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A REPORT ON
 FURTHER EXTENSIONS TO, AND DETAIL WITHIN
 THE WEST SEDGWICK (LAKE MARGARET) GRID
 NEAR QUEENSTOWN, WEST COAST TASMANIA
 ON BEHALF OF
 THE MOUNT LYELL MINING AND RAILWAY COMPANY LTD.

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	REF. No. 10,076/84			

PRIVATE AND CONFIDENTIAL

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THE WEST SEDGWICK (LAKE MARGARET) GRID
NEAR QUEENSTOWN, WEST COAST TASMANIA
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BY

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GEOPHYSICIST

SYDNEY, N.S.W.

MAY, 1977

TAS-035B

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GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

In further extensions to the West Sedgwick grid, a significant electrical induced polarization response some 1500 feet to 2000 feet long, was delineated within the Mottled Dark Green Lithic Tuff unit, and trending grid north-north-east/south-south-west across Crown Hill. It is recommended that the source of this response, the most significant in the entire West Sedgwick grid, be unambiguously identified.

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INTRODUCTION

Further reconnaissance electrical induced polarization surveys were carried out in the central and south western sections of the West Sedgwick grid. In addition pole-dipole detail was obtained over four lines.

These surveys were undertaken at the request of Mr. K. Reid Chief Geologist of the Mt. Lyell Mining & Railway Company Ltd.

The work was carried out variously under senior Scintrex party leaders, B. Ekstrom and R. Lindberg on 3.75 production days between 16th and 22nd November, 1976 and two production days on the 4th and 5th February, 1977. On site geological supervision was undertaken by P. Brophy, while geophysical direction was undertaken by the author.

This work follows on from work carried out in December, 1973 and in December 1974/January 1975 described in reports TAS-018B and TAS-025C respectively. As the whole survey grid has been surveyed by theodolite since the data from the earlier surveys was contoured, the gradient data from all three surveys has been

re-presented on Plates 2 (apparent chargeability) and 3 (apparent resistivity).

The method and equipment are described in detail in reports TAS-035C and TAS-035D, and the reader is directed to those reports.

DATA PRESENTATION

The gradient array data profiles are presented on Plate 1 at the horizontal scale of 1 inch = 200 feet and vertical scales of 1 inch = 10 milliseconds for chargeability and 2 inches = 1 logarithmic cycle for resistivity expressed in ohm-metres. The pole-dipole detail is presented on Plate 4 at the horizontal scale of 1 inch = 100 feet and vertical scales as above.

Plates 2 and 3 respectively present the contour interpretations of apparent chargeability and apparent resistivity, both at the scale of 1 :6000.

NOTE: PLATES 2 AND 3 REPLACE PLATES 3 (CHARGEABILITY) AND 2 (RESISTIVITY) PRESENTED IN REPORT TAS-018B, AND PLATES 3A AND 2A PRESENTED IN REPORT TAS-025C (TAS-018B AMENDED). IT IS RECOMMENDED THAT THESE EARLIER PLATES BE ANNOTATED ACCORDINGLY.

DISCUSSION OF THE DATA

The gradient array extensions are discussed first, with a detailed discussion of the pole-dipole following.

GRADIENT ARRAY EXTENSIONS

LINE 48S *Surveyed between 450E and 2550E*

The *apparent resistivity* shows material variation over the section surveyed, with a range between 600 ohm-metres and 5500 ohm-metres, with major distortions. The resistivity gradually *decreases* from west to east. The most significant feature was a material increase in resistivity to over 5500 ohm-metres from about 1600 ohm-metres between about 950E and 1200E. This feature is associated with *higher* chargeabilities on the eastern flank, of 7 to 8 milliseconds above background. The interpreted source is a resistive (acid ?) unit which carries sulphides in disseminated form on its eastern margin (less than 1% by volume). The maximum depth to source is considered to be of the order of 150 feet, while the eastern margin forms a sharp contact.

West of the above feature a 5 millisecond chargeability response was associated with a fall in apparent resistivity of over 2000 ohm-metres to 1500 ohm-metres. The source of this minor response is considered to be disseminated sulphides (of the order of ½% by volume) within a host which is less resistive

than the enclosing rock units.

The apparent resistivities reach a low of less than 1000 ohm-metres between 1800E and 2350E. This low reaches 600 ohm-metres at 2250E. This feature is associated with slightly higher background chargeabilities of 12 to 15 milliseconds and probably represents a more mafic (or sedimentary) rock unit.

LINE 54S Surveyed between 650E and 2650E

The general form of the resistivity profile is similar to line 48S which shows higher resistivities to 5000 ohm-metres plus, in the west, to less than 1000 ohm-metres in the east. Between 700E and 1100E two distinct resistivity highs of 6000 ohm-metres and 4000 ohm-metres at 750E and 1000E respectively were defined. It is not certain whether these resistive rock units correlate with those described above at 1100E on line 48S, although it has the same characteristics. Lower chargeabilities of up to 5 milliseconds above background were noted above these resistivity highs. The sources are therefore considered to be resistive rock units carrying small amounts of sulphides (less than ½%-1% by volume). The maximum depth to source appears to be of the order of 100 feet at most.

The resistivity low between about 1900E and 2600E centred at 2400E correlates with a very similar feature logged on line 48S at

2250E. This infers continuity of geology through these lines.

LINE 60S Surveyed between 350E and 2650E

The resistivity profile shows some variation from the two lines to the north. The background is somewhat lower in the east, but the less than 1000 ohm-metres section was still recorded between 2100E and 2400E. a resistive section centred at 1950E reaches a high 7000 ohm-metres above the 800 ohm-metres background and is accompanied by lower than background chargeabilities of about 5 milliseconds. The source is considered to be a resistive rock unit low in mafic minerals - e.g. an acid volcanic (or sedimentary) unit.

The chargeability profile shows little similarity with lines to the north, although correlation to the south is excellent. Between 900E and 1900E higher chargeabilities of up to 20 milliseconds against background of 10 \pm 2 milliseconds were noted. Within this zone a 27 milliseconds response was noted at 1750E, accompanied by a 750 ohm-metres resistivity low against background of 1500 ohm-metres to the west and 2000 ohm-metres to the east. The source is considered to be disseminated sulphides (or graphite) within a host less resistive than the enclosing material. This is a significant response and worthy of further careful investigation.

LINE 66S Surveyed between 1450W and 2750E

The general resistivity profile is flat over the entire section, with variations being from 800 ohm-metres to 3000 ohm-metres. No narrow resistive units such as recorded on lines to the north have been noted (e.g. 1950E on line 60S). Thus the geological regime on this line may show a change between lines 60S and 66S.

