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REPORT ON
DETAILED EIP GRADIENT ARRAY SURVEYS
LITTLE WILSON RIVER GRID
NEAR ZEEHAN, TASMANIA
ON BEHALF OF
RENISON LIMITED

22 OCT 1982

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PRIVATE AND CONFIDENTIAL

REPORT ON
DETAILED EIP GRADIENT ARRAY SURVEYS
LITTLE WILSON RIVER GRID
NEAR ZEEHAN, TASMANIA
ON BEHALF OF
RENISON LIMITED

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PREFACE

During the period between the preliminary report and the receipt of the additional geodata, the geological interpretation was considerably revised (perhaps including input from the preliminary report). This report is therefore somewhat more peicemeal than the author would like. Due to the urgency in delivery, only a revision of the preliminary comments and not a re-write of the whole report, has been undertaken in this final report.

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SUMMARY

The survey over the Little Wilson River grid has revealed a series of low amplitude induced polarization anomalies, and associated (but not necessarily coincident) low amplitude magnetic field anomalies, in turn associated with or in close proximity to the limestone unit. While the signature is similar to that seen over skarn zones, the amplitudes are less than normally observed over skarns. Nevertheless follow-up of these anomalies is recommended.

Outside the limestone areas few significant anomalies were recorded, most being of secondary interest at best.

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DISCUSSION OF RESULTS

*GENERAL CHARACTERISTICS OF THE ROCK UNITS*Granites

This unit is characterised by a wide range of resistivities from 500 ohm-metres to over 10,000 ohm-metres, but an 'average' value of about 2000 \pm ohm-metres is recorded.

The 'normal' range for unweathered granites is from 2000 ohm-metres on the low end of the spectrum to 20,000 ohm-metres on the high end of the range. Those areas in the central and eastern section where the granites are lower than 1000 ohm-metres (and particularly 700 ohm-metres), must be considered to be anomalous within the granites. Only detailed comparison between granite outcrops within the 'resistive' and 'conductive' areas will explain these differences.

In most cases granites are seen as structureless when viewed via their electrical characteristics. This is certainly not the case here as there are distinct resistor and conductor axes which can be traced over many hundreds of metres within the granites, and even into the sediments and ultrabasics, which imply their extension at shallow depths beneath these units.

What is interesting is that this unit has a distinct (national) grid north south trend in the west, i.e. either side of 364000E, and a (national) grid 025° \pm orientation in the east. In the west the source of the resistor trends continue well south of the granite contact, for instance the resistor which trends from about 2460E on line 20N extends for some 500 to 600 metres south of the granite

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ultrabasic contact to 1250E on line 14N. This suggests that the granites may in fact lie at shallow depths below the sediment/ultrabasic and/or the underlying granites have influenced the electrical characteristics of these units - for instance in the case of the ultrabasics by silicification (see below).

The background chargeabilities within the granites show a considerable range, from 5 millivolts/volt to over 30 millivolts/volt in the north-west quadrant of the area. Normal granites are characterised by low 5 to 10 millivolts/volt backgrounds therefore values above these limits must be due to compositional variations due to the presence of sulphides or higher values of mafic minerals. On the whole the four main rock types - granite, limestone, ultrabasic and quartzite - cannot be distinguished on a basis of their background chargeability.

On the whole the granites are characterised by low magnetic field relief, however, towards the margins of the granite, anomalous indications occur and trend into the sediments and ultrabasics.

Ultrabasics

The resistivities within this unit range from under 500 ohm-metres to over 7000 ohm-metres with the average being 2000 ohm-metres, somewhat high for ultrabasics. This unit is characterised by a series of relative resistor and conductor axes which generally extend over 600 to 1000 metres or more. The strike of these features in the north is 340° (national grid) and in the south, almost (national) grid north south.

The chargeability within this unit varies from 10 millivolts/volt in the central sections to over 20 millivolts/volt in the north and south. These values are,

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if anything, low for ultrabasics. The one distinguishing feature of this unit is the range in magnetic field distortion which occurs of up to 1500 gamma against background.

