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A REPORT ON  
GRADIENT ARRAY EIP SURVEYS  
OVER THE EAST HEEMSKIRK GRID  
NEAR ZEEHAN, WEST COAST TASMANIA  
ON BEHALF OF  
RENISON LIMITED

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PRIVATE AND CONFIDENTIAL

A REPORT ON  
GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION SURVEYS  
OVER THE EAST HEEMSKIRK GRID  
NEAR ZEEHAN, WEST COAST TASMANIA  
ON BEHALF OF  
RENISON LIMITED

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SYDNEY, N.S.W.

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Data Profiles (Standard Renison Sheets) 1:2000 D'wg Nos TH 373-386

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} 1:5000 Zeehan C2/2 & D1/1 Geophysical.

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**SUMMARY**

*A number of anomalies located in the gradient array survey carried out over the East Heemskirk grid have the characteristics of low resistivity, high chargeability, magnetic field distortion and associated tin geochemistry. As such they are considered to be of prime interest for follow-up by diamond or percussion drilling.*

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A REPORT ON

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*INTRODUCTION*

Following on pole-dipole surveys carried out over the area in January, 1978 (described in Scintrex report TAS-052A dated April, 1978 by the author), a more comprehensive coverage was undertaken by Scintrex over 16½ single and 7 double operator days between 18 November and 17 December, 1979. The operation was under the immediate direction of Mr. G.J. Street, M.Sc.DIC. G. Street was assisted by M. Joseph, B.Sc., G. Cahill, B.Sc., R. Prydon and A. Hudson.

In all, some 18 kilometres of gradient array were involved carried out over 15 lines.

*METHOD*

Brief comments on the method are appended to this report.

*EQUIPMENT*

A 3 kilowatt time domain transmitter was used to energise 2000 metres to 3000 metres current dipoles placed well outside the area on lines cut for that purpose. The resultant primary and secondary fields were monitored using compatible Scintrex IPR-8 and IPR-10 receivers.

**SCINTREX***DATA PRESENTATION*

The gradient array data has been added to the standard Renison data sheets, and in addition, the resistivity and chargeability data has been contoured up on standard Renison sheets at the scale of 1:5000.

*DISCUSSION OF RESULTS*

Firstly, each line is discussed separately from north to south. The January, 1978 report is referred to by page numbers as follows: \*P4

*LINE 5000N**\*P4/6*

A significant induced polarization anomaly of five times background was defined centred at 1765E accompanied by a depression in the resistivity of about 50% to about 300 ohm-metres. The source would therefore be weakly interconnected chargeable material at a maximum depth of perhaps 40 to 50 metres. This anomaly was not seen as a major anomaly on the pole-dipole array, however, a minor "shoulder" on that data clearly confirms its presence. The explanation for the difference in response may well be that the source is narrow. The inferred dip is to the west. A weak magnetic response is slightly offset to the west.

At 1615E a significant induced polarization anomaly of 40 millivolts/volt above the 20 millivolts/volt background was defined having a 200 ohm-metres apparent resistivity as against a background of 4000 ohm-metres to the west and half this to the east. The maximum depth to source on the gradient array was 40 to 50 metres. The *form* suggests a west dip *and* a more disseminated hanging wall. The chargeability anomaly is coincident with the magnetic depression between two distinct maxima recorded 30 metres either side of this peak.

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At 1320E, 1390E and 1445E maxima of 20 to 30 millivolts/volt above background were recorded from sources that have depths of the order of 40 metres. Only the centre anomaly has a depression in the apparent resistivity to 250 ohm-metres from 4000 ohm-metres. Thus, some conduction is present within the central (1390E) source. The pole-dipole data infers a 25 metres depth to these sources.

*LINE 4800N*

*No pole-dipole data*

The form of the resistivity and chargeability data on this line cannot readily be related to line 5000N. West of about 1450E chargeabilities vary about the 10 millivolts/volt level, while resistivity ranges within 2000 to 6000 ohm-metres. This area is underlain by granites. To the east of 1450E the resistivity decreases progressively to 1000 ohm-metres (+) while the background chargeabilities rise to 20 to 30 millivolts/volt over the Oonah quartzites. Within this zone some increases in chargeability were noted as follows:

The most significant was a maximum of 35 millivolts/volt (shoulder) and 55 millivolts/volt above background centred at 2020E and 2060E respectively. The maximum depth to source is estimated at 50 to 60 metres in each case. While a depression in resistivity was noted over these maxima, the actual resistivity at 4000 ohm-metres must be considered high, and thus the inferred source would likely be weakly connected at best. The sharp distortion in magnetic field noted over this anomaly indicates the presence of either magnetite or pyrrhotite.

Within the broad high to the west, maxima at 1730E and 1845E represent disseminated material, probably of formational origin.

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LINE 4600N

\*P6/8

The *form* of the data is similar to line 4800N. Presumably the high 10,000 to 5000 ohm-metres resistivity and low 10 millivolts/volt chargeabilities west of 1450E mark the presence of the granite below. A second similar section between 1550E and 1650E(+50 metres) also demonstrates the presence of granite.

Between the two, a broad source has been located at 1525E having a chargeability some 25 millivolts/volt above the 10 millivolts/volt background. The apparent resistivity data infers a disseminated source as the absolute values remain a high 1000 ohm-metres. The depth to source is about 25 to 50 metres.

At 1770E in an area mapped as having sedimentary float, a distinct chargeability anomaly was recorded which gave no distortion in the resistivity data. This infers a disseminated source. The maximum depth to source inferred from the gradient data is of the order of 50 metres, which confirms the pole-dipole data. The asymmetry implies an east dip.

To the east, two distinct sources were located at 1885E and 1940E, again, with no change in the apparent resistivity. The disseminated sources are inferred to have maximum depths of 35 metres and 45 metres respectively. Comparison with the pole-dipole data implies a maximum depth of 25 metres for the western source and 50 metres for the eastern source. The *form* of the anomaly suggests an east dip.

LINE 4400N

No pole-dipole data

High resistivities were noted west of 1660E where a significant 8 fold

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increase in chargeability occurs, revealing lower 1000 ohm-metres rocks to the east. As before, low 10 to 12 millivolts/volt background chargeabilities were noted over the granite.

Within the granite a 25 millivolts/volt anomaly accompanied by a broad local depression in resistivity to 2500 ohm-metres was recorded at 1565E. The source is disseminated and has a maximum depth of 50 metres (perhaps less).

Two broad (±50 metres) sources were located centred at about 1720E and 1810E which have anomalous responses of about 20 millivolts/volt above background. The former is associated with 1000 ohm-metres resistivities while the latter is associated with a change in resistivity (and rock type). Strong tin geochemistry was noted in the vicinity, particularly in the case of that centred at 1810E, however, the anomaly is not one of the better geophysical anomalies. The maximum depths to the sources are 35 metres at 1720E and 50 metres at 1810E.

A significant response of 45 millivolts/volt centred at 1985E, together with a shoulder at about 1965E are inferred to come from sources at depths no greater than 20 metres. The latter shows no change in resistivity while the major peak at 1985E shows a minor depression to 400 ohm-metres. The source is again interpreted as being disseminated. Pyrrhotite and/or magnetite makes a contribution to the source material as a distinct magnetic distortion accompanies this anomaly.

The most easterly response recorded was defined at 2045E where a 25 millivolts/volt anomaly was located from within 150 to 200 ohm-metres material. A small 'local' distortion in the magnetic field indicates the presence of magnetite or

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pyrrhotite, however, these alone could not account for the source. The maximum depth indicated is 25 metres. Quite strong tin geochemistry enhances this otherwise relatively small induced polarization anomaly.

*LINE 4200N**\*P8/9*

The most significant feature is a rapid fall off in the resistivity data to the east from 10,000 ohm-metres to less than 400 ohm-metres at 1563E. This defines the easternmost expression of the granite.

Of great significance is a 30 millivolts/volt above background chargeability maximum centred at 1625E and a minor but significant 10 millivolts/volt above background anomaly at 1570E. There is a significant resistivity low of 250 ohm-metres centred at 1580E. The maximum depth is assessed to be 50 metres. Now, the presence of gossan, erratic magnetic readings and high tin(etc) geochemistry, makes this anomalous zone of prime interest, and clearly demonstrates the anomaly as material, rather than due to end effects (see\*P8/9).

East of about 1800E(+) the chargeability remains at a high background level of 30 millivolts/volt while resistivities vary from 1000 ohm-metres to 1800 ohm-metres. As gossan float together with erratic magnetic readings have been recorded over this sector, it is suggested that alterations of sulphides and/or graphite containing magnetite and/or pyrrhotite may be present over this zone. The more resistive sections being more silica rich (i.e. quartzites, sandstones and the like).

*LINE 4000N**No pole-dipole data*

The eastern margin of the granite is marked dramatically by a 20 fold increase

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in resistivity from 1000 ohm-metres in the east to 20,000 ohm-metres in the west at 1562E. Associated with this contact is a broad 50 millivolts/volt anomaly centred between 1550E and 1600E and accompanied by a distinct *negative* distortion in the local magnetic field. The source is interpreted as being due to coarse grained sulphides and/or graphite containing significant quantities of pyrrhotite and/or magnetite which have remnant magnetism. (This feature often indicates the presence of pyrrhotite). A maximum depth to source of 40 metres is indicated and while the anomaly is of prime geophysical interest, its potential economic interest is much enhanced by its location on the granite contact and the high accompanying tin geochemistry.

No other significant anomalies were located on the gradient data.

## LINE 3800N

\*P9/12

The eastern extremity of the granite is marked by a sharp change in the induced polarization background from 15 to 20 millivolts/volt to the west to anomalous 50 millivolts/volt(+) levels to the east. Unlike the lines to the immediate north, there is no sharp drop-off in resistivity to mark the contact, although a *gradual change* was recorded.

A substantial above background anomaly of 35 millivolts/volt was defined at 1335E, whose maximum depth is of the order of 40 metres (the pole-dipole data infers 25 metres). The source must be disseminated due to the very high accompanying resistivity of 3000 ohm-metres(+) in both gradient and pole-dipole data, and must contain either pyrrhotite and/or magnetite due to the 2000 gamma distortion in the magnetic field. This anomaly is considered of secondary (B) interest.

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An above background response of 50 millivolts/volt was defined at 1435E which is accompanied by a depression in the resistivity to 700 ohm-metres from 1500 ohm-metres to the immediate east and west. The maximum depth to source is assessed to be of the order of 60 metres from the gradient data, while the pole-dipole infers it to be as shallow as 30 metres(+). The source either dips west, or, more likely, a second related source may be present at 1400E and is seen as a "shoulder". An accompanying distortion in the magnetic field infers the presence of magnetite and perhaps pyrrhotite also. The economic interest of the anomaly is increased by a tin geochemistry high of similar form.

No other significant induced polarization anomalies were located.

*LINE 3600N*

*No pole-dipole data*

High resistivities of 4000 ohm0metres and background chargeabilities of 20 millivolts/volt over the granites in the west show an abrupt change at 1350E which probably marks the *precise* granite contact. To the immediate east of this contact, two significant anomalies, each of 35 millivolts/volt above background were recorded at 1385E and 1435E. The resistivity decreases 75% to about 550 ohm-metres. The maximum depth to source in each case is estimated at about 40 metres. These are significant induced polarization responses and are enhanced by a *negative* magnetic anomaly over the westerly one, which *may* indicate the presence of pyrrhotite (with magnetite), also the very high 550 ppm soil geochemistry centred at 1460E down slope from the projected source rocks.

As a relatively small 6 millivolts/volt anomaly at 1560E is accompanied by no change in the apparent resistivity, a disseminated source at maximum depth of

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35 metres is interpreted.

A broad 20 millivolts/volt increase in chargeability centred at 1900E +50 metres is accompanied by a sympathetic increase in the local magnetic field and tin soil geochemistry. The maximum depth to source is about 60 metres. High chargeability values continue to the east, and these are considered to be formational.

LINE 3400N

\*P12/14

The mapped position of the granite (at about 950E) is not reflected in the apparent resistivity or chargeability data profiles. However, between about 975E and 1110E, lower resistivities of 350 ohm-metres were recorded accompanied by higher chargeabilities of 35 millivolts/volt as against a background of about 20 millivolts/volt.

The first significant chargeability response was recorded centred at 1310E. There is no appreciable change in the 1000 to 1500 ohm-metres and thus the source is interpreted as disseminated in form. There are narrow magnetic field increases either side of this chargeability anomaly indicating the presence of magnetite (and/or pyrrhotite). The maximum depth to source is estimated at 40 to 50 metres, however, the pole-dipole infers a 25 metres depth. A substantial copper and lesser zinc geochemistry high lies down slope from this maximum.

To the east the next most significant induced polarization anomaly was defined at 1470E as a 35 millivolts/volt response showing no significant change in the 1000 ohm-metres resistivity. The disseminated source has an estimated maximum depth of about 40 metres. The pole-dipole data infers a shallow 25 metres

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maximum depth. A small increase in magnetic field to the west and a stronger increase just to the east of the maximum indicates the presence of magnetite and possibly pyrrhotite. There is also a sympathetic increase in the soil tin to 400 ppm.

A further broad induced polarization high of up to 50 millivolts/volt against background was recorded centred at 1560E and extends +50 metres either side of this point. The associated resistivity is reduced to 300 ohm-metres from 1000 ohm-metres to the west, so some interconnection within the source is present.

The maximum depth as established from the gradient data is 60 metres, however, the pole-dipole infers a depth as shallow as 25 metres to the top of the body. High zinc geochemistry was recorded to both the east and west of this feature.

The most easterly feature defined on the gradient survey was defined at 1785E. Here a 65 millivolts/volt was recorded from a source which shows no distortion in the resistivity data, so inferring it to be disseminated or electrically discontinuous. The gradient array indicates a *maximum* depth of about 50 metres however, the pole-dipole indicates about 25 metres. There is a strong associated magnetic field distortion of +500 gamma indicating that magnetite is contained within the source. However, magnetite is not considered to be the *whole* cause of the chargeability; sulphides, graphite (or serpentinite?) may also be present. Note that pyrrhotite *alone* would not account for the high magnetic field at this point.

LINE 3200N

No pole-dipole data

A rapid fall-off in resistivity from 8000 ohm-metres(+) to 1500 ohm-metres was recorded at about 460E which is coincident with a change from 15 millivolts/volt

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background to the west to 30 millivolts/volt to the east. This boundary is attributed to the granite/hornfels boundary. Between about 460E and 800E the recorded chargeability background is about 35 millivolts/volt with local peaks rising above this level at 490E, 560E, 660E and 770E respectively. These maxima are accompanied in a broad way by higher magnetic fields which indicate more mafic mineral segregations may give rise to "formational" increases in background.

Between about 970E and 1260E the regime changes. Here a series of distinct maxima were observed at 1000E (40 millivolts/volt), 1035E (50 millivolts/volt) 1120E (57 millivolts/volt), 1175E (45 millivolts/volt) and 1240E (45 millivolts/volt). Most are accompanied by a distinct depression in the resistivity to 400 to 700 ohm-metres from 1500 to 2500 ohm-metres outside this area. The maximum depth to the source is invariably about 30 metres. This zone is accompanied by a sharp increase in local magnetic field demonstrating the presence of magnetite although this alone does not account for the high chargeability - other material such as sulphides, graphite (or serpentinite?) must be present. Significantly higher geochemical data was recorded over this zone.

Higher resistivities of 2000 ohm-metres + were recorded between 1275E and 1450E, together with lower chargeability background. This may indicate the limits of a subcrop of granite/hornfels as both occur as float over this section.

A small but distinct chargeability maximum was defined at 1360E from high resistivity of 2500 ohm-metres. The 20 millivolts/volt anomaly has an estimated depth to source of 40 metres. A sharp 5000 ohm-metres magnetic field increase indicates the presence of magnetite, while geochemical activity increases down

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slope. This suggests that the 'contact' zone is close.

The largest induced polarization anomaly located, namely 120 millivolts/volt, was defined at 1510E and is accompanied by a depression in the resistivity to 150 ohm-metres from 2500 ohm-metres, 100 metres east and west of the anomaly. The maximum depth to source looks to be about 30 to 40 metres. The anomaly is flanked to the west by a broad 5000 gamma increase in magnetic field and to the east by a smaller 3500 gamma increase. This suggests a moderately conducting sulphide 'core' surrounded by magnetite. No increase in geochemistry was defined above the moderate level seen 100 to 200 metres either side of the anomaly. No significant outcrop was recorded. The anomaly is considered of prime geophysical interest.

No other significant anomalies were recorded on the gradient survey.