The main feature noted on this line was a 55 milliseconds response centred at 1650E which is accompanied by a marked decline in resistivity to 500 to 600 ohm-metres from 2000 ohm-metres. The form of this response suggests a shallower depth to source of less than 100 feet, and a gradual build-up towards the centre in chargeable material, rather than sharp boundaries. The chargeable material is contained within a host which is less resistive than the enclosing rocks, but the source itself is considered to be either disseminated or if "massive" or "vein like", still must be electrically discontinuous.

LINE 72S Surveyed between 1350W and 2800E

The profile form of both the apparent chargeability and apparent resistivity data are similar to that observed on line 66S. Resistivity background varies about 800 ohm-metres and about 3000 ohm-metres. Two zones of lower resistivities were noted, the first between 400E to 900E is considered to be a rock type change, but the second between 1400E and 1800E is accompanied

by high chargeabilities (see below).

The most significant feature on the chargeability data profile was a significant induced polarization anomaly centred between 1400E and 1600E. Two distinct peaks of 46 milliseconds at 1450E and 44 milliseconds at 1550E were accompanied by low resistivities of the order of 400 ohm-metres. There is a gradual build-up in the chargeability response from both the east and west for some 200 to 300 feet. This indicates the main zone to be surrounded by a significant disseminated halo within the more resistive boundary rocks.

The source is considered to be disseminated sulphides (or graphite) within a host rock less resistive than the enclosing rock types. However, within the more resistive wall rocks, disseminated sulphides of lesser volume are considered to be present. The maximum depth to source is difficult to assess due to the gradual increase in sulphides with depth, however, a guesstimate would be 100 feet to 200 feet.

LINE 78S Surveyed between 1250W and 350E (Old baseline)

The general form of the chargeability and resistivity data shows a similar form to that seen to both the north and south, however, the major chargeability anomaly recorded on line 72S and to the north of that line is much reduced in amplitude (see below).

Chargeabilities of greater than 20 milliseconds recorded between 750E and 1500E accompanied by lower apparent resistivities of less than 1000 ohm-metres as against 3000 ohm-metres to east and west, are considered to be the southern correlative of the major response recorded centred at 1500E on line 72S. A peak value of 37 milliseconds (against backgrounds of 5 milliseconds at 2000E and 16 to 20 milliseconds at 600E) was recorded at 1350E. The associated apparent resistivity of 700 ohm-metres suggests a disseminated sulphide or graphite source rather than a "massive" one. The maximum depths to source are considered to be between 100 and 200 feet, but are difficult to gauge due to the source not having sharply defined sides. This anomaly is not *clearly* seen on line 84S, but *may* correlate with two narrow sources at 300E and 450E - See report TAS-025C.

The only other significant chargeability response was recorded to the east of 100E (Old baseline) where chargeabilities rise from a low background of 5 milliseconds on the baseline to over 25 milliseconds 400 feet east. The high 2000 ohm-metres resistivities show the source to be disseminated sulphides (or graphite). This response can be traced south across line 84S, but is not seen on line 90S, and *may* continue north across lines 72S and 66S (see Report TAS-018B).

LINE 84S Surveyed between 1050E and 2750E (new baseline) 250E (old baseline)

The main feature noted on the recently surveyed section, is the

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rise in chargeability from a 5 milliseconds base level on the eastern end of this line at 2500E of 5 milliseconds to 2750E where it reaches 30 milliseconds. As apparent resistivities remain about 1000 ohm-metres, the source material must be disseminated or if massive, electrically discontinuous sulphides (or graphite) within a resistive host.

LINES 90S AND 96S

No significant responses.

POLE-DIPOLE DETAIL

The pole-dipole survey was conducted over four lines, 96S, 99S, 105S and 108S, two of which, 96S and 108S, have been previously surveyed using gradient array.

Each pole-dipole line is discussed separately.

LINE 108S

A sharp well defined gradient EIP chargeability anomaly of some 20 milliseconds or so superimposed on a lowish background of 7 milliseconds was recorded at 550E. The maximum depth to the source was considered to be about 50 to 100 feet.

The pole-dipole data shows a *classic* double peak response on the $a = 50$ feet, $n = 1$ to 4 data. This clearly shows the source to

lie at a maximum depth between 100 feet and 200 feet at about 525E. This data also confirms the source to have a less resistive core with apparent resistivities of less than 300 ohm-metres being recorded. It should be noted that should the source be significantly less wide than the dipole used (50 feet), this will somewhat understate the conductivity of the source by dilation of the response.

The multi-spaced data shows that cover and/or oxidation in this area is of very limited thickness.

LINE 105S

On this line the pole-dipole array was surveyed using an *a* spacing of 100 feet at $n = 1, 2, 3$ and 4. The anomaly appears to indicate a source within 100 to 150 feet of surface centred at 500E, which on the shallower spacing is seen to have apparent resistivities of as low as 100 to 200 ohm-metres. The interpretation of this response is that the source increases in significance with depth; is either conductive and narrow near surface; or merely oxidised near surface to give lower resistivities and chargeabilities.

It is worth noting that the gradient data on line 102S shows only normal backgrounds with a very minor increase at 700E (4 milliseconds) which would not normally be considered significant (see report TAS-025C).

LINE 99S

This line was surveyed using pole-dipole at $a = 100$ feet and n spacings of 1 to 4 between 050E and 900E.

This data reveals a chargeable source to lie at about 650E at a depth estimated to be about 100 feet. The chargeable source has resistivities of 500 ohm-metres which indicates a host less resistive than the enclosing material. The source width *may* be as great as 100 feet.

LINE 96S

The gradient array data showed a 10 to 12 milliseconds response situated at 460E coincident with an increase in apparent resistivity to about 2000 ohm-metres from a 1000 ohm-metres background. The $a = 50$ feet $n = 1$ to 4 pole-dipole data shows a 15 to 20 milliseconds response to be present between about 350E and 550E which gives the appearance of a double peak. Thus the depth to source is considered to be less than 25 to 30 feet. The apparent resistivity data shows no significant change in the 500 ohm-metres resistivity.

It is concluded that the source lies between 25 and 30 feet vertically below 450E, and that the source is disseminated or electrically discontinuous sulphides within a resistive host at depth.

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A second chargeable source located on the gradient array at 850E was confirmed on the pole-dipole array. The maximum depth is considered to be between 50 and 100 feet. The shallow ($a = 50$ feet, $n = 1$) spacing, shows the zone near surface to be somewhat more conductive. This may indicate the presence of some oxidation over the source.

