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EXPERIMENTAL
INDUCED POLARIZATION SURVEY

GLOVE MINE AREA

SANTA CRUZ COUNTY, ARIZONA

FOR

C. F. & I. STEEL CORPORATION

July 1971

GEOEX Job 631

EXPERIMENTAL
INDUCED POLARIZATION SURVEY

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JULY 1971

HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5964, Tucson, Arizona 85703

GEOEX Job 631

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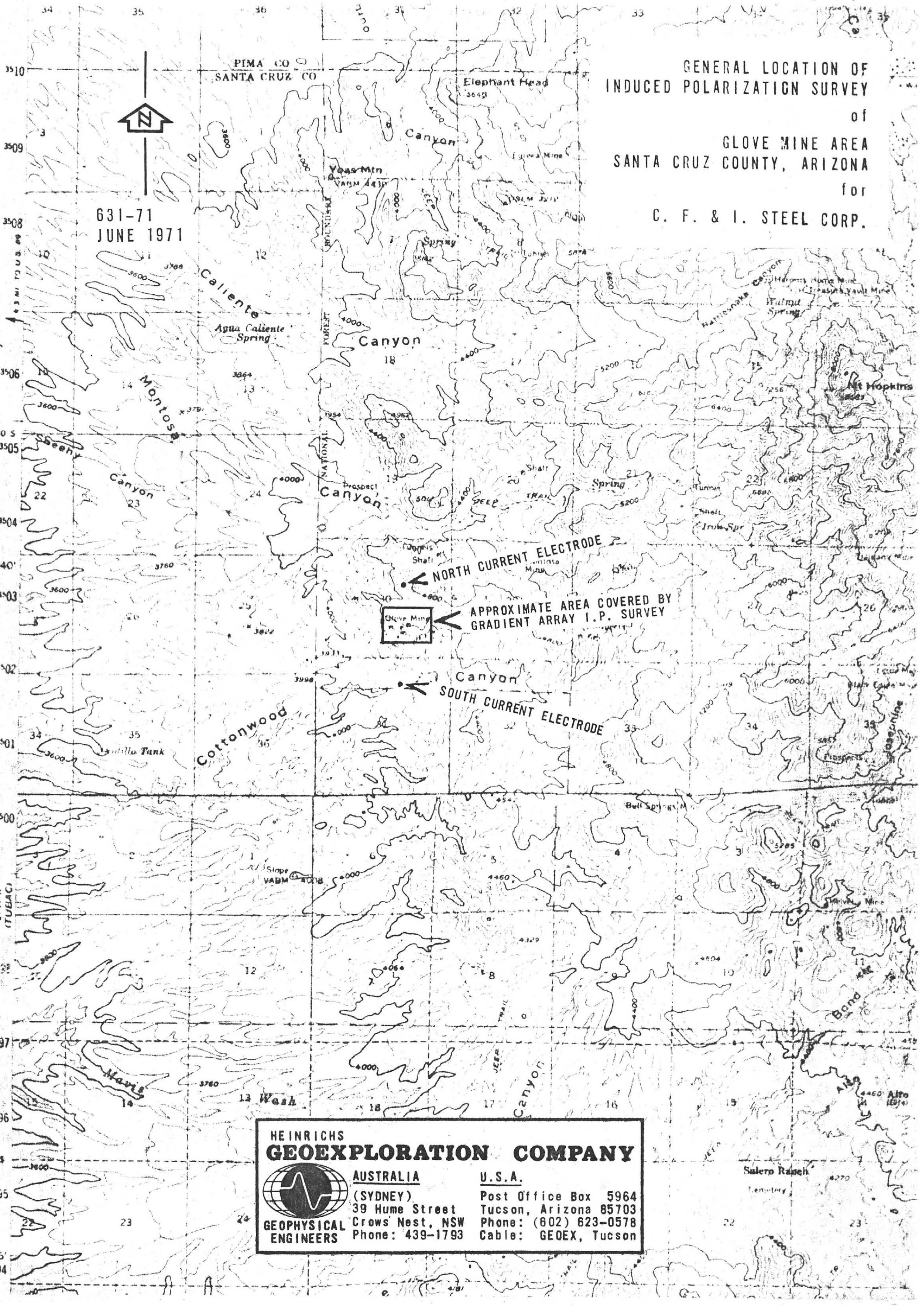
GENERAL LOCATION OF
INDUCED POLARIZATION SURVEY
of
GLOVE MINE AREA
SANTA CRUZ COUNTY, ARIZONA
for
C. F. & I. STEEL CORP.
631-71
JUNE 1971
PIMA CO
SANTA CRUZ CO
Elephant Head
Canyon
Caliente
Agua Caliente Spring
Canyon
Montosa
Sheehy
Canyon
Canyon
Mt Hopkins
Rattlesnake Canyon
Walnut Spring
Spring
Prospect
NATIONAL FOREST BOUNDARY
NORTH CURRENT ELECTRODE
APPROXIMATE AREA COVERED BY
GRADIENT ARRAY I.P. SURVEY
Glove Mine
Canyon
SOUTH CURRENT ELECTRODE
Cottonwood
Josephine
Bull Springs Mine
Mavis
Wash
Canyon
Salero Ranch
HEINRICHS
GEOEXPLORATION COMPANY
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INTRODUCTION

At the request of Mr. James Brooks of C. F. & I. Steel Corporation, Heinrichs GEOExploration Company conducted an initial experimental induced polarization survey in the immediate Glove Mine Area, Santa Cruz County, Arizona. The field work was conducted during the interim May 13 through June 3, 1971.

This experimental work was done to determine if the Glove Mine lead-zinc sulfide ore zone is detectible with I. P. and, if so, attempt to locate other similar zones along strike as well as better defining the known ore zone if possible. The expected strike can be inferred by previous mining in the near surface oxide zone, by surface geology and by the trend of an elongate geochemical heavy metal soil sample anomaly partially correlating with the mineralized zone.

The experimental nature of this survey comes about as a result of the theoretical predicted relative poor detectibility of the sulfide ore zone by I. P. (or any geophysical method, for that matter) because of its apparent small size compared to depth of burial. The ore zone is reported to be a pencil shaped zone roughly 20 to 30 feet in diameter plunging about 30° in a southeasterly direction and coming to within about 350 to 400 feet of the surface at its most shallow point. Even though the ore is massive galena-sphalerite with some pyrite and should be very conductive relative to the surrounding limestones and should exhibit a strong I. P. effect, it occupies such a limited proportion of the volume being searched that its response at the surface would likely be lost in the normally expected background variations. A minor pyrite fringe surrounding the ore zone was noted in the drilling, possibly increasing the geophysical detectibility somewhat.

Two conventional north-south dipole-dipole I. P. lines with a 300 foot dipole spacing were run; Line 1 near Drill Hole #8 where the ore zone is roughly 400 feet deep and Line 2 just east of Drill Hole #7 where minor non-ore but somewhat shallower sulfides were indicated.

Inconclusive results were obtained with the two dipole-dipole lines and a gradient array I. P. survey was tried. Dipole-dipole Lines 1 and 2 were rerun on 100 foot gradient stations, with more encouraging results. Subsequently, nine more north-south gradient lines were run on a 200 foot line separation roughly covering a grid 2,100 feet east-west by 1,500 feet north-south in dimension.

Concurrently with the gradient work, an electrode was grounded in the ore zone through Drill Hole # 8 and several surface dipole traverses along lines radiating out from the hole, were run to see if any useful information could be obtained in this manner.

The dual frequency I. P. technique was used for all three surveys with sending frequencies of 3.0 and 0.3 Hz. utilizing a GEOEX Mark 4C receiver and a GEOEX Mark 7 sender. GEOEX personnel supervising the work in the field were C. S. Ludwig, Senior Geophysicist; P. A. Head, Geophysicist and J. P. Matthews, Geophysicist. The report is by C. S. Ludwig assisted by the GEOEX staff.

The two conventional dipole-dipole I. P. traverses are presented as sectional data sheets showing the apparent resistivity, percent frequency effect (PFE) and metallic conduction factor (MCF) contoured in pseudo-sectional form with self potential (SP) in profile form. The gradient array I. P. data is presented both as stacked profiles, one each for apparent resistivity, PFE and MCF and associated S.P., and as separate contour plans of the apparent resistivity and PFE. The radial drill hole survey is shown on two separate sheets for the two lines run for both apparent resistivity and PFE.

We wish here to thank both Mr. James Brooks and Mr. Jack Gillespie for their valued assistance in the field.

CONCLUSIONS AND INTERPRETATIONS

Line 1 (dipole-dipole) shows no obvious anomalous response correlating with the known ore zone. However, a very weak but definite shallow source anomaly is noted near 7.5N correlating with a high resistivity zone. Also, minor increased response is seen near 12.0S apparently correlating with a well grounded fence. These two anomalies may be producing interference in the zone of interest which could be masking a very weak, subtle, anomaly due to the ore zone.

Line 2 (dipole-dipole), however, does show a subtle PFE anomaly centered near 0.0N/S correlating well with the projected ore trend. Minor increased response north of 7.5N and south of 13.5S, likely correlating with the two similar zones of response on Line 1, is further from the zone of interest and therefore produces less interference than on Line 1.

The 0.0N/S Line 2 anomaly is so weak and poorly defined that no depth or size estimates can reasonably be made and with the lack of any obvious ore response on Line 1, the dipole-dipole work was discontinued and a gradient array tried.

The initial gradient coverage on and near Lines 1 and 2 showed very weak but rather well defined PFE response approximately correlating with the ore zone. With these encouraging results, a 2,100 foot portion of the expected mineral trend in the mine working area was processed by a total of eleven gradient lines about 200 feet apart.

This gradient coverage in plan shows a very weak but well defined PFE anomaly correlating quite well with the mineralized trend for the entire strike length processed. The Glove Fault roughly defines the south boundary of the anomaly except on the west end. However, structural complexities to the west are reported by Mr. Brooks and the Glove Fault may actually bend or split and still be defining the southern boundary of the anomaly.

Line 1 and east thereof over the known ore zone, the PFE anomaly shows two parallel highs about 250 feet apart, with the ore zone, as defined by existing drilling, lying between the two highs. Assuming the ore zone is the cause of this PFE response, several possibilities could explain the apparent discrepancy between the plotted anomaly position and the ore zone position.

The area in question is a rather steep hillside with about a 30° slope up to the north on Lines 1 and 4 in particular. A polarizable body 400 feet deep vertically below its surface projection will produce at the surface an anomaly peak effect centered about 200 feet down slope (to the south). This fits the south lobe of the PFE high with respect to the ore zone quite well and, if so, implies that the north lobe may be reflecting an untested similarly polarizable body below a point about 250 feet up slope from the known ore zone.

Another possibility is that the two lobes are really just a single source anomaly, complexly shaped as a result of resistivity inhomogeneities and topographic variations.

Alternately, the anomalism may not be reflecting the ore zone at all. The south lobe may be due to minor mineralization or, conceivably, clay within or near the Glove Fault and the north lobe related to some unknown polarizer giving rise to the observed effects.

The slope-shift possibility is considered the most reasonable explanation at this time and is certainly the most economically interesting possibility.

Assuming a cylindrical source, depth estimates range from about 250 to 350 feet (normal to the slope) or roughly 300 to 400 feet vertical depth and are compatible with depths to the nearest surface portion of the known ore zone. The reported southeast plunge of the ore zone is not particularly evident in the data but the topography present is complicated enough to preclude detailed interpretation of depths.

The estimated 350 to 400 foot vertical depth roughly applies to the entire strike length covered except for Line 11 on the west end of the area where a much broader and slightly stronger anomaly is noted. This considerable length of anomalism is quite uniform in strength and implies a source much longer to the west than the known ore zone. However, enough drilling has not been completed west of the ore zone to really know its true extent.

If a tabular, steeply dipping (vein-like) source is assumed, depths about 100 feet shallower are estimated to the top of the source than with a cylindrical source. Narrow anomalies of this length are often caused by steeply dipping tabular bodies and this type of source should be considered as well as the rod-like source apparently defined by the drilling to date.

The near surface PFE high seen near 7.5N on dipole-dipole Line 1 is also present as a near surface high on the gradient array with excellent correlation. This anomaly, where crossed on Lines 1, 3, 8, 7 and 10, has roughly the same southeasterly strike as the ore zone and is associated with a pronounced high resistivity zone. A dark massive limestone outcropping on the ridge crest above the Glove Mine appears to be the source. Finely divided graphite or pyrite in the limestone is likely the polarizable material.

Line 1 was extended south to cross the anomaly noted near 12.0S on the dipole-dipole coverage to verify that the anomaly is caused by the grounded fence. A gradient PFE high is present at 12.0S definitely offset from the fence which is at 12.7S. However, the anomaly is actually a crossover and the inflection point correlates very well with the fence. The fence is only about 600 feet from the south current electrode and is therefore not in a very uniform electric field - perhaps causing the crossover rather than a more symmetric high as expected.

The gradient array resistivity plots, in particular the plan, shows several features of interest. The Glove Fault shows up very well as a sharp break in slope with the Precambrian granite to the south averaging about five times lower in resistivity than the limestones directly to the north. Again, there is an area of more complex data west of Line 2 where the Glove Fault may branch.

The ore zone appears to correlate with a broad resistivity high of unknown cause somewhat similar in shape to the PFE high. A very high resistivity trend on the north end of the grid, as previously mentioned, correlates with a near surface source PFE high and a massive dark limestone outcrop on the ridge top.

The self potential information taken with the gradient and dipole-dipole I. P. coverage shows very little of interest; mostly minor background variations. A sharp 200 millivolt low at 11.5N on Line 3 is perhaps of some interest, but has no associated I. P. anomalism.

The down hole radial I. P. lines show nothing particularly diagnostic. The north end of the north-south line near 7.5N does show the high resistivity PFE anomaly noted in the other surveys. Both radials show possibly spurious high PFEs near the collar of the (uncased) drill hole, perhaps caused by nearby artificial grounded conductor interference.

Inductive coupling interference was not appreciable during any of the three I. P. surveys and was checked by taking PFEs at several different pairs of frequencies (running a spectrum).

RECOMMENDATIONS

Drilling or drifting is certainly warranted to further evaluate the economic significance of the gradient PFE anomalism. The north lobe of the PFE high on Lines 1 and 4 should be tested either by drilling several vertical holes collared in the vicinity of 2.0N between Lines 1 and 4 or, preferably, underground drilling collared near the ore zone between Lines 1 and 4 bearing NNE and inclined from roughly horizontal to 20° or 30° above horizontal to follow the topographic slope. The vertical holes should be about 500 to 600 feet deep and the underground holes about 350 feet long.

Underground drilling is also suggested near Line 3 to test a portion of the single elongate PFE high. Horizontal to +/- 30° inclined drilling bearing NNE from the 360 or 440 level is initially recommended with holes about 250 feet long.

These drill targets, if similar in size to the known ore zone, will be very small zones difficult to intersect and several offset holes may be necessary to obtain intersection. Samples of the various materials encountered in the drilling should be tested in the laboratory in case the polarizable cause is not obvious on inspecting the drill core.

If this drilling meets with any success, additional testing along entire anomaly strike length defined to date should be initiated and the gradient grid extended, mainly to the west, to determine its extent and locate further drilling targets.

Underground gradient array coverage could be quite helpful along the longer more north-south drifts and would give additional detail on the anomaly much closer to its source.

PROCEDURES

The dipole-dipole coverage was obtained using standard field methods and similarly presented as on previous C. F. & I. projects and has been discussed in previous reports.

The gradient array technique utilizes two grounded current electrodes placed far enough on either side of the area to be processed so that the area is in an approximately uniform electric field. This field is preferably oriented normal to the expected target strike, if known, and measurements are taken along lines normal to strike. In this case, the grounded current electrodes were placed about 1,800 feet north and 2,700 feet south of the center of the gridded area. Rugged topography made it inefficient to place the north electrode any further north, as would be desired ideally, to better center the area processed between the two electrodes.

Also, the voltage measurements are made over a short enough distance relative to the current dipole length, so that they will approximate (when divided by that distance) the gradient of the voltage in the normal-to-strike direction.

One important item to note in gradient work is that the depth of penetration is determined by the current dipole length and not the voltage measuring dipole length. For a given grid, depth manifests itself by broadness of anomaly shape just as in a magnetic, gravity or SP survey and the resulting I. P. data is interpreted and presented in a very similar fashion to these other geophysical techniques. Changing the voltage measuring lengths (station spacing) only effects the detail of the resultant data and not the depth response. The plan and profile data are plotted at the midpoint between the two voltage measuring points.