**LINE 3000N****\*P14/16**

High apparent resistivities were defined between 00 and 460E where a rapid fall-off from 10,000 ohm-metres to 1500 ohm-metres was recorded. This point represents the granite/hornfels contact. Relatively low 20 millivolts/volt chargeabilities were noted within the granite. The first significant feature was a 'shoulder' whose source is estimated to be centred at 480E. This has a resistive background of 1700 ohm-metres which shows a disseminated source to be present. The suggested depth is not greater than 40 metres. A moderate increase in geochemistry was noted close to this response which may enhance its economic interest.

A substantial 184 millivolts/volt response was defined at 530E which is

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accompanied by a low 250 ohm-metres resistivities. The maximum depth to the source which is probably interconnected sulphides (graphite or serpentinite?) is approximately 40 metres and the anomaly is of prime geophysical interest. The form of the anomaly *suggests?* a west dip to the source.

The next significant anomaly was located centred at 700E where a 60 millivolts/volt response was recorded about 35 to 40 millivolts/volt above background. The 400 ohm-metres accompanying resistivity infers a weakly interconnected source which is interpreted as having a maximum depth of about 35 metres. Magnetite is inferred within the source, but is not the whole source of the anomaly.

Two similar maxima of 30 and 35 millivolts/volt above background were defined at 835E and 880E respectively from sources at 40 metres depth. The high resistivity infers a disseminated source.

A most significant "twin" response was recorded with maxima of 50 millivolts/volt and 60 millivolts/volt above background at 1080E and 1115E. The accompanying resistivities are 80 ohm-metres and 200 ohm-metres, which are abnormally low and may infer "massive" to "near massive" mineralisation. The form of the anomaly suggests a *west dip* not east dip as per the pole-dipole array. The maximum depth inferred from the pole-dipole data was 60 to 70 metres.

The least significant anomaly defined was located at 1230E and is a broad response from a wide source. The 25 millivolts/volt above the 30 millivolts/volt background anomaly is accompanied by a broad depression in the resistivity to 600 ohm-metres. The pole-dipole infers a less chargeable cover, and a depth

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to source of about 40 to 50 metres. A 2500 gamma increase in magnetic field indicates the source contains magnetite, but is not the whole source of the anomaly defined.

No other significant results were located on this line.

*LINE 2800N**No pole-dipole data*

A major change in form was noted between lines 2800N and 3000N. Except for a broad chargeability high between 1050E and 1450E which is accompanied by 700 to 4000 ohm-metres resistivities, there were no significant anomalies located on this traverse.

*LINE 2750N**No pole-dipole data*

The results recorded on this line remain above 2500 ohm-metres west of 200W to 600W. East of 325W the background chargeability of 10 millivolts/volt is typical of granites, while much higher 40 millivolts/volt maxima at 560W and between 530W and 420W are due to wholly disseminated sulphides within the granite(?)

*LINE 2700N**No pole-dipole data*

East of about 380E very high resistivities of 2500 ohm-metres(+) accompanied by low 10 millivolts/volt backgrounds are typical of granite.

To the west, a high 30 millivolts/volt above background chargeability was recorded between 225E and 375E, and 40 millivolts/volt at 140E. These are not accompanied by any change in the high resistivity. Thus the source must be

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disseminated sulphides within the granites(?)

*LINE 2600N*

*\*P16/18*

Between 300E and 475E high resistivities increasing from 2000 ohm-metres in the west to 7500 ohm-metres were recorded together with 12 millivolts/volt(+) background typical of granites. At 495E and 535E two dramatic decreases to 300 ohm-metres were recorded. At 490E a sharp increase in chargeability was noted from a slightly conductive source at a depth of 20-25 metres. A similar response at 540E has a similar source and depth, but extends into more resistive 2000 ohm-metres material to the east.

A broad zone of 30 to 40 millivolts/volt was recorded between 770E to 1425E which is overlain by less chargeable material of lower resistivity (soils?)

The only significant anomaly located on this background was recorded centred at 1350E and extending 50 metres east and west of this point. The accompanying resistivities remain a high 1000 ohm-metres while the magnetic field has a local substantial increase. The pole-dipole data indicates a maximum depth of the order of 25 to 30 metres. The source is interpreted as disseminated sulphides plus graphite.

*SOME COMMENTS ON THE CONTOUR INTERPRETATIONS*

The chargeability and resistivity data has been contoured onto standard Renison sheets at the scale of 1:5000.

The granites are characterised by very high resistivity of 4000 ohm-metres to 20,000 ohm-metres, and by low chargeability of 10 to 20 millivolts/volt. The

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latter shows an increase from 10 millivolts/volt(+) in the north to 20 millivolts/volt(+) in the south, suggesting a compositional change in that direction. The contact between granites in the west and hornfels to the east is often sharp, especially where the granite/hornfels contact is at a steep strike angle to the survey line. The resistivities over the granites on lines 3400N and 3600N are lower due to the 30° - 40° strike of the granite to the current flow, thus causing a slewing of the current path.

East of the granite contact, isolated relative resistivity highs (say 2 to 3 fold increases) associated with low chargeability backgrounds are often found in areas where granite outcrop or float has been recorded.

An exception to the high resistivity/low chargeability recorded over the granites was located in the south west of the grid, in the vicinity of the Globe Mine (line 2700N). High chargeability of up to 35 millivolts/volt (20 millivolts/volt above background) is associated with high 2000 to 3000 ohm-metres resistivities, which are in fact *slightly less* than the 5000 ohm-metres seen to the north and south. The Globe Mine itself is situated on the south-eastern flank of the chargeability high, the centre of which is some 100 metres(+) to the north west. A detailed gradient set-up (such as used over the Federation grid) would be required to detail this zone, however, the *form* is similar to those observed over mineralisation in that grid.

The most significant and potential economic induced polarization anomalies located were defined semi-parallel to and in close proximity to the granite/hornfels contact. A significant number of chargeability anomalies occur west of the granite contact, these invariably lie within relatively resistive lows.

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From a purely geophysical standpoint sulphide or graphite are equally likely sources, with magnetite, although the magnetic field rarely indicates magnetite to be the primary source. Similarly the magnetic anomaly is often too high to be caused wholly by pyrrhotite.

The trends contoured are those suggested by interline correlation and these *have not* been biased by the recently available geological map provided by Renison Limited. For a *unique* contour map a closer spacing would be required, however, only for gross units striking at shallow angles relative to the lines is the contour presentation at variance with the mapped geology.

**CONCLUSIONS****Profiles:-**

- 1 - The gradient array data has precisely defined the location of each of the polarizable sources first detected in the 1978 pole-dipole survey, and has resolved multiple sources. In a number of cases locations have been adjusted, and in one case (5000N/1735E) completely changed the emphasis of the anomaly.
- 2 - In spite of the fact that the line intervals have been closed from 400 metres in the 1978 survey to 200 metres, interline correlation is still not possible due to the complex strike and limited strike length of the polarizable events.
- 3 - A summary of significant induced polarization responses is given below. Lines marked(\*) were previously surveyed with pole-dipole, and anomalies

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marked (#) have significantly changed location or emphasis.

The geophysical interest of each anomaly has been graded partly on *form* and partly on *amplitude*. The form considered most significant is where the source is seen to be less resistive than background, chargeable, and to have a related magnetic field distortion. Grading is from A to D.

*Significant Anomalies:-*

<u>Line</u>	<u>Station</u>	<u>Maximum Depth</u>	<u>Geophysical Interest</u>
5000N*	1765E #	40-50 metres	A/B
5000N*	1615E	25-40 metres	A
5000N*	(1320E	40 metres (+)	B
5000N*	(1390E	40 metres (+)	A/B
5000N*	(1450E	40 metres (+)	B
4800N	2020E	50-60 metres	B/C
4800N	2060E	50-60 metres	B
4600N*	1525E	25-50 metres	B/C
4600N*	1770E	25-50 metres	C
4600N*	(1885E #	25-35 metres	B
4600N*	(1940E	50 metres	B/C
4400N	1565E	50 metres	C
4400N	1720E	35 metres	D
4400N	1810E	50 metres	C (Tin high)
4400N	1965E	20 metres	B
4400N	1985E	20 metres	B
4400N	2045E	20 metres	B/C (Tin high)

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<u>Line</u>	<u>Station</u>	<u>Maximum Depth</u>	<u>Geophysical Interest</u>
4200N*	(1625E	50 metres	A (Tin high)
4200N*	(1570E	-	A (Tin high)
4000N	1570E+25 metres	40 metres	AA (Tin high)
3800N*	1335E	25-40 metres	B (Tin high)
3800N*	1435E	60 metres	A (Tin high)
3600N	1385E	40 metres	A/B (Tin high)
3600N	1435E	40 metres	A/B (Tin High)
3600N	1560E	35 metres	D
3600N	1900E	60 metres	D/C (Tin high)
3400N*	1310E	40-50 metres	B/C (Copper/zinc high)
3400N*	1470E	25-40 metres	B/C (Tin high)
3400N*	1560E	25-60 metres	B (Zinc high)
3400N*	1785E	25-60 metres	B
3200N	1000E)		
3200N	1035E)		
3200N	1120E)	30 metres	B/C Geochem. high
3200N	1175E)		
3200N	1240E)		
3200N	1360E	40 metres	C
3200N	1510E	30-40 metres	A
3000N*	480E	40 metres	B/C
3000N*	530E	40 metres	A
3000N*	700E	35 metres	C
3000N*	835E	40 metres	C
3000N*	880E	40 metres	C
3000N*	(1080E	40 metres	A/B

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<u>Line</u>	<u>Station</u>	<u>Maximum Depth</u>	<u>Geophysical Interest</u>
3000N*	(1115E	40 metres	A/B
3000N*	1230E	40-50 metres	B/C
2800N	-		
2750N	-		
2700N	Disseminated within granites only		
2600N*	490E	20 metres	C
2600N*	540E	20 metres	C
2600N	1350E+50 metres	25-30 metres	B/C

*Contour Maps:-*

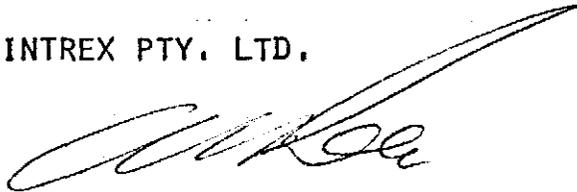
- 1 - The granites are characterised by low chargeability of 10 millivolts/volt(+) in the north which increases gradually to 20 millivolts/volt(+) in the south. Overall resistivities are high, between 4000 and 20,000 ohm-metres within this unit.
- 2 - The hornfels is characterised by higher background chargeabilities of 30 millivolts/volt and lower resistivities of 1000 ohm-metres (+).
- 3 - Areas mapped as quartzites have 2000 ohm-metres resistivities and lower chargeabilities of 25 millivolts/volt(+) on average.
- 4 - The only anomaly within the granite was located to the north-west of the Globe Mine (line 2700N), however, many anomalies having higher chargeability and lower resistivities were defined in the 'sediments' east of the granites, the most interesting of which were located on or close to the granite/hornfel contact.

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The author looks forward to discussing the results of this survey with Renison Limited in the near future.

Respectfully submitted on behalf of:

SCINTREX PTY. LTD.



A.W. HOWLAND-ROSE, MSc, DIC, AMAus IMM, FGS.

GEOPHYSICIST

## APPENDIX

BRIEF SIMPLE COMMENTS ON THE GRADIENT, DIPOLE-DIPOLE AND POLE-DIPOLE ARRAYS  
AND ON DECAY FORM

## INTRODUCTION

In the case of the surveys discussed in this report, it is important that the geologist can relate the geophysical data to the underlying geology if he is to make the best use of this data. It is the author's opinion that *only* the geologist will be able to relate the data to geology. For this reason brief, simple comments follow on the salient features of the gradient, dipole-dipole and pole-dipole arrays. These comments show how the data relates to the volume of underlying rock which influences it. Comments are also made on the decay form.

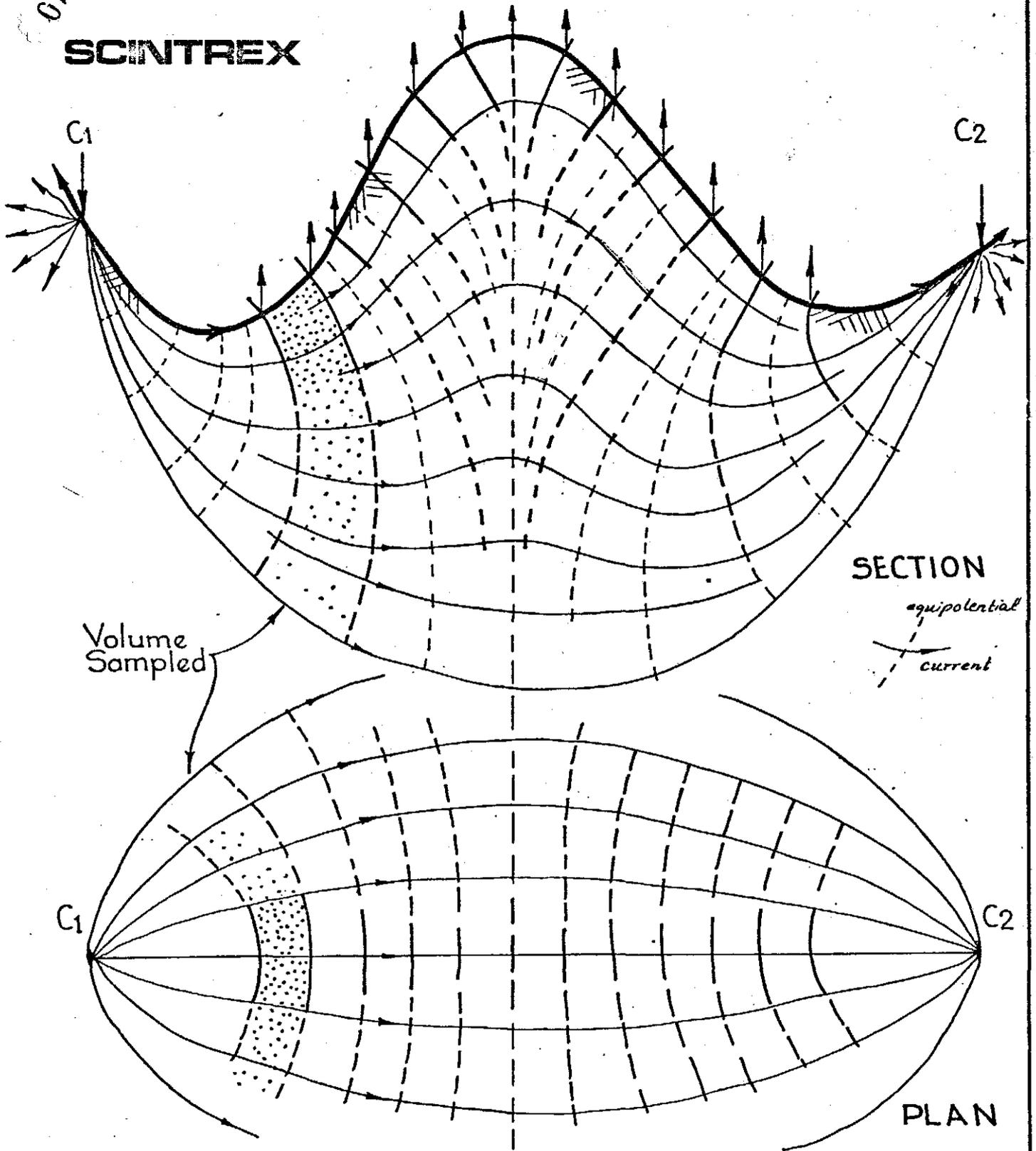
## DISCUSSION

*Gradient Array:-* In this array both current electrodes are distant from the potential dipole. Figure 1 displays the salient features of the *primary* current flow and primary equipotential field generated during energisation and shows the influence of terrain on the current paths. From this diagram it can be seen that the *apparent resistivity* measurement is a summation of a volume of material normal to the local slope, *beneath* the surface and at *right angles* to the line.

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

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

FIGURE 1.

5 cm

**SCINTREX**

Page - two

Note particularly that the *source volume is normal to slope* and not vertically beneath the potential dipole. Therefore all maximum depths refer to depths below surface *normal to the slope*.