A third very minor response of 2 to 3 milliseconds above background was recorded on the gradient array at about 1050E. This is seen on the $a = 50$ feet, $n = 3$ spacing as a broad response of about 2 to 3 milliseconds. However, the response is hardly seen on the other spacings.

The apparent resistivities recorded on this line by the pole-dipole array were often less than 30% to 50% of those observed on the gradient array. This, together with the fact that the resistivity observed, often increased with the larger spacings on the pole-dipole array, indicates the presence of a shallow conductive (soil ?) cover over some section of the lines.

SOME COMMENTS ON THE CONTOUR INTERPRETATIONS IN THE "NEW AREAS"

The additional areas surveyed west of the main grid appear to have a grid north-north-east to north-east strike as judged by

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the occurrence of the major induced polarization highs. This apparent strike conforms with that observed on the magnetic contour interpretations of the main grid (see report TAS-018B Plate 4) between lines 78S and 42S. Such a trend could not have been readily apparent on either the chargeability or resistivity data due to the low amplitude of variations of the properties, although this trend *could* be contoured in.

Undoubtedly the main feature on the area as a whole is the major grid north-north-east/south-south-west trending induced polarization response centred at 1400E to 1600E on line 72S. (Crown Hill anomaly). This response is seen to extend over 2000 feet and is characterised by both high chargeabilities and a conductive centre. This zone lies in close proximity to, and semi-parallel to a narrow "Mottled Dark Green Crystal Lithic" member of the Comstock Tuff unit. Although no argillaceous beds have been mapped coincident with the response, they have been mapped on *either side of it* on line 72S (at 1400E and at 1900E). It is significant that higher chargeabilities (20 milliseconds, plus) are pretty well confined to the areas mapped as "Mottled Dark Green Crystal Lithic Tuff" west of the main baeline. It is also significant that both pyrite and shale formations have been recorded in the area. The former could well account for the higher chargeabilities observed, while the latter, the lenticular shape of the anomalies. However, it cannot be assumed that this is so, and the Crown Hill anomaly

should be carefully investigated to ascertain its source.

The "Mottled Dark Green Lithic Tuff" is generally characterised by low resistivities, however, those observed within the area mapped as Crown Hill Porphyry are also low, the difference between them appears to be in their chargeability background, the latter being about half the level of the former.

In general, those areas mapped as Ignimbrites are characterised by the highest resistivities (3000 + ohm-metres), although areas of lower resistivities do occur (1500 ohm-metres). Chargeabilities over these areas are, however, low.

CONCLUSIONS

1. A significant induced polarization response (Crown Hill Anomaly) was recorded on lines 60S to 78S inclusive, which may continue on to line 84S between 200E and 400E (See Report TAS-025C). The higher chargeabilities are generally accompanied by lower resistivities, which indicate the chargeable material to be contained within a host less resistive in comparison with the enclosing material. The source, however, is *not* considered to be conductive as such, as the *absolute* resistivities are too high (400 to 1000 ohm-metres).

The extent of this zone is as follows....

- Line 60S: higher background 1000E - 1900E, anomaly centre
27 milliseconds at 1750E.
- Line 66S: higher background 250E - 1850E, anomaly centre
50 milliseconds at 1650E.
- Line 72S: higher background 650W - 1900E, anomaly centres
46 milliseconds at 1450E and 44 milliseconds at 1550E.
- Line 78S: higher background 700W - 1650E, anomaly between
750E and 1500E, centred at 1350E (?) 37 milliseconds.

2. The pole-dipole data reveals the following...

- a) The gradient response on line 108S at 550E was confirmed. The depth appears to be less than 50 to 100 feet, while the source is indicated to be narrow and conductive.
- b) The depth to source on line 105S appears to be 100 to 150 feet below surface. The source is either oxidised near surface, or is conductive, only near surface. The former explanation is favoured.
- c) The source on line 99S is again shown to be conductive and chargeable and lies at a depth of about 100 feet below surface at 650E (± 25 feet).
- d) The source of the disseminated sulphide (or graphite) response on line 96S is considered to be at 25 to 30 feet below 450E.

A second smaller response at 850E was confirmed to lie

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at a maximum depth of between 50 and 100 feet.

3. The Crown Hill induced polarization anomaly stands out not only in the new areas, but also in the area as a whole. It appears that the higher chargeability zones and lower resistivity areas are confined to the zones mapped as "Mottled Dark Green Lithic Tuffs" and as pyrite and shales have been noted in this area, the pyrite in disseminated form *may* account for the higher chargeabilities while the lenticular anomaly *may* be due to slates. In spite of this it is strongly recommended that the source of the Crown Hill anomaly be clearly ascertained.

The Crown Hill porphyry unit, like the Mottled Dark Green Lithic Tuffs, is characterised by the lower resistivities (1500 ohm-metres and less). However, on the whole, they can be distinguished from them by lower chargeability backgrounds (12 + milliseconds).

The Ignimbrite areas are characterised by higher resistivities (3000 ohm-metres+) and low chargeability (12 milliseconds₊).

4. It is considered that the pole-dipole detail surveyed on this grid was not superior to the initial gradient array data, other than to better define the source. This conclusion will of course, not generally be true.

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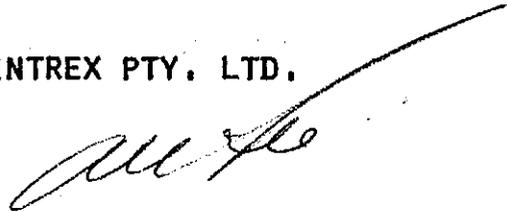
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Page - seventeen

5. It is recommended that a ground magnetometer survey be carried out over the extensions west of the main baseline, preferably in the two magnetometer mode used on the Beatrice and White Spur grids.

