812743

93-B-1
Copper Creek
(Malabar Mining - Gibraltar)

COMINCO LTD.

Exploration Division | Western District

N.T.S. 93-B-9

# GEOPHYSICAL REPORT

# INDUCED POLARIZATION AND RESISTIVITY SURVEYS

# GIBRALTAR MINES LTD. PROPERTY

# WILLIAMS LAKE AREA, B. C.

August 26, 1966 | George D. Tikkanen

## SUMMARY

A combined induced polarization and resistivity survey was carried out by Cominco's IP crew on parts of the Granite Mountain property of Gibraltar Mines Ltd.

The area shows widespread anomalous results, some of which correlate with the known mineralization. Some anomalous areas have been tested, with the cause of the anomalous IP effects still unexplained.

A number of anomalous locations have been selected, and it has been recommended that these locations be studied with respect to all other available data and the most promising areas tested. Additional reconnaissance IP surveys have been recommended as a part of any continuing exploration program.

## INTRODUCTION

The Granite Mountain property is presently held by Cominco Ltd., under an agreement with Gibraltar Mines Ltd.

The property is located on the southwest slope of Granite Mountain, five miles east of the Fraser River and approximately 30 miles north of Williams Lake, B.C.

The Keevil Mining Group Ltd. and Gibraltar Mines Ltd. have carried out past work, mainly in a restricted area of known mineralization. An adit has been driven 110 feet. A number of diamond drill holes have been drilled, some mapping has been done, some geochemical work, and IP surveys on two previous occasions. Keevil's 1962 IP survey, made with equipment of an unknown type, gave unsatisfactory and erratic results. A small survey by Hunting in 1963 gave much better results, but was restricted in size.

The 1966 Cominco IP survey was designed to cover areas of known mineralization and to cover some of the interesting parts of the property away from the known mineralization.

## GEOLOGY

The geological setting of the mineralization and alteration has been described as being typical of porphyry copper type mineralization. Granodiorite is the predominant rock type, with limited areas of schist. Mineralization grading roughly 0.5% copper has been commonly intersected in drill holes.

The geology will be adequately covered in other reports covering Cominco work.

## SURVEY

### Method:

The survey was performed by J. B. Johnston between June 24 and July 23, 1966, assisted by other Cominco employees. The instrument employed was Cominco's McPhar model 650 induced polarization unit.

Standard survey practice employed 300-foot electrode spreads, with n values of 1, 2 and 3. Minor detailed work was done using 200-foot spreads. Varied line spacing was used, as the plan shows.

### Data Presentation:

The following data is presented with this report:

1. Plan of IP data, Gibraltar Property - Plate No. 93B-GIB-P-1.
2. The following data plots:

| Line No. | Dipole Length | Plate No. |
|---|---|---|
| 64E | 300' | IP-1-1 |
| 56E | 300' | IP-1-2 |
| 48E | 300' | IP-1-3 |
| 40E | 300' | IP-1-4 |
| 32E | 300' | IP-1-5 |
| 20E | 300' | IP-1-6 |
| 16E | 300' | IP-1-7 |
| 8E | 300' | IP-1-8 |
| 0 | 300' | IP-1-9 |
| 4W | 300' | IP-1-10 |
| 4W | 200' | IP-1-11 |
| 8W | 300' | IP-1-12 |
| 8W | 200' | IP-1-13 |
| 12W | 300' | IP-1-14 |

| Line No. | Dipole Length | Plate No. |
|---|---|---|
| 16W | 300' | IP-1-15 |
| 20W | 300' | IP-1-16 |
| 24W | 300' | IP-1-17 |
| 28W | 300' | IP-1-18 |
| 40W | 300' | IP-1-19 |

Discussion:

The survey showed relatively high background metal factors, but a number of significant anomalies were located.

The plan shows the location of the IP anomalies, which were selected from a study of the data plots, and the plan also shows the third separation (n = 3) values for the metal factor, in contoured form. The third separation has been contoured to show line to line correlation of the results at the deepest level of investigation. The anomaly locations will not necessarily coincide with the peaks on the third separation, since the first and second separations, if anomalous, will have been considered as well in the location of the anomaly. The most profitable use of the contours is as a trend indicator.

The anomalies have been classified into three groups: definite, probable, and possible. The grouping was based on the strength of the metal factor, the frequency effect, and the pattern of the anomaly. In general, the true metal factor should be directly related to the volume of chargeable material; however, the survey measures the apparent metal factor, and a large volume with a small percentage of sulphides could show the same metal factor value as a smaller body with a higher sulphide content. The apparent metal factor will approximate the true metal factor when the metal factor is unchanged for several readings within the anomaly; this is most often seen in the case of an anomaly whose dimensions are large, and depth to the top is small, relative to the electrode spread. It is therefore possible for a small percentage of chargeable material to cause a relatively strong anomaly if the measured metal factor approaches the true metal factor.

Survey Results:

A discussion of each individual anomaly is unnecessary, since most of the surveyed area is anomalous to some degree. Since pattern drilling has been done in the mineralized area south of the baseline and west of line zero, the IP data here can be used for comparison with unknown areas. The IP results would be dependent upon total sulphide content, so that drill logs should be studied and total sulphide content used in explaining IP anomalies.

A very large anomalous area extends from about 8E to 28W, and from 15S to the northern extent of the readings, at about 40N. The southern part of this anomalous area includes the known area of mineralization. The larger northerly section, where the anomalies are stronger, has been tested only in a few places, with discouraging results. The anomaly peaks could be a reflection of the depth to the causative bodies, in that, the anomaly intensity increases if the depth to the body decreases.

The complete evaluation of the anomalous areas will include a cross reference study against all available data, including drilling, trenching, geochemical surveys and geological surveys.

The most promising locations are given below and should be checked against all available data to determine their favourability.

1. <u>Line 16+00W, 14+00N</u>: C34

The second separation (n = 2) shows metal factor values of over 300, with percent frequency effects of 10 and resistivities of about 30. This is the central part of an anomaly that trends southerly, towards the main mineralized area.

2. <u>Line 28+00W at 36+00N</u>:

The second separation shows metal factor values of over 500, with frequency effects of 10 and resistivities in the order of 20. This is the strongest part of an anomaly which appears to be related to the first described zone on L16+00W. Hole C31 should have tested another part of this anomaly.

3. <u>Line 64+00E from 36 to 39N</u>:

On the second separation, a metal factor of 182 was located, with a percent frequency effect of about 11 and resistivities of 60. This is a sharply defined zone. This anomaly is near a geochemical indication located by the Keevil Group. There is apparently some doubt as to whether or not this area is covered by Gibraltar claims.

4. <u>Line 40+00E at 14+00N</u>: C35

A third separation metal factor anomaly of 118 has a moderate percent frequency effect of 4.7, with a very low resistivity of about 40. It is likely relatively deep, although shallower measurements are also somewhat anomalous.

5. <u>Line 20+00E from 7+50S to 10+50S</u>:

A sharply defined anomaly occurs, with maximum metal factor of 95 on the first separation. It has a strong percent frequency effect of 11, with a resistivity of about 120. It is apparently at a relatively shallow depth and could come to the bedrock surface.

6. Line 8+00W at 19+50N:

A strong anomaly occurs, with a metal factor of about 400, percent frequency effects of 12 and resistivities in the order of 30. It seems to be related to the anomalous area tested by DDH C-31.

## CONCLUSIONS

1. A combined induced polarization and resistivity survey, covering approximately 19 line miles, was carried out by the Cominco IP crew, using 300-foot dipoles and taking readings at n = 1, 2 and 3.

2. The survey covered an area near the known mineralization but the entire property was not systematically prospected.

3. The area surveyed showed anomalous values over relatively large areas. The known mineralization shows distinct anomalies, but to the north somewhat stronger anomalies occur, although limited testing in this northern area has not satisfactorily explained the anomalous IP effects.

4. The IP survey has indicated a number of favourable areas. Based on available information, six have been selected as the most promising and have been previously listed under heading "Survey Results".

## RECOMMENDATIONS

1. The six anomalous locations listed under "Survey Results" should be cross-checked against other available data including past drilling and trenching, geology and geochemistry, and the most favourable ones tested.

2. A continuing exploration program should include systematic IP coverage of all the remaining geologically favourable parts of the property.

Submitted by: ______________________

George D. Tikkanen,
Senior Exploration Geophysicist.

GDT:hc.
Aug.26'66.

Distribution
- Exploration, Mtl
- Chief Geologist, Expl.
- Western District
- Field File
- Toronto
- GDT

COMINCO LTD.