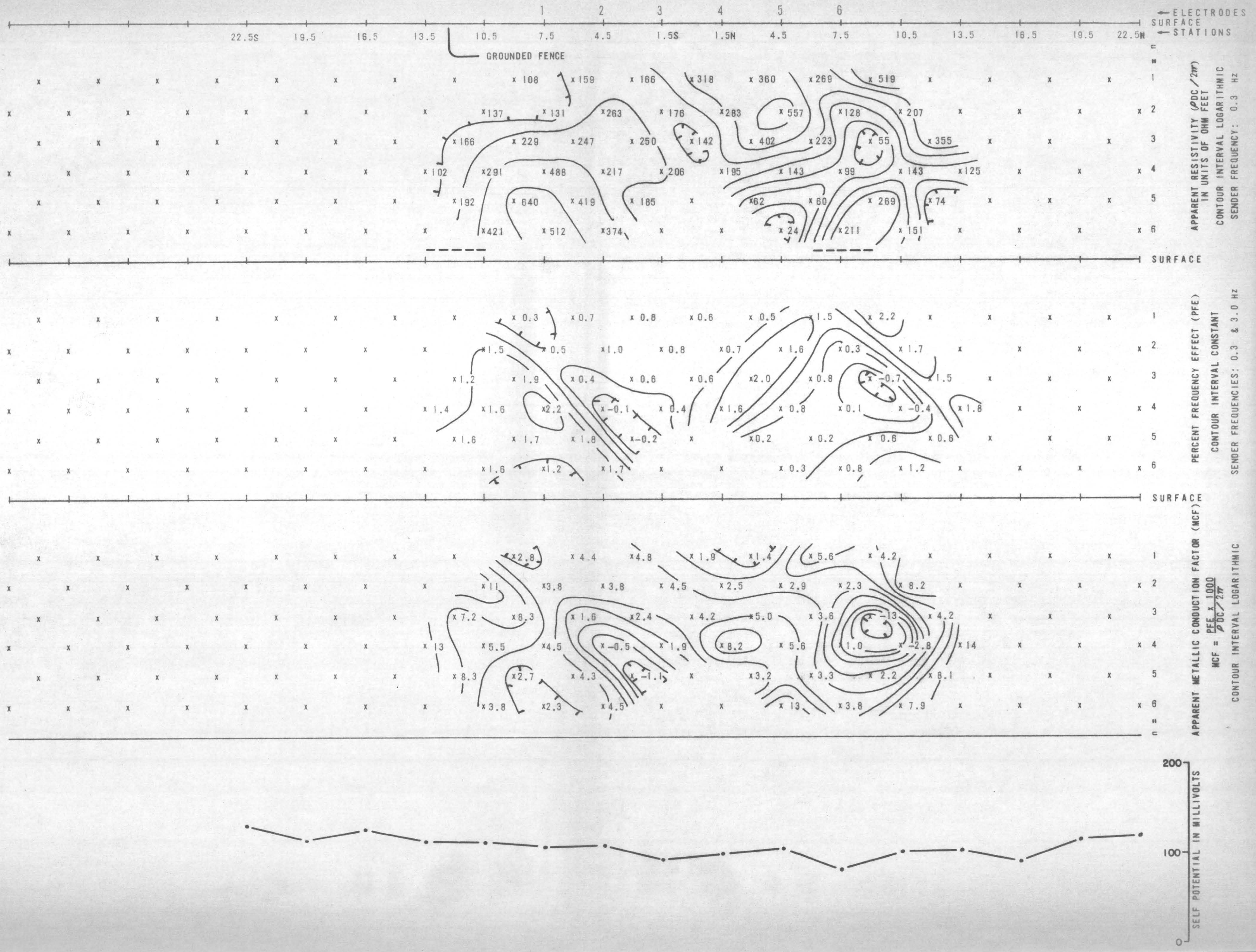
The drill hole radial work was done by placing one current electrode down Drill Hole # 8 at about 445 feet below the collar to contact the ore zone. Receiving measurements were made along radial lines run from the collar of the hole with a voltage measuring dipole spacing of 100 feet. The data are shown as profiles with the values plotted at the midpoint of the voltage measuring dipole. The south gradient array current electrode was used as the "infinite" current return.

Respectfully submitted,
Heinrichs GEOEXploration Company

Chris S. Ludwig, Senior Geophysicist

Walter E. Heinrichs, President

July 2, 1971
P. O. Box 5964
Tucson, Az. 85703



631-71

LINE NO.
1
SPREAD(S)
1

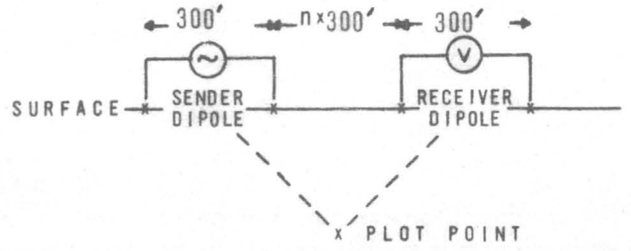
INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET for

C. F. & I. STEEL CORP.

RELATIVE ANOMALY STRENGTH

VERY WEAK | WEAK | MODERATE | STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



AREA
GLOVE MINE
LOOKING
WEST
DATE
MAY 1971

File

HEINRICHS
GEOEXPLORATION COMPANY
GEOPHYSICAL ENGINEERS

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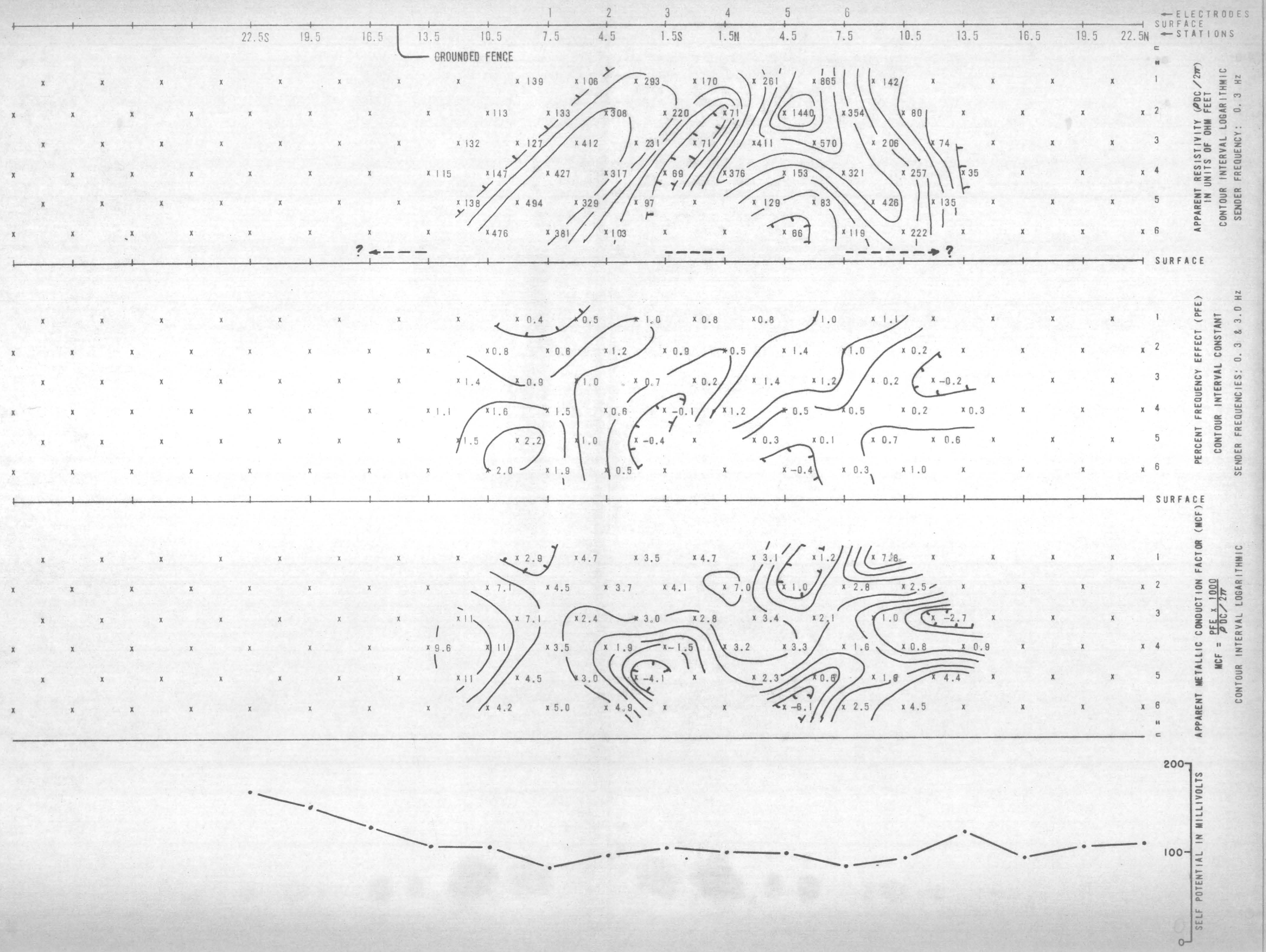


831-71

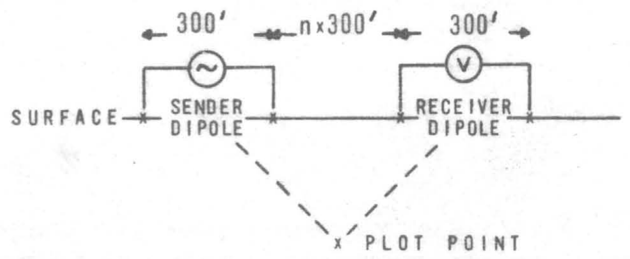
LINE NO. 2
SPREAD(S) 1

INDUCED POLARIZATION TRAVERSE SECTIONAL DATA SHEET
for
C. F. & I. STEEL CORP.

RELATIVE ANOMALY STRENGTH

VERY WEAK — WEAK — MODERATE — STRONG

DIPOLE DIPOLE ELECTRODE ARRAY



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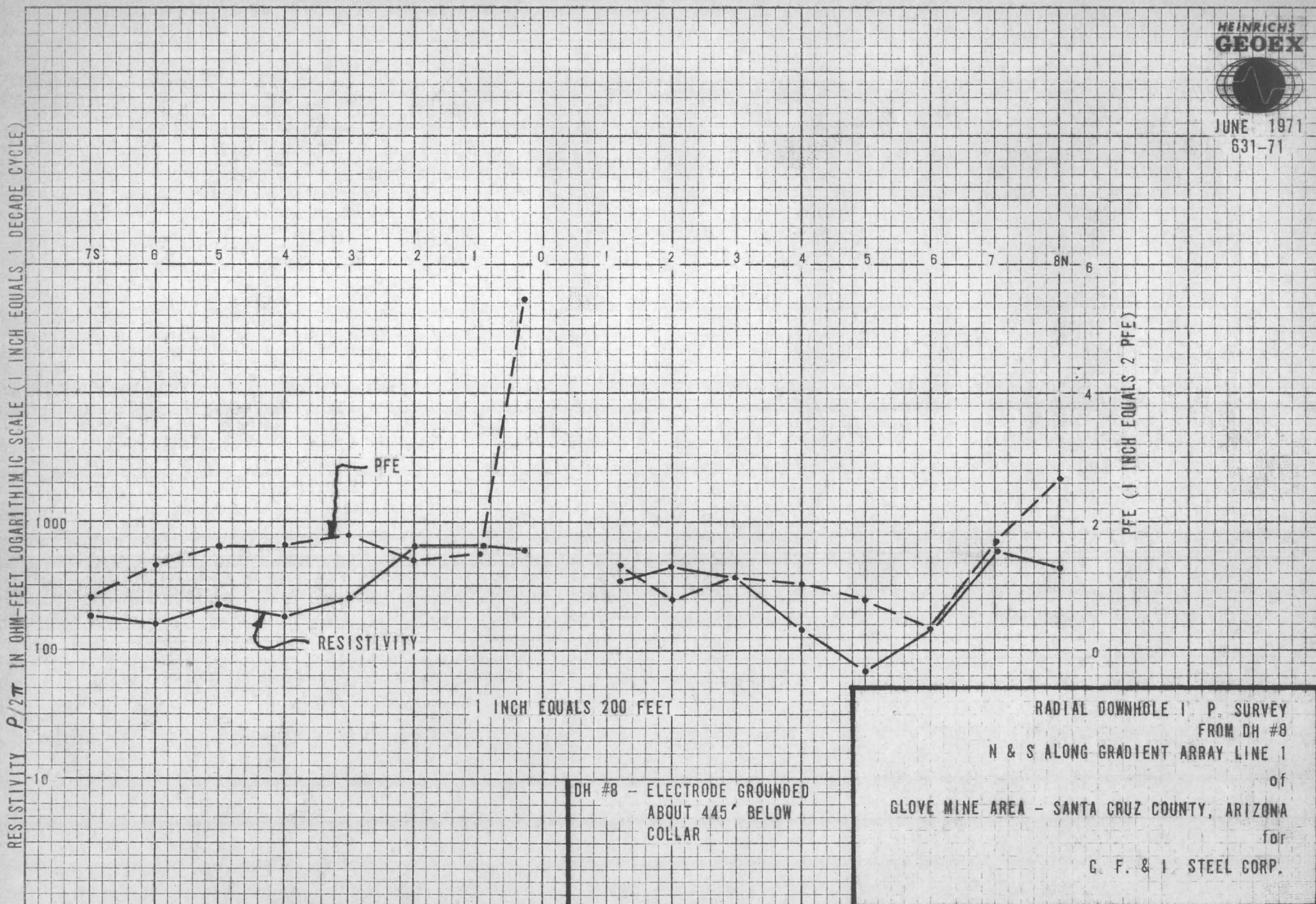
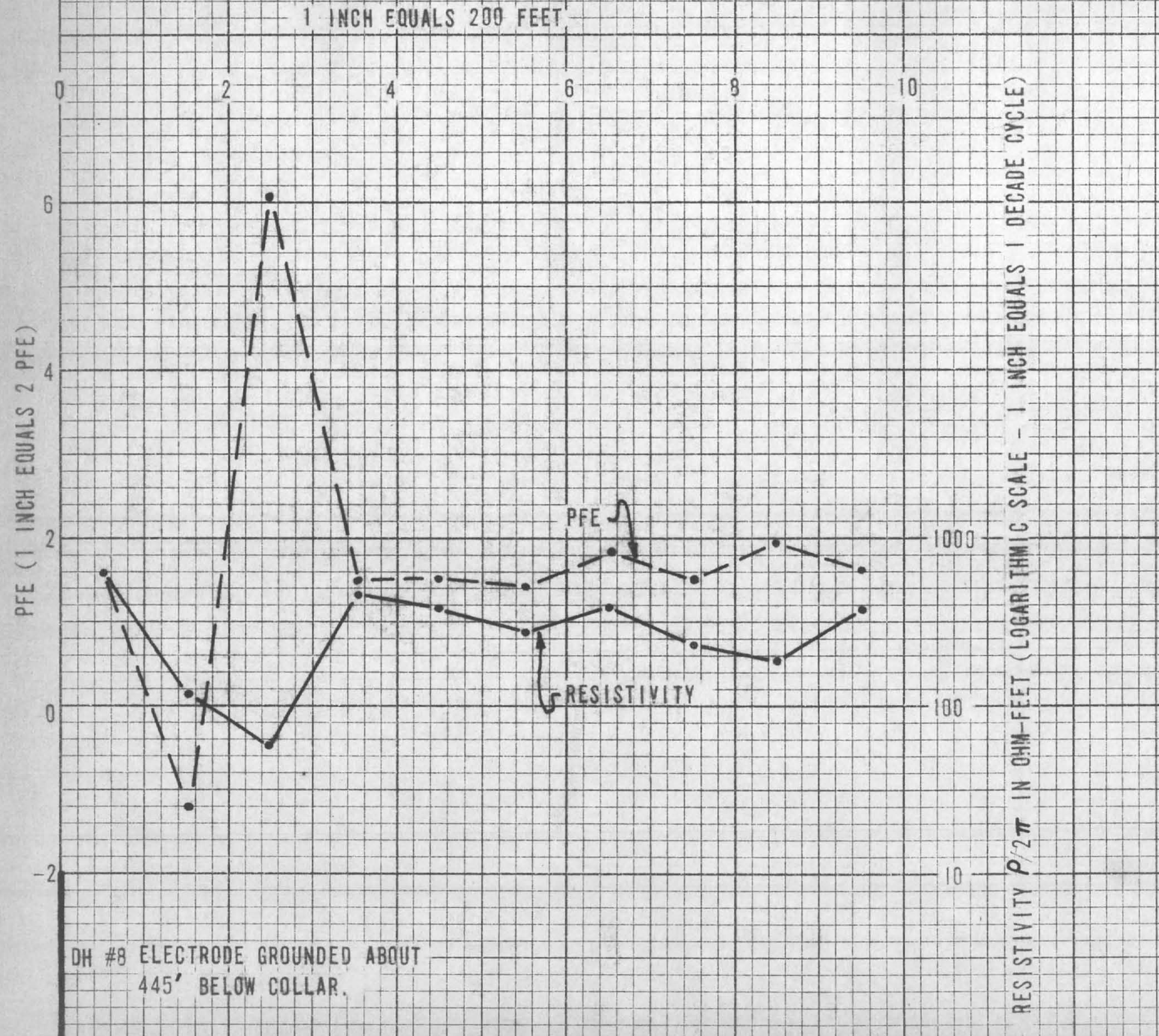

HEINRICHS
GEOEX
JUNE 1971
631-71
RADIAL DOWNHOLE I. P. SURVEY
FROM DH #8
N & S ALONG GRADIENT ARRAY LINE 1
of
GLOVE MINE AREA - SANTA CRUZ COUNTY, ARIZONA
for
C. F. & I. STEEL CORP.
7S
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8N
PFE
RESISTIVITY
1000
100
10
6
4
2
0
PFE (1 INCH EQUALS 2 PFE)
RESISTIVITY $\rho/2\pi$ IN OHM-FEET LOGARITHIMIC SCALE (1 INCH EQUALS 1 DECADE CYCLE)
1 INCH EQUALS 200 FEET
DH #8 - ELECTRODE GROUNDED
ABOUT 445' BELOW
COLLAR



HEINRICHS GEOEX

JUNE 1971
631-71

RADIAL DOWNHOLE I. P. SURVEY
FROM DH #8
S 57° E ALONG PROJECTED ORE TREND
of
GLOVE MINE AREA - SANTA CRUZ COUNTY, ARIZONA
for
C. F. & I. STEEL CORP.

