

76-1187

337001

E.L. 12/72

A REPORT ON A GRADIENT ARRAY

EIP RECONNAISSANCE SURVEY

BULGOBAC AREA (BOCO GRID)

WEST COAST TASMANIA

ON BEHALF OF

E.Z. COMPANY OF AUSTRALASIA LIMITED

OPEN FILE

MICROFILMED

PRIVATE AND CONFIDENTIAL

A REPORT ON A GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION RECONNAISSANCE SURVEY
BULGOBAC AREA (BOCO GRID)
WEST COAST, TASMANIA
ON BEHALF OF
ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

BY

A.W. HOWLAND-ROSE
MSc, DIC, AMAusIMM, FGS.
GEOPHYSICIST

CONTENTS

Summary	
Introduction	Page 1
Method and Equipment	Page 2
Data Presentation	Page 6
Discussion of Results	
Significant Electrical Induced Polarization Responses	Page 7
Electrical Soundings	Page 25
Conclusions	Page 26
The Contour Interpretations	Page 27
Final Conclusions	Page 29

Table I - List of Current Dipoles

Electrical Soundings SX #1, SX #2, SX #3

VOL II

Plate 1 - Electrical Induced Polarization Data Profiles:- *3 sheets*

Plate 2 - Total Magnetic Field Data Profiles:- *3 sheets*

Plate 3 - Apparent Resistivity Contour Plan:- *2 sheets*

Plate 4 - Apparent Chargeability Contour Plan:- *2 sheets*

Plate 5 - Total Magnetic Field Contour Plan:- *2 sheets*

Plate 6 - Physical Property Map:- *2 sheets*

**SCINTREX PTY. LTD.**

Formerly

SEIGEL ASSOCIATES AUSTRALASIA PTY. LTD.

GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

A reconnaissance gradient array electrical induced polarization survey carried out in the Bulgobac area, West Coast Tasmania on behalf of the Electrolytic Zinc Company of Australasia Limited, has recorded some twenty two induced polarization anomalies of note, eight of which are considered of primary/secondary, or of secondary geophysical interest.

In general the amplitudes of the induced polarization anomalies are low, and are superimposed on low to very low backgrounds. This situation is quite atypical of the West Coast.

It is considered that the assessment of the induced polarization anomalies located in this survey should not be based on either the form or amplitude of the anomalies located, but rather on their geological and structural setting, and on any associated geochemical anomalism.

503

A REPORT ON A GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION RECONNAISSANCE SURVEY
BULGOBAC AREA (BOCO GRID)
WEST COAST, TASMANIA
ON BEHALF OF
ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED

INTRODUCTION

At the request of Mr. G. Dunbar, Chief Geologist for West Coast Mines, Scintrex Pty. Ltd. executed electrical induced polarization surveys in the gradient array over three periods.

The party leader and periods over which these surveys were conducted are as follows.....

- R. Lindberg, about 12 production days between 31st March and 15th April, 1976.
- P. Cunneen, about 14 production days between 5th and 25th May, 1976
- B. Ekstrom, about 15 production days between 7th and 24th July, 1976.

Considering the work was carried out during the worst weather period of the year on the west coast, the productivity was satisfactory.

The objective of these surveys, together with total magnetic field surveys executed by the Electrolytic Zinc Company, was to locate and define zones of potential economic interest, and in addition, map, and if possible, delineate, rock units using the three properties of chargeability, resistivity, and magnetic field.

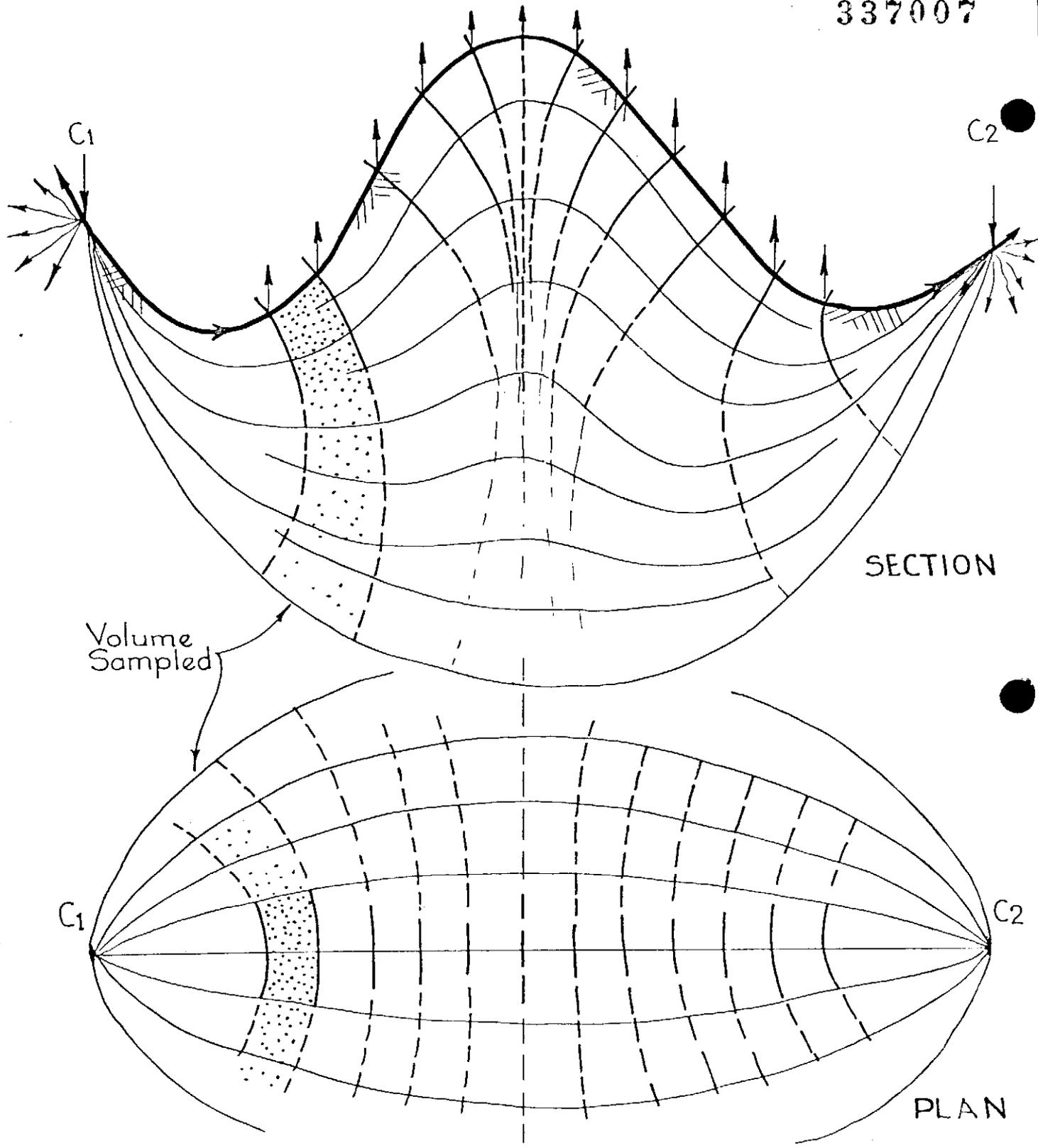
METHOD AND EQUIPMENT

A Scintrex 2.5KW time domain transmitter, powered by an 8HP Briggs and Stratton motor generator, was used to energise the field, with a Scintrex IPR-7 receiver investigating the resultant primary (resistivity) and secondary (induced polarization) fields.

The reconnaissance method employed the gradient array which consisted of large current dipoles of the order of 1600 metres placed *across* strike. A list of the current dipoles employed is shown in Table I. The potential dipoles ranged between 20 and 25 metres.

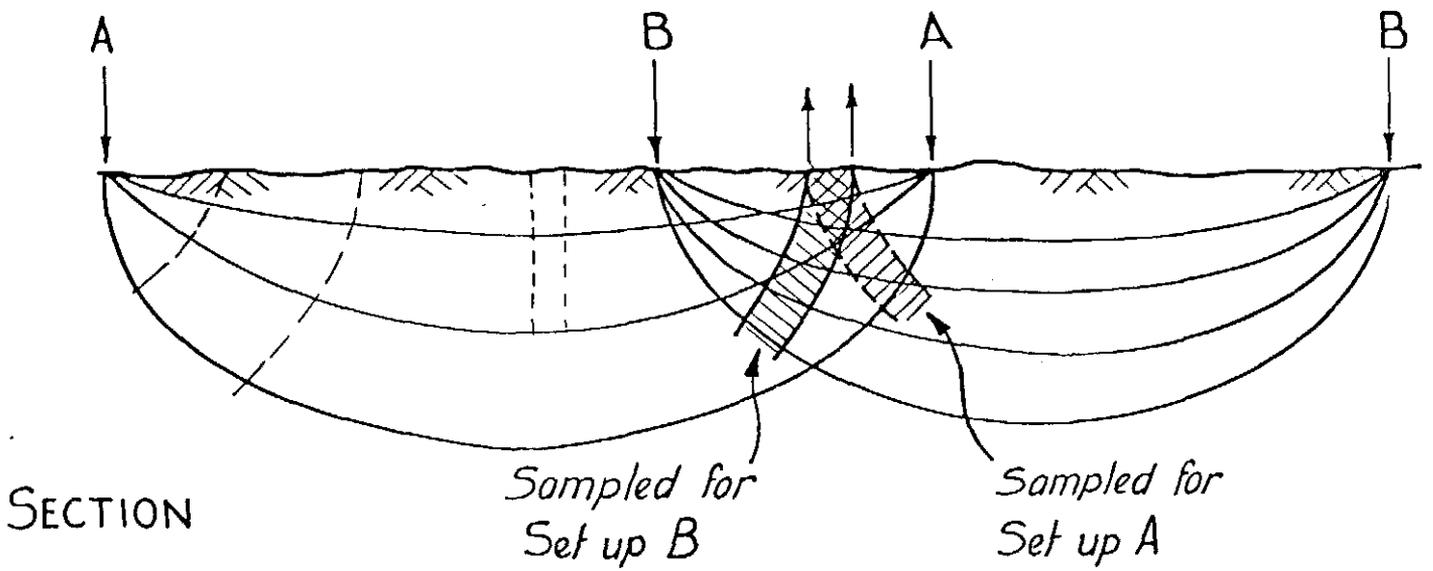
In order to understand the volume from which the apparent resistivity and chargeability data is sampled, the following very brief comments (perhaps over simplified) are made.

In this array the current poles are distant from the potential dipole. Figure 1 displays the salient features of the primary

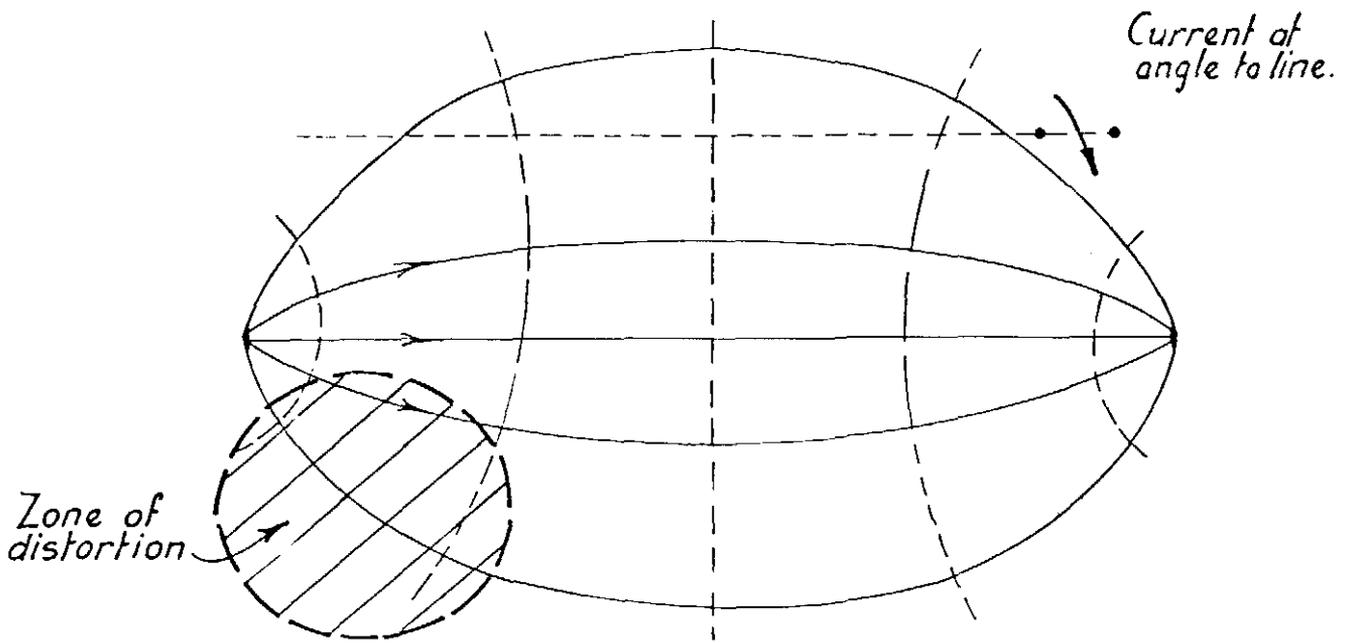


Diagrammatic Representation of Primary Current and Potential Field in Steep Topography.

FIGURE 1



2(a) *Explanation of difference in P_a measurements for "end-on" arrays.*



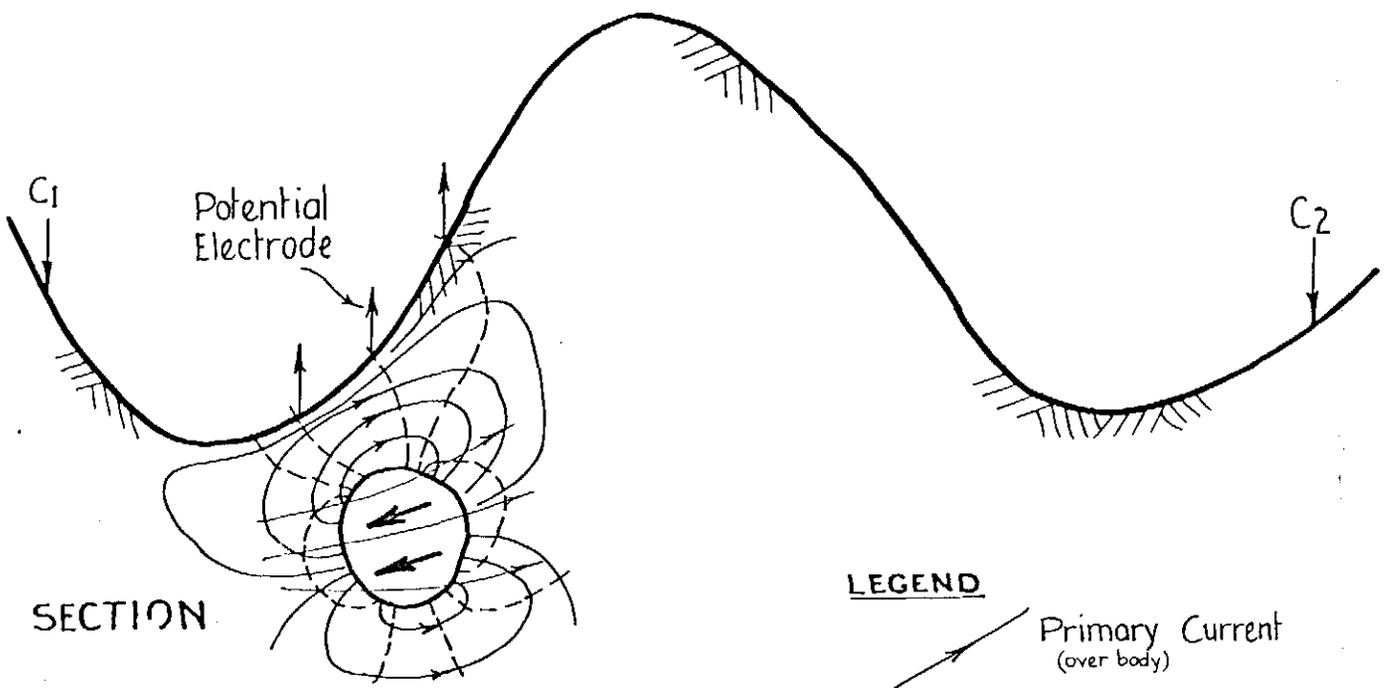
2(b) *Explanation of exaggeration at edges of array.*

current flow and the primary equipotential field generated during energisation, and, in exaggerated form, shows the influence of terrain on the current paths. From this diagram it can be seen that the *apparent resistivity* measurement is a summation of the volume of material normal to local slope beneath the surface and at right angles to the line.

The apparent resistivity will be *biased by* the influence of each current electrode, but the *relative* values of *adjacent* readings can be considered *reliable*. As each electrode is approached, the readings become *increasingly biased by* that electrode.

Each in-line (i.e. along strike) gradient block will show a similar anomaly form, however, end-on gradient blocks *may* show material differences as the overlapping potential dipole will not necessarily be sampling the same volume of material. This is increasingly true as the current pole is approached. Figure 2A illustrates this situation diagrammatically.

