECOMMENDATIONS AND INTERPRETATION	2
BASIS OF THE INDUCED POLARIZATION METHOD	1a

IN MAP POCKET: (Total 4 pieces)

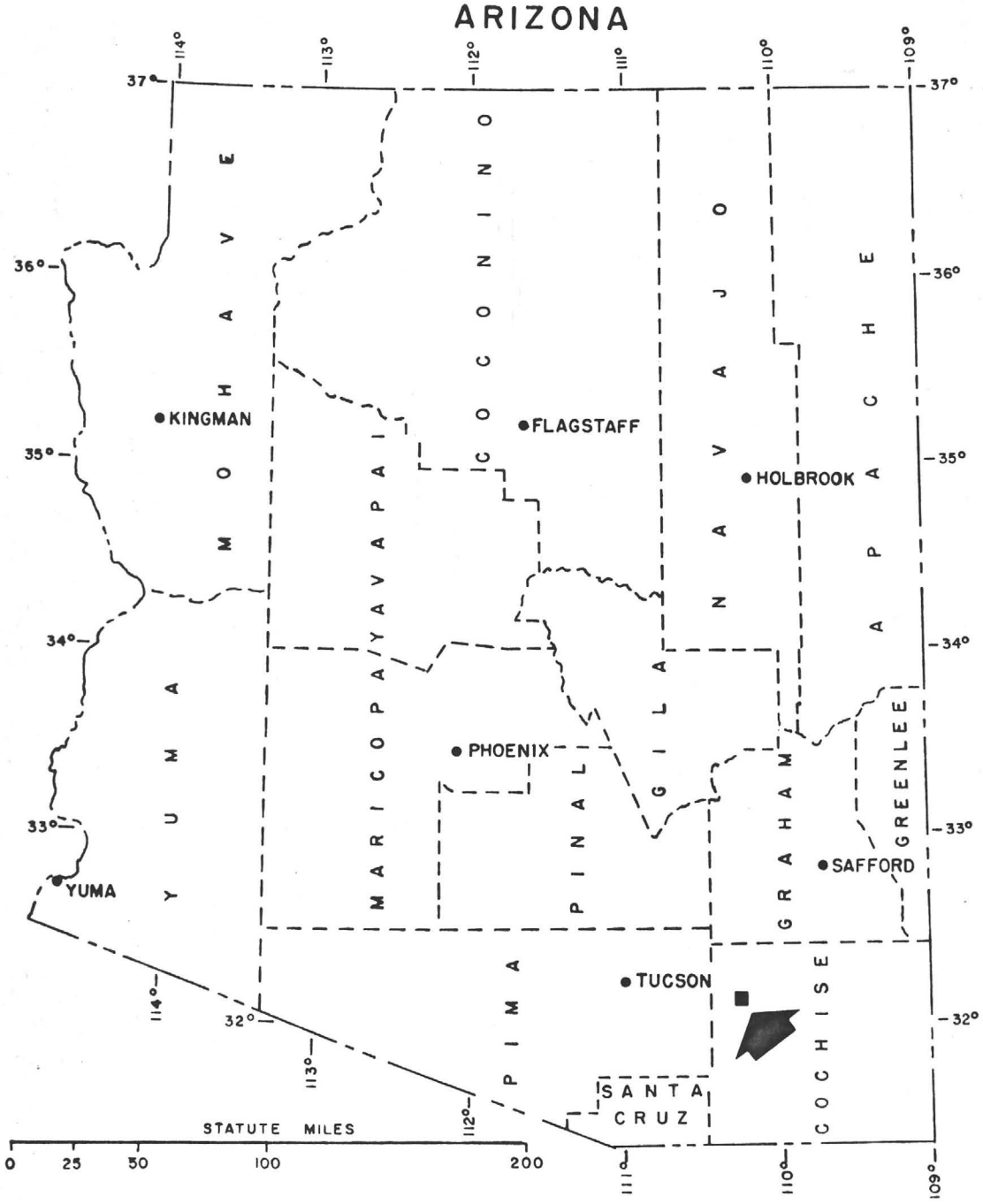
Induced Polarization Location and Interpretation Plan

Sectional Data Sheets: (All a=750')
- Line 1
- Line 2
- Line 3

GENERAL LOCATION OF

DRAGOON AREA

COCHISE COUNTY, ARIZONA



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INTRODUCTION

At the request of Mr. Jim Brooks of C. F. & I. Steel Corporation, Heinrichs Geoexploration Company conducted an initial induced polarization survey in the Dragoon Area, Cochise County, Arizona. The field work was run during the interim March 13 to March 19, 1968.

