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Induced Polarization Survey

Philimena Mine Area

Pima County, Arizona

for

Cyprus Exploration Company

February 1975

by

GEOEX

STRAITHMORE UNION STRU

INDUCED POLARIZATION SURVEY

PHILINENA MINE AREA

PIMA COUNTY, ARIZONA

FOR

CYPRUS EXPLORATION COMPANY

FEBRUARY 1975

BY

**HEINRICHS GEOEXPLORATION COMPANY
P.O. BOX 5964 TUCSON, ARIZONA 85703**

GEOEX Job #999

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Line 5E	
Line 20E	

INTRODUCTION

At the request of Mr. C. B. Hutchens, Exploration Geologist with Cyprus Exploration Company, Heinrichs GEOEXPLORATION Company completed a two line reconnaissance induced polarization (IP) survey over a portion of the Philimena Mine area, Pima County, Arizona. The field work took place on February 20, 21 and 24, 1975, with a crew consisting of Joseph Hayes, Geophysical Crew Chief assisted by Robert Villasenor and Brent Olson.

The purpose of this survey was to detect and delineate any significant subsurface sulfide zones in an area of scattered oxide copper showings.

CONCLUSIONS AND RECOMMENDATIONS

Both lines show a zone of very weakly anomalous IP response. This response is strongest on Line 5E and lies mainly between 5N and 15N. Line 20E shows a zone of response only slightly above background lying between about 10.5N and 18N. Assuming the two anomalous zones correlate, an ENE-WSW trend is suggested which includes the Philimena Mine and several nearby prospects.

The cause of the anomalous response could be minor sulfide mineralization or minor quantities of other metallic lustered non-sulfide minerals such as magnetite and certain other iron and manganese oxides, or graphite or conceivably even certain clay minerals. The response is too weak to be very certain of its cause and also it is likely too weak to be of direct economic interest. However, in that a trend may be present, increasing in strength to the WSW, some additional IP coverage is perhaps justified in that direction by continuing the initial N-S IP grid at least two more lines to the west.

The anomalism shows only a very slight improvement in strength with increased depth. Interpreted depth to the top of the polarizable material is likely between 250 and 500 feet below surface. The responsive material appears to continue with depth at least to the limit of resolvable penetration which is roughly 1000 feet below surface for the 500 foot dipoles used.

The resistivity shows a minor high correlating with the anomalous IP response on both lines and is perhaps suggestive of a relatively unaltered rock type being involved. The self potential data shows only background variations having no significant appearing correlation with the IP results.

Drilling of the IP anomaly is not recommended at this time based on the results to date unless there are economically encouraging geological or geochemical correlating factors involved.

PROCEDURES

A GEODEX MARK 4 multifrequency IP system was employed to obtain this coverage and utilized a sending frequency pair of 0.3 and 3.0 hz. The colinear dipole-dipole array was used with seven current electrodes and a dipole length of 500 feet. Two lines were run, both oriented N-S and spaced 1500 feet apart. The SW corner of Section 27 was established as the coordinate origin with stations designated in hundreds of feet.

Sending-receiving dipole separations range from 1 to 6 dipole lengths on both lines and, typically, this should give resolvable depth penetration within the zone from about 1/3 dipole length to as much as 2 dipole lengths. For the 500 foot dipoles used here, the resolvable response zone would then be roughly from about 150 feet to as much as 1000 feet below surface.

The data are presented on "sectional" data sheets, one for each line, showing from top to bottom: resistivity, percent frequency effect (PFE) and metallic conduction factor(MCF) contoured in "sectional" form. The self potential readings taken in conjunction with the IP readings are shown at the bottom of the sheet in profile form. An "Induced Polarization Location and Interpretation Plan" is also included showing the surface projected plan interpretation at a scale of 1" = 1000'.