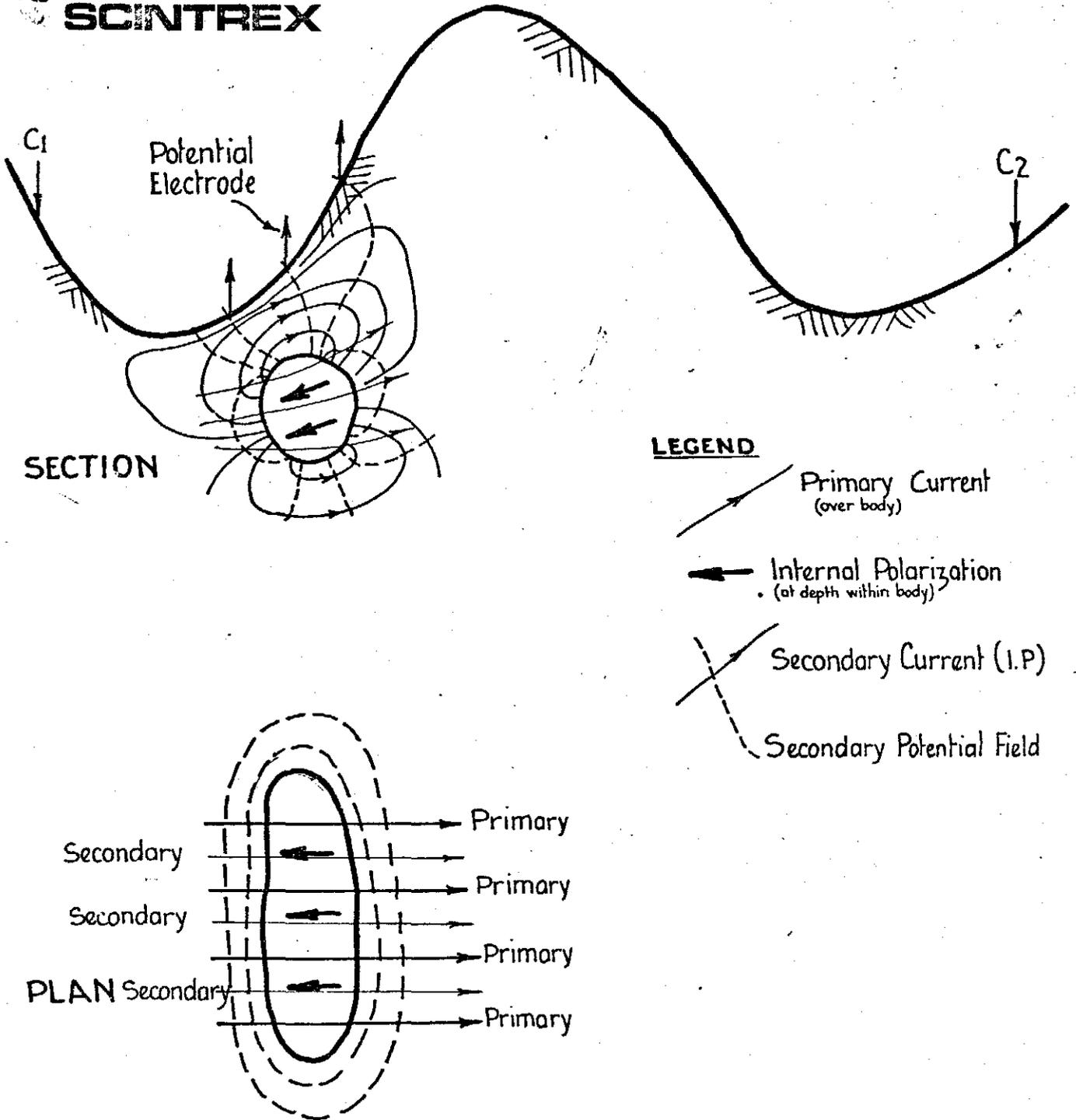
Note also that the volume of material *closest to* the potential electrodes will influence the data most. It is difficult to easily quantify the complex relationship between the volume of material sampled and its distance from the potential dipole.

Figure 2 displays the secondary current pattern generated from the decay of induced polarization effect *within* a chargeable sulphide source, together with the equipotential field generated by that decay. Note that due to the necessarily curved nature of the current flow outside the body, the on-surface manifestation is *wider than the source width*. Note also that the volume sampled in the primary potential field (apparent resistivity  $\rho_a$ ) is not necessarily the same volume as is the secondary potential field (apparent chargeability  $Ma$ ). This is, of course, true for *any* array.

*Dipole-Dipole:-* In this array the current dipole is generally small, generally 20 to 100 metres. Figure 3 displays the current pattern in section and in plan for a dipole-dipole array. The equipotential  $P_1$  and  $P_2$  tap a volume as shown in this diagram whose characteristics are read on the  $n = 1$  station and plotted as a single point midway between the transmitting dipole  $C_1$  to  $C_2$  and the potential dipole  $P_1$  to  $P_2$ . As progressively higher  $n$  values are read, a deeper and wider volume of material is sampled, this always being plotted midway between the transmitting and receiving dipole, and at a deeper level in the pseudo-section presentation used in this report. It is *vital* to realise that this data point

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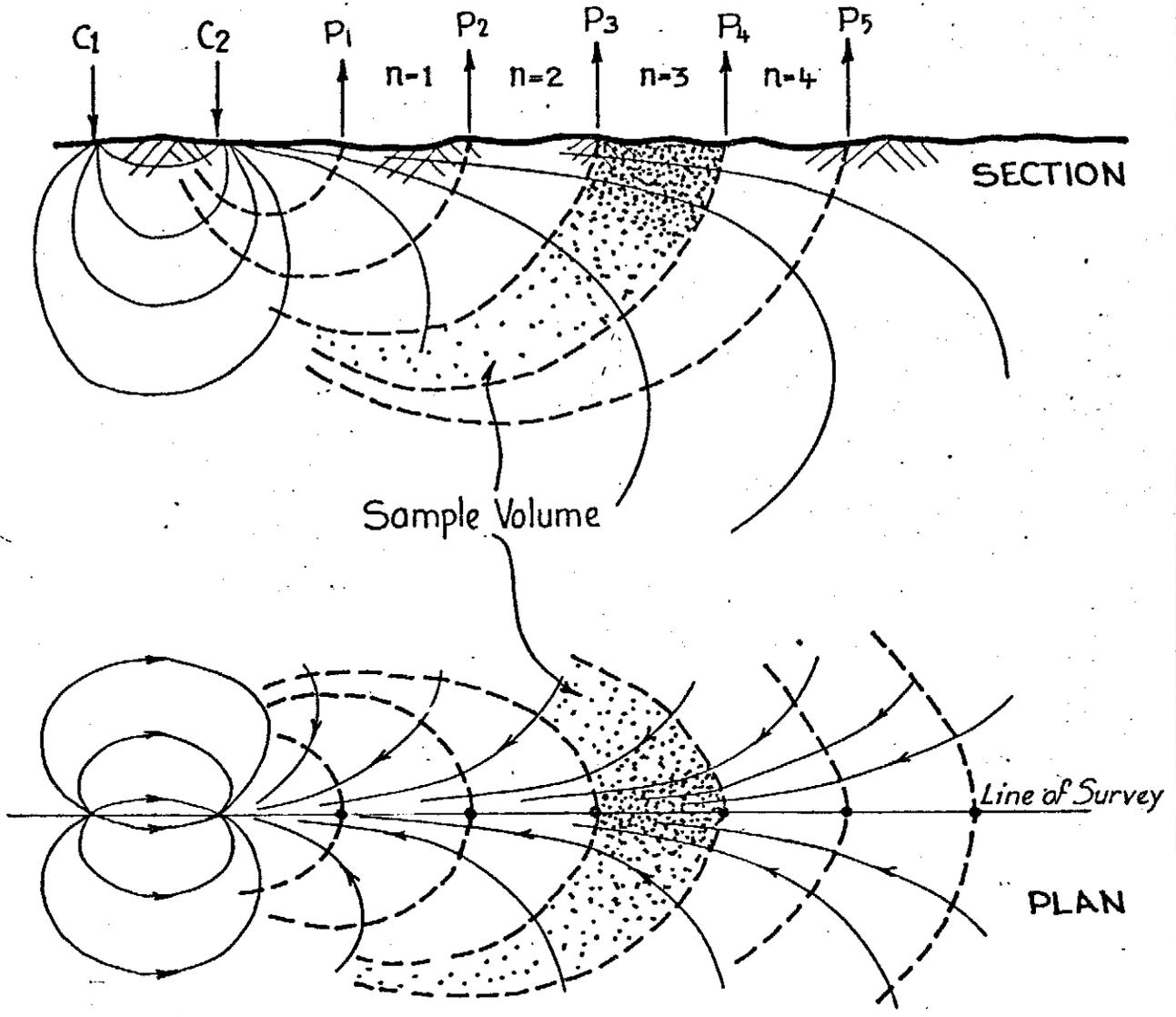


Diagrammatic representation of secondary current (I.P. effect) and secondary potential field in steep terrain.

FIGURE 2.

5 cm

# SCINTREX



Dipole - Dipole Array  
 Primary current paths and equipotential field  
 Showing volumes sampled

FIGURE 3.

5 cm

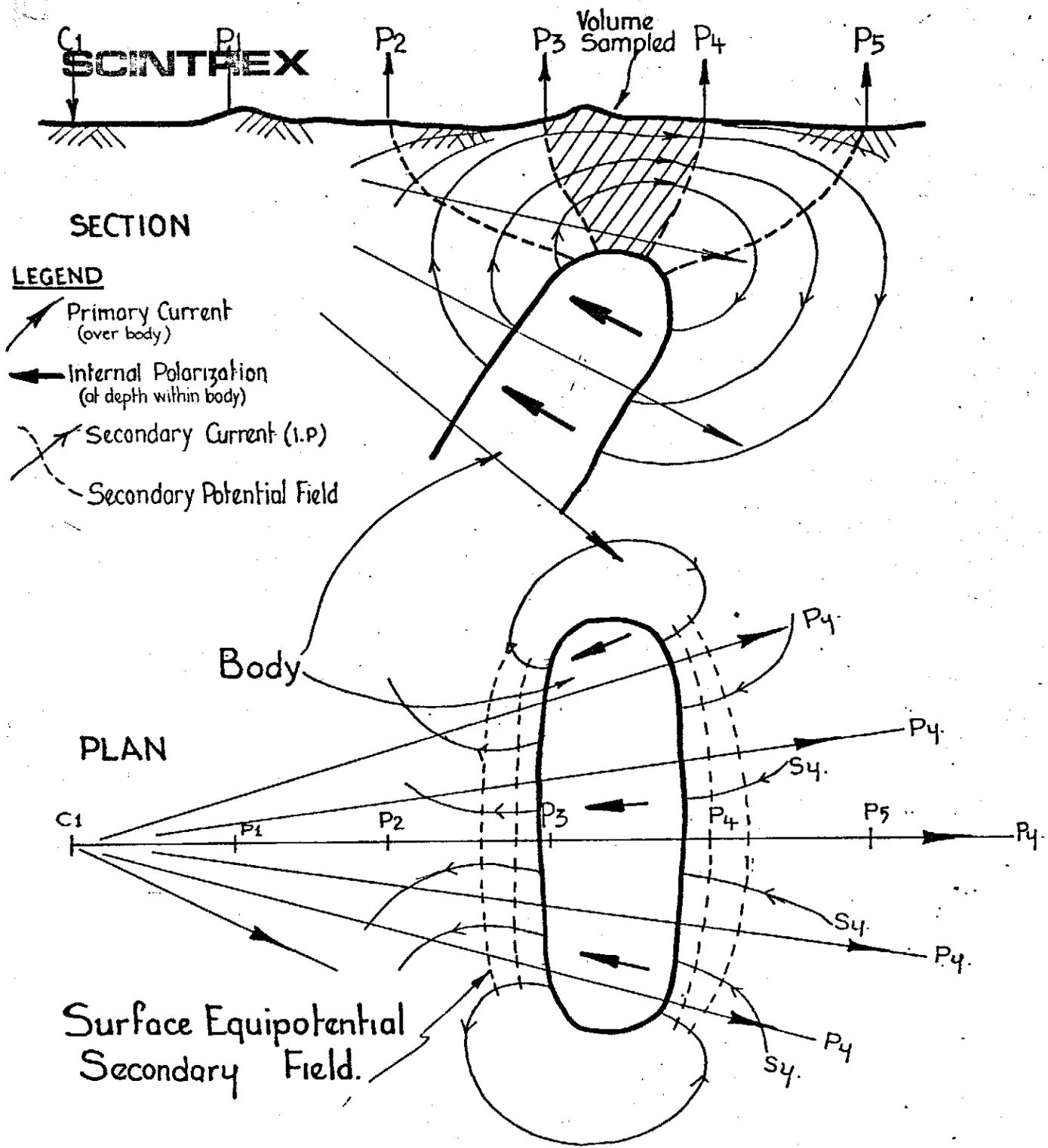
does not represent the characteristics of the ground at the point plotted, but that of the *total volume* sampled.

A further characteristic of the array is that where the effective spacing ( $n \times a$ ) is greater than the depth to the source, a 'high' (or 'low', depending on characteristics) will occur as each of the dipoles (i.e. transmitting  $C_1$  and  $C_2$  and potential  $P_1$  and  $P_2$ ) pass over the source of that anomaly. The resultant  $45^\circ$  patterns on the pseudo-section DO NOT represent dip, or even depth extent, but merely represent a complex interference pattern over the source due to the potential and current dipoles. For a single source, this *double peak effect* can be recognised as it tends to have two maxima displaced by  $(n \times a + w)$  where  $w$  is the width of the source. For multiple bodies this is difficult if not impossible to resolve by dipole-dipole arrays alone.

The enclosed Figure 4 shows the discharge of the energy stored in the body. As can be seen, the area sampled in section is tapped between the equipotentials generated by the discharge of the stored energy. These will not necessarily be of the same form as those for the resistivity data, although they are, for convenience, plotted in the same format as for resistivity. Again, it is vital to note that they represent the volume sampled as shown in Figure 4, *and not* the characteristics of the point at which they are plotted. Double peaks also occur as each of the two sets of electrodes pass over a source, where  $n \times a$  is greater than the depth to source. Where  $n \times a$  is less than the depth to source, a single maximum will be produced midway between the energising and measuring dipoles  $C_1/C_2$  and  $P_1/P_2$ .

*Pole-Dipole:-* This array is similar in principle to the dipole-dipole array,

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Current path and secondary equipotential field due to discharge of stored energy (I.P. effect) in the case of Pole-Dipole or Dipole-Dipole.

FIGURE 4.

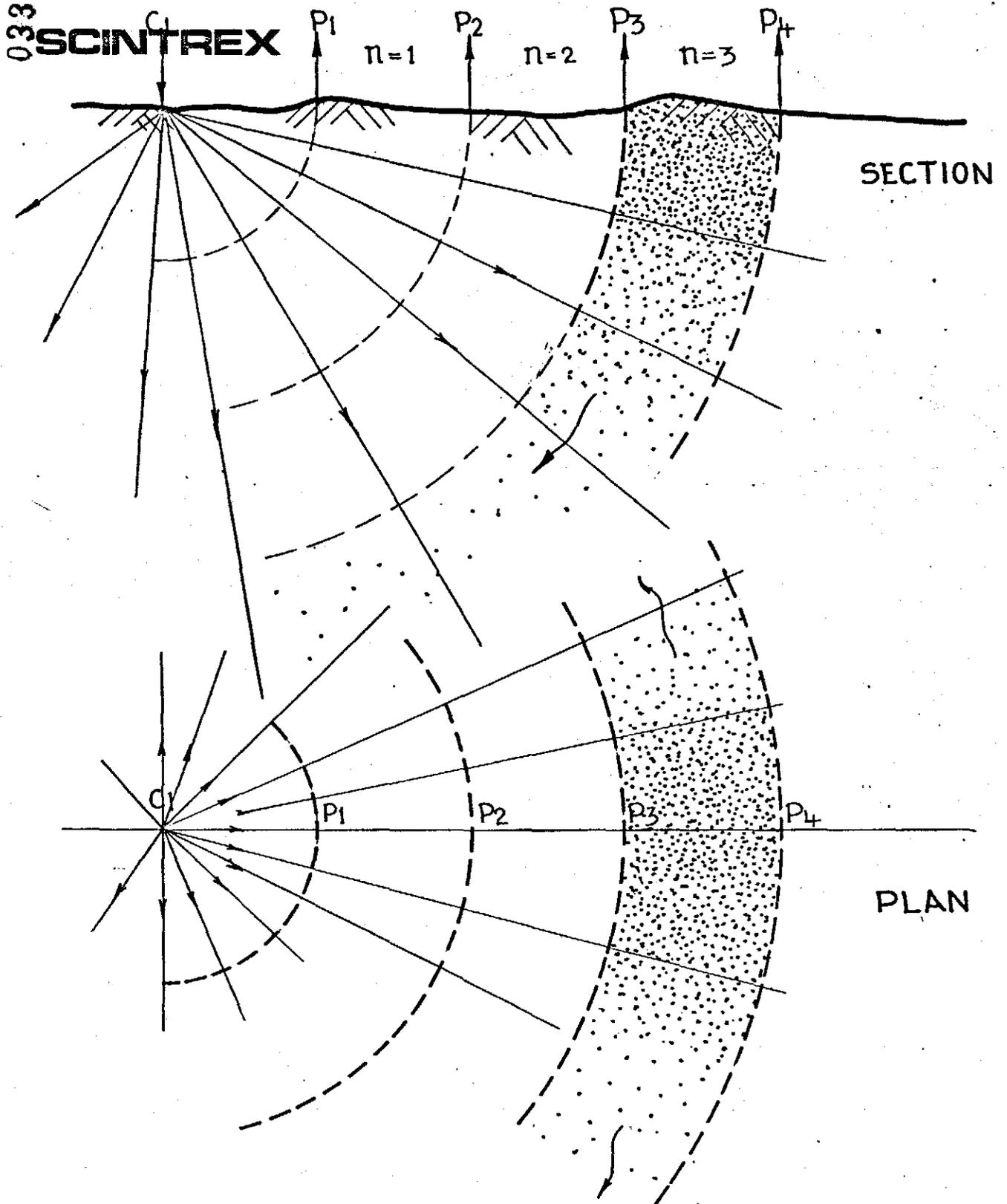
5 cm

**SCINTREX**

except that a single electrode is placed 'close' to the potential dipole, with an 'infinite' electrode placed  $10 \times n \times a$  away from the 'pole-dipole' set-up, and, where practical, at right angles to it. The enclosed Figure 5 shows the distribution of current flow in section and in plan, about the pole source  $C_1$ . The potential electrodes  $P_1$  and  $P_2$  tap off the volume between them, which is contained between spheres whose centres are the pole source. The primary current reading is normalised for the geometry and plotted in profile or pseudo-section format as per dipole-dipole, namely, midway between the closest potential and current dipoles, which in the pseudo-section format is  $45^\circ$  towards the pole source. The chargeability reading is generated in a similar fashion to that described for dipole-dipole (Figure 4).