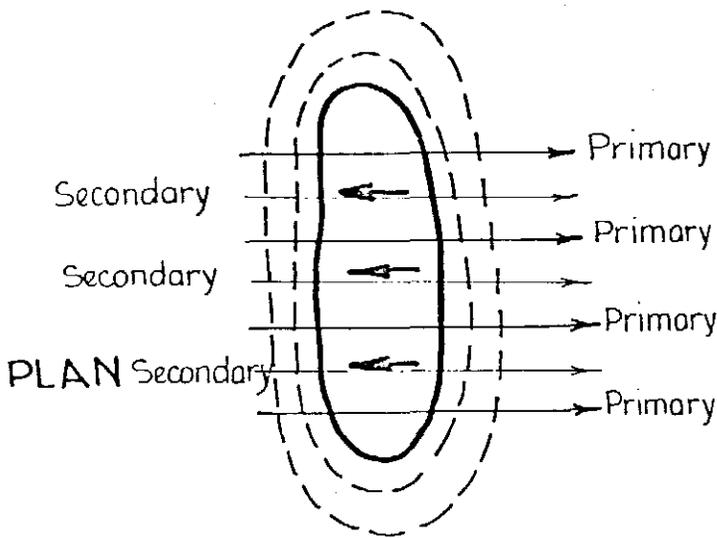
Distortion can also occur at the extremities of the array as shown in Figure 2B. This is due to the angle of the primary energising current to the reading potential. If there is a *conductive* unit at, near, or at right angles, to the line, the current will run at right angles to the line, and thus the equipotentials will be parallel to the reading dipole. Therefore



SECTION

LEGEND

-  Primary Current (over body)
-  Internal Polarization (at depth within body)
-  Secondary Current (I.P)
-  Secondary Potential Field



PLAN

Diagrammatic representation of secondary current (I.P.effect) and secondary potential field in steep terrain.

FIGURE 3

readings in the "zone of distortion" should be regarded with caution.

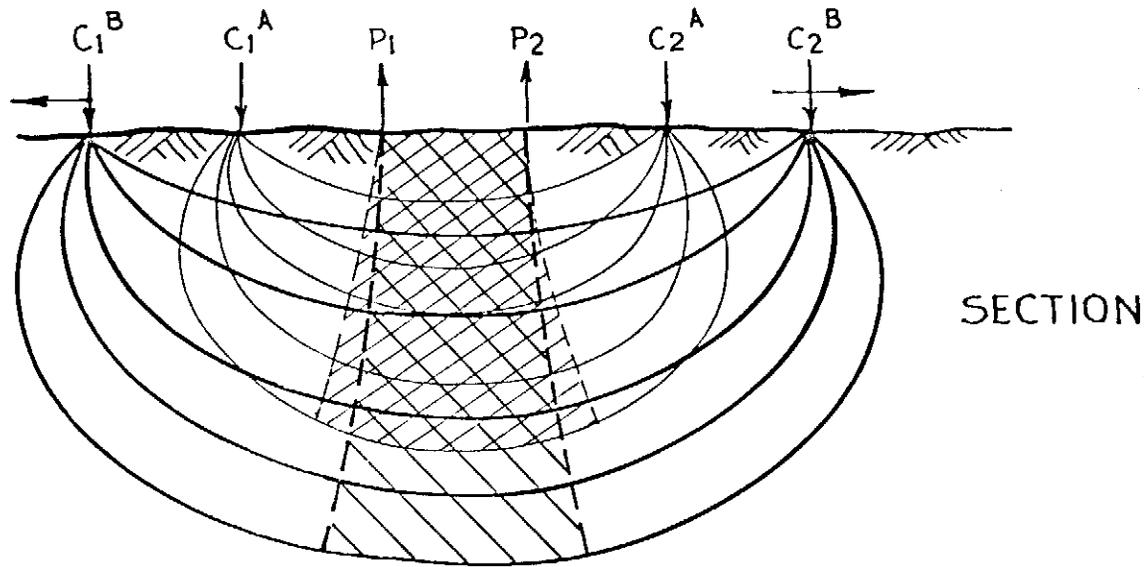
Note particularly that the *source volume* is *normal to slope* and not vertically beneath the potential dipole.

Note also that the volume of material *closest* to the potential electrodes will influence the data most. It is difficult to easily quantify the complex relationship between the volume of material sampled and its distance from the potential dipole.

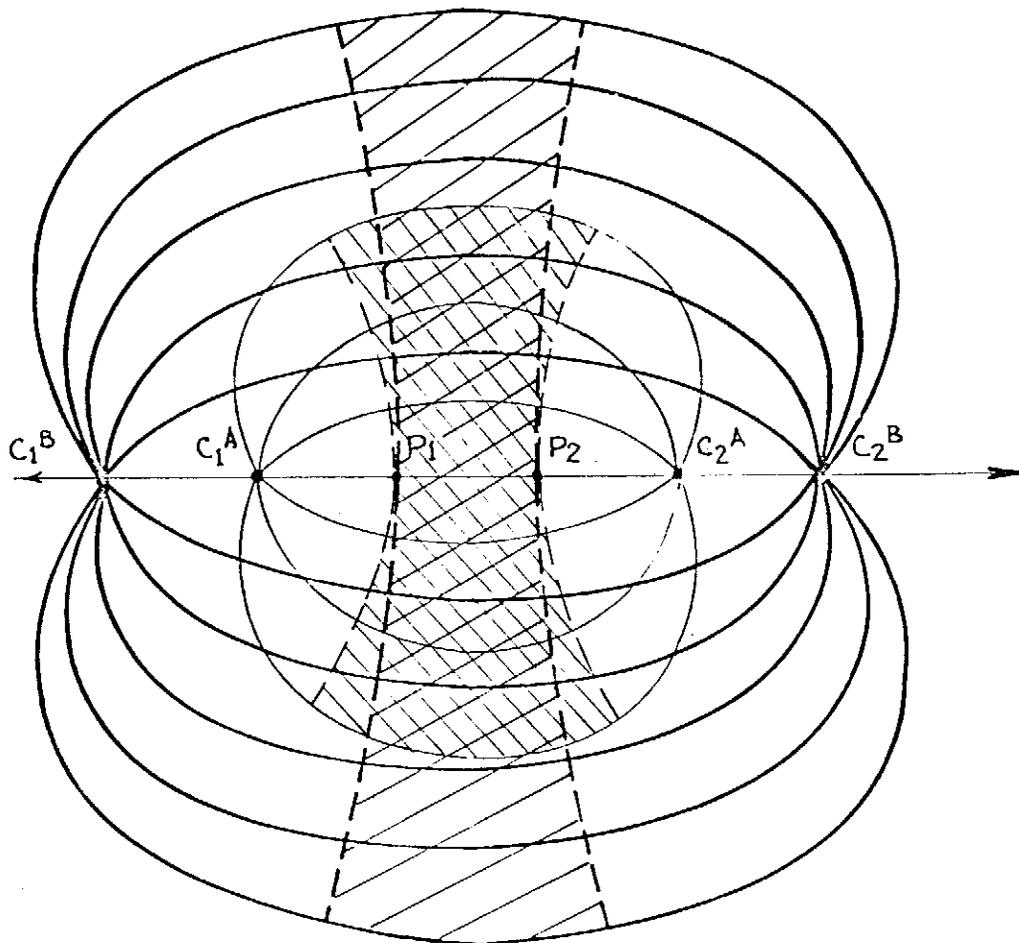
Figure 3 displays the secondary current pattern generated from the decay of induced polarization effect *within* a chargeable sulphide source, together with the equipotential field generated by that decay. Note that due to the necessarily curved nature of the current flow outside the body, the on-surface manifestation is *wider than the source width*. Note also that the volume sampled in the primary potential field (apparent resistivity ρ_a) is not necessarily the same volume as is the secondary potential field (apparent chargeability, Ma). This is, of course, true for *any* array.

Both the apparent chargeability and apparent resistivity are plotted midway between the potential electrodes.

337012



SECTION



PLAN

Schlumberger array showing the primary equipotential field by which the resistivity measurements are taken.

FIGURE 4

Schlumberger Array: This array was employed to test the horizontal layering at three locations at Bulgobac. On Figure 4 the two potential electrodes, P_1 and P_2 are placed *between* the two current electrodes, C_1 and C_2 . The latter are then progressively moved out and progressively deeper volumes are sampled. Note that progressively larger *sideways* sampling *also* occurs. Thus lateral *and* longitudinal inhomogeneities can influence the results.

A comparison with standard curves will indicate horizontal layering and will be reliable *providing* (i) the layering *is* horizontal, (ii) there are no *lateral* inhomogeneities, and (iii) there are no *longitudinal* inhomogeneities (i.e. along traverse lines). In the present circumstances, only the first and second layer can be considered really reliable.

The apparent chargeability is similarly acquired, and once the apparent resistivity has been studied, can also be used to compute depth to chargeable layers.

The total magnetic field in the grid area was recorded by Electrolytic Zinc Company using a Scintrex MP-2 proton precession magnetometer. The data was processed by Scintrex. The data was smoothed prior to contouring.

DATA PRESENTATION

The apparent resistivity and apparent chargeability profiles are presented on Plate 1 at the horizontal scale of 1:5000 and vertical scales of....

resistivity 5 centimetre = 1 log cycle

chargeability 1 centimetre = 2 milliseconds

Notes: The chargeability is presented on an exaggerated scale due to the low amplitudes recorded in the area.

The grid positions as shown on the data profiles for both Plates 1 AND 2 DO NOT incorporate the corrections received from Electrolytic Zinc, as the drafting was completed prior to their receipt.

Plate 2 shows the proton precession magnetometer survey data at the horizontal scale of 1:5000 and vertical scale of 1 centimetre = 20 gammas with the base level being 62,600 gammas.

Plates 3, 4 and 5 respectively, show the apparent resistivity, apparent chargeability and total magnetic field data in contour form at a scale of 1:5000. (There are two sheets to each plate).

Plate 6 shows an interpretation of these physical properties.

The three electrical soundings SX #1, SX #2 and SX #3 are shown on a five inch log cycle for apparent resistivity and spacings and are presented at the end of this report.

DISCUSSION OF RESULTS

The significant induced polarization anomalies are first discussed below by a brief description of the salient features of the physical property contour interpretations.

SIGNIFICANT ELECTRICAL INDUCED POLARIZATION RESPONSES

The most significant anomalies are shown on Plate 4 in roman numerals. In general the amplitude of the responses are not great and rarely exceed twice local background. These backgrounds themselves are low, and in the northern section extremely low, and quite atypical of conditions normally encountered on the west coast. One point of interest is that 2% - 5% disseminated pyrite occurs as only a minor induced polarization response (2 to 3 milliseconds) superimposed on a low 6 milliseconds background. It is considered then that a possible cause of the low chargeability *may* be a coarse grain size to the causative mineralisation. This would give *minimal surface area*, and as the IP effect is proportional to the total surface area, this *could* explain the low chargeabilities observed.

Geophysical priorities have been assigned to the data. These

014

priorities are assessed in comparison with known pyrite-lead-zinc mineralisation responses on the West Coast and elsewhere. Essentially the signature is one of moderate chargeability (say twice background) on a slight depression in apparent resistivity. Pyrite-lead-zinc deposits *lean in copper* are not generally conductive, and in this region vary between 30 and 300 ohm-metres *within* the body, and can only be considered conductive over *small* localised areas within the body. These zones of local conductivity almost invariably show higher copper values. On surface recorded apparent resistivities over known zones in the region are of the order of 1000 ohm-metres, while induced polarization responses are of 10 to 20 milliseconds above background. However, in all other cases known to the author, the backgrounds were in the range 10 to 20 millisecond. In this locality the backgrounds were half this range (see above.)

The amplitude of the chargeability anomaly is not considered as important as the geological environment and the local geochemical signature. This is especially true on the wide spaced lines of the reconnaissance grid, as we may not be seeing the maximum response.

With the above in mind, the geophysical priorities are as assessed below.

A Moderate to high chargeability, appreciable decline in

apparent resistivity to the order of 1000 ohm-metres - in all respects like "type" deposit.

- B Moderate increase in chargeability above background, with some decrease in apparent resistivity.
- C Some increase in chargeability, no material decrease in apparent resistivity
- D Increase in chargeability with increase in apparent resistivity.

Each zone is discussed individually below....

*ZONE I - Line 11960N @ 11675E, Line 12120N @ 11750E, Line 12280N @ 11550E
(Priority C)*

On all three lines this response is about twice the low 6 milliseconds observed to the immediate west. The proximity of the electrode at 11800E/12120N may distort the response observed on 11960N. As apparent resistivities vary between 2000 and 3000 ohm-metres, the host to the chargeable material is highly resistive.

The source width is from 11650E to 11700E on line 11960N, 11450E to 18000E on line 12120N and 11400E to 11600E on line 12280N. The depth to source does not exceed 25 to 50 metres.

IN SUMMARY..... the high resistivity and 6 millisecond chargeability is

considered to be due to a disseminated sulphide (or graphite) source within a resistive host rock. The low amplitude may indicate a rock type variation rather than a sulphide source of material interest.

ZONE IA - Line 11960N @ 11275E

(Priority D)

This response of about 10 milliseconds within a 4 millisecond background was recorded between about 11225E and 11325E, and is coincident with an increase in apparent resistivity from 1500 ohm-metres to over 10,000 ohm-metres. The maximum depth to source is considered to be 25 metres. This response is coincident with a 200 gammas + local increase in magnetic field.

IN SUMMARY.....the chargeable material is disseminated in form and contained within a highly resistive unit. Although the increase in magnetic field indicates the presence of magnetite or pyrrhotite, if the former, it is not considered that the observed anomaly could be due to this source. The zone may represent a rock type change.

ZONE II - Line 13240N @ 11450E

(Priority C)

Between 11425E and 11550E a six to eight millisecond response superimposed on a 6 millisecond background was recorded within a 2000 ohm-metre background. The maximum depth to source of the chargeable material is observed to be of the order of 25 metres. There is some slight suggestion of a decrease in

apparent resistivity at about 11460E but this is minor only. A 120 gamma increase in total magnetic field was observed over this response. Thus the chargeable source includes magnetite, but cannot be the sole source.

The chargeability data suggests an extension of this zone to the east of 11400E on line 13400N, while the magnetic field data suggests an extension to the south on line 13080N at 11540E.

IN SUMMARY..... the source is again considered to be disseminated chargeable material within a resistive host. A more mafic rock unit could be the source.

ZONE III - Line 13880N @ 11190E (ZONE III A @ 10975E)
 (Priority B) Line 13720N 11075E-11240E
 Line 13400N @ 11130E

The most significant response in this zone was recorded on line 13720N between 11075E and 11240E. The apparent chargeability increases from a 4 milliseconds background to over 12 milliseconds between 11100E and 11220E. There *may* be some exaggeration in the chargeability as the primary energising field is at about 45° to this response, nevertheless the zone remains of interest. The apparent resistivity reaches a high 2000 to 3000 ohm-metres over this zone, while the magnetic field remains undisturbed. The maximum depth appears to be less than 20 metres at 11220E. Subject to the limitations of the large gap between lines 13720N and 13400N (200 metres) this zone appears to be closed to both north and south. The separate anomaly of 5 milliseconds at 10975E on line 13880N (III A) is of

particular interest.

IN SUMMARY..... the source is disseminated chargeable material within a resistive host rock. Magnetite does not contribute to the source response. The response at 10975E on line 13880N is most interesting.

ZONE IV - Line 12120N @ 10775E

(Priority B/C)

Superimposed on a low 6 millisecond background, this 12 millisecond response is coincident with a 200% increase in apparent resistivity from the 1000 ohm-metre background. The maximum depth is assessed to be of the order of 20 to 35 metres. There is a very slight decrease in magnetic field of 40 gammas. This response is not necessarily seen to either the north or south and thus the maximum strike length is of the order of 200 metres.

IN SUMMARY this most significant 12 millisecond induced polarization response although still associated with a 2000 ohm-metres host, is of interest. The source is either disseminated, or if "massive" electrically discontinuous.

ZONE V - Line 12760N 10600E-10775E

(Priority A/B) Line 12600N 10425E-10750E

This anomaly is some 6 to 7 milliseconds above the 6 millisecond background on line 12760N and shows a distinct peak at about 10625E and 10680E and 10750E. Unlike the zones discussed above,

19

this response is associated with a *decrease* in apparent resistivity from a 7000/10,000 ohm-metres background to about 2000 ohm-metres (a 70% drop). Thus the host to the mineralisation is more conductive than the enclosing rocks. A similar situation was observed on line 12600N where a 6 milliseconds response was recorded on a 6 milliseconds background to 1000 ohm-metres at 10600E. No material disturbance in the magnetic field was observed on either line.

The anomaly forms suggests a 25 to 35 metres maximum depth to the source. The maximum inferred strike length of the zone is of the order of 500 to 600 metres.

IN SUMMARY..... the form of this response is considered of interest, namely, a lowering of resistivity relative to background, and an increase in apparent chargeability. The amplitude of the chargeability (6 milliseconds +) above background is however, small. The host to the chargeable material is less resistive (1000 ohm-metres) than the enclosing rock types. This response is of primary to secondary priority.

ZONE VI - Line 13720N @ 10300E
(Priority D/C) Line 13400N @ 10330E

A distinct 5 to 6 millisecond induced polarization response at 10330E on line 13400N is coincident with a doubling in apparent resistivity from the 4000 ohm-metres background to 6000 ohm-metres. The maximum depth to source is assessed to be of the order of 40

metres. This anomaly itself is coincident with a minor (20-30 gamma) relative low to the immediate west of a 250 gamma high. On line 13720N the response extends from 10250E to 10375E and is about 8 milliseconds above the 6 to 8 milliseconds background. A doubling of apparent resistivity to about 7000 ohm-metres clearly infers a resistive host. The maximum depth of this response on this line is considered to be of the order of 25 to 40 metres.

IN SUMMARY..... this anomaly is due to disseminated chargeable material within a resistive host. As such it is considered of low priority, as it probably represents a rock type change.

ZONE VII - Line 12120N @ 10475E
(R'way Line) Line 11960N @ 10500E

This anomaly is considered to be due to the railway line only.