Respectfully submitted on behalf of:

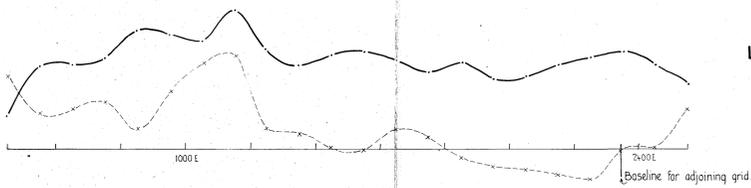
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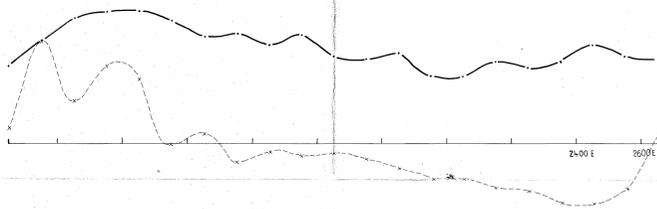
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GEOPHYSICIST

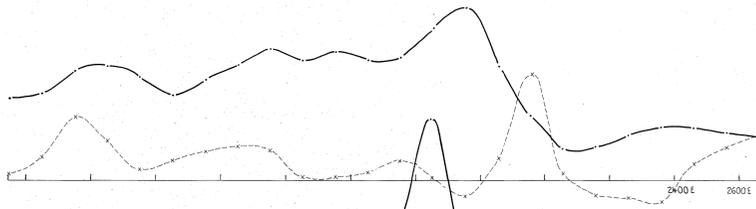
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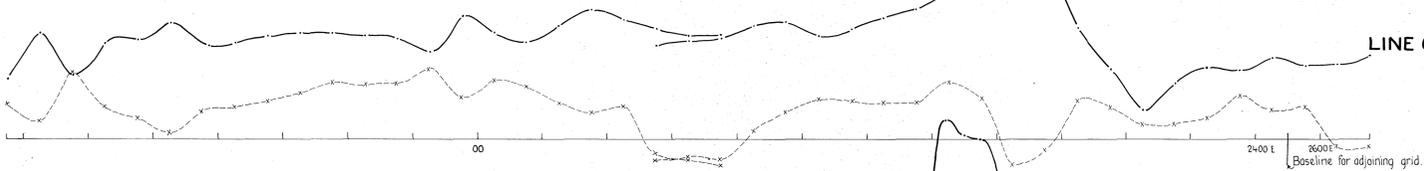
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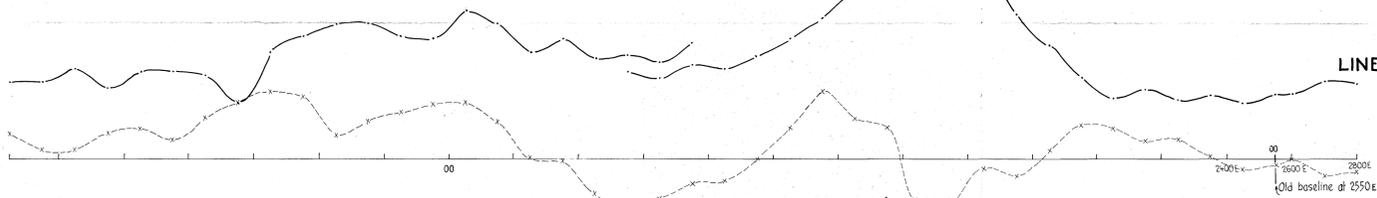
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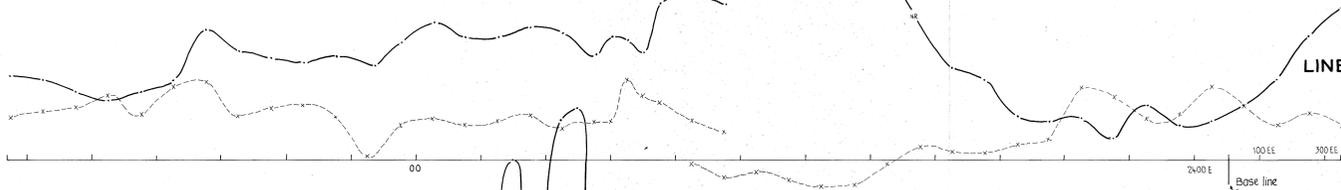
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LINE 66S

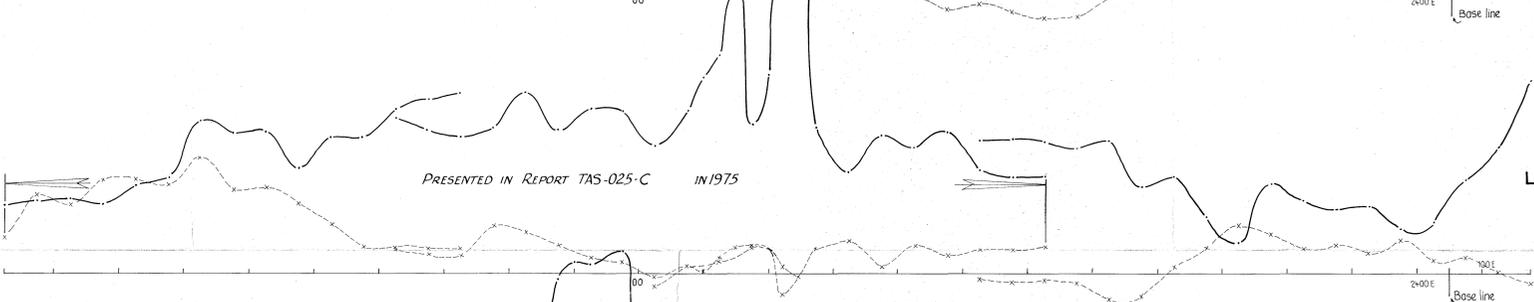


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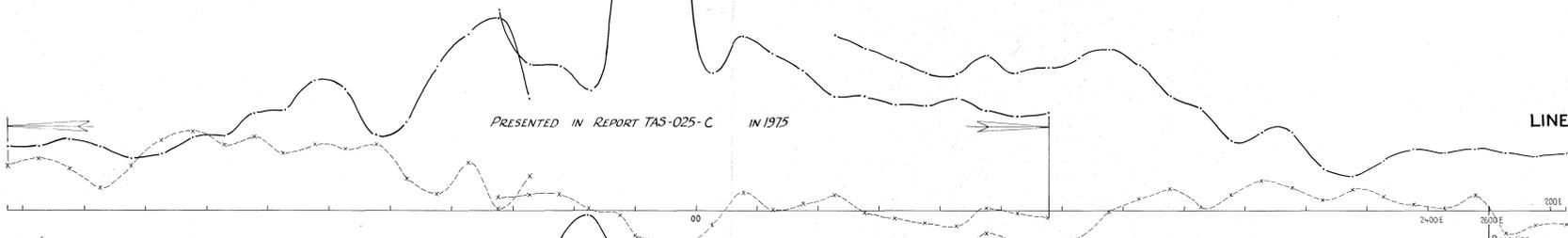