File

COMMENTS ON DRILLING I.P. TARGETS

To maximize the probability that a recommended drill hole will intersect the source of an induced polarization anomaly, the following points should be considered:

1. The anomaly has been caused by some physical property, hopefully a polarizable body containing economically interesting metallic mineralization, and this property should be determined before abandoning the anomaly.

2. Location of drill holes should be made relative to the actual sending and receiving electrode positions as they exist on the ground.

3. Due to inherent limitations in the I.P. method, depth interpretations are only approximate and the determination of dip is severely limited, particularly for angles greater than 45°. Also, targets can generally be laterally resolved no finer than the station spacing (dipole length). Because of these limitations, targets less than one dipole spacing in width, particularly when steeply dipping or deeper than the dipole length, may be difficult to intersect. In these cases, several drill holes in a fence line should be considered. For the steeply dipping cases, angle drilling may also prove advantageous, mainly where the direction of dip can be geologically inferred and the drill hole oriented such that an optimum intersection of the zone of interest is obtained.

4. An observed anomaly can be the effect of a polarizable body laterally offset to the side of a line and therefore, if practical, drilling should be confined to those portions of the anomalous zones well defined by several lines. Also, it should be noted that a single line cannot define the strike direction of an elongate anomalous zone - another reason for utilizing several parallel lines.

5. Logging of the drill core must be done with special care to note the quantity of all possible polarizable material such as pyrite, graphite, magnetite, manganese oxides and clay minerals as well as the polarizable ore minerals. The anomalous source could conceivably be overlooked if the core is not carefully logged.

6. Typical sections of core representing the gross physical properties of material encountered in the drilling should be tested in the laboratory for their I.P. parameters, if there is some doubt about confirmation of the anomalous source.

EXPERIMENTAL
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GLOVE MINE AREA

SANTA CRUZ COUNTY, ARIZONA

for

C. F. & I. Steel Corporation

JULY 1971

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P. O. Box 5964, Tucson, Arizona 85703

GEOEX Job 631

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Line 2 (dipole-dipole), however, does show a subtle PFE anomaly centered near 0.0N/S correlating well with the projected ore trend. Minor increased response north of 7.5N and south of 13.5S, likely correlating with the two similar zones of response on Line 1, is further from the zone of interest and therefore produces less interference than on Line 1.

The 0.0N/S Line 2 anomaly is so weak and poorly defined that no depth or size estimates can reasonably be made and with the lack of any obvious ore response on Line 1, the dipole-dipole work was discontinued and a gradient array tried.

The initial gradient coverage on and near Lines 1 and 2 showed very weak but rather well defined PFE response approximately correlating with the ore zone. With these encouraging results, a 2,100 foot portion of the expected mineral trend in the mine working area was processed by a total of eleven gradient lines about 200 feet apart.

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The ore zone appears to correlate with a broad resistivity high of unknown cause somewhat similar in shape to the PFE high. A very high resistivity trend on the north end of the grid, as previously mentioned, correlates with a near surface source PFE high and a massive dark limestone outcrop on the ridge top.

The self potential information taken with the gradient and dipole-dipole I. P. coverage shows very little of interest; mostly minor background variations. A sharp 200 millivolt low at 11.5N on Line 3 is perhaps of some interest, but has no associated I. P. anomalism.

The down hole radial I. P. lines show nothing particularly diagnostic. The north end of the north-south line near 7.5N does show the high resistivity PFE anomaly noted in the other surveys. Both radials show possibly spurious high PFEs near the collar of the (uncased) drill hole, perhaps caused by nearby artificial grounded conductor interference.

Inductive coupling interference was not appreciable during any of the three I. P. surveys and was checked by taking PFEs at several different pairs of frequencies (running a spectrum).

RECOMMENDATIONS

Drilling or drifting is certainly warranted to further evaluate the economic significance of the gradient PFE anomalism. The north lobe of the PFE high on Lines 1 and 4 should be tested either by drilling several vertical holes collared in the vicinity of 2.0N between Lines 1 and 4 or, preferably, underground drilling collared near the ore zone between Lines 1 and 4 bearing NNE and inclined from roughly horizontal to 20° or 30° above horizontal to follow the topographic slope. The vertical holes should be about 500 to 600 feet deep and the underground holes about 350 feet long.

Underground drilling is also suggested near Line 3 to test a portion of the single elongate PFE high. Horizontal to +/- 30° inclined drilling bearing NNE from the 360 or 440 level is initially recommended with holes about 250 feet long.

These drill targets, if similar in size to the known ore zone, will be very small zones difficult to intersect and several offset holes may be necessary to obtain intersection. Samples of the various materials encountered in the drilling should be tested in the laboratory in case the polarizable cause is not obvious on inspecting the drill core.

If this drilling meets with any success, additional testing along entire anomaly strike length defined to date should be initiated and the gradient grid extended, mainly to the west, to determine its extent and locate further drilling targets.

Underground gradient array coverage could be quite helpful along the longer more north-south drifts and would give additional detail on the anomaly much closer to its source.

PROCEDURES

The dipole-dipole coverage was obtained using standard field methods and similarly presented as on previous C. F. & I. projects and has been discussed in previous reports.

The gradient array technique utilizes two grounded current electrodes placed far enough on either side of the area to be processed so that the area is in an approximately uniform electric field. This field is preferably oriented normal to the expected target strike, if known, and measurements are taken along lines normal to strike. In this case, the grounded current electrodes were placed about 1,800 feet north and 2,700 feet south of the center of the gridded area. Rugged topography made it inefficient to place the north electrode any further north, as would be desired ideally, to better center the area processed between the two electrodes.

Also, the voltage measurements are made over a short enough distance relative to the current dipole length, so that they will approximate (when divided by that distance) the gradient of the voltage in the normal-to-strike direction.

One important item to note in gradient work is that the depth of penetration is determined by the current dipole length and not the voltage measuring dipole length. For a given grid, depth manifests itself by broadness of anomaly shape just as in a magnetic, gravity or SP survey and the resulting I. P. data is interpreted and presented in a very similar fashion to these other geophysical techniques. Changing the voltage measuring lengths (station spacing) only effects the detail of the resultant data and not the depth response. The plan and profile data are plotted at the midpoint between the two voltage measuring points.

The drill hole radial work was done by placing one current electrode down Drill Hole # 8 at about 445 feet below the collar to contact the ore zone. Receiving measurements were made along radial lines run from the collar of the hole with a voltage measuring dipole spacing of 100 feet. The data are shown as profiles with the values plotted at the midpoint of the voltage measuring dipole. The south gradient array current electrode was used as the "infinite" current return.

COPY

Respectfully submitted,
Heinrichs GEOEXploration Company

Chris S. Ludwig, Senior Geophysicist

Walter E. Heinrichs, President

July 2, 1971
P. O. Box 5964
Tucson, Az. 85703

ELLIOT GEOPHYSICAL COMPANY
Mining Geophysical Engineers
4653 EAST PIMA STREET TUCSON, ARIZONA 85712 TEL. (602) 793-2421

September 13, 1971 Ref: CF1E

HEINRICHS GEOEX
Cable: GEOEX
REC'D DEC 10 1971 REC'D
BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Mr. James R. Brooks
C F & I Steel Corporation
7503 E. Osborne Road
Scottsdale, Arizona 85252

Dear Jim:

Re: Review of Experimental Induced Polarization Survey, Glove Mine Area, Santa Cruz County, Arizona.

As requested by you in a meeting on August 3, 1971, I have reviewed the experimental induced polarization-resistivity survey work at the Glove Mine in Santa Cruz County, Arizona by Heinrichs Geoexploration Company, Tucson, Arizona. Subsequent to this I held a meeting with Chris Ludwig and Paul Head of the staff of Heinrichs Geoexploration Company on August 5, 1971. In that this program was an experimental program involving different techniques than conventional modes of operation for induced polarization-resistivity surveys a certain amount of discussion of the ramifications, field procedures, data reduction techniques, and interpretive procedures performed by Heinrichs Geoexploration Company was indeed in order.

The data available to me for study and review consisted of the following:

1. Report: Experimental Induced Polarization Survey, Glove Mine Area, Santa Cruz County, Arizona for C F & I Steel Corporation, July, 1971, Heinrichs Geoexploration Company, Job Number 631, C. S. Ludwig and W. E. Heinrichs, July 2, 1971.

2. Geologic Map, Montosa-Cottonwood Canyons Area, Santa Cruz County, Arizona, John W. Anthony 1951, Scale 1" = 1000 feet.

3. Mt. Wrightston, Arizona quadrangle sheet 15 minute 1958.

Subsequent to the examination and analysis in review of the data we met on September 8, 1971 and discussed the conclusions reached by me. This letter is, therefore, in support of our meeting of September 8, 1971 and presents the conclusions and recommendations of the review of the Heinrichs experimental data.

The Glove Mine is located in T. 20 S., R. 14 E. and generally in section 30, at approximate latitude of 31^{o}-40' N. and longitude of 110^{o}-57' W. The known economic mineralization at the Glove Mine is a cylindrical body approximately 20 to 30 feet in diameter with a southeasterly flat plunge. The ore contains massive galena, massive sphalerite, and some pyrite. The top of the sulfides do not come within about 360 feet of surface while above 360 feet the ore zone is predominately oxidized. The ore zone mineralization itself should have a moderately high conductivity certainly in relation to the surrounding limestone and therefore should respond to any of several electrical geophysical techniques. However, the geometry of the ore zone as presently known from geological studies, underground workings, and diamond drillings would suggest that the zone is very restrictive in size and therefore in relation to its depth it would be an extremely small and difficult target to detect by any of the common electrical geophysical methods such as electromagnetics, induced polarization, or resistivity. It is reported that there may be a halo of disseminated mineralization around the ore zone perhaps increasing the diameter of the overall mineralized zone to the order of 100 to 200 feet. Even considering the halo as part and parcel of the target zone it is still an extremely difficult target to detect under more than 350 feet of relatively unmineralized cover.

Consequently standard techniques of electrical geophysical methods likely would not have any application. Heinrichs Geoexploration Company have clearly pointed out this poor detectibility and have performed a test program that was clearly considered to be experimental from the onset with no guarantees of success. Their approach was to employ a gradient array which is an inline array with widely spaced current electrodes, in this case north and south of the Glove Mine, and conventional induced polarization and resistivity measurements were made utilizing a very short receiver dipole. The current electrodes were placed about 1800 feet N. and 2700 feet S. of the Glove Mine. The potential electrode dipole was 100 foot run on 11 north-south profiles. In addition, Heinrichs Geoexploration Company also performed two conventional inline dipole-dipole electrode array setups utilizing 300 foot dipoles. This data was for correlation purposes and did not materially add any information to the experimental program.

Heinrichs Geoexploration Company have employed the gradient array with apparent success in Australia for a number of years. However, the gradient array has not been employed very much in Southwestern United States exploration in that it is difficult to employ in low surface resistivity conditions. The gradient array is very susceptible to noise influences due to electromagnetic line magnetic coupling effects and general electrical noise because of the typically poor signal levels available with this array. As a consequence, those organizations that have attempted to use it in the Southwest have been very disappointed with the results. Heinrichs Geoexploration Company in employing it at the Glove Mine have run somewhat of a risk that noise fields could enter the data making interpretations difficult if not in fact impossible. Fortunately, the average resistivity levels in the immediate Glove Mine Area due to limestone host rock are moderately high. In resistivity units of $\frac{\rho}{2\pi}$ in ohm feet the average levels are 100 to 500 which is equivalent to a range of 200 to 1000 ohmmeters. These resistivity levels should be sufficiently high that electromagnetic line coupling effects and other noise field effects should be minimal in the data. Heinrichs Geoexploration Company have presented the data in profiles along each of the 11 lines surveyed and in contoured presentation at a scale of 1 inch equals 50 feet. These presentations are available for both the induced polarization data and the resistivity data.

We knew high ρ because of previous D-D work ∴ No risk!

True

ρ/2π

The resistivity data clearly reflects the Glove fault, a major structural feature, running northwest-southeast with high resistant limestones to the north of the fault and lower resistivity intrusive rocks south of the fault. The resistivity data would suggest that in progressing westward the Glove fault does swing to the south to account for a high resistivity zone on line 6. At least near surface a block of high resistant limestone must exist on the south side of the Glove fault. This may or may not be consistent with recent geologic mapping. Further, the resistivity data reflects some interfingering of low resistivity material within the limestone suggesting either intrusive rocks buried underneath the limestones or a change in structural properties of the limestone giving rise to more porosity and hence a severe drop in resistivity. With simple gradient array profiling it is difficult to determine depths to these features and therefore their significance is of questionable value. It is not anticipated that any valuable information in terms of the ore zone in the Glove Mine would be recognizable in the resistivity data.

The companion induced polarization data is the crucial data to analyze in terms of possible indication of the Glove Mine mineralization. A perusal of the contoured presentation of the induced polarization data yields two elongated parallel anomalously high zones running from the western most lines to the eastern most lines. The elongation and continuity in these two zones is disturbing and does not appear to correlate with the geology as is presently known. Particularly this is true of the northern most elongated zone which is the higher responsive zone of the two and this feature overlies limestone as mapped at surface with no suggestion of any structure or mineralization that could give rise to this induced polarization feature. The gradient of the anomaly are high suggesting that this zone is reflecting a mineralized zone or structure at or near surface, and yet there is no evidence of this at the present surface or in any of the canyons cutting it. This zone badly needs explanation in that if this zone is indicating a fault zone or mineralization then this would seriously degrade the possible application of this technique at the Glove Mine area.

The southern zone again extends from west to east and is noted on every line that was surveyed with the gradient array. This zone does in general follow the surface trace of the Glove fault which is known to be a major structure and therefore this zone may be reflecting generalized structural disturbance and mineralization along the Glove fault and associated with it. There is a suggestion in perusing the induced polarization data that these two zones are actually a scissor structure crossing in the central part of the area with one zone striking virtualy east-west and the other zone striking approximately parallel of the Glove fault with a bearing of approximately N. 60° W. Over the known ore zone at the Glove Mine the anomalous zone seems to split into two branches but this may merely be reflecting the split of two mineralized zones associated with major structures and at the ore zone lies on the east side of the intersection of the scissor faults. The ore zone is known to plunge to the south-eastern direction. Therefore, it is very difficult to concede that this gradient array data is reflecting that actual ore zone. It is of course a geologic possibility that there could be more than one ore zone lying in en echelon along and parallel to the Glove fault.

Basically it is disturbing to me that this zone is so continuous at about the same level of response and apparent on every line surveyed. Obviously no distinct anomaly associated with the known ore zone is present in this data and given the data and not knowing about the presence of the ore zone there is no way possible to spot drill hole testing over the ore zone without recommending drill holes all the way along the responsive zone. In terms of anomaly magnitude the zone appears to become wider and higher in value on the western most line of the survey which is Line 11. Heinrichs Geoexploration Company personnel have made an attempt to quantitatively interpret the induced polarization responsive zones and they cannot come up with the suggestion of plunge of the ore zone but in effect they obtained a virtual constant depth of indicated response material giving rise to this anomalous feature. Again this immediately suspects that it is due to something other than the economic mineralized zone with a known plunge at the Glove Mine.

Heinrichs Geoexploration Company people have made recommendations for drill testing several of the features of this anomalous zone. I disagree with these recommendations and consider them totally premature. I do however feel that the work to date of an experimental nature has not been a complete waste. There may be merit in this approach and the data may be trying to tell us something about structure, structural control, and a generalized mineralization in the Glove Mine area. If so the information could be quite valuable in an indirect sense to guide further exploration activities in this potentially interesting area.

[I don't know how else to evaluate these anomalies]

In my opinion the key to the solution to this approach is to determine the extent of this southern anomalous elongated induced polarization zone and whether it continues eastward and westward ad infinitum or whether it does ultimately cut off and encloses a zone of mineralization or structure along the Glove fault or associated with it. Therefore, I recommend that a select few additional lines be surveyed with the same gradient array technique. I would recommend that four additional lines be surveyed: two lines west of the present survey and two lines east of the present survey. I would further suggest that the lines be located at 400 foot spacings in order to cover more distance along strike of the feature for a minimum amount of survey effort. Therefore, specificly, I am recommending north-south lines as follows:

1. 400 feet W. of line 11
2. 800 feet W. of line 11
3. 400 feet E. of line 10
4. 800 feet E. of line 10

[agreed as a minimum]

This data would be to confirm the existence and extent of this anomalous zone. The lengths of the lines could be so determined to cover only the anomalous portion as projected from the existing data at hand. If the survey of the above four recommended lines shows a cut off of the zone then I would survey intermediate lines at 200 foot spacings. If on the other hand the lines recommended show the same zone persisting for another 800 feet each side of the present surveyed area then I would consider it an adequate test that this structure continues for all intent purposes ad infinitum and therefore probably has little or no economic significance to guide further exploration.

In further to the above, I think a careful study of all geological data and underground information and drill holes should be performed to see if there is any mineralization to justify the existence of this anomalous zone to the south to ascertain whether it is attempting to indicate any possible associated mineralization or structure that could have a usefulness in guidance for further exploration. Also further geological considerations should be given to the northern anomalous zone, in which to the best of my knowledge no known structure of mineralization exists. An explanation for this zone is badly needed in order to ascertain the overall usefulness of this technique.