APPENDIX I

**Notes on the Induced Polarization Method**

## NOTES ON THE INDUCED POLARIZATION METHOD

Theory:

Polarization is the separation of charge, or blocking action of metallic or electronic conductors within a medium of ionic solution conduction. Induced polarization refers to this blocking action when caused by an applied electric field.

In its geological context induced polarization, or I.P., refers to the electro-chemical blocking phenomenon exhibited by metallic minerals such as most sulphides and graphite, under the influence of an applied current. When a current is passed through the ground the conduction is ionic and is dependent upon ions in the water content of the ground, because most minerals have a much higher specific resistivity than ground water. The "metallic" minerals have specific resistivities which are much lower than ground water. The I.P. effect occurs at the interfaces between ionic conductive conditions in the ground waters and the electronic conductive conditions in the metallic minerals.

The blocking action, or I.P. effect, increases with the time during which the current is flowing, hence if the current is periodically reversed, a higher frequency current will show less blocking, or I.P. effect, than will a low frequency, since less time is available for the blocking to occur at the higher frequency. It is therefore possible to measure the I.P. effect by measuring the resistivities at two frequencies. Essentially, this is the basis of the frequency domain I.P. system.

The percent frequency effect is defined as $\frac{\rho_L - \rho_H}{\rho_L}$ x 100, where $\rho_L$ and $\rho_H$ are the resistivities at the low and high frequencies, respectively. The percent frequency effect is the parameter measured to show the I.P. effect, and is the frequency domain equivalent of the chargeability m used in time domain I.P. work.

The resistivity is actually the apparent resistivity, which is an averaged value. It is obtained from the current, potential, and geometry of the electrode system. The resistivity plotted is the low frequency resistivity value and the units are ohm feet/$2\pi$. To convert these units to ohm meters, commonly used in some other I.P. systems, the ohm feet/$2\pi$ values should be multiplied by 1.9.

The metal factor values are obtained by dividing the percent frequency effect by the resistivity and multiplying by a factor of 1000. The metal factor is proportional to the change in conductivity as the frequency of the applied current is varied, and can be shown to be equal to $(\sigma_H - \sigma_L) \times 2\pi \times 10^5$, where $\sigma_H$ and $\sigma_L$ are the conductivities at the high and low frequencies, respectively. The metal factor is generally more diagnostic than the frequency effect alone.

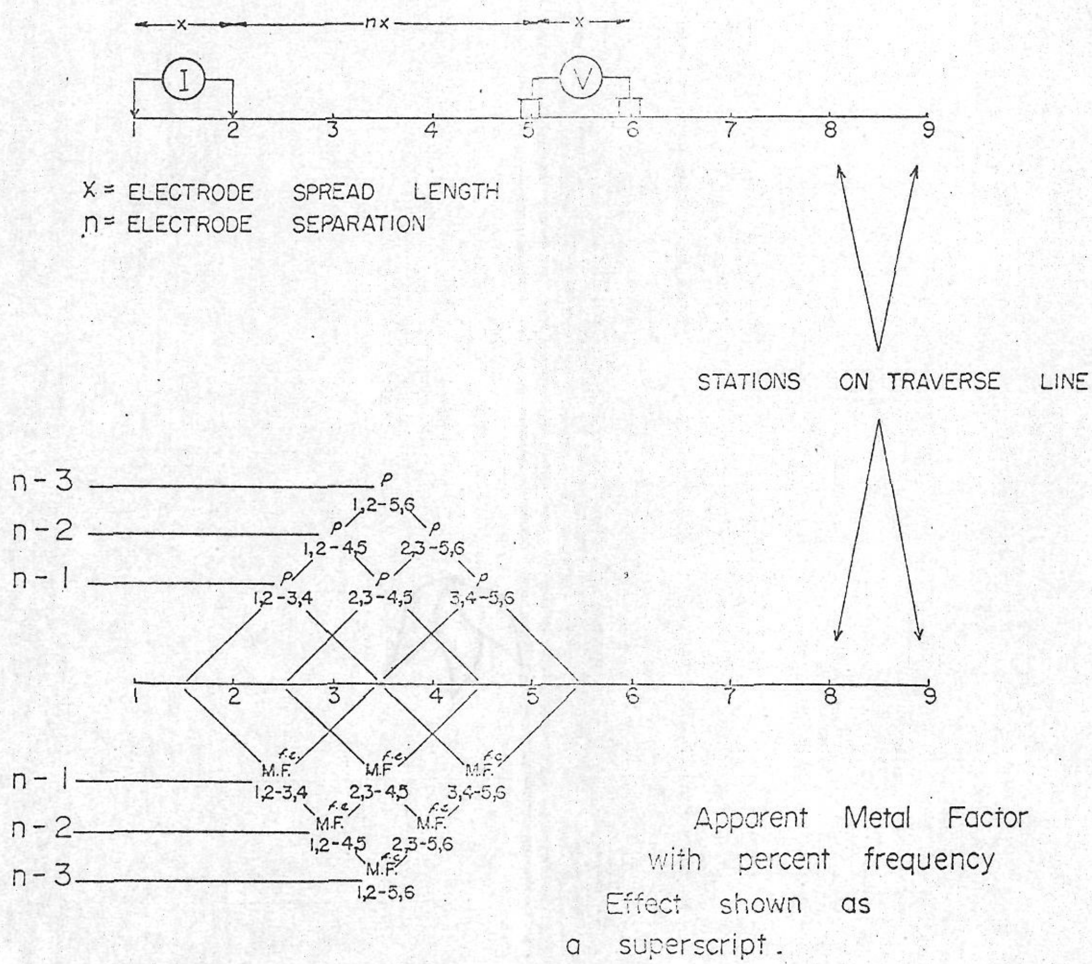
Procedure:

Current is applied to the ground at two current electrodes ($C_1$ and $C_2$) spaced a distance x apart. The potential is measured at two potential electrodes ($P_1$ and $P_2$) also spaced a distance x apart and in line with the current electrodes. For any given locations of $C_1$ and $C_2$, readings are taken when the distance between the nearest current and potential electrodes is equal to nx, and n has values of 1, 2, 3, etc. The electrode spacing x is determined by the requirements of the survey. Larger values of x would be used when the object is greater depth penetration and faster progress, whereas smaller values of x are employed in more detailed surveys and provide more accurate anomaly location, but for the smaller values of x the penetration is less and the survey slower. The penetration is greater for the larger n values.

The values of the resistivity, metal factor and percent frequency effect are plotted on "psuedo-sections", where the plotting point is determined by the intersection of lines drawn at 45° from the horizontal, and originating at the mid-points of the current electrode spread and the potential electrode spread, as shown in the diagram. The resistivities are plotted and contoured above the line and the metal factors plotted and contoured below the line. The percent frequency effect is shown on a superscript at the metal factor value. Depths to causative bodies cannot be scaled from the "psuedo-section", however.

The most favourable type of anomaly would show a frequency effect high with a resistivity low, to provide a marked metal factor high. A frequency effect high, with little or no change in resistivity, to provide a metal factor high, mirroring the frequency effect high, is also favourable. Of lesser interest, but of possible importance, are those anomalies showing no frequency effect change, but a distinct resistivity low, to produce a metal factor anomaly. The type of anomaly, its strength, size and shape should be considered in relation to the geological setting and the target sought.

# DIAGRAM SHOWING ELECTRODE ARRAY AND PLOTTING METHOD

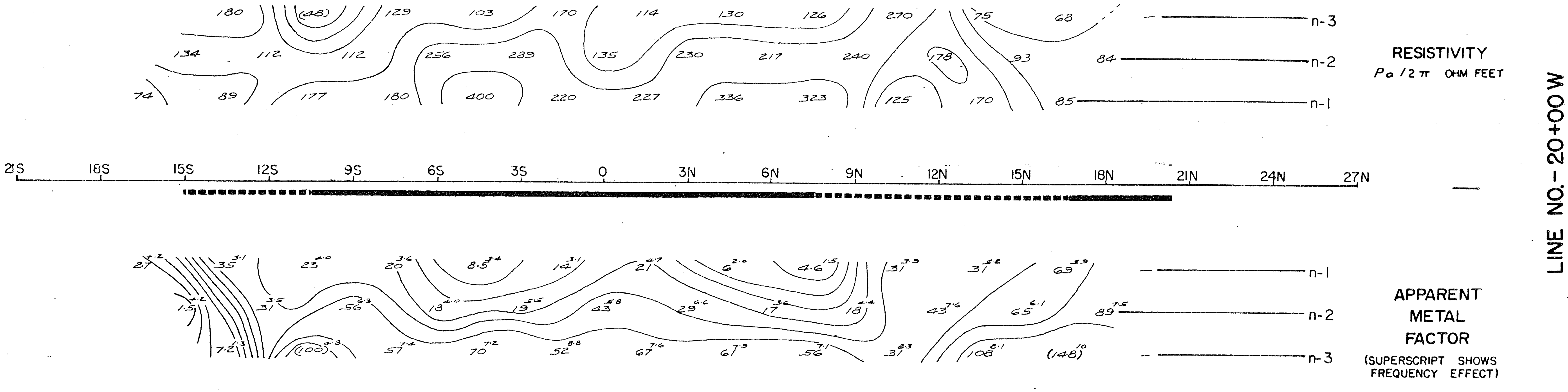


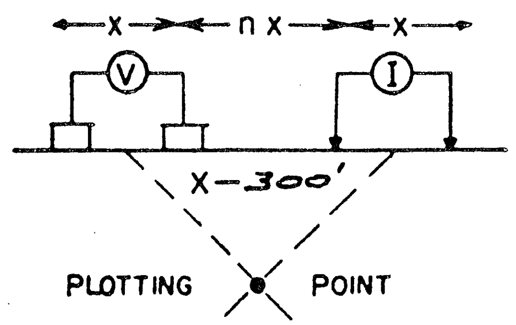
# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