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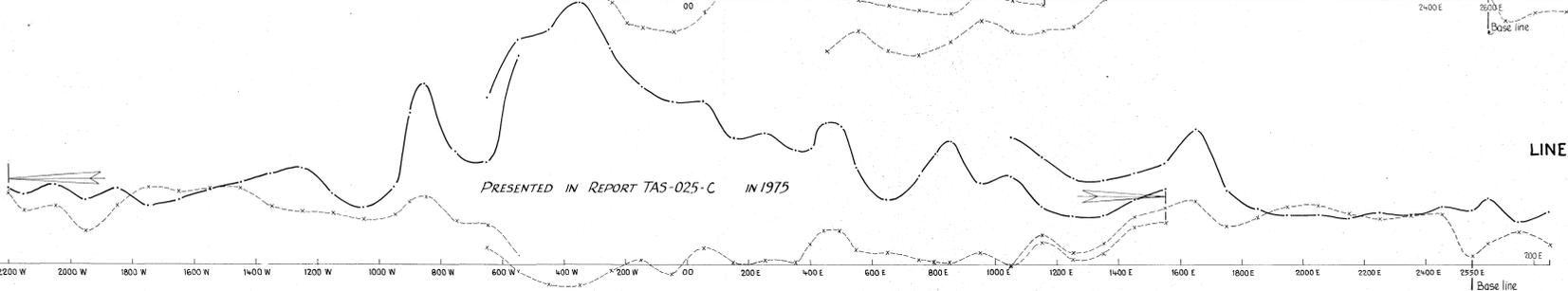
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10,000
Chargeability in Milliseconds
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LINE 84S



LINE 90S



LINE 96S

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LEGEND

Chargeability 1 inch = 10 milliseconds
Base Level: 00 milliseconds
Resistivity 2 inches = 1 logarithmic cycle
Base Level: 1000 ohm-metre

**MOUNT LYELL MINING
RAILWAY COMPANY**
WEST SEDGWICK (E)
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**ELECTRICAL INDUCED POLARIZATION
GRADIENT ARRAY
DATA PROFILES**

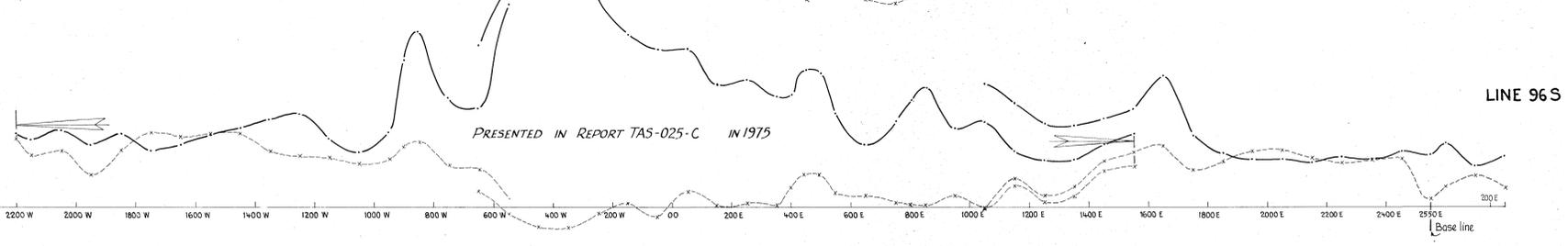
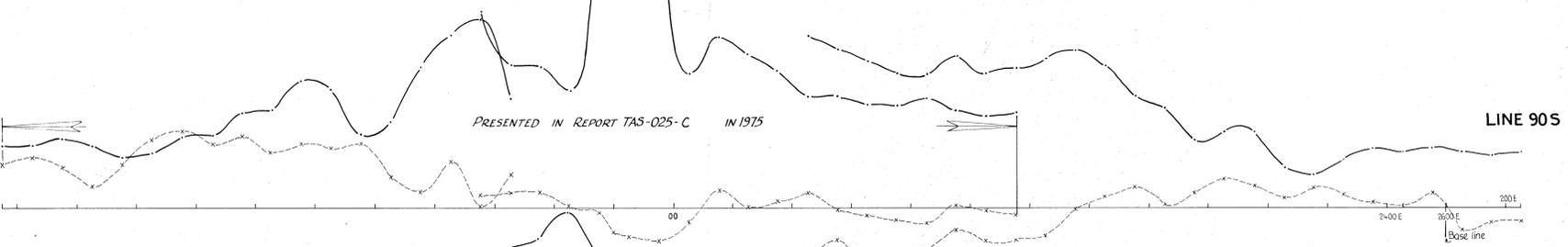
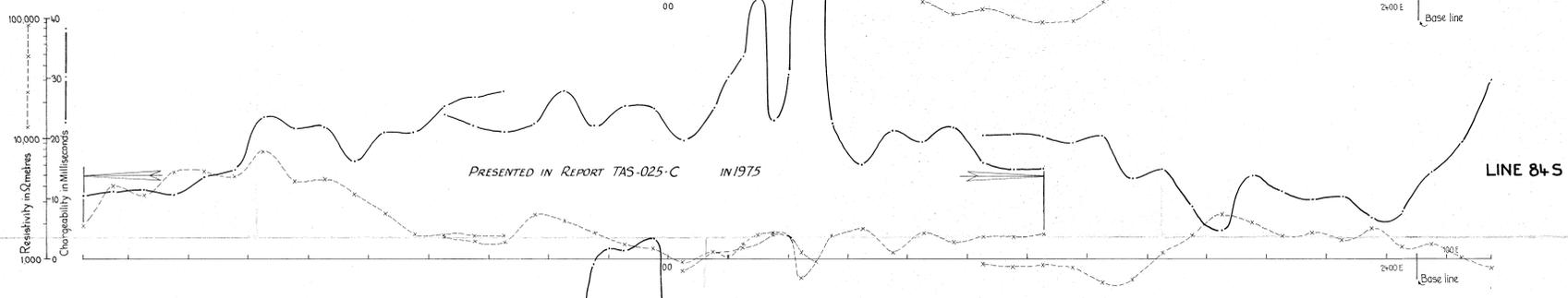
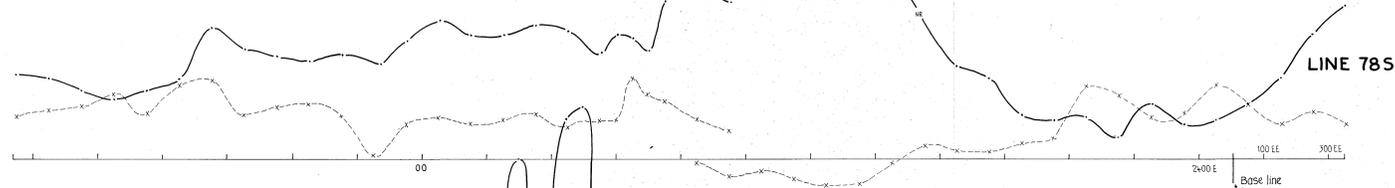
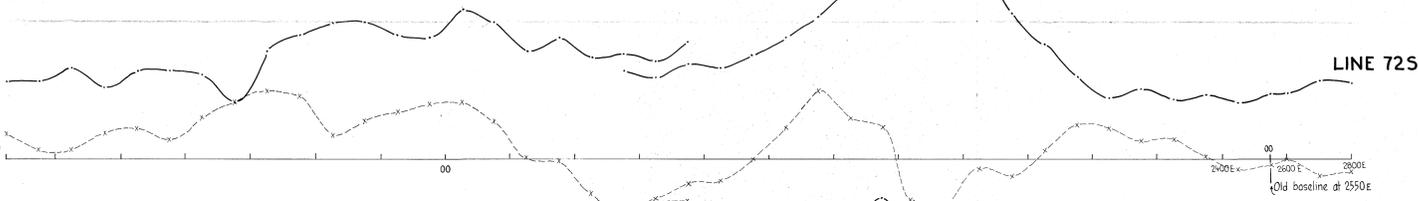
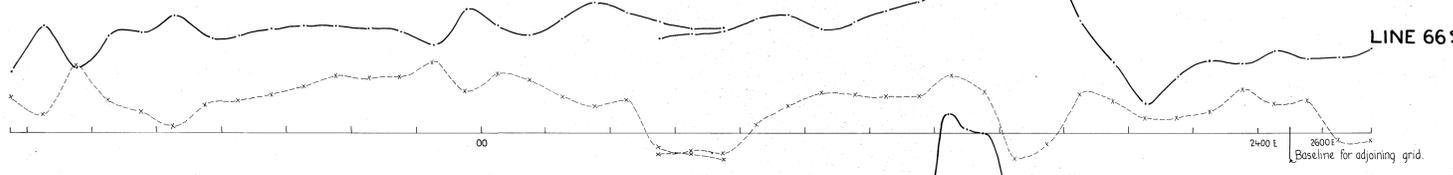
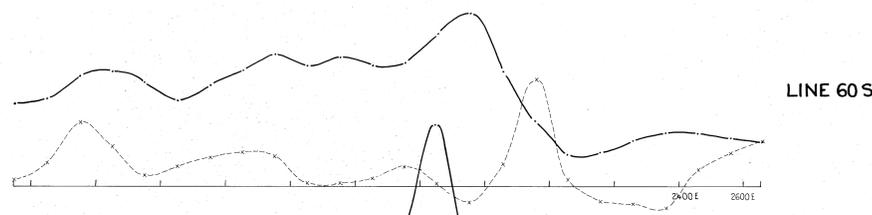
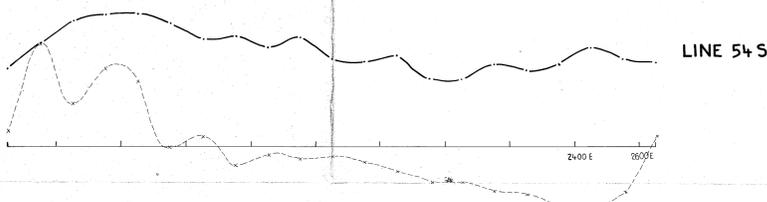
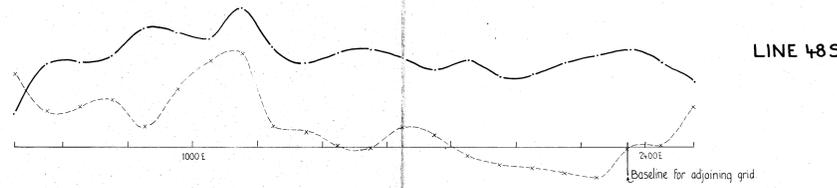
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Scale 1:2400