A total of three spreads of 750 foot dipole spaced induced polarization coverage was obtained. This gives a total surface coverage of 27,000 feet of which 15,750 feet is "subsurface" plotted data. The lines were all oriented N50°E - S50°W and on a common N40°W baseline. Line 1 was centered about 370 feet N40°W of the C. F. & I. drill hole #6. The lines are separated 750 feet with Line 2 being 1,500 feet northwest and Line 3, 750 feet northwest of Line 1.

The induced polarization technique used was the dual frequency system employing sending frequencies of 0.15 and 3.0 Hz. The electrode configuration utilized was the standard collinear dipole-dipole array which on a 750 foot dipole spacing typically gives resolvable penetration within the zone from about 200 feet to 1,000 feet below surface.

The purpose of this electrical survey was to attempt to locate any possible related sulfide zones associated with an oxidized copper intersection seen in a drill hole testing a magnetic anomaly found by C. F. & I. Steel.

Data are presented on sectional data sheets, one for each spread showing resistivity percent frequency effect (PFE) and metallic conduction factor (MCF) contoured in section with self potential (SP) in profile form. An induced polarization location and interpretation plan is also presented to show the surface projected anomalism in relation to the land net. For further details of interpretation theory, see the Basis of the Induced Polarization Method appended to the report.

Geoex personnel involved in the field work were J. King, geophysical crew chief, D. McCoy and G. Routt, technical assistants. Report and interpretation by Chris S. Ludwig, Senior Geophysicist, assisted by the Geoex staff.

CONCLUSIONS, RECOMMENDATIONS AND INTERPRETATION

Induced polarization anomalism of probable sulfide character was seen in proximity to the drill hole (#6) on Line 1 in particular and possibly on Line 3 just northwest. However, the results are quite complicated and due to the complexity of the response, there are two alternate interpretations of the source and location of anomalism on Line 1. One interpretation is that there are two separate zones of anomalism each associated with a resistivity low. The stronger zone is centered at about 11.25SW and the other somewhat weaker zone occurs near 11.25NE.

The anomaly at 11.25SW is likely caused by a steeply dipping narrow (less than 500 feet wide) polarizable source, suboutcropping probably within 750 feet of the surface. The weaker zone at 11.25NE could be due to a similar source but somewhat deeper and probably weaker.

The alternate interpretation is that the source is a broad relatively horizontal mineralized layer lying approximately between stations 7.5SW to 7.5NE. The depth to this zone could be as deep as 1,000 feet below surface. This zone appears to have limited thickness.

Either interpretation suggests a minimum of around 1% by volume polarizable material (sulfide, graphite or metallic lustered oxide). Higher percentages of sulfide are possible if the source is restricted in extent. Also, a combined interpretation of both alternates is possible.

The anomaly may extend as far northwest as Line 3 but either deeper or weaker since the response on Line 3 is considerably attenuated. In fact, the possible anomalous zone centered near 11.25NE, Line 1 appears to be absent on Line 3, only the southwest zone appears or the broad flat lying alternate. However, the structure, as evidenced by the resistivity, apparently continues on through Line 3 to at least as far northwest as Line 2 (where no I.P. anomalism is seen).

The self potentials show a decrease to the southwest on all three lines and is likely a regional gradient rather than related to oxidizing sulfides.