Gibraltar Property

NOTE LOGARITHMIC CONTOUR INTERVAL

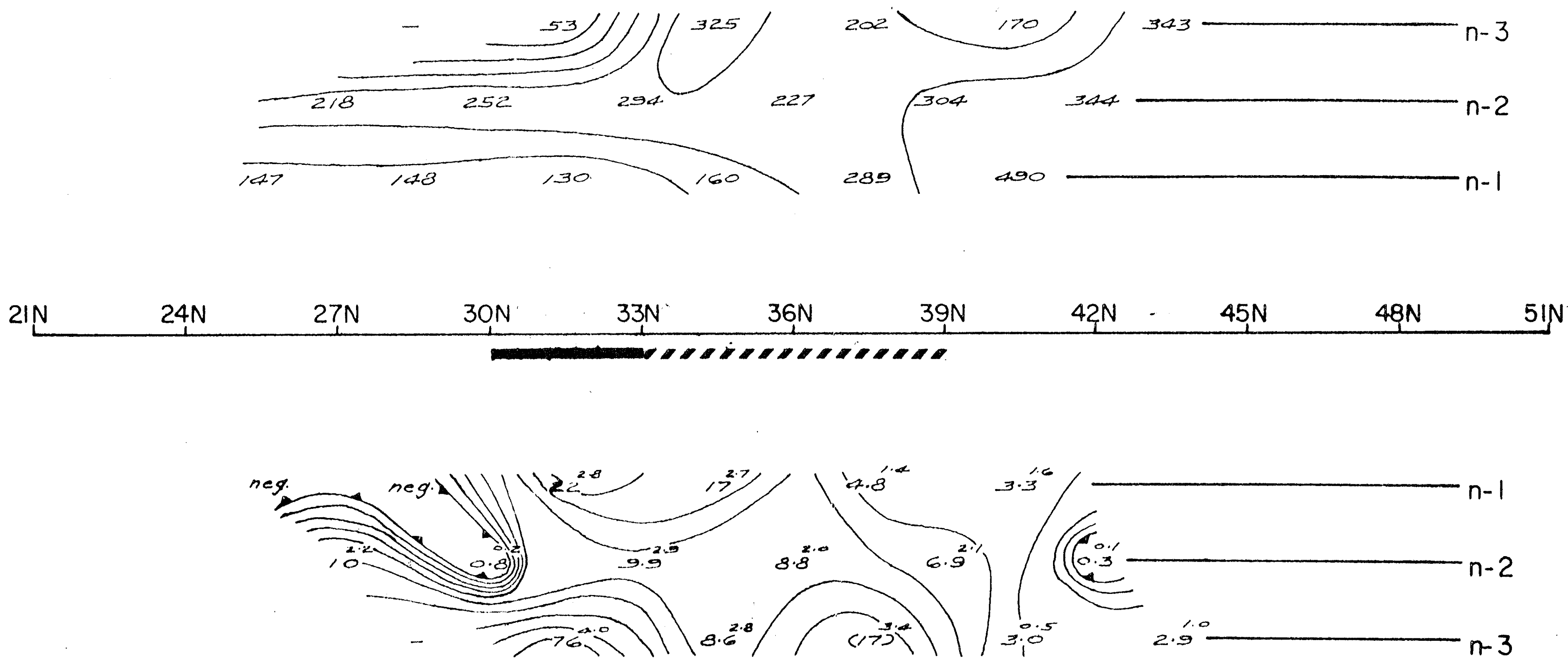
# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.

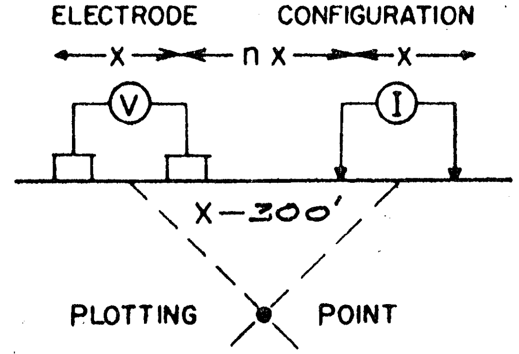
LINE NO. - 48+00E




RESISTIVITY
$P_a/2\pi$ OHM FEET

APPARENT METAL FACTOR (SUPERSCRIPT SHOWS FREQUENCY EFFECT)

ELECTRODE CONFIGURATION

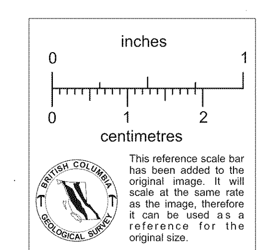



SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE




Gibraltar Property

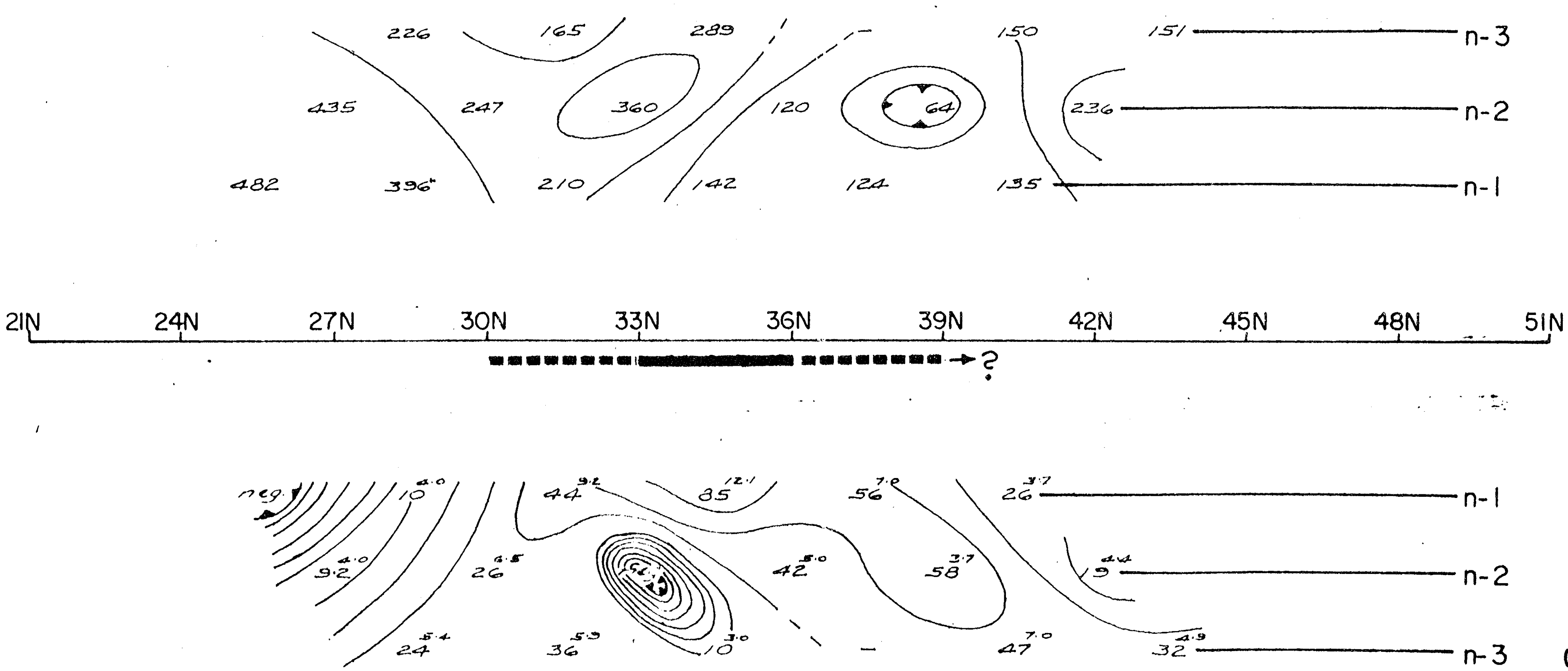
NOTE LOGARITHMIC CONTOUR INTERVAL

# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




RESISTIVITY

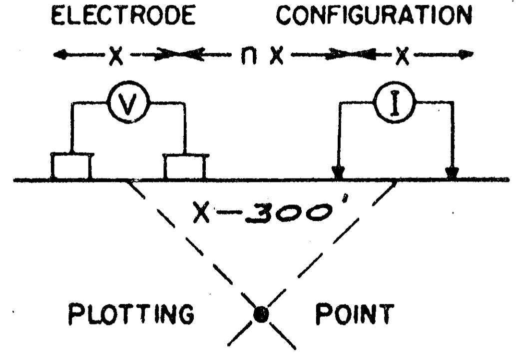
Pa / 2π OHM FEET

LINE NO.- 56+00E

APPARENT METAL FACTOR

(SUPERSCRIPT SHOWS FREQUENCY EFFECT)