Respectfully submitted,

Heinrichs GEOEXPLORATION Company



Chris S. Ludwig
Chief Geophysicist



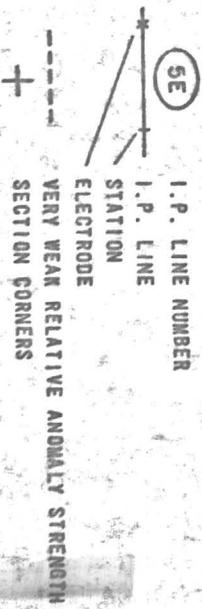
CSL:mt

INDUCED POLARIZATION LOCATION
AND INTERPRETATION PLAN

PHILIMENA MINE AREA
PIMA COUNTY, ARIZONA

for
CYPRUS EXPLORATION COMPANY

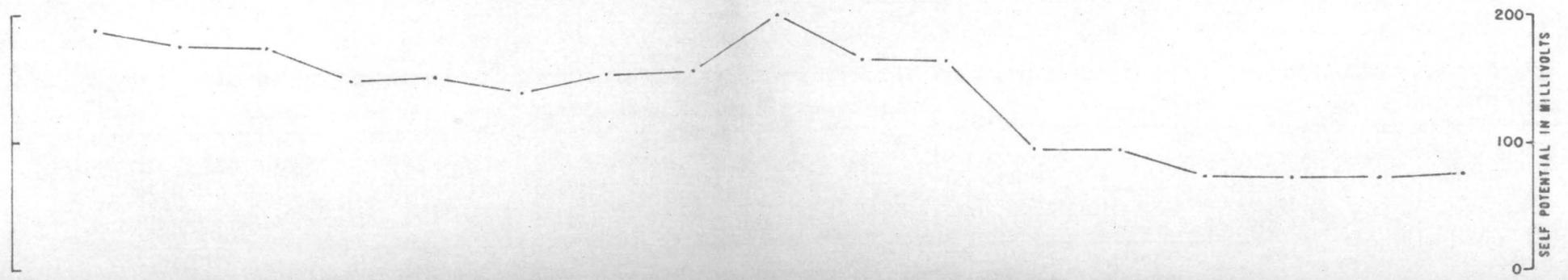
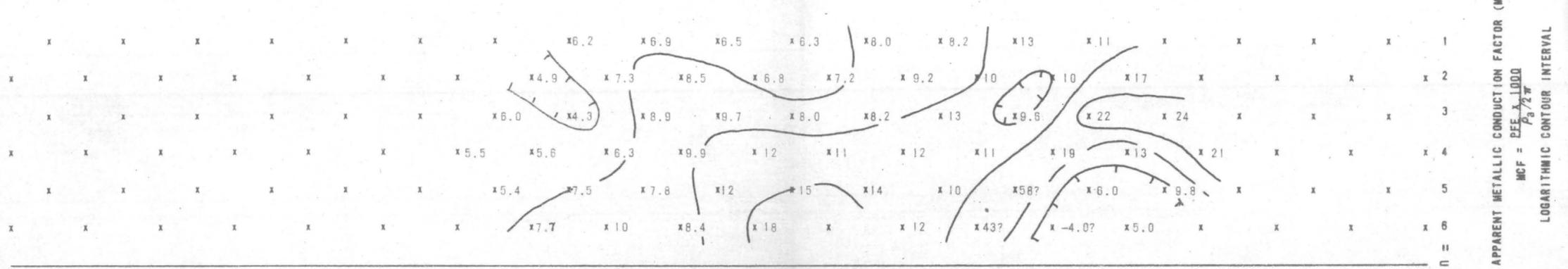
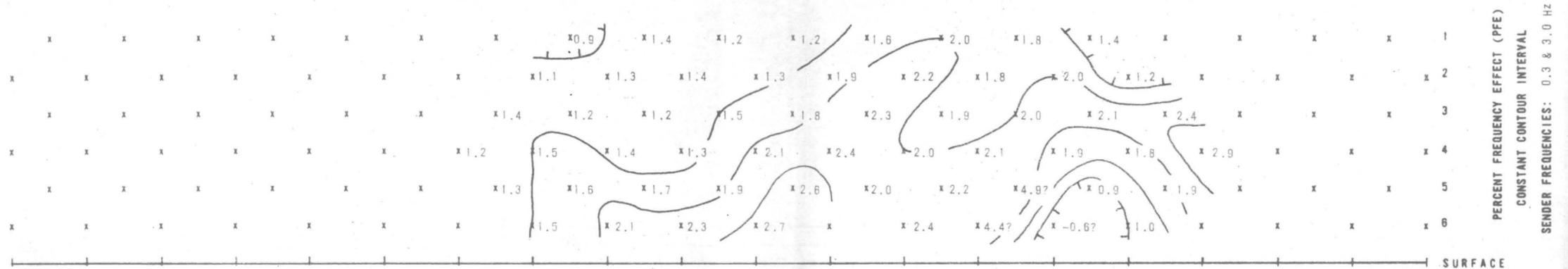
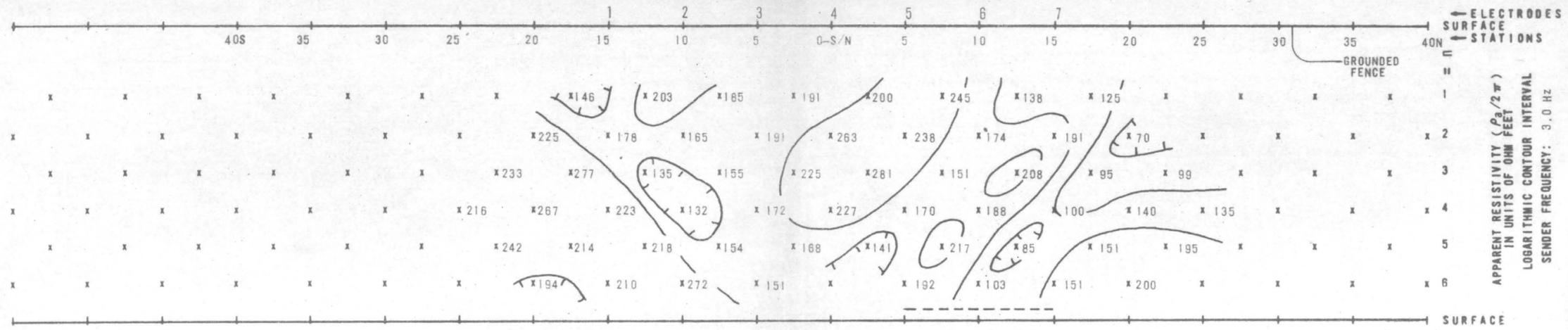
by
HEINRICHS GEOEXPLORATION COMPANY
Job number 999-75 February 1975