In summary, the work by Heinrichs Geoexploration Company is of apparently reasonably good quality and they have made a serious effort to perform a new approach of an experimental nature in an attempt to detect the lead/zinc sulfide ore zone at the Glove Mine. The data is at least quite interesting and may be attempting to reflect mineralization or structure associated with the Glove fault and when analyzed and used properly could help in guiding further exploration at this potentially interesting property. I do consider the conclusions and recommendations by Heinrichs Geoexploration Company to be a bit premature and that further work of the same nature with additional survey lines outlined above should be performed before any additional drilling is attempted to test any geophysical conclusions. In further to the above, some additional geological study and analysis of all data at hand should be made to ascertain if any geologic or mineralization cause can be derived as to the cause of the two anomalous zones present in the data.

I am particularly disturbed by the elongation of these two zones suggesting that they are reflecting topography or other delineated structures and are not directly associated with mineralization associated with the lead/zinc sulfide ore zone at the Glove Mine. I would be happy to review the subsequent gradient array data if your organization should decide to perform this additional work prior to any further drill testing of the concepts proposed in the Heinrichs Geoexploration Company report.

Respectfully submitted,

ELLIOT GEOPHYSICAL COMPANY

Registered Professional Engineer (Geophysical) CERTIFICATE NO. 6877 CHARLES L. ELLIOT Date Signed 9-13-71 Arizona U. S. A.

Charles L. Elliot

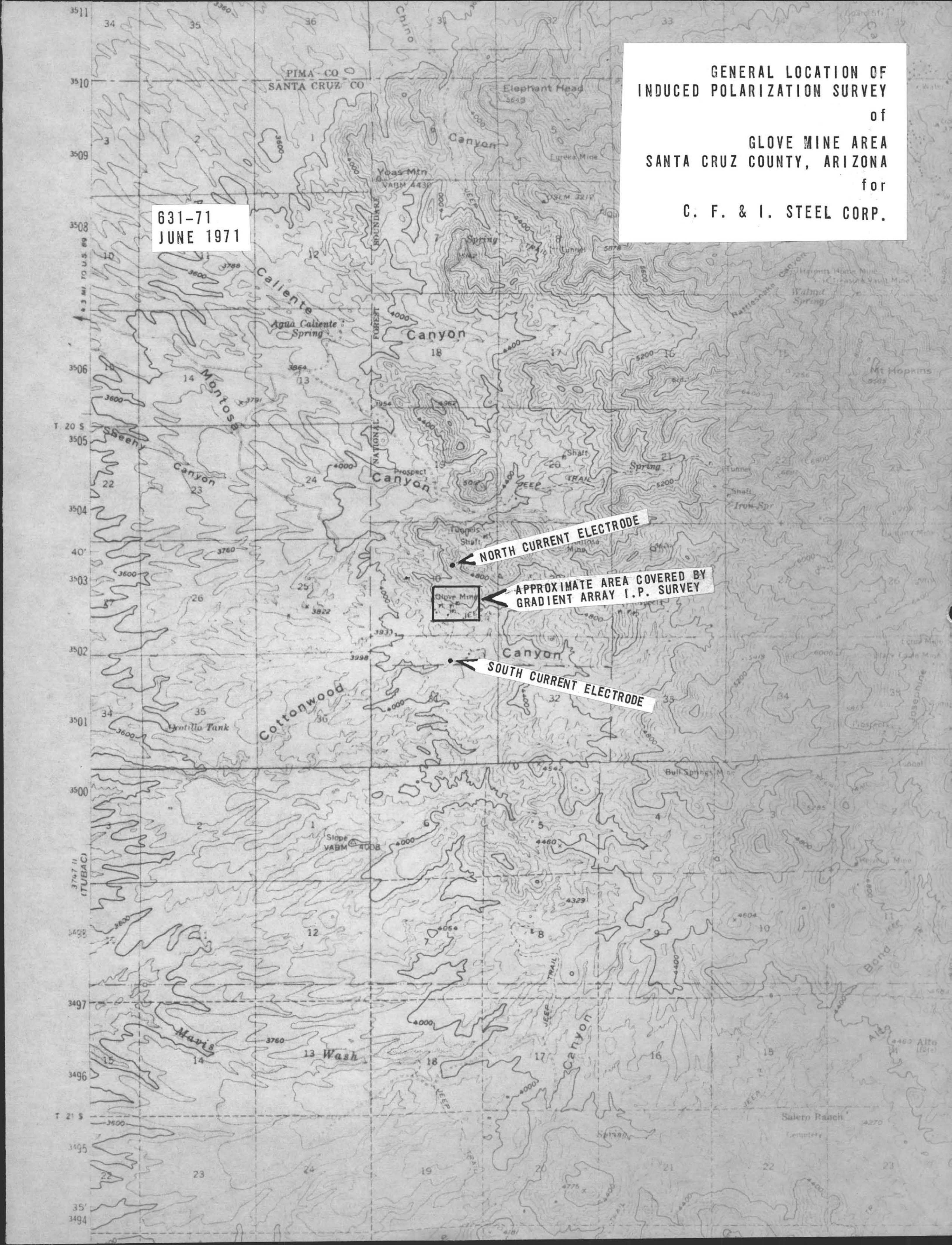
Charles L. Elliot

CLE:bt
Copy: David G. Ellingwood

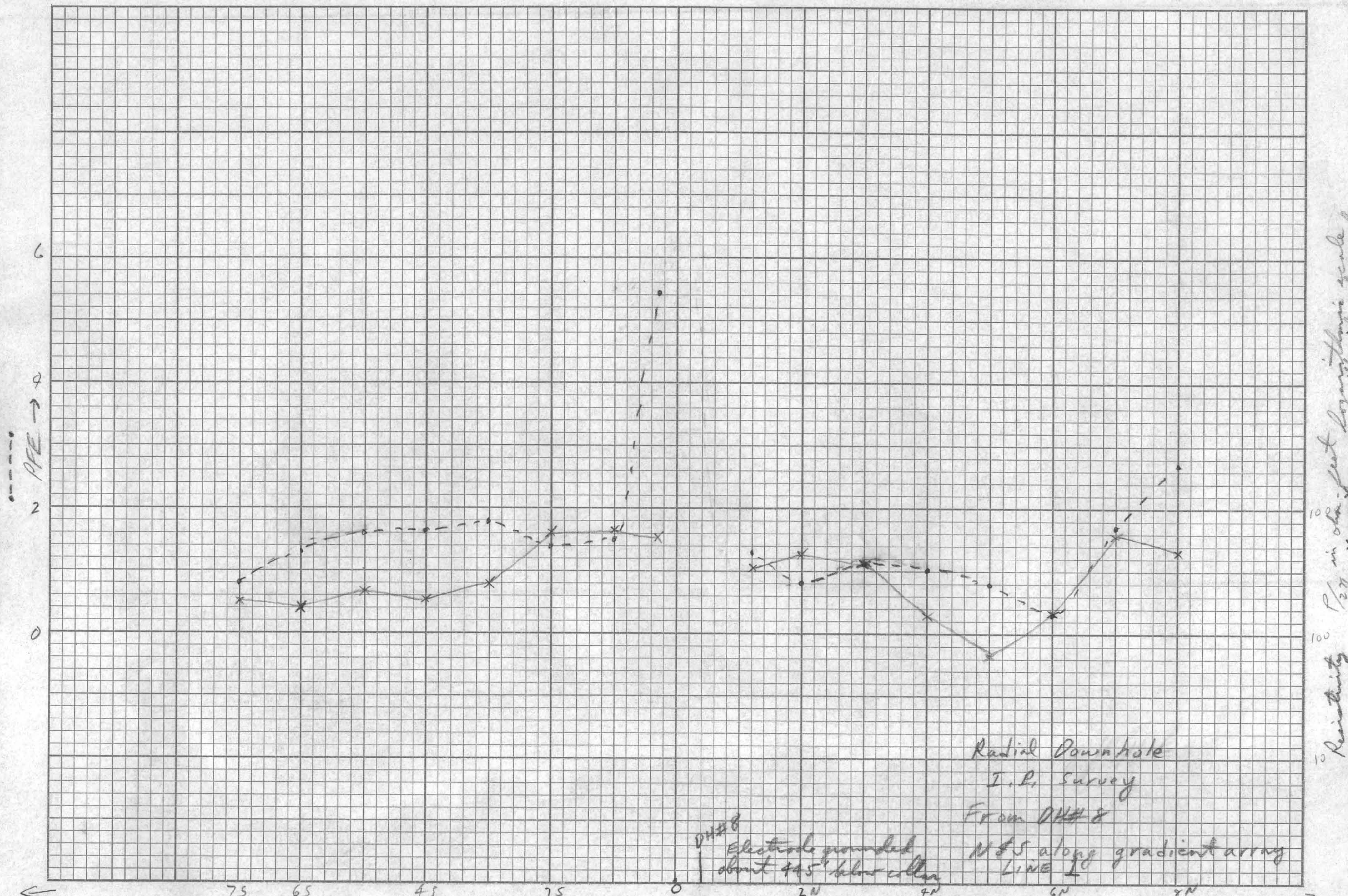
CF&I STEEL CORPORATION
P. O. BOX 1522
SCOTTSDALE, ARIZONA 85252

SCOTTSDALE, AZ
PM
DEC 14
1971

Heinrichs Geoexploration Co.
P. O. Box 5964
Tucson, Arizona 85705

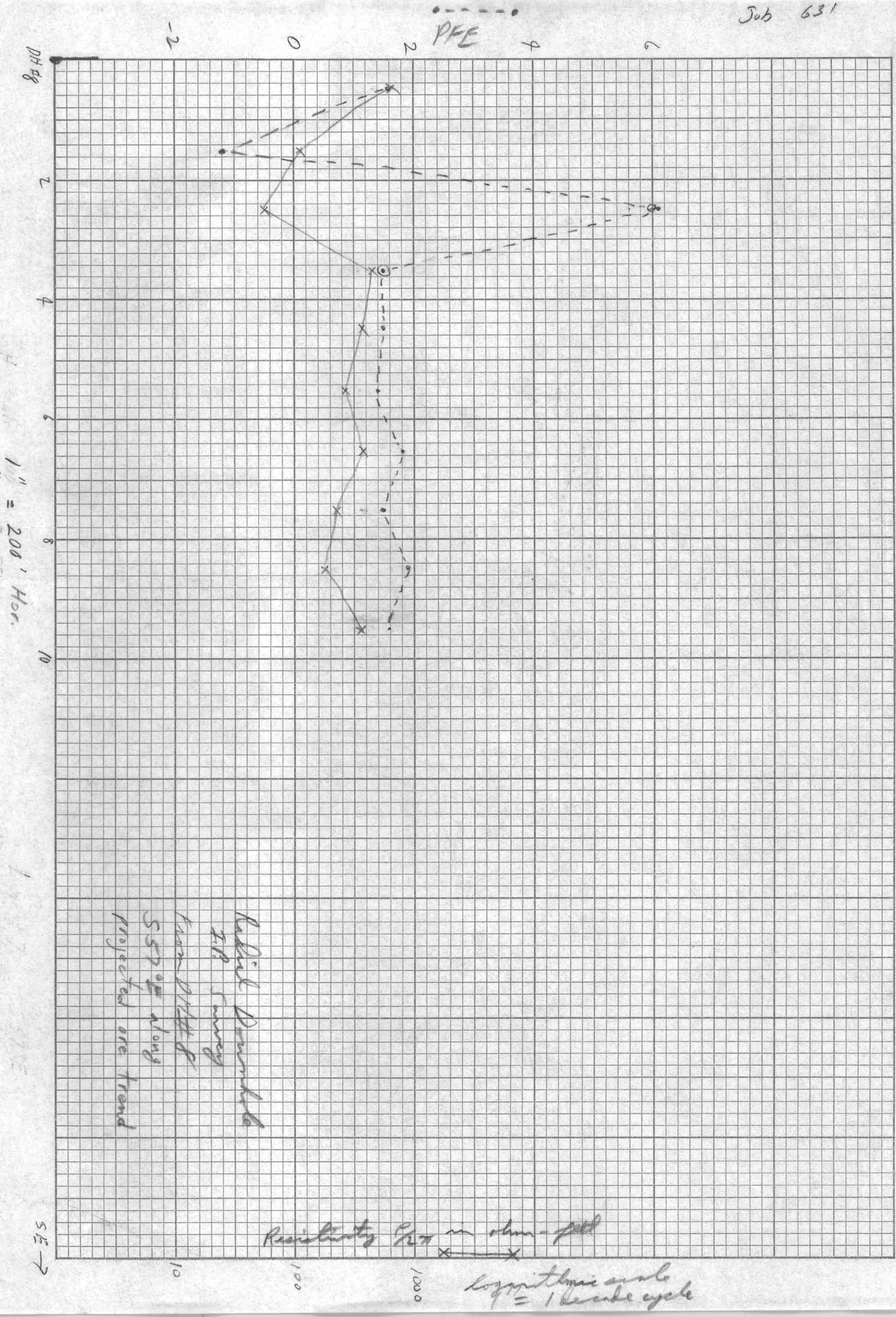

GENERAL LOCATION OF
INDUCED POLARIZATION SURVEY
of
GLOVE MINE AREA
SANTA CRUZ COUNTY, ARIZONA
for
C. F. & I. STEEL CORP.
631-71
JUNE 1971
NORTH CURRENT ELECTRODE
APPROXIMATE AREA COVERED BY
GRADIENT ARRAY I.P. SURVEY
SOUTH CURRENT ELECTRODE
PIMA CO
SANTA CRUZ CO
Elephant Head
Canyon
Yoas Mtn
Caliente
Agua Caliente Spring
Canyon
Montosa
Sheehy
Canyon
Prospect
Canyon
Glove Mine
Canyon
Cottonwood
Ocotillo Tank
Mt Hopkins
Bull Springs Mine
Mavis
Wash
Canyon
Salero Ranch
T. 20 S
T 21 S
NATIONAL FOREST BOUNDARY
JEEP TRAIL

Job 631



~~DH 8 not quite on line see plan map~~

1" = 200' Hor.


Job 631
PFE
DH#8
-2
0
2
4
6
2
4
6
8
10
1" = 200' Hor.
Pole-Dipole
I.P. Survey
from DH#8
S57°E along
projected ore trend
Resistivity ρ/2π in ohm-feet
logarithmic scale = 1 decade cycle
10
100
1000
SE →

+1.0 SP Balance

Electrode 13 DH #8 440 to 450 deep

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 631 Glove

LINE 1 HALF ____ S.P. ____ DATE 5/20

PAGE 1

SEND	ODD sta at DH 8, about									Cal
RECEIVE	0.7 – 1.7N	1.5N – 2.5N	2.5 – 3.5	3.5 – 4.5	4.5 – 5.5	5.5 – 6.5	6.5 – 7.5	7.5 – 8.5		
RANGE	1.0	10	1.0	1.0	1.0	1.0	10	1.0		10
DC 1 1.0		0.0					0.6			
DC 2 .3	1.1	0.4	+0.8	+0.7	+0.5	0.0	1.4	2.4		-0.3
DC 3 .1		0.6					2.1			
DC 4										
DC 5										
DC 6 Chst	332	434	384	138	66	144	619	471		
DC 7										
DC 8										
DC AVG.										
AC 1 3.0	80.1	148.0	67.7	51.4	21.9	41.55	152.0	98.4		200.0
AC 2	+0.2	-0.2	0.0	0.0	0.0	0.0	+0.1	0.0		0.0
AC AVG.										
S.P.	-1.2	+2.6	+7.7	+9.0	+13.3	+7.5	-13.2	+9.6		
AC NOISE										
POT RES.										

Drill Hole #8 electrode

PAGE 2

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 631
LINE 1 HALF 5 S.P. ____ DATE 5/21

SEND	DDH 8									
RECEIVE	to 0.0	0.0 - 0.55	.55 - 1.5	1.5 - 2.5	2.5 - 3.5	3.5 - 4.5	4.5 - 5.5	5.5 - 6.5	6.5 - 7.5	
RANGE	1.0	1.0	10	10	1.0	1.0	1.0	1.0	1.0	
DC 1										
DC 2 .3	5.8	~~[illegible]~~ 5.3	~~[illegible]~~ 1.0	0.9	1.5	1.5	1.4	1.0	0.5	
DC 3										
DC 4										
DC 5 e/[illegible]		605	670	631	250	185	171	158	176	
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	33.45	16.95 ~~14.8~~	139.0	215.0	96.2	69.05	56.9	45.6	43.25	
AC 2	-0.2	+0.3	-0.4	-0.3	0.0	+0.4	+0.2	0.0	0.0	
AC AVG.										
S.P.	+29.8	-4.3	+0.4	+9.7	-10.1	+38.1	+31.3	-2.2	+19.3	
AC NOISE										
POT RES.										

(Receiver is East of Pot) CuRRent Line ≅ 11 50 NE of Line 7

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE 2

PROJECT 631

LINE 7 HALF ____ S.P. ____ DATE 5/21

SEND	Rept	Rept		Rept						Cal
RECEIVE	4 - 3	3 - 2	3 - 2.5	3 - 2.5	3.5 - 3					Check
RANGE	10	1	1.	1.0	10					10
DC 1 1.	0.4	2.8	2.9	0.5	2.1					-0.3
DC 2 .3	1.1	5.3	4.2	1.2	3.1					-0.4
DC 3 .1	1.7	9.0	8.9	2.9	1.4 ✓					-0.5
DC 4										
DC 5			??	? ?						
DC 6										
DC 7										
DC 8										
DC AVG.										
AC 1	175.0	21.0	~~18.3~~ 19.0	21.0	130.0					201.5
AC 2	0.0	-0.6 ?		-1.0	-0.5					0.0
AC AVG.										
S.P.	+2.0	+13.1	+16.1							
AC NOISE										
POT RES.										