As with the dipole-dipole array, a double peak will result when  $n \times a$  is greater than the depth to source, however, with pole-dipole it will be asymmetric. This will be true for both major resistivity features as well as for chargeability features. An example of this asymmetry for different depth to spacing arrays is shown for the three-array. (The three-array is a pole-dipole array when  $n = 1$  and the  $a$  spacing is varied.)

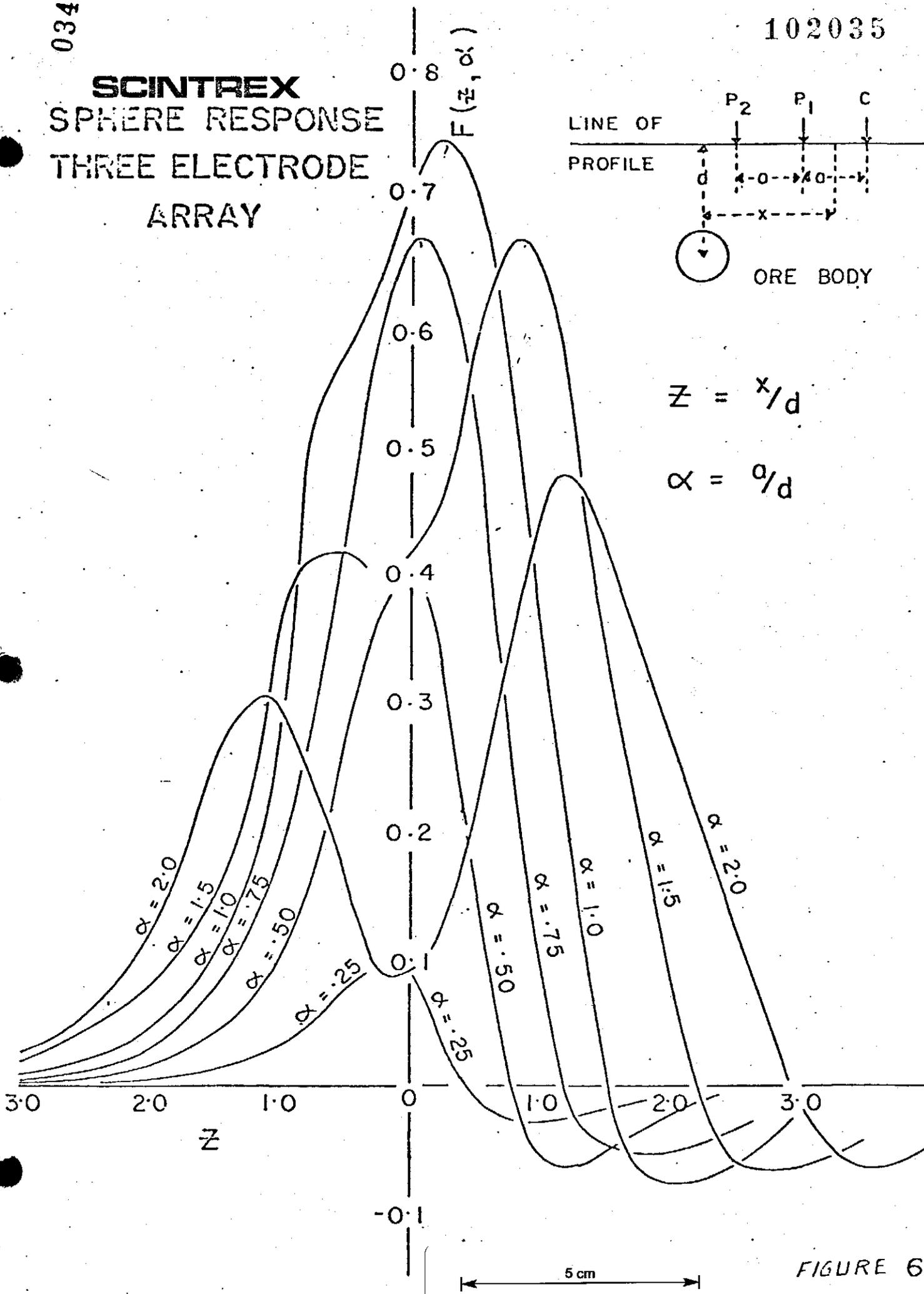
*The Choice Between Arrays:-* Even after some thirty years of active use of gradient, dipole-dipole and pole-dipole arrays, controversy still reigns as to the relative merit of the various arrays. Much depends on the object of the programme, the terrain, the type of source sought, the type and complexity of the overburden/oxidation. Table 1 shows a comparison between arrays which may be helpful, taken from a fairly recent Canadian Geological Survey publication. In resistive mountainous terrain the author prefers the gradient array as the prime reconnaissance method due to the high productivity (2 to 5 times that for



Current Path and Primary Equipotential Field  
from Pole-Dipole Array

FIGURE 5

# SCINTREX SPHERE RESPONSE THREE ELECTRODE ARRAY



5 cm

FIGURE 6

035

TABLE 1  
(Table 3.1)

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**SCINTREX** Comparison of IP Survey Electrode Arrays

(after Sumner, 1972)

	Advantages	Disadvantages	Survey Speed	Signal to-Noise	EM Coupling Rejection
<b>Parallel Field Arrays Wenner</b>	Anomalies symmetrical Synchronous detector possible Many case histories available	Requires more wire: larger field crew Poor resolution Unfavourable in capacitive coupling situations	Fair	Good	Fair
<b>Schlumberger</b>	Symmetrical array Synchronous detection possible Fewer men required Works well in layered earth Type curves available	Less horizontal resolution Unsuitable for horizontal profiling Capacitive coupling possible	Fair	Fair	Fair
<b>Gradient</b>	Map interpretation easier Less masking by conductive overburden Penetration good; safer Communications easier Can use two or more receivers Less topographic effect Data easily contoured in plan Useful where difficulty in making good current contacts	Poor resolution with depth Poor in low resistivity areas Geometric factor varies complexly	Good	Fair	Poor
<b>Potential-About-a-Point Three-Array</b>	Good reconnaissance array Fairly good resolution	Asymmetrical More wire needed	Fair	Good	Good
<b>Pole-Dipole, Collinear</b>	Good resolution Good subsurface coverage	Asymmetrical Asymmetrical	Fair	Fair	Fair
<b>Perpendicular Three-Array, Pole-Dipole, Pole-Pole Pole-Pole (Two-Array)</b>	Virtually eliminates EM coupling	More wire needed	Fair to Poor	Fair	Very Good
	Smaller crew needed Less wire needed than for some arrays Good penetration in nonconductive overburden	Susceptible to masking by conductive overburden	Good	Fair	Poor
<b>PDR (Potential Drop Ratio)</b>	Sensitive to lateral variations "Common mode" noise rejection	Complex interpretation	Fair	Good	Fair
<b>Dipole Field Array</b>					
<b>Dipole-Dipole, Collinear</b>	Symmetrical, good resolution Good penetration Less survey wire needed	Slow unless equipment is portable Resistivity topographic effects Interpretation somewhat involved	Fair	Poor	Fair
<b>Dipole-Dipole, Parallel</b>	Special use for EM coupling interpretation	Not used for routine surveying	Poor	Poor	Fair
<b>Down-the-Hole Arrays</b>					
<b>Azimuthal Array (One Potential Electrode Down the Hole)</b>	Fair for exploration purposes Useful in finding the best search direction	Interpretation complex Negative anomalies Strong geometric effects Mainly measures changes in resistivity	Fair	Good	Good
<b>Radial Array (One Current Electrode Down the Hole, mise-à-la-masse)</b>	Good for exploration purposes Useful in finding the best search direction Hole need not stay open	Interpretation complex Negative anomalies Not good for obtaining rock properties	Fair	Good	Good
<b>In-Hole Arrays (More than One Electrode in the Hole)</b>	Good for obtaining rock properties Good for assaying Interpretation simple	Current densities may be too large Possible capacitive coupling problems Not designed for exploration purposes Special equipment, expensive	Good	Fair	Good

Extract from: Geological Survey of Canada - Paper 75-31 "Borehole Geophysics Applied to Metallic Mineral Prospecting: A Review"

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dipole-dipole), but this should be followed-up by detailed dipole-dipole or pole-dipole surveys as the gradient array, while giving 'maximum depths', cannot give 'minimum depths' as moving source arrays can. Similarly pole- or dipole-dipole surveys which have complex or multiple sources can very often be resolved by use of limited gradient array detail. While pole-dipole is more efficient to apply in mountainous terrain, it tends to yield asymmetric double peak anomalies, however, to the trained observer, this is no disadvantage.

*Brief Comments on Decay Form:-* In most surveys three 'slices' of the decay form for the induced polarization response are acquired for each station as shown in Figure 7. While six slices are capable of being measured ( $M_1$  to  $M_6$ ), they are normally combined into pairs  $M_1 + M_2 = M_1$  etc. as shown in Figure 7(C). Each of the slices  $M_1$  to  $M_6$  is normalised for a 'normal' decay form such that should the decay form be 'normal'  $M_1 = M_3 = M_5$ . Thus the operator can immediately recognise any anomalous decay forms which may arise from one of two major sources. Firstly the type of the source can influence the decay form. Coarse grained efficient sources such as sulphides show *slow* decay forms, magnetic and fine grained sulphides often show *fast* decay forms. This can be shown as  $\Delta M = M_5 - M_1$ , where positive  $\Delta M$  infers *slow* decay form and negative  $\Delta M$  *fast* decay form. A superior parameter is  $\Delta M_n$  where

$$\Delta M_n = \frac{M_5 - M_1}{M_3} \times 100 \text{ (in percent)}$$

which is essentially  $\Delta M$  normalised for the amplitude of the decay.  $\Delta M$  and  $\Delta M_n$  are merely short hand ways to profile changes in decay form and are essentially qualitative and relative.

Decay forms can also demonstrate the presence of electromagnetic coupling as Figure 7 shows. This is a regional effect as shown on Figure 7(b). This will

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normal decay

7(a)

decay curve modified by coupling

7(b)

electromagnetic coupling

V

M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	M <sub>4</sub>	M <sub>5</sub>	M <sub>6</sub>
(M <sub>1</sub> )		(M <sub>3</sub> )		(M <sub>5</sub> )	

7(c)

modification of normalised decay form as read by IPR-8 or IPR-10

EFFECTS OF ELECTROMAGNETIC COUPLING ON IPR-8 / 10

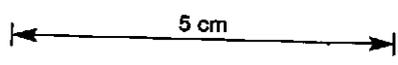


Fig. 7

**SCINTREX**

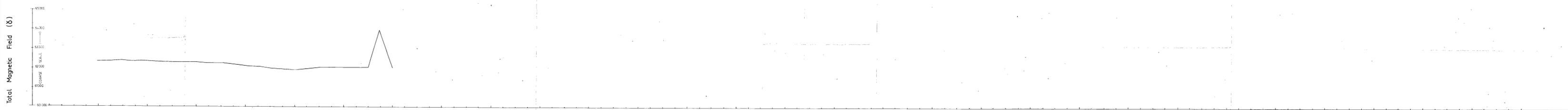
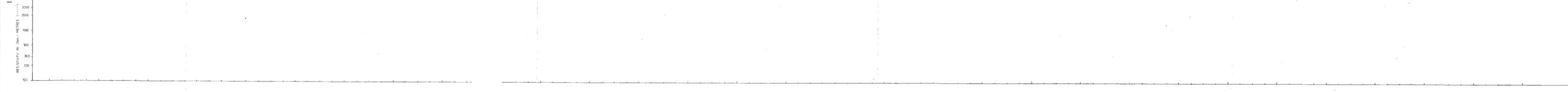
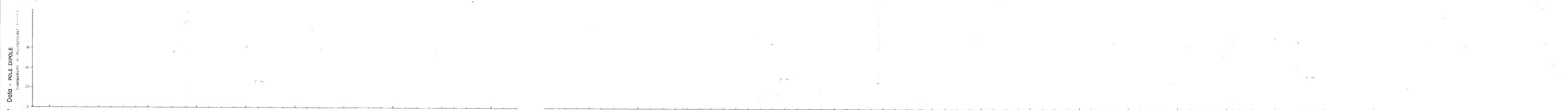
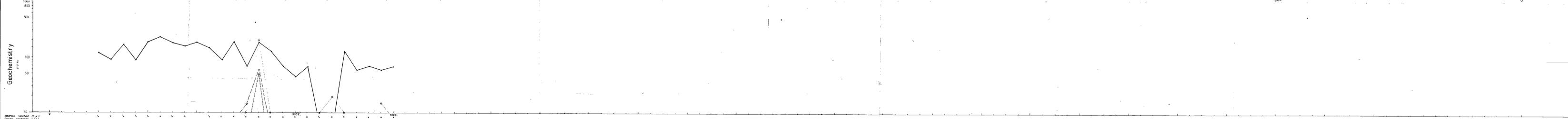
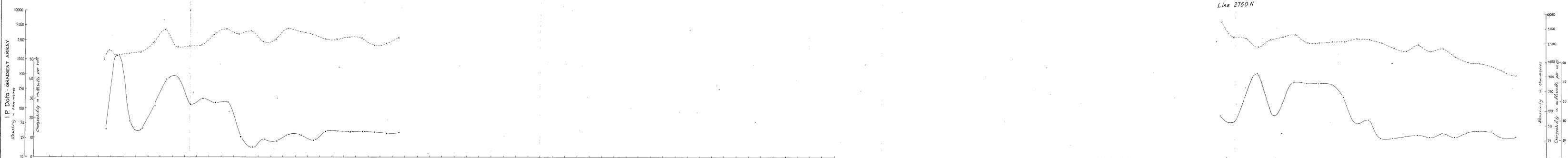
produce a normalised  $M_1$  smaller than either  $M_3$  or  $M_5$ .

*Conclusion:-* The above comments are indeed simplistic, and should be considered as a guide only. The author would be pleased to supply references on additional reading on any of the points commented upon.

A.W. HOWLAND-ROSE, MSc, DIC, AMAus IMM, FGS.

AN INDEX TO TRANSPARENCIES THAT MAY BE REFERRED  
TO IN THIS REPORT WILL BE FOUND IN TCR 85-2426.





REVISION LIMITED 102042

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 100 E. - 700 E.