ZONE VIII - Line 13080N @ 10125E
(Priority D)

A minor 4 millisecond above background anomaly is coincident with a 50% drop in apparent resistivity to about 3000 ohm-metres. This response is considered of minor interest only.

ZONE IX (E) - Line 11640N @ 10200E
(Priority D) Line 11960N @ 10250E

Very minor chargeability highs of 2 to 4 milliseconds superimposed on a 6 millisecond background are accompanied by an increase in

apparent resistivity. A rock type change is considered the source.

ZONE IX (W) - Line 11640N @ 9975E

(Priority D)

A 4 millisecond induced polarization response on an 8 millisecond background whose source is interpreted as lying between about 9925E and 10025E, is accompanied by a minor decrease in apparent resistivity to about 1500 ohm-metres at 9960E. A formational change is the suggested source.

ZONE X - Line 11640N @ 9760E (open to the south)

(Priority D)

The two sharp (8 and 4 milliseconds) anomalies above background were noted at 9760E and 9800E respectively. As higher resistivities of 3000 ohm-metres (as against 1000 ohm-metres to the east) were recorded, the source is considered to be minor units of chargeable material within a resistive host. The maximum depth is considered to be 10 to 20 metres.

Steep changes in magnetic field in this vicinity indicate a magnetic unit at or close to surface. The actual anomaly position is, however, marked by a magnetic low.

IN SUMMARY..... the low amplitude of the anomaly together with the resistive nature of the source, is considered to be most likely caused by a more mafic and resistive rock type.

ZONE XI - *Line 12760N @ 9690E*
(Priority B) *Line 13080N @ 9730E*
 Line 13240N @ 9650E
 Line 13400N @ 9725E

This low amplitude anomaly superimposed on a relatively high (8 to 10 milliseconds) background, was seen on line 12760N at 9690E, line 13080N at 9730E, line 13240N at 9650E and line 13400N at 9725E.

On line 13080N a small 5 to 6 millisecond response is coincident with a marked 80% drop in apparent resistivity to 3000 ohm-metres. Although the amplitude of the response is low, the *form* is certainly of interest. The source is shallow, less than 25 metres, and the profile shape suggests a west dip to the source. There is a small 30 to 40 gammas increase in magnetic field over this zone which infers the presence of magnetite or pyrrhotite within the source. However, the anomaly cannot be wholly due to magnetite.

On line 13240N the response is negligible, being of 2 milliseconds only, at 9650E and therefore of minor interest only. A similar response was also recorded on line 13400N at 9725E.

IN SUMMARY..... only on line 13080N was the response significant. On this line a more conductive source was located which contains magnetite (in small quantities) and/or pyrrhotite. At best the response is of priority B.

23

ZONE XII - Line 13240N 9125E-9275E
(Priority B/C) Line 13080N @ 9200E
 Line 12760N @ 9125E
 (open to south)

The most southerly response was recorded on line 12760N at 9125E. At this point an 8 to 9 millisecond response is superimposed on a 10 millisecond background. The latter is higher than normal for the area. The apparent resistivity shows a 30%-40% drop from the higher 4000 ohm-metres background. The magnetic field shows a 40 gamma *low* coincident with this response. The depth to source is less than 40 metres and may in fact sub-outcrop.

On line 13080N at 9200E a 7 to 8 millisecond response was recorded with high resistivities of the order of 3500 ohm-metres. This anomaly lies within a relative low in the magnetic field. The maximum depth to the source is estimated at 50 metres.

On line 13240N the response reaches about 6 milliseconds above the 11 to 12 millisecond background at 9225E. However, on this line the anomaly is *broad* and was recorded from 9125E to 9275E. The resistivity of the source is some 6000 ohm-metres, i.e. *above* the local 4000 ohm-metres background. Maximum depth to source is difficult to gauge. Again, the anomaly lies within a minor low in the magnetic field.

IN SUMMARY..... this anomaly particularly on line 12760N and 13080N, is

of some some interest in spite of the high resistivities recorded. The source is disseminated chargeable material - sulphides or graphite. The magnetic low infers that magnetite is not present within the source.

ZONE XIII - Line 13720N @ 9390E

(Priority B)

A distinct 8 to 10 milliseconds response on a 10 to 12 milliseconds background was located on line 13720N at 9390E on a sharp change in apparent resistivity from 2000 ohm-metres at 9360E to 6000 ohm-metres at 9425E. The anomaly is open to the north and closed to the south. The maximum depth to source is estimated to be less than the potential dipole used.

IN SUMMARY..... this zone clearly represents a disseminated source at depth on, or in close proximity to, a contact between a resistive rock unit to the east and a more conductive unit to the west.

ZONE XIV - Line 12760N @ 9010E

(Priority C/D) (open to south)

A 4 to 6 millisecond response from a narrow source was recorded centred at 9010E within a highly resistive (8000 ohm-metres) unit. A very minor (10 to 20 gammas) response is coincident with this high.

The maximum depth to the source is considered to be of the order of 40 metres.

IN SUMMARY..... the highly resistive nature of the response infers a disseminated source only. Thus the interest is minor only.

ZONE XV - Line 13240N @ 9025E

(Priority C)

Within 4000 ohm-metre resistivities, a small but definite induced polarization response of 4 milliseconds on a 10 millisecond background was recorded. The source is within a dipole (25 metres) of surface and is probably a variation in rock type only.

ZONE XVI - Line 13880N @ 10070E

(Priority C)

On line 13880N the anomaly peaks at 10070E with a 7 millisecond response against a low 5 milliseconds background. Unlike most of the other induced polarization features described, this response has an almost exact correlation with an increase in apparent resistivity from a background of 2000 ohm-metres to 15,000 ohm-metres. Also there is a clear depression of about 30 gammas in the magnetic field over this section. The depth to source is certainly less than the potential dipole used, namely 20 metres. A further small narrow peak of 4 milliseconds above background at about 10130E together with a very sharp low to 2 milliseconds below background between these two peaks coincides with a 1300 ohm-metre low. Certainly this feature either outcrops or sub-outcrops, and it may be due to "massive" chargeable material surrounded by more disseminated material. The resistive unit could be due to an

acid volcanic carrying some chargeable material.

IN SUMMARY..... this zone is of disseminated chargeable material within a highly resistive unit which is low in magnetic minerals. An acid volcanic unit carrying some chargeable material is a possible source.

ZONE XVII - Line 15000N @ 11860E
(Priority D) Line 14840N @ 11700E
 Line 14680N @ 11725E

On line 14680N, 5 to 6 millisecond chargeabilities were recorded on a 8 millisecond background between 11700E and 11775E. The apparent resistivities over this sector are from 1500 ohm-metres to 1000 ohm-metres. On line 14840N, a 3 to 4 millisecond anomaly superimposed on higher 2500 to 3000 ohm-metres resistivities, probably forms part of this zone. On line 15000N at 11860E a small but significant response of 4 milliseconds above the 8 millisecond background was observed on 1700 ohm-metres background. No significant disturbance in the magnetic field was noted over this zone. The maximum depth to source on all three lines is of the order of 25 metres.

IN SUMMARY..... the source of these small induced polarization responses along this zone is again considered to be disseminated chargeable material within a generally resistive host.

ZONE XVIII - Line 14840N 11525E-11590E
(Priority D) Line 14680N 11570E-11610E

3 to 4 millisecond responses superimposed on an 8 millisecond background were observed on both lines and are coincident with a six fold increase in apparent resistivity to 10,000 ohm-metres on line 14680N and a three fold increase to 5000 ohm-metres on line 14840N. The maximum depths to source are of the order of 25 metres.

IN SUMMARY..... the source of these responses is disseminated chargeable material within a resistive host. Magnetite makes little or no contribution to the source.

ZONE XIX - Line 15000N 11270E-11380E
(Priority B/A) Line 14840N 11350E-11450E

The physical property data has been interpreted as indicating a dislocation between lines 15000N and 14840N, which in effect splits this zone.

On line 15000N a very sharp increase in chargeability from a background of 6 milliseconds to over 14 milliseconds was recorded between 11270E to 11380E. There is a *decrease* in apparent resistivity over this response to about 1700/1800 ohm-metres from over 3000 ohm-metres to east and west. There is a 30 gamma overall increase in magnetic field over this response with a sharp local increase of 100 gammas coincident with a chargeability peak at 11270E.

The response on line 14840N between 11350E and 11450E of up to 5 milliseconds above the 8 milliseconds background is accompanied by high 3000 ohm-metre resistivities, although there is an indication of a slight fall. The magnetic field is about 20 gammas below background on this anomaly. The maximum depths to source are of the order of 25 metres.

IN SUMMARY..... these responses are of secondary interest as they infer some decrease in apparent resistivity over their chargeable source. It is considered that the source on line 15000N is either at, or just below surface.

ZONE XX - Line 16920N @ 9350E
(Priority B) Line 16600N 9350E-9450E
 Line 16440N 9325E-9400E
 Line 16280N 9400E-9525E

This zone lies on, or just *east of* a high resistive zone of about 3000 ohm-metres, whose contact with a low (200 to 400 ohm-metres) is parallel to the zone and some 25 to 50 metres to the west. The resistive unit is mapped as acid-intermediate and the less resistive unit, fine grained sheared crystalline lavas.

Zone XXII (See below) on the other hand, lies on, or just *west of* the above contact.

These responses of 5 to 6 milliseconds occur superimposed on an extremely low 5 to 6 millisecond background, and for this reason

may well represent a formational change only, i.e. an increase in mafic minerals in an acid volcanic environment or, alternatively, a less oxidised section. On line 16440N the response is clearly associated with an increase to 5000 ohm-metres from the 2500 ohm-metres background. Thus the host to the mineralisation is clearly resistive. On line 16280N however, there is a very definite *reduction* in apparent resistivity from the 5000 ohm-metres background to less than 2000 ohm-metres over the entire anomaly at 9480E.

On line 16600N the anomaly between 9350E and 9450E *may* correlate with this zone, although the resistivity data suggests it is a separate zone as it lies on a material change in resistivity from 500 ohm-metres to the west, to over 5000 ohm-metres to the east. The 8 millisecond chargeability is superimposed on a very low 3 millisecond background.

A very narrow response of 0 - 2 milliseconds was recorded on line 16920N at 9350E which may represent the most northerly manifestation of this zone.

There is no clear correlation between the magnetic field and the chargeability responses over this zone.

The maximum depths indicated are about 25 to 30 metres.

IN SUMMARY..... this zone is interesting in spite of the low amplitude of the chargeability recorded, especially on line 16280N where the chargeability material is either contained within a zone of low resistivity or contributes to the low resistivity itself.

*ZONE XXI - Line 16440N @ 9850E
(Priority B) Line 16280N @ 9900E*

This small but distinctive anomaly is about 6 millisecond above the very low 4 milliseconds background on line 16440N, and is associated with a 50% reduction in the 2000 ohm-metre background resistivities. On this line there is a slight 20 gammas increase in the magnetic field over this anomaly. The maximum depth is considered to be of the order of 20 to 30 metres.

On line 16280N two very sharp responses of 8 and 4 milliseconds above the low 4 millisecond background were recorded at 9890E and 9930E, both of which are associated with a 40%-60% reduction in the 2000 to 3000 ohm-metres background resistivity. The maximum depth to this response is less than the 20 metres dipole used, and it may even outcrop in the case of 9890E.

IN SUMMARY..... these responses are considered of interest in spite of their small amplitude as they show an increase in chargeability and a clear decrease in resistivity. However, their source is electrically discontinuous chargeable material, of which magnetite can be but a minor constituent.

ZONE XXII - *Line 16920N centred at about 9200E*

(Priority B?)

This 4 millisecond response is located on the contact between high resistivity (5000 ohm-metres) to the east, and low resistivity (300 ohm-metres) to the west. Thus the anomaly lies on a contact between two highly contrasting rock units. The anomaly cannot really be seen to the south and is open to the north.

The maximum depth is about 25 metres or so.

IN SUMMARY..... it is difficult to assess this response from a single line, however, lying on a contact as it does, it is of some interest. Further ground follow-up is recommended.

ELECTRICAL SOUNDINGS

Some three Schlumberger electrical soundings were carried out at Bulgobac. Each is discussed in detail below.

SX #1 Line 15160N at 9760E (parallel to strike)

This Schlumberger electrical sounding indicates a resistive surface layer having a thickness of 20 metres and a resistivity of about 2300 ohm-metres. The chargeability of this zone decreases with depth to a minimum of about 2 milliseconds. The lower level has a resistivity of the order of 500 ohm-metres after which both the resistivity and chargeability increase.

The $M_a - M_1$ log plot clearly indicates a more chargeable layer at depth, but insufficient data points are available for a diagnostic depth to be calculated.

SX #2 Line 14680N at 10920E (parallel to strike)

A resistive surface layer of about 2200 ohm-metres some 8 metres thick is underlain by a less resistive unit of some 600 ohm-metres, which in turn is underlain by a more resistive and chargeable unit.

SX #3 Line 13880N at 10040E (parallel to strike)

As observed on the above soundings, a resistive (to 2000 ohm-metres) surface layer of low chargeability (less than 1 millisecond), is underlain at 10 metres by a less resistive layer of about 500 ohm-metres or so. The $M_a - M_1$ log plot of the chargeability data infers a depth to the more chargeable zone of 8 to 9 metres.

CONCLUSIONS

The above soundings show a resistive surface layer of 8 to 20 metres thick and of 2000 to 3000 ohm-metres resistivity in all three cases. In all cases, the surface layer is of low chargeability (1 to 4 milliseconds). The underlying less resistive zone was of about 500 ohm-metres and still of low chargeability (eventhough somewhat higher than the near surface layer).

Unfortunately the soundings did not go to sufficiently large

spacings to ascertain the depth of the third layer which is more resistive, and, in two cases, more chargeable than the upper layers. However, the depth to the more resistive layer is not considered to be greater than 70 to 100 metres at the most.

The physical meaning of the observed data is not truly understood by the author. It is suggested that the upper layer *may* represent a resistive alluvium layer with very low chargeability, perhaps caused by oxidation products being "flushed out" by high rainfall. The underlying less resistive layer may indicate a different weathering regime, while the more resistive and chargeable layer at depth infers freshrock, the depth of which cannot be greater than 70 to 100 metres.

THE CONTOUR INTERPRETATIONS

The apparent resistivity, apparent chargeability and total magnetic field contour interpretations have been displayed on Plates 3, 4 and 5 respectively.

Only very brief remarks are made below as the plates are self-explanatory. It is suggested that further discussions be held after the data has been studied from an outcrop point of view.

The apparent resistivity and magnetic field interpretations are considered to be reliable due to the higher changes in

54

amplitude recorded. However, the chargeability interpretation is considered reliable only in broad outline, as smaller amplitude responses cannot be unambiguously traced between lines, although the matching of anomalous responses between lines was assisted by the magnetic and apparent resistivity data.

A "physical property" interpretation plan has been constructed from Plates 3, 4 and 5, but relies mainly on the magnetic and apparent resistivity data. This is presented on the two sheets of Plate 6. This interpretation was developed independently of the geology kindly provided by the Electrolytic Zinc Company.

The inferred strike of all three properties is approximately grid north-east/south-west. It is suggested that a series of semi grid north-south dislocations divide the area up as shown on Plate 6.

In general it appears that the more siliceous units are the more resistive (horizontal shading on Plate 6) while slight increases in magnetic field (to several hundred gammas) occur in both acid and intermediate units.

Further discussions will be required to clarify the detailed geological implications of these contour maps and the interpretation plan derived from them.

FINAL CONCLUSIONS

1. The background induced polarization observed in the area is abnormally low for the West Coast. It is suggested that this is due to (i) a lack of mafic and chargeable minerals and/or (ii) a coarseness of grain size within the rock units.
2. A wholly geophysical priority rating has been given for the induced polarization responses recorded. The *form* of geophysical responses *expected* from a pyrite-lead-zinc deposit is one of high to moderate chargeability with *lower* apparent resistivity, generally of the order of 1000 ohm-metres or less. However, the author considers that the geological and structural setting together with the geochemical signature is of greater importance than either the *form* or *amplitude* of the geophysical anomaly. Thus the bias should not be left to geophysical criteria alone.
3. No specific drilling recommendations have been made, as additional geological, geochemical and perhaps geophysical evaluation is required.
4. No specific electrical induced polarization work is recommended. However, due to the wide line separation and the "sideways vision" of the gradient array, some limited pole-dipole detail is recommended over zones considered of interest prior to final site selection for diamond drilling.

5. The high overall apparent resistivity recorded in the area, together with the distinct lack of even narrow conductors, makes it difficult to explain the presence of the Input anomalies located in terms of this data alone. However, the acid button grain swamps *can* often have extremely low resistivities of the order of 10 to 20 ohm-metres, and it is possible that these caused some of the airborne anomalies, as the gradient array would have minimised the influence of very shallow conductive surface zones.
6. The three electrical soundings carried out, all show a resistive surface layer of low chargeability, underlain by a less resistive zone still of low chargeability, which is itself underlain by a more resistive and chargeable layer at depth. The depth of the surface zone ranged from 8 to 20 metres, while the depth of the resistive zone can only be estimated to be at a maximum of 70 to 100 metres.

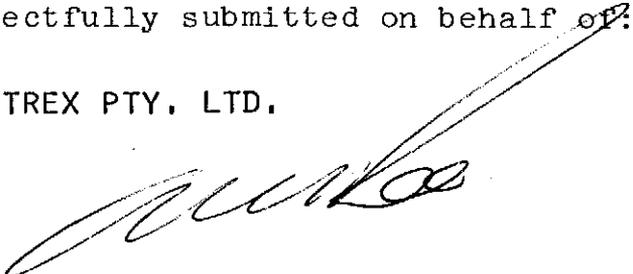
It is recommended that further soundings be carried out to a distance sufficient to clearly ascertain the depth of the freshrock.