ELECTRODE CONFIGURATION




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE



Gibraltar Property

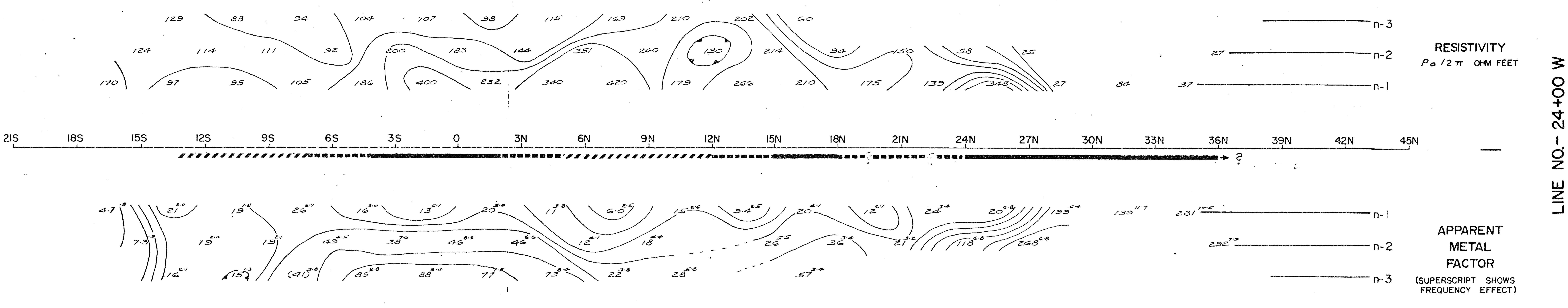
NOTE LOGARITHMIC CONTOUR INTERVAL

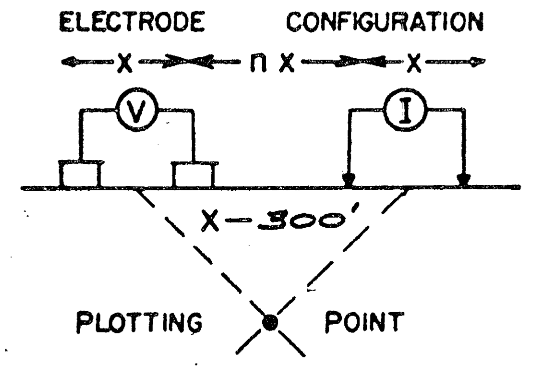
# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

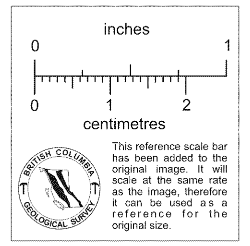
SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE



*Gibraltar Property*

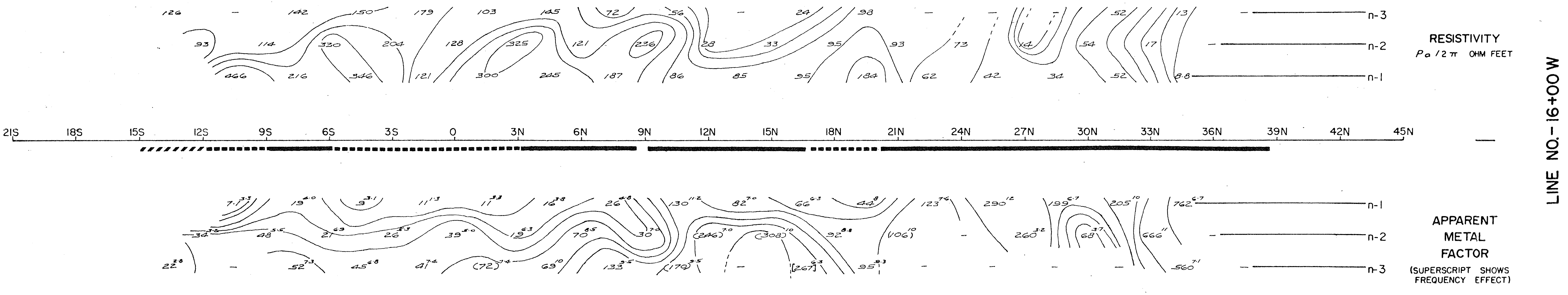
NOTE LOGARITHMIC CONTOUR INTERVAL

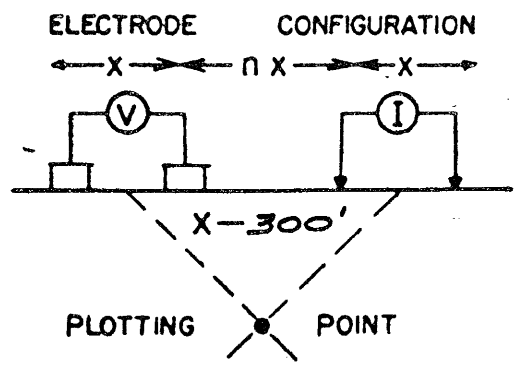
# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

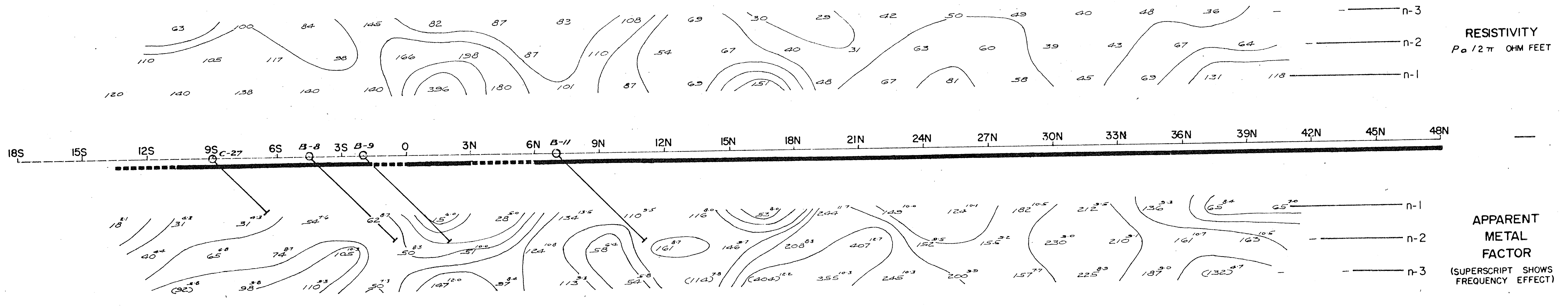
Gibraltar Property

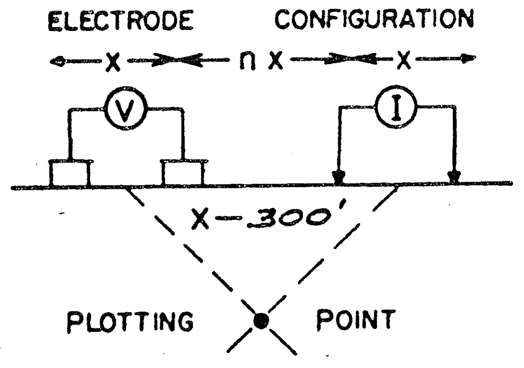
# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.