We recommend that the C. F. & I. drill hole #6 be continued to about 1,000 feet to test the broad-flat anomaly interpretation. However, even if sulfides are encountered of a concentration high enough to explain the anomaly, drilling on the 11.25SW alternate may still prove interesting since it is possible both interpretations are valid. If no significant sulfides are seen above 1,000 feet in drill hole #6, then we definitely recommend testing the 11.25SW zone.

Taking advantage of the indicated northeast dip in the Horquilla limestone (on which this anomaly is centered), a vertical drill hole is recommended near station 9.4SW Line 1 and should be drilled to at least 750 feet unless intersection is definitely obtained sooner.

Because of the pronounced increase in anomalism to the southeast from Line 2 to 3 to 1, additional I.P. is recommended in this direction. A line on the same grid centered about 1,000 feet S40°E of Line 1 would avoid the railroad track interference. If there are grounded fences,

pipes or cables on the southeast railroad right-of-way, possibly more than 1,000 feet S40°E of Line 1 will be necessary. The same dipole spacing is recommended. Also, there is a suggestion of continuing anomalism on the extreme southwest end of Line 1 that should be looked at in greater detail. This could be done by adding a spread to the southwest on Line 1.

If the initial drilling proves interesting and correlates with the I.P., a detailed survey is recommended to outline the zone and guide future drilling.

Respectfully submitted,

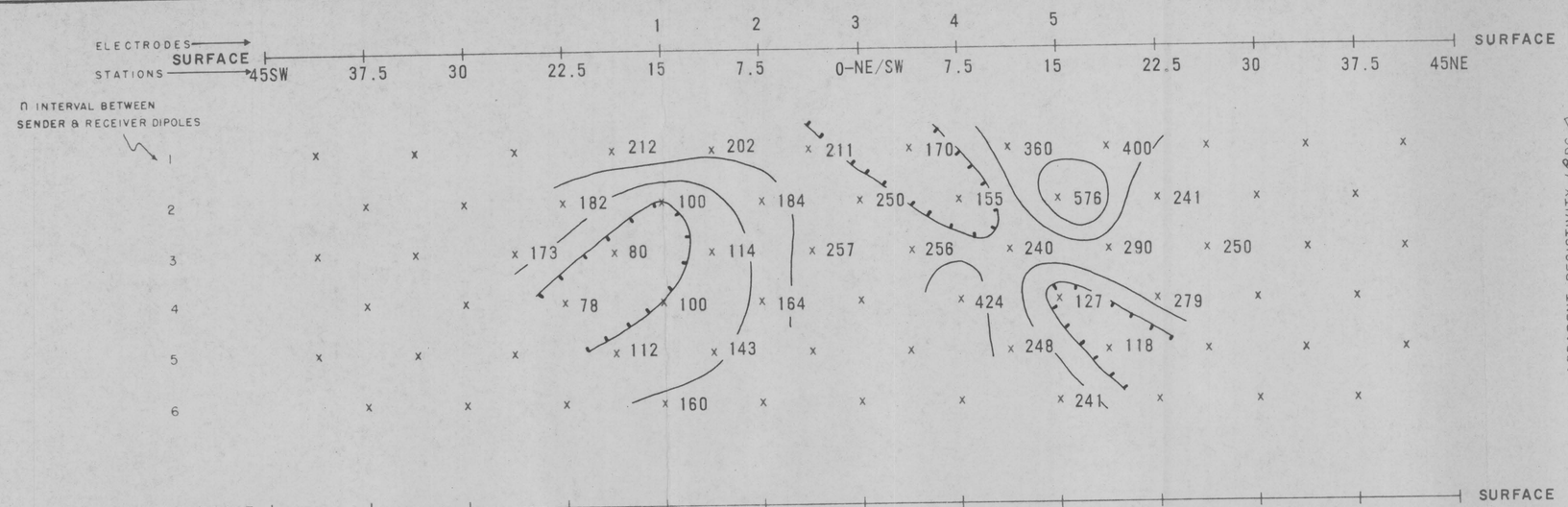
HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Senior Geophysicist