27/26
34/35

T 17 S — R 10 E

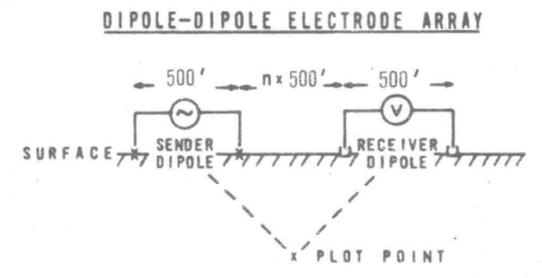
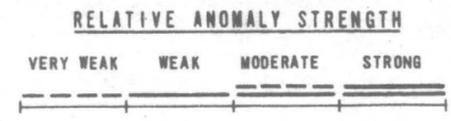
SCALE: 1" = 1000'



999-75

INDUCED POLARIZATION TRVERSE SECTIONAL DATA SHEET
of
PHILIMENA MINE AREA
PIMA COUNTY, ARIZONA
for
CYPRUS EXPLORATION COMPANY

LINE NO.
5E
SPREAD(S)
1
BEARING
N-S



DATE
FEBRUARY 1975

HEINRICHS  GEOEXPLORATION COMPANY

806 W. GRANT ROAD, POST OFFICE BOX 5964, TUCSON, ARIZ., 85703, PHONE: (602) 623-0578

I. P. RECEIVER NOTES, JOB No. 999 AREA Philamena Mine
 LINE SE, HALF N, SR. 1, $\alpha =$ 500', BEARING _____
 SENDER STA. 0 = ELECTRODE No. 4, DATE 2-21-75



PAGE 6
**HEINRICHS
 GEOEX**

SEND	1-2	6-7	5-6	4-5	7-4	2-3	1-2	6-7	5-6	4-5
RECEIVE	20N	20					25N	25		7
MULTIPLIER	1.0	1.0	1.0	1.0	1.0	1.0	0.1	1.0	1.0	0.1
PFE	2.2	1.6	2.2	2.2	2.3	2.4	2.6	1.4	2.3	2.1
CUR. (AMPS)	3	2	3	2	2	3	3	2	3	2
POINT No.										
SEP. (n)										
H. F. MV	82.6	171	97.5	28.4	12.8	12.7	7.02	23.7	19.4	6.79
DRIFT	-	-	-	-	-	-	-	-	-	-
I.0 PFE $K_n/1000$	52.5	1.5	6	15	30	52.5	84	6	15	30
0.3 PFE P_{CAL}										
0.1 PFE PFE_c	2.0	1.4	2.0	2.0	2.1	2.2	2.4	1.2	2.1	1.9
3.0 MV $P/2\pi$	141	125	191	208	188	217	192	70	95	100
DRIFT MCF	14	11	10	9.6	11	10	12	17	22	19
S. P.		-21						-1		
NOISE										0.3 m/sy
POT RES.		ok								
CULT & CMTS				verified dipole						