7. The contour interpretations have indicated a grid north-east/south-west strike for the underlying geological units. A detailed study of the apparent resistivity and magnetic data suggests a series of grid north-south dislocations. The

observed pattern could, however, also be caused by lensing of the geological units. Further discussions will be required to clarify the geological implications of the data contained in Plates 3 to 6.

Respectfully submitted on behalf of:

SCINTREX PTY, LTD.



A.W. HOWLAND-ROSE, MSc, DIC, AMAusIMM, FGS.

GEOPHYSICIST

TABLE I
Current Electrodes and Lines Surveyed

9200E-10800E on 12120N

Line 11640N 9450E-10650E
Line 11960N 9450E-10630E
Line 12120N 9230E-10510E
Line 12280N 9450E-10510E
Line 12600N 9450E-10510E

10200E-11800E on 12120N

Line 11960N 10590E-11710E
Line 12120N 10470E-11770E
Line 12280N 10450E-11590E
Line 12600N 10470E-11570E

8500E-10100E on 13240N

Line 12760N 8850E-9790E
Line 13080N 8850E-9790E
Line 13240N 8810E-9810E
Line 13400N 8930E-9810E
Line 13720N 8970E-9750E

9350E-10950E on 13240N

Line 12760N 9710E-10590E
Line 13080N 9710E-10590E
Line 13240N 9710E-10590E
Line 13400N 9710E-10590E
Line 13720N 9710E-10590E

10200E-11960E on 13240N

Line 12760N 10610E-11630E
Line 13080N 10510E-11590E
Line 13240N 10510E-11910E
Line 13400N 10510E-11410E
Line 13720N 10510E-11330E

9200E-10800E on 14360N

Line 13880N 9510E-10490E

Line 14200N 9510E-10470E
Line 14360N 9510E-10450E
Line 14520N 9510E-10450E
Line 14680N 9490E-10470E
Line 14840N 9510E-10470E

11700E-10100E on 14360N

Line 13880N 10410E-11390E
Line 14040N 10410E-11390E
Line 14200N 10410E-11390E
Line 14360N 10410E-11390E
Line 14520N 10410E-11390E
Line 14680N 10410E-11390E
Line 14840N 10410E-11390E

10600E-12200E on 15000N

Line 14680N 11110E-11770E
Line 14840N 11010E-11750E
Line 15000N 10910E-11910E

8800E-10400E on 15480N

Line 15000N 9110E-10090E
Line 15160N 9110E-10110E
Line 15320N 9110E-10090E
Line 15480N 9110E-10130E
Line 15640N 9110E-10090E
Line 15800N 9210E-10090E

9700E-11300E on 15480N

Line 15000N 10070E-11170E

Line 15320N 10070E-11070E
Line 15480N 10070E-10990E
Line 15640N 10070E-10810E

Line 15960N 10050E-10530E

10200E-11800E on 15000N

Line 15160N 10730E-11390E
Line 15320N 10710E-11050E

TABLE IPage - two8700E-10300E on 16440N

Line 15960N 9010E-10010E

Line 16280N 9010E-10010E

Line 16440N 8850E-10010E

Line 16600N 9010E-9790E

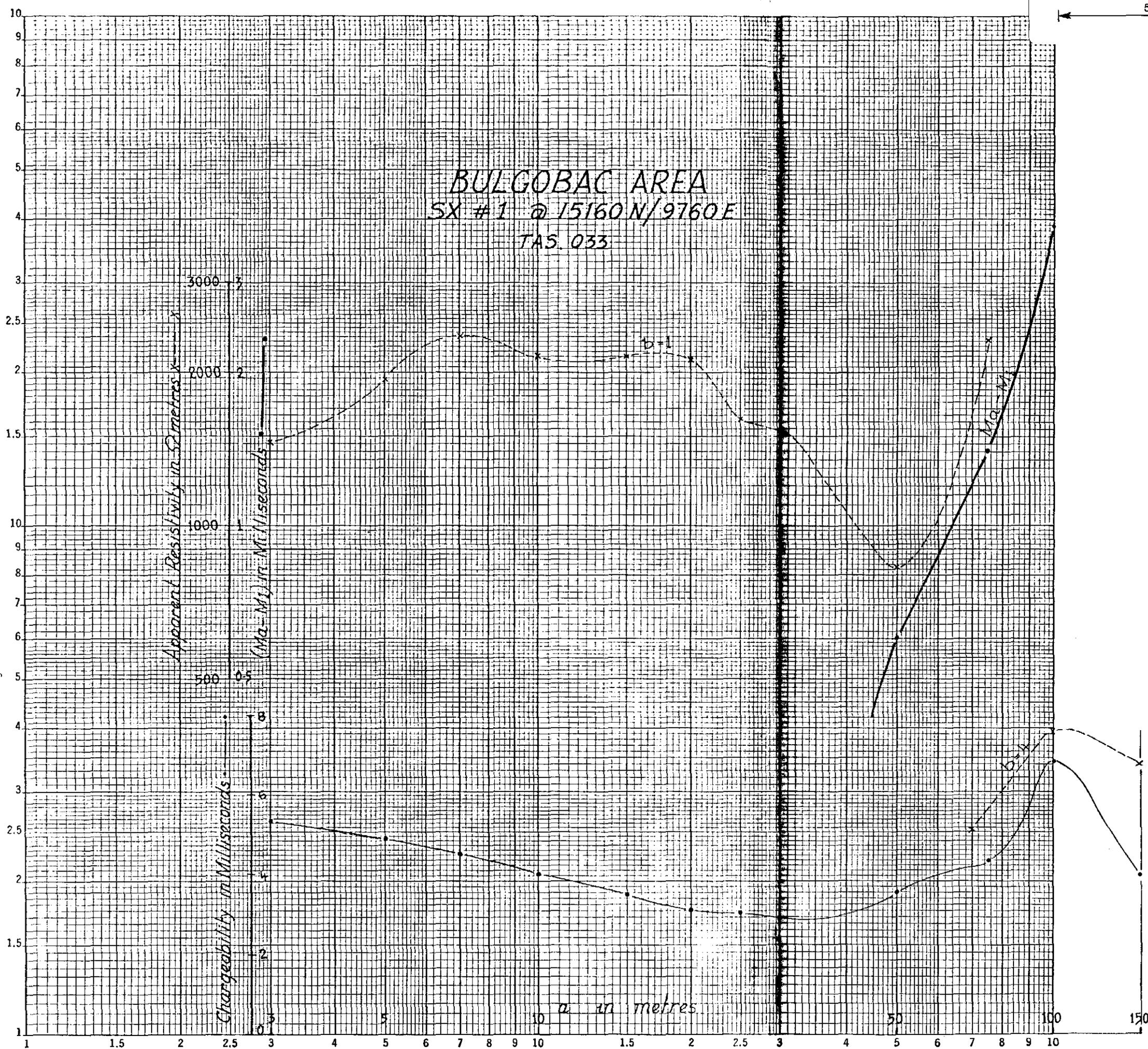
Line 16920N 9010E-9530E

040

5 cm

337042

BULGOBAC AREA
 SX #1 @ 15160 N/9760 E
 TAS. 033

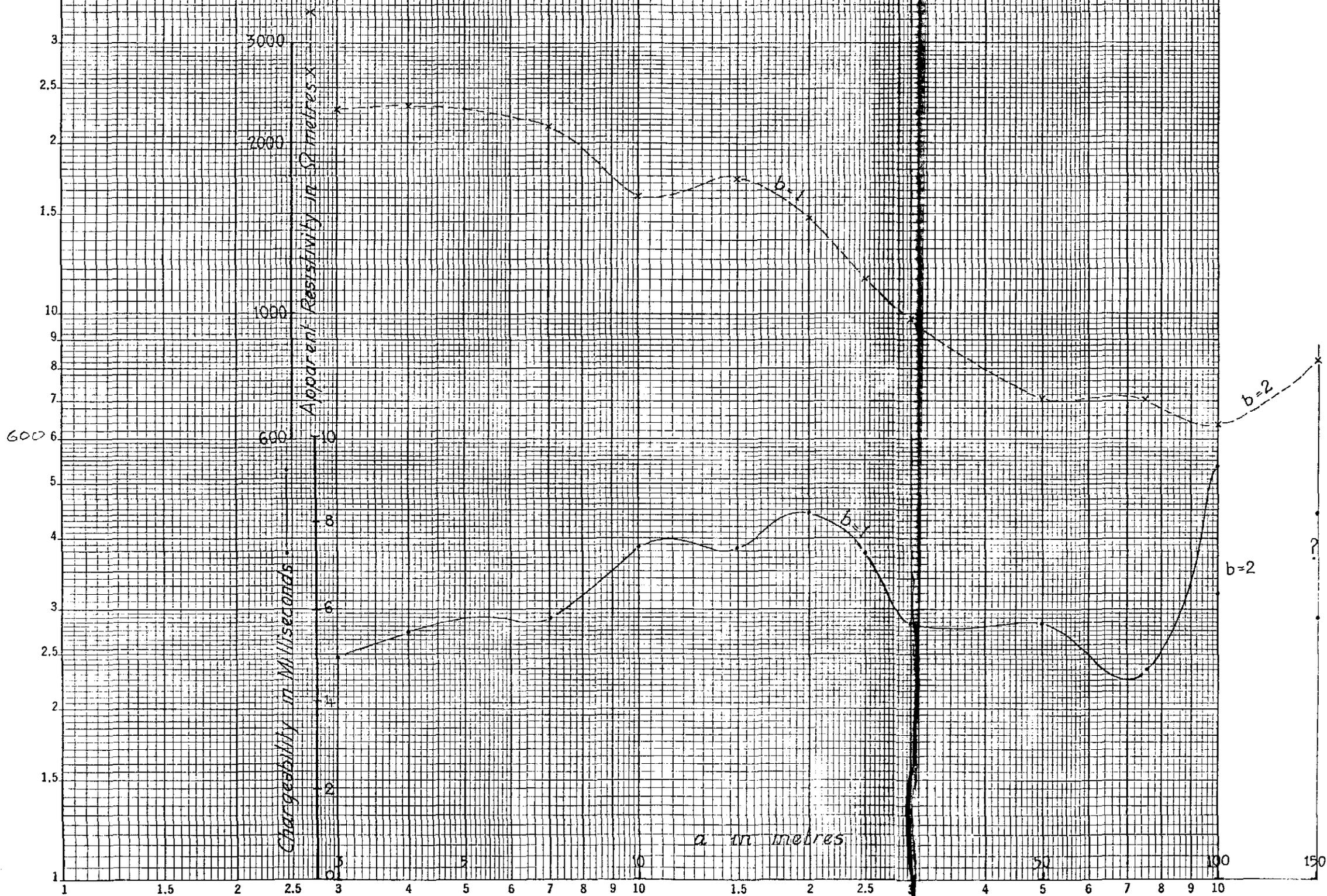


041

5 cm

337043

BULGOBAC AREA
SX #2 @ 14580 N / 10920 E
TAS. 033

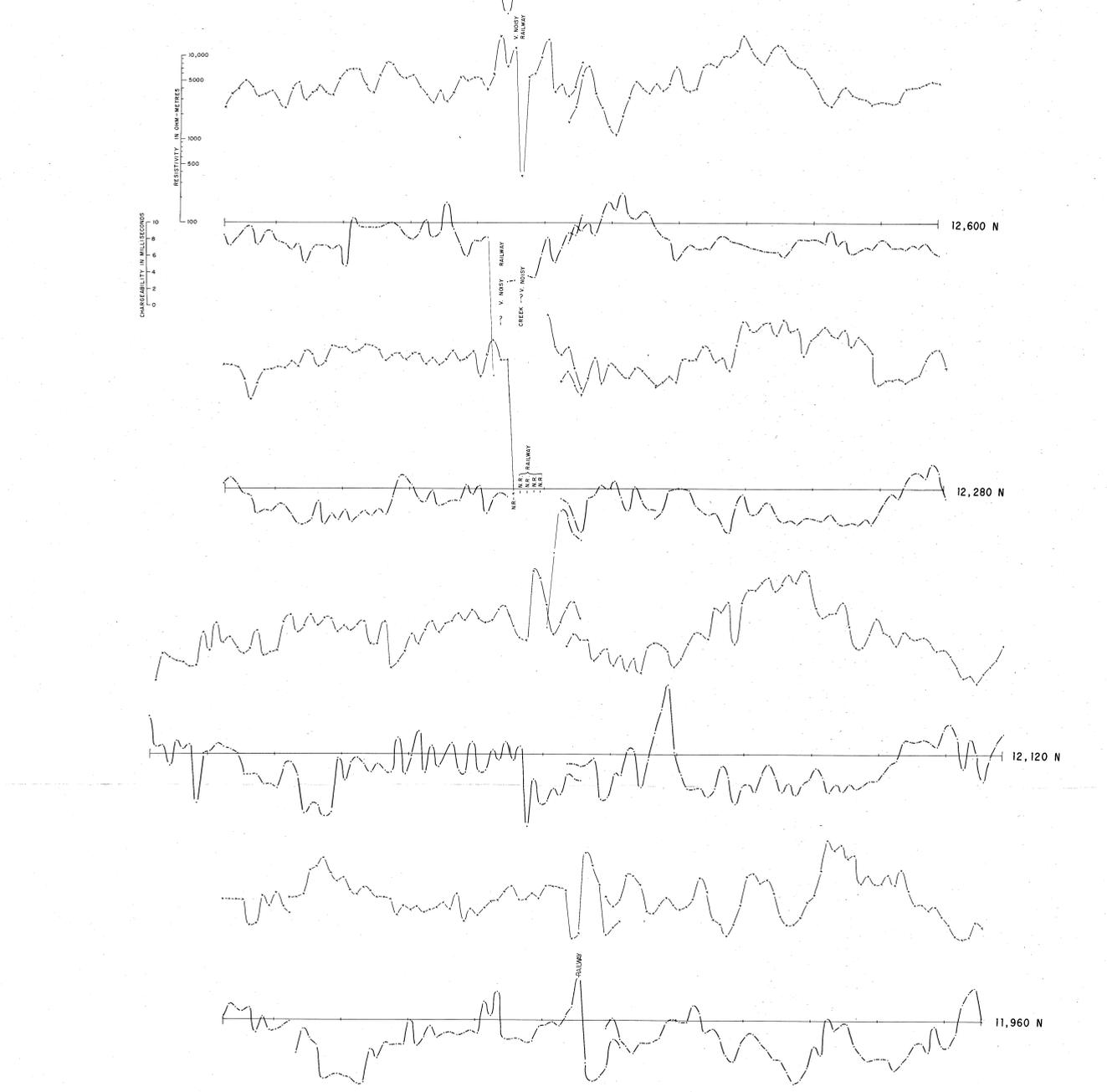
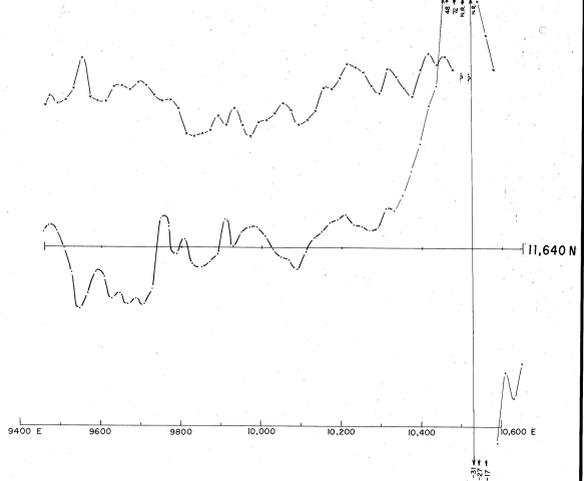
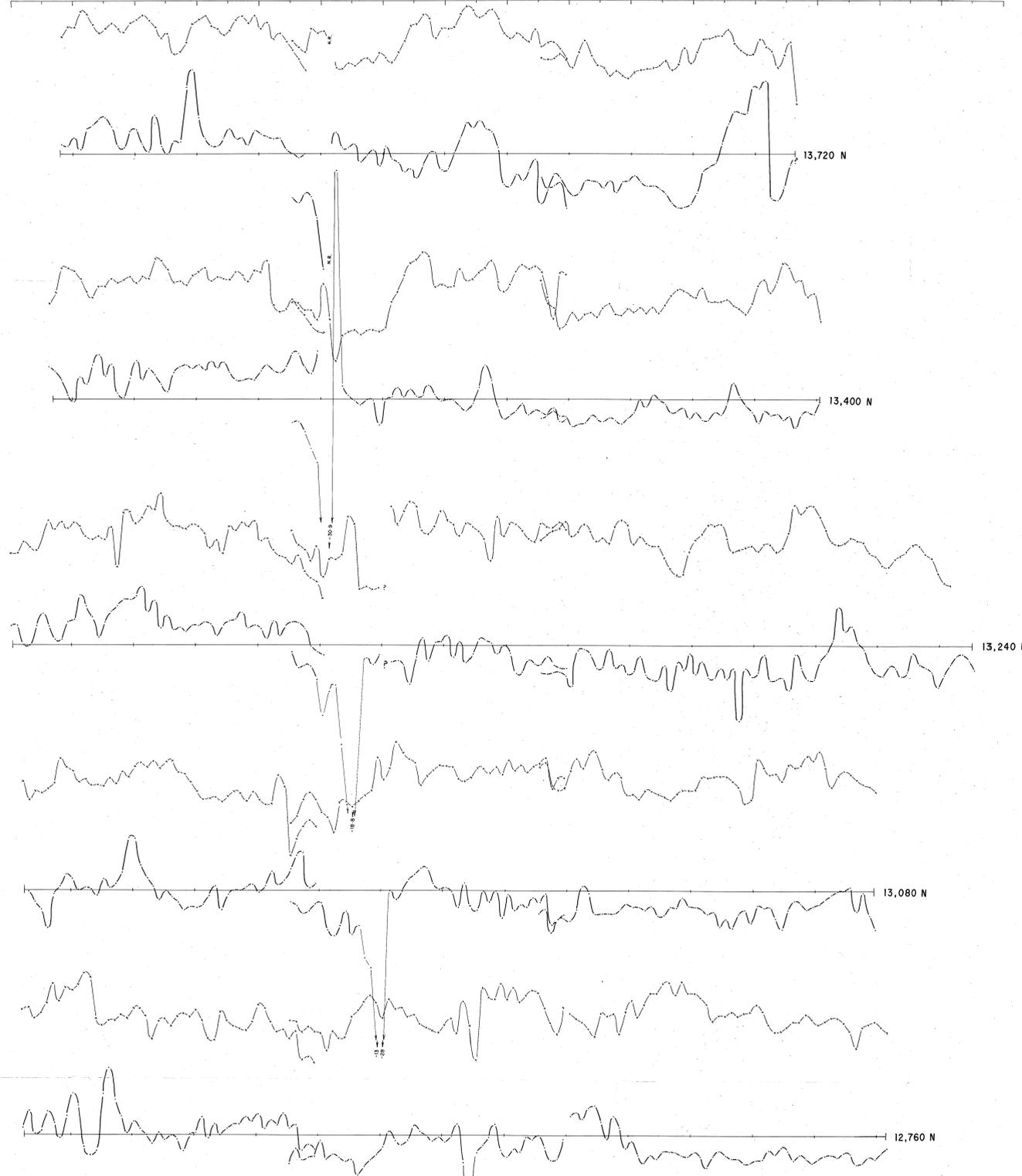


CONTENTS

- Plate 1 - Electrical Induced Polarization Data Profiles - 3 sheets.
- Plate 2 - Total Magnetic Field Data Profiles - 3 sheets
- Plate 3 - Apparent Resistivity Contour Plan - 2 sheets.
- Plate 4 - Apparent Chargeability Contour Plan - 2 sheets.
- Plate 5 - Total Magnetic Field Contour Plan - 2 sheets.
- Plate 6 - Physical Property Map - 2 sheets.

