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A REPORT ON

ELECTRICAL GEOPHYSICAL SURVEYS

OVER THE BEATRICE GRID

NEAR QUEENSTOWN, TASMANIA

ON BEHALF OF

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

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GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

Further detailed pole-dipole, dipole-dipole, electrical soundings and detailed gradient array have shown the north-western section of the Beatrice grid to have large induced polarization responses characteristic of disseminated sources, which in the area of the soundings appears to be overlain by a layer which is resistive and has low chargeability.

With the exception of a 10 milliseconds (14 millivolts/volt) response at 16N/ 1165W (as yet unexplained), the correlation between the detailed and reconnaissance surveys is good.

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INTRODUCTION

A series of gradient reconaissance, gradient detail, down-hole, Schlumberger array soundings, dipole-dipole and pole-dipole electrical induced polarization surveys were carried out over the Beatrice grid in the 78/79 field season. The details of each of these surveys is as set out in Table I.

Each of the above surveys is separately discussed

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TABLE I

GRADIENT ARRAY EXTENSIONS

C_1, C_2 at 800W and 2500W on line 17N, P_1, P_2 30 metres

Line 20N from 2085W to 1515W

Line 18N from 2055W to 1395W

Line 16N from 2265W to 1185W

Line 14N from 2385W to 1215W

DETAILED GRADIENT ARRAY

C_1, C_2 at 400W and 1400W on line 18N, P_1, P_2 10 metres

Line 20N from 1215W to 605W

Line 18N from 1385W to 605W

Line 16N from 1195W to 605W

C_1, C_2 at 250W and 1250W on line ~~14N~~ 12 N, P_1, P_2 10 metres

Line 14N from 1255W to 605W

Line 12N from 1045W to 455W

Line 10N from 1045W to 455W

POLE -DIPOLE

a = 20 metres n = 1 to 4

Line 1 300N to 20N

Line 2 320N to 40N

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DIPOLE - DIPOLE

a = 20 metres n = 1 to 4

Line 16N 940W to 820W

ELECTRICAL SOUNDINGS

SX-1 Line 16N/1162W

b = 0.1, a = 1, 2, 5, 10, 20, 50, 100

b = 2, a = 100, 200, 400

SX-2 Line 18N/1700W

b = 1, a = 10,20, 50, 100, 200, 300

DOWN-HOLE EIP & RESISTIVITY

Three-array a = 2.5 metres

MS-1 from 21 metres to 327 metres

MS-2 from 46 metres to 299 metres

MS-3 from 20 metres to 325 metres

GRADIENT ARRAY CHECK LINE

C_1, C_2 at 1960W and 00W on Line 16N, P_1, P_2 = 30 metres

Line 16N from 1695W to 735W

I - EXTENSIONS TO BEATRICE GRID

The data profiles are presented on a horizontal scale of 1:2500, and vertical scales of 1 centimetre = 2 millivolts/volt for chargeability, while resistivity in ohm-metres was shown on a 10 centimetre log cycle. The chargeability and resistivity data has been spliced into the original contour plan at the scale of 1:6000.

The lines surveyed were as follows:

20N 2085W to 1515W

18N 2055W to 1395W

16N 2265W to 1185W

14N 2385W to 1215W

The energising dipole for these lines was placed at 17N/800W and 17N/2500W. The reading interval was 30 metres, while three slices M_1, M_3 and M_5 were read but only M_3 is displayed on the data profiles, as on the whole, only very minor deviations from a normal decay form were observed.

The salient features observed in the survey are best viewed in contour form. This shows a major contact crossing line 16N and 14N at about 1820W and 1650W respectively. On the former the contact is sharp and on the latter more gradual between higher chargeabilities of 40 millivolts/volt(+) to the north-east, and lower chargeability background of less than 10 millivolts/volt to the south-west.

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The former have an approximate grid north-west/south-east trend, while the latter have a grid north-south trend. The sharp change also infers either a near vertical contact, or one which dips to the east. On line 16N the contact is very sharp, inferring a rapid transition such as a fault between the low and high chargeability sectors. On line 14N the chargeability increase is more gradual, inferring a progressive increase in chargeable material from west to east, *or* perhaps a westerly dipping slope to a sharper contact.

North of line 16N the western boundary of this zone is open.

The resistivity over the highly chargeable sector to the north-east has a lower background resistivity of 2000 ohm-metres (±) as against twice this to the west. This infers that the western sequence is of higher silica content and very minor mafic mineral content. The north-eastern sector must be due to disseminated material within a resistive host. There cannot be significant interconnection between sulphides over any significant length.

Each of the significant features on each line is discussed below by line.

LINE 20N ..... On this line the chargeability remains above 40 millivolts/volt between the western end of the line (which is open to the west) and 1575W, east of which a sharp fall was recorded to 25 millivolts/volt at 1525W. While the entire section between these co-ordinates is anomalous, a number of local maxima at 1950W (52

millivolts/volt), 1725W (50 millivolts/volt), 1660W (51 millivolts/volt) and a shoulder at 1600W (44 millivolts/volt) all represent local segregations of chargeable material within this section. None of these maxima are related to significant decreases in resistivity, and therefore the sources are wholly disseminated in nature.

Their *form* suggests steep dips to the sources in all four cases, with perhaps the suggestion of an east dip in the case of 1950W. In all cases the maximum depth to source looks to be of the order of 75 metres.

LINE 18N ..... This line, while very broadly similar to line 20N, is in detail very different. While high chargeabilities above 45 millivolts/volt characterised the data profile between 1600W and 2025W, the fall off to the east was gradual on this line as against rapid on line 20N. The western contact is extremely sharp with the fall in chargeability being from 57 millivolts/volt at 2025W to 14 millivolts/volt only 25 metres to the west. Normally such a fall would be suspect, however, a similar fall was noted on line 16N to the south. The contact between the chargeable eastern and less chargeable western section is thus sharp, lies at about 2040W and is shallow, being less than 25 metres.

The individual chargeability maxima cannot be related to any seen to the south or north. These were 56 millivolts/volt at 2025W, 54 millivolts/volt at 1937W and 62 millivolts/volt at 1785W. The depths to these maxima appear to be of the order of 25, 35 and 50

metres respectively.

The resistivities remain about the 2000 ohm-metres level over the whole sector and show no significant change over the more chargeable zones. Thus, like the lines to the immediate north and south, the source is disseminated chargeable material. The decay form, just a little faster than normal, infers a 'normal' grain size to the causative material.

LINE 16N ..... This line was surveyed over a longer line length from 1185W to 2265W and shows three distinct units. The most spectacular was a high 52 millivolts/volt response from 1825W to 1425W. The contacts on both sides are sharp, inferring a rapid transition between the chargeable and non-chargeable sources. The general form suggests a steep east dip to the zone as a whole. The resistivities at about 2000 ohm-metres over this zone indicate a disseminated source. These increase to 5000 ohm-metres to the immediate west and to 2500 ohm-metres to the immediate east, showing that while the source is resistive, it is less so than the enclosing rocks. The chargeability maxima at 1750W, 1550W and 1450W of 55, 56 and 52 millivolts/volt shows 30%, 50% and 40% depressions in resistivity, indicating some interconnection between the causative sulphides (or graphite). Maximum depth to source is difficult to gauge, but assuming the local maxima at 1755W and 1455W to be single sources, the depth would appear to be a maximum of 75 metres.

To the east the chargeability levels off at about 36 millivolts/volt(±)

while the resistivity falls to about 1000 ohm-metres.

To the west a most dramatic change was recorded - a fall in chargeability to a background of about 2 to 5 millivolts/volt. (This is confirmed on the line to the south also) The resistivity is a higher 3000 to 5000 ohm-metres inferring, together with the low chargeability, an acid rock, with very low mafic mineral content.

An anomaly of some 16 millivolts/volt accompanied by lower resistivities of about 2700 ohm-metres was recorded at 2150W. The *form* of the response suggests an east dip. The maximum depth to source is about 60 metres.

LINE 14N ..... The general form of the data with low 8 millivolts/volt backgrounds in the west and high anomalous values in the east of 40 millivolts/volt is similar to line 16N. However, the western contact of the high chargeability zone is a gradual one rising from 8 millivolts/volt at 2000W to 48 millivolts/volt at 1500W. Whether this represents (a) a gradual increase in chargeable material from west to east, or (b) a *lensing out* between lines or (c) a dipping contact, is not known. Over the highest chargeabilities east of 1550W, there is a depression in resistivity to about 2000 ohm-metres from 4000 ohm-metres, inferring that there may be some interconnection between the sulphide (or graphite) source. Due to the form of the response it is not possible to judge depth.

The western section between 2400W and 2000W has low chargeabilities

of 6 to 8 millivolts/volt and high 3000 to 5000 ohm-metres resistivity. The rocks therefore are probably highly acid and of low mafic mineral content. Superimposed on this low background was a sharp 19 millivolts/volt response at 2230W which is accompanied by a depression of 30% in the resistivity to 2900 ohm-metres. The maximum depth to source is about 60 metres. This response correlates with that recorded on line 16N at 2150W and line 12N at 2085W. On the latter, the resistivity is much more depressed, and the chargeability is greater.

CONCLUSIONS

1 - The high chargeability zone consists of a series of individual maxima which probably represent segregations of chargeable material within a broad, chargeable host. The strike of the zone as a whole is about grid north-west/south-east. The strike of the individual events does not appear continuous. The western margin may be at least in part a fault. Resistivities of 2000 ohm-metres (±) indicate the chargeable source to be disseminated in nature, while the form of the anomalies suggest depths to source varying from 60 to 80 metres.

2 - To the south-west of the chargeable zone referred to above, the resistivity increases to 3000 to 4000 ohm-metres while the background chargeability remains a low 6 to 10 millivolts/volt(±). These rocks must be mafic mineral poor. A distinctive induced polarization anomaly clearly demonstrates the strike direction in this section to be grid north-south in conformity with that seen on lines 12N and to the south on the original survey.

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The anomaly located is best seen on line 12N at 2085W (original reconnaissance survey), but is clearly traced across lines 14N at 2230W and 16N at 2150W, where the maximum depth of source is about 60 metres.

II - DETAILED SURVEY

The data profiles are presented at a horizontal scale of 1:1000, while the contour presentation of the data is at the scale of 1:2000. The data profiles employ a vertical scale of 1 centimetre = 2 millivolts/volt while the resistivity in ohm-metres is shown on a 10 centimetre log cycle.

Lines 20N, 18N, 16N, 14N, 12N and 10N were surveyed using a 10 metre potential dipole between *about* 600W and 1200W. The current dipole was 1000 metres ~~placed on line 10N~~. All three slices M_1, M_3 and M_5 were recorded, but only M_3 has been plotted.

Each line is discussed separately below.

LINE 20N ..... The most striking feature is the very high chargeability recorded between 950W and 1135W of 38 millivolts/volt(+). Within this zone there are three distinct highs as follows.

Between 1062W and 1135W chargeability rises very sharply to 65 millivolts/volt ($\pm$6). The sides of the response suggest a maximum depth to source of 20 metres, while the sharpness infers a rapid transition into less chargeable rocks. The associated resistivities are 1500 to 3000 ohm-metres. The two minima of 1300 and 1500 ohm-metres recorded at 1115W and 1095W probably indicate some weak interconnection within the chargeable material.

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The second chargeability maximum was centred at 1015W where a 70 millivolts/volt response was recorded from a source estimated to be some 30 metres below surface (assuming a single source). The resistivity of 2000 metres again infers a disseminated source.

The most easterly maximum reaches a 58 millivolts/volt at 975W with a depression in resistivity to 2000 ohm-metres. A related shoulder of 45 millivolts/volt at 955W is also situated within a relative low. To the immediate east, the chargeability falls to near zero, while the resistivity rises to 5000 ohm-metres. These conditions exist to 800W (where cliffs interrupt the profile). East of 750W the resistivities fall progressivley to about 1500 ohm-metres while chargeability background rises from 8 millivolts/volt(±) to 12 millivolts/volt, higher chargeability being coincident with lower resistivity. Distinct maxima of 16, 16 and 22 millivolts/volt at 675W, 645W and 625W are interpreted as coming from shallow sources at about 15 metres.

LINE 18N ..... This line was surveyed between 605W and 1385W, with a gap between 1095W and 1135W.

The most significant chargeability response was recorded between 960W and 1085W. Between these limits the chargeability rises rapidly to 62-77 millivolts/volt, and is accompanied by slightly lower apparent resistivities of 2500 ohm-metres (±) as against 5000 ohm-metres to the immediate east and west. Thus, while the source material is less resistive than the enclosing rocks, it is

not conductive as such. The source is probably disseminated or weakly interconnected graphite or sulphides. The form of the edges of the anomaly suggest a steep dip, a sharp contact and a maximum depth of 75 metres to the source.

For 100 metres to the west of the anomaly the background chargeability is 20 to 22 millivolts/volt, after which it decreases to 8 millivolts/volt at 1335W. A sharp fall in apparent resistivity from 3000 ohm-metres at 1140W to 600 ohm-metres at 1195W infers a *major* change in rock type over this section. A similar rapid decrease in apparent resistivity from 1200 ohm-metres at 1300W to less than 200 ohm-metres at 1350W was recorded. Again a major change in rock type over this sector is interpreted.

To the immediate east of the prominent chargeable feature between 955W and 1085W, a sharp 26 millivolts/volt response was centred at 895W, against a background of about 10 millivolts/volt. The accompanying 3000 ohm-metres resistivity shows no material change, inferring a wholly disseminated source. The source has a maximum depth of 60 metres, and *may* dip steeply to the west.

Abnormally low near zero to negligible values were recorded for chargeability between 730W and 840W, over a zone having resistivity between 2500 and 4000 ohm-metres. This zone duplicates a similar one located in the reconnaissance survey, and correlates well with a similar zone on line 20N between *about* 825W and 950W. The source is obviously unusual, as high resistivity and low chargeability are

rarely seen together, particularly over a width of 100 metres or so. Very similar results were obtained on the reconnaissance surveys, which indicate the phenomenon is real.

East of 700W chargeability increases rapidly between 730W where they are near zero and 650W where they are 34 millivolts/volt. While there is an overall decline in resistivity, the resistivities of 1500 to 3000 ohm-metres still infer a disseminated, or if massive, electrically discontinuous source. A maximum at 645W and shoulders at 675W and 700W infer a series of separate sources, or a greater segregation of chargeable material at these points. The maximum depth to source is *about* 30 metres, assuming a single source.

LINE 16N ..... This line was re-surveyed between 605W and 1195W.

The most significant feature observed was anomaly 4.1 which was seen here in similar form as a major 60 millivolts/volt response at 980W $\pm$10 metres and 69 millivolts/volt at 935W. The former is associated with 2500 ohm-metres and the latter 1500 ohm-metres, which, while lower than the immediate background to the east and west of 5000 to 4000 ohm-metres, still infers a disseminated source. The maximum depth of this source is estimated at 50 metres ($\pm$). To the east and west of these two maxima, chargeabilities gradually decrease, and 'shoulders' and smaller maxima infer a series of lesser segregations of chargeable material to lie within more resistive rocks. This whole section lies on higher background of

26 millivolts/volt (+) between 850W and 1200W.