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 TRACED: T.G.D.S.  
 DATE: JULY 19  
 SCALE: 1:2000  
 DRAWING NO.: TH 374

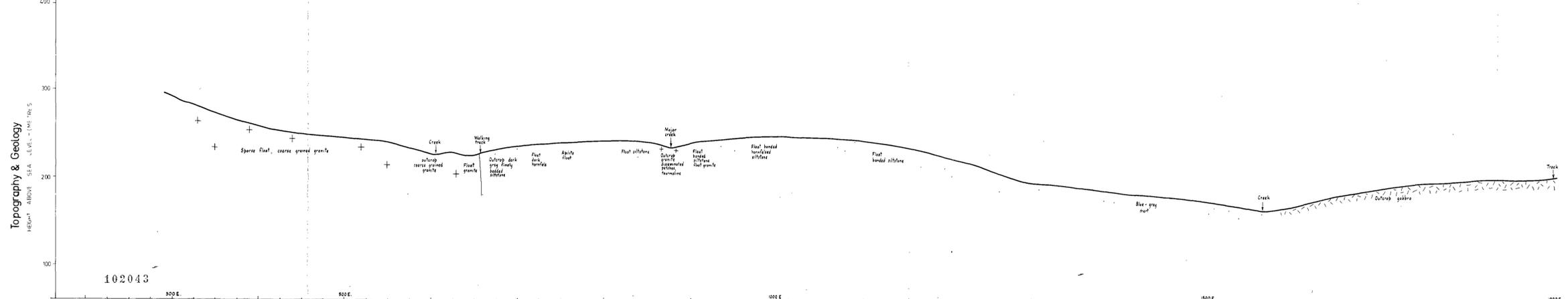
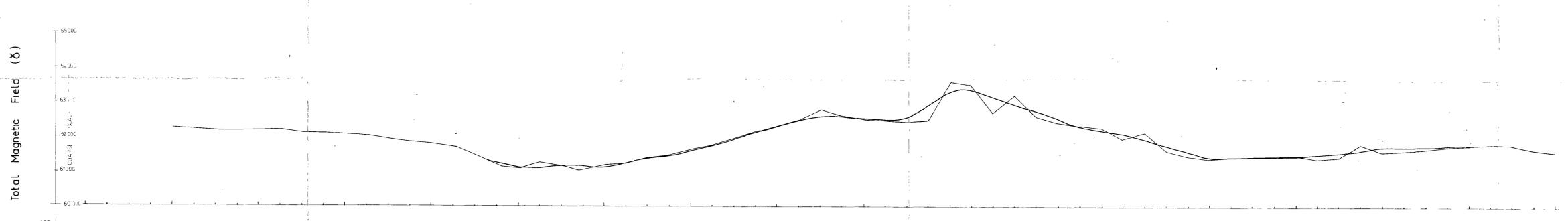
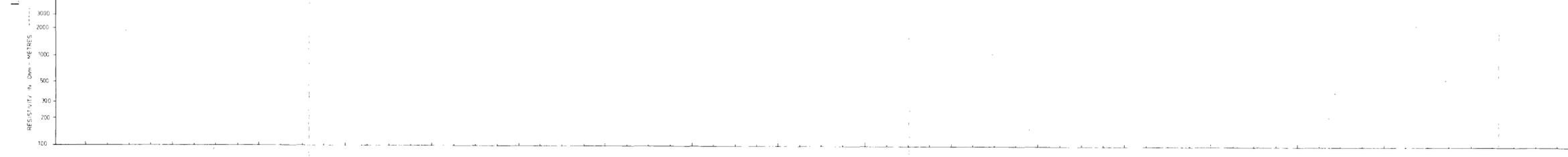
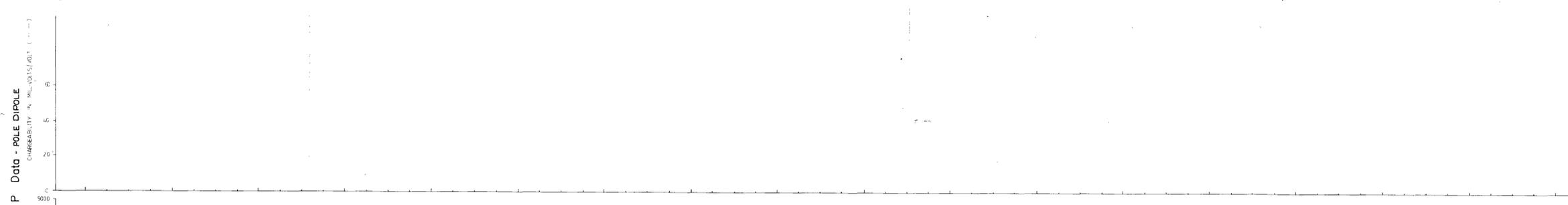
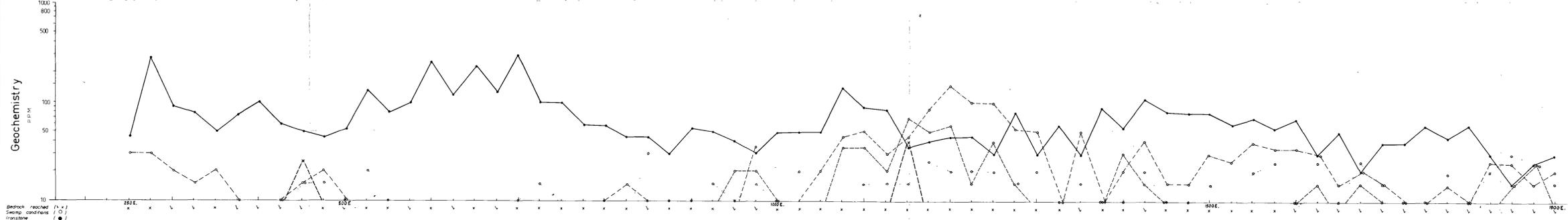
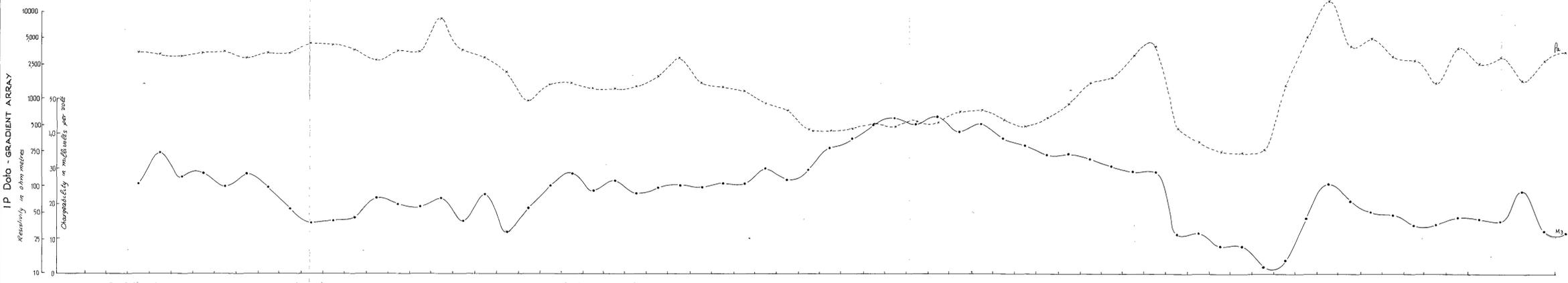
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 CHARGEABILITY & RESISTIVITY GRADIENT ARRAY

**MAGNETICS**  
 Scale

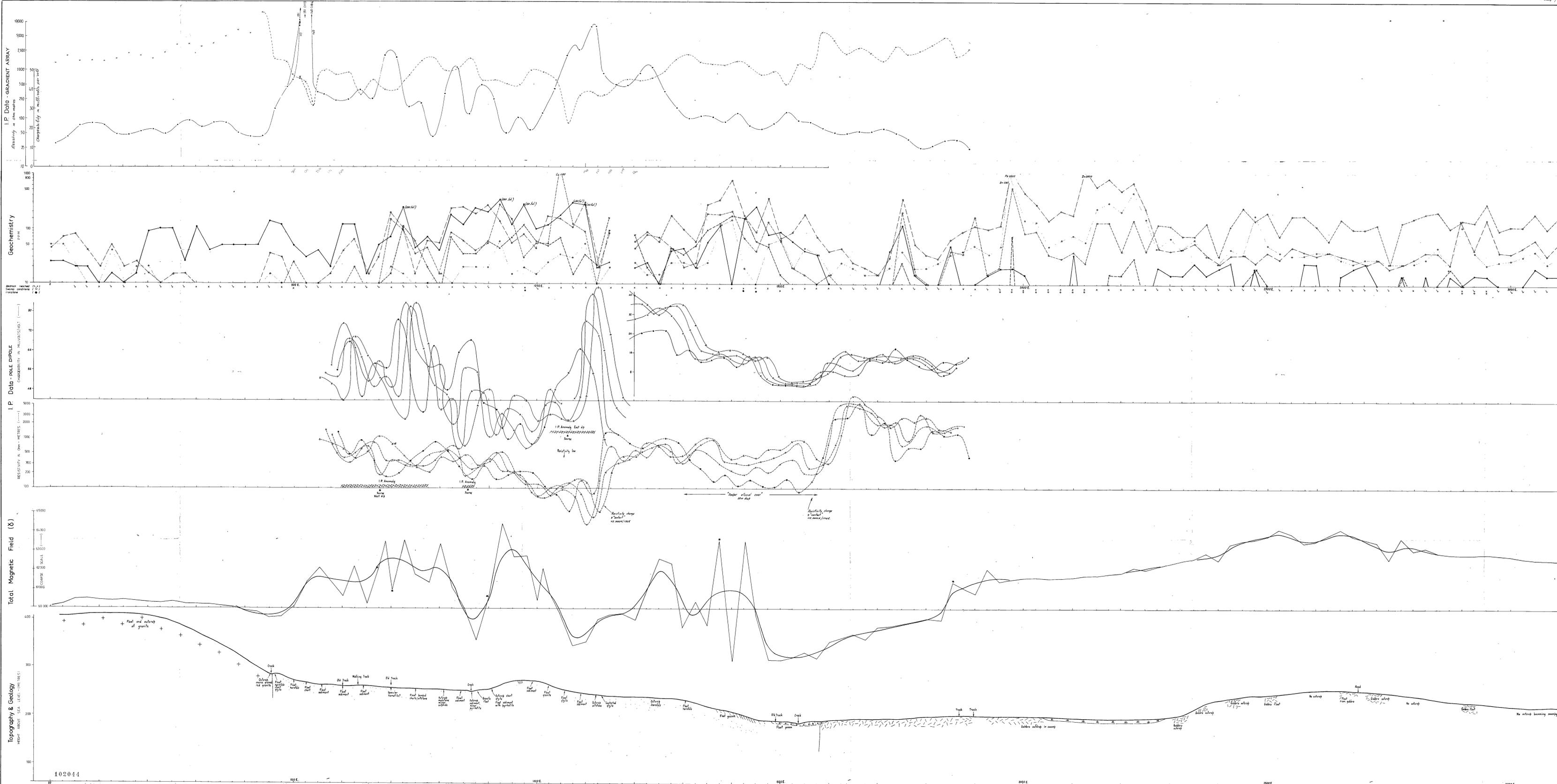
**GEOCHEMISTRY**  
 MS

**I.P. DATA**  
 CHARGEABILITY & RESISTIVITY POLE DIPOLE

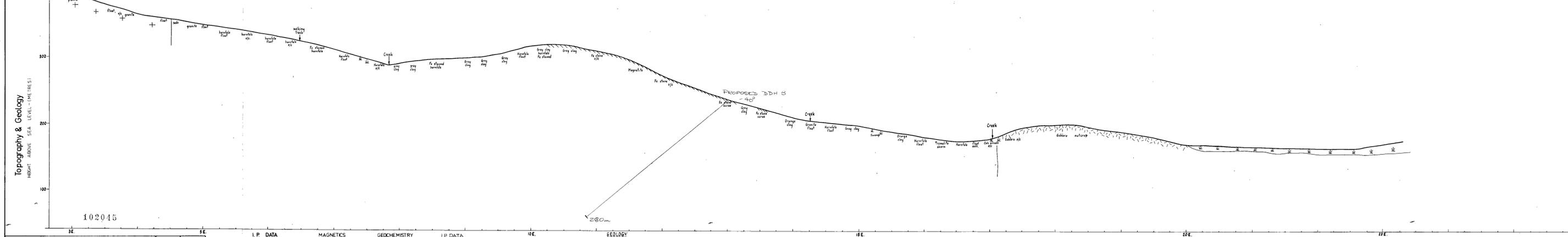
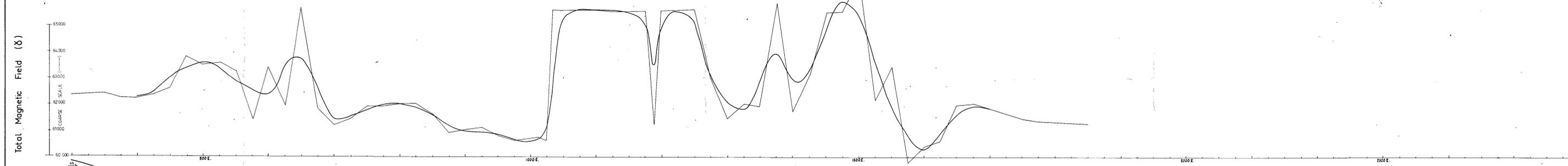
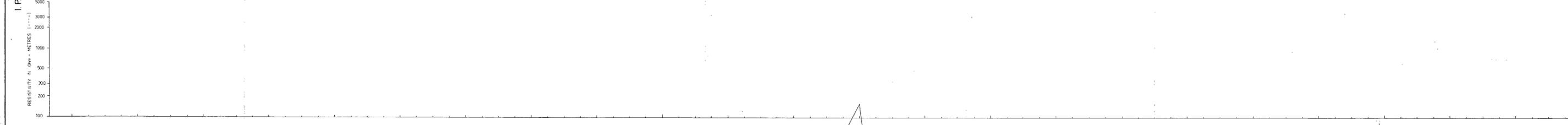
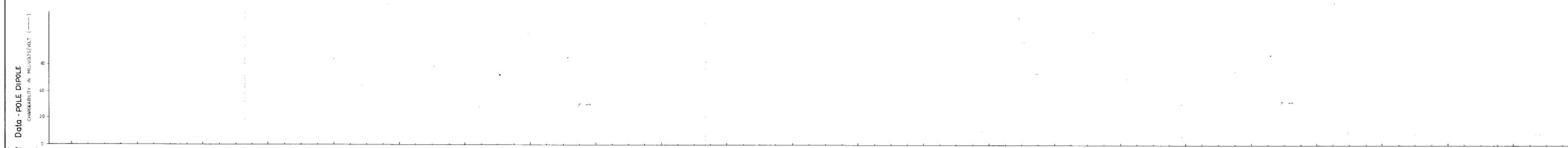
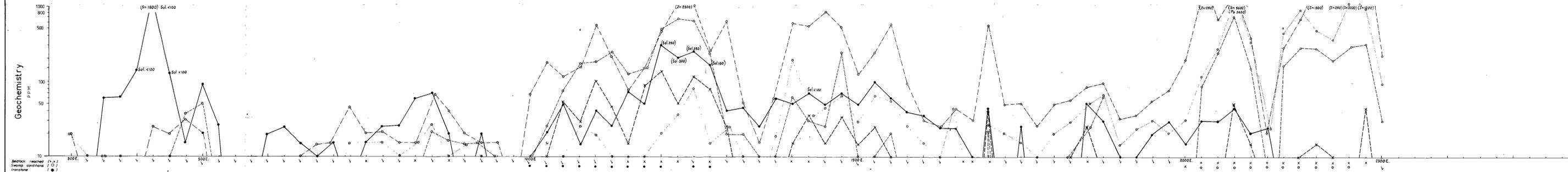
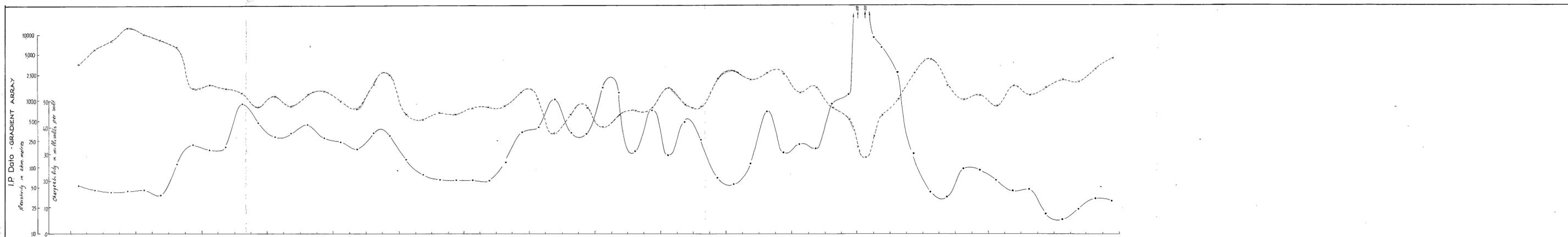
**GEOLOGY**  
 Swamp  
 Heemskirk granite  
 Devonian siltstone and related basic rocks  
 Devonian siltstone, limestone, gneiss  
 Metasedimentary siltstone, calc-schist  
 Devonian quartzites, shales, siltstones