OPEN FILE

8800 E 9000 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E



LEGEND

RESISTIVITY Symbol = ————
 5 cm = 1 logarithmic cycle
 Base level = 100 ohm-metres

CHARGEABILITY Symbol = ————
 1 cm = 2 milliseconds
 Base level = 10 milliseconds

ELECTROLYTIC ZINC COMPANY
 OF
AUSTRALASIA LIMITED
 BULGOBAC AREA
 ROSEBERY, TASMANIA

GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION SURVEY

DATA PROFILES



SURVEYED & COMPILED BY:-
SCINTREX PTY. LTD.
 APRIL - JULY 1976



337016

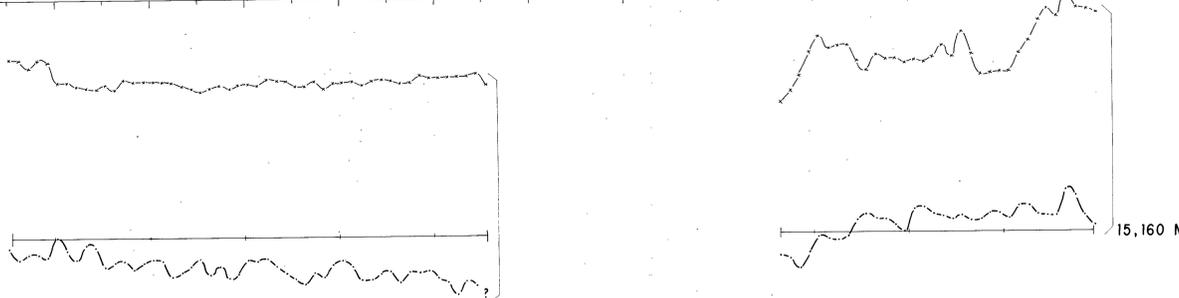
SCALE 1:5000

001

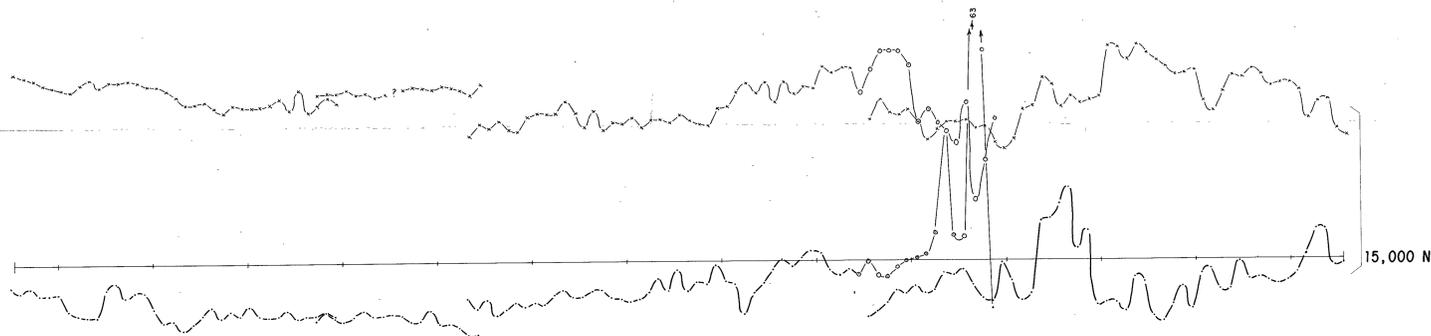
100

8800 E 9000 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E

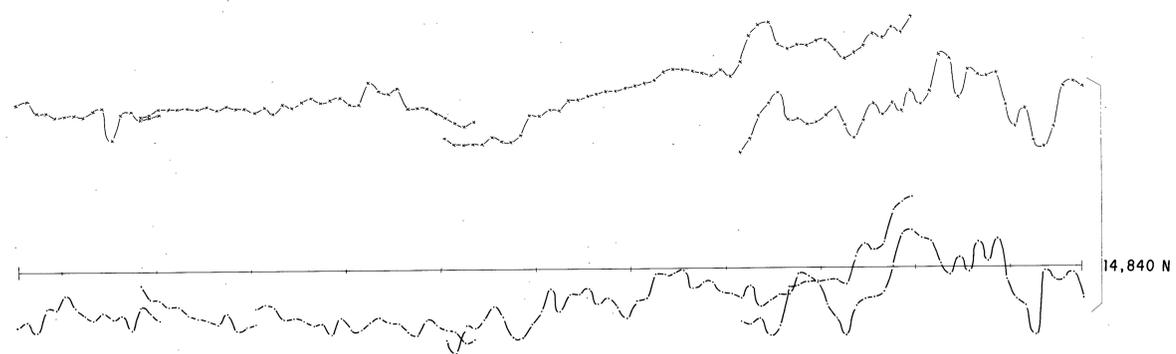
9000 E 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E



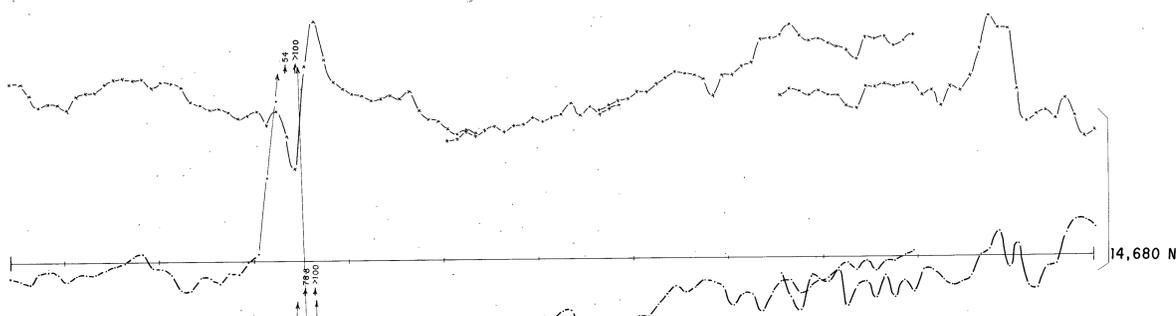
15,160 N



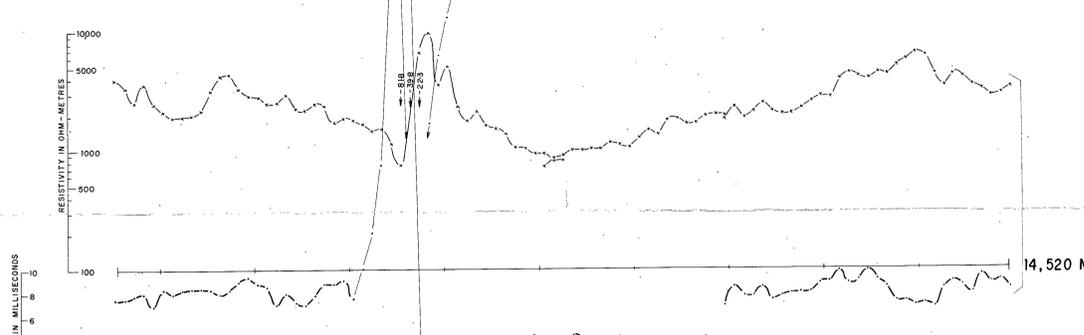
15,000 N



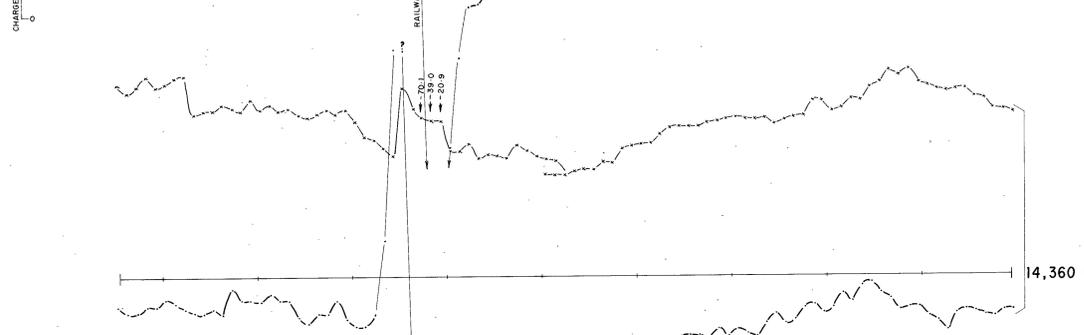
14,840 N



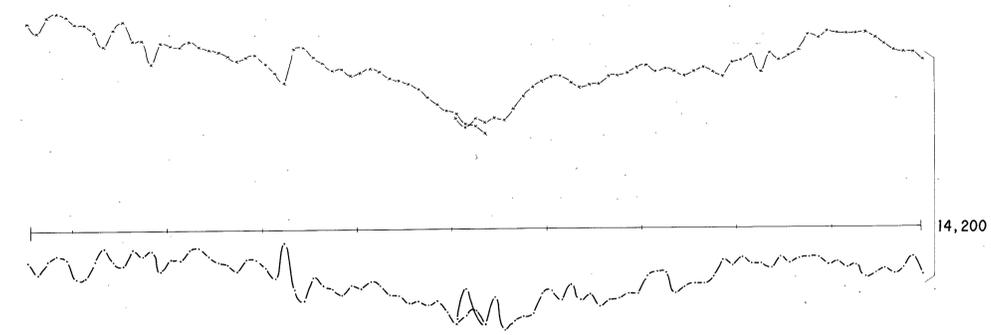
14,680 N



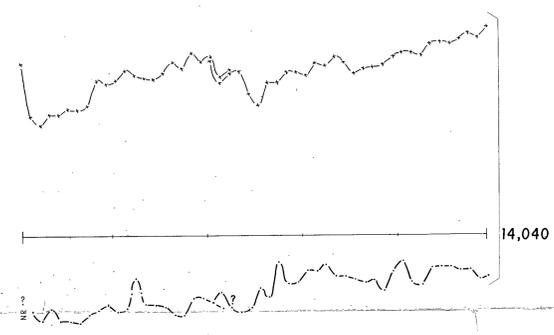
14,520 N



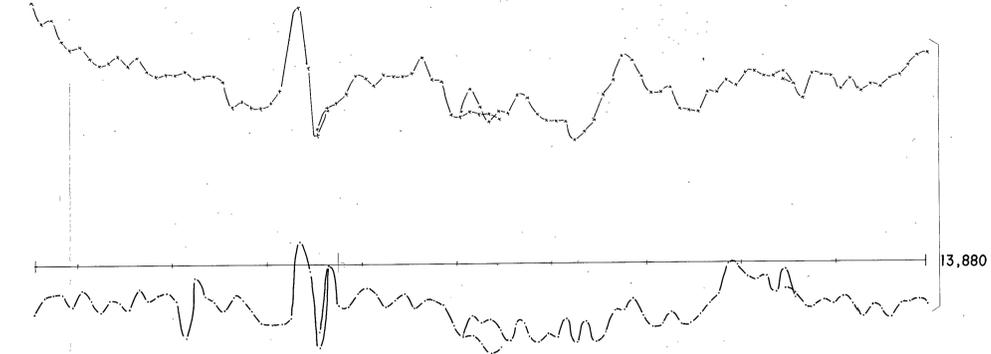
14,360 N



14,200 N



14,040 N



13,880 N

RESISTIVITY IN OHM-METRES
10000
5000
1000
500
100
10
5
4
3
2
1
0

CHARGEABILITY IN MILLISECONDS
10
5
4
3
2
1
0

RAILWAY LINE

201
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

200
200
200

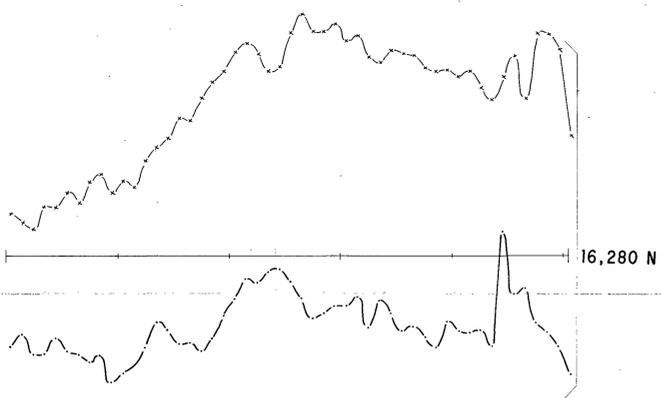
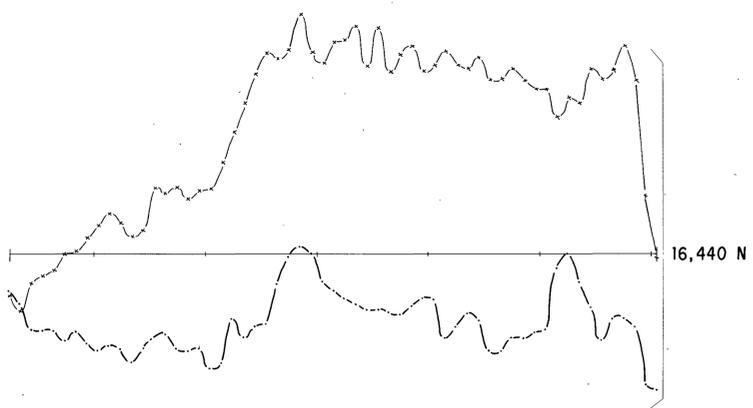
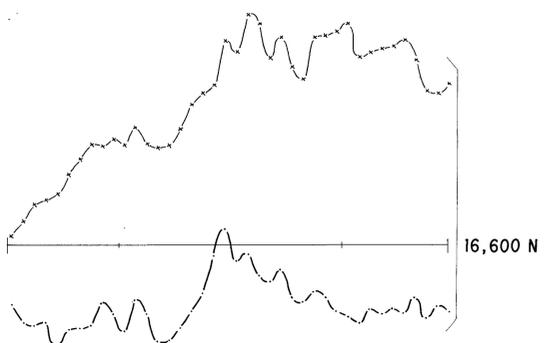
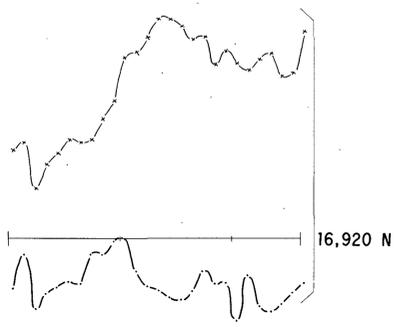
200
200
200