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

S 57°E

PROJECT 631 Glove

LINE 7 HALF E SP. DATE 5/21

PAGE

SEND										Cal
RECEIVE	0 - 1SE	1SE 2SE	2 - 3	3 4	4 - 5	5 - 6	6 - 7	7 - 8	8-9	9-10	I = 2.0
RANGE	1.0	1.0	1.0	10.	10.	1.0	1.0	1.0	1.0	1.0	10
DC 1 1.0											-0.2 | -0.2
DC 2 .3	1.3	-1.4	5.6	1.2	1.2	1.1	1.5	1.2	1.6	1.3	-0.3 | -0.3
DC 3 .1											-0.6 | -0.5
DC 4											
DC 5 9/27	649	111	56	453	361	267	360	230	183	355	
DC 6											
DC 7											
DC 8											
DC AVG.		31.85									
AC 1	70.9	~~28.0~~	20.8	174.0	128.0	83.05	95.75	52.1	35.4	58.55	200.
AC 2	0.0	+0.2	-0.4	0.0	+0.1	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.											
S.P.	+2.7	-1.4	+4.7	+11.2	+15.7	+9.0	+12.6	+16.0	+17.8	+2.5	
AC NOISE											
POT RES.											

$$\ell_a/2\pi \simeq \left| \frac{aV}{I} \left[\frac{1}{\sqrt{n^2+d^2}} - \frac{1}{\sqrt{(n+1)^2+d^2}} \right]^{-1} \right|$$

$d = 445'/100' = 4.45$ $I = 2000$

Line 7 $a = 100'$

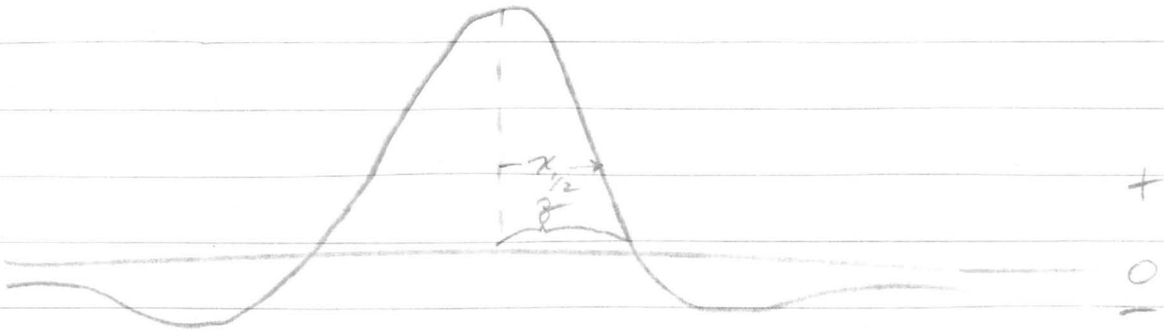
$n = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9$

n	$[\quad]^{-1}$			$\ell_a/2\pi$	
0	$\left[\frac{1}{4.45} - \frac{1}{\sqrt{1+4.45^2}}\right]^{-1}$			$183 \times 0.05 \times 70.9$	$= 649$
1	$\left[\frac{1}{\sqrt{1+4.45^2}}\ .21925 - \frac{1}{\sqrt{4+4.45^2}}\ .20496\right]^{-1}$			$70.0 \times 0.05 \times 31.85$	111
2	$\left[\frac{1}{\sqrt{4+4.45^2}}\ .20496 - \frac{1}{\sqrt{9+4.45^2}}\ .18633\right]^{-1}$			$53.7 \times 0.05 \times 20.8$	56
3	.18633	16	.16712	52.1 (174)/20	453
4	.16712	25	.14939	56.4 (128)/20	361
5	.14939	36	.13386	64.4 (83.05)/20	267
6	.13386	49	.12055	75.1 (95.75)/20	360
7	.12055	64	.10923	88.3 (52.1)/20	230
8	.10925	81	.09960	103.6 (35.4)/20	183
9	.09960	100	.09136	121.4 (58.55)/20	355

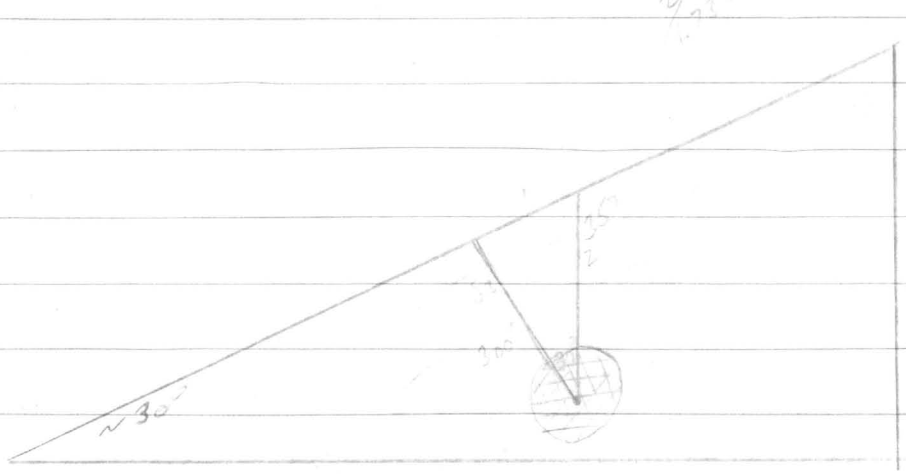
0.7	$\left[\frac{1}{\sqrt{.7^2+4.45^2}}\ .22198 - \frac{1}{\sqrt{1.7^2+4.45^2}}\ .20992\right]^{-1}$			82.9 (80.1)/20	332	
1.5	$\left[\frac{1}{\sqrt{1.5^2+4.45^2}}\ .21294 - \frac{1}{\sqrt{2.5^2+4.45^2}}\ .19591\right]^{-1}$			58.7 (148)/20 (215)	434	631
2.5	.19591	3.5^2	.17663	51.9 (67.7)/20 (96.2)	384	250
3.5	.17663	4.5^2	.15801	53.7 (51.4)/20 (69.05)	138	185
4.5	.15801	5.5^2	.14134	60.0 (21.9)/20 (56.9)	66	171
5.5	.14134	6.5^2	.12694	69.4 (41.55)/20 (45.6)	144	158
6.5	.12694	7.5^2	.11466	81.4 (152)/20 (43.25)	619	176
7.5	.11466	8.5^2	.10422	95.8 (98.4)/20	471	

.5 .22331 $.5^2$ .21294 1.5^2 96.4   670

.771235   214.41165   1430



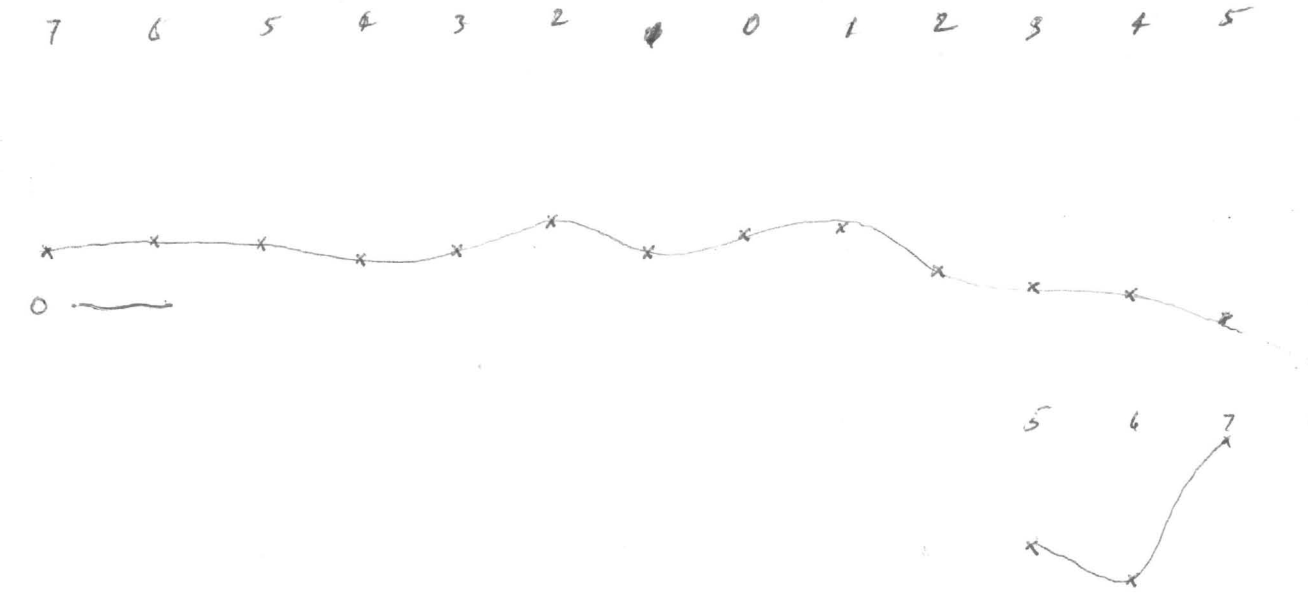
$1.89\, x_{1/2} = z$



INDUCED POLARIZATION SENDER NOTES

Project: Line 3 - 'wof #1 Line: 631 Glove Date: 5/18/71

Send												
Receive	4.5N-5.5	5.5-6.5N	6.5-7.5	7.5-8.5	4.5-3.5	3.5-2.5	2.5-1.5	1.5-0.5N	0.5N-0.5S	.5S-1.5S	1.5-2.5	2.5-3.5
Time freq	3.0 0.3	→	→	→	→	→	→	→	→	→	→	→
Range												
Current	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Send												
Receive	3.5-4.5	4.5-5.5	5.5-6.5	6.5-7.5								
Time freq	3.0 0.3	→	→	→								
Range												
Current	1.0	1.0	1.0	1.0								



7 6 5 4 3 2 0 1 2 3 4 5
0
5 6 7

INDUCED POLARIZATION SENDER NOTES

Project: 631 Glove Line: Gradient Line 1 Date:

Send												
Receive	S → 7.5-6.5	6.5-5.5	N 5.5.4.5	4.5-3.5	3.5-2.5	2.5S-1.5S	1.5S-.5S	.5S-0.5N	0.5-1.5	1.5-2.5	2.5-3.5	3.5-4.5
Time freq	3. 1.0	3. .3	3. .3									
Range PFE	.3 .1 1.0	1.1	1.1	0.9	1.0	1.5	1.1	1.3	1.4	0.7	0.4	0.2
Current	VOLTS 820 → 1.	1.	1.	1.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Send	5.											
Receive	4.5-5.5	5.5-6.5	6.5-7.5	7.5-8.5								
Time	3. -0.3			3.0 1.0 .3 .1								
Range	-0.3	-0.8	1.7	1.9								
Current	1.0	1.0	1.0	1.0								

x 2.5S ... ... 2.5N x

INDUCED POLARIZATION SENDER NOTES

Project: 631 Glove Line: 2 Gradient Date: 5/18/71

Send												
Receive	7.5S-6.5S	6.5-5.5	5.5-4.5	4.5-3.5	3.5-2.5	2.5-1.5	1.5-0.5S	.5S-.5N	.5N-1.5N	1.5-2.5	2.5-3.5	3.5-4.
Time freq	3.0-0.3											
Range												
Current	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Send												
Receive	4.5-5.5	5.5-6.5	6.5-7.5									
Time freq	3.0-0.3											
Range												
Current	1.0	1.0	1.0									

JOB 631, LINE 2, Spread 1, 5 ½, 5/14/71 300.

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 631 Glove

LINE 2 HALF 5 SP. 1 DATE 5/14/71

PAGE 1

SEND	CAL	3-4	4-5	5-6	2-3	3-4	4-5	5-6	1-2	2-3
RECEIVE	4-5	4.5-7.5S	→	→	7.5-10.5S	→	→	→	10.5-13.5S	→
RANGE	1	10	1	0.1	10	1	1	0.1	1.0	1
DC 1	-0.1	0.9	0.8	0.1	0.4	1.0	0.6	-0.2	0.3	0.5
DC 2										
DC 3										
DC 4 Cur	0.6	0.6	0.6	.6	1	.6	.6	.6	1	1
DC 5 #	1	1	2	3	4	5	6	7	8	9
DC 6 n		1	2	3	1	2	3	4	1	2
DC 7										
DC 8										
DC AVG.										
AC 1	60.5	197.	36.8	4.85	118.	51.2	15.4	2.32	155.5	36.9
AC 2 PFE	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
AC AVG.										
S.P.	3.0	-11.8			+21.7				+0.8	
AC NOISE	0.3									
POT RES.		12K			8.5K				14K	

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE 2

PROJECT 631 - Glove

LINE 2 HALF 5 S.P. 1 DATE 5/14/

SEND	3-4	4-5	5-6	1-2	2-3	3-4	4-5	5-6	1-2	2-3
RECEIVE	⟶	⟶	⟶	13.5-16.55	⟶	⟶	⟶	⟶	16.5-19.55	⟶
RANGE	1	1	0.1	1	1	1	0.1	0.1	1	0.1
DC 1	0.9	0.5	-0.5	0.7	0.8	1.4	0.9	0.4	1.3	1.5
DC 2										
DC 3										
DC 4 Cm	.6	.6	.6	1	1	.6	.6	.6	1	1
DC 5 #	10	11	12	13	14	15	16	17	18	19
DC 6 n	3	4	5	2	3	4	5	6	3	4
DC 7										
DC 8										
DC AVG.										
AC 1	27.4	10.6	1.87	31.5	14.1	14.15	6.26	1.225	14.6	8.09
AC 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.				+19.5					+23.0	
AC NOISE						G Fence @	15:05			
POT RES.				25K					5K	

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

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PROJECT 631 - Glove

LINE 2 HALF 5 S.P. 1 DATE 5/14/[illegible]

SEND	3-A	4-5	1-2	2-3	3-4					
RECEIVE	→	→	19.5-22.55	→	→					
RANGE	0.1	0.1	0.1	0.1	0.1					
DC 1	2.1	1.8	1.0	1.4	1.9					
DC 2										
DC 3										
DC 4 Cur	.6	.6	1	1	.6					
DC 5 #	20	21	22	23	24					
DC 6 N	5	6	4	5	6					
DC 7 Kn	31.5									
DC 8										
DC AVG.										
AC 1	9.29	4.49	6.37	4.34	5.60					
AC 2	0.0	0.0	0.0	0.0	0.0					
AC AVG.										
S.P.			+16.8							
AC NOISE			19.5	on Road	& 20' S of	Brace Cage	2T ?			
POT RES.			6K							

INDUCED POLARIZATION SENDER NOTES

Project: 631 Line: 2 Sp 1 Date: 5/14/71

Send	3-4	4-5	5-6	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5	5-6
Receive	4.5s —	7.5 s	→	7.5—10.5	—	—	—	10.5—13.5	—	—	—	—
Time												
Range	840	790	650	700	830	770	660	730	710	840	780	650
Current	0.6	.6	.6	1.0	0.6	0.6	0.6	1.0	1.0	0.6	.6	.6
Send	1-2	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	13.5 —	16.5	—	—	—	16.5—19.5	—	—	—	19.5—22.5	—	—
Time												
Range	720	690	820	780	640	710	700	820	780	710	710	820
Current	1.0	1.0	.6	.6	.6	1.0	1.0	0.6	0.6	1.0	1.0	.6

freq 3.0 0.3 Cal 2-3 570 0.6

JoB 631, Line 2, Spread 1, N½, 5/17/71 300.