I. P. RECEIVER NOTES, JOB No. 999 AREA Philamena Mine
 LINE SE, HALF N, SP. 1, a 500m, BEARING NS
 SENDER STA. 0 = ELECTRODE No. 4, DATE 2/21/75



PAGE 7

HEINRICHS
GEOEX

SEND	3-4	2-3	6-7	5-6	4-5	3-4	6-7	5-6	4-5	CHL
RECEIVE	←	30N	30	—	—	35N	35	—	40N	
MULTIPLIER	0.1	0.1	1.0	1.0	0.1	0.1	1.0	1.0	0.1	
PFE	5.7	4.8	2.6	2.0	1.1	-0.4	3.1	2.1	1.2	+0.2
CUR. (AMPS)	2.5	3	2.5	3.3	2.8	2.5	2.5	3.3	2.8	1.0
POINT No.										
SEP. (n)										
H. F. MV	3.35	3.75	16.8	15.7	8.23	4.60	11.5	12.5	6.82	102.2
DRIFT	4.13	10.4	—	—	—	—	—	—	—	
1.0 PFE $K_n/1000$	52.5	84	75	30	52.5	84	30	52.5	84	
0.3 PFE P_{CAL}										
0.1 PFE PFE_c	4.9	4.4	2.4	1.8	0.9	-0.6	2.9	1.9	1.0	
3.0 MV $P/2\pi$	95	103	99	140	151	151	135	195	200	
DRIFT MCF	58	43	24	13	6.0	-4.0	21	9.8	5.0	
S. P.			noisy				+3			
NOISE			spikes	0.8-1.0 MV						
POT RES.	PFE noisy		OK							
CULT & CMTS	35 sec. 2 sec. 2 sec.		grounded fence approx 3IN							
			angle in from W passes 5.0' from sta 30N							

I. P. SENDER NOTES

JOB No. 999 AREA Philamena Mine ALINE SE, HALF 5, Sp. 1, DATE 2-20-75PAGE 1HEINRICHS
GEOEX

SEND	5-6	6-7	7-8	5-6	6-7	3-4	4-5	5-6	6-7	
RECEIVE	0	55	5		105	10			155	
RANGE	10x200	10x200	10x200			10x200	10x200	10x200	10x200	
VOLTAGE	440	620	560	600	600	630	550	430	610	
CURRENT	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-3	3-4	4-5	5-6
RECEIVE	15				205	20				→
RANGE	10x200					10x300				
VOLTAGE	470	620	550	430	610	530	470	620	540	420
CURRENT	2.0	2.0	2.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0

FREQUENCIES

SENDER No.

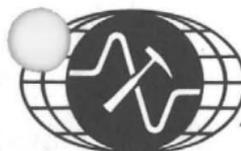
OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. SENDER NOTES

 JOB No. 999 AREA Phitomena Mine A.
 LINE SE, HALF S, SP. 1, DATE 2/20/75
PAGE 2HEINRICH'S
GEOEX

SEND	6-7	1-2	2-3	3-4	4-5	5-6				
RECEIVE	255	25				305				
RANGE		10x300	10x200							
VOLTAGE	600	520	460	610	540	420				
CURRENT	2.0	3.0	2.0	2.0	2.0	2.0				
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4			
RECEIVE	30		355	355	35		405			
RANGE	10x300	10x200			10x300	10x200				
VOLTAGE	510	450	610	530	520	450	610			
CURRENT	3.0	2.0	2.0	2.0	3.0	2.0	2.0			

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. SENDER NOTES

 JOB No. 799 AREA Philamina Mine
 LINE 5E, HALF ✓, SP. 1, DATE 2/21/75
PAGE 13HEINRICHS
GEOEX

SEND	SP	SP	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3
RECEIVE	0-5N	5-10N	10			15N	15			20N
RANGE			10x200		10x300		10x200			
VOLTAGE			550	630	690	510	420	550	630	690
CURRENT			2.0	2.0	3.0	3.0	2.0	2.0	2.0	3.0
SEND	1-2	6-7	5-6	4-5	3-4	2-3	1-2			
RECEIVE	20N	20					25N			
RANGE		10x200	10x300							
VOLTAGE	510	620	640	540	620	690	500			
CURRENT	3.0	2.0	3.0	2.0	2.0	3.0	3.0			