337047

9000 E 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E

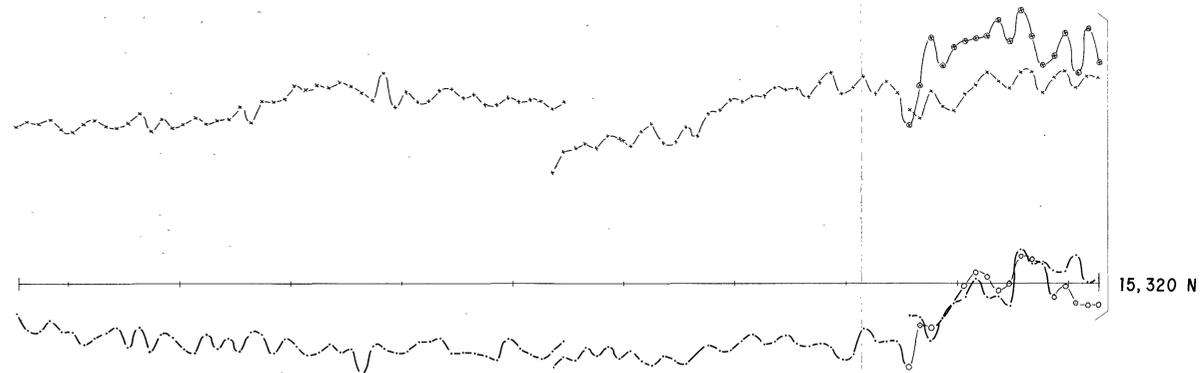
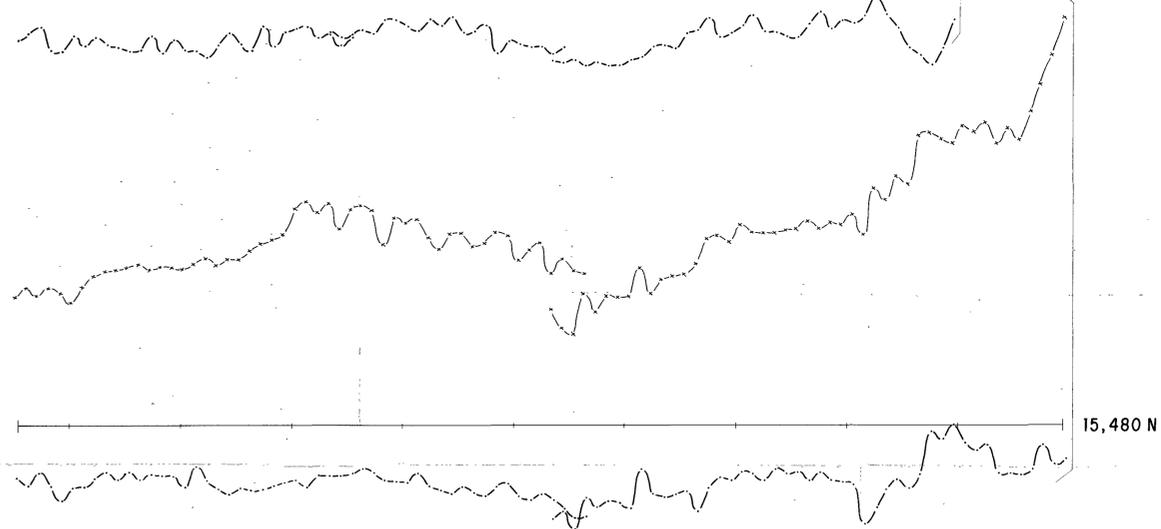
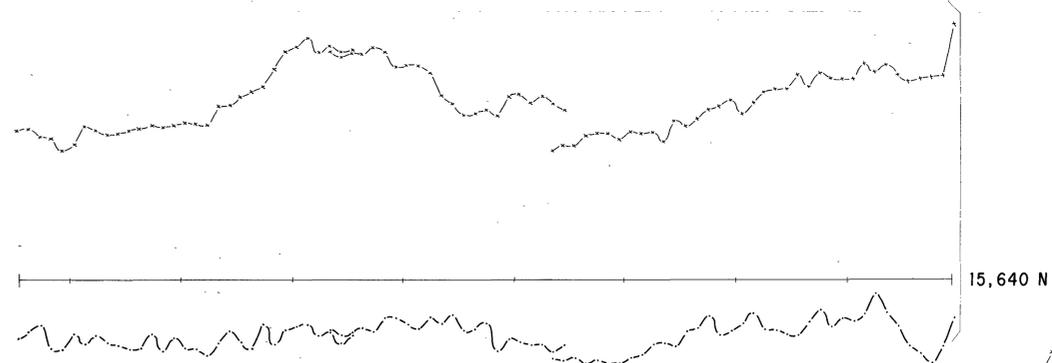
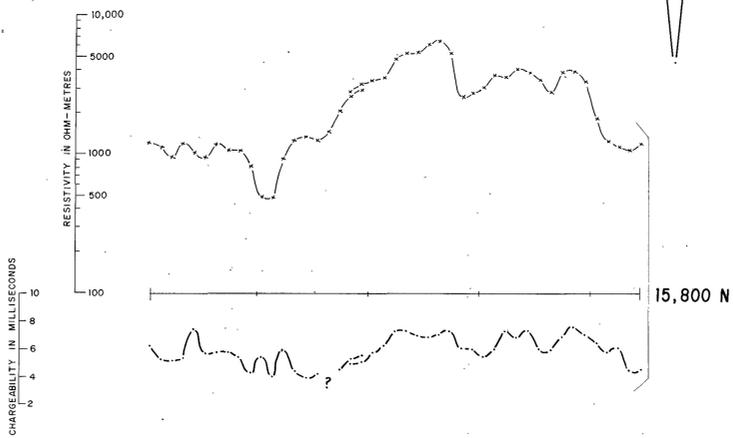
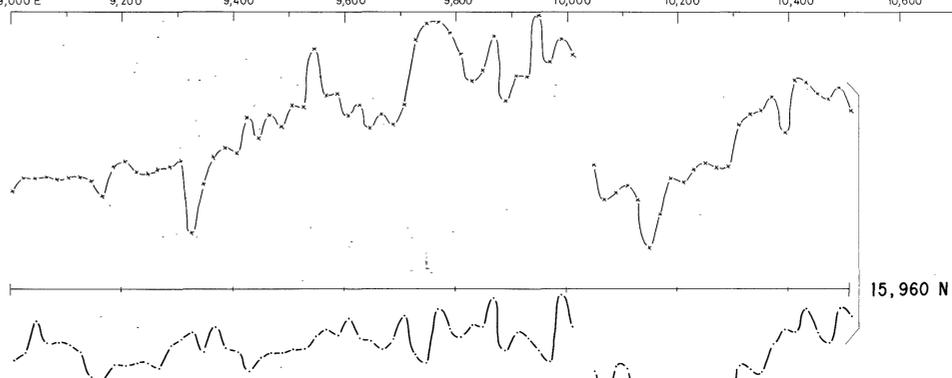


8800 E 9,000 9,200 9,400 9,600 9,800 10,000 E



8800 E 9000 9200 9400 9600 9800 10,000 E

9,000 E 9,200 9,400 9,600 9,800 10,000 10,200 10,400 10,600 10,800 11,000 11,200 E

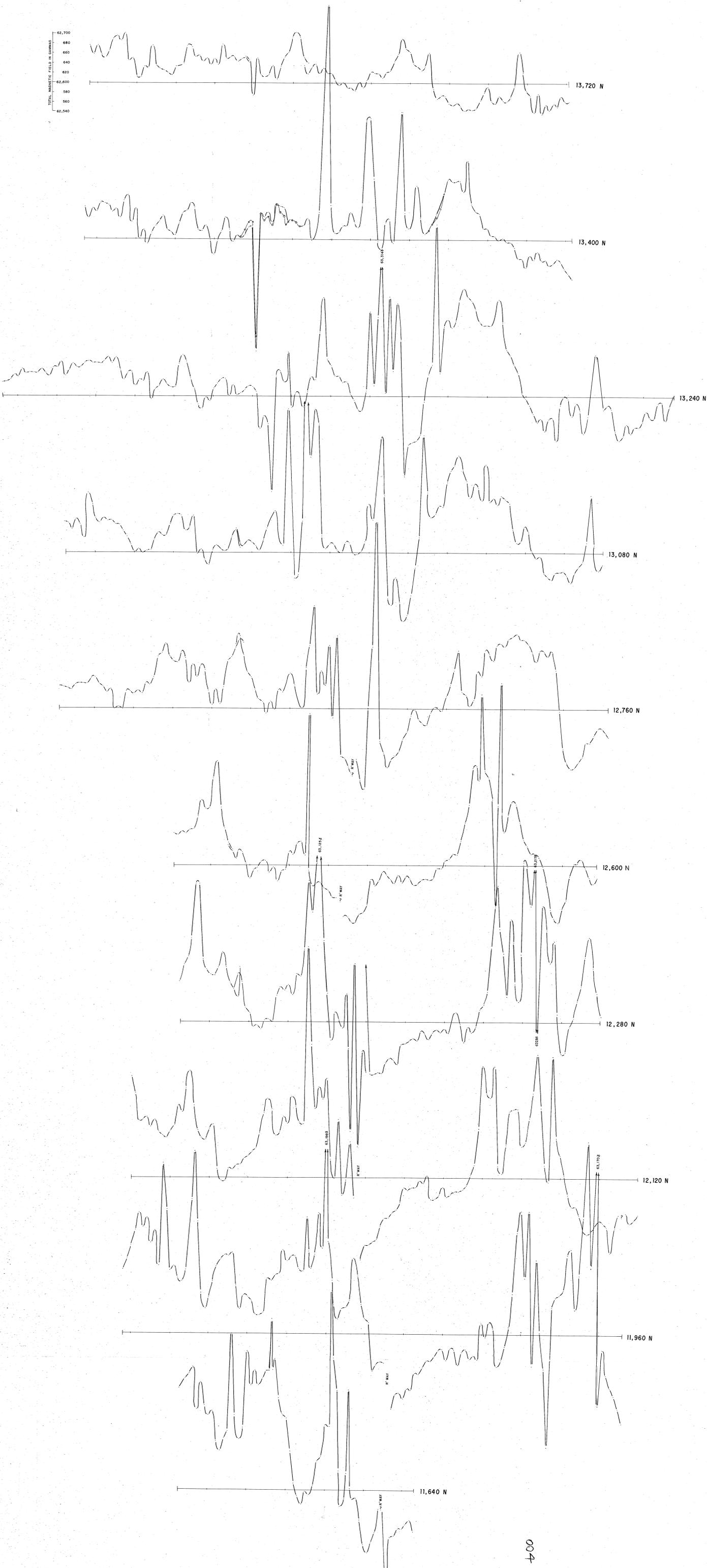


9000 E 9200 9400 9600 9800 10,000 10,200 10,400 10,600 10,800 11,000 11,200 E



8400 E 8600 8800 9000 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E

TOTAL MAGNETIC FIELD IN GAMMAS
62,700
680
640
620
580
560
62,540



SCALE 1 cm = 20 gammas
BASE LEVEL = 62,600 gammas

ELECTROLYTIC ZINC COMPANY
OF
AUSTRALASIA LIMITED
BULGOBAC AREA
ROSEBERY, TASMANIA

TOTAL FIELD MAGNETOMETER SURVEY
DATA PROFILES

1 cm
SURVEYED & COMPILED BY
SCINTREX PTY. LTD.
APRIL - JULY 1976



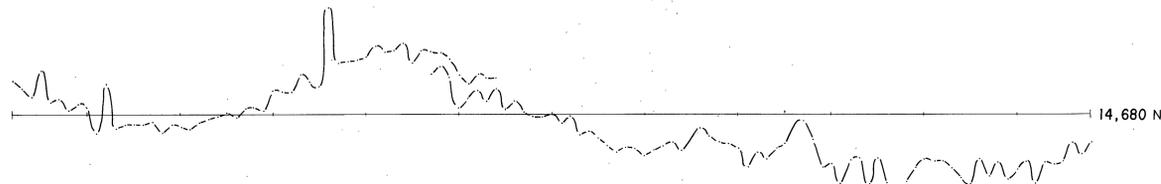
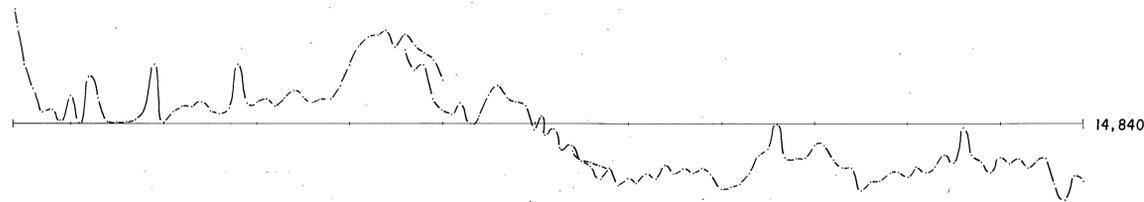
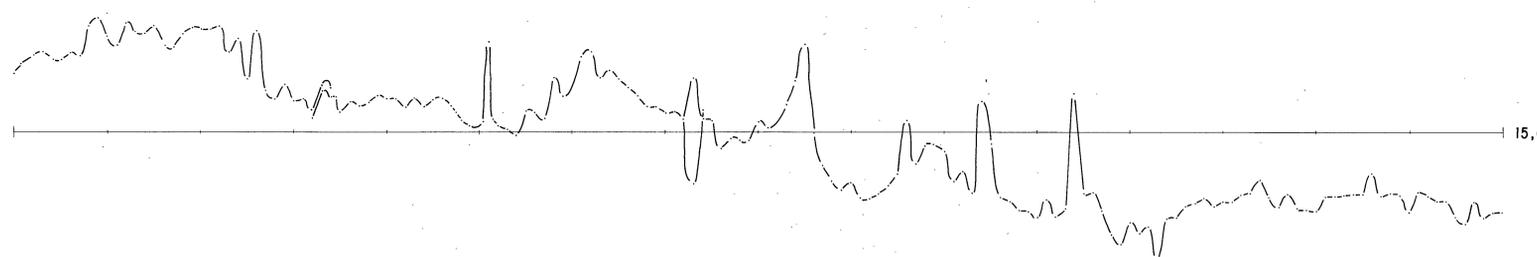
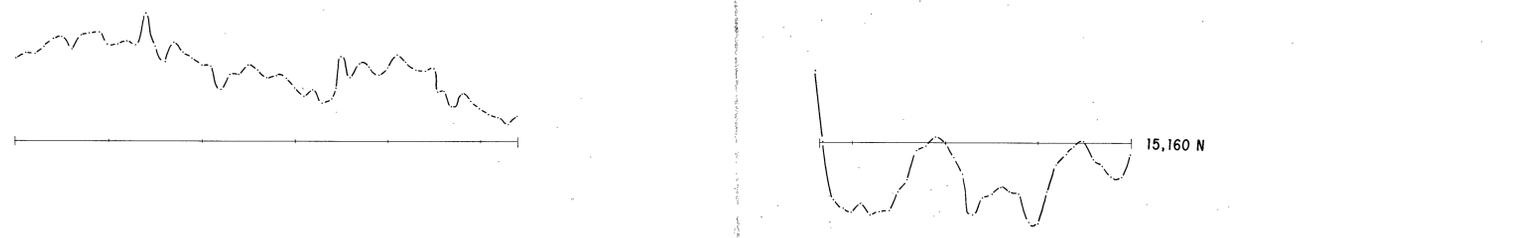
100 0 100 200 300 400 metres
SCALE 1:5000

337010

004

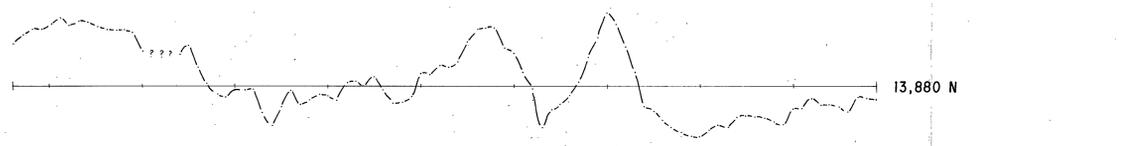
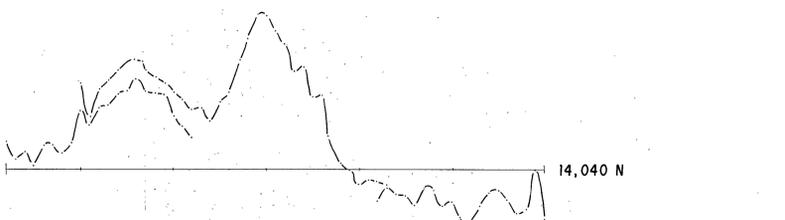
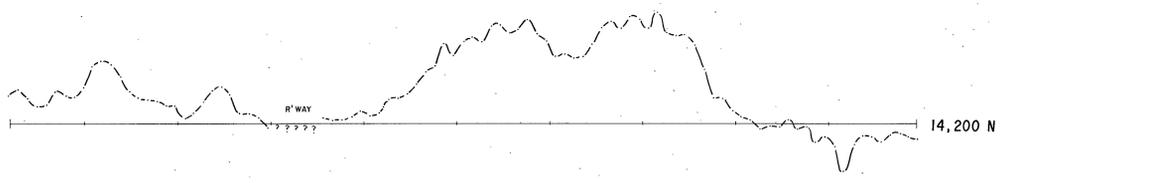
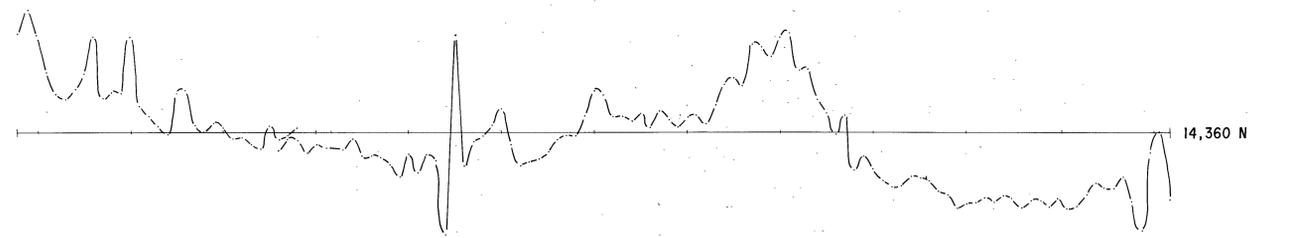
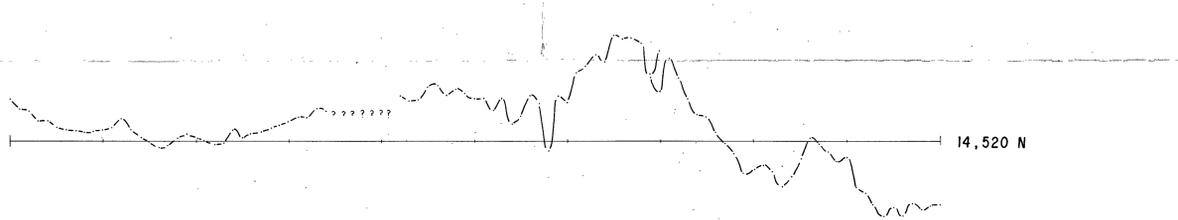
8400 E 8600 8800 9000 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 E