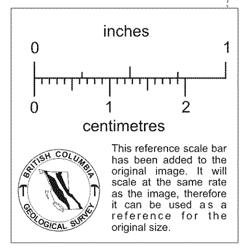

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL



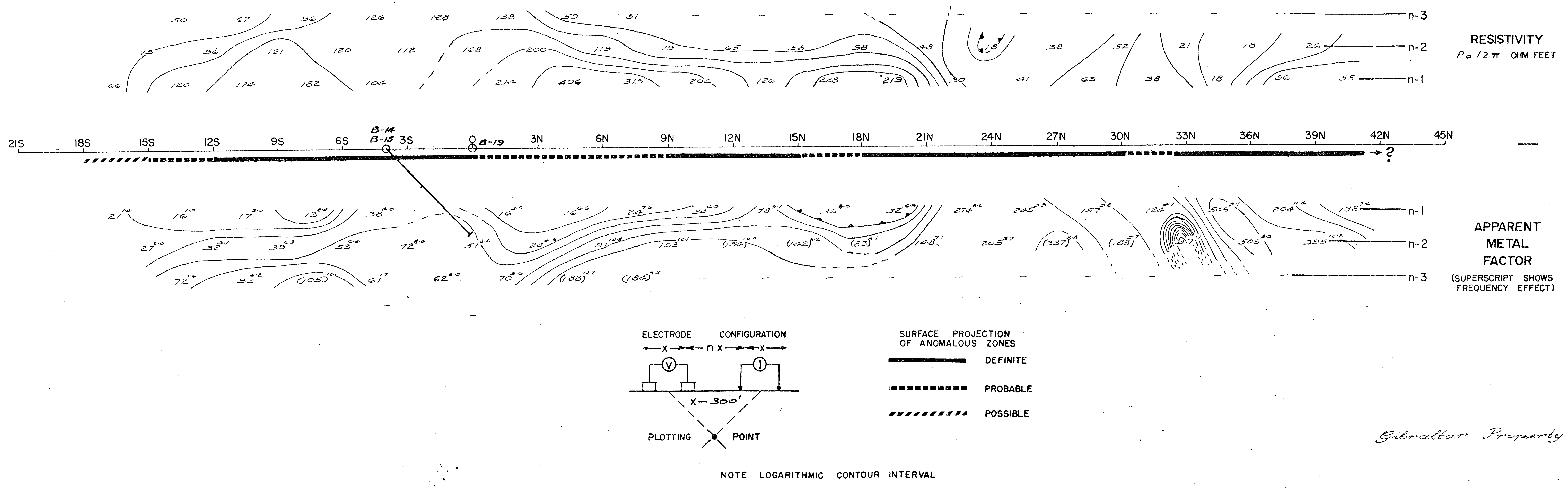

Gibraltar Property

# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale – One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




Gibraltar Property

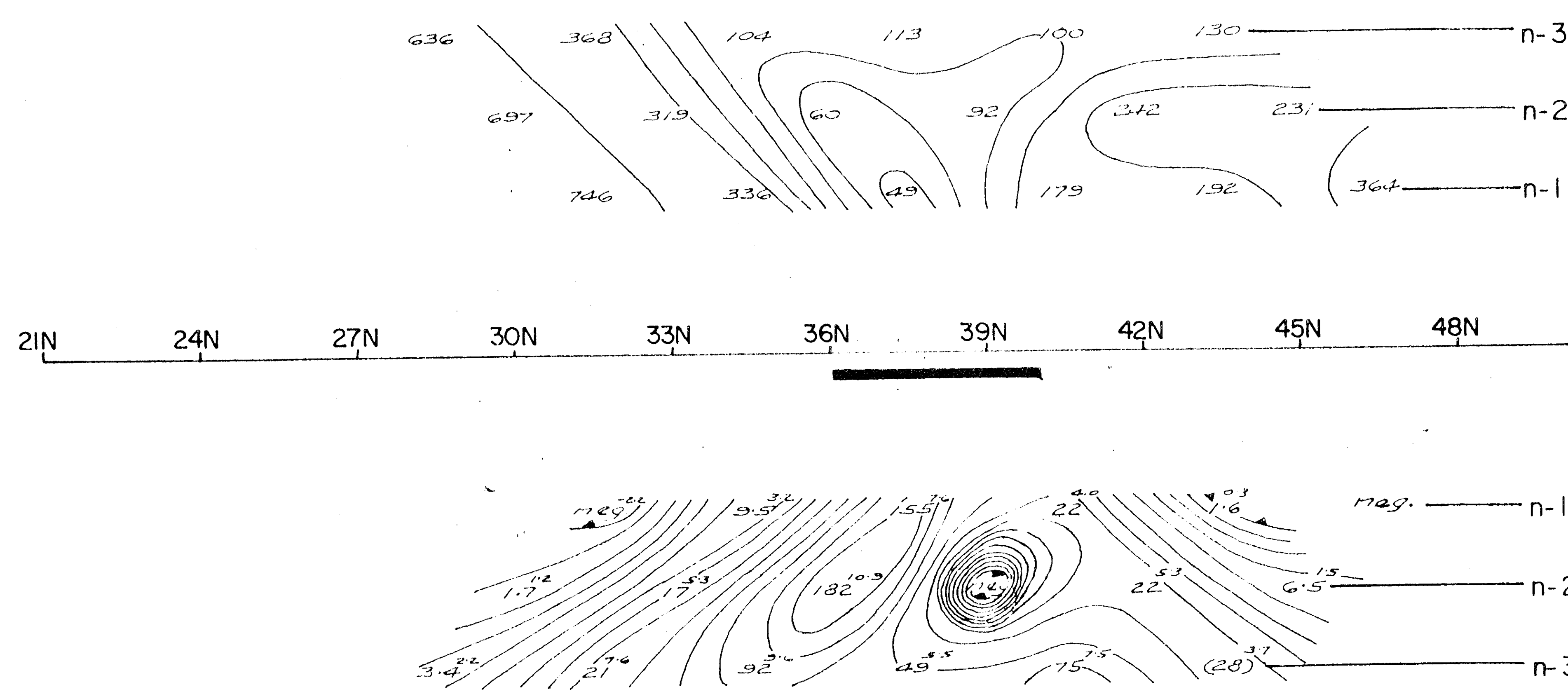
I.P.-1-1

# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




RESISTIVITY

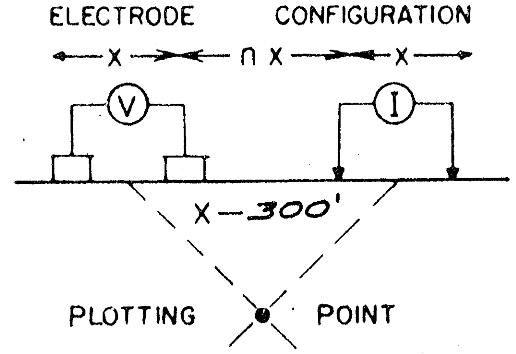
$P_o/2\pi$ OHM FEET

LINE NO.-64+00E

APPARENT METAL FACTOR

(SUPERSCRIPT SHOWS FREQUENCY EFFECT)