East of 850W a marked change in background chargeability occurs. Between 850W and 720W it is about 12 millivolts/volt, and between 720W to 600W about 6 millivolts/volt. Between these limits the apparent resistivity lies between 2000 ohm-metres and 6000 ohm-metres. Each of these chargeability differences represent compositional variation in the underlying rocks.

A distinct difference in profile form was noted west of the main response, 4.1, at about 1160W. On the original survey, a response of about 28 milliseconds was recorded, about 7 to 10 milliseconds above background (i.e. 10 to 14 millivolts/volt). In the present survey, and in a check line run to check the difference, there is no such distortion. Also, there are significant variations in resistivity. These differences are discussed under a separate heading.

LINE 14N ..... This line was surveyed between 605W and 1255W and the broad features are similar to lines 16N and 12N. In detail there are, however, considerable variations. A comparison with the detailed data shows generally good correlation, with the smaller dipole giving infinitely better resolution.

The major anomalism was located between 855W and 1065W. A distinct and significant response of 42 millivolts/volt at 865W was resolved from a shoulder of 14 milliseconds (20 millivolts/volt) in the original survey. A very slight fall in the 4500 ohm-metres resistivities to 3000 ohm-metres infers some interconnection within the

sulphide and/or graphite source. The maximum depth to source is about 30 metres. Between 915W and 1050W the chargeability varies between 44 and 50 millivolts/volt with inferred segregations of chargeable material at 925W, 965W, 1000W and 1025W. The maximum depth to source is difficult to ascertain except at 925W, where 40 metres appears to be the order. The first two maxima, and the last maximum are accompanied by distinct depression in resistivity to 1500 ohm-metres (±) while that at 1000W is about 2500 ohm-metres.

To the west of the major chargeable feature the background level of 28 millivolts/volt between 1070W and 1250W is accompanied by resistivity ranging from 1000 ohm-metres to 2000 ohm-metres. This correlates well with the equivalent unit to the north and south. The rock type must have significant mafic mineral content (and/or lesser sulphide and graphite) and is obviously less resistive than that usually observed in the region.

The electrical properties observed to the east of the main feature of interest are quite different. The background falls from 4000 ohm-metres at 840W to about 2000 ohm-metres at 600W, while the chargeability background is an unusually low 4 millivolts/volt. Superimposed on this background are three *relatively* significant responses of 12, 10 and 14 millivolts/volt at 780W, 725W and 645W, all accompanied by higher than local background resistivities. The sources therefore are disseminated in nature, and the source therefore is most likely an increase in the mafic mineral content of the rocks, which overall, are very low. The maximum depth to

source appears to be of the order of 20 metres.

LINE 12N ..... The general form of the chargeability profile is similar to line 14N, and shows a general north-north-west/south-south-east strike to the major high of 34 millivolts/volt which has contact with the ultra-low background to the east at about 730W, and to the higher background (26 millivolts/volt ±) to the west at about 860W.

The chargeability high between 730W and 860W has minor maxima at 765W, 795W, 815W and 835W, all of which lie within a *relative* resistivity low of 2000 ohm-metres as against 4000 to 6000 ohm-metres to the immediate west and east respectively. The maximum depth to the source cannot be accurately gauged.

To the west of 860W the chargeability background at 26 to 32 millivolts/volt is higher than average, while the resistivity at 3000 ohm-metres (±) infers a resistive host to that chargeable background, which is probably due to mafic mineral content.

To the east of 730W the chargeability background is an abnormally low 4 millivolts/volt (±2), while the resistivity varies between about 5000 ohm-metres in the west to 1500 ohm-metres in the east. Within this zone, relative highs of 16 millivolts/volt at 585W, 24 millivolts/volt at 565W, 24 millivolts/volt at 515W and 17 millivolts/volt at 475W are estimated to have sources at depths of 20 metres, 25 metres, 30 metres and 20 metres respectively. These

highs together with the low background are similar to units seen both to the north on line 14N and to the south on line 10N, but the *precise* correlation between zones is not possible.

LINE 10N ..... The higher readings were confined to a narrower width than those recorded on lines to the north, that is between 700W and 765W. Two distinct maxima each of 52 millivolts/volt at 715W and 750W are accompanied by 40% reductions in resistivity to 3000 ohm-metres and 1200 ohm-metres respectively. The cut-off of the eastern maxima is extremely sharp at 700W which infers either a vertical dip or more likely, a dip to the west to the chargeable source. The maximum depth to the source in both cases is about 35 metres.

To the west of 770W the background decreases from about 32 millivolts/volt to 22 millivolts/volt at 950W, and then increases to 36 millivolts/volt at the end of the line at 1045W. This section corresponds to similar sections seen to the west of the chargeability high on lines to the north.

To the east of the high, the background falls to near zero between 690W and 570W, and about 8 millivolts/volt between 570W and 450W. Over this section, the resistivities vary between 2500 ohm-metres and 6000 ohm-metres, averaging about 4000 ohm-metres. The source therefore is considered to be silica high, and mafic mineral poor overall, except for a section between 525W and 565W where chargeability of 10 to 14 millivolts/volt above this low level were

recorded from a source whose maximum depth is estimated at 20 metres.

CONCLUSIONS

1 - With the exception of line 16N which is discussed separately, the detailed survey gave much greater resolution and often resolved separate maxima, indicating two separate sources where only one was inferred by the reconnaissance spacing (e.g. zone 4.1 at 735W ± on line 10N). Similarly 'shoulders' on the reconnaissance spacing were shown to be of greater importance on the finer spacing, e.g. 865W on line 14N.

2 - The centre of all lines shows a significant chargeability high 40 millivolts/volt in amplitude, enclosed by an abnormally low chargeability rock unit to the east, and one of just higher than normal background to the west. While the overall strike appears about grid north south in the north, it veers to grid west 20° north in the south. Individual maxima cannot, however, be correlated from line to line, which infers an 'en-echelon' or lensoidal folded or even faulted series of segregations of chargeable material whose individual strike lengths are less than the line spacing.

As nowhere is the resistivity low over these maxima, the source is inferred to be disseminated, or at least electrically discontinuous. Some maxima show an *increase* in resistivity inferring perhaps silicification, while in other cases *depressions* in resistivity are observed, which infers some

interconnection between chargeable grains. Nowhere, however, are the sources conductive.

The maximum depths to individual segregations of chargeable material vary between 25 metres and 75 metres but average about 40 metres (±).

3 - To the west of the above, the backgrounds are invariably a higher than normal 28 to 36 millivolts/volt, while the resistivities remain high. There are rarely any significant chargeability responses superimposed thereon. 2000 ohm-metres (±) resistivities indicate the source rock to be resistive, and the chargeable material may be disseminated mafic material with perhaps sulphides, magnetite and/or graphite also present.

4 - The most interesting unit from an academic standpoint occurred to the east of the chargeable central zone where higher resistivities of 3000 ohm-metres (±) were coincident with low 5 to 10 millivolts/volt backgrounds. This infers a silica rich rock carrying low mafic mineral content. Local chargeability maxima superimposed on this low, indicate increases in mafic mineral content or alternatively sulphides. or graphite?

III - POLE-DIPOLE

Two pole-dipole traverses were conducted along tracks approximately grid north of diamond drill hole MS-2, to cross lines 14N and 16N as shown in the location diagram, (Figure 1).

The two lines are presented in pseudo-section form for the a = 20 metres, n = 1 to 4 spacings used. The current electrode was to the south.

The two traverses were surveyed in order to ascertain the chargeability and resistivity of black shale and sulphide bearing rocks which were located in the two bulldozer-cut tracks into the areas for access *after* the initial gradient array reconnaissance survey. The initial survey showed very low 4 milliseconds chargeabilities and high 4000 ohm-metres resistivities on line 2, and higher chargeabilities of 12 to 14 milliseconds at or in very close proximity to line 1, also with high resistivity. The detailed survey (see Plate 1) shows chargeability values which in form resolve narrower zones well (e.g. 14N/865W). The object of this survey was to investigate these rocks again, using a profile in the opposite sense to the original survey direction, as the strike was observed to be at a shallow angle to the gradient current flow on the original survey.

LINE 1 ..... commenced midway between lines 12N and 14N and crossed line 14N at 890W and line 16N at 840W and continued to a point about 90 metres beyond line 16N.

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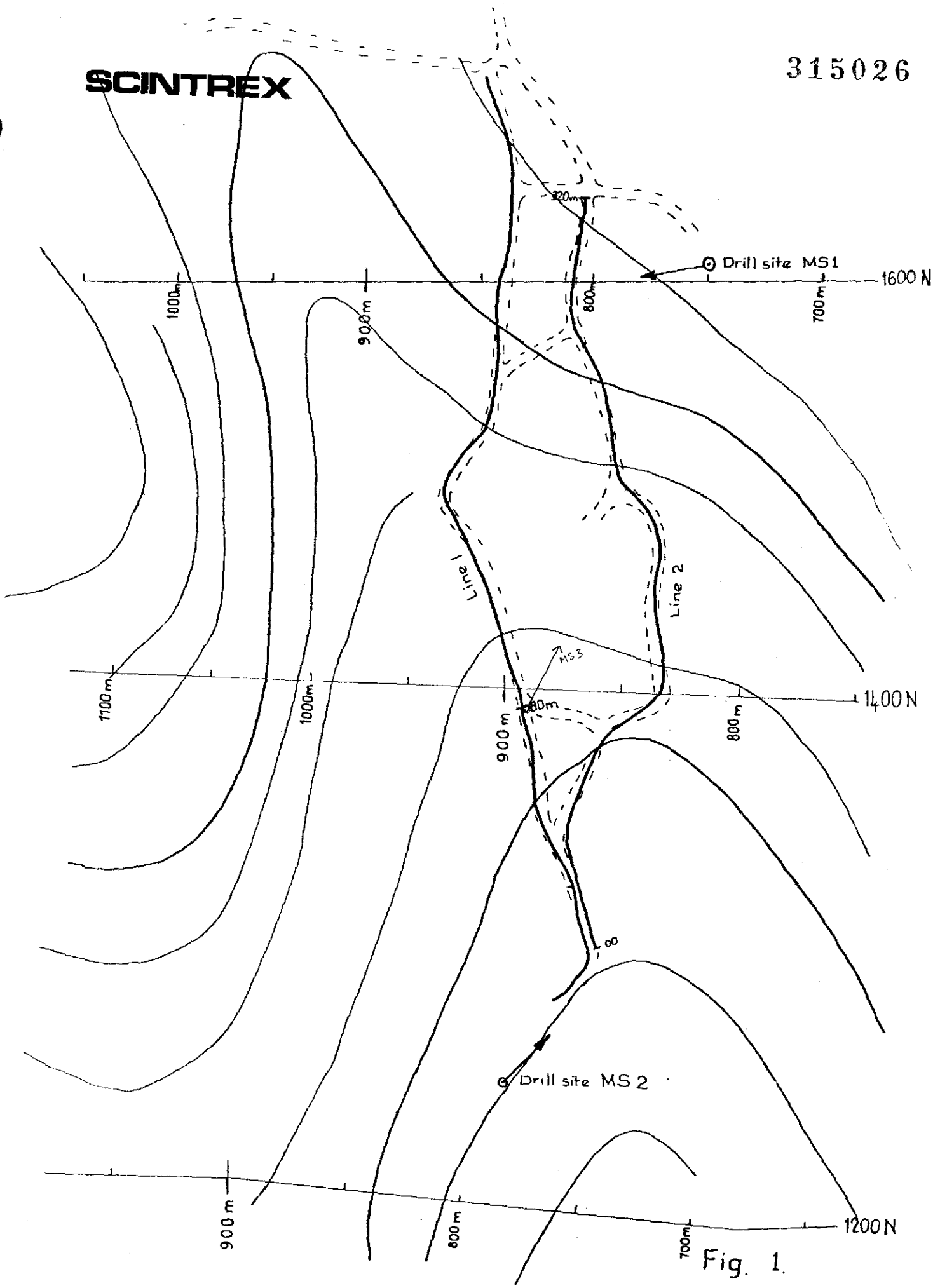


Fig. 1.

The first major observation is the much higher chargeabilities observed between about 60N and 280N of 45 to 50 millivolts/volt (32 to 36 milliseconds). The resistivities at 1000 to 2000 ohm-metres, while lower than observed on the gradient array, are still high. The chargeable source therefore is of an electrically discontinuous nature overall. As remarked above, this lies in close proximity to high chargeabilities to the immediate west (and on line 14N to the east also), which the Author understands lies under the crystal tuffs.

From the short a = 20 metre spacing it is quite clear that the chargeable source comes close to surface, and shows little structural variation within the zone, except perhaps an inference that below 240N ($\pm$20 metres) the rocks are *less chargeable* and *more resistive* than immediately above.

LINE 2 ..... starts off in close proximity to line 1, but then veers east to cross line 14N at about 830W, and line 16N at 815W.

The first observation is that the overall chargeability between about 250N and 40N is at 20 to 30 millivolts/volt (14 to 21 milliseconds) which is less than line 1, and more so outside these limits. (The gradient array chargeabilities also reached their minimum over this section - i.e. to the east of line 1). The resistivity varies about 2000 ohm-metres $\pm$500 ohm-metres, indicating like line 1 that the chargeable source is disseminated.

Higher values on the pole-dipole of up to 30 millivolts/volt at about 80N mark the position of the chargeable lense defined on the detailed survey at 14N/855W.

Between 140N and 180N a 'layering' in the chargeability was observed, n = 1 being 16 millivolts/volt(±), increasing progressively to 33 millivolts/volt at n = 4. This infers the surface layer of 20 metres(±) to have a lesser chargeability (16 millivolts/volt±) than the material at depth (40 millivolts/volt). These values are then similar to the central section of pole-dipole on line 1.

CONCLUSIONS

The pole-dipole chargeabilities are higher by a significant margin than those recorded on the reconnaissance gradient array, but broadly comparable with the detailed survey over the same section. The direction of energisation for the gradient array was at a shallow angle to strike and thus the inhomogeneity of electrical properties has most likely been emphasised here. It should be noted in this respect that both resistivity and chargeability *are not* homogeneous to different current energisation directions in all rocks. This inhomogeneity is naturally greatest in 'layered' rocks and minimal in homogeneous rocks (such as granulites).

IV - DIPOLE-DIPOLE, 16N

A short section of line 16N was surveyed using an a = 20 metres, n = 1 to 4, and the data is presented in standard pseudo-section format. The line was covered from 940W to 820W.

The data shows a progressive increase from low values of 3 to 8 millivolts/volt in the east (820W) to in excess of 40 millivolts/volt west of 940W. The resistivities range between 400 and 2600 ohm-metres, the lowest being on the n = 4 reading at 900W, coincident with relatively high chargeability. The high resistivity recorded on the n = 1 spacing either side of 900W corresponds well with a resistive feature centred at 920W on the detailed gradient array. The lower n = 4 readings are 'illusory' and are due to a 'double peak' effect of the lower resistivities centred at 895W and 925W either side of the high.

What the data does show is that the chargeability and resistivity features observed between 925W and 960W lie within 20 metres of surface.

Between *about* 860W and 900W the depths to chargeable sources under a less chargeable (14 millivolts/volt±) and less resistive (600 to 1000 ohm-metres) surface layer, is of the order of 40 to 60 metres. Further east still, no significant chargeability features were recorded.