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. SENDER NOTES

 JOB No. 999 AREA Philamina Mine
 LINE SF, HALF N, SP. 1, DATE _____
PAGE 24HEINRICHS
GEOEX

SEND	6-7	5-6	4-5	3-4	2-3	6-7	5-6	4-5	3-4	
RECEIVE	25				30N	30			35N	
RANGE				10x250		10x250	10x330	10x280	10x250	
VOLTAGE	610	630	540	690 ⁷⁸⁰	690	770	700	760	780	
CURRENT	2.0	3.0	2.0	4.0 ^{2.5}	3.0	4.5	3.3	2.8	2.5	
SEND	6-7	5-6	4-5							
RECEIVE	35		40N							
RANGE	10x250	10x330	10x280							
VOLTAGE	770	700	760							
CURRENT	2.5	3.3	2.8							

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. RECEIVER NOTES, JOB No. 999 AREA Philomena Mine
 LINE 20E, HALF S, SP. 1, $a =$ 500', BEARING NS
 SENDER STA. 3N = ELECTRODE No. 4, DATE 2/24/75



PAGE 3

HEINRICH'S
GEOEX

SEND		6-7	1-2	2-3	3-4	4-5	5-6			
RECEIVE		275	22				275			
MULTIPLIER		0.1	1.0	1.0	1.0	0.1	0.1			
PFE		2.1	1.5	1.4	1.3	1.7	2.2			
CUR. (AMPS)		2.7	1.1	2.5	2.7	2.7	2.7			
POINT No.										
SEP. (n)										
H. F. Mv		5.80	22.1	16.6	13.8	8.38	5.27			
DRIFT		±0.2	-	-	-	-	-			
1.0 PFE $K_n/1000$		84	6	15	30	52.5	84			
0.3 PFE P_{CAL}										
0.1 PFE PFE_c		1.9	1.3	1.2	1.1	1.5	2.0			
3.0 MV $P/2\pi$		176	118	97	150	159	160			
DRIFT MCF		11	11	12	7.3	9.4	12			
S. P.			-9							
NOISE										
POT RES.										
CULT & CMTS										

AC noise spikes to 648 mv receiver at 17-225; gone at 22-275

I. P. RECEIVER NOTES, JOB No. 999 AREA Philomena MineLINE 20E, HALF N, SR. 1, $a = 500'$, BEARING NSSENDER STA. 3N = ELECTRODE No. 4, DATE 2/24/75PAGE 7HEINRICHS
GEOEX

SEND	3-4	2-3	6-7	5-6	4-5	3-4	6-7	5-6	4-5	
RECEIVE	←	33N	33			38N	38		43N	
MULTIPLIER	1.0	0.1	1.0	1.0	1.0	0.1	1.0	0.1	0.1	
PFE	1.6	1.7	1.2	1.4	1.7	1.7	1.2	1.4	1.6	
CUR. (AMPS)	2.7	2.3	2.7							→
POINT No.										
SEP. (n)										
H. F. MV	11.2	5.03	27.7	19.7	12.7	8.67	12.3	9.65	6.70	
DRIFT	-	+0.3	-	-	-	-	-	-	-	
1.0 PFE $K_n/1000$	52.5	84	75	30	52.5	84	30	52.5	84	
0.3 PFE P_{CAL}										
0.1 PFE PFE_c	1.4	1.5	1.0	1.2	1.5	1.5	1.0	1.2	1.4	
3.0 MV $P/2\pi$	213	180	150	214	241	264	134	183	204	
DRIFT MCF	6.6	8.4	6.6	5.6	6.2	5.7	7.5	6.5	6.9	
S. P.			-8				+78			
NOISE										
POT RES.										
CULT & CMTS	Fence at approx. 37N apparently <u>ungrounded</u> (wood posts)									

I. P. SENDER NOTES

 JOB No. 999 AREA Philomena Mine A.
 LINE 20F, HALF 5, SP. 1, DATE 2/24/75
PAGE 1HEINRICHS
GEOEX