9,000 E 9,200 9,400 9,600 9,800 10,000 10,200 10,400 10,600 10,800 11,000 11,200 11,400 11,600 11,800 12,000 12,200 E



TOTAL MAGNETIC FIELD IN GAMMAS

62,700
680
660
640
620
62,600
580
560
62,540



9000 E 9200 9400 9600 9800 10000 10200 10400 10600 10800 11000 11200 11400 11600 11800 12000 12200 E

337050



005

JOB N° TAS-033

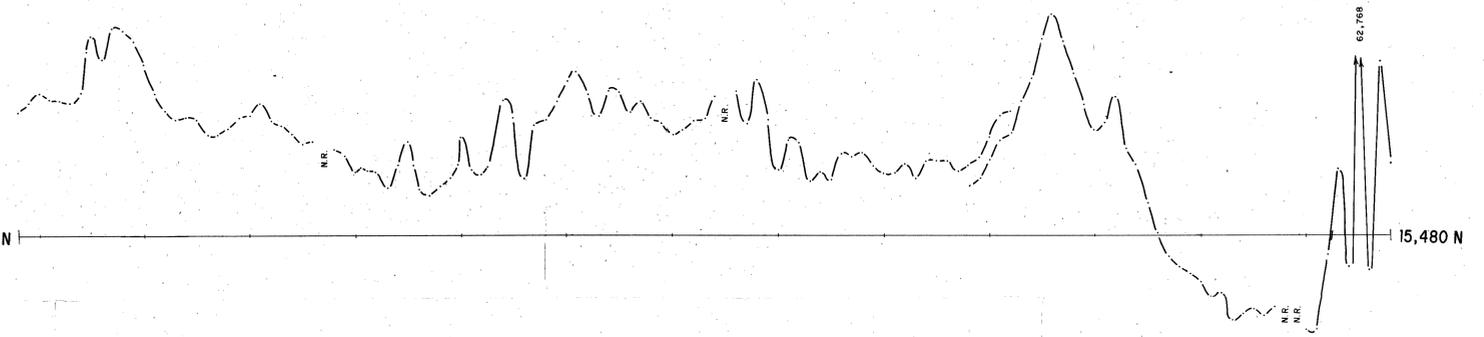
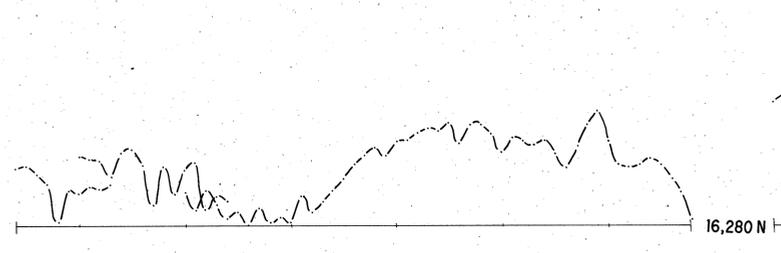
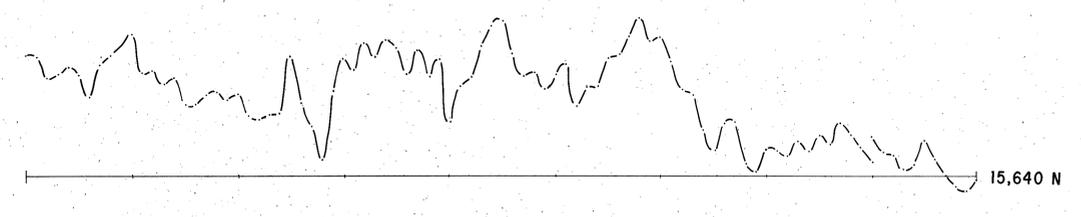
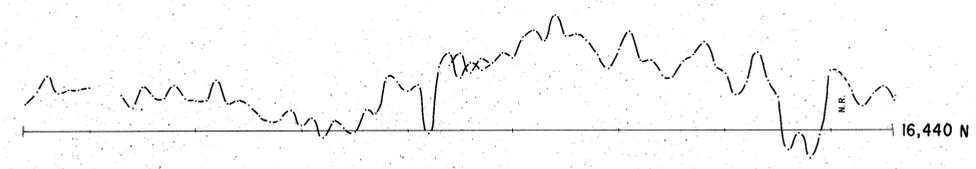
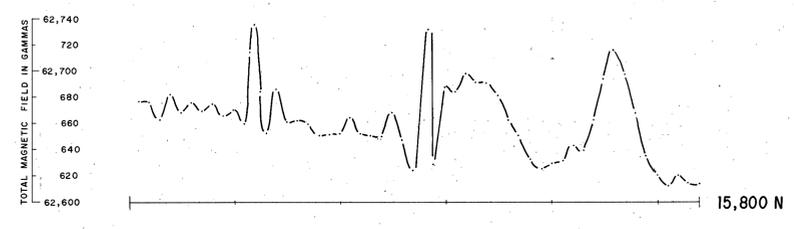
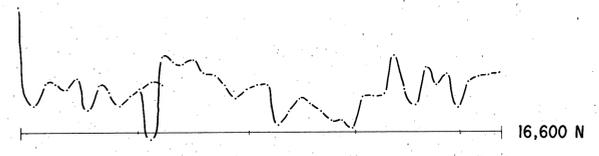
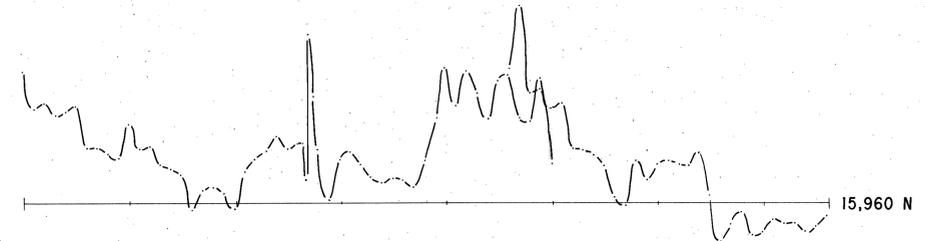
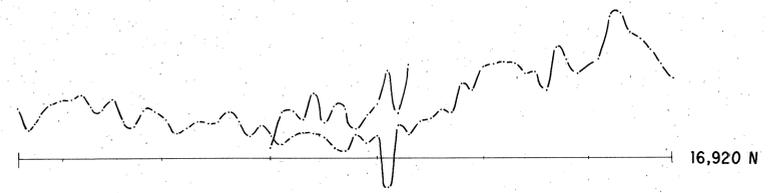
SHEET 2 OF 3

PLATE 2

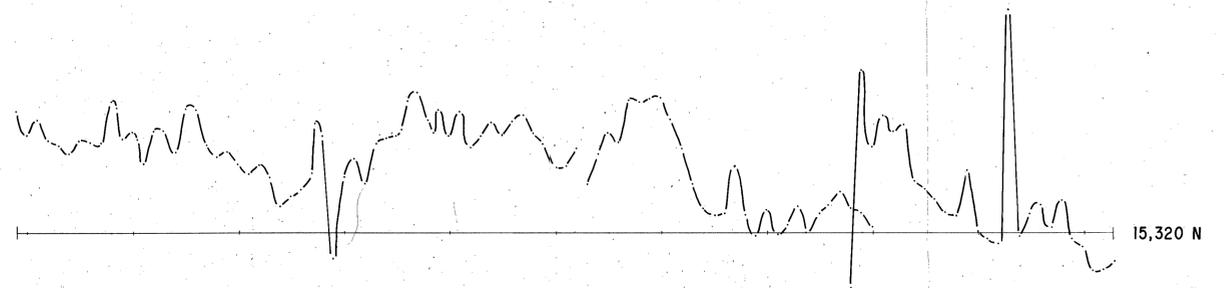
76-11872a

8,400 E 8,600 8,800 9,000 9,200 9,400 9,600 9,800 10,000 10,200 10,400 E

9,000 E 9,200 9,400 9,600 9,800 10,000 10,200 10,400 10,600 10,800 11,000 11,200 11,400 E

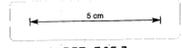


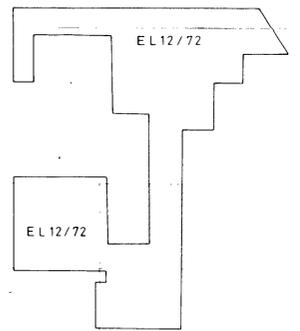
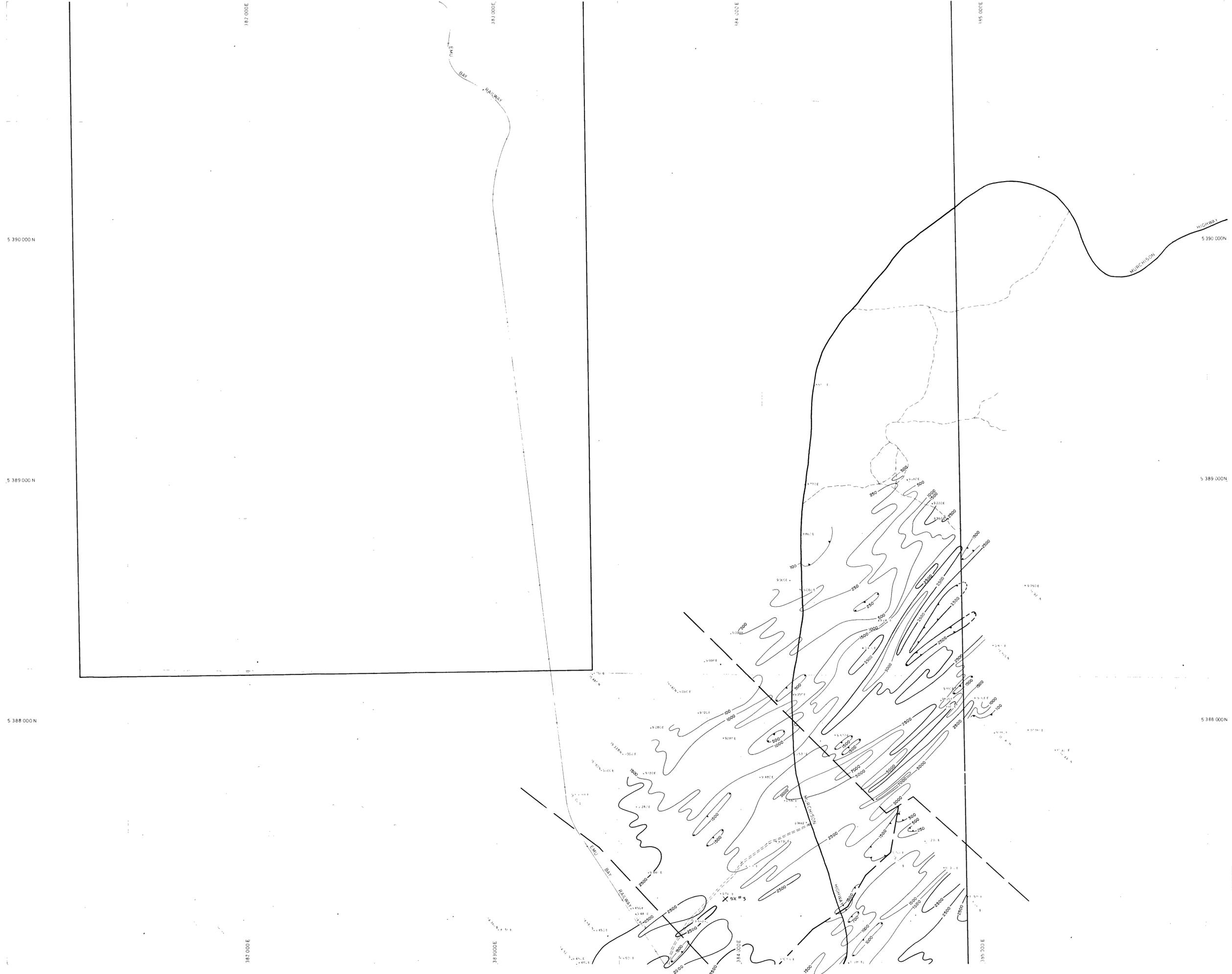
8400 E 8600 8800 9000 9200 9400 9600 9800 10,000 10,200 10,400 E



8800 E 9000 9200 9400 9600 9800 10,000 10,200 10,400 10,600 10,800 11,000 11,200 11,400 E

337051





337052
5m

ELECTROLYTIC ZINC CO OF ASIA LTD	
PROJECT BULGOBAC EL 12/72	TAS
CORRECTED BOGO GRID SHOWING	
RESISTIVITY CONTOUR PLAN	
(IN OHM METRES)	
SCALE 1 5 000	Surveyed & Compiled by SCINTREX Pty Ltd APRIL 1976
REFERENCE	REF NO
DATE 8/9/76 DRAWN R.A.H. GEOLOGY N.H.H.	

00



5 386 000 N

5 385 000 N

5 384 000 N

382 000 E

383 000 E

384 000 E

385 000 E

382 000 E

383 000 E

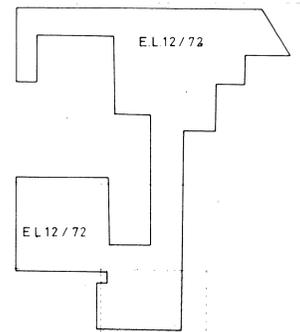
384 000 E

385 000 E

5 386 000 N

5 385 000 N

5 384 000 N



337053

5 cm

ELECTROLYTIC ZINC CO OF ASIA LTD			
PROJECT	BULGOBAC EL12/72	TAS	
CORRECTED BOCO GRID SHOWING			
RESISTIVITY CONTOUR PLAN			
(IN OHM METRES)			
SCALE	1 5 000	Surveyed & Compiled by	
REFERENCE		SCINTREX Pty Ltd APPC-117	REF NO
DATE	8/9/76	DRAWN	R.A.H.
		GEOLOGY	N.M.H.

76-11872

008

SCINTREX PTY. LTD. SHEET 2 OF 2. PLATE 3

800



600

5 390 000 N

5 389 000 N

5 388 000 N

145 000 E

145 000 E

145 000 E

145 000 E

388 000 E

388 000 E

388 000 E

388 000 E



HIGHWAY

MURCHISON

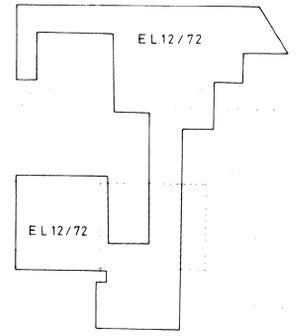
XXII

XX

XXI

5 389 000 N

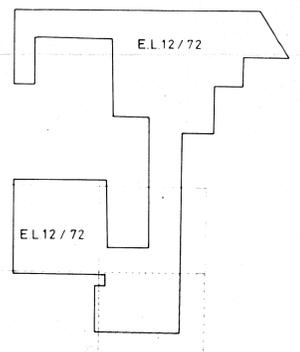
5 388 000 N



5m

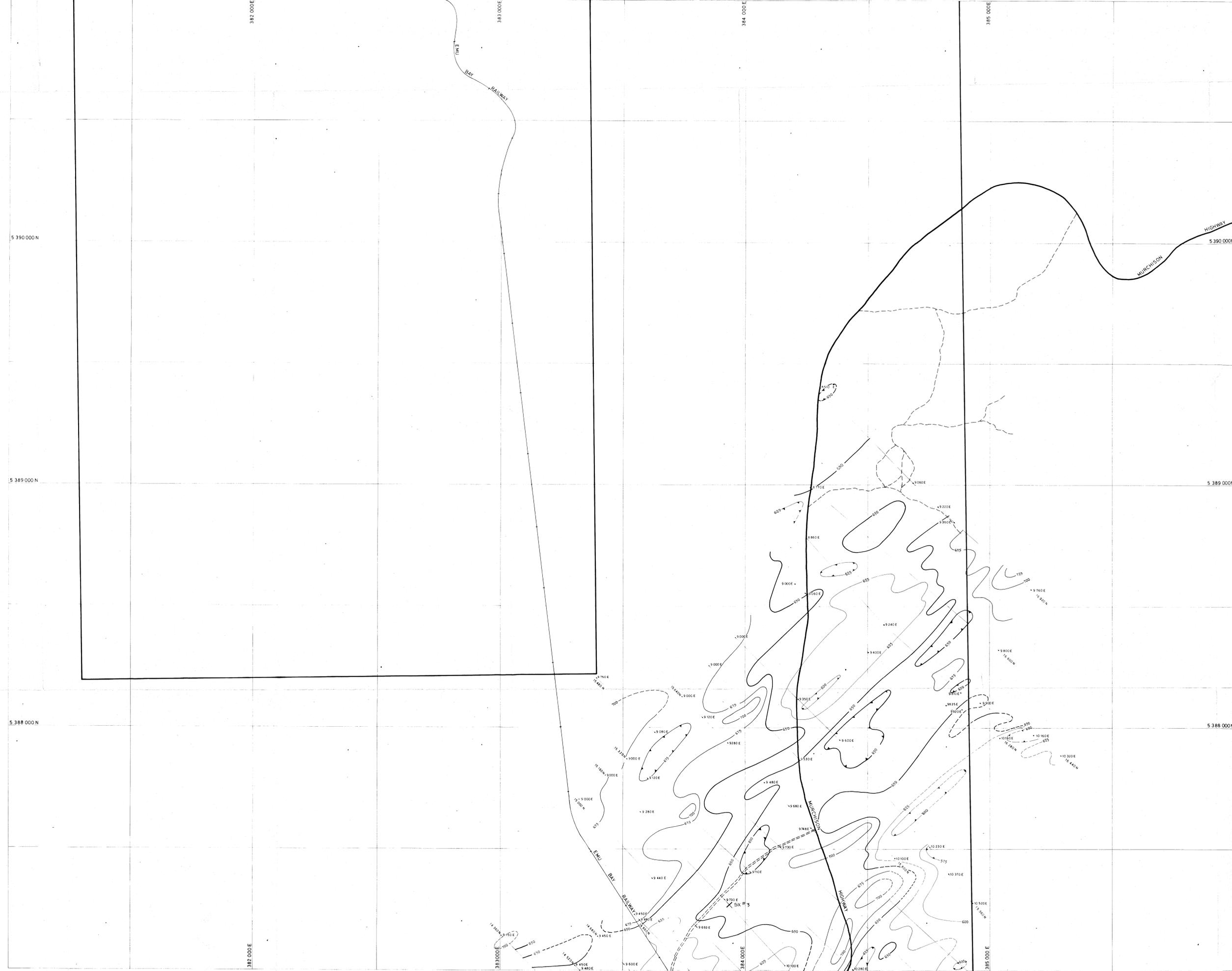
337054

ELECTROLYTIC ZINC CO. OF ASIA LTD.	
PROJECT BULGOBAC EL 12/72	TAS
CORRECTED BOCO GRID SHOWING	
CHARGEABILITY CONTOUR PLAN	
(IN MILLISECONDS)	
Survey & Compiled by SCINTREX Pty Ltd APRIL 1976	
SCALE 1 5 000	REF NO
DATE 8/9/76	DRAWN R A H
GEOLOGY N H H	