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HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 631 Glove
LINE 2 HALF N SP. 1 DATE 5/12/7[illegible]

SEND	CAL	3-4	4-5	5-6	4-5	5-6	5-6	3-4	2-3	1-2
RECEIVE	4-5	1-2	———	——→	2-3	——→	3-4	4.5-7.5N	———	——→
RANGE	1	10	1	0.1	10	1	10	10	1	0.1
DC 1	-0.1	1.0	0.8	0.2	0.7	0.4	0.7	0.7	0.4	0.1
DC 2										
DC 3										
DC 4 Cur	0.6	.6	———	———	———	———	———	———	——→	.9
DC 5 #	2	1	2	3	4	5	6	7	8	9
DC 6 n		1	2	3	1	2	1	1	2	3
DC 7										
DC 8										
DC AVG.										
AC 1	60.35	192.5	36.5	4.74	113.	11.9	173.5	174.	11.9	7.10
AC 2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.	3.0	-9.0	-6.9	-1.1				-13.0		
AC NOISE	0.3	1.5S-4.5S	1.5S-1.5N	1.5N-4.5N						
POT RES.		15K	10K	8K				16K		

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

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PROJECT 631 Glove
LINE 2 HALF N S.P. 1 DATE 5/17/71

SEND	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2	5-6
RECEIVE	7.5-10.5N →				10.5-13.5N →					13.5-16.5N
RANGE	10	10	1	1	10	1	1	0.1	0.1	1
DC 1	0.9	1.3	1.3	1.1	1.1	0.9	1.1	0.4	0.2	0.1
DC 2										
DC 3										
DC 4 Cm	.6	.6	.9	.9	.9	.6	.6	.9	.9	.9
DC 5 #	10	11	12	13	14	15	16	17	18	19
DC 6 n	1	2	3	4	1	2	3	4	5	2
DC 7 Km	.9	3.6	9	18					31.5	
DC 8										
DC AVG.										
AC 1	574.	238.	40.8	18.7	141.	58.8	37.8	7.65	3.70	20.2
AC 2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.	+8.7				+28.1					-28.4
AC NOISE										
POT RES.	14K				8K					22K

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 631 Glove

LINE 2 HALF N S.P. 1 DATE [illegible]

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SEND	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	5-6	4-5	3-4
RECEIVE	→			→	16.5-19.5N	→		→	19.5-22.5N	→	
RANGE	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DC 1	0.1	0.4	0.0	-0.5	-0.3	0.1	0.6	0.2	0.2	0.5	0.9
DC 2			~								
DC 3			-0.4-+0.3								
DC 4 Gn	.6	.6	.9	1.333	.9	.6	.6	1.333	.9	.6	.6
DC 5 #	20	21	22	23	24	25	26	27	28	29	30
DC 6 n	3	4	5	6	3	4	5	6	4	5	6
DC 7 Ky				51.9							
DC 8											
DC AVG.											
AC 1	13.8	10.7	2.38	1.75	7.45	8.60	8.10	3.15	1.76	2.57	2.63
AC 2	0.0	0.0	+0.1	+0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.											
S.P.					+11.3				+1.6		
AC NOISE											
POT RES.					25K				25K		

INDUCED POLARIZATION SENDER NOTES

Project: 631-71 Line: 2-5-1 Date: 5-17-71

Send	3-4	4-5	5-6	4-5	5-6	5-6	3-4	2-3	1-2	4-5	3-4	CAL
Receive	1-2	1-2	1-2	2-3	2-3	3-4	5-6	4.5-7.5 →		7.5-	10.5 →	4-5
~~Time~~	840	800	640	800	640	640	840	460	620	800	840	800
Range	2-B	→		2-B	→		2-B	→		2-B	→	2B
Current	600m	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.9	0.6	0.6	.6
Send	2-3	1-2	5-6	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2
Receive	→		10.5-	13.5	→			13.5-	16.5	→		
Time	640	620	840	800	840	640	620	840	800	840	640	840
Range	2B	→	2B	→				2B	→			
Current	0.9	0.9	0.9	0.6	0.6	0.9	0.9	0.9	0.6	0.6	0.9	1.333

INDUCED POLARIZATION SENDER NOTES

Project: 631-71 Line: 2-S-1 N-S Date: 5-17-71

Send	5-6	4-5	3-4	2-3	5-6	4-5	3-4					
Receive	16.5-19.5	→	→	→	19.5-22.5		—					
Time	840	800	840	840	840	800	840					
Range	2-B	→	→	2.B	→	→	→					
Current	0.9	0.6	0.6	1.333	0.9	0.6	0.6					
Send												
Receive												
Time												
Range												
Current												

JOB 631 LINE 2 SPREAD 1 SOUTH 1/2 5/14/71 300 FEET=DIPOLE LENGTH
CAL GROUP NO. 1

CAL CUR	PFE	AC1	AC2	AC FREQ	DC FREQ	PFE CAL	RHO CAL
.600	-.10	60.500	0.00	3.00	.30	-.1000	.9917

COMPUTED DATA									FIELD DATA					
POINT NO.	N	RHO	PFE	MCF	CCPFE	CCMCF	CPFE		PFE	CUR	PT.	N	AC1	AC2
1	1	295.99	1.00	3.4	1.00	3.4	0.00	**	.90	.60	1	1	197.000	0.00
2	2	220.95	.90	4.1	.90	4.1	0.00	**	.80	.60	2	2	36.800	0.00
3	3	72.29	.20	2.8	.20	2.8	0.00	**	.10	.60	3	3	4.850	0.00
4	1	105.85	.50	4.7	.50	4.7	0.00	**	.40	1.00	4	1	118.000	0.00
5	2	308.01	1.15	3.7	1.15	3.7	0.00	**	1.00	.60	5	2	51.200	-.10
6	3	230.69	.70	3.0	.70	3.0	0.00	**	.60	.60	6	3	15.400	0.00
7	4	68.96	-.10	-1.5	-.10	-1.5	0.00	**	-.20	.60	7	4	2.320	0.00
8	1	139.35	.40	2.9	.40	2.9	0.00	**	.30	1.00	8	1	155.500	0.00
9	2	132.53	.50	4.5	.60	4.5	0.00	**	.50	1.00	9	2	36.900	0.00
10	3	411.68	1.00	2.4	1.00	2.4	0.00	**	.90	.60	10	3	27.400	0.00
11	4	317.26	.60	1.9	.60	1.9	0.00	**	.50	.60	11	4	10.600	0.00
12	5	96.97	-.40	-4.1	-.40	-4.1	0.00	**	-.50	.60	12	5	1.870	0.00
13	2	113.36	.80	7.1	.80	7.1	0.00	**	.70	1.00	13	2	31.500	0.00
14	3	126.98	.90	7.1	.90	7.1	0.00	**	.80	1.00	14	3	14.100	0.00
15	4	427.31	1.50	3.5	1.50	3.5	0.00	**	1.40	.60	15	4	14.150	0.00
16	5	329.19	1.00	3.0	1.00	3.0	0.00	**	.90	.60	16	5	6.260	0.00
17	6	102.56	.50	4.9	.39	3.8	.11	**	.40	.60	17	6	1.225	0.00
18	3	132.14	1.40	10.6	1.40	10.6	0.00	**	1.30	1.00	18	3	14.600	0.00
19	4	146.73	1.60	10.9	1.60	10.9	0.00	**	1.50	1.00	19	4	8.090	0.00
20	5	494.34	2.20	4.5	2.20	4.5	0.00	**	2.10	.60	20	5	9.290	0.00
21	6	381.15	1.90	5.0	1.90	5.0	0.00	**	1.80	.60	21	6	4.490	0.00
22	4	114.96	1.10	9.6	1.10	9.6	0.00	**	1.00	1.00	22	4	6.370	0.00
23	5	137.61	1.50	10.9	1.50	10.9	0.00	**	1.40	1.00	23	5	4.340	0.00
24	6	475.84	2.00	4.2	2.00	4.2	0.00	**	1.90	.60	24	6	5.600	0.00

JOB 631 LINE 2 SPREAD 1 NORTH 1/2 5/17/71 300 FEET=DIPOLE LENGTH
CAL GROUP NO. 2

CAL CUR	PFE	AC1	AC2	AC FREQ	DC FREQ	PFE CAL	RHO CAL
.600	-.10	60.350	0.00	3.00	.30	-.1000	.9942

COMPUTED DATA									FIELD DATA					
POINT NO.	N	RHO	PFE	MCF	CCPFE	CCMCF	CPFE		PFE	CUR	PT.	N	AC1	AC2
1	1	290.23	1.05	3.6	1.05	3.6	0.00	**	1.00	.60	1	1	192.500	.10
2	2	219.69	.90	4.1	.90	4.1	0.00	**	.80	.60	2	2	36.500	0.00
3	3	70.90	.30	4.2	.30	4.2	0.00	**	.20	.60	3	3	4.740	0.00
4	1	169.87	.80	4.7	.80	4.7	0.00	**	.70	.60	4	1	113.000	0.00
5	2	71.34	.50	7.0	.50	7.0	0.00	**	.40	.60	5	2	11.900	0.00
6	1	260.81	.80	3.1	.80	3.1	0.00	**	.70	.60	6	1	173.500	0.00
7	1	261.56	.80	3.1	.80	3.1	0.00	**	.70	.60	7	1	174.000	0.00
8	2	71.34	.50	7.0	.50	7.0	0.00	**	.40	.60	8	2	11.900	0.00
9	3	70.73	.20	2.8	.20	2.8	0.00	**	.10	.90	9	3	7.100	0.00
10	1	864.57	1.00	1.2	1.00	1.2	0.00	**	.90	.60	10	1	574.000	0.00
11	2	1439.59	1.40	1.0	1.40	1.0	0.00	**	1.30	.60	11	2	238.000	0.00
12	3	411.31	1.40	3.4	1.40	3.4	0.00	**	1.30	.90	12	3	40.800	0.00
13	4	376.29	1.20	3.2	1.20	3.2	0.00	**	1.10	.90	13	4	18.700	0.00
14	1	141.87	1.10	7.8	1.10	7.8	0.00	**	1.10	.90	14	1	141.000	.20
15	2	354.26	1.00	2.8	1.00	2.8	0.00	**	.90	.60	15	2	58.800	0.00
16	3	570.48	1.20	2.1	1.20	2.1	0.00	**	1.10	.60	16	3	37.800	0.00
17	4	152.87	.50	3.3	.50	3.3	0.00	**	.40	.90	17	4	7.650	0.00
18	5	129.14	.30	2.3	.30	2.3	0.00	**	.20	.90	18	5	3.700	0.00
19	2	80.49	.20	2.5	.20	2.5	0.00	**	.10	.90	19	2	20.200	0.00
20	3	206.21	.20	1.0	.20	1.0	0.00	**	.10	.60	20	3	13.800	0.00
21	4	320.73	.50	1.6	.50	1.6	0.00	**	.40	.60	21	4	10.700	0.00
22	5	82.90	.05	.6	-.04	-.5	.09	**	0.00	.90	22	5	2.380	.10
23	6	6551.95	-.45	-.1	-.45	-.1	0.00	**	-.50	1.33	23	6	175.000	.10
24	3	73.92	-.20	-2.7	-.20	-2.7	0.00	**	-.30	.90	24	3	7.450	0.00
25	4	257.02	.20	.8	.20	.8	0.00	**	.10	.60	25	4	8.600	0.00
26	5	425.74	.70	1.6	.70	1.6	0.00	**	.60	.60	26	5	8.100	0.00
27	6	118.76	.30	2.5	.21	1.8	.09	**	.20	1.33	27	6	3.150	0.00
28	4	3510.08	.30	.1	.30	.1	0.00	**	.20	.90	28	4	176.000	0.00
29	5	134.95	.60	4.4	.60	4.4	0.00	**	.50	.60	29	5	2.570	0.00
30	6	221.84	1.00	4.5	1.00	4.5	0.00	**	.90	.60	30	6	2.630	0.00

Job 631 Line 1 Sp 1 N/2 5/13/71

300.

To be prepared
for punching

3 ¢ 0.3 Hz

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 631 (Glove Mine)
LINE 1 HALF N½ S.P. 1 DATE 5/13/7[illegible]

PAGE 1

SEND	CAL	3-4	4-5	5-6	4-5	5-6	5-6	3-4	2-3	1-2
RECEIVE	4-5	1-2	→	→	2-3	→	3-4	4.5=7.5N	→	→
RANGE	1	10	1	0.1	10	1	10	10	10	1
DC 1	-0.1	0.7	0.7	0.4	0.5	0.7	0.3	0.4	0.4	0.5
DC 2										
DC 3										
DC 4	.6	1	1	0.6	1	0.6	0.6	1	2	2
DC 5										
DC 6 CUR	0.6	1	—	.6	1	.6	—	1	2	—
DC 7 #	1	1	2	3	4	5	6	7	8	9
DC 8 n		1	2	3	1	2	1	1	2	3
DC AVG.										
AC 1	60.4	184.	49.0	9.51	354	47.1	240.	403	158	31.8
AC 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.	3.0	+6.7						-23.5		
AC NOISE	0.3	1.5N-4.5N								
POT RES.								23K		

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT 631 (Glove)

PAGE 2

LINE 1 HALF N S.P. 1 DATE 5/13/71

SEND	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2	5-6
RECEIVE	7.5-10.5N →				10-5-13.5N →					13.5-16.5N
RANGE	10	10	1	1	10	1	1	1	0.1	1
DC 1	1.4	1.5	1.9	1.5	2.1	0.2	0.7	0.7	0.1	1.6
DC 2										
DC 3										
DC 4										
DC 5 Cur	.6	1.	2. →		.6	1. →		2 →		.6
DC 6 #	10	11	12	13	14	15	16	17	18	19
DC 7 n	1	2	3	4	1	2	3	4	5	2
DC 8										
DC AVG.										
AC 1	178.	153.5	88.2	21.5	341.	35.8	24.8	15.85	3.94	34.2
AC 2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
AC AVG.										
S.P.	+18.1				+2.9					-13.1
AC NOISE										
POT RES.	13K				18K					25K

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PAGE 3

PROJECT 631 Glove

LINE 1 HALF N S.P. 1 DATE 5/13/71

SEND	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	5-6	4-5	3-4
RECEIVE	→				16.5-19.5N	→			19.5-22.5N		→
RANGE	0.1	0.1	0.1	0.01	1	0.1	0.1	0.1	0.1	0.1	0.1
DC 1	-0.90	0.0	0.1	0.5 0.2	1.4	-0.3	0.5	0.7	1.7	0.5	1.1
DC 2				-0.6 → 1.0							
DC 3				-1.2							
DC 4				?							
DC 5											
DC 6											
DC 7 Crg	1.	—	2	—	.6	1	1	2	.6	1.	1.
DC 8 ?	20	21	22	23	24	25	26	27	28	29	30
DC AVG. ?	3	4	5	6	3	4	5	6	4	5	6
AC 1	6.23	5.56	3.82	0.966	23.4	8.03	8.55	6.36	4.12	2.35	2.99
AC 2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
AC AVG.											
S.P.					+25.9				+3.1		
AC NOISE											
POT RES.					26K				36K		

Job 631 Linc 1 5/1 S½ 5/14/71 300.

72
15
360
72
1040

12772,60
1721,53
1404.51
4398.69

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PAGE 4

PROJECT 631 Glove
LINE 1 HALF 5 SP. 1 DATE 5/14/71

0.6

SEND	CAL	3-4	4-5	5-6	2-3	3-4	4-5	5-6	1-2	2-3
RECEIVE	2-3	4.5-7.55	→	→	7.5-10.55	→	→	→	10.5-13.55	→
RANGE	1	10	1	0.1	10	1	1	0.1	10	1
DC 1	-0.1	0.7	0.7	0.4	0.6	0.9	0.5	0.3	0.2	0.4
DC 2										
DC 3										
DC 4										
DC 5										
DC 6 CUR	1.0	1	—	.6	2.	1	—	.6	2	—
DC 7 #	2	1	2	3	4	5	6	7	8	7
DC 8 3		1	2	3	1	2	3	4	1	2
DC AVG.										
AC 1	100.6	184.	49.2	9.56	352	72.7	27.8	6.89	241.	73.0
AC 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.	3.0	-1.6			+3.3				+2.6	
AC NOISE	0.3									
POT RES.		13K			14K				8K	

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

1350 -80 1280

PAGE 5

PROJECT 631 Glove
LINE 1 HALF 5 SP. 1 DATE 5/14/71

SEND	3-4	4-5	5-6	1-2	2-3	3-4	4-5	5-6	1-2	2-3
RECEIVE	⟶	⟶	⟶	13.5-16.5S ⟶	⟶	⟶	⟶	⟶	16.5-19.5S ⟶	⟶
RANGE	1	1	0.1	1	1	1	1	0.1	1	1
DC 1	0.3	-0.2	-0.3	1.4	1.8	2.1	1.7	1.6	1.1	1.5
DC 2										
DC 3										
DC 4										
DC 5										
DC 6 cur	1	—	.6	2	—	1	—	.6	2	—
DC 7 #	10	11	12	13	14	15	16	17	18	19
DC 8 n	3	4	5	2	3	4	5	6	3	4
DC AVG.										
AC 1	27.5	12.13	3.55	75.7	50.3	26.7	13.15	4.41	36.7	32.0
AC 2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
AC AVG.										
S.P.				+14.1					-10.3	
AC NOISE	Fence @ 12.8									
POT RES.	Grounded (Well)			9.5K					83K	

PAGE 6

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT 631 Glove
LINE 1 HALF 5 SP. 1 DATE 5/19/7

SEND	3-4	4-5	1-2	2-3	3-4		SP	SP		
RECEIVE	→	→	19.5-22.5	→	→		1.5N-1.5S	1.5S-4.5S		
RANGE	1	0.1	1	1	0.1					
DC 1	1.6	1.1	1.3	1.5	1.5					
DC 2										
DC 3										
DC 4										
DC 5										
DC 6 Cur	1	—	2	—	1					
DC 7 II	20	21	22	23	24					
DC 8 η	5	6	4	5	6					
DC AVG.										
AC 1	20.1	10.09	11.2	12.1	8.28					
AC 2	0.0	0.0	0.1	0.0	0.0					
AC AVG.										
S.P.			+13.0				-5.5	+15.8		
AC NOISE			Very poorly grounded fence w 2 S							
POT RES.			48K				7.5K	11K		

INDUCED POLARIZATION SENDER NOTES

Project: Glove 631 Line: 1 S/1 a = 300 Date: 5/13/71

Send	3-4	4-5	5-6	4-5	5-6	5-6	3-4	2-3	1-2	4-5	4-3	3-2
Receive	1-2	——	——	2-3	——	3-4	4.5-7.5	——	——	7.5-16.5	——	——
Time												
Range	510	590	740	650	740	740	850	790	570	660	850	790
Current	1.0	1.0	.6	1.0	.6	.6	1.0	2.0	2.0	.6	1.0	2.0

Send	2-1	5-6	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3	1-2	4-5
Receive	——	16.5 – 13.5					13.5 – 16.5	——	——	——	——	Cal
Time												
Range	570	740	640	530	790	560	730	650	540	780	560	660
Current	2.0	.6	1.0	1.0	2.0	2.0	.6	1.0	1.0	2.0	2.0	.6

(2)

INDUCED POLARIZATION SENDER NOTES

Project: Glove 631 Line: 1 Sp 1 a = 300 Date: 5/13/71

Send	5-6	4-5	3-4	2-3	5-6	4-5	3-4	2				
Receive	16.5 —	19.5	—	—	19.5-21.5	—	—					
Time												
Range	730	650	530	780	730	640	540					
Current	0.6	1.0	1.0	2.0	0.6	1.0	1.0					
Send												
Receive												
Time												
Range												
Current												