ELECTRODE CONFIGURATION




SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Gibraltar Property

NOTE LOGARITHMIC CONTOUR INTERVAL

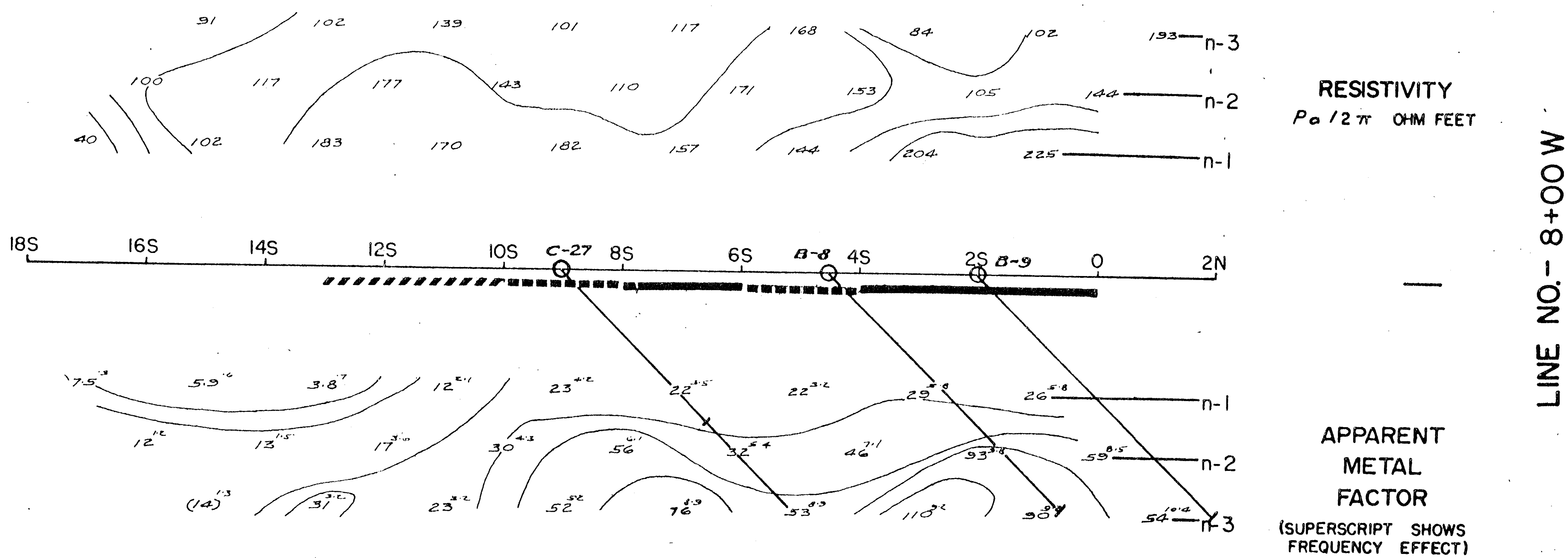
I.P.-1-13

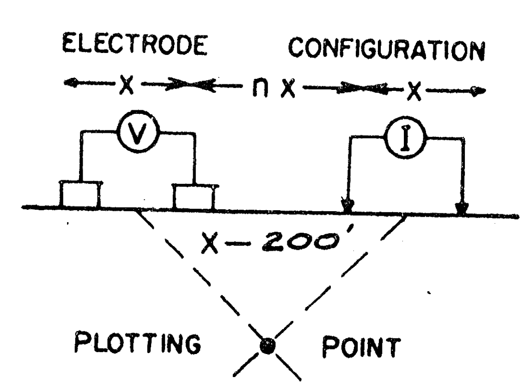
# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One inch = 200 Feet

SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

Gibraltar Property

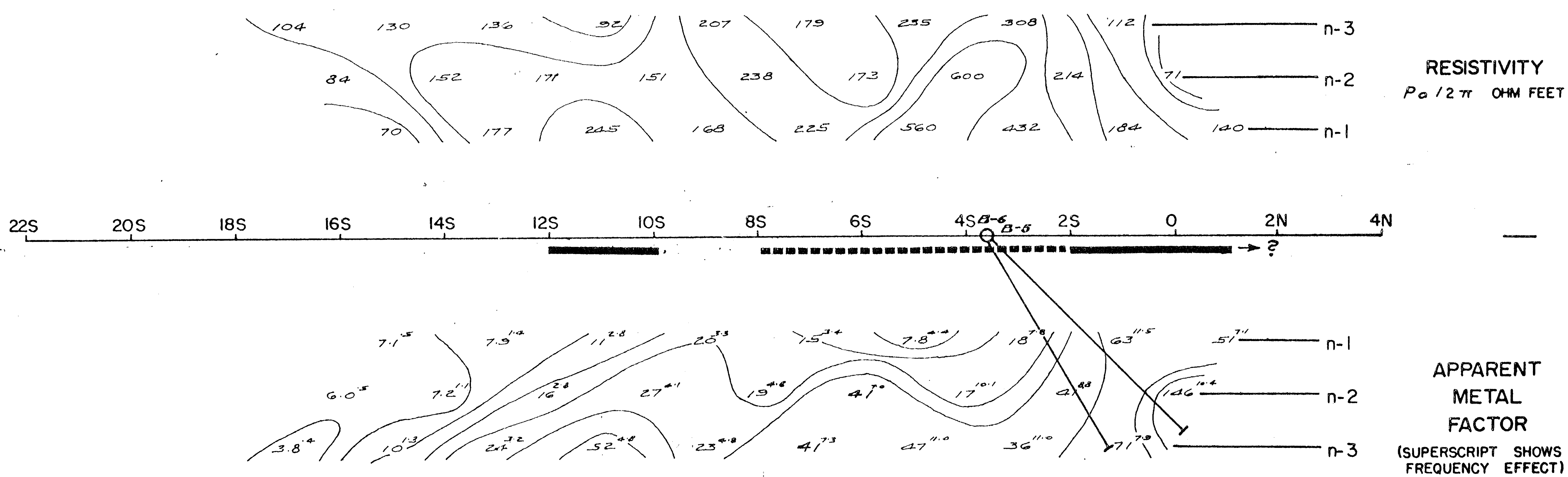
NOTE LOGARITHMIC CONTOUR INTERVAL

# COMINCO LIMITED

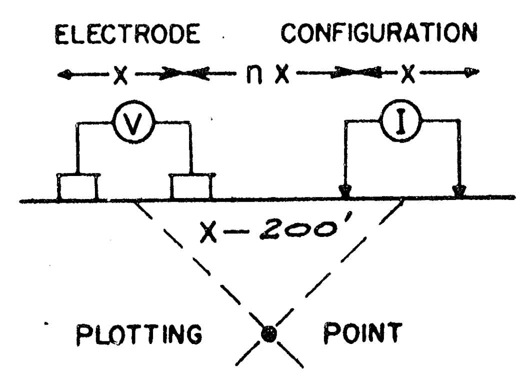
## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 200 Feet

SURVEYED BY: Cominco Ltd.




LINE NO.- 4+00 W




SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

Gibraltar Property

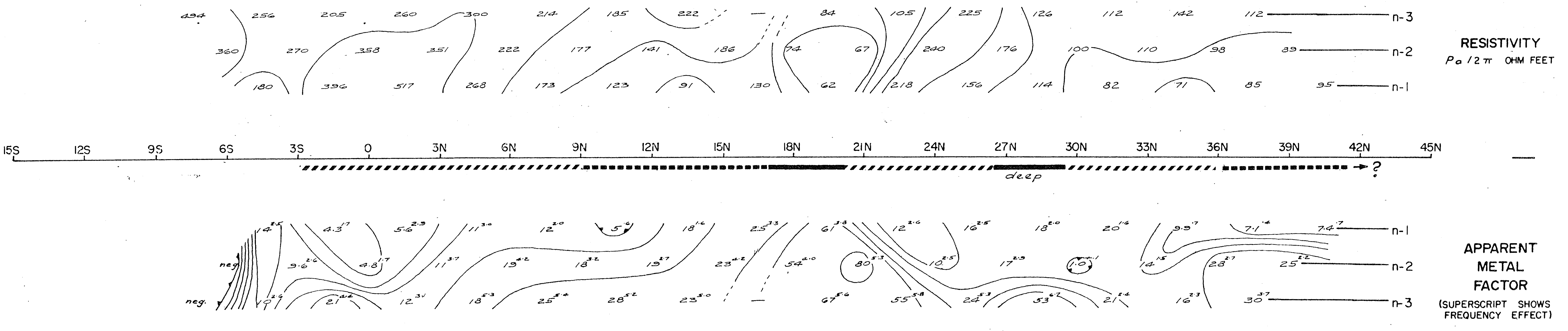
NOTE LOGARITHMIC CONTOUR INTERVAL

# COMINCO LIMITED

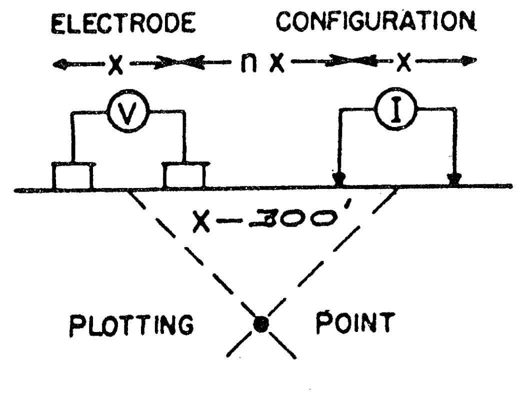
## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale – One Inch = 300 Feet