Gordon Limestone

This unit is not clearly distinguishable from the granite, ultrabasic or quartzite units on a basis of the electrical properties alone. The general chargeability background within this unit is about 10 to 15 millivolts/volt, while the average resistivity is about 1500 ohm-metres. The lower values of 700 ohm-metres observed over the Quaternary deposits are due to the limestone itself having low intrinsic resistivity and thus more subject to weathering, as well as to lower resistivities within the Quaternary deposits themselves.

The average bulk chargeabilities observed in *clean* limestones are low - of the order of 6 to 8 millivolts/volt. The higher background observed in this unit is probably due to shale, mudstone and perhaps(?) graphite inclusions.

The magnetic field background is fairly flat, but with some four anomalous zones of up to 2000 gamma above background. These zones may well be the sites of skarn zones as in some cases higher chargeabilities were defined in their vicinity.

The centres of these magnetic field anomalies are situated as follows:

Line 15.5N at 1860E

Line 16N at 1920E* and Line 16.5N at 2070E*

Line 15N at 1650E

Line 13N at 1250E

* higher than local background induced polarization responses

Crotty Quartzite

This unit is indistinguishable from the adjacent limestones in terms of resistivity level or form, chargeability or magnetic field. The bulk of the area has low chargeability background of 10 millivolts/volt(+). Within this unit at 2050E on line 13N and at 1737E on line 12.5N, extremely sharp resistivity lows were defined which on the former line is associated with an extremely high chargeability response. Massive sulphides or graphite at these sites which lie sub-parallel to the river (along strike?) are possible. These are the only possible indications of massive sulphides seen in the area.

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COMMENTS ON INDIVIDUAL LINES

LINE 18N

This line shows a number of distinct regimes. Between 1900E and 3025E the resistivity data shows a sharp and wide variation from 1000 ohm-metres to 8000 ohm-metres, with the average being of the order of 3000 \pm 500 ohm-metres. The chargeability over this section remains at low normal background levels, varying from 10 to 12 millivolts/volt in the west to 14 millivolts/volt \pm 2 millivolts/volt in the east. Local variations of 2 to 4 millivolts/volt against this background are considered to be due to minor compositional variations only. As observed elsewhere in the region, ΔM_n values of -10% to -15%(+) imply a fine grained and/or inefficient source for that background.

A sharp fall-off in apparent resistivity from 6000 ohm-metres at 2900E to 800 ohm-metres at 3060E-3140E was recorded. Thus a significant geological boundary is noted at 3025E+. A small but definite 10 millivolts/volt above background response was recorded centred at 3112E, with a similar response at 3162E. The former is associated with higher resistivity of 800 ohm-metres, while the latter is associated with a marked resistivity low of 330 ohm-metres. The maximum depth to source is 25 metres. Both decay forms are slightly faster than normal. This zone is of secondary interest at best.

Between *about* 3375E and 3525E chargeabilities fall to a very low 6 millivolts/volt(+), while resistivities fall to 300 ohm-metres at two narrow sections. This section would also appear to represent a unique rock type, and may represent the location of crotty quartzite.

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Comparison with other Geodata

The magnetic field over the granites shows little relief - a characteristic of most granites. The new work carried out between 2850E and 3550E must be suspect as the two separate profiles show a significant divergence not due to natural phenomenon.

The geological mapping shows the granite/crotty quartzite contact to be at about 3200E, however, a significant resistivity change from 5700 ohm-metres at 2975E to 800 ohm-metres (+) east of this point, occurs at about 3025E. This may indicate either that the granite contact is further west, or that the eastern margin has a changed composition. The induced polarization over the granites is a low 10 to 12 millivolts/volt, rising towards the eastern margin, but of significance is the sharp high between about 3090E and 3175E. Sharp local soil tin values at, and down slope of the response enhance the interest of the sources interpreted at 3112E and 3162E from secondary to primary interest.