INDUCED POLARIZATION SENDER NOTES

Project: 631 Glove Line: 1 - 7/1 5½ a=300 Date: 5/14/71

Send	3-4	4-5	5-6	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5	5-6
Receive	4.5 —	7.55 —	—	7.5 —	10.55 —	—	—	10.5 —	13.5 —	—	—	—
Time												
Range	530	650	730	790	530	660	730	570	790	530	650	730
Current	1.0	1.0	0.6	2.	1.0	1.0	0.6	2.0	2.0	1.0	1.0	.6
Send	1-2	2-3	3-4	4-5	5-6	1-2	2-3	3-4	4-5	1-2	2-3	3-4
Receive	13.5 —	16.5 —	—	—	—	16.5 —	19.5 —	—	—	19.5 —	22.55 —	—
Time												
Range	580	780	540	650	730	570	790	530	650	570	780	530
Current	2.0	2.0	1.0	1.0	0.6	2.0	2.0	1.0	1.0	2.0	2.0	1.0

freq 3.0 0.3 Cal 2-3 460 1.0

JOB 631 LINE 1 SPREAD 1 NORTH 1/2 5/13/71 — 300 FEET=DIPOLE LENGTH

CAL GROUP NO. 1

CAL CUR	PFE	AC1	AC2	AC FREQ	DC FREQ	PFE CAL	RHO CAL
.600	-.01	60.400	0.00	3.00	.30	-.0100	.9934

COMPUTED DATA — FIELD DATA

POINT NO.	N	RHO	PFE	MCF	CCPFE	CCMCF	CPFE		PFE	CUR	PT.	N	AC1	AC2
1	1	165.67	.71	4.3	.71	4.3	0.00	**	.70	1.00	1	1	184.000	0.00
2	2	176.48	.71	4.0	.71	4.0	0.00	**	.70	1.00	2	2	49.000	0.00
3	3	142.29	.41	2.9	.41	2.9	0.00	**	.40	.60	3	3	9.510	0.00
4	1	318.10	.51	1.6	.51	1.6	0.00	**	.50	1.00	4	1	354.000	0.00
5	2	282.72	.71	2.5	.71	2.5	0.00	**	.70	.60	5	2	47.100	0.00
6	1	358.72	.31	.9	.31	.9	0.00	**	.30	.60	6	1	240.000	0.00
7	1	361.78	.41	1.1	.41	1.1	0.00	**	.40	1.00	7	1	403.000	0.00
8	2	283.67	.41	1.4	.41	1.4	0.00	**	.40	2.00	8	2	158.000	0.00
9	3	142.88	.51	3.6	.51	3.6	0.00	**	.50	2.00	9	3	31.800	0.00
10	1	268.97	1.41	5.2	1.41	5.2	0.00	**	1.40	.60	10	1	178.000	0.00
11	2	557.23	1.51	2.7	1.51	2.7	0.00	**	1.50	1.00	11	2	153.500	0.00
12	3	401.80	1.91	4.8	1.91	4.8	0.00	**	1.90	2.00	12	3	88.200	0.00
13	4	195.12	1.51	7.7	1.51	7.7	0.00	**	1.50	2.00	13	4	21.500	0.00
14	1	518.84	2.06	4.0	2.06	4.0	0.00	**	2.10	.60	14	1	341.000	.10
15	2	128.30	.21	1.6	.21	1.6	0.00	**	.20	1.00	15	2	35.800	0.00
16	3	223.30	.71	3.2	.71	3.2	0.00	**	.70	1.00	16	3	24.800	0.00
17	4	142.71	.71	5.0	.71	5.0	0.00	**	.70	2.00	17	4	15.850	0.00
18	5	61.71	.11	1.8	-.03	-.5	.14	**	.10	2.00	18	5	3.940	0.00
19	2	207.12	1.56	7.5	1.56	7.5	0.00	**	1.60	.60	19	2	34.200	.10
20	3	55.26	-.74	-13.4	-.74	-13.4	0.00	**	-.80	1.00	20	3	6.230	-.10
21	4	99.43	.01	.1	.01	.1	0.00	**	0.00	1.00	21	4	5.560	0.00
22	5	59.83	.11	1.8	-.04	-.6	.15	**	.10	2.00	22	5	3.820	0.00
23	6	24.31	.51	21.0	-.27	-11.1	.78	**	.50	2.00	23	6	.966	0.00
24	3	355.34	1.91	5.4	1.91	5.4	0.00	**	1.90	.60	24	3	23.400	0.00
25	4	143.17	-.29	-2.0	-.29	-2.0	0.00	**	-.30	1.00	25	4	8.030	0.00
26	5	268.91	.51	1.9	.51	1.9	0.00	**	.50	1.00	26	5	8.550	0.00
27	6	210.76	.71	3.4	.71	3.4	0.00	**	.70	2.00	27	6	8.360	0.00
28	4	124.88	1.71	13.7	1.71	13.7	0.00	**	1.70	.60	28	4	4.120	0.00
29	5	73.91	.46	6.2	.35	4.8	.11	**	.50	1.00	29	5	2.350	.10
30	6	151.36	1.11	7.3	1.11	7.3	0.00	**	1.10	1.00	30	6	2.990	0.00

JOB 631 LINE 1 SPREAD 1 SOUTH 1/2 5/14/71 300 FEET=DIPOLE LENGTH
CAL GROUP NO. 2

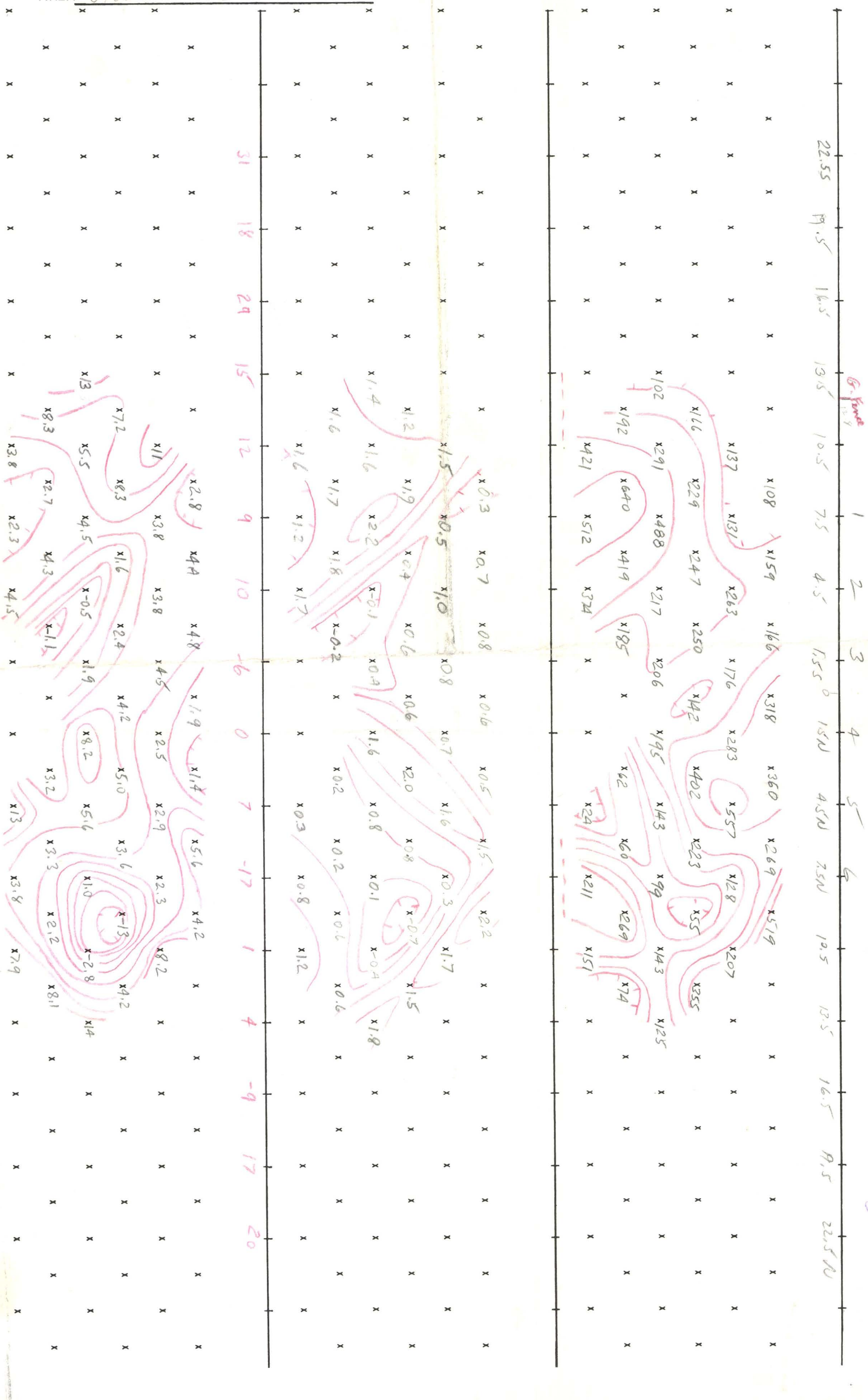
CAL CUR	PFE	AC1	AC2	AC FREQ	DC FREQ	PFE CAL	RHO CAL
1.000	-.10	100.600	0.00	3.00	.30	-.1000	.9940

COMPUTED DATA									FIELD DATA					
POINT NO.	N	RHO	PFE	MCF	CCPFE	CCMCF	CPFE		PFE	CUR	PT.	N	AC1	AC2
1	1	165.93	.80	4.8	.80	4.8	0.00	**	.70	1.00	1	1	184.000	0.00
2	2	177.47	.80	4.5	.80	4.5	0.00	**	.70	1.00	2	2	49.200	0.00
3	3	143.26	.50	3.5	.50	3.5	0.00	**	.40	.60	3	3	9.560	0.00
4	1	158.56	.70	4.4	.70	4.4	0.00	**	.60	2.00	4	1	352.000	0.00
5	2	262.76	1.00	3.8	1.00	3.8	0.00	**	.90	1.00	5	2	72.700	0.00
6	3	250.20	.60	2.4	.60	2.4	0.00	**	.50	1.00	6	3	27.800	0.00
7	4	206.29	.40	1.9	.40	1.9	0.00	**	.30	.60	7	4	6.890	0.00
8	1	108.13	.30	2.8	.30	2.8	0.00	**	.20	2.00	8	1	241.000	0.00
9	2	131.27	.50	3.8	.50	3.8	0.00	**	.40	2.00	9	2	73.000	0.00
10	3	247.01	.40	1.6	.40	1.6	0.00	**	.30	1.00	10	3	27.500	0.00
11	4	217.18	-.10	-.5	-.10	-.5	0.00	**	-.20	1.00	11	4	12.150	0.00
12	5	184.89	-.20	-1.1	-.20	-1.1	0.00	**	-.30	.60	12	5	3.550	0.00
13	2	137.48	1.45	10.5	1.45	10.5	0.00	**	1.40	2.00	13	2	75.700	.10
14	3	229.27	1.90	8.3	1.90	8.3	0.00	**	1.80	2.00	14	3	50.300	0.00
15	4	488.24	2.20	4.5	2.20	4.5	0.00	**	2.10	1.00	15	4	26.700	0.00
16	5	419.17	1.80	4.3	1.80	4.3	0.00	**	1.70	1.00	16	5	13.150	0.00
17	6	374.49	1.70	4.5	1.70	4.5	0.00	**	1.60	.60	17	6	4.410	0.00
18	3	166.13	1.20	7.2	1.20	7.2	0.00	**	1.10	2.00	18	3	36.700	0.00
19	4	290.86	1.60	5.5	1.60	5.5	0.00	**	1.50	2.00	19	4	32.000	0.00
20	5	640.07	1.70	2.7	1.70	2.7	0.00	**	1.60	1.00	20	5	20.100	0.00
21	6	511.57	1.20	2.3	1.20	2.3	0.00	**	1.10	1.00	21	6	10.090	0.00
22	4	101.60	1.35	13.3	1.35	13.3	0.00	**	1.30	2.00	22	4	11.200	.10
23	5	192.47	1.60	8.3	1.60	8.3	0.00	**	1.50	2.00	23	5	12.100	0.00
24	6	421.46	1.60	3.8	1.60	3.8	0.00	**	1.50	1.00	24	6	8.280	0.00