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LEGEND

Chargeability 1 inch = 10 milliseconds
 Base Level: 00 milliseconds

Resistivity 2 inches = 1 logarithmic cycle
 Base Level: 1000 ohm-metres.

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 WEST SEDGWICK (EXTENSIONS)
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**ELECTRICAL INDUCED POLARIZATION SURVEY
 GRADIENT ARRAY
 DATA PROFILES**

5 cm

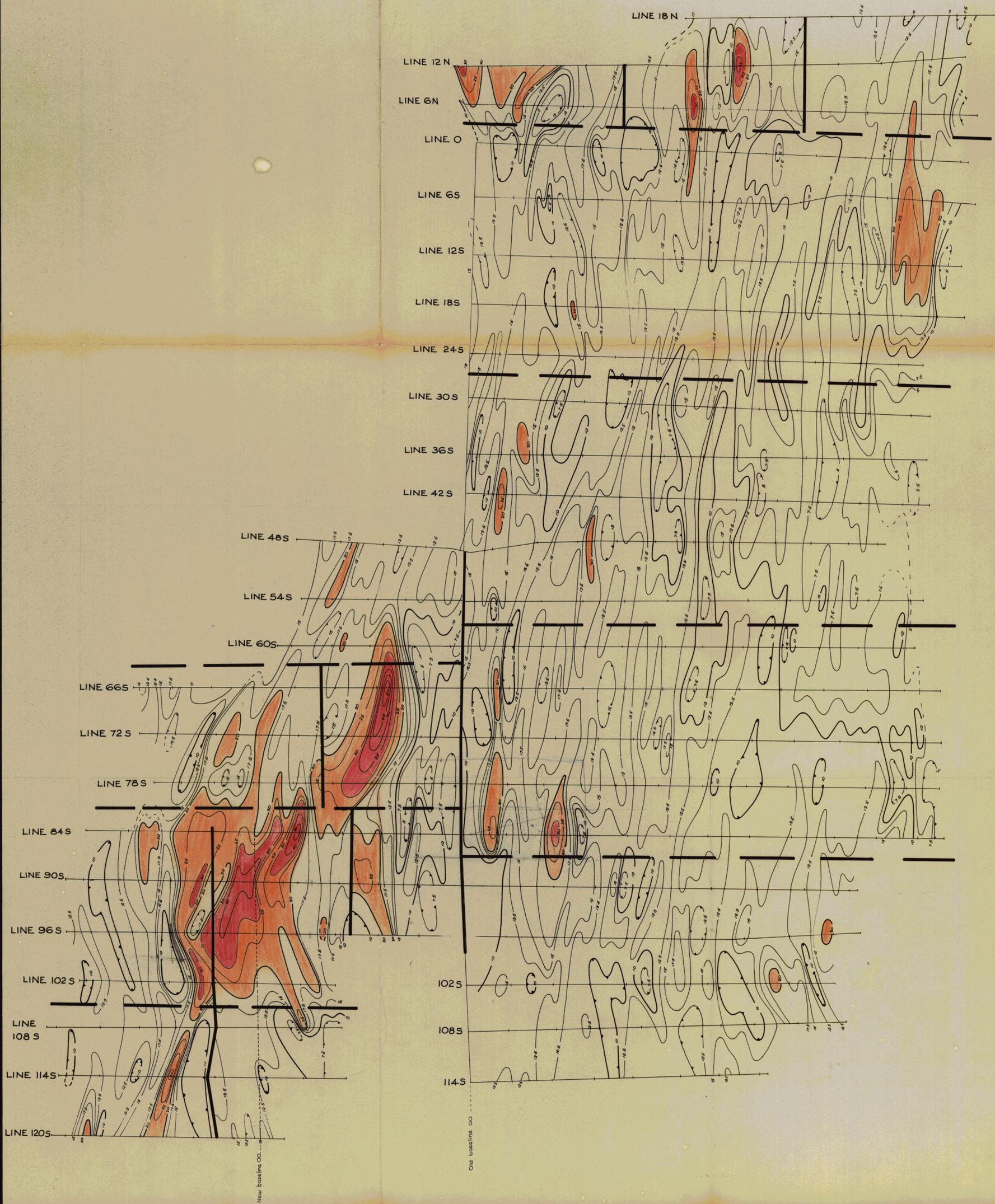
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 NOVEMBER - FEBRUARY 1977