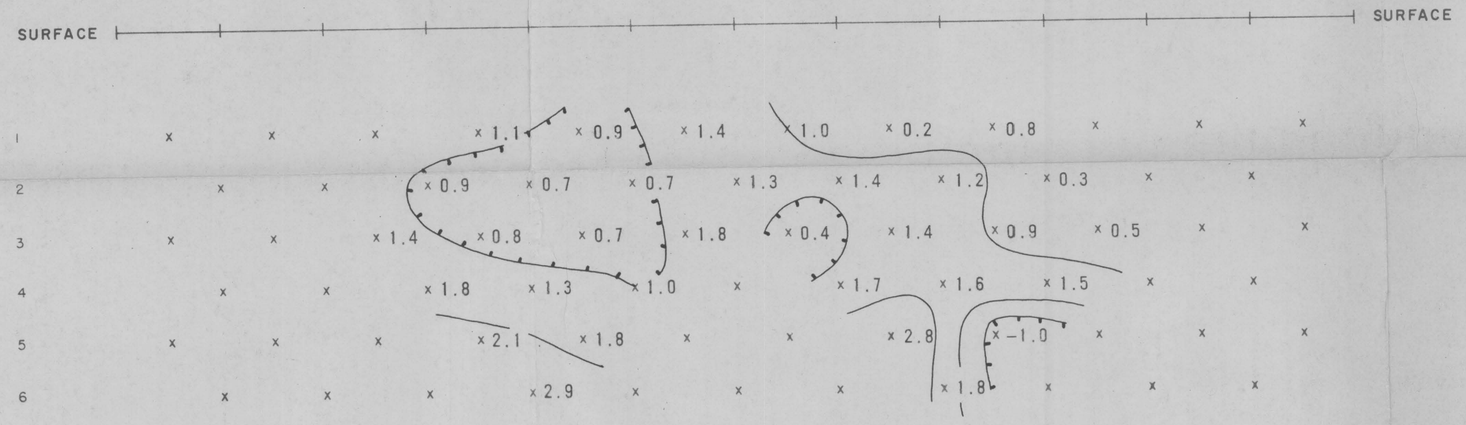
APPROVED: W. E. Heinrichs Jr.
Walter E. Heinrichs, Jr.
President & General Manager

April 2, 1968
Tucson, Arizona

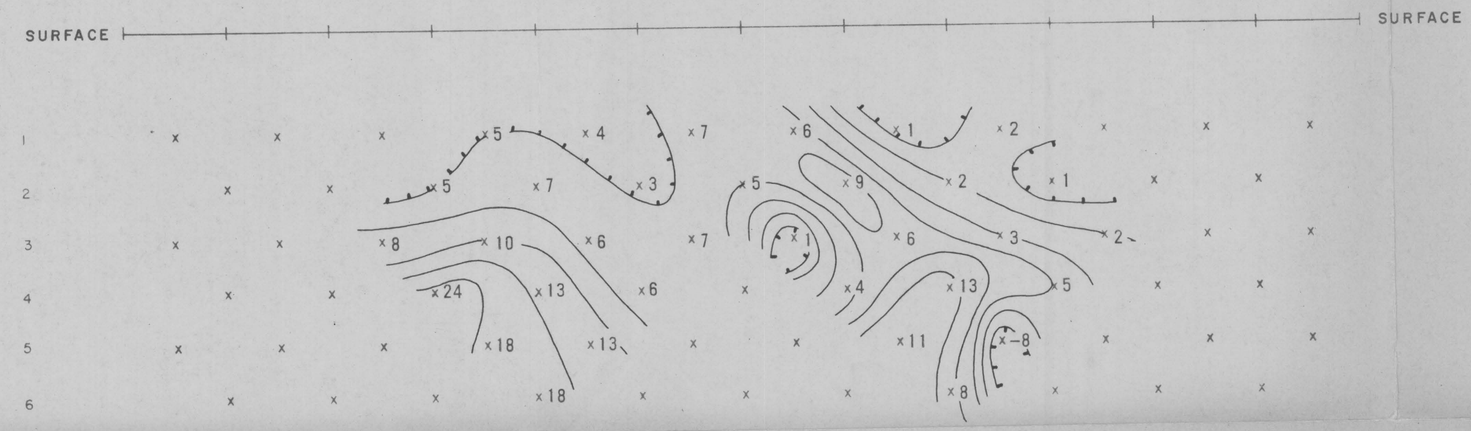


APPARENT RESISTIVITY ($\rho_{DC}/2\pi$) IN UNITS OF OHM FEET

CONTOUR INTERVAL LOGARITHMIC
SENDER FREQUENCY: 0.15 c.p.s.