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LINE 17N

The general form of the data is very similar to line 18N. The section between 1600E and about 2690E is equivalent to 1900E to 3150E on line 18N. The resistivity varies from a low 600 ohm-metres (at 2037E) to just under 10,000 ohm-metres (at 1688E), with the average being about 2000 ohm-metres. The variation in chargeability is greater than seen on line 18N, however, the slight increase from 10 millivolts/volt(+) in the west to 14 millivolts/volt in the east of the section is similar. On this line, however, there is a significant increase in chargeability from a local background of 9 millivolts/volt to 22 millivolts/volt at 1737E associated with a distinct resistivity low of 1600 ohm-metres as opposed to the local background of 5000 ohm-metres. The maximum depth to the source may be as great as 50 to 60 metres, while a slightly finer than normal grain size is suggested by the -9% ΔM_n value. The source is considered to be of secondary to primary geophysical interest.

A sharp resistivity low was defined centred at 2037E. Here, 600 ohm-metres as opposed to a 1700 ohm-metres background was recorded coincident with a small chargeability anomaly of 5 to 6 millivolts/volt above the local 10 millivolts/volt background. The depth to source looks to be about 25 metres or less. The anomaly is considered to be of tertiary interest only.

An extremely low resistivity unit was defined at 2762E coincident with a slight increase in chargeability. The 270 ohm-metres resistivities are 5% to 10% of the level observed to the east and west. Related to this feature is a sharp local increase in chargeability to 22 millivolts/volt from 12 millivolts/volt at 2788E. This section may indicate a disseminated halo to a more massive source

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centred within the relative conductor at 2762E. (This site is stratigraphically equivalent to 3162E on line 18N.) The grain size within the source is normal. The anomaly is considered to be of secondary to primary interest.

Comparison with other Geodata

The magnetic field data shows a 200 gamma change in background level west of about 2000E. This indicates a change in composition. West of this change in background, chargeability values are lower, and background resistivities slightly higher, which tends to confirm compositional change. A significant 400 gamma increase in magnetic field was defined at 2800E associated with a significant resistivity low (due to the fault?), and most importantly, a significant increase in chargeability of about 10 millivolts/volt above local background. A local single tin value at 2780E may enhance the interest of this anomaly somewhat. The increased magnetic field indicates the presence of magnetite (and/or pyrrhotite), however, this is not solely the source of the response.

The significant chargeability response defined at 1737E shows no anomalous tin or arsenic values, and thus is inferred to be due to barren sulphides.

The tertiary geophysical contact response centred at 2037E is, however, enhanced in interest due to higher tin values either side of the response.

LINE 16.5N

This short line was surveyed between 1600E and 2250E. Over this section the chargeability sharply varies between 6 and 14 millivolts/volt, with the maxima being situated at 1700E +50 metres, 1888E, 1988E and 2112E +20 metres. These responses, which probably represent compositional anomalies, are superimposed on a decline in resistivity from 7000 ohm-metres in the west to 5500 ohm-metres at 2140E. None of the responses are considered significant, and all lie within 25 to 50 metres of surface.

Comparison with other Geodata

The magnetic field data shows an anomaly against background of about 2000 gamma centred at about 2060E. This response lies in close proximity to the limestone/serpentinite boundary, and on the western flank of one of the chargeability anomalies. What is of particular interest is that coinciding with the magnetic field anomaly is a significant increase in tin values from background to about 150 ppm. Thus the western flank of the chargeability anomaly is considered to be of possible economic interest on a secondary priority basis.

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LINE 16N

The character of this profile changes completely from that seen on line 17N. In the west a sharp resistivity high of 2000 to 13,000 ohm-metres against a 400 ohm-metres(+) background, was observed between 1225E and 1710E. Chargeabilities range from 10 millivolts/volt to over 20 millivolts/volt. Now the geological mapping shows that this unit coincides with the mapped coarse to medium granite unit. However, it differs from the bulk of the granites covered on the lines to the north in that (a) it is considerably more resistive, and (b) the 'average' chargeability is considerably higher. Individual maxima which may represent either "anomalies" or compositional variations were defined at 1250E, 1400E, 1500E+ and 1660E. The maximum depths to source of these sources are 20 metres, 25 metres and 75 metres respectively.