RENISON LIMITED 80-11-20 EAST HEEMSKIRK GRID. SPL 129 LINE 2800 N. 300 E. - 1900 E. SCALE: 1:2000 METRES 	DRAWN: J.B.S. TRACED: T.G.D.S. DATE: JULY '79 SCALE: 1:2000 DRAWING NO.: TH 375	<b>IP DATA</b> CHARGEABILITY & RESISTIVITY POLE - DIPOLE CHARGEABILITY & RESISTIVITY GRADIENT ARRAY Mg Pa	<b>MAGNETICS</b> Smoothed curve Error magnitude reading	<b>GEOCHEMISTRY</b>	<b>IP DATA</b> CHARGEABILITY & RESISTIVITY GRADIENT ARRAY Mg Pa	<b>GEOLOGY</b> Swamp Heemskirk granite Precambrian? - Cambrian sediments Magnetite goethite limonite "gossan" Hornfelsed siltstones, calc-silicates Predominantly quartzites, shales siltstones Cambrian gabbro and related basic rocks
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<b>RENISON LIMITED</b> EAST HEEMSKIRK GRID SPL 129 5214 LINE 3000 N. 00 E. - 3100 E.		DRAWN: J. G. R. TRACED: T. G. S. DATE: 2007-09 SCALE: 1:2000 DRAWING NO.: TH 376	<b>I.P. 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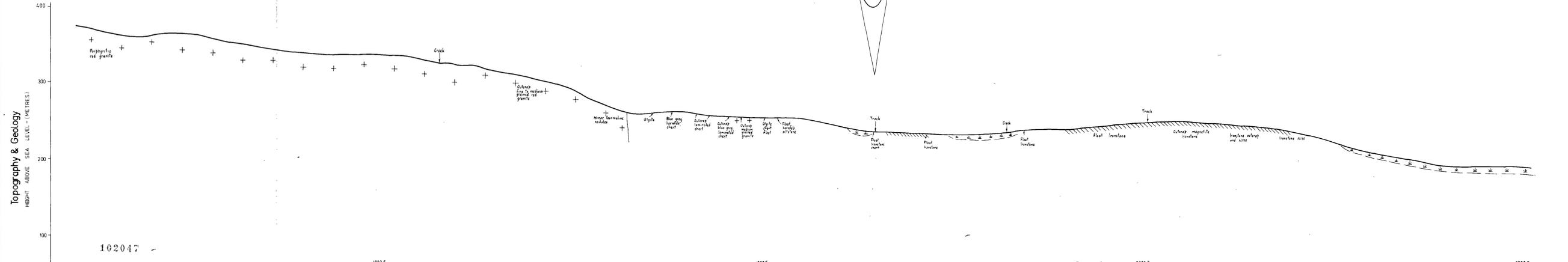
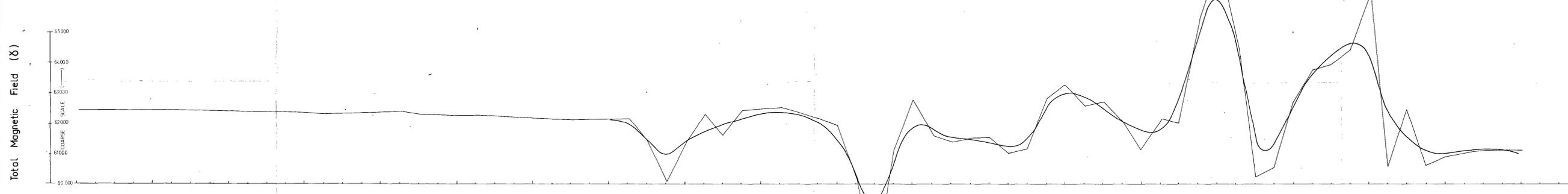
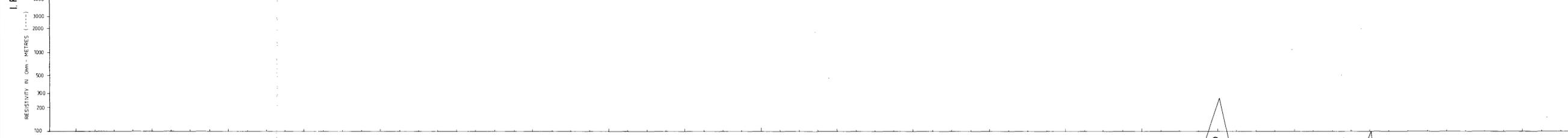
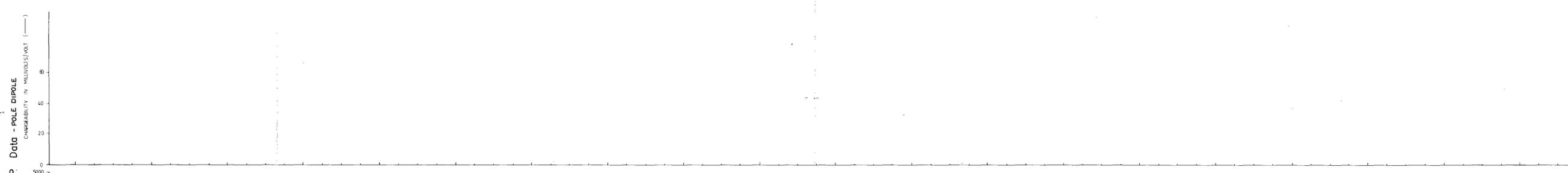
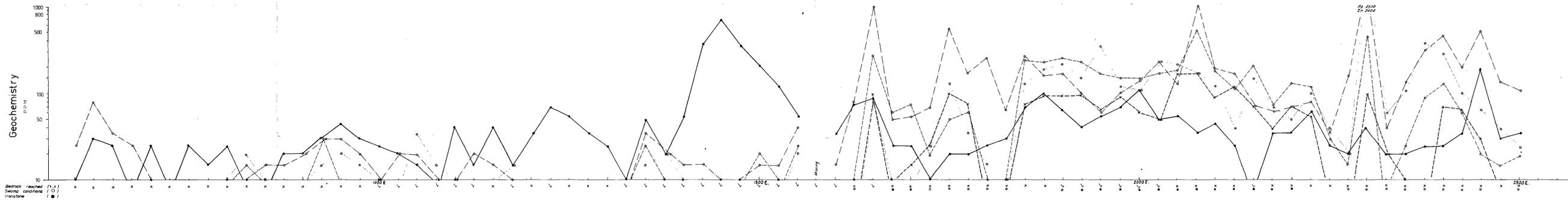
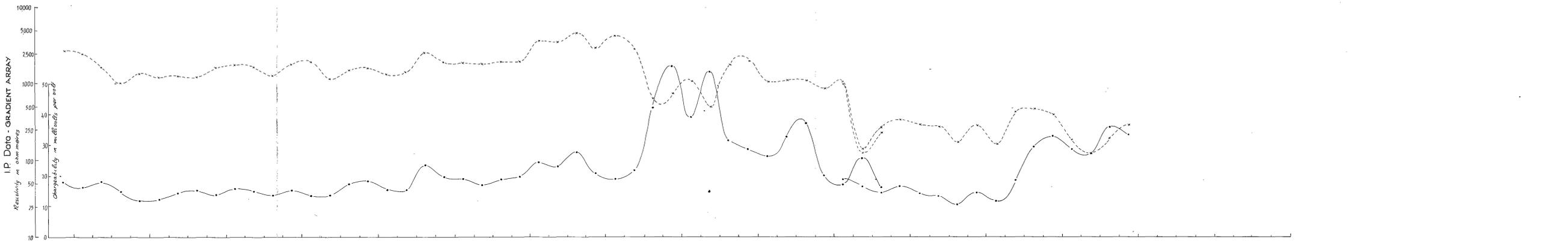


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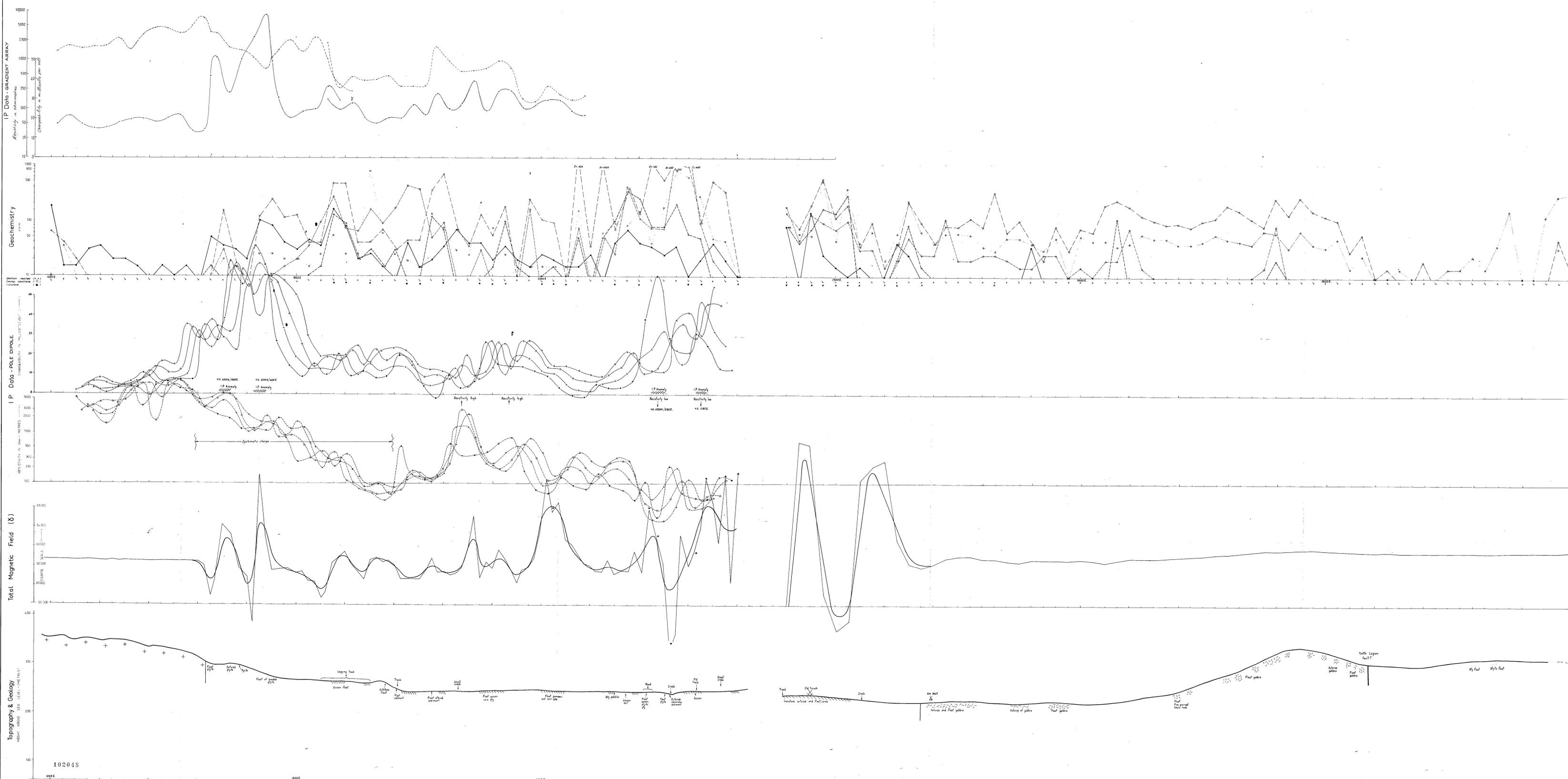
RENISON LIMITED 20-14-20  
 EAST HEEMSKIRK GRID S.P.L. 129  
 5215 LINE 3200 N.  
 300 E. - 2300 E.  
 SCALE: 1:2000 METRES  
 DRAWN: T.G.S.  
 DATE: JULY 79  
 SCALE: 1:2000  
 DRAWING No. TH 377

<b>I.P. DATA</b> CHARGEABILITY & RESISTIVITY POLE - DIPOLE 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve	<b>MAGNETICS</b> 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve	<b>GEOCHEMISTRY</b> Cu Pb Zn As	<b>I.P. DATA</b> CHARGEABILITY & RESISTIVITY GRADIENT ARRAY 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve 500E Scale Sawtooth Curve	<b>GEOLOGY</b> Swamp Heemskirk granite Precambrian? - Cambrian sediments Magnesian gneiss, limestone "gossan" Hornfelsed siltstones, calc-silicates Predominantly quartzites, shales, siltstones Cambrian gabbro and related basic rocks
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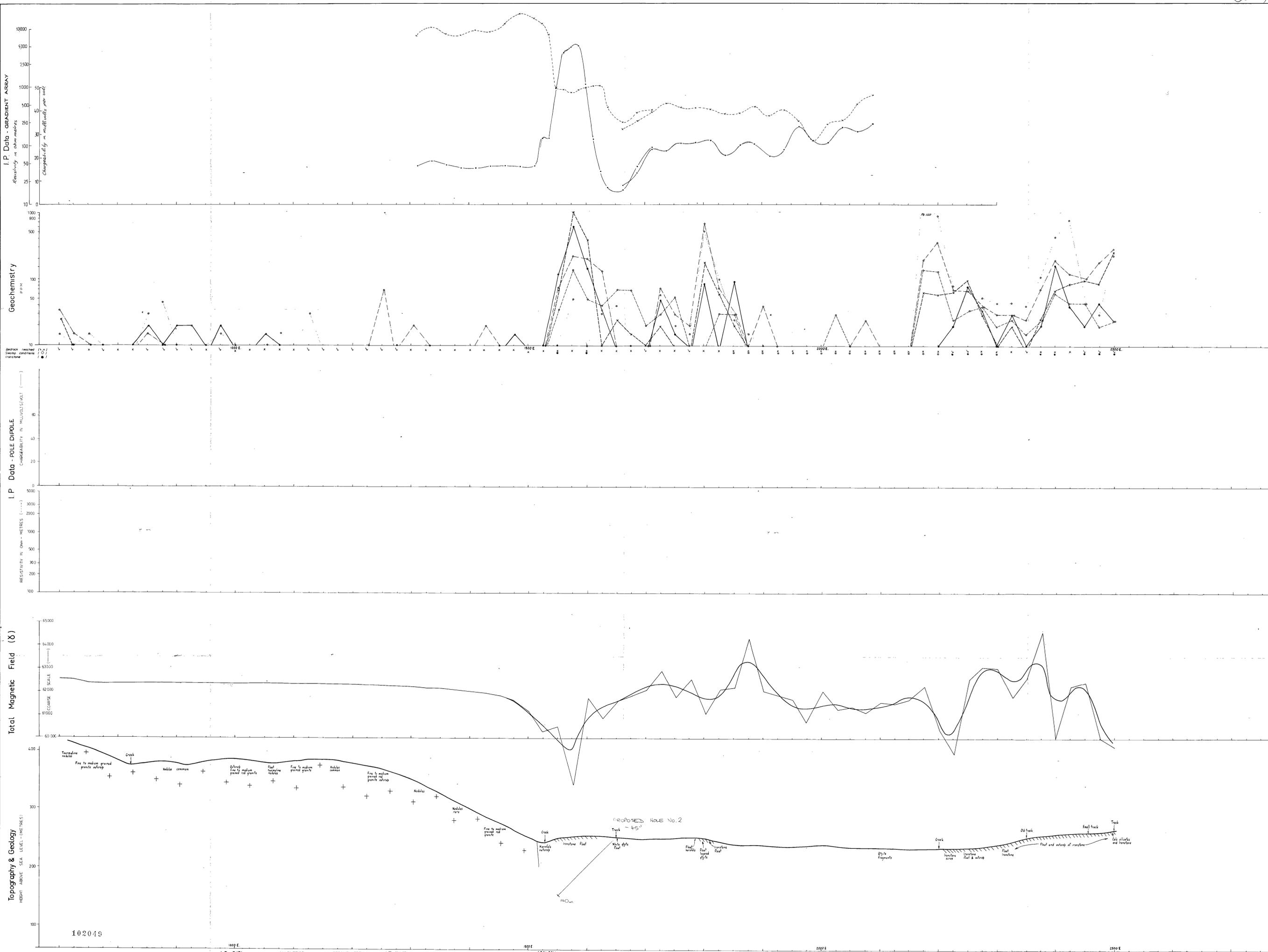