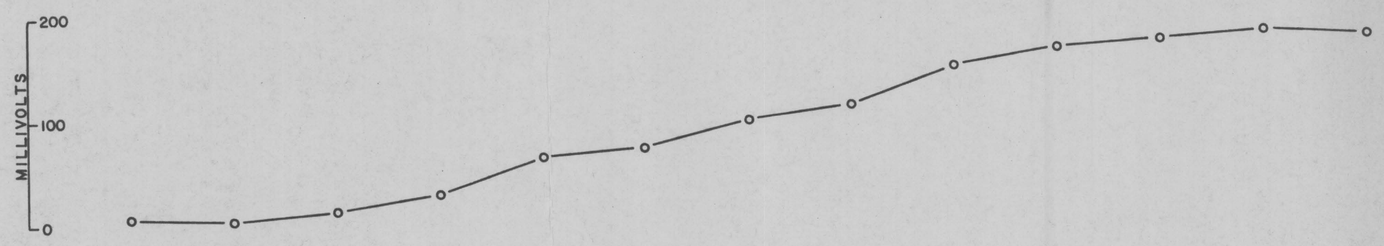
PERCENT FREQUENCY EFFECT (PFE)
CONTOUR INTERVAL CONSTANT
SENDER FREQUENCIES: 0.15 & 3.0 c.p.s



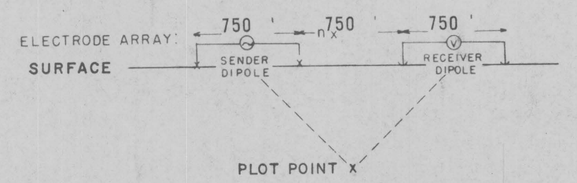
APPARENT "METALLIC CONDUCTION" FACTOR (MCF)
$\left(MCF = \frac{PFE \times 1000}{\rho_{DC}/2\pi}\right)$

CONTOUR INTERVAL LOGARITHMIC

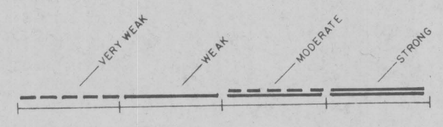
SELF POTENTIAL



EXPLANATION



RELATIVE ANOMALY STRENGTH



LOOKING N 40° W

DRAGOON AREA

SECTIONAL DATA SHEET
LINE NO. 2
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY
SCALE: 1" = 750' DATE: MARCH 1968

FOR

C F & I STEEL CORPORATION

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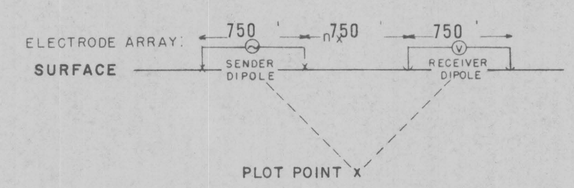
EXPLANATION



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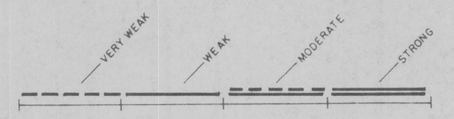