The next distinct unit moving east was defined between 1710E and about 2040E. Between these coordinates the resistivity ranges between 1300 ohm-metres and 425 ohm-metres, while the chargeabilities likewise show extreme variation from 6 millivolts/volt at 2000E to over 18 millivolts/volt at 1837E +25 metres. Now, this unit approximates to the mapped position of the serpentinite. The electrical characteristics observed fall within those which can be observed over ultrabasics. When this is borne in mind the three stations at 1812E, 1837E and 1862E where readings in excess of 18 millivolts/volt were recorded, can be considered anomalous and worthy of follow-up. The data suggests shallow (25 metres) sources at 1812E and 1862E. A distinct rise in resistivity from 550 ohm-metres to 1300 ohm-metres was recorded, indicating the source to be of a disseminated nature, while the decay form is slightly faster than normal. These responses are considered to be of secondary geophysical interest at best. At 1900E+, a local magnetic high of 1500 gamma was recorded which lies to the east of the chargeability maximum.

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Although mapped as an ultrabasic this zone should be borne in mind as a possible skarn.

Between 2070E and 2350E chargeabilities vary about the 8 millivolts/volt mark while resistivities vary from 1700 ohm-metres to 500 ohm-metres. These characteristics are similar to those mapped over the granites to the north (lines 17N and 18N), but are quite different to the granite mapped on this line between 1200E and 1700E, and east of 2350E where the resistivities are much higher. Thus the granites to the east of the Gordon Limestone may have a different composition to those on the western contact and perhaps that to the north also.

Comparison with other Geodata

The quiet magnetic field data together with the dramatic increase in resistivity east of 1215E imply the ultrabasic/granite contact to be at this point rather than as mapped at 1380E(+). The eastern margin of the granites at 1735E coincides well with a rapid fall off in resistivity at this point.

Strong soil anomalies in tin were recorded centred at 2000E +50 metres, close to the western margin, and within the limestone unit, but there are no truly significant induced polarization anomalies associated with this geochem.

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LINE 15.5N

Between the western end of the line at 1462E and 1662E, a series of sharp changes in resistivity from 7000 ohm-metres (between 1537E and 1625E) to 650 ohm-metres at 1512E and 1000 ohm-metres at 1637E was recorded. The chargeability likewise shows a variation from a low 9 millivolts/volt at 1510E to 20 millivolts/volt at 1460E and 1600E. These characteristics correlate well with the granite west of the Gordon Limestone on line 16N which are also mapped over this unit. The 10 millivolts/volt anomaly centred at 1600E must be due to a disseminated source due to the high 7000 ohm-metres resistivities accompanying it. Since 20 millivolts/volt is anomalous for granite, this feature (which correlates with a similar feature on line 16N at 1650E) *may* be worthy of follow-up, although compositional change within the granites is also possible. Both anomalies are considered of secondary/tertiary interest.

Between 1660E and 1820E lower resistivities to 450 ohm-metres(+) at 1688E and 1737E were recorded. A higher average resistivity of about 1200 ohm-metres(+) was recorded over the mapped Gordon Limestone. The 'background' in the limestones is about 10 millivolts/volt. At or slightly to the west of 1750E, a 10 millivolts/volt above background anomaly was defined. This is anomalous for limestone which may well be present below the alluvium. This anomaly also lies close to a 2000 gamma magnetic field distortion. Thus the lower resistivity/higher chargeability and higher magnetic field are considered to be of interest as a sulphide and magnetite or pyrrhotite source. The anomaly is considered of primary/secondary geophysical interest.

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Comparison with other Geodata

The magnetic field data shows a magnetic source at about 1760E which produces a distortion above background of about 3000 gamma. Now, this is coincident with a relatively polarizable source (see above) at 1762E which is overlain by Quaternary deposits. While high surface geochemistry occurs over this section, it may be solely due to transported material from the old workings, however, the mapped presence of limestones just east of the anomaly together with lower resistivities, certainly enhance the potential economic interest of this anomaly to primary.

The western flank of the main limestone outcrop at 1900E is marked by a magnetic field distortion of about 600 gamma. In this case no associated chargeabilities were recorded on the small hill, and no anomalous tin values were noted.