Scale 1:2400

Job No TAS-035-B Sheet 1 of 1 PLATE 1

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LEGEND:
Chargeability contours in milliseconds
Gradient block boundary

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ELECTRICAL INDUCED POLARIZATION SURVEY
GRADIENT ARRAY
CHARGEABILITY CONTOURS



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NOVEMBER - FEBRUARY 1977

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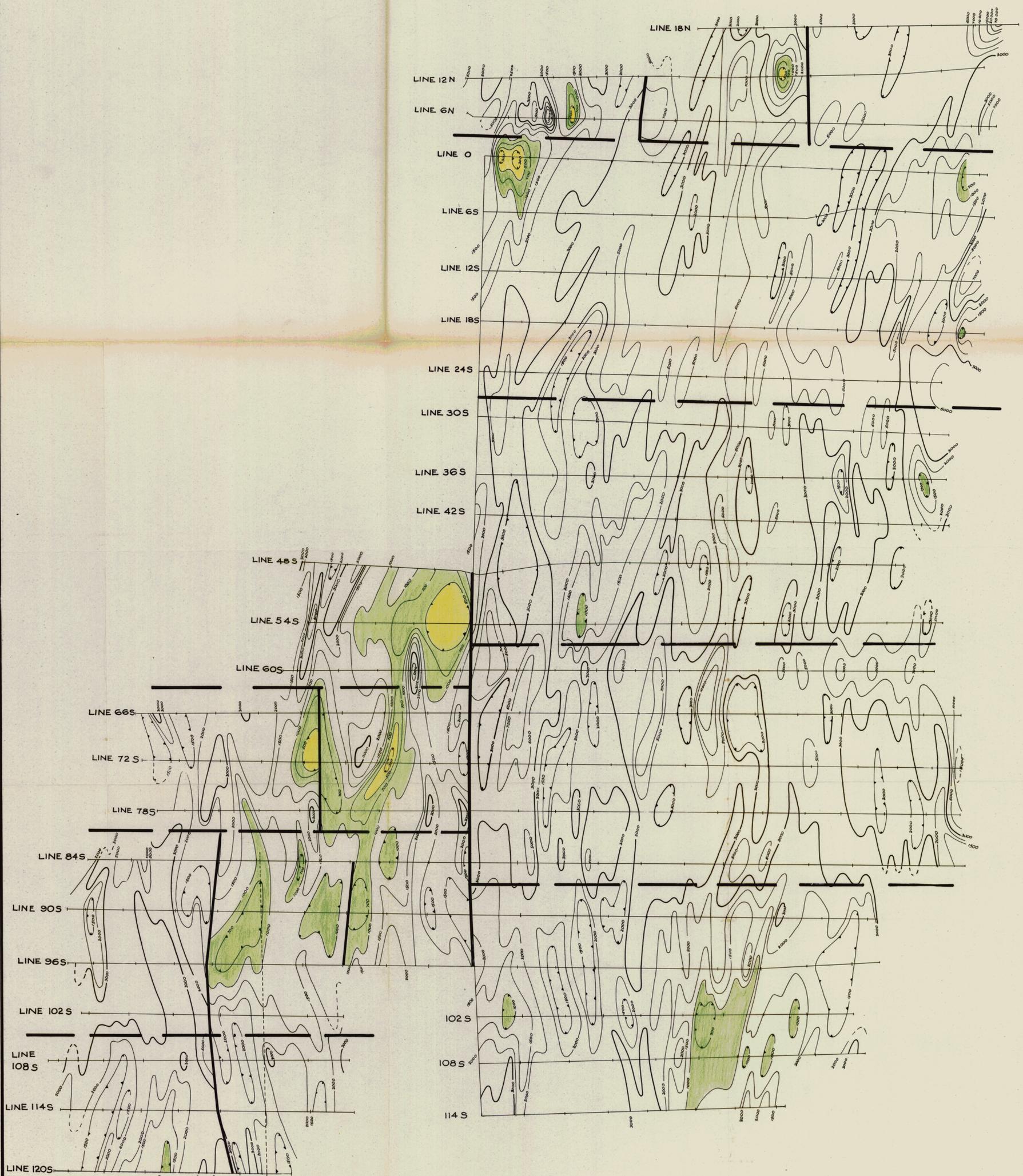
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Job No TAS-035-B Sheet 1 of 1

PLATE 2

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LEGEND:
 Resistivity contours in ohm-metres
 Gradient block boundaries

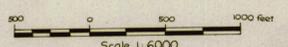
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**ELECTRICAL INDUCED POLARIZATION SURVEY
 GRADIENT ARRAY
 RESISTIVITY CONTOURS**