LOOKING N 40° W

DRAGOON AREA

SECTIONAL DATA SHEET

LINE NO. 3

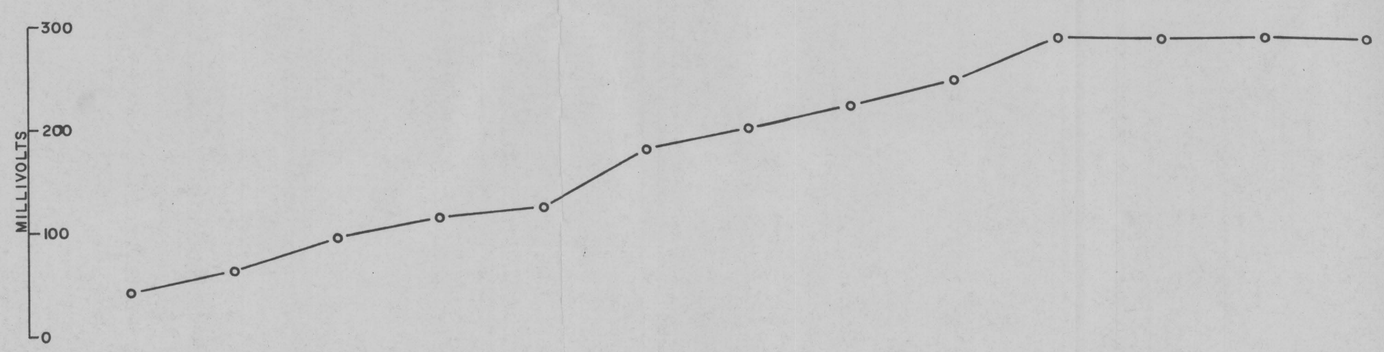
INDUCED POLARIZATION TRAVERSE

HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 750' DATE: MARCH 1968

FOR

C F & I STEEL CORPORATION



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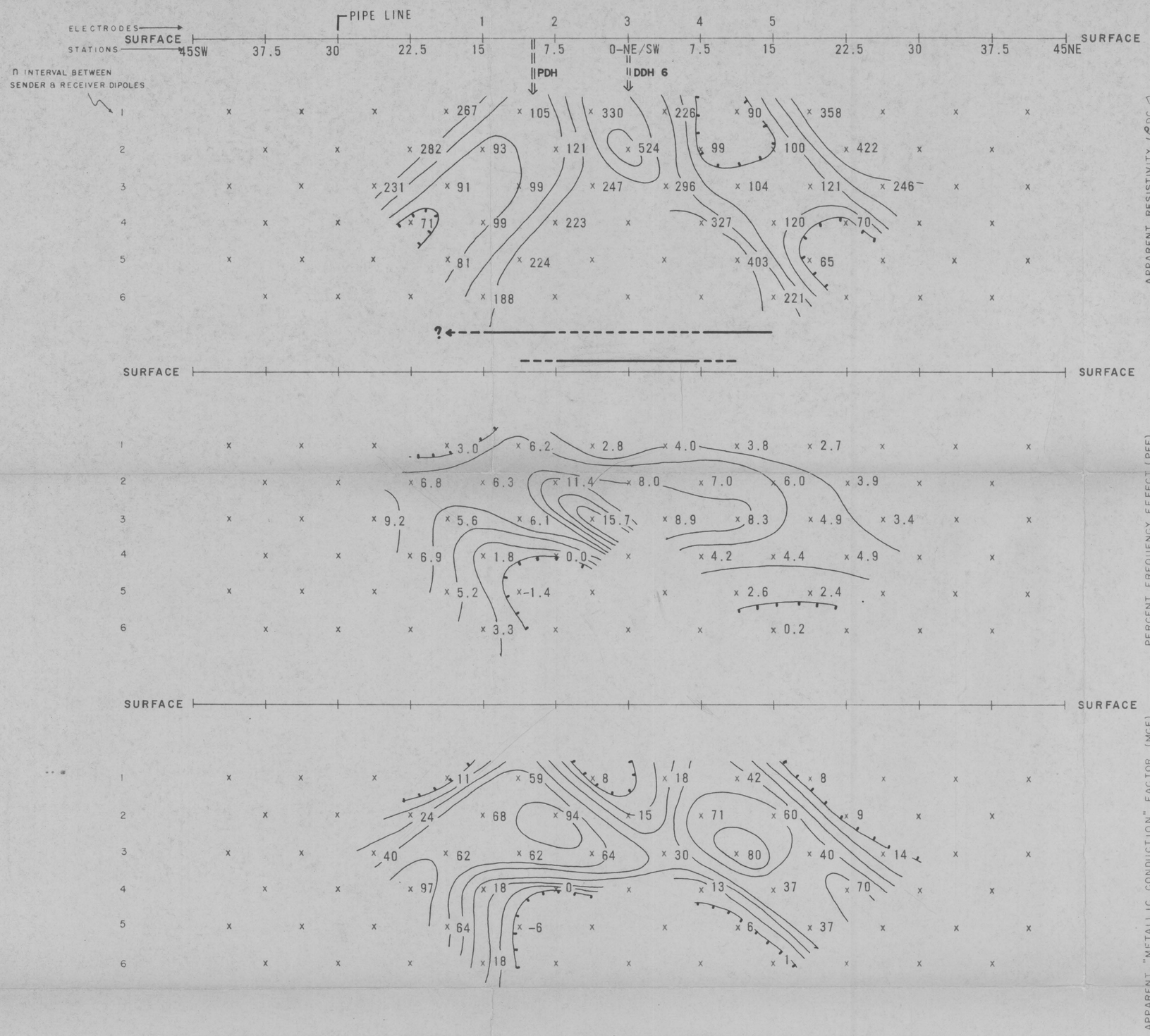
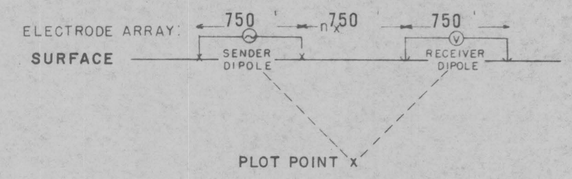
geophysical engineers