CONCLUSIONS

The dipole-dipole line gives better 'minimum depth' information on the features detailed by the gradient array, but, as can be seen, does not resolve individual events well. 'Layering' between 900W± to 860W± infers a cover of about 50 metres (±) above more chargeable material below.

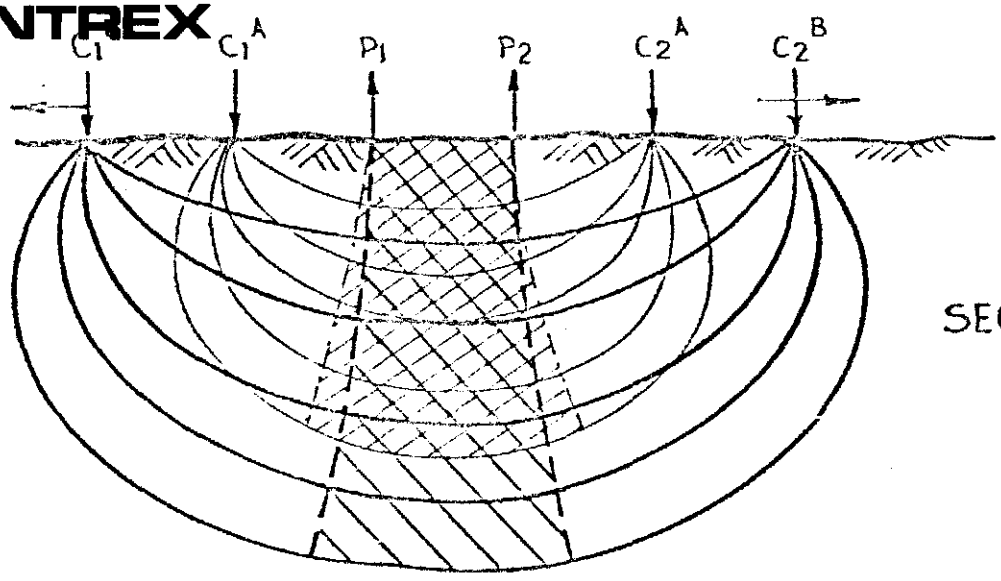
V - ELECTRICAL SOUNDINGS

METHOD

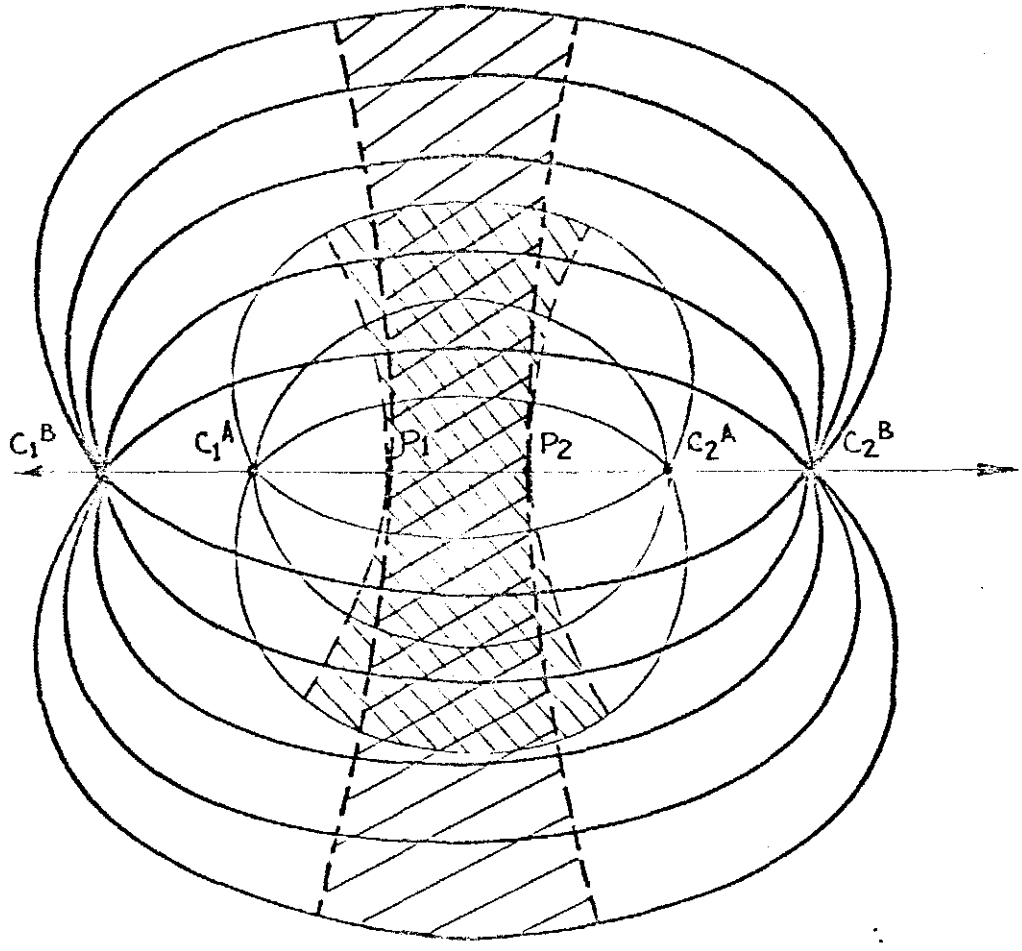
Some comments on the method are warranted in this case. The array chosen for the two soundings was the Schlumberger array and this is diagrammatically shown in Figure 2. Potential electrodes, P_1 and P_2 were placed a short distance apart, and current transmitted via electrodes C_1^A and C_2^A and the relevant resistivity computed from the voltage drop noted between P_1 and P_2. The chargeability was also measured via P_1 and P_2. The current electrodes are then subsequently moved to position C_1^B and C_2^B and further resistivity and chargeability measurements acquired. C_1 and C_2 were further moved out on a semi-log basis to 300 and 400 metres for the two soundings at Beatrice.

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 all three are certain to be present to some degree, and therefore the interpretation should be considered qualitative rather than quantitative. An additional complication in this case is that the terrain and access precluded the soundings being carried out on a plane (Note the depth to the contacts for an *inclined plane* will be *normal to* that plane, and not *vertical*).

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SECTION



PLAN

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

FIGURE 2.

PRESENTATION

The data from the two soundings in presented on 5 inch log cycle, the spacing a [$\frac{1}{2}(C_1 - C_2)$], in metres, and the apparent resistivity in ohm-metres.

The chargeability is presented in millivolts/volt, both as the actual reading and as a residual, the latter being the observed reading minus the assumed bulk value for the surface material. The observed readings are shown at a scale of 1 centimetre = 2 millivolts/volt, while the residual is presented on a 5 inch log scale.

SOUNDING 16N/1162W (SX-1) ..... The sounding was carried out as far as possible along strike.

Making the assumptions above, it can be readily seen that the upper layer is a resistive 10,000 ohm-metres and has low 10 millivolts/volt background chargeability within it. The decay form is about normal. The depth to the decrease in resistivity which takes place for spacings greater than a = 100 metres is assessed to be of the order of 40 to 60 metres. This must be regarded as a 'best guess' as the overlap reading for a = 100 metres and the steepness of the profile form for data points for a = 100 metres and greater both show that one or more of the conditions (i) to (iii) above are not wholly true.

A computer interpretation of the above gave the following layering:

Thickness	Depth	Resistivity
0.77	0.77	3371
20.73	21.50	13821
84.40	105.90	5407
48.00	153.90	2027
999845.10	999999.00	5226

It will be noted that this interpretation puts the less resistive layer assessed by the Author to be at 40 to 60 metres, at about 106 metres. The latter is the more likely as it takes into account the complex layering inferred by the profile.

The Author assesses the depth to the chargeable horizon to be of the order of 115 metres ± assuming a large contrast in the bulk resistivity of the overlying and underlying resistivities.

The decay form observed within both the upper low background zone and chargeable lower zone was about normal.

SOUNDING 18N/1700W (SX-2) ..... In this case the resistivity looks to be about 1000 ohm-metres (+) down to and including the chargeable layer. A computer interpretation assuming items (i) to (iii) above makes a more detailed interpretation as follows:

Thickness	Depth	Resistivity
4.77	4.77	2766.40
11.13	15.90	626.80
2.10	18.00	20813.20

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Thickness	Depth	Resistivity
75.80	93.80	571.70
999905.20	999999.00	3414.40

The chargeability data is difficult to fit (as always!). However, a best guess solution gives a depth to the chargeable sources of about 60 metres ±10 metres. This puts it within the less resistive zone (572 ohm-metres), which has a resistivity similar to that which lies *above* the chargeable layer in sounding SX-1.

The decay form observed on all readings was just a little slower than normal, ΛMn being about -4% for the most chargeable section, and -6.7% in the low background upper section. A finely disseminated and/or inefficient source is thus inferred.

CONCLUSIONS

1 - While the soundings carried out on lines 16N and 18N give reasonable fits (as field soundings go) to type curves, and infer depths to the chargeable horizons of 115 metres(±) and 60 metres (±), The assumptions of horizontal layering, lateral and longitudinal inhomogeniety and a planar surface make these estimates tentative. What is important is they they both show a relatively resistive and low chargeability upper layer, underlain by a less resistive and more chargeable lower layer.

2 - The absolute resistivity observed in the two soundings show that on line 16N they are ten fold more resistive in the upper

resistive section. This material difference in electrical properties infers a material difference in the rock type. Both, however, show low chargeability.

VI - DOWN HOLE EIP AND RESISTIVITY SURVEYS

The location of MS-1 and MS-2 are shown on Figure 1, the location of MS-3 is not known at the time of writing.

The data is displayed on a down hole scale of 1 centimetre = 5 metres, with the resistivity in ohm-metres being on a 10 centimetre log scale, the chargeability at 1 centimetre = 2 millivolts/volt and the normalised decay form, ΔMn, at 1 centimetre = 10%.

All three holes were logged using a three-array, a = 2.5 metres spacing moved at 2.5 metre intervals. The energising cycle was two seconds on, and a three slice programme was employed, with only M_3 and ΔMn being plotted. A Scintrex IPR-8 receiver and a Scintrex 2.5 kilowatt transmitter were used.

At the time of writing no geological logs are available to the writer, the comments made therefore concern the geophysics only.

MS-1 ..... The chargeability and resistivity profiles allow the hole to be divided into a number of distinct units.

30 - 125 metres:- The background resistivity may be regarded as 2000 ohm-metres, while the chargeability background ranges between 6 and 8 millivolts/volt. Superimposed on the latter are maxima as follows:-

a) 51 to 69 metres - three individual peaks of 28, 34 and 35

millivolts/volt at 54, 62 and 67 metres were accompanied by resistivities of 3000, 2500 and 2000 ohm-metres, while the decay form is near normal. The source is at hole, disseminated and of average grain size.

b) Up to 10 millivolts/volt above background was recorded between 74 metres and 97 metres, again with fairly normal decay forms, but in this case within more highly resistive rocks to 5000 ohm-metres (+). The source is again disseminated and of 'average' grain size, but this time contained within a host more resistive than the enclosing rocks.

c) The third maximum was defined at 113 metres, where 20 millivolts/volt above the 6 millivolts/volt background was observed from resistivities of 1700 ohm-metres as opposed to 3000 ohm-metres above and below. The source is again considered to be disseminated but is contained within a host *less* resistive than the enclosing rocks.

This unit certainly accounts for the shale group picked up on the pole-dipole surveys on line 2 in the vicinity of MS-1. ??

128 - 190 metres:- Over this section a progressive rise in background chargeability was observed from almost zero backgrounds between 128 metres and 160 metres rising through 4 to 6 millivolts/volt between 175 metres and 190 metres. The resistivity also rises progressively from 4000 ohm-metres to 5500 ohm-metres, and is

characterised by a sharp contact with the enclosing rocks.

This unit has very similar characteristics to that located on line 16N between 600W and 800W, and may therefore represent a section of this zone.

195 - 285 metres:- Between these limits the resistivity marks a sharp decline from 4000 ohm-metres(+) to a base level of about 1200 ohm-metres between 195 and 270 metres with the lowest readings being less than 1000 ohm-metres. A broad section of high chargeability to above 30 millivolts/volt was defined between 196 metres and 280 metres.

Individual maxima within this zone rise to over 90 millivolts/volt the most significant zones being between 241 metres and 249 metres (90 millivolts/volt)m and between 252 metres and 275 metres (68 millivolts/volt). Both these zones show predominantly fast decay forms inferring either a fine grain size or an inefficient source.

A number of distinct narrow zones of lesser resistivity to 300 ohm-metres were noted within this zone, with one at 230 metres being as low as 123 ohm-metres. However, no part of the chargeability recorded in this hole can be considered conductive as such.

The decay forms between 197 metres and 212 metres are up to 10% slower than normal, indicating a coarser grain to the causative source. All other decay forms are near normal.

The characteristics of this section, namely chargeable material having 'bulk' resistivity of the order of 1000 ohm-metres, could well account for the characteristics seen under the crystal tuff unit; the higher resistivity recorded over the tuffs being due to the dilution effect of the more resistive tuffs themselves.

285 - 327 metres:- Over this section the resistivity is a relatively high 5000 ohm-metres(+) with individual maxima to 20,000 ohm-metres. The chargeability background has a base level of about 14 millivolts/volt, with individual maxima rising to 10 millivolts/volt above this base.

MS-2 .....This hole has three distinct rock units over the hole length. These are as follows:

47 - 93 metres:- High chargeabilities of above 40 millivolts/volt were recorded within this zone between 50 metres and 85 metres. The decay forms vary from fast (ΔMn = -4% at 56 metres) to slow (ΔMn = +3% at 71 metres). The resistivity data shows two distinct 8 metres(±) resistivity lows of 700 ohm-metres at 62 metres and 1200 ohm-metres at 78 metres below the 2500 ohm-metres(±) background above and below. The source therefore is disseminated chargeable material within a host which is less resistive than the enclosing rocks. No zones within it can, however, be considered to be conductive as such.

The geophysical characteristics of this zone bear a resemblance to

the lower zone located in MS-1 centred between about 195 metres and 270 metres, rather than the upper chargeable zone in MS-1 between 50 metres and 60 metres.

95 - 257 metres:- This long section is characterised by a 2100 ohm-metres base level with a number of zones to 6000 ohm-metres. The chargeability over this section has a base level between 6 and 4 millivolts/volt, and has near normal decay forms.

This zone is very similar to that located in hole MS-1 between 125 metres and 195 metres, except that in MS-2 the resistivity recorded is slightly lower.

260 - 300 metres:- Between these limits the resistivity falls to 600 ohm-metres between 260 and 267 metres and to 700 ohm-metres at 282 metres. It does, however, remain at or just below 1000 ohm-metres between the limits above as against 2000 ohm-metres(+) above and below.

The chargeability rises to 14 millivolts/volt at 284 metres, 24 millivolts/volt at 288 metres and 16 millivolts/volt at 294 metres, but is a low 4 millivolts/volt over most of this resistivity low. The decay form is just slightly slower than normal over the high chargeabilities, but is faster than normal over the low resistivity/ low chargeability section.

MS-3 ..... This hole was seen to be divided into a number of distinct units as follows:

20 - 60 metres:- Between the beginning of the hole at 20 metres and 60 metres, chargeabilities are significantly higher than the lower background observed below. Three distinct chargeability maxima were observed at 57 metres of 38 millivolts/volt within 8000 ohm-metres resistivities, at 50 metres of 54 millivolts/volt within 1500 ohm-metres resistivities and at 38 metres of 44 millivolts/volt within 1300 ohm-metres resistivities. All lie within a zone whose background chargeability is about 25 millivolts/volt between 60 and 20 metres.