JOB# 631 LINE# 1 SP 1 a = 300' LOOKING West

CLIENT C.F.&I. Steel Corp. DATE May 1971 FREQUENCIES 0.3 & 3.0 Hz

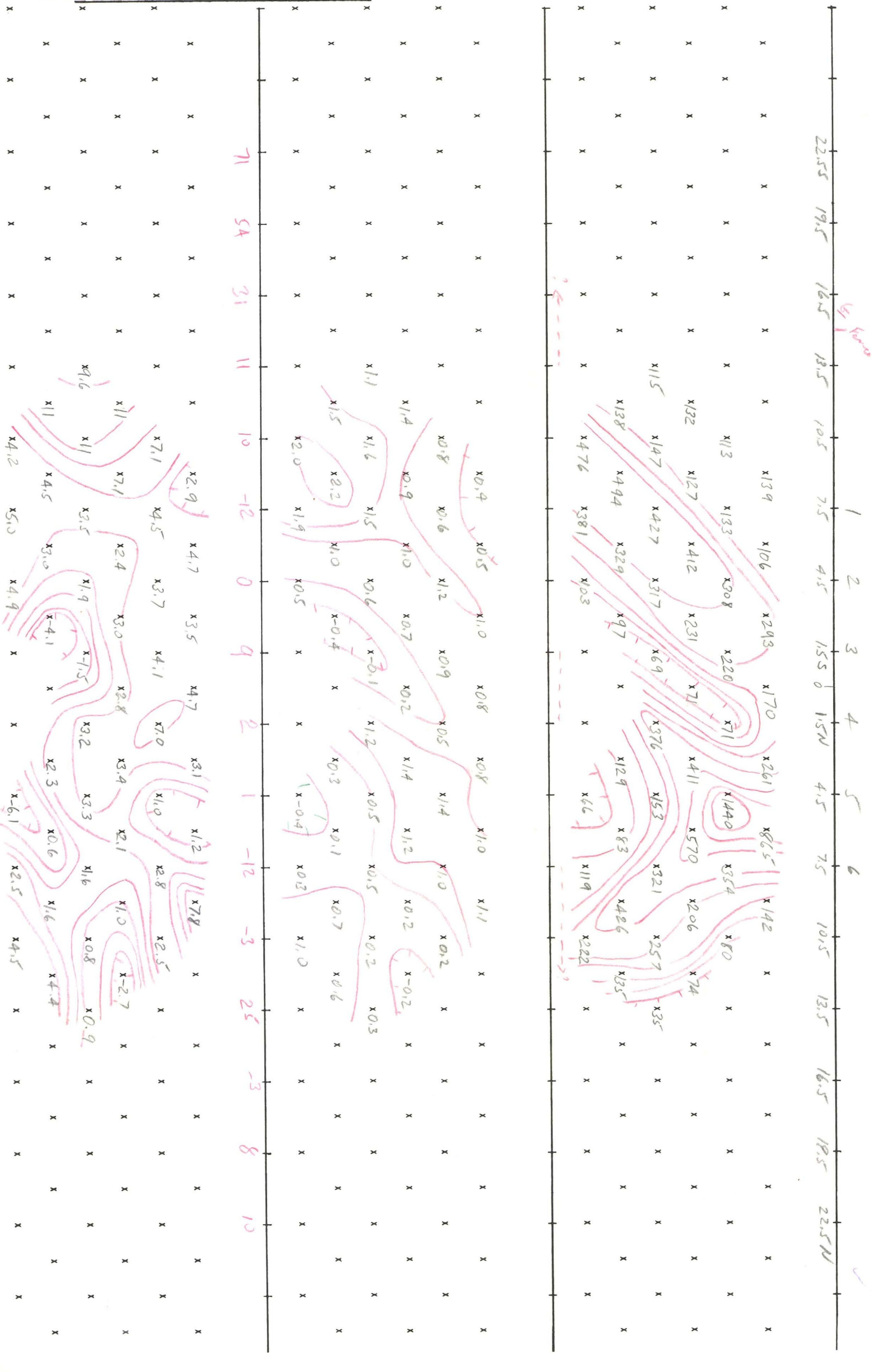
AREA Glove Mine

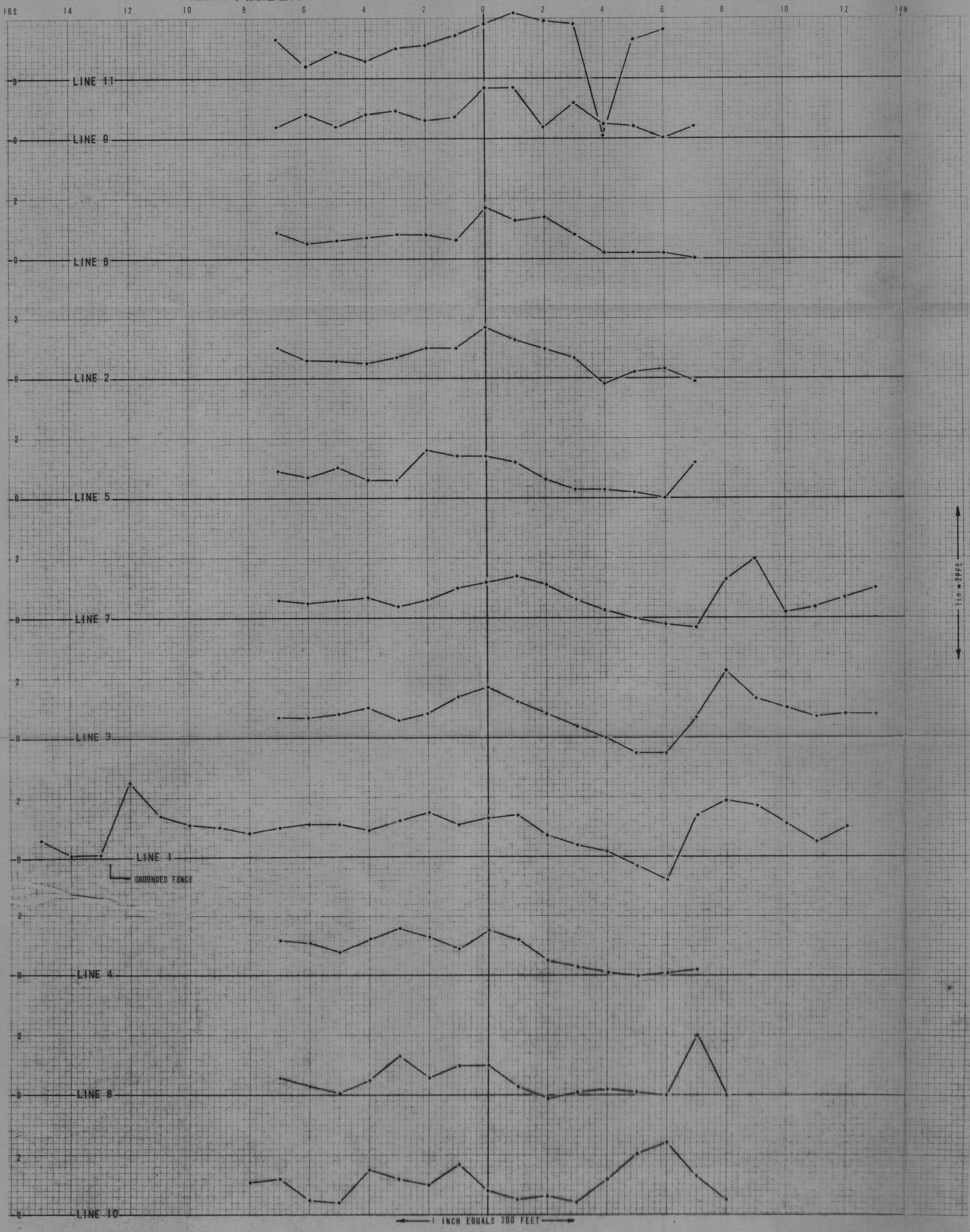


JOB# 631 LINE# 2 SP 1 a = 300' LOOKING West

CLIENT C.F. & I. DATE May 1971 FREQUENCIES 0.3 & 3.0 Hz

AREA Glove Mine





HEINRICHS
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geophysical engineers vancouver sydney
631-71

PFE PROFILES (GRADIENT ARRAY)
of
GLOVE MINE AREA - SANTA CRUZ COUNTY, ARIZONA

FOR
C. F. & I. STEEL CORP

SCALE	DRAWN BY JAY DOWNS	DATE JUNE 1971

HEINRICHS
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631-71

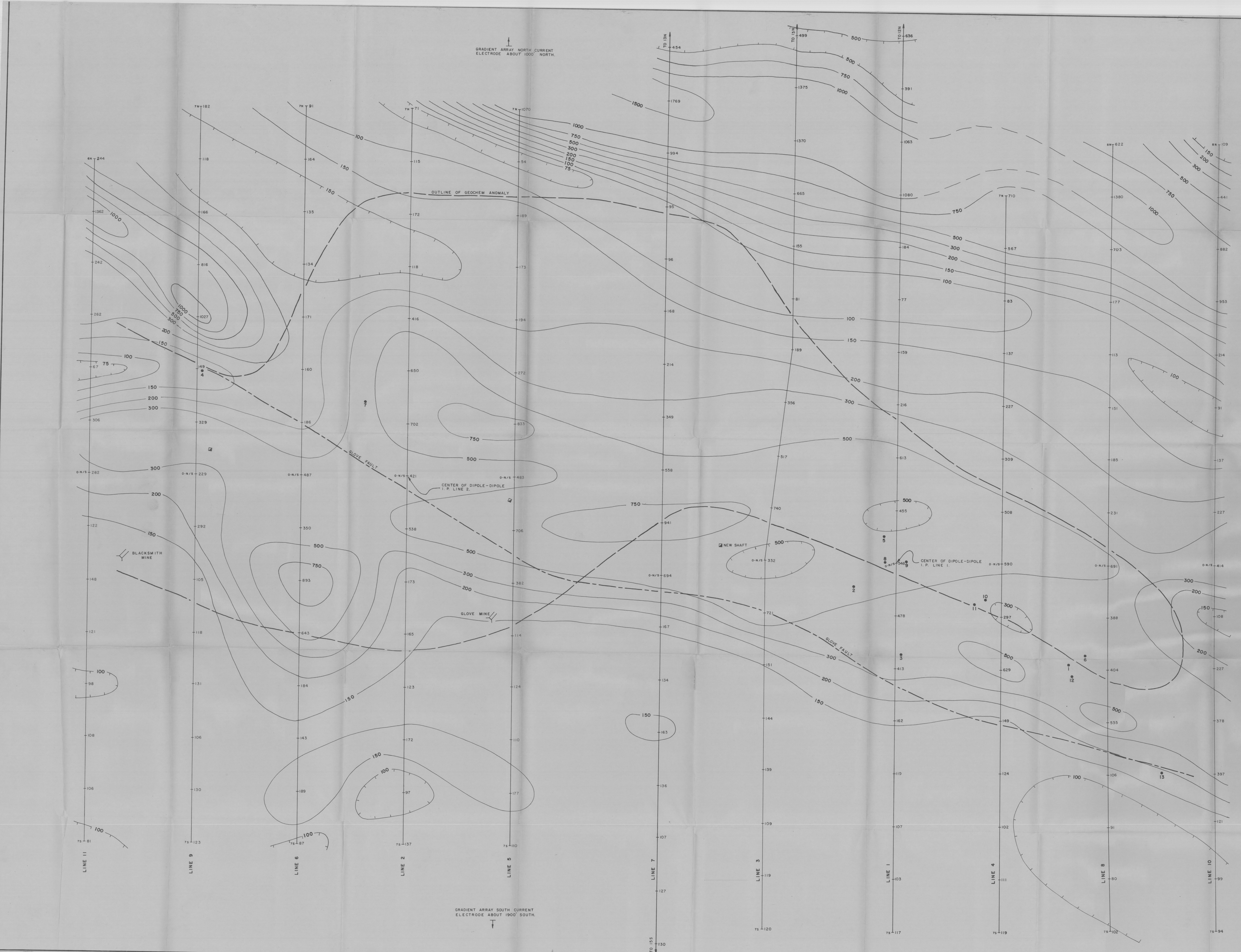
$\rho a/2\pi$ IN OHM FEET (GRADIENT ARRAY)
of
GLOVE MINE AREA - SANTA CRUZ COUNTY, ARIZONA

FOR
C. F. & I. STEEL CORP.

SCALE	DRAWN BY JAY DOWNS	DATE JUNE 1971


HEINRICHS GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney
631-71
GRADIENT ARRAY PLAN
(PERCENT FREQUENCY EFFECT (PFE))
OF
GLOVE MINE AREA
SANTA CRUZ COUNTY, ARIZONA
FOR
C. F. & I. STEEL CORP.
SCALE: 1" = 50'
EXPLANATION
SHAFT
ADIT
ZONE OF 1.2+ PFE
DRILL HOLE & NO.
NOTE: STATIONS ARE 100' SLOPE DISTANCE & NOT CORRECTED TO PLAN.
LINE 11
LINE 9
LINE 6
LINE 2
LINE 5
LINE 7
LINE 3
LINE 1
LINE 4
LINE 8
LINE 10
BLACKSMITH MINE
GLOVE MINE
GLOVE FAULT
NEW SHAFT
CENTER OF DIPOLE-DIPOLE I.P. LINE 2
CENTER OF DIPOLE-DIPOLE I.P. LINE 1
OUTLINE OF GEOCHEM ANOMALY
ORE ZONE
GRADIENT ARRAY SOUTH CURRENT ELECTRODE ABOUT 1900' SOUTH
GRADIENT ARRAY NORTH CURRENT ELECTRODE ABOUT 1000' NORTH


LINE II
BLACKSMITH MINE



HEINRICHS
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POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers vancouver sydney
631-71

GRADIENT ARRAY PLAN
(APPARENT RESISTIVITY ($\rho a/2\pi$))
OF
GLOVE MINE AREA
SANTA CRUZ COUNTY, ARIZONA

FOR
C. F. & I. STEEL CORP.

SCALE: 1" = 50' | DRAWN BY: JAY DOWNS | DATE: JUNE 1971

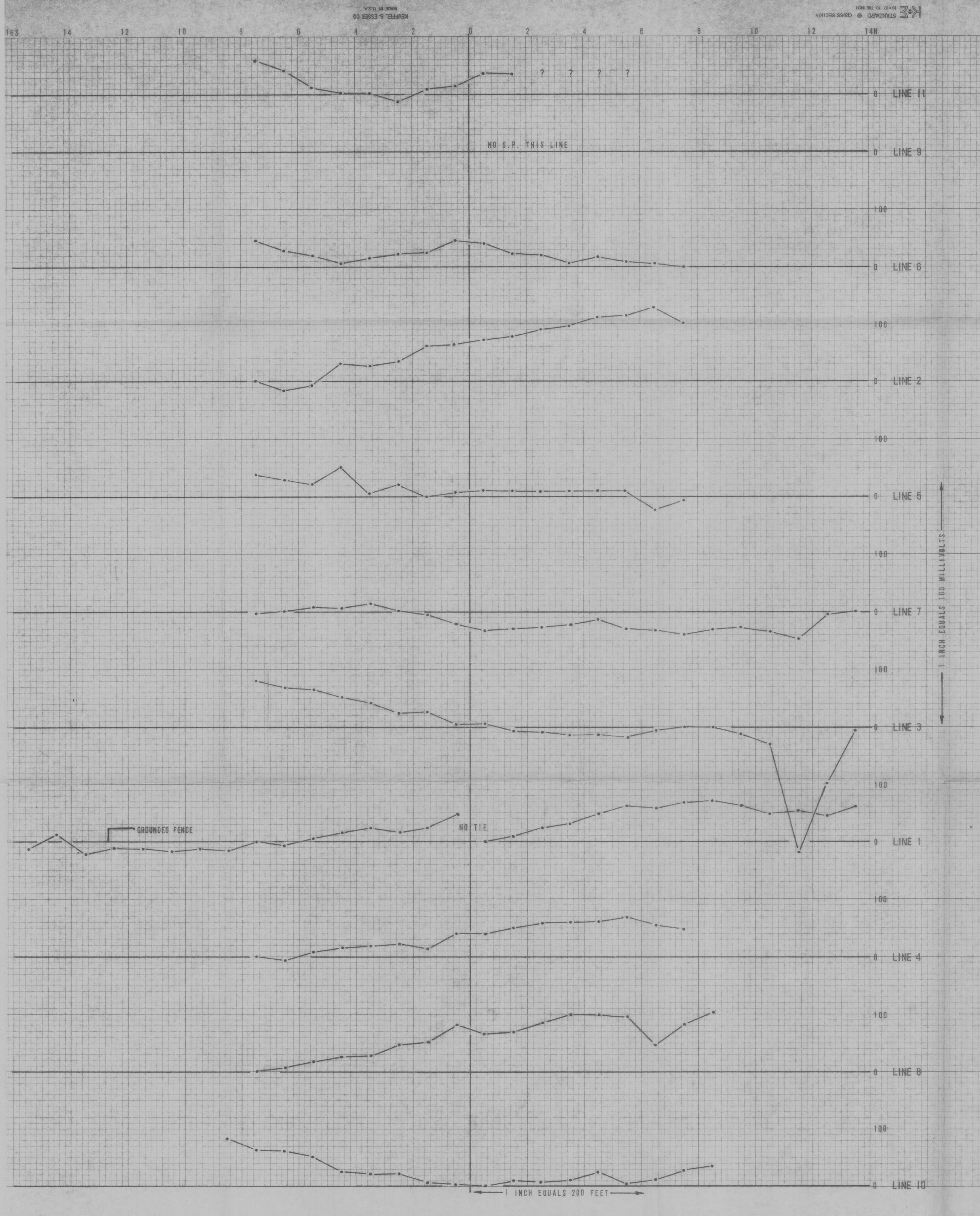
EXPLANATION

SHAFT

ADIT

DRILL HOLE & NO.

NOTE: STATIONS ARE 100' SLOPE DISTANCE & NOT CORRECTED TO PLAN.



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

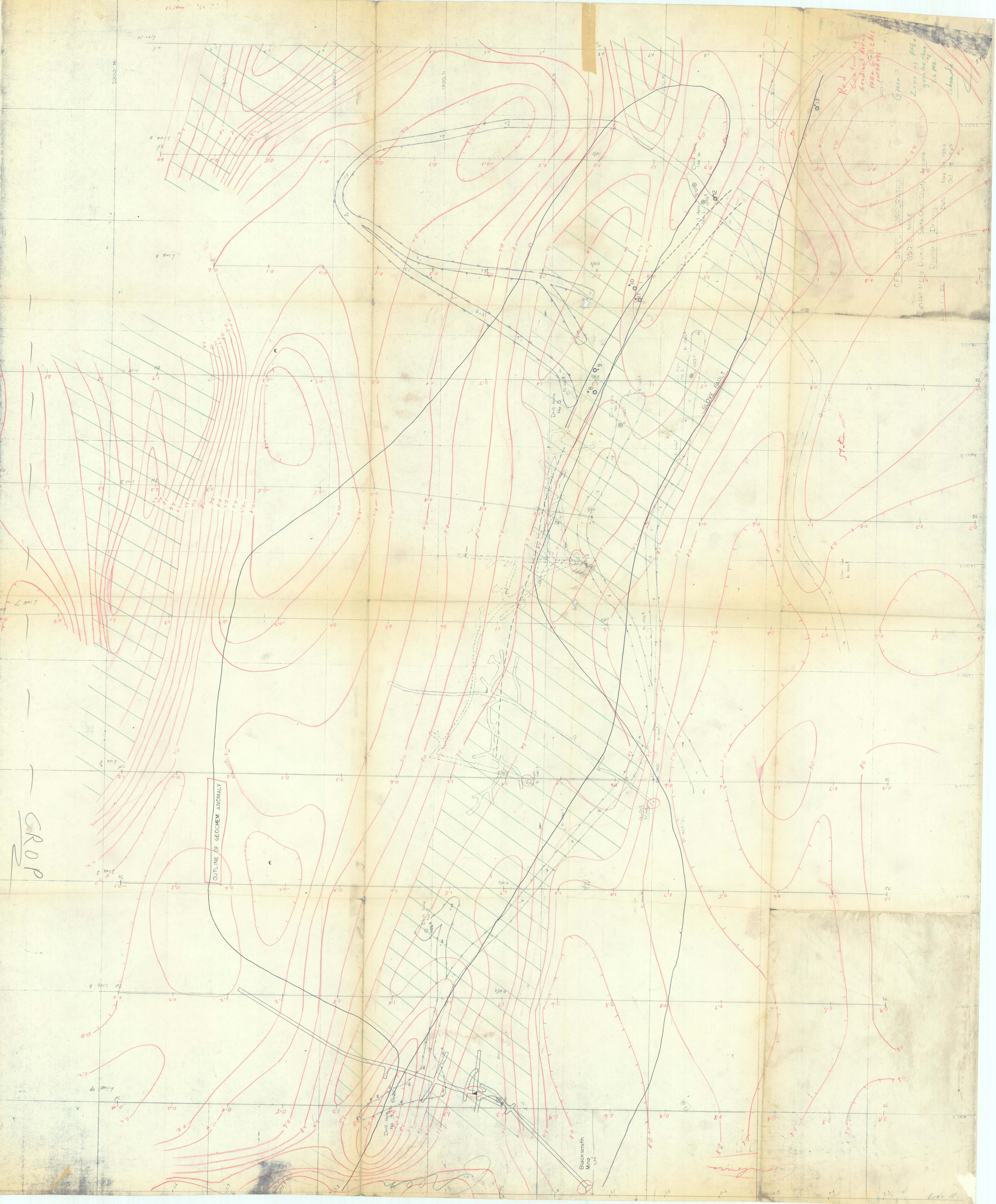
631-71

SELF POTENTIAL (GRADIENT ARRAY)
of
GLOVE MINE AREA - SANTA CRUZ COUNTY, ARIZONA

FOR

C. F. & I. STEEL CORP.

SCALE	DRAWN BY JAY DOWNS	DATE JUNE 1971


CF&I STEEL CORPORATION
GLOVE MINE
Tyndall Mining District - Santa Cruz County, Arizona
Diamond Drilling
Date May 24, 1969
Oct. 18, 1969
Scale 1" = 50
Red = Contours of Gradient Array PFE @ 0.2 PFE INTERVAL
Green = Zone of PFE greater than 1.2 PFE
Schematic
OUTLINE OF GEOCHEM ANOMALY
GLOVE FAULT
Blacksmith Mine
CROP