Wholly over the eastern section of the limestones between 1900E and 2200E, higher tin geochemistry was recorded, while the magnetic field goes negative (relative to background) by 600 gamma at 2020E(+), then slightly above background between 2100E and 2300E. The magnetic 'low' could be due to field reversal within skarn magnetite, but the low chargeability would infer only minimal sulphides to be present.

SCINTREX*LINE 15N*

This profile was run about 100 metres south of the mapped location of the granites. To the west of 1650E ultrabasics were recorded, while between 1650E and 2250E limestones were mapped. East of 2250E crotty quartzites were mapped.

The resistivity data is dominated by a substantial resistive unit between 1200E and 1675E, within individual maxima of 10,000 ohm-metres at 1262E, 6500 ohm-metres at 1437E and 5500 ohm-metres at 1588E. The chargeability over this resistive unit rises well over the 10 millivolts/volt background giving local maxima of 20 millivolts/volt at 1350E and 24 millivolts/volt at 1462E. The *relative* resistivity low of 1400 ohm-metres at 1500E together with the local chargeability maximum of 8 millivolts/volt against the high 16 millivolts/volt background, may be of interest as it lies 'close' (?) to the contact. The local 200 gamma increase in magnetic field *may* enhance its interest. However, this feature is quite like the resistor seen on 16N between 1220E and 1700E which traversed the ultrabasic/granite contact at 1400E. Thus perhaps the alteration associated with a shallow lying granite has influenced the resistivity of the ultrabasic and the ultrabasic/limestone contact.

Comparison with other Geodata

The magnetic field level shows a gradual background rise from 61900 gamma(+) at 1100E to 62900 gamma (+) at 2200E as the sedimentary rocks are entered. Interestingly enough, the magnetic fields observed over the serpentinites are *lower* than those near the quartzites!

A most distinctive boundary was defined at 1200E. Resistivities rise ten-fold

to the east thereof, while chargeabilities double to 16 millivolts/volt. The magnetic field shows a change in gradient at this point, and increases east thereof also. The geophysical evidence then would appear to indicate a *major* rock type change at 1200E(+).

For about 50 to 70 metres either side of 1700E significant tin geochemistry to 100 ppm was reached. Two magnetic field distortions of 600 gamma and 500 gamma were defined on the flanks thereof at about 1650E and 1760E respectively. While there are no clear increases in chargeability over these sections (although the western unit has a higher background), these anomalies should be considered further as possible skarn zones.

A small sharp 4 to 6 millivolts/volt response at 2000E over an outcrop of crotty quartzite is not considered significant.

SCINTREX*LINE 14.5N*

On this line the Gordon Limestones were recorded from 1500E to about 1700E where crotty quartzites were recorded. The limestones show rapid changes in apparent resistivity from lows of 730 ohm-metres at 1488E, 1000 ohm-metres at 1600E and 790 ohm-metres at 1688E to a high of 2500 ohm-metres at 1662E. These rapid and sharp changes indicate substantial changes within the limestones themselves. The chargeabilities give a high background (for limestones) of 12 to 14 millivolts/volt, with an anomaly of 9 millivolts/volt at 1450E, 22 millivolts/volt at 1512E and shoulder at 1550E. The overall zone between 1400E and 1588E is anomalous. The accompanying resistivities vary *about* the 1000 ohm-metres mark, while the decay forms are only slightly faster than normal. The disseminated source is considered of secondary geophysical interest at best.

There were no other significant responses.

Comparison with other Geodata

As on other lines, the magnetic field increases over the limestone and quartzite units above that seen over the serpentinites.

The soil tin values increase in sympathy with the increase in chargeability between 1400E and 1588E (see above). This would appear to enhance the interest of the chargeability response, however, the tin may be accumulated in sediments associated with the Little Wilson River. Against this a series of minor (50 to 100 gamma) magnetic field highs at 1475E, 1550E and 1625E *may?* indicate some skarn activity within the limestones, albeit subdued. On balance the potential interest of the chargeability anomaly between 1400E and 1588E is enhanced to secondary to

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secondary plus.