SEND	5-6	6-7	4-5	5-6	6-7	3-4	4-5	5-6	6-7	CAL
RECEIVE	3N	2S	2		75	7			125	
RANGE	10x330	10x300	10x300	10x300	10x300	10x300				
VOLTAGE	740	⁴⁴⁰ 620	680	650	660	630	680	640	660	
CURRENT	3.3	3.0 ^{3.0}	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
SEND	2-3	3-4	4-5	5-6	6-7	1-2	2-2	3-4	4-5	5-6
RECEIVE	12				175	17				2716 →
RANGE	10x210	10x290	10x290	10x300	10x300	10x110	10x230	10x270		
VOLTAGE	730	600	650	640	620 ⁶⁹⁰	730	640	550	600	560
CURRENT	2.6	2.90	2.9	3.0	2.0 ^{2.7}	1.1	2.3	2.7	2.7	2.7

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. SENDER NOTES

JOB No. 999 AREA Philomena Mine
 LINE 20E, HALF N, SP. 1, DATE 2/24/75

PAGE 2HEINRICHS
GEOEX

SEND	6-7	1-2	2-3	3-4	4-5	5-6				
RECEIVE	225	22				275				
RANGE	10x270	10x110	10x250	10x270						
VOLTAGE	580	720	690	550	590	560				
CURRENT	2.7	1.1	2.5	2.7	2.7	2.7				
SEND	1-2	2-3	3-4	4-5	1-2	2-3	3-4			
RECEIVE	27			325	32		375			
RANGE										
VOLTAGE	720	1040	540	590	720	630	450			
CURRENT	1.1	2.3	2.7	2.7	1.1	2.3	2.7			

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

I. P. SENDER NOTES

 JOB No. 999 AREA Pharamena Mine
 LINE 208, HALF N, SP. 1, DATE 2/24/75
PAGE 3HEINRICHS
GEOEX

SEND	SP	SP	4-5	3-4	2-3	1-2	5-6	4-5	3-4	2-3
RECEIVE	3-8N	8-13N	13			18N	18			
RANGE			210x10	200x10	230x10	170x300	10x270	10x270	10x270	10x230
VOLTAGE			560	520	600	565	530	560	520	600
CURRENT	-	-	2.7	2.7	2.3	.9	2.7	2.7	2.7	2.3
SEND	1-2	6-7	5-6	4-5	3-4	2-3	1-2	6-7	5-6	4-5
RECEIVE	23N	23					28N	28		
RANGE	10x110	10x270	10x270	10x270	10x270	10x230	10x110	10x270	10x270	10x270
VOLTAGE	700	540	530	560	520	600	700	540	530	560
CURRENT	1.1	2.7	2.7	2.7	2.7	2.3	1.1	2.7	2.7	2.7

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

1-2 = 1.1

2-3 = 2.3

3-4 = 2.7

4-5 = 2.7

5-6 = 2.7

6-7 = 2.7

J. P. SENDER NOTES

JOB No. 999 AREA Philomena Mine A
 LINE 20E, HALF N, SP. 1, DATE 2/24/75



PAGE 4

HEINRICHS
GEOEX

SEND	3-4	2-3	6-7	5-6	4-5	3-4	6-7	5-6	4-5	
RECEIVE	←	33N	33			38N	38		43N	
RANGE	10x270	10x230	10x270							
VOLTAGE	520	600	540	530	560	520	540	530	560	
CURRENT	2.7	2.3	2.7	2.7	2.7	2.7	2.7	2.7	2.7	
SEND										
RECEIVE										
RANGE										
VOLTAGE										
CURRENT										

FREQUENCIES

SENDER No.

OPERATOR

RECEIVER No.

OPERATOR

COMMENTS:

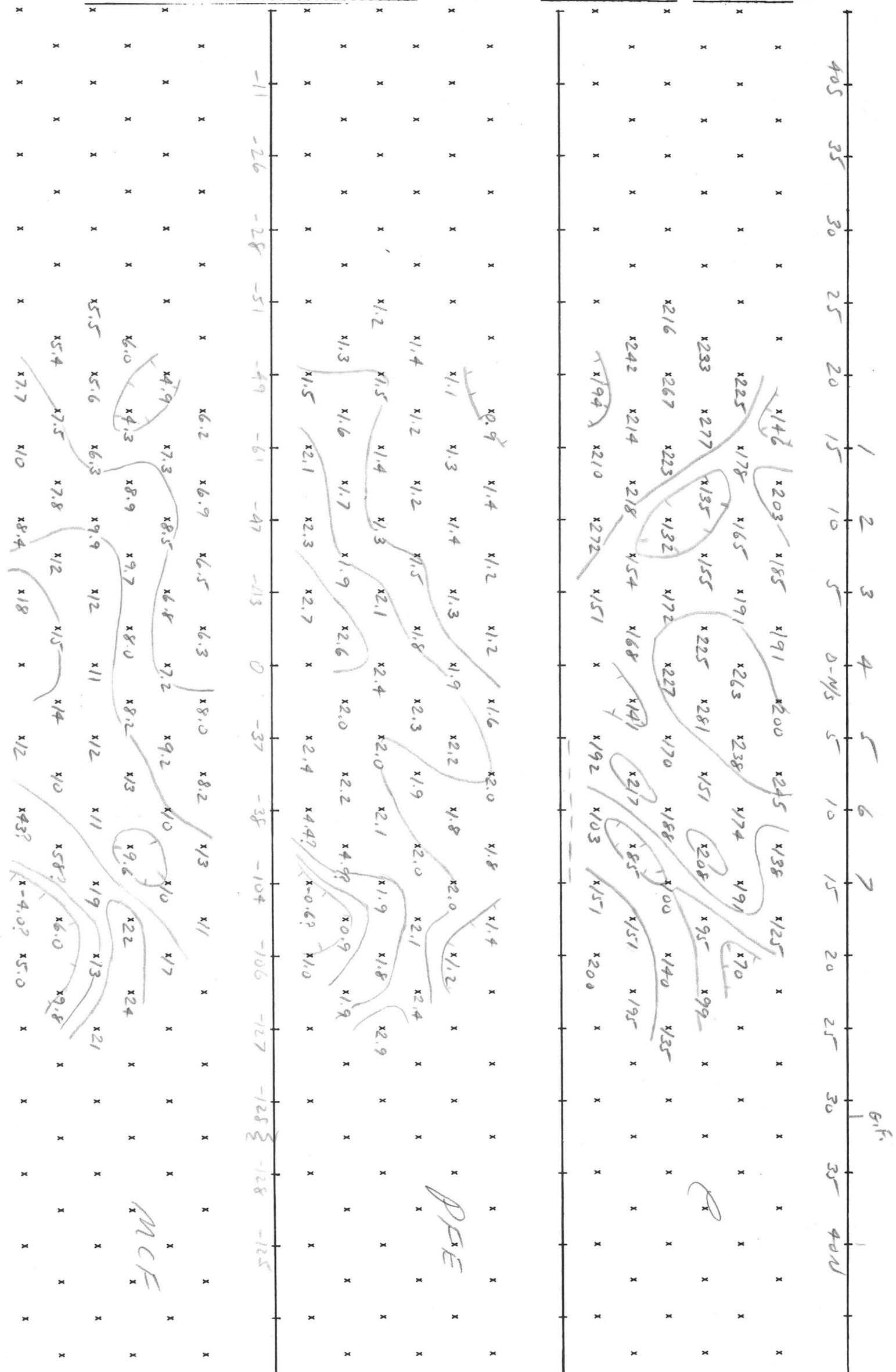
JOB # 999 CLIENT Cypress Exploration Company

DATE February 1975 AREA Philomena Mine

LINE# 5E SP 1 a= 500' BEARING N-S

RESISTIVITY FREQUENCIES 3.0

FREQUENCIES 0.3 & 3.0 Hz

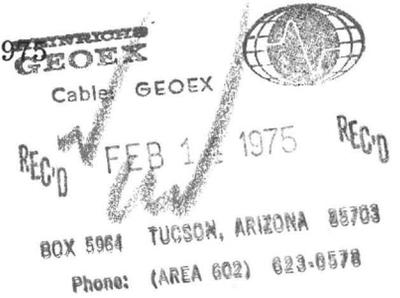


F
Cyprus Exploration Company

J 977
555 South Flower Street
Los Angeles, California 90071
Telephone 213) 489-3700

Cable Selmud Losangeles
Telex 67-4601
TWX 910) 321-2958

February 12, 1975



AIRMAIL

Mr. Chris S. Ludwig, Chief Geophysicist
Heinrichs Geoexploration Company
P. O. Box 5964
806 West Grant Road
Tucson, AZ 85703

Dear Mr. Ludwig:

Enclosed is an accepted copy of your letter of January 30, 1975, setting forth the terms for the IP survey to be performed in Pima County, Arizona.

Please note that this agreement is entered under the name of Cyprus Mines Corporation, not Cyprus Exploration Company, and that our corporate office address in Los Angeles has been changed on item 14 (bb).