EXPLANATION



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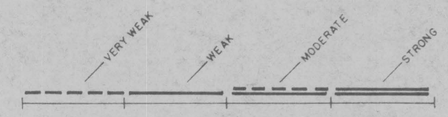


LOOKING N 40° W

DRAGOON AREA

SECTIONAL DATA SHEET

LINE NO. 1

INDUCED POLARIZATION TRAVERSE

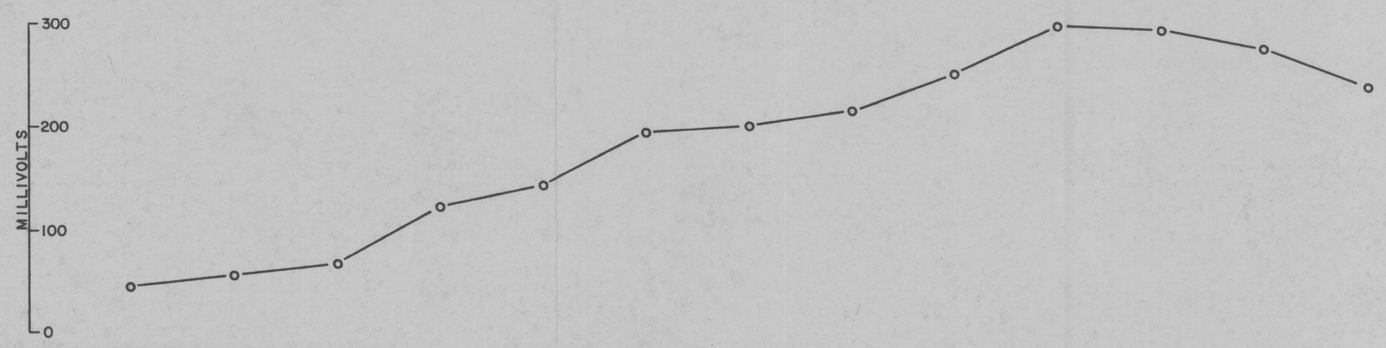
HEINRICHS GEOEXPLORATION COMPANY

SCALE: 1" = 750' DATE: MARCH 1968

FOR

C F & I STEEL CORPORATION

SELF POTENTIAL



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