This zone is similar to 250 metrest in MS-1 and 70 metrest in MS-2

65 - 260 metres:- Over this long section the resistivity decreases from a base level of 2000 to 3000 ohm-metres to about 1000 ohm-metres down hole. Similarly, the chargeability background drops from about 10 millivolts/volt in the upper section to less than 5 millivolts/volt between 210 metres and 245 metres.

Superimposed on this background a number of distinct 20 millivolts/volt maxima were observed at 115 metres, 133 metres, 146 metres and 174 metres, all of which show a minor decrease in the high resistivity.

The section between about 210 metres and 260 metres is similar to that between 130 metres and 190 metres in MS-1 and 95 metres and 280 metres in MS-2.

270 - 330 metres:- Between these limits a distinct change in background

chargeability to the 15 millivolts/volt level was observed with individual maxima to 20 millivolts/volt. The resistivity also increases progressively. Between 265 metres and 295 metres the resistivity is about 4000 ohm-metres, then increases progressively to 100,000 ohm-metres at 325 metres. This situation is not seen in either of the other two holes MS-1 and MS-2. This data suggests a highly silicified unit, certainly below 310 metres.

CONCLUSIONS

1 - High chargeability and moderate to high resistivity in the upper sections of MS-1 and MS-2 can be equated to the electrical characteristics observed over the shale units on traverses 1 and 2 of the pole-dipole survey.

2 - The low chargeability high resistivity sections in holes 2 and 3 may be equated to the low chargeability/high resistivity sections noted in the gradient array reconnaissance (and detail) surveys on lines 14N and 16N either side of 800W and 750W respectively.

VII - THE PROBLEM OF ANOMALY 1600N/1155W

BACKGROUND AND DATA

1 - On the original gradient array reconnaissance survey a chargeability maximum of about 32 milliseconds (about 45 millivolts/volt), which was part of a broader chargeable zone which commenced at about 900W and was open to the west, was recorded. Two other like maxima were observed at 945W and 975W. The anomaly at 1155W was also associated with a distinct and definite decrease in resistivity to 200 ohm-metres from 3500 ohm-metres east of 900W.

This data was read in the field by Bengt Ekstrom, our most experienced operator and has been examined and been assessed to be entirely valid. The gradient array was placed such that the energising field could not have been distorted in the vicinity of this anomaly. Thus it is concluded that the original anomaly is valid.

2 - An extension gradient array survey was executed in the current survey programme. The current dipole was placed at 800W and 2500W on line 17N. Unfortunately the line commened at 1185W and goes to the west. Nevertheless the overlap extended to 1320W. The anomaly is seen here as a much reduced 36 millivolts/volt against 34.6 millivolts/volt at 1200W which compares with 45 millivolts/volt and 37 millivolts/volt in the first survey. Also, while the two resistivity minima at 1245W and 1185W are confirmed, they

are very much reduced in amplitude.

3 - Also in the present season a detailed gradient survey was run over an area which included 16N/1185W. The current dipole was placed at 400W and 1400W on line 18N, while a 10 metre potential dipole was employed. The operator was R.A. Bennett, also an extremely experienced operator (in excess of five year).

The data showed a dramatic change in format. Whereas the strong anomalies located between 900W and 1025W on the original survey were confirmed by similar order responses, that at 1155W was recorded only as a broad (50 metres±) zone of 2 to 3 millivolts/volt above background (22 millivolts/volt). Also, the two distinct resistivity minima observed in the first survey and inferred in the extension survey (but in reduced form) were not distinctly seen.

An examination of the data has shown it to be quite valid - the decay form is not at all abnormal.

The current pole position on the western side at 18N / 1400W could be considered to have produced an edge of array effect. Certainly differences in energising fields and the resultant lower resistivities could be accounted for by a source which caused the equipotentials to parallel the survey line in the first survey. Without a complex situation in the area (which may well be) it would be difficult to see how this could have

occurred.

A further thought was that one could regard the second survey as having very much more limited penetration due to the proximity of the electrode (which is true as the configuration approximates a pole-dipole one). Thus it was decided to run one check line using a much greater current dipole placed on line.

4 - This line was surveyed by D.J.T. Webb on 19th February, 1979 using a current dipole of about 2 kilometres placed at 1960W and 00, and a 30 metre potential dipole.

The resistivity data confirms the extension survey data [(2) above] to the west, and the *form* of the resistivity data on the original reconnaissance survey [(1) above] including the position of the two resistivity minima at 1060W and 1245W. The chargeability on the anomaly 4.1 was also confirmed with similar amplitude to the first survey. However, the 10 milliseconds (14 millivolts/volt) response at 1155W was seen as a small 3 millivolts/volt response.

? 1155W

DISCUSSION

In all our experience of overlap and detail, this 'disappearance' of the 10 milliseconds (14 millivolts/volt) response at 16N/1155W is unique. Bearing in mind the experience of the operators involved and the definitive anomalies recorded, the conclusion is that *all* sets of data are correct, and that the response at 16N/1155W must

be a unique function of that array, probably produced by some unique and complex aspect of the structure.

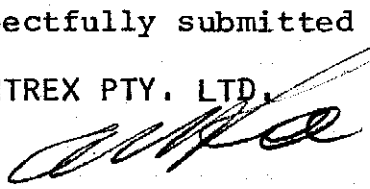
However, from all the check lines this cannot be considered a significant anomaly as the non-repeatability implied the response to be an exaggeration of a relatively minor feature, perhaps akin to those on the outside quadrants of the gradient array where the equipotential can be made to run *along* lines rather than *across* them.

The electrical sounding carried out along strike over this anomaly is discussed in detail above, but the depth to the chargeable layer could be as great as 115 metres(±). The maximum depth to source inferred from the anonaly at 1165W assuming a horizontal layering and homogeneity is at most 75 metres.

In conclusion the writer must say that the disappearance of the anomaly at 16N/1155W is not readily explained by a very careful study of all the factors which could have influenced these surveys. However, the author is convinced that the source, 'if real' must be relatively minor or it would have been confirmed by one or other of the check arrays run.

Respectfully submitted on behalf of:

SCINTREX PTY. LTD.



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

GEOPHYSICIST

315048

SCINTREX

MICROFILMED

OPEN FILE

A REPORT ON

ELECTRICAL GEOPHYSICAL SURVEYS

OVER THE BEATRICE GRID

NEAR QUEENSTOWN, TASMANIA

ON BEHALF OF

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

PLATES AND PROFILES

Director | A.O. | C.G. | E.O. | D.S.M.E. Registrar | D. Dir. | E & IL

2 OCT 1984

DEPT. OF MINES

F. No. 1907/84

046

315049

LINE 20N

Beatrice

GRADIENT ARRAY EIP

TAS-062

ρ_a Ωm

5000

2000

1000

500

M mv/v

52

48

44

40

36

32

28

24

20

16

A_4

M_3 30m dipole spacing

2200W 2100W 2000W 1900W 1800W 1700W 1600W 1500W

Correct peg numbers

2220W

1620W

* Add 120m to peg numbers given in this report

K&E 10 X 10 TO THE CENTIMETER 25 X 25 CM KEUFFEL & ESSER CO. MADE IN U.S.A.

047

315050

LINE 18 N

Beatrice

GRADIENT ARRAY EIP

TAS-062



K&E 10 X 10 TO THE CENTIMETER 359-23 MADE IN U.S.A.

12 14 14

048

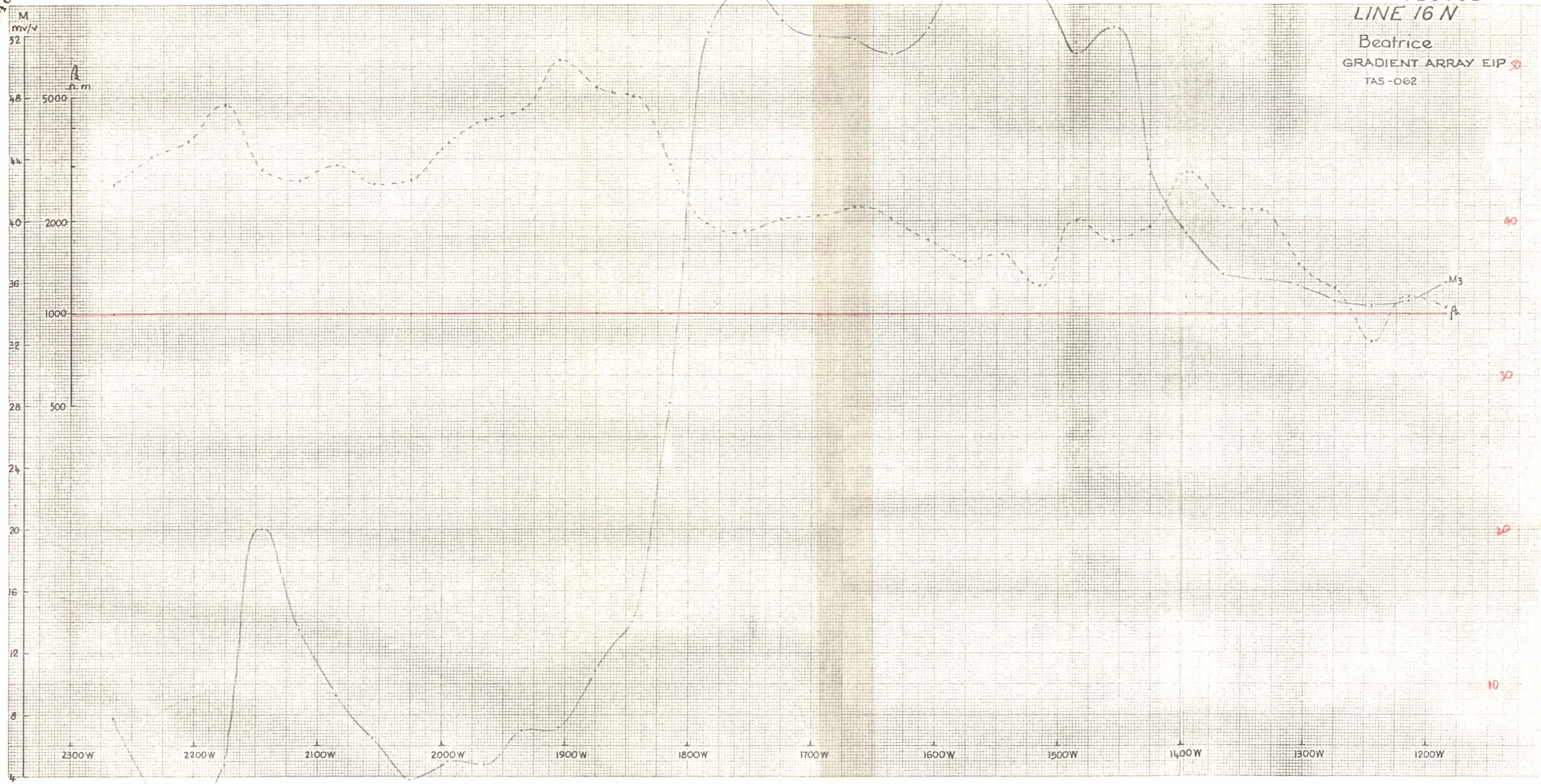
315051

LINE 16 N

Beatrice

GRADIENT ARRAY EIP

TAS-062



K&E KEUFFEL & ESSER CO. MADE IN U.S.A. 10 X 10 TO THE CENTIMETER 25 X 25 CM.

4 1 5 1 2

315052

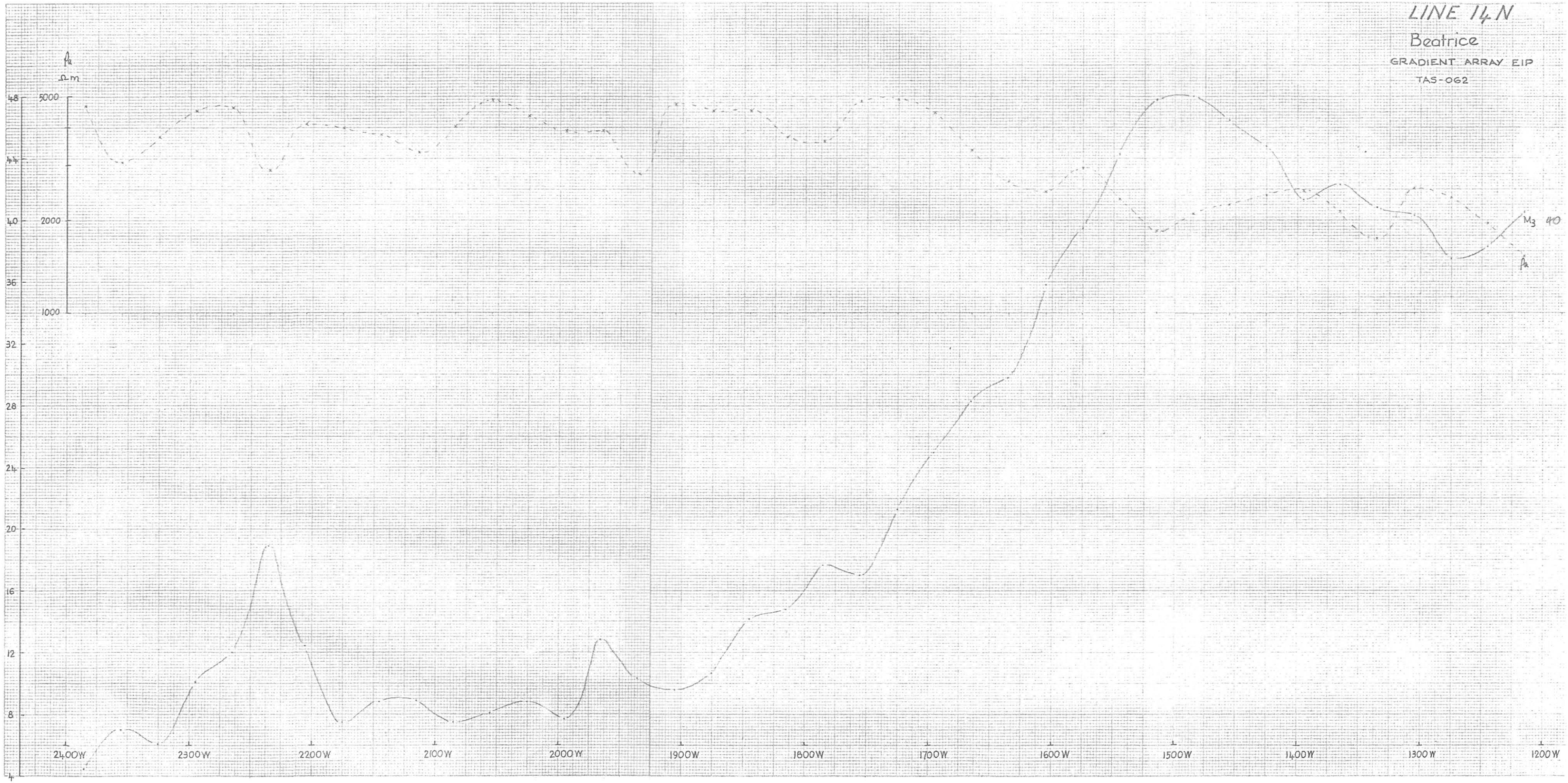
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LINE 14N