<b>REXON LIMITED</b> 20-420 <b>EAST HEEMSKIRK GRID S.P.L. 129</b> 5217 LINE 3600 N. 600 E. - 2500 E. SCALE: 1:2000 METRES 		DRAWN: J. Lee TRACED: J.G.D.S. DATE: JULY '79 SCALE: 1:2000 DRAWING No.: T.H. 379	<b>I.P. DATA</b> CHARGEABILITY & RESISTIVITY POLE - DIPOLE 5000 Scale Smallled curve Error: magnetometer reading	<b>MAGNETICS</b> 5m Cu Pb Zn As	<b>I.P. DATA</b> CHARGEABILITY & RESISTIVITY POLE - DIPOLE Mg Pb	<b>GEOLOGY</b> Swamp Heemskirk granite Devonian? - Cambrian sediments Magnetic gneiss, limonite "gossans" Hornfelsed siltstones, calc-silicates Predominantly quartzites, shales, siltstones Cambrian gabbro and related basic rocks
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<b>RENISON LIMITED</b> 20-10-10 <b>EAST HEEMSKIRK GRID SPL 129</b> LINE 3800 N. 1000 E. - 4000 E. SCALE: 1:2000 METRES TH 380		DRAWN: J. E. G. TRACED: T. S. S. DATE: 2007/19 SCALE: 1:2000 DRAWING No.: TH 380	<b>IP DATA</b> CHARGEABILITY & RESISTIVITY CHARGEABILITY: 1000 Scale RESISTIVITY: 1000 Scale CHARGEABILITY: 1000 Scale RESISTIVITY: 1000 Scale	<b>MAGNETICS</b> MAGNETIC ANOMALY MAGNETIC ANOMALY MAGNETIC ANOMALY	<b>GEOCHEMISTRY</b> GEOCHEMISTRY GEOCHEMISTRY GEOCHEMISTRY	<b>IP DATA</b> CHARGEABILITY & RESISTIVITY CHARGEABILITY: 1000 Scale RESISTIVITY: 1000 Scale CHARGEABILITY: 1000 Scale RESISTIVITY: 1000 Scale	<b>GEOLOGY</b> Heemskirk granite Proterozoic Cambrian gabbro and related basic rocks Metasediments Metasediments Metasediments Metasediments
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RENISON LIMITED  
 EAST HEEMSKIRK GRID S.P.L.129  
 5219 LINE 4000 N.  
 700 E. - 2500 E.  
 SCALE: 1:2000 METRES

DRAWN: J. G. C.  
 TRACED: T.E.D.E.  
 DATE: JULY '79  
 SCALE: 1:2000  
 DRAWING No.  
 TH 381

**I.P. DATA**  
 CHARGEABILITY & RESISTIVITY  
 POLE - DIPOLE  
 5000 Scale  
 Smoothed curve  
 Electric magnetometer reading

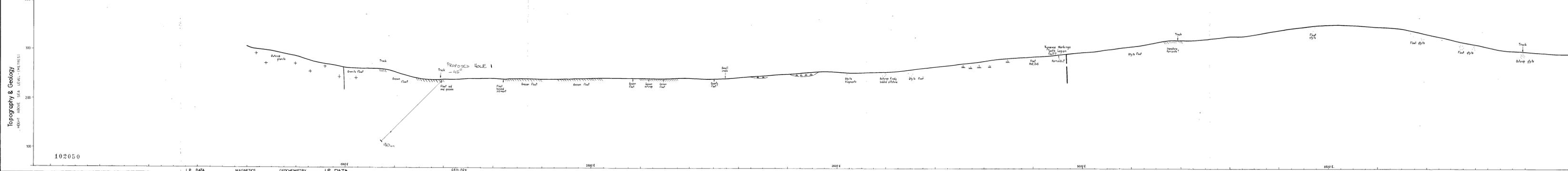
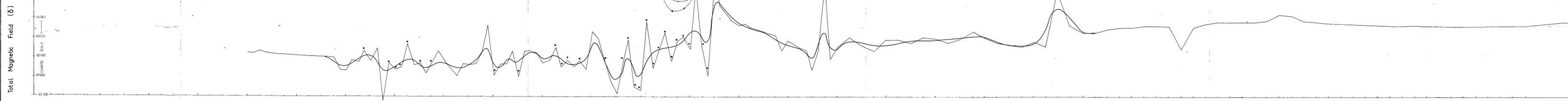
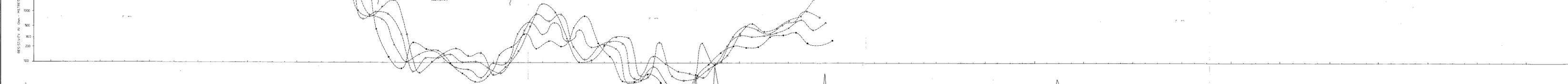
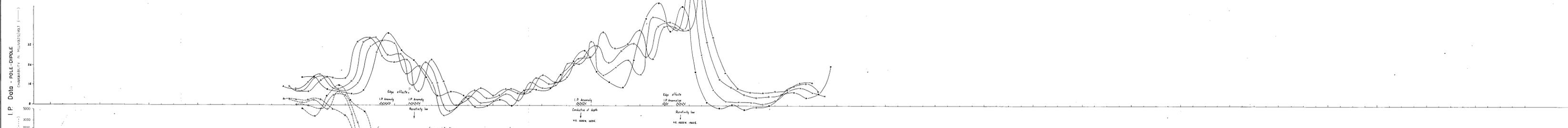
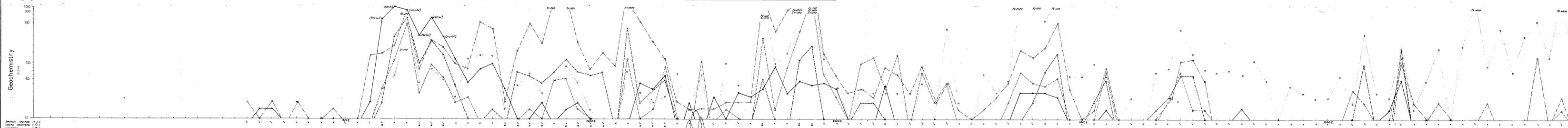
**MAGNETICS**  
 5000 Scale  
 Smoothed curve

**GEOCHEMISTRY**  
 P.P.M.  
 1000  
 500  
 100  
 50  
 25  
 10

**I.P. DATA**  
 CHARGEABILITY & RESISTIVITY  
 GRADIENT ARRAY  
 M5  
 Pa

**GEOLOGY**  
 Swamp  
 Hemskirk granite  
 Cambrian gabbro and related basic rocks  
 Magnetic gneiss, limestone "gossan"  
 Hornfelsed siltstones, calc-silicates  
 Predominantly quartzite, shales, siltstones

Scale: 50m



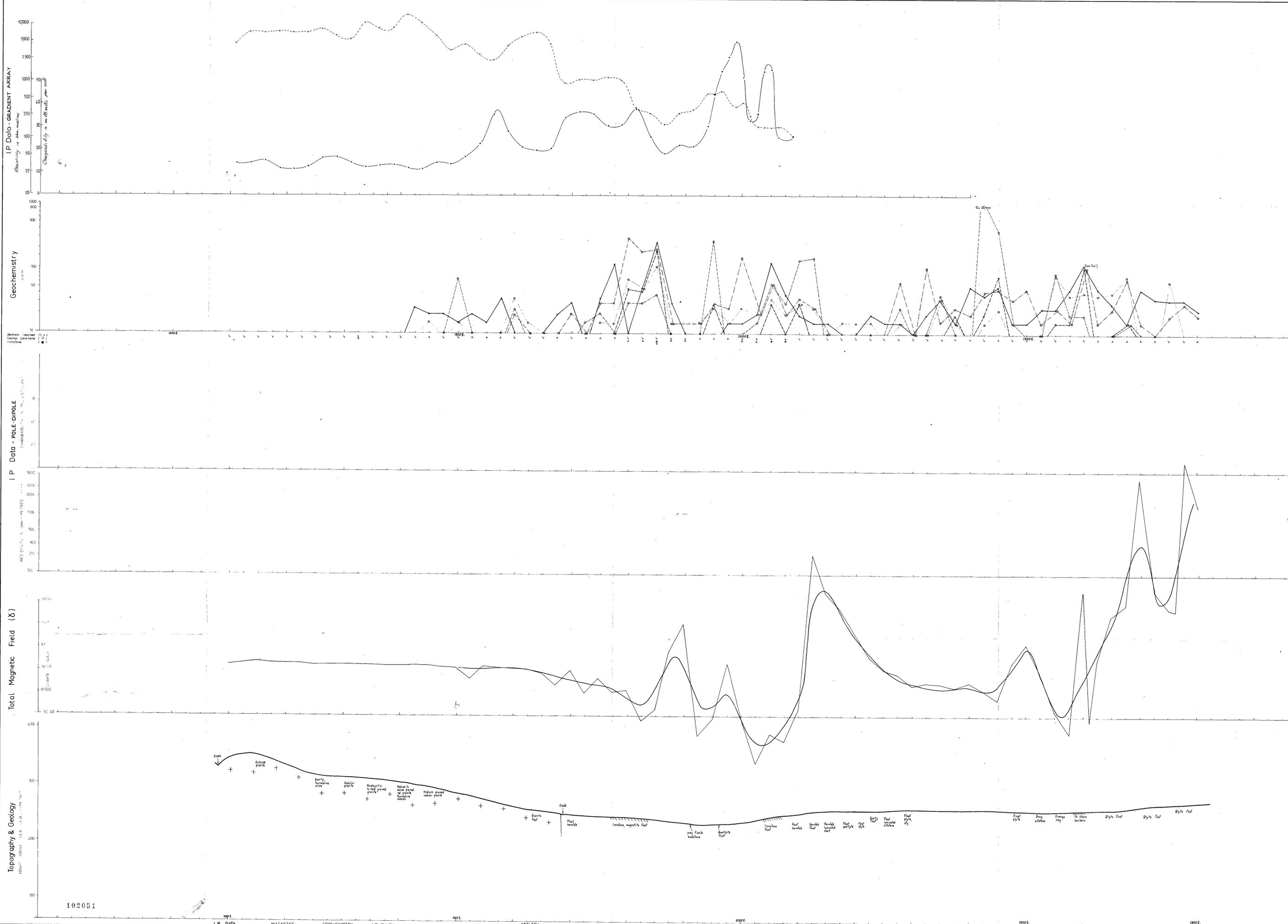
RENISON LIMITED  
 EAST HEEMSKIRK GRID SPL 129  
 LINE 4200 N.  
 1300 E. = 4000 E.  
 SCALE 1:2000 METRES  
 DRAWN 2/8/99  
 TRACED Y.G.S.  
 DATE JULY 99  
 SCALE 1:2000  
 DRAWING No. TH 382

**IP DATA**  
 CHARGEABILITY & RESISTIVITY  
 POLE-DIPOLE  
 CHARGEABILITY & RESISTIVITY  
 GRADIENT ARRAY

**MAGNETICS**  
 5000 Scale  
 Smoothed curve  
 Error magnetic reading

**IP DATA**  
 CHARGEABILITY & RESISTIVITY  
 GRADIENT ARRAY  
 H3  
 H4

**GEOLOGY**  
 Swamp  
 Migmatite granite  
 Mylonitic gneiss  
 Metasediments  
 Metasediments, calc-silicates  
 Predominantly quartzitic  
 Metasediments



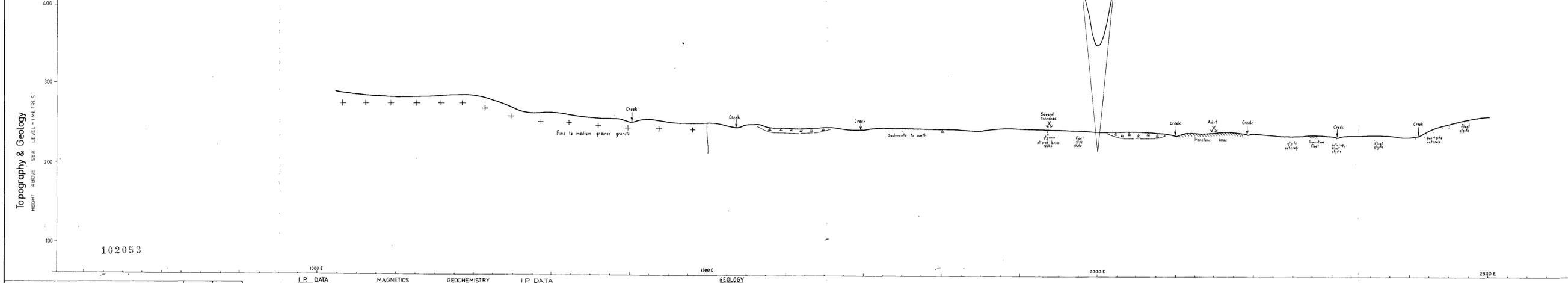
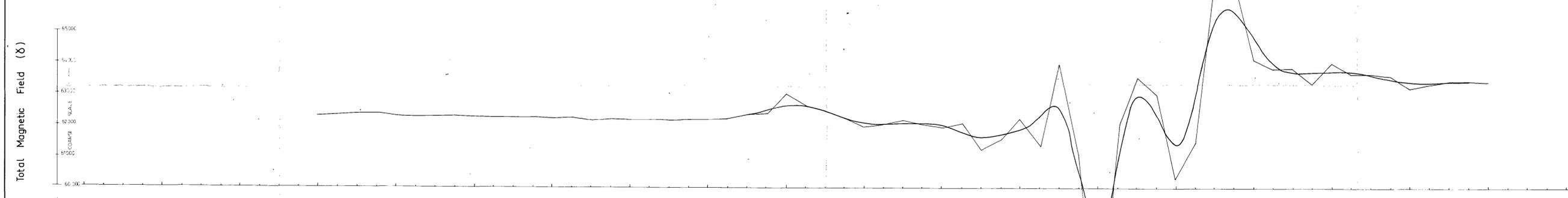
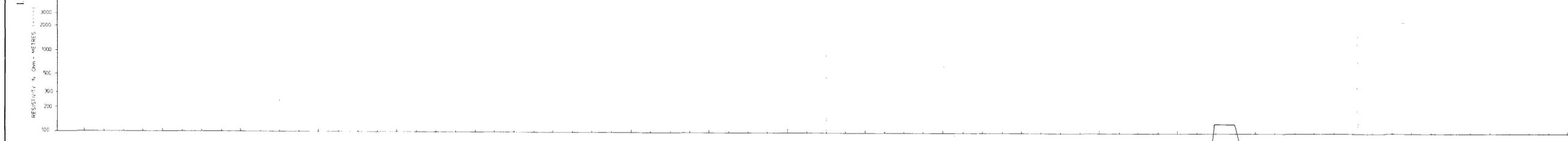
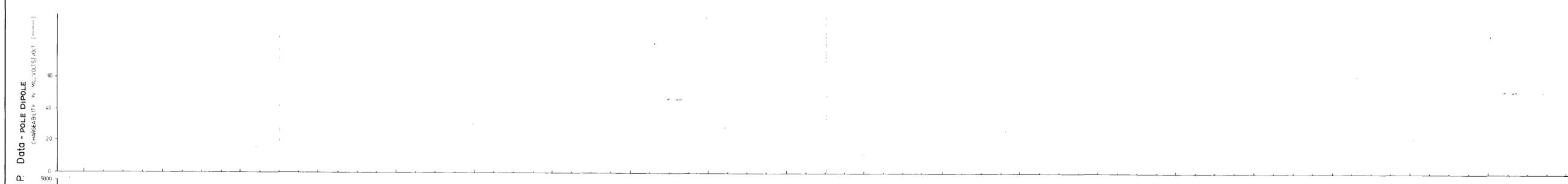
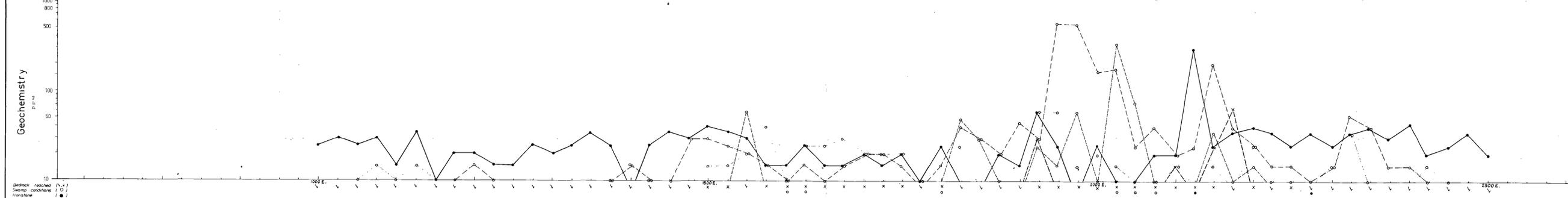
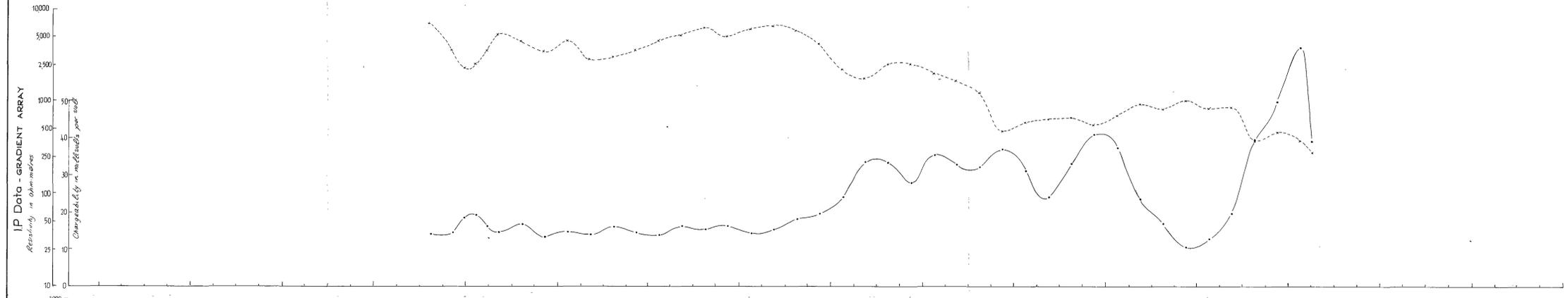
RENISON LIMITED 20-1420  
 EAST HEEMSKIRK GRID S.P.L. 129  
 5221 LINE 4400 N.  
 1100 E. - 2800 E.  
 SCALE: 1:2000 METRES