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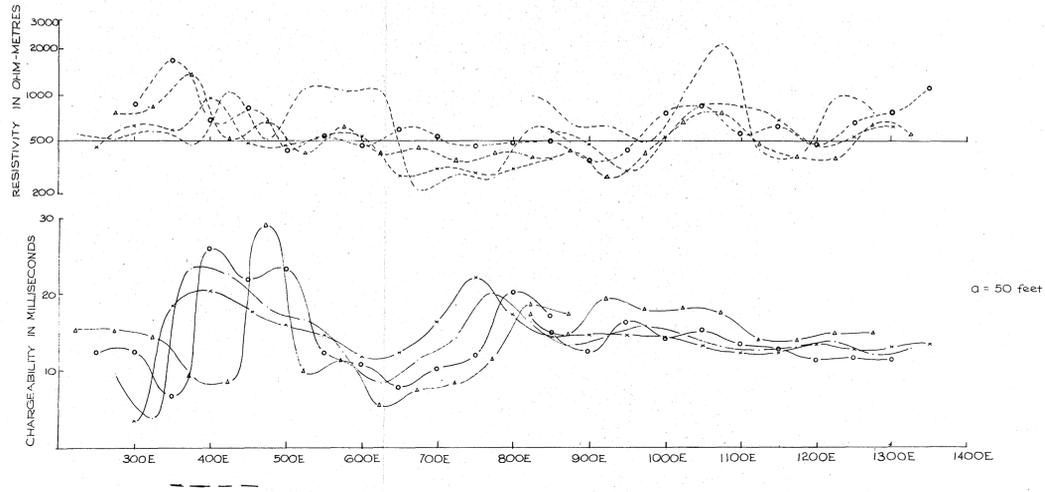
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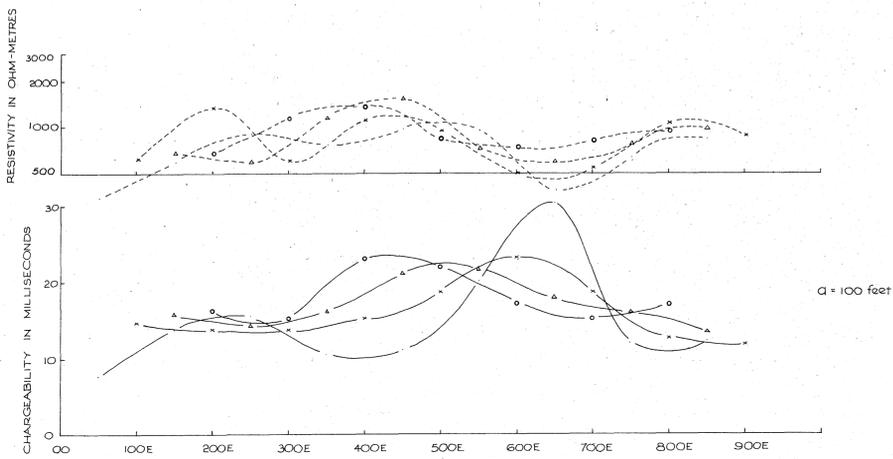
Job N° TAS-035-B Sheet 1 of 1 PLATE 3

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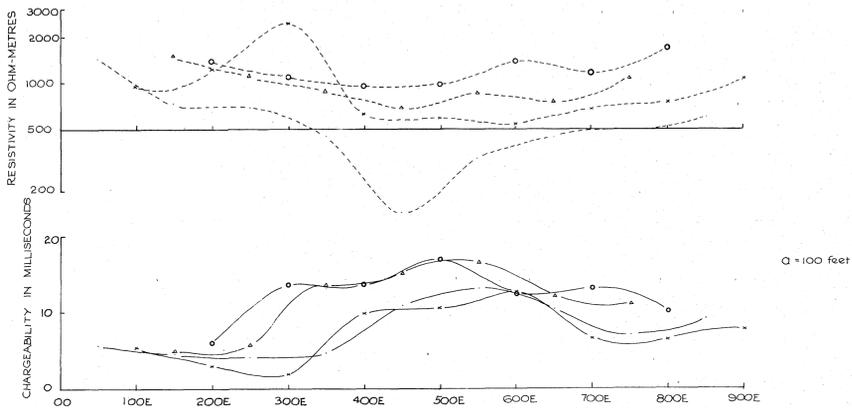
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Line 99 S

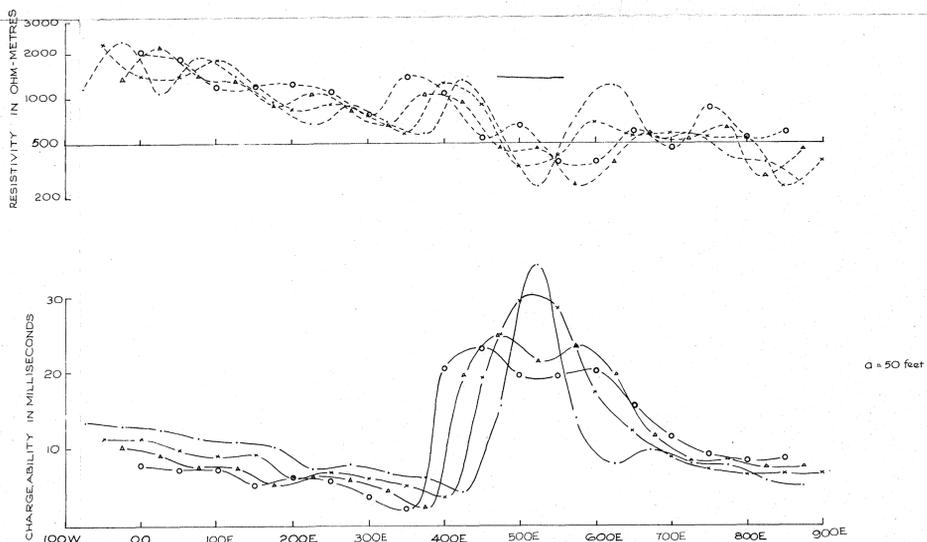


Line 105 S



LEGEND:
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 n = 2 ———
 n = 3 ———
 n = 4 ———

Line 108 S



**MOUNT LYELL MINING &
 RAILWAY COMPANY LTD**
 WEST SEDGWICK
 (NR) QUEENSTOWN - WEST COAST - TASMANIA

322025
 ELECTRICAL INDUCED POLARIZATION SURVEY
 POLE - DIPOLE
 DATA PROFILES

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Scale 1:1200

Job No TAS-O35-B Sheet 1 of 1 PLATE 4

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