Beatrice

GRADIENT ARRAY EIP

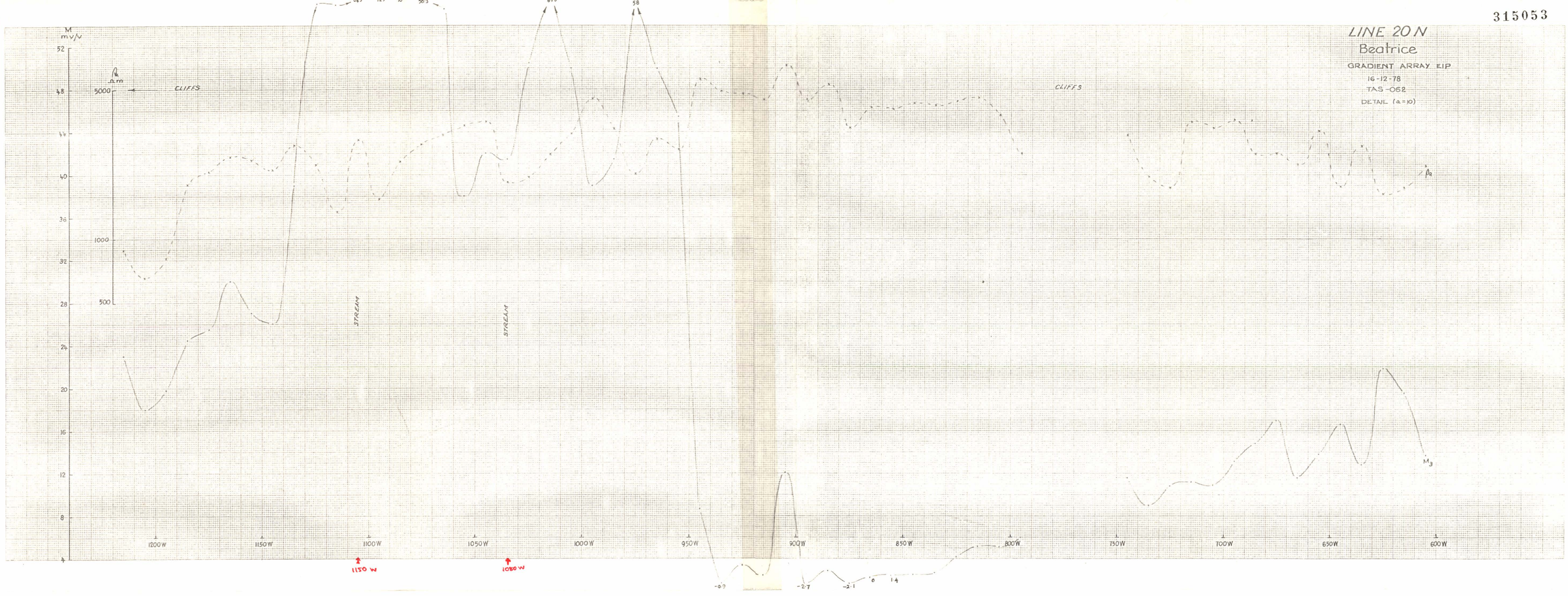
TAS-062



050

315053

LINE 20 N
Beatrice
GRADIENT ARRAY EIP
16-12-78
TAS-062
DETAIL (a=10)



051

315054

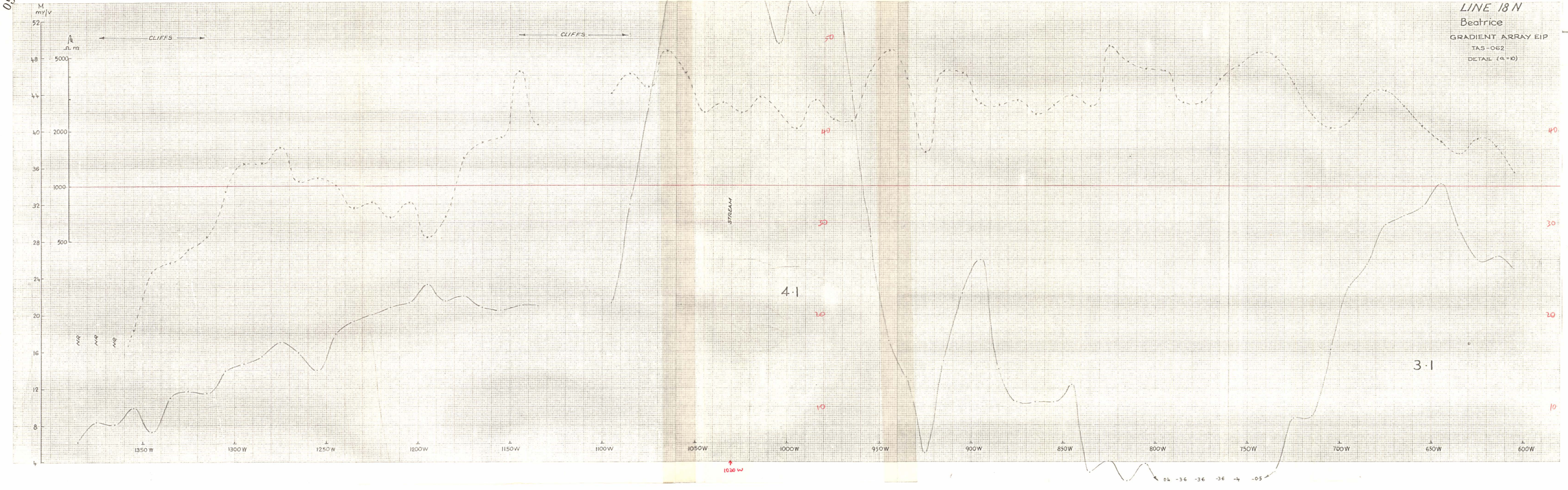
LINE 18 N

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GRADIENT ARRAY EIP

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DETAIL (n=10)



052

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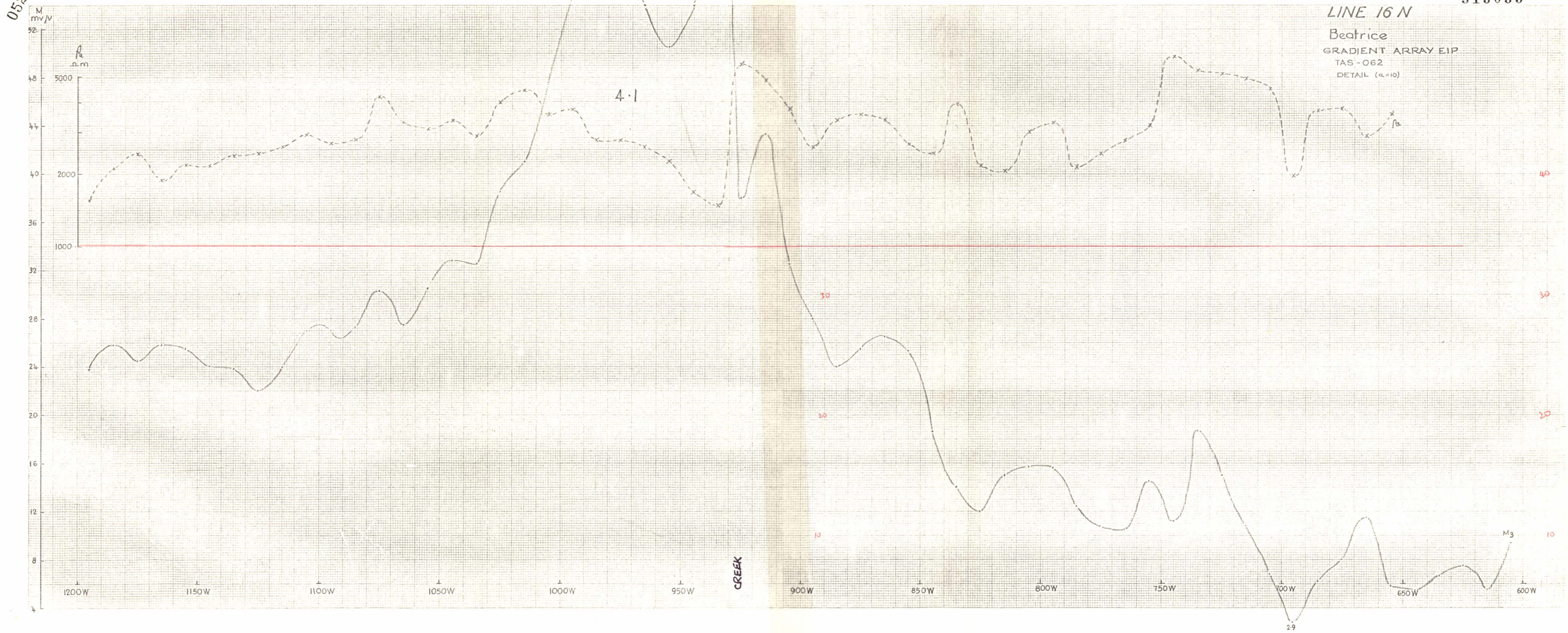
LINE 16 N

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GRADIENT ARRAY EIP

TAS-062

DETAIL (a=10)



053

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LINE 14 N

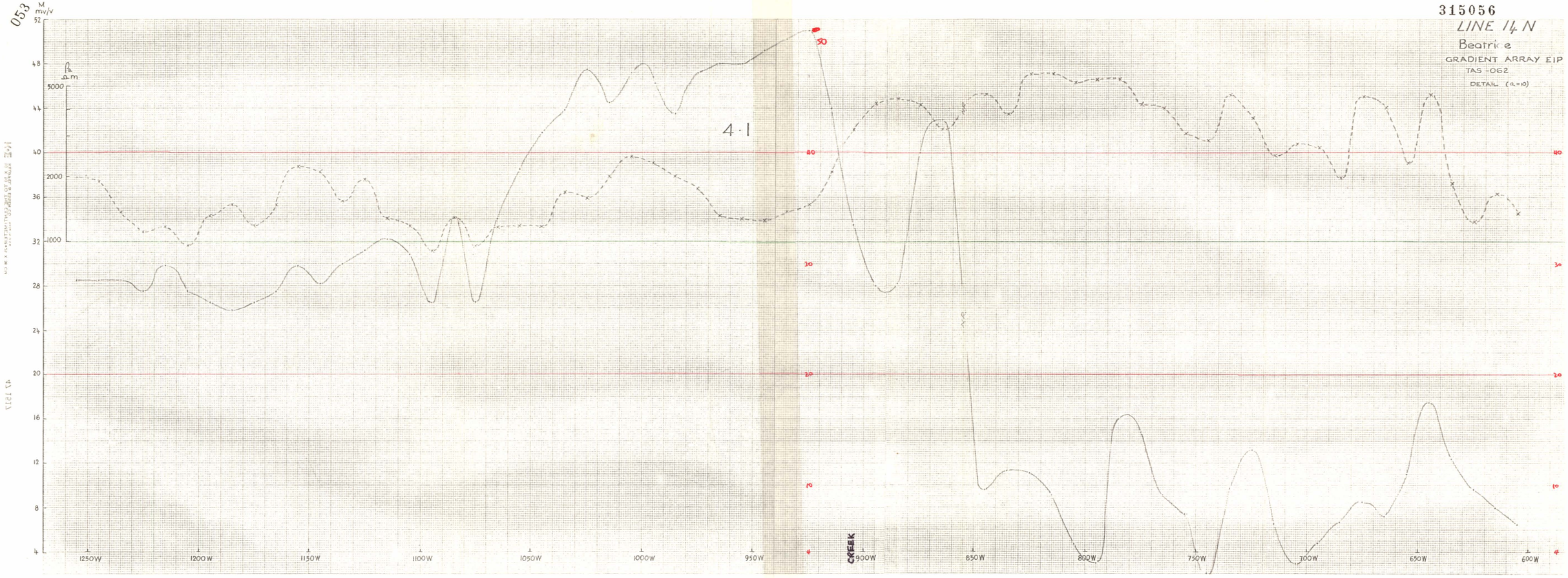
Beatrice

GRADIENT ARRAY EIP

TAS - 062

DETAIL (a=10)

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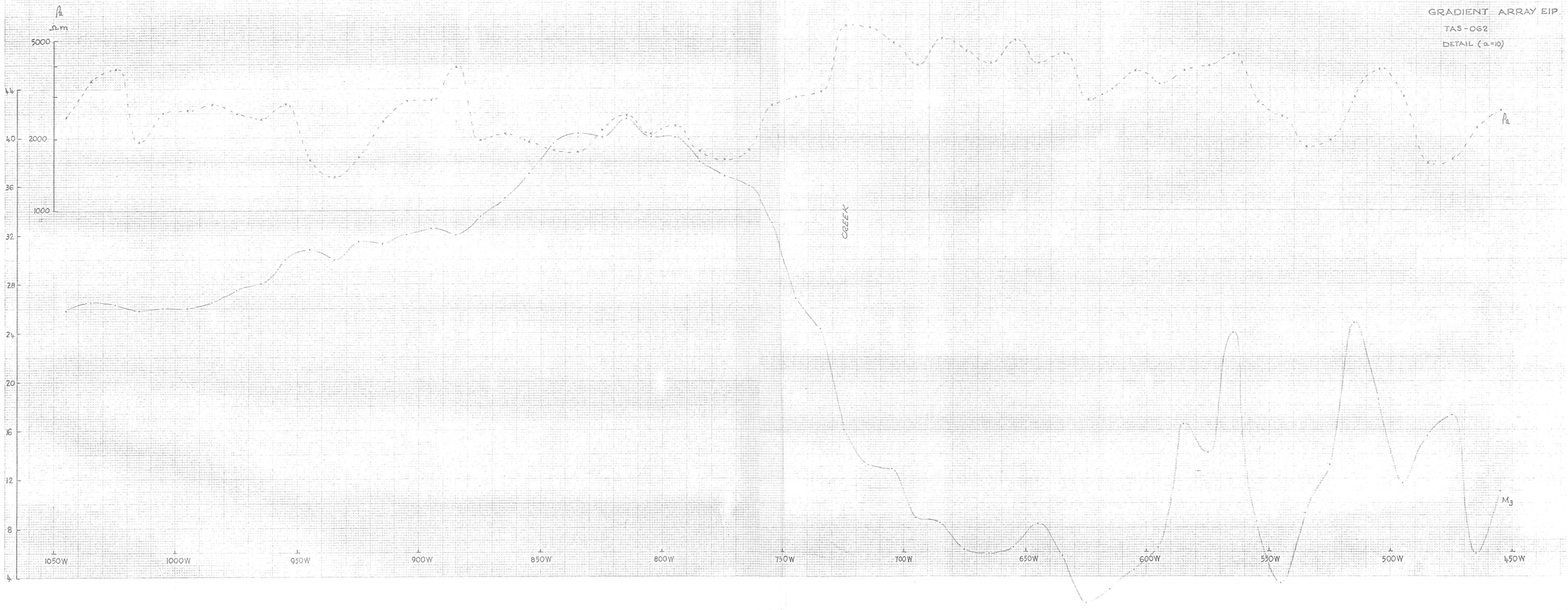
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Beatrice