SURVEYED BY: *Cominco Ltd.*




LINE NO.- 16+00 E




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

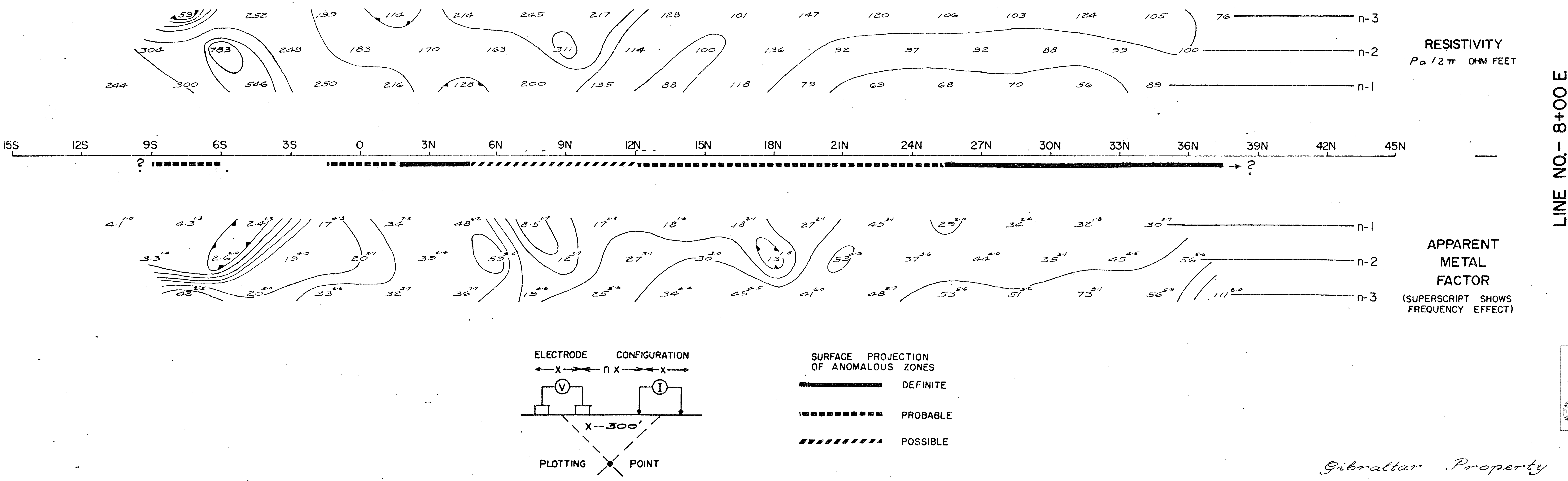
*Gibraltar Property*

# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale – One Inch = 300 Feet

SURVEYED BY: *Cominco Ltd.*




NOTE LOGARITHMIC CONTOUR INTERVAL

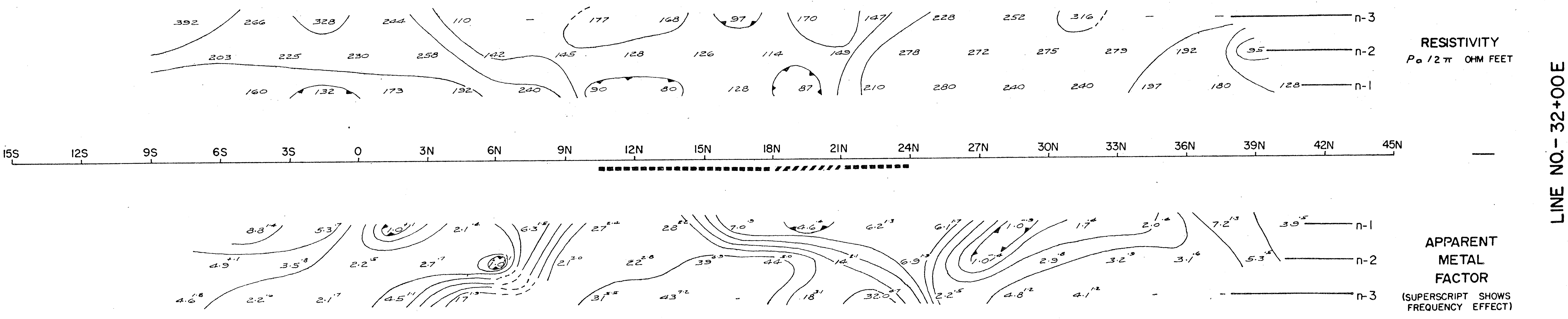
*Gibraltar Property*

# COMINCO LIMITED

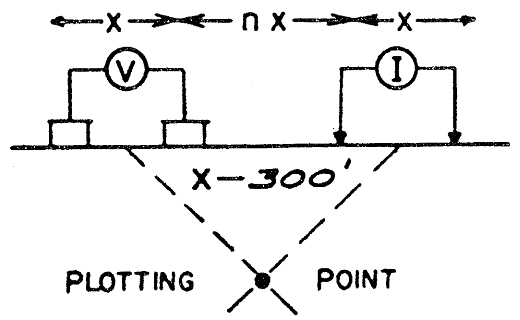
INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




ELECTRODE CONFIGURATION




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

Gibraltar Property

NOTE LOGARITHMIC CONTOUR INTERVAL

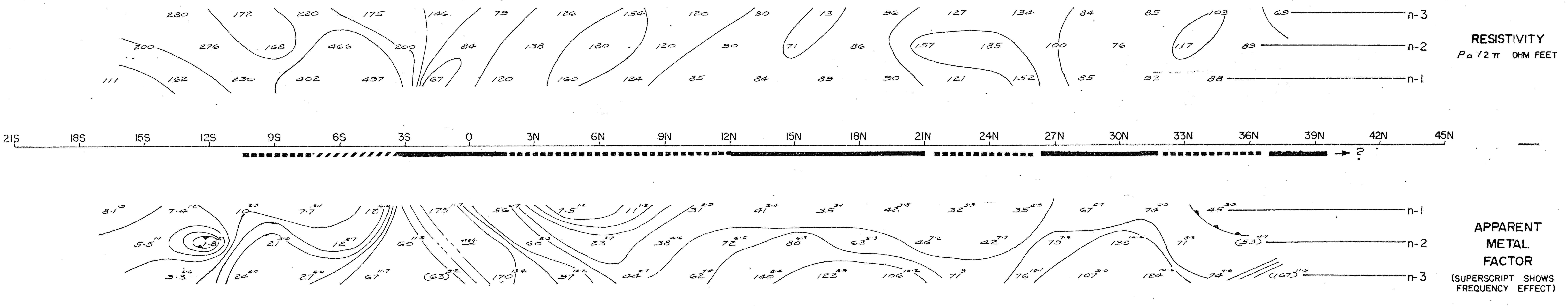
# COMINCO LIMITED

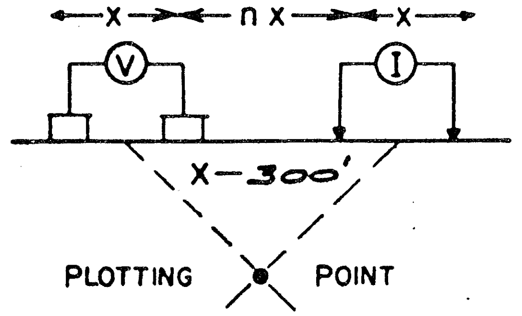
INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.

LINE NO.-0+00




SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

Gibraltar Property

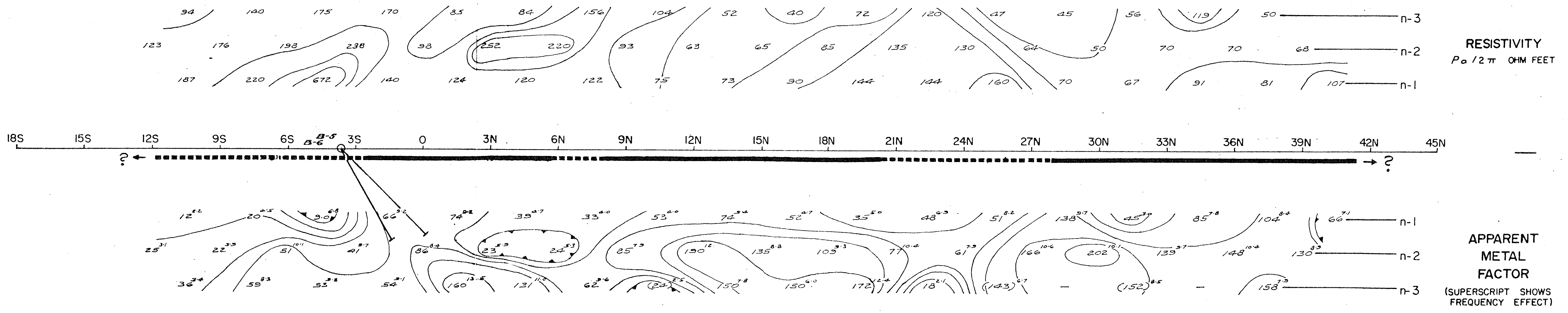
I.P.-1-10

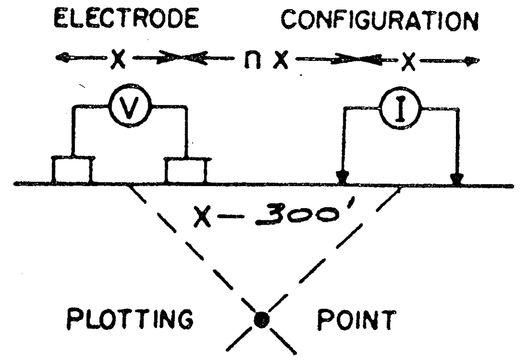
# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale—One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