SCINTREX*LINE 14N*

On this profile the significant geological contacts were mapped as follows: ultrabasic/limestones at 1470E and limestone/crotty quartzite at 1680E. While there are considerable changes in the resistivity data from a base level of 1000 ohm-metres(+) to 5000 ohm-metres, the three geophysical units do not show up uniquely via their electrical characteristics. However, the magnetic field data shows significant changes within the ultrabasic unit, while the limestone and crotty sandstones are relatively quiet.

The chargeability data gives a background of 10 to 12 millivolts/volt on all three units, with a number of very low amplitude 'anomalies' superimposed thereon. There were defined as follows:

6 millivolts/volt at 1288E and 1337E

8 millivolts/volt at 1650E and 6 millivolts/volt at 1712E

7 millivolts/volt at 1888E and 1950E

In all cases the depth to source is less than 50 metres. All anomalies are considered of tertiary geophysical interest which may be increased at 1288E and 1337E due to the presence of high tin values in the soils.

Comparison of 1980/1982 Work

While the *form* of the chargeability and resistivity responses are similar for the most part, some interesting differences do occur. For instance, the anomaly at 1950E is much enhanced on the 1980 survey. This may indicate a greater importance with depth. Also, while the chargeability and resistivity backgrounds generally remain similar, west of 1350E the 1980 data is progressively higher westwards.

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This again indicates higher chargeabilities at depth (i.e. indicates a less chargeable surface zone to be present here). Also, this surface zone is inferred to be slightly less resistive.

Comparison with other Geodata

The magnetic field remains 'quiet' over the eastern section of the serpentinites east of 1300E, and over the limestones and crotty quartzites, while no anomalous geochemistry was recorded east of 1600E.

The additional geodata does not in this case enhance the interest of any of the minor anomalies defined.

SCINTREX*LINE 13N*

This line was surveyed about 100 metres south of 14N with the ultrabasic/limestone contact being mapped at 1300E (+) with the limestone/crotty sandstone contact being at 1550E.

The apparent resistivity data shows dramatic changes from 6000 ohm-metres to 500 ohm-metres within the limestone unit, while the bulk of the chargeability values recorded lie between 12 and 16 millivolts/volt.

Higher chargeabilities were recorded between 1188E and 1400E on a number of individual centres at 1212E, 1262E, 1337E and 1388E. The depths to source are all less than 25 to 35 metres and all are associated with relative resistors implying a disseminated source within a resistive silicified(?) host. None are considered of greater than tertiary interest.

On the eastern margin, at 1588E, a 5 millivolts/volt response was recorded coincident with a substantial increase in resistivity from 1500 ohm-metres to 6000 ohm-metres. Again a resistive host is interpreted.

Two similar maxima of 4 to 5 millivolts/volt and 10 millivolts/volt were recorded within resistive rocks at 1788E and 1887E, both within crotty sandstones. The maximum depth to each source is estimated at 25 to 40 metres.

Within the crotty quartzite unit a spectacular resistivity low of 270 ohm-metres as against background of 7000 ohm-metres was defined at 2037E. An extremely high 84 millivolts/volt anomaly was recorded coincident with the resistivity low,

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and shows a normal decay form. The maximum depth to source is not greater than 25 metres and the source is considered to be sulphides or perhaps sulphide and graphite. As sulphides have been recorded on the creek 100 or so metres to the south-south-west, this anomaly may relate to an extension of that zone. This anomaly is considered of secondary/primary interest.

Comparison with other Geodata

The most significant feature is the high soil geochemistry, particularly in tin, recorded within the Quaternary deposits associated with the Little Wilson River, all down slope from the chargeability anomalies at 1212E and 1262E (see above). However, it is more than likely that these anomalous soils are non-residual and thus of limited value. Thus none of the anomalies' interest has been enhanced.

As there is no anomalous geochemistry associated with the significant chargeability/resistivity anomaly at 2037E, this response is slightly down-graded to secondary interest.

The significant soil geochemistry at 1550E(+) (down slope from the induced polarization response at 1588E), is considered to be worthy of further investigation as a target of secondary priority.