GRADIENT ARRAY EIP

TAS-062

DETAIL (a=10)



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055

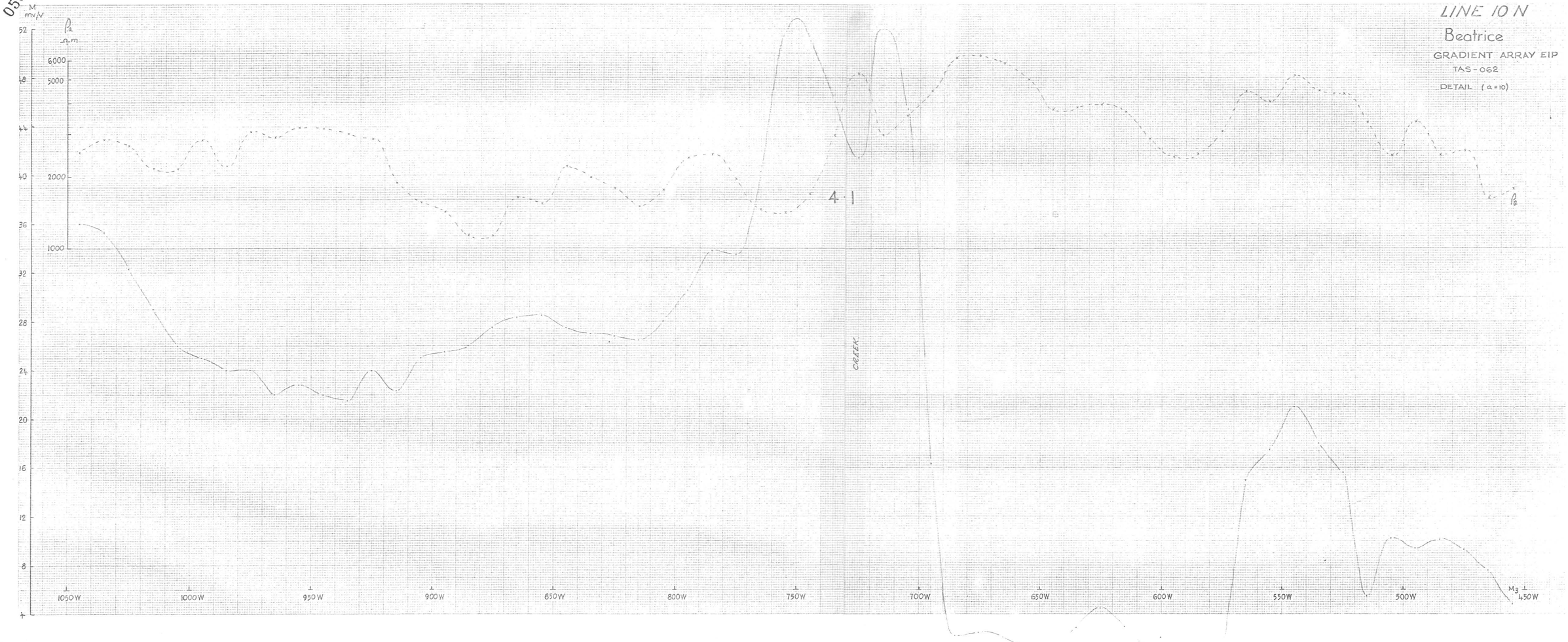
LINE 10 N

Beatrice

GRADIENT ARRAY EIP

TAS-062

DETAIL (a=10)



DATE	
PLOTTED BY	
PULSE	Rx.
DIPOLE SPACING	

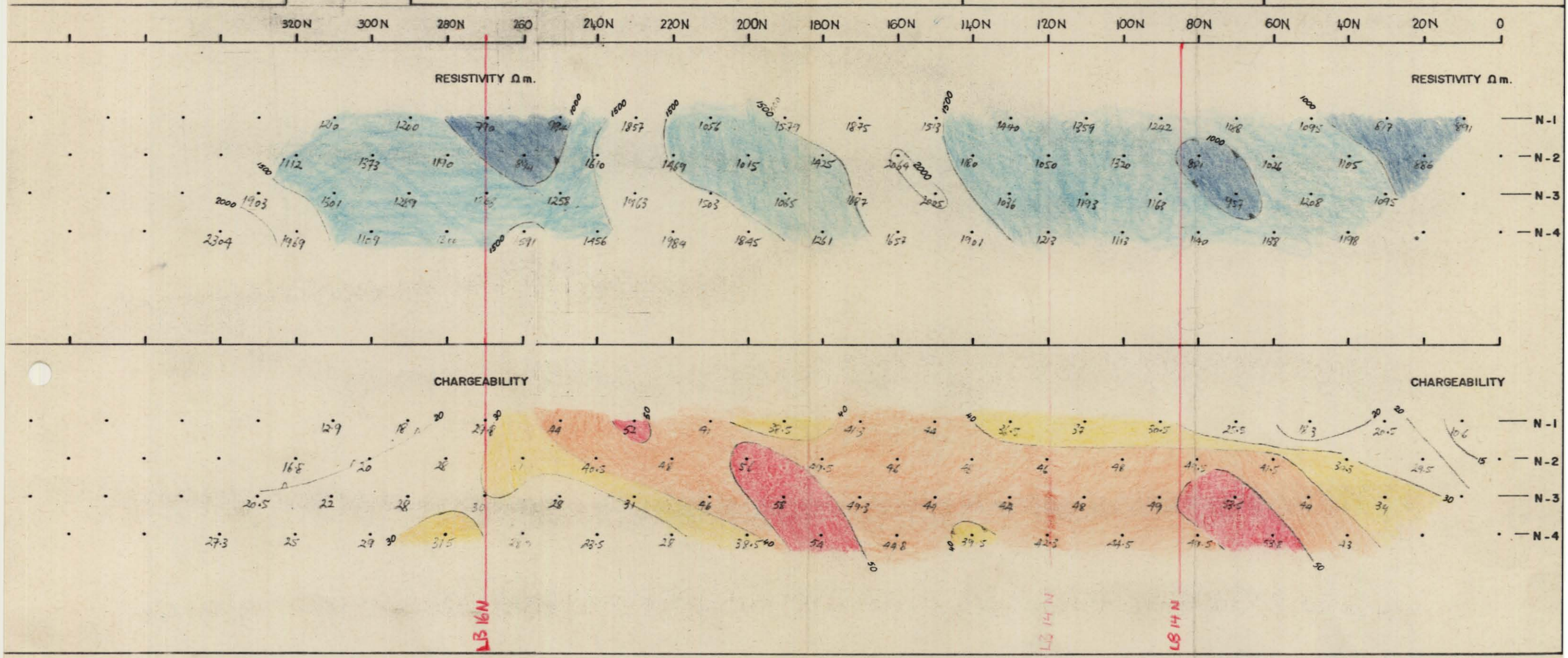
SCINTREX PTY. LTD.

INDUCED POLARIZATION AND RESISTIVITY SURVEY

POLE - DIPOLE ARRAY

DATE 18-12-78	
PLOTTED BY R.A.B.	
PULSE 2 Sec.	Rx. IPR-8
DIPOLE SPACING 20 m	

LINE No. 1. Western Road	
PROSPECT BEATRICE	
JOB No. TAS-062	



056

315059

DATE	8-1-79
PLOTTED BY	R.A.B.
PULSE	2 Sec.
Rx.	
DIPOLE SPACING	20m

SCINTREX PTY. LTD.

INDUCED POLARIZATION AND RESISTIVITY SURVEY

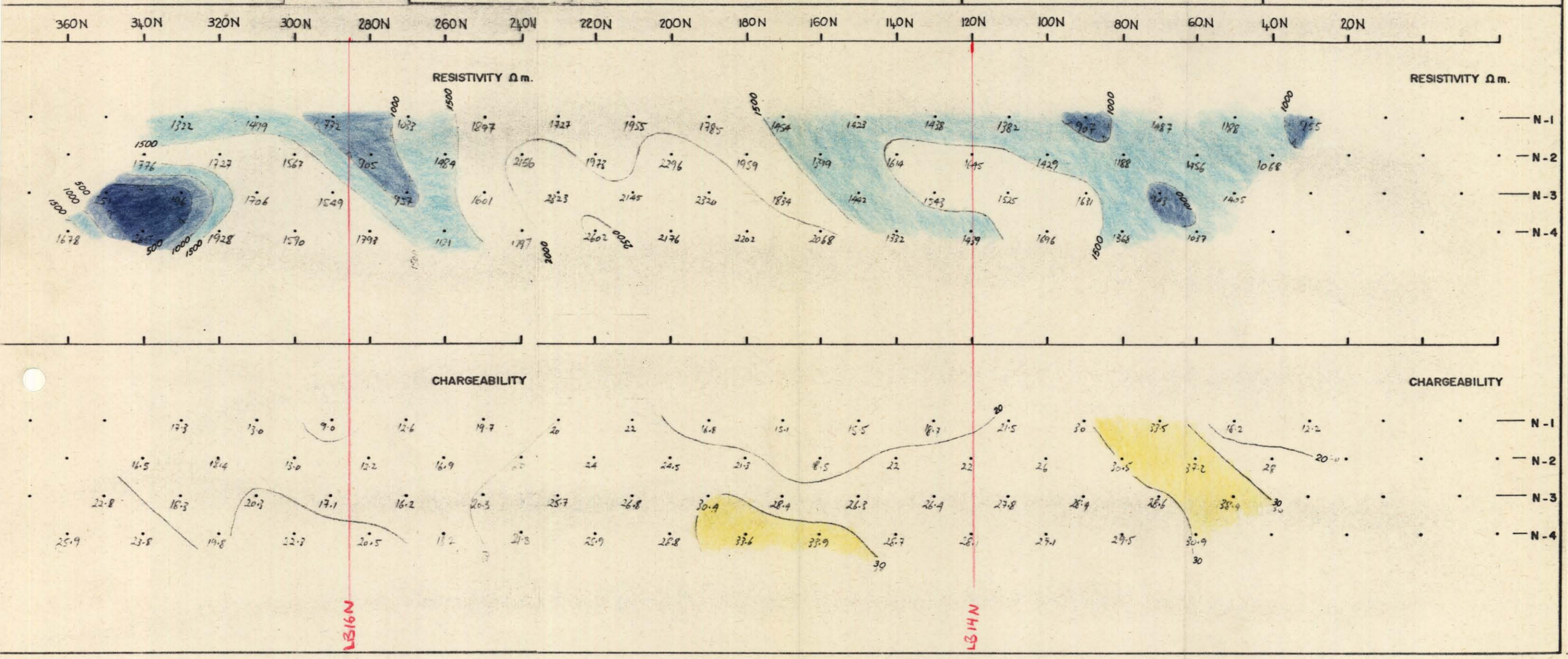
POLE - DIPOLE ARRAY

DATE	8-1-79
PLOTTED BY	R.A.B.
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Rx.	
DIPOLE SPACING	20 M

LINE No. 2 Eastern road

PROSPECT BEATRICE

JOB No. TAS-062



057

315060

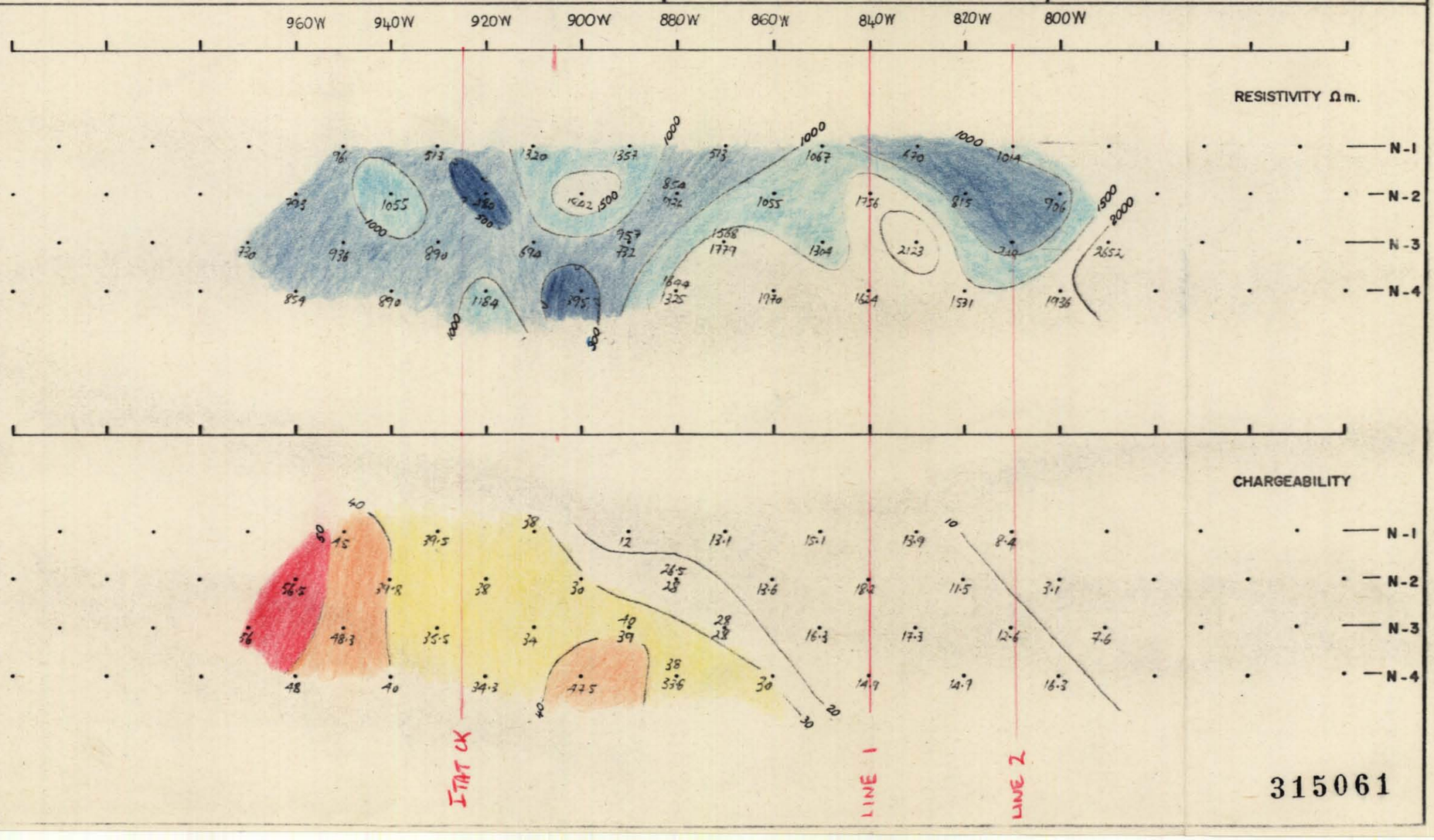
058

SCINTREX PTY. LTD.

INDUCED POLARIZATION AND RESISTIVITY SURVEY

DIPOLE - DIPOLE ARRAY

DATE 20-12-78	LINE No. 16 N
PLOTTED BY RAB	PROSPECT BEATRICE
PULSE 2 Sec / Rx. IPR-8	JOB No. TAS-062
DIPOLE SPACING 20 M	



315061

059

315062

SX-1

16 N / 1162 W

Resistivity in ohm-metres

Conductivity in millimhos per volt.