Yours truly,

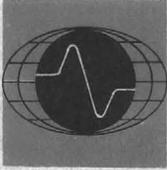
M W Seery
M. W. Seery
Administrative Staff Geologist

mjk

Enclosure

cc: G. S. Branson (enclosure)
J. E. Worthington (enclosure)

CYPRUS



HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA 85703. P.O. BOX 5964, PHONE: (602) 623-0578

January 30, 1975

**Mr. C. B. Hutchens
Exploration Geologist
Cyprus Exploration Company
Suite 161
South 400 Jefferson Street
Spokane, Washington 99204**

**Re: I.P. Survey - Phillimena
Mine Area, Sec. 27, T17S
R10E and Vicinity
Pima County, Arizona
GEOEX Job #999**

Dear Mr. Hutchens:

This letter sets forth our understanding of the terms and conditions under which Heinrichs GEOEXploration Company (hereinafter called "Contractor") agrees to perform an induced polarization survey for Cyprus Exploration Company (hereinafter called "Company") in the vicinity of the Phillimena Mine, Pima County, Arizona, commencing on or about February or March, 1975.

1. Contractor agrees to furnish induced polarization equipment and a three man field crew, using conventional field procedures, over terrain to be specifically designated by officials of Company. Services of other personnel of Contractor's technical staff will be made available as mutually agreed upon by the parties should the need for such services arise. Company will not be required to furnish any field assistants. Contractor understands that initially two north-south lines are anticipated, about 1500 feet apart, to give roughly two line miles of 500 foot dipole coverage centered about 500 feet and 2000 feet east of the SW corner of Section 27, T.17S., R.10E.

2. Company agrees to pay Contractor for the services of the three-man field crew and for the use of the equipment furnished by Contractor, at the rate of \$350.00 per ten-hour work day, including travel. Overtime will be charged at the rate of \$52.50 per hour for work in excess of fifty hours per week. The final report charge will be \$500.00. Charges for the services of personnel in addition to the three-man field crew and for equipment beyond that specified in paragraph one above shall be at such rates as the parties may agree upon if and when the necessity for such additional personnel or equipment arises.

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No costs or expenses in excess of or in addition to those set forth in this Agreement shall be incurred by Contractor without the prior written consent of Company.

12. Contractor shall perform the services set forth in this Agreement pursuant to the direction and control of Company.

13. Contractor agrees to indemnify and save harmless Company against any and all loss and expense, including attorney's fees and other legal expenses, by reason of liability imposed or claimed to be imposed by law upon Company for damage because of bodily injury, including death at any time resulting therefore, or on account of damage to property sustained by any person or persons arising out of or in consequence of the performance of the work, whether or not such bodily injuries or damage to property are due to or claimed to be due to any negligence or acts, including violation of any duty imposed by a statute, ordinance or regulation, of Contractor, the subcontractors, the employees or agents of any of them.

14. Contractor will obtain and continue in force, during the term of this agreement, at its own expense, all insurance specified below. Contractor will not commence work nor allow any subcontractor to commence work until all insurance has been approved and accepted by Company.

The insurance continued in force by Contractor is the following:

- a) Workmen's Compensation and Occupational Disease Disability insurance as required by the laws of the state wherein the work is to be performed.
- b) Employer's Liability insurance, unless the laws of the state in which the work is to be performed preclude an independent right of action by an employee against an employer under common law.
- c) Comprehensive Automobile Liability insurance with Bodily Injury limits of no less than \$500,000 each person and 1,000,000 each accident and Property Damage with a limit of no less than \$100,000 each accident.
- d) Comprehensive General Liability and Property Damage Insurance including Operation, Protective and Contractual Liability coverages with Bodily Injury limits of no less than \$500,000 each occurrence, and \$300,000 aggregate contractual.

Contractor shall furnish Company with certificates of insurance which shall include the following statements:

- aa) At least ten (10) days prior to effective date of any material change or cancellation, written notice thereof

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will be sent by registered mail to Cyprus Mines Corporation
555 South Flower St., Suite 3700, Los Angeles, CA 90071

bb) Contractual Liability insurance covers the liability
of the insured assumed under the indemnity and insurance
provisions of the Agreement entered into with Cyprus
Exploration Company under date of January 30, 1975.

If this letter satisfactorily sets forth the terms and conditions of our
Agreement, please indicate your acceptance by signing and returning the en-
closed copy to us.

Very truly yours,

Heinrichs GEOEXploration Co.



Chris S. Ludwig
Chief Geophysicist

CSL:mt
Enclosure

Accepted by:

Cyprus Mines Corporation

By: J. L. House

Title: Senior Vice President

Date: February 10, 1975