Gibraltar Property

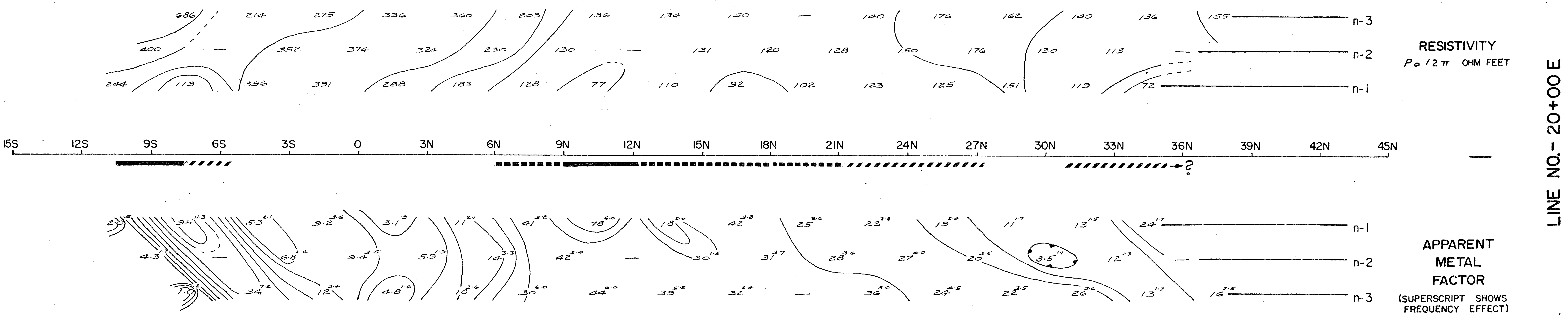
I.P.-1-6

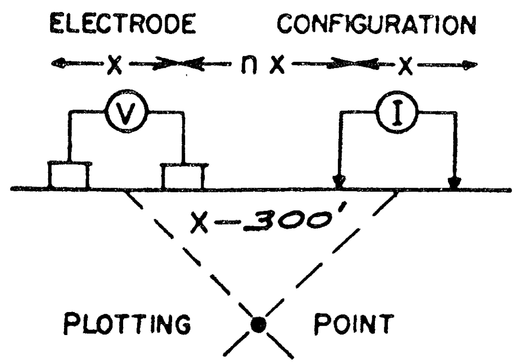
# COMINCO LIMITED

## INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

Gibraltar Property

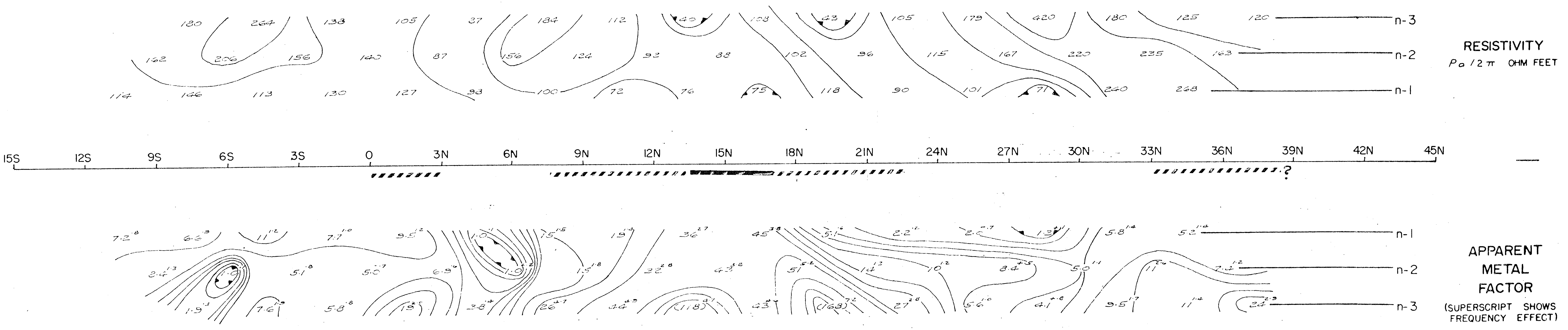
I.P.-1-4

# COMINCO LIMITED

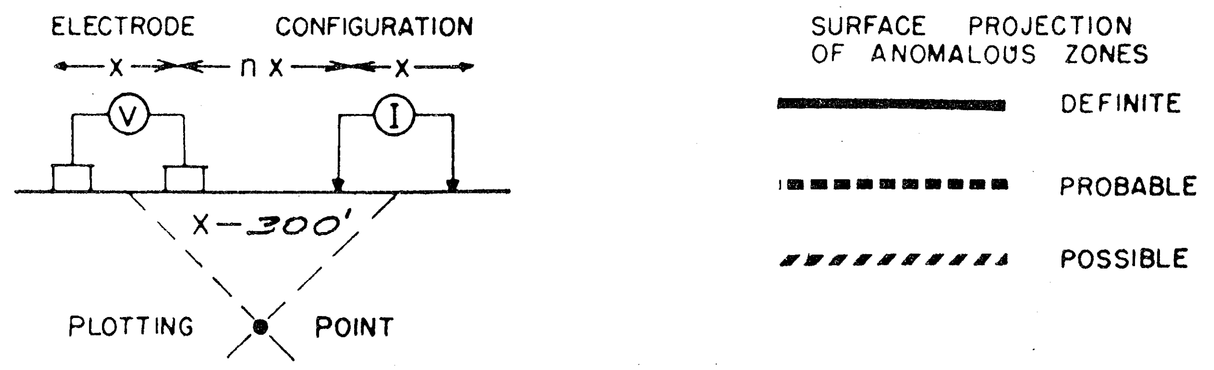
INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.




LINE NO. - 40+00E




NOTE LOGARITHMIC CONTOUR INTERVAL

Gibraltar Property

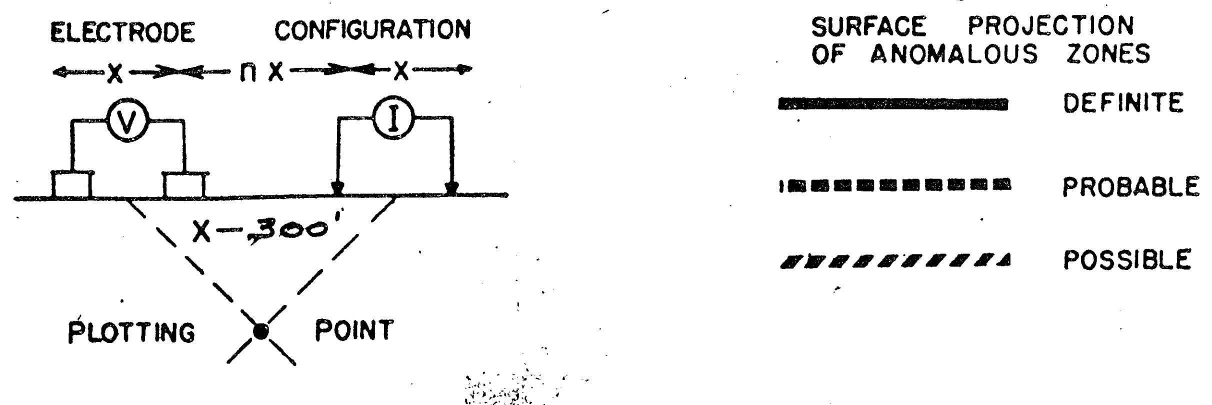
# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale — One Inch = 300 Feet

SURVEYED BY: *Cominco Ltd.*


LINE NO. - 40+00 W




*Gibraltar Property*

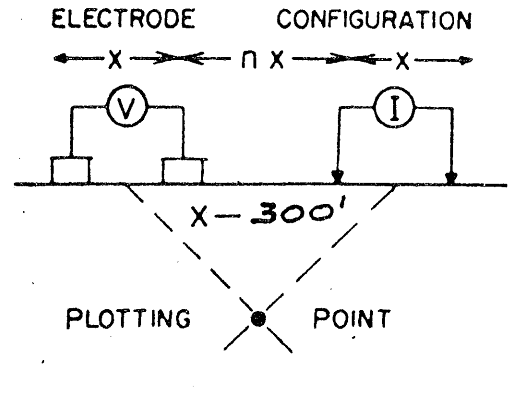
NOTE LOGARITHMIC CONTOUR INTERVAL

# COMINCO LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Scale – One Inch = 300 Feet

SURVEYED BY: Cominco Ltd.


SURFACE PROJECTION OF ANOMALOUS ZONES

- DEFINITE
- PROBABLE
- POSSIBLE

NOTE LOGARITHMIC CONTOUR INTERVAL

Gibraltar Property