'a' in metres

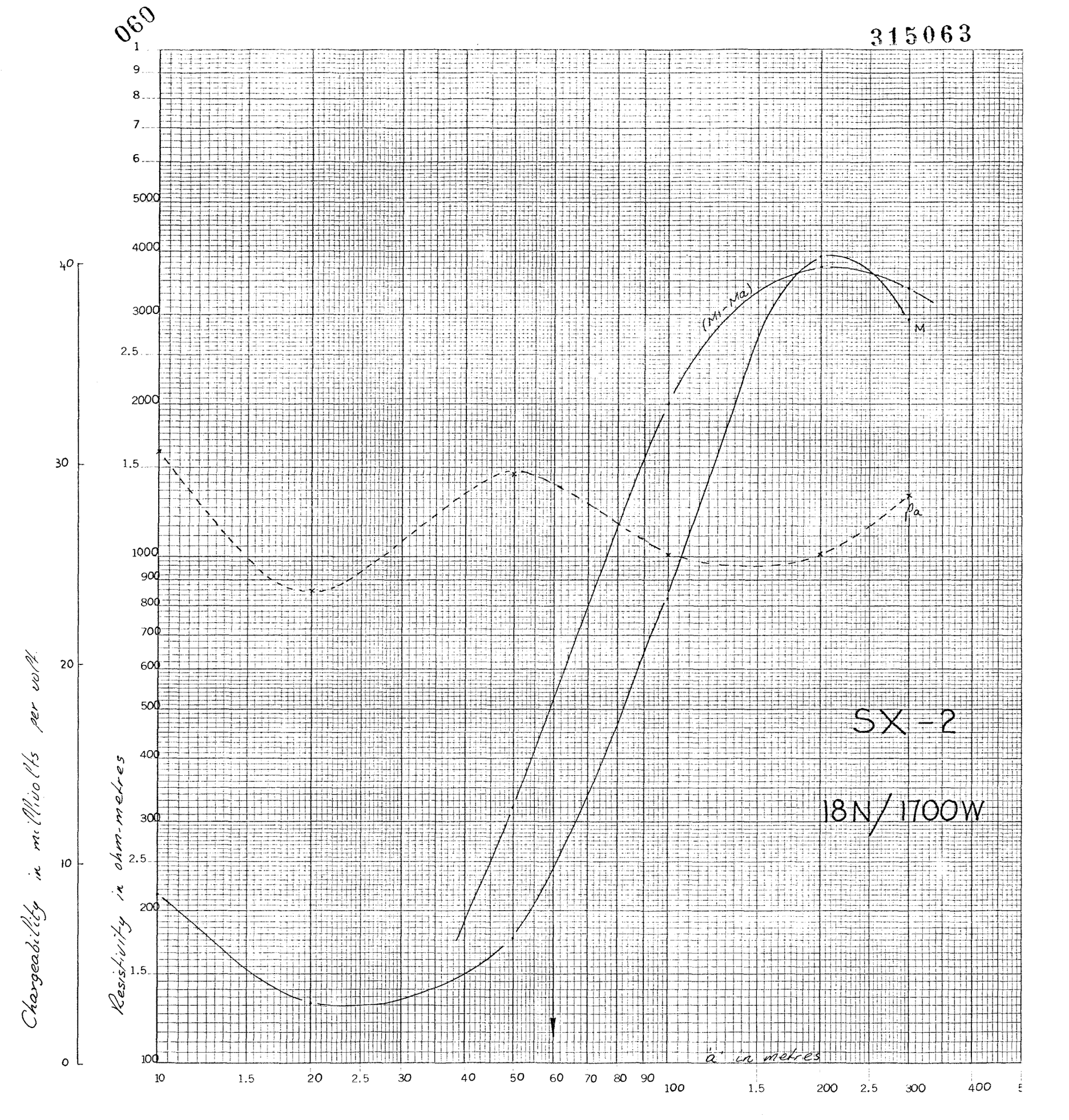
$(M_1 - M_{a_1})$

M

ρ_a

060

315063


Chargeability in millivolts per volt
Resistivity in ohm-metres
'a' in metres
(Mi-Ma)
M
ρa
SX-2
18N/1700W

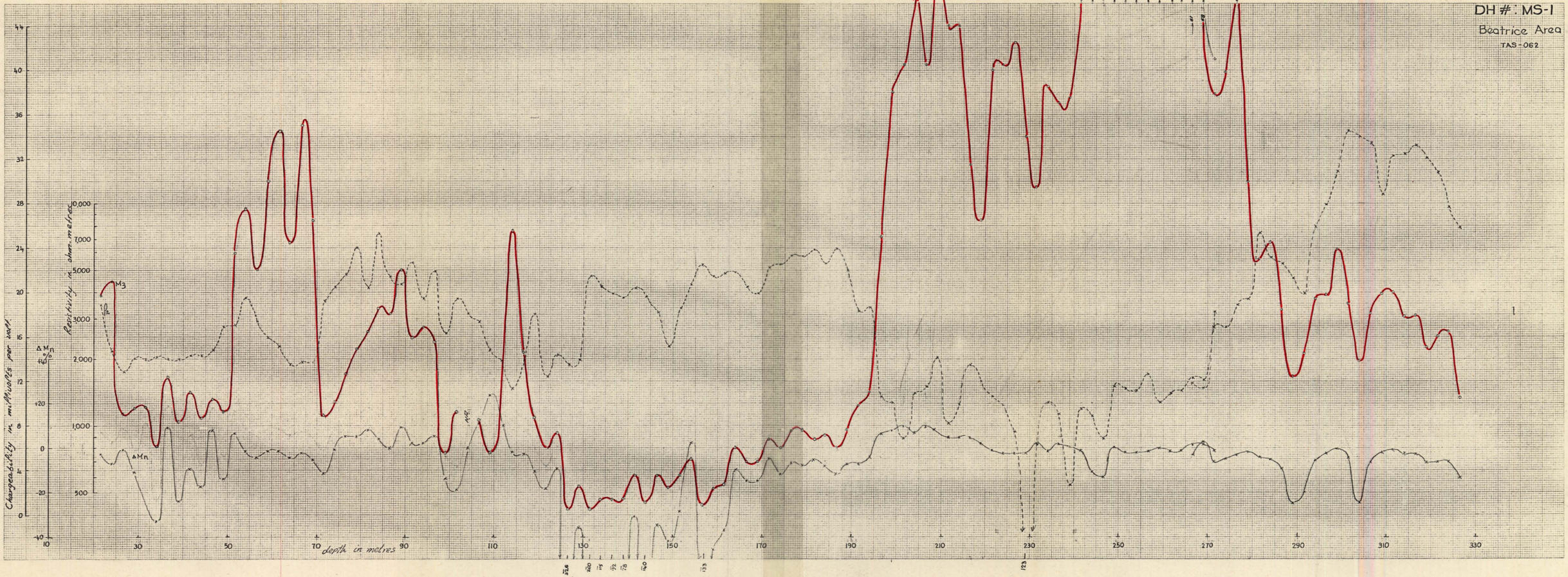
061

315064

DH #: MS-1

Beatrice Area

TAS-062



062

315065

DH #: MS-2

Beatrice Area

TAS-062



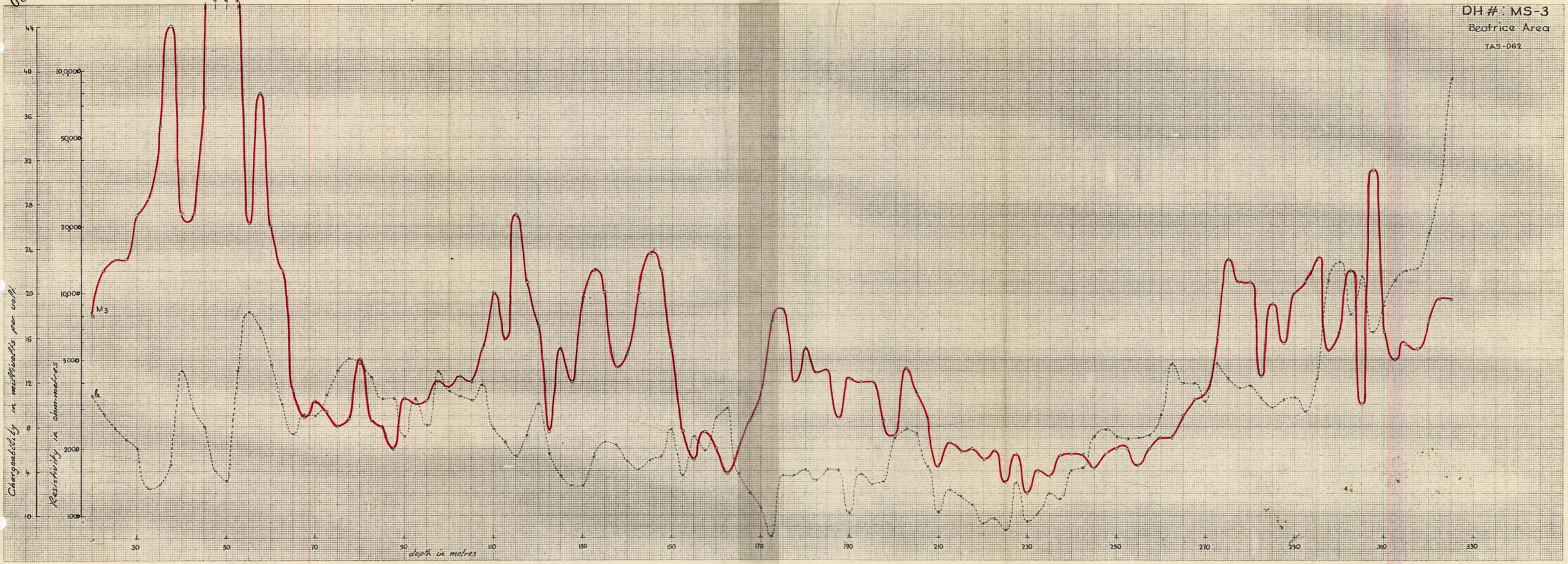
063

315066

DH#: MS-3

Beatrice Area

TAS-062



064

315067

CHECK LINE

LINE 16 N

Beatrice Area

GRADIENT ARRAY EIP

TAS-062

N.B. SCALE AS PER EXTENSIONS TAS-062

Chargeability in milliwatts per volt

52
48
44
40
36
32
28
24
20
16
12
8
4

Resistivity in ohm-metres

10000
5000
1000

1700 W
1600 W
1500 W
1400 W
1300 W
1200 W
1100 W
1000 W
900 W
800 W
700 W

065

315068

CHECK LINE
LINE 16 N
Beatrice Area
GRADIENT ARRAY EIP
TAS-062

N.B. SCALE AS PER ORIGIONAL RECONNAISSANCE GRID (TAS-035)

Chargeability in milliVolts per volt.

42
40
36
32
28
24
20
16
12
8
4
0

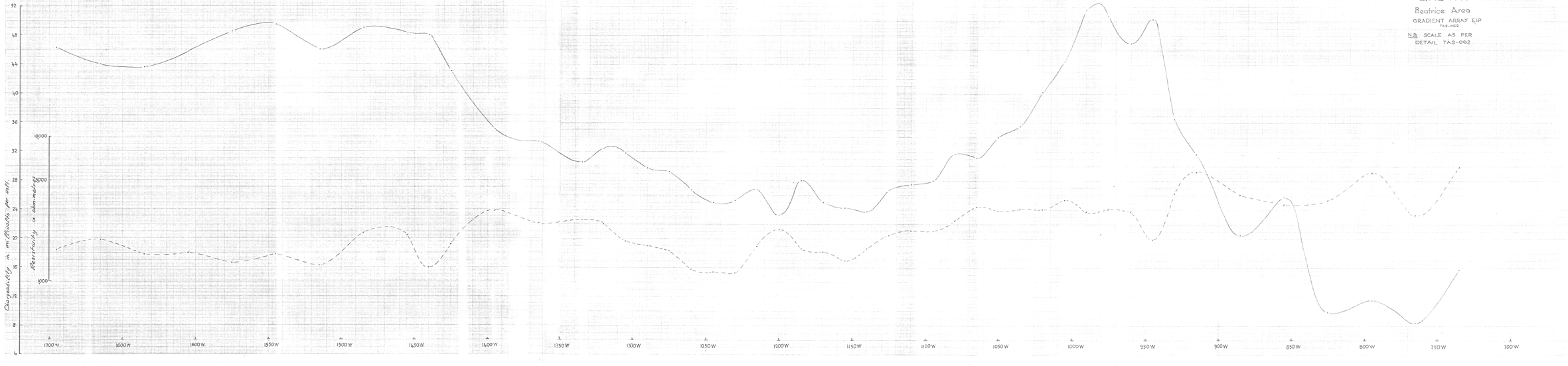
Resistivity in ohm-metres

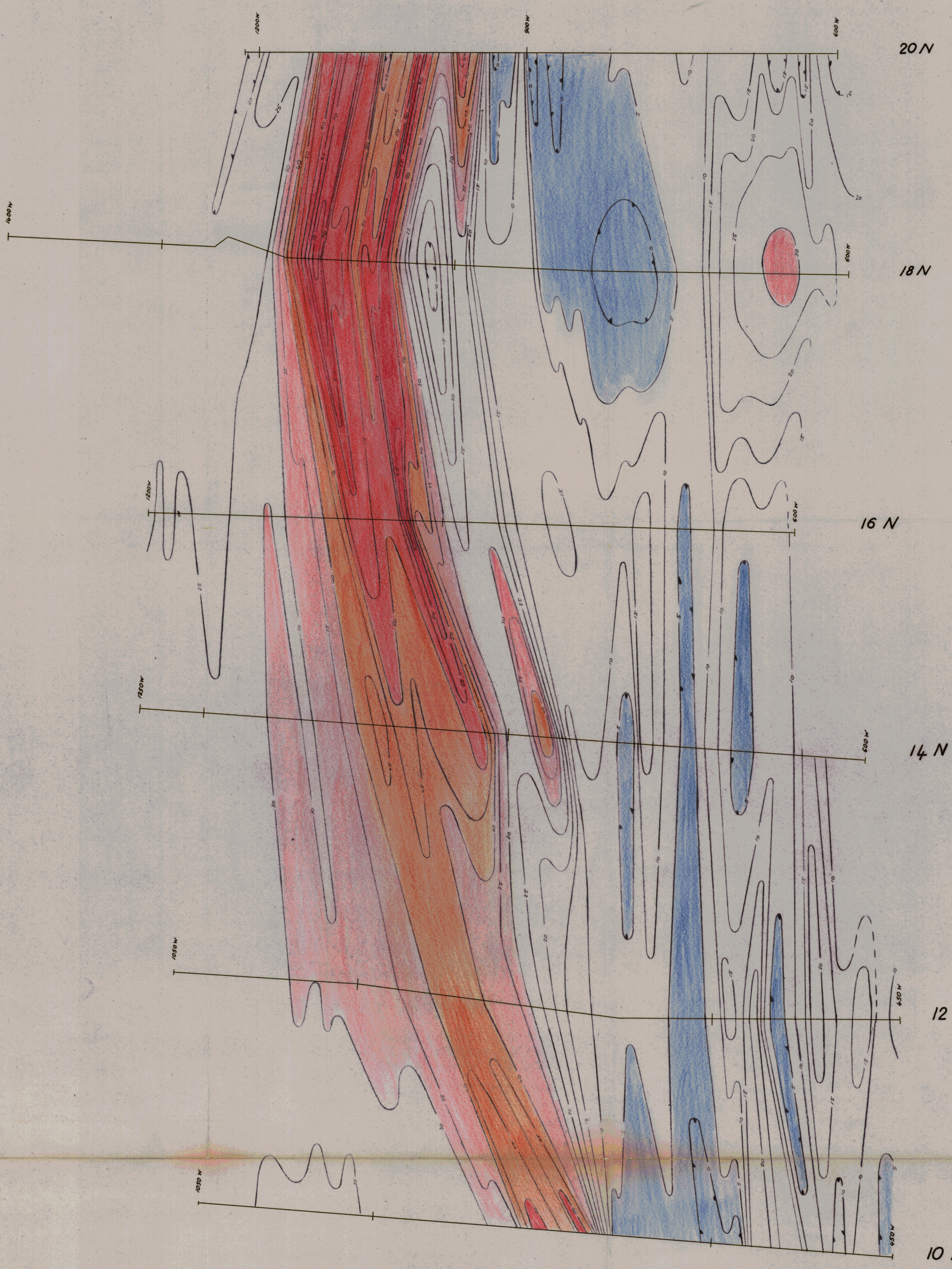
10000
5000
1000

1650 W
1500 W
1350W
1200W
1050W
900W
750W

CHECK LINE
LINE 16N
Beatrice Area
GRADIENT ARRAY EIP
TAS-002

N.B. SCALE AS PER
DETAIL TAS-062





MOUNT LYELL MINING & RAILWAY COMPANY

BEATRICE GRID

QUEENSTOWN - WEST COAST - TAS.