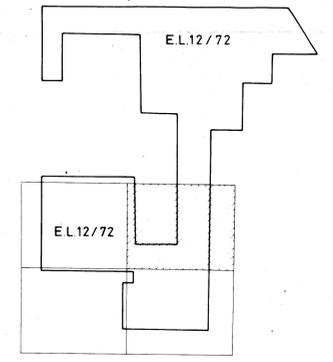


337055

ELECTROLYTIC ZINC CO. OF ASIA LTD	
PROJECT: BULGOBAC EL12/72	TAS
CORRECTED BOCO GRID SHOWING	
CHARGEABILITY CONTOUR PLAN	
(IN MILLISECONDS)	
Surveyed & Compiled by SCINTREX Pty Ltd APRIL-JULY 1976	
SCALE 1 : 5 000	REF NO.
DATE 8/9/76 DRAWN R.A.H. GEOLOGY N.H.H.	

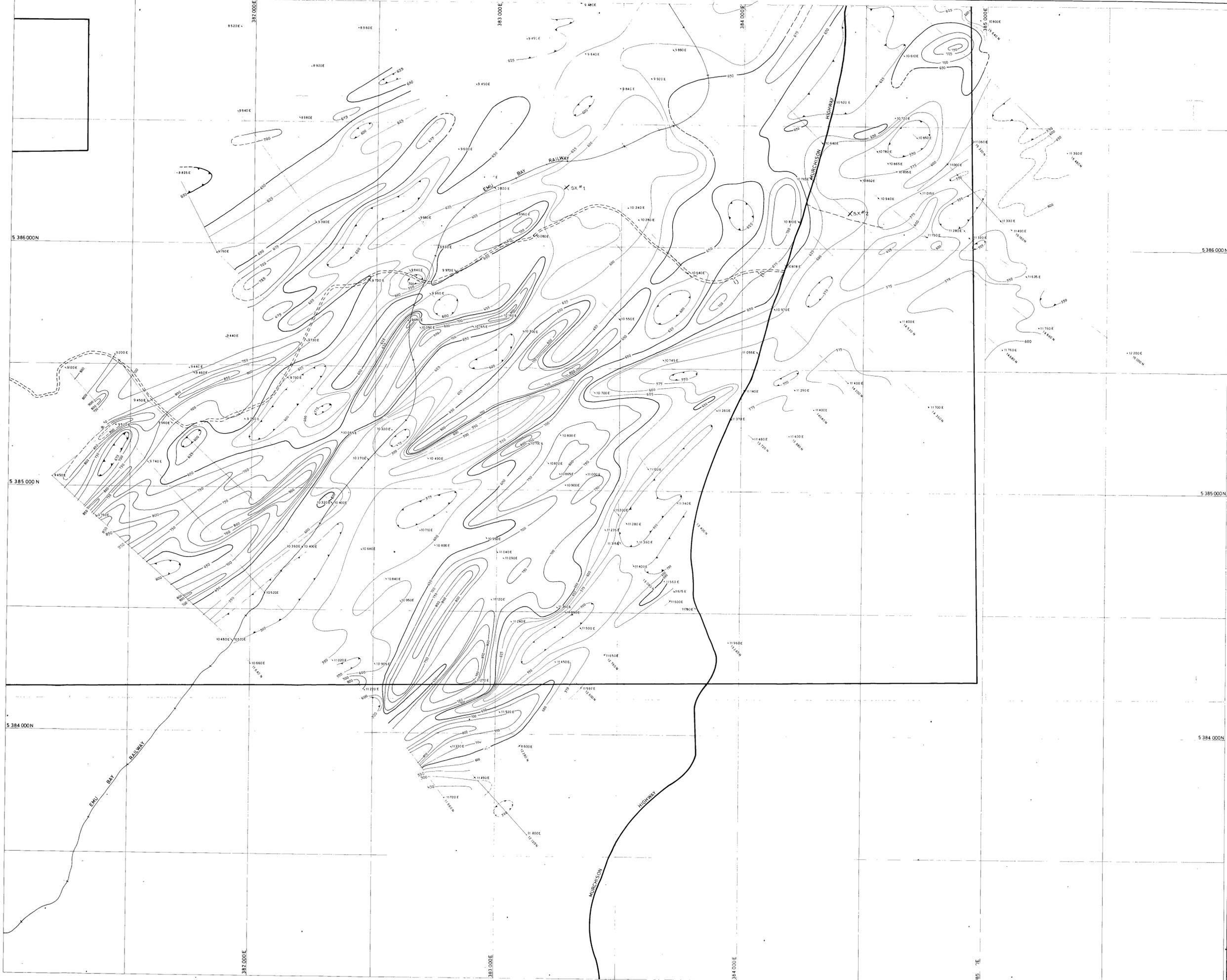


Add 62,000 to all values.

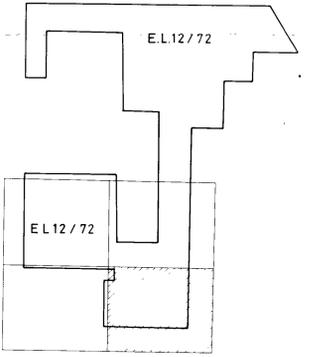


337056

ELECTROLYTIC ZINC CO. OF ASIA. LTD	
PROJECT: BULGOBAC EL.12/72	TAS
CORRECTED BOGO GRID SHOWING	
TOTAL MAGNETIC FIELD	
CONTOUR PLAN	
(IN GAMMAS)	
SCALE: 1 : 5 000	Compiled: SCINTREX Pty Ltd SEPT. 76
REFERENCE	REF NO
DATE: 8/9/76	DRAWN R.A.H. GEOLOGY N.H.H.



Add 62,000 to all values.

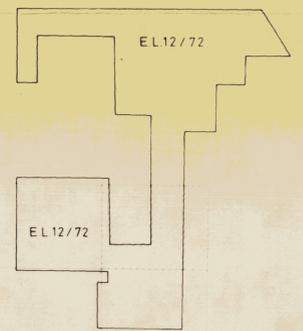
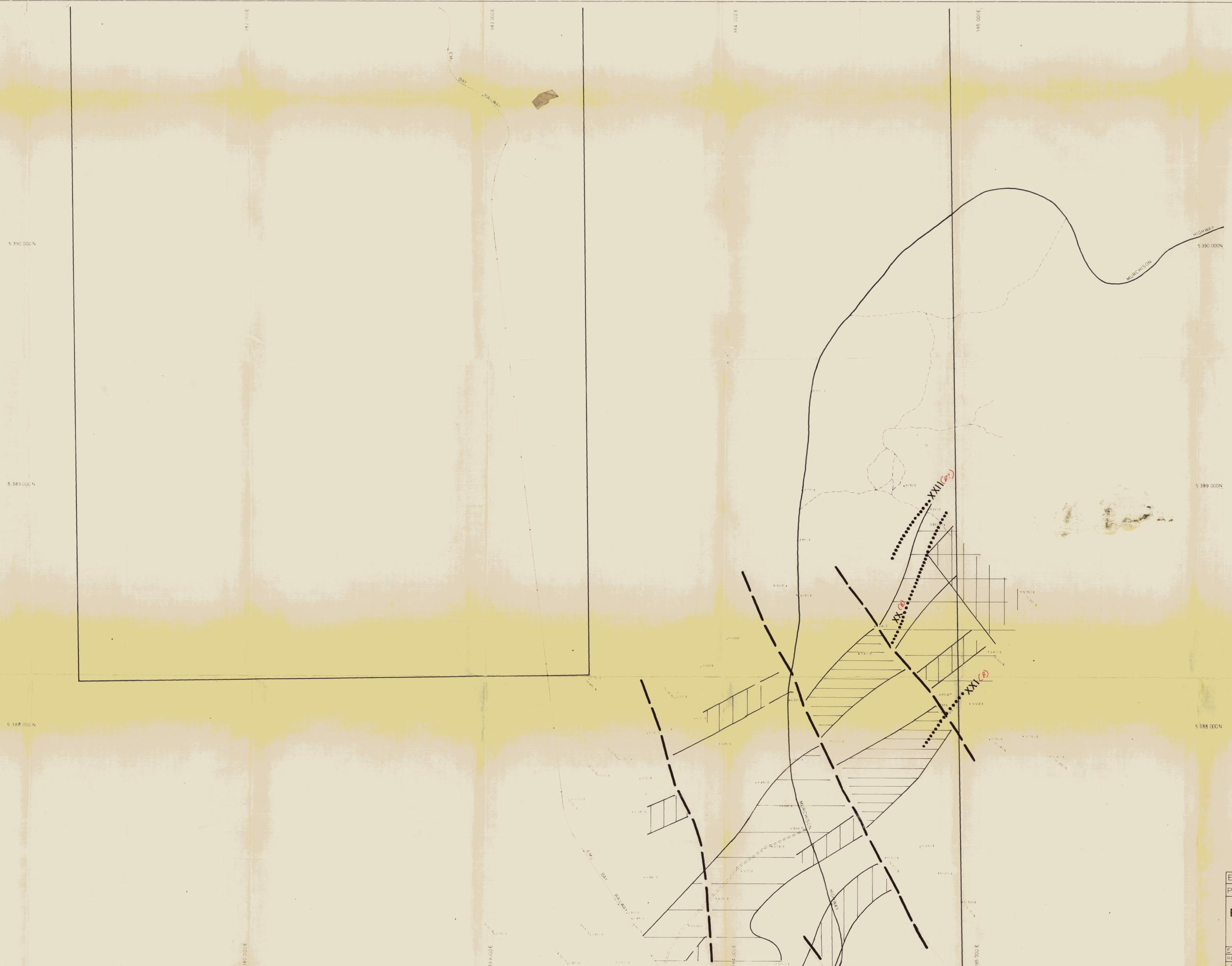


337057

ELECTROLYTIC ZINC CO OF ASIA LTD
 PROJECT. BULGOBAC EL12/72 TAS

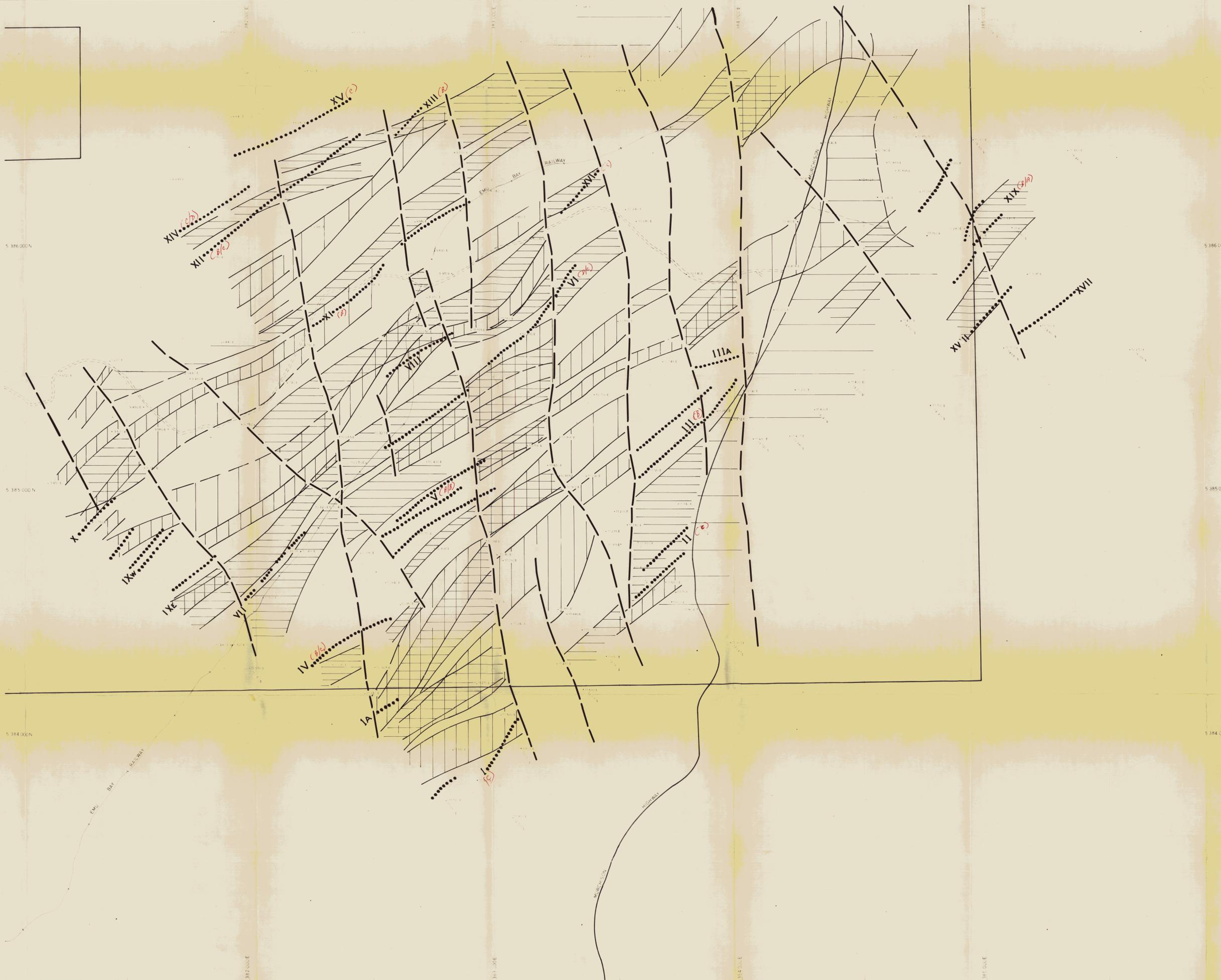
CORRECTED BOCO GRID SHOWING
TOTAL MAGNETIC FIELD
 CONTOUR PLAN
 (IN GAMMAS)

SCALE 1 : 5 000
 REFERENCE SCINTREX Pty Ltd SERP: 011
 DATE 8/9/76 DRAWN R A H GEOLOGY N H H REF. NO.



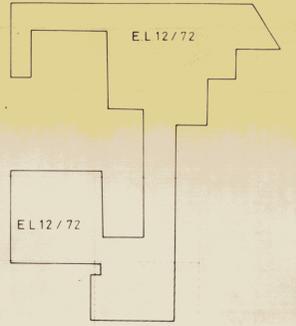
337058
 FOR LEGEND SEE SHEET 2

ELECTROLYTIC ZINC CO OF ASIA LTD	
PROJECT BULGOBAC EL 12/72	TAS
CORRECTED BOCO GRID SHOWING	
PHYSICAL PROPERTY -	
- INTERPRETATION PLAN	
SCALE 1:5000	Compiled by SCINTREX Pty Ltd Sept-Dec 1976
REFERENCE	REF NO
DATE 8/9/76	DRAWN R.A.H. GEOLOGY N.H.H.



LEGEND

-  Low Resistivity
-  Moderate Resistivity
-  High Resistivity
-  Weak Magnetic High
-  Moderate Magnetic High
-  Induced Polarization Highs
-  Possible Faults



337059
5cm

ELECTROLYTIC ZINC CO OF ASIA LTD		
PROJECT	BULGOBAC EL12/72	TAS
CORRECTED BOCG GRID SHOWING		
PHYSICAL PROPERTY - INTERPRETATION PLAN		
SCALE	1 : 5 000	Compiled by SCINTREX Pty. Ltd. SEP 1976
REFERENCE		REF NO
DATE	8/9/76	DRAWN R.A.H. GEOLOGY N.H.H.