DRAWN	T.G.D.S.
DATE	JULY 79
SCALE	1:2000
DRAWING No.	TH 383

<b>IP DATA</b>	<b>MAGNETICS</b>	<b>GEOCHEMISTRY</b>	<b>IP DATA</b>	<b>GEOLOGY</b>
CHARGEABILITY & RESISTIVITY POLE-DIPOLE	Swamp	Heemskirk granite	Swamp	Heemskirk granite
CHARGEABILITY & RESISTIVITY GRADIENT ARRAY	Swamp	Heemskirk granite	Swamp	Heemskirk granite
CHARGEABILITY & RESISTIVITY GRADIENT ARRAY	Swamp	Heemskirk granite	Swamp	Heemskirk granite
CHARGEABILITY & RESISTIVITY GRADIENT ARRAY	Swamp	Heemskirk granite	Swamp	Heemskirk granite

Cambrian gabbro and related basic rocks  
 Magnetite, goethite, limonite  
 Hornfelsed siltstones, calc-silicates  
 Predominantly quartzites, shales, siltstones



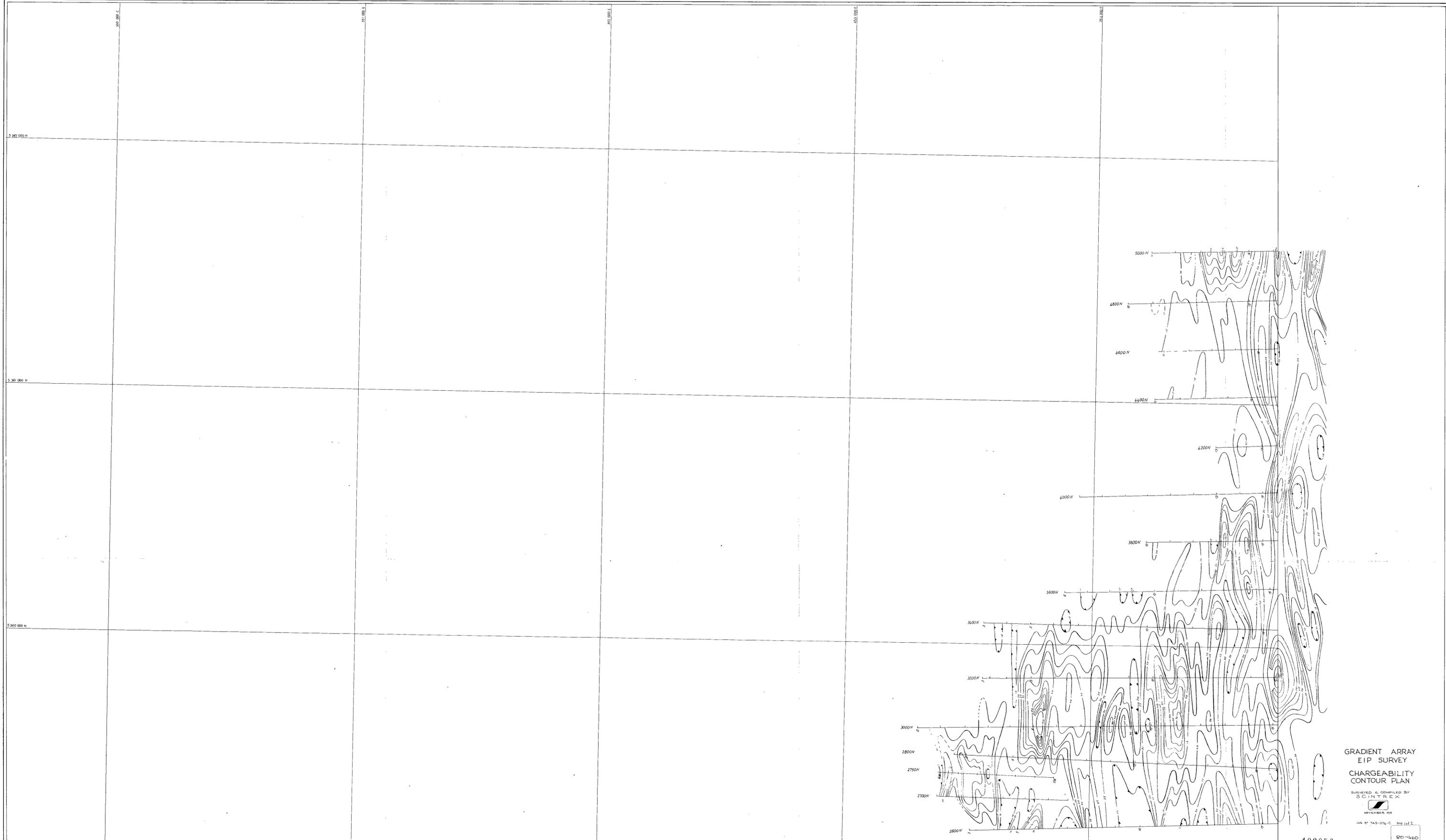


RENISON LIMITED 20-420  
EAST HEEMSKIRK GRID S.P.L. 129  
5223 LINE 4800 N.  
1000 E. - 2500 E.  
SCALE: 1:2000 METRES  
DRAWN: J. J. J.  
TRACED: T.S.D.S.  
DATE: JULY 79  
SCALE: 1:2000  
DRAWING No. TH 385

IP DATA: CHARGEABILITY & RESISTIVITY POLE - DIPOLE  
MAGNETICS: Smoother Curve, Erroric magnetometer reading  
GEOCHEMISTRY  
IP DATA: CHARGEABILITY & RESISTIVITY GRADIENT ARRAY  
GEOLOGY: Swamp, Heemskirk granite, Precambrian? - Cambrian sediments, Magnetic gneissite, limonite, "gossan", Hornfelsed siltstones, calc-silicates, Predominantly quartzites, shales, siltstones, Cambrian gabbro and related basic rocks.

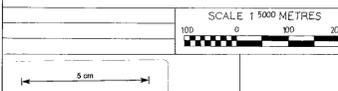


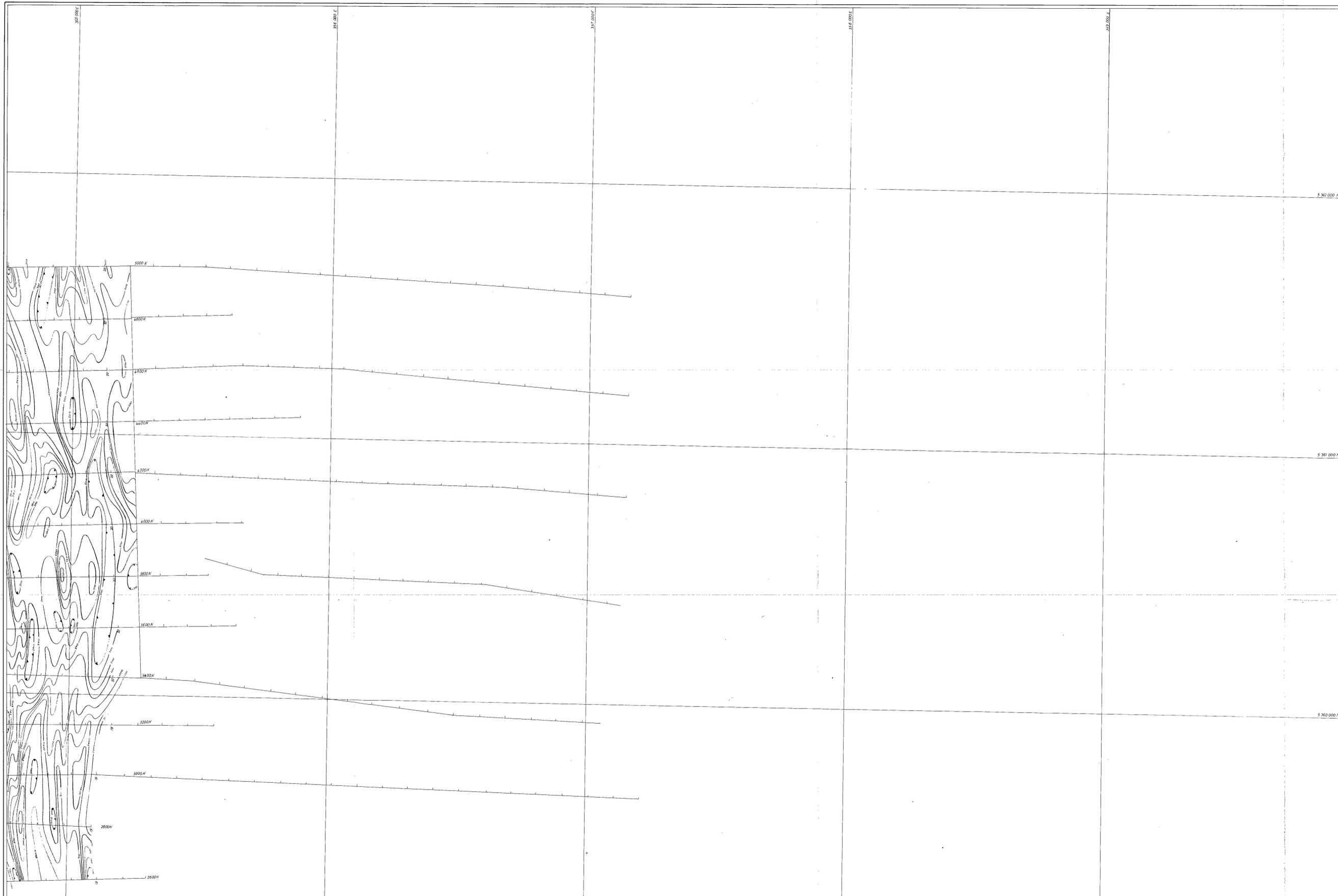




GRADIENT ARRAY  
EIP SURVEY  
CHARGEABILITY  
CONTOUR PLAN  
SURVEYED & COMPILED BY  
SCINTREX  
NOVEMBER 97  
HA 11 745-074-C 312 (of 2)

102056  
RENISON LIMITED  
ZEEHAN C2/2(81) 5209





GRADIENT ARRAY  
 EIP SURVEY  
 RESISTIVITY  
 CONTOUR PLAN  
 SURVEYED & COMPILED BY  
 SCINTREX  
 NOVEMBER 1999  
 J44 NY TAB 01/C SH 1 of 2

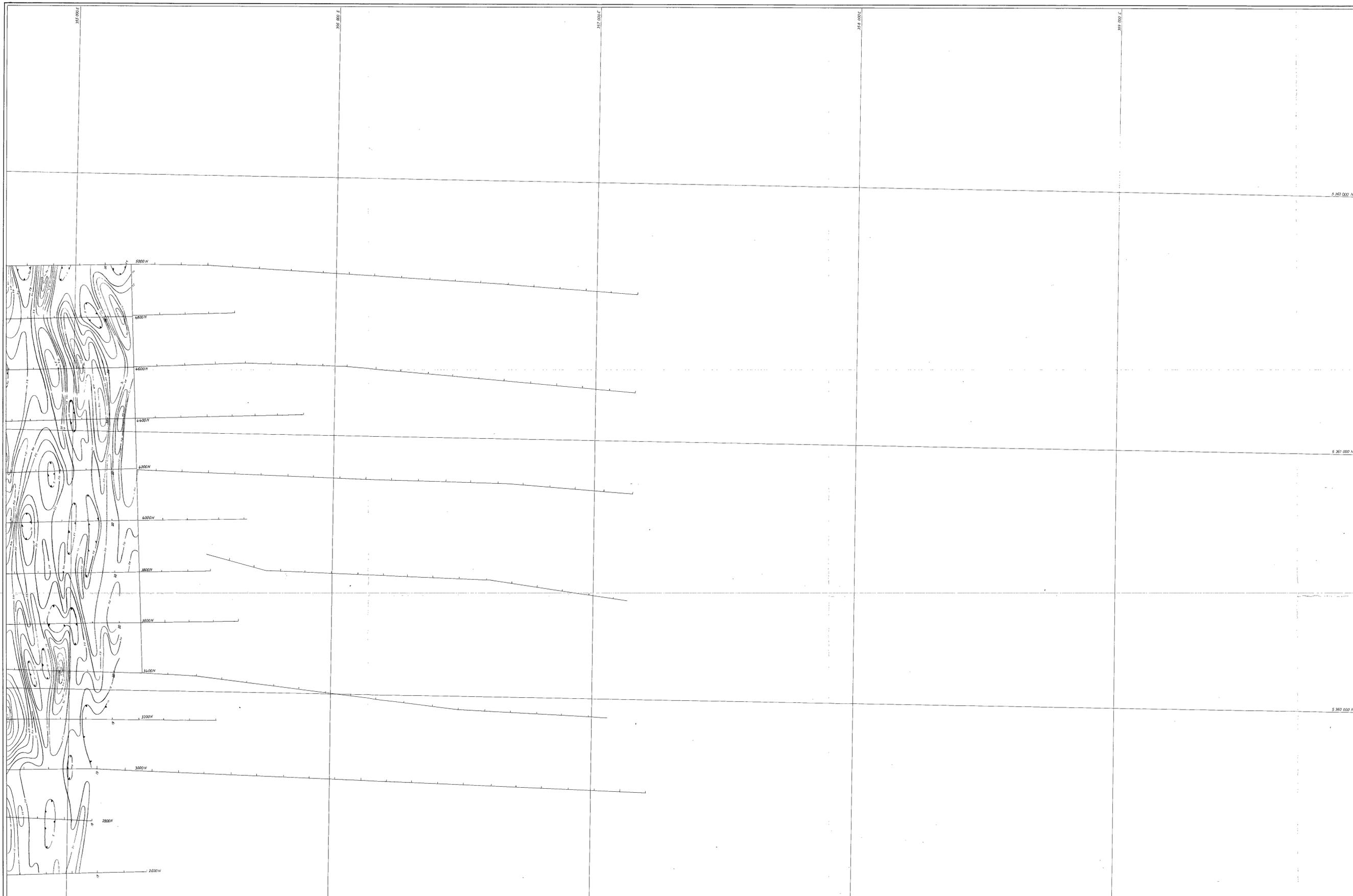


102057  
 RENISON LIMITED

ZEEHAN D1/1 (A)

5208





GRADIENT ARRAY  
 EIP SURVEY  
 CHARGEABILITY  
 CONTOUR PLAN  
 SURVEYED & COMPILED BY  
 SCINTRIX  
 NOVEMBER 1999

102058

14 N TAS 071 C Sh 1 of 2  
 80-11-20

RENISON LIMITED

ZEEHAN D1/1 (B) 5210

SCALE 1:5000 METRES