GRADIENT ARRAY EIP DETAIL
CHARGEABILITY CONTOUR PLAN

SURVEYED & COMPILED BY

SCINTREX

DECEMBER 1978

315070

5 cm

SCALE 1:2000

NOTE ENLARGED SCALE

JOB Nº TAS - 062

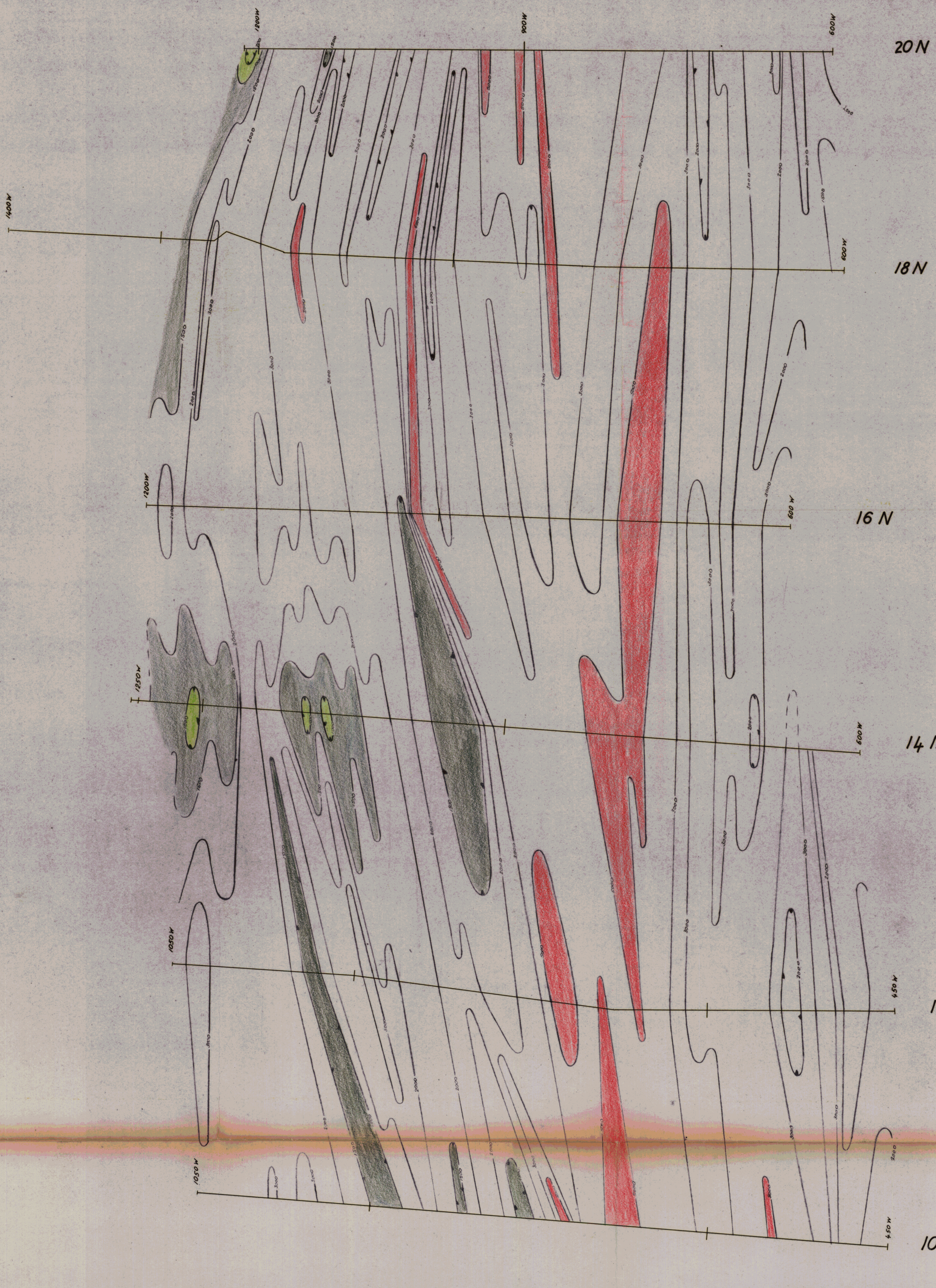
SHT 1 of 1

PLATE 1.

Revised 23-2-79

001

84-2245 vol 2



MOUNT LYELL MINING RAILWAY COMPANY

BEATRICE GRID

QUEENSTOWN - WEST COAST - TAS

GRADIENT ARRAY E.I.P. DETAIL
RESISTIVITY CONTOUR PLAN

SURVEYED & COMPILED BY

SCINTREX

DECEMBER 1978

315071

5 cm

SCALE 1:2000

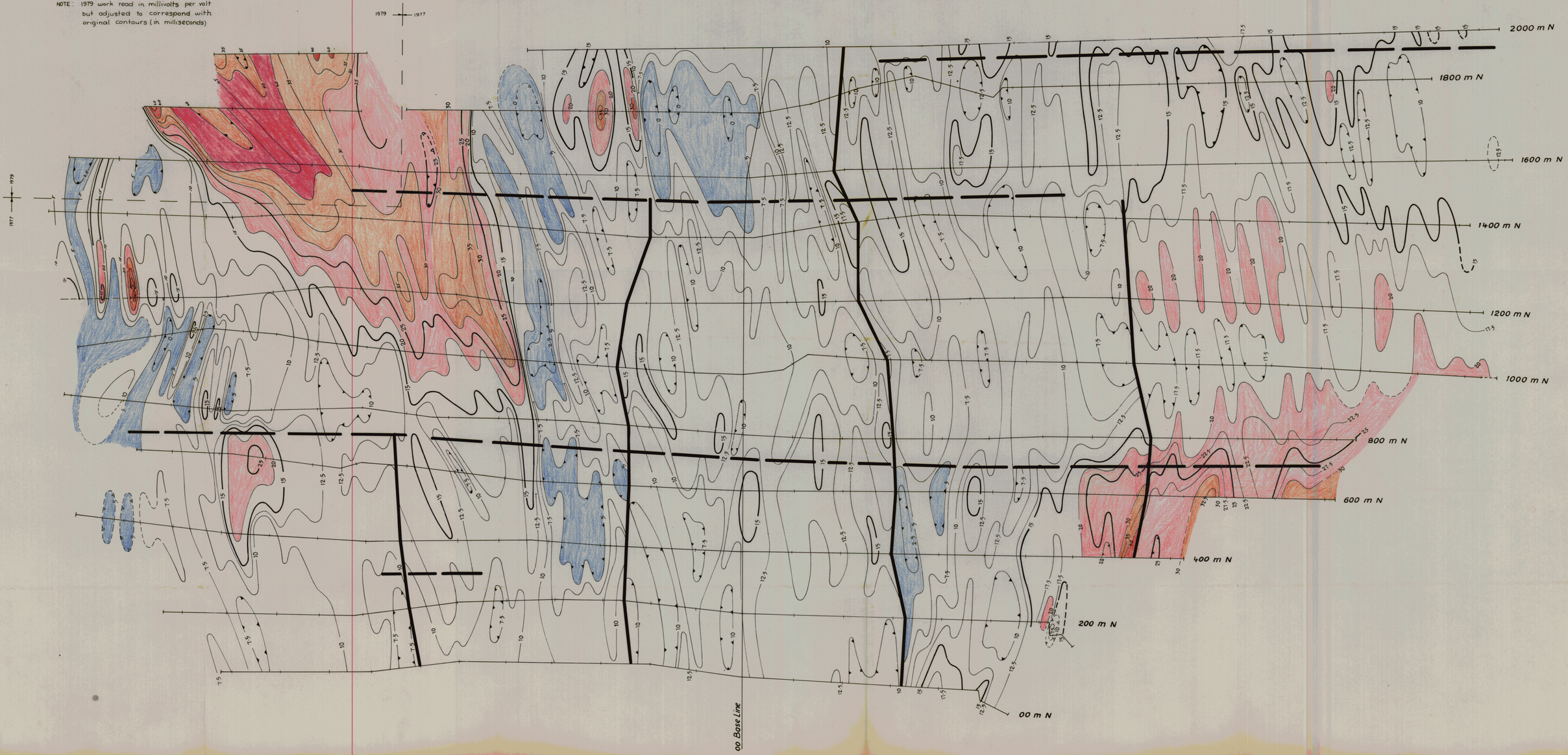
NOTE ENLARGED SCALE

JOB Nº TAS-062 SHT 1 of 1 PLATE 2.

Revised 23-2-79

84-2245 vol 2 G 002

NOTE: 1979 work read in millivolts per volt but adjusted to correspond with original contours (in milliseconds)



LEGEND

Chargeability contours in milliseconds

Gradient block boundary

MOUNT LYELL MINING & RAILWAY COMPANY LTD.

BEATRICE GRID

(NR.) QUEENSTOWN - WEST COAST TASMANIA

ELECTRICAL INDUCED POLARIZATION SURVEY
GRADIENT ARRAY
CHARGEABILITY CONTOUR PLAN

SURVEYED & COMPILED BY
SCINTREX PTY., LTD.

FEBRUARY 1977
Revised APRIL 1979

315072

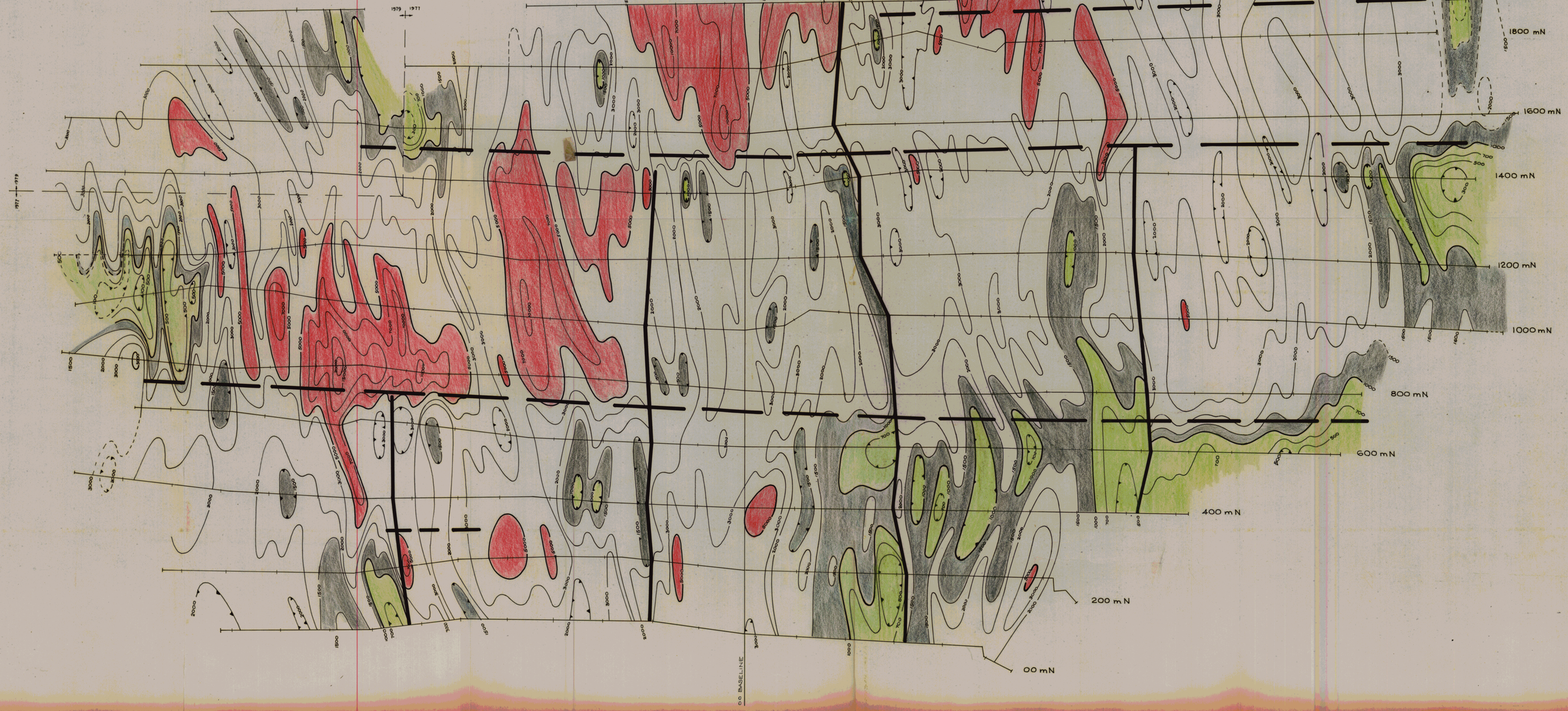
5 cm

240 180 120 90 60 30 00 120 240 (metres)

003

BL-2245 vol 2

JOB Nº TAS-035-D. Sheet 1 of 1 PLATE .
REVISED TAS-062 SHT 1 of 1 PLATE 3



LEGEND :

Resistivity contours in ohm-metres

Gradient block boundary

MOUNT LYELL MINING & RAILWAY COMPANY LTD.

BEATRICE GRID

(NR.) QUEENSTOWN - WEST COAST TASMANIA

ELECTRICAL INDUCED POLARIZATION SURVEY

GRADIENT ARRAY

RESISTIVITY CONTOUR PLAN

SURVEYED & COMPILED BY

SCINTREX PTY., LTD.

FEBRUARY 1977

Revised APRIL 1979

315073

5 cm

240 180 120 90 60 30 00 120 240 (metres)

84-2245

004

JOB Nº TAS-035-D Sheet 1 of 1 PLATE

REVISED TAS-062 SHT 1 of 1 PLATE 4