SCINTREX*LINE 12.5N*

The limestone has been mapped to the west of the western end of this line, with the eastern boundary with the crotty quartzite being located at 1500E.

As seen on other lines, the limestones appear to be marked by relative resistivity lows. The background chargeability values range about 10 to 12 millivolts/volt over the limestone, but at and into the crotty quartzites between 1600E and 1800E chargeability ranges to 18 millivolts/volt with high 8000 ohm-metres resistivities. Within the high resistivities a marked low of 150 ohm-metres was defined at 1737E. Unfortunately due to the low signal strength the chargeability reading was noisy but looked to be about 20 millivolts/volt. The decay forms are faster than normal with ΔM_n being between -10% and -15%. The response may be related to the high chargeability/low resistivity zone seen on line 12N at 1737E, if not stratigraphically then genetically. This response is of secondary to tertiary geophysical interest.

Comparison with other Geodata

The additional geodata does not change or enhance the interest of the generally minor chargeability responses defined. However, a small 170 gamma (+) increase in magnetic field at 1600E may be of interest should the limestone boundary be east of this point.

SCINTREX*LINE 12.25N*

The bulk of this line was surveyed over the crotty quartzites, with the Gordon Limestone/ultrabasic contact being well to the west of the end of the survey line at 1212E. The mapped position of the limestone/crotty quartzite contact is at about 1390E. The limestone has a minor chargeability of 4 millivolts/volt over the background centred at about 1312E. The source is inferred to be disseminated as there is no change in the high 2000 ohm-metres resistivities. This anomaly is of little significance.

Between 1420E and 1760E chargeabilities rise from an assumed background of 8 to 9 millivolts/volt to 16 to 18 millivolts/volt, while resistivities rise in sympathy to over 6000 to 7000 ohm-metres between 1600E and 1800E (across the river). This section probably correlates to about 1600E to 1840E on line 12.5N. Other than this section, there are no anomalous readings on this line.

Comparison with other Geodata

The additional geodata does not assist in detailing zones of interest on this line.

LINE 12N

On this line the ultrabasic/Gordon Limestone contact was seen at about 1340E, while the limestone/crotty quartzite contact was mapped at 1500E. In this case the limestones are marked by higher 18 to 19 millivolts/volt values across the 150 metres width, with lower values to 8 millivolts/volt being seen to the west and east over the ultrabasics and quartzites. The resistivities on the limestone section were a high 2500 to 3000 ohm-metres, with higher still values to 9000 ohm-metres being seen over the quartzite. Other than the higher charge-abilities over the limestones, there are no anomalous indications.

Comparison with other Geodata

The additional geodata does not assist in detailing zones of interest on this line.

CONCLUSIONS

- 1 The serpentinite/Gordon Limestone and Gordon Limestone/crotty quartzite boundaries are, from a geophysical point of view, often quite difficult to resolve, and yet, from the three geophysical parameters of magnetic field, resistivity and chargeability, would generally be expected to yield diagnostic differences (particularly the western contact of the limestone). The fact that they do not, could be due to the proximity of the granite at perhaps shallower depths below, (a) having influenced the chargeabilities of the rocks themselves, and (b) the influence of the granite itself on the data.

- 2 On the whole the results of the geophysical responses over, and in close proximity to the Gordon Limestone, are disappointing. The indications of possible skarn zones exist, however, the amplitude of both the magnetic field distortions and chargeabilities are lower than normally observed over skarns, and in addition, are of limited areal extent. However, the 'old' geophysical adage that "amplitude of anomalies is no criteria of their economic merit" should be borne in mind - particularly for skarn zones which are notoriously variable.

- 3 A summary of the significant anomalies together with their assessed "geophysical" and "economic" interest is given in the table overleaf.

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SIGNIFICANT ANOMALIES

<u>Line</u>	<u>Station</u>	<u>Amplitude/background</u>	<u>Type</u>	<u>Maximum Depth</u>	<u>Geophysical Priority</u>	<u>Economic Priority</u>
18N	3112E	10/12	R	25 metres	Secondary (-)	Primary
	3162E	10/12	L	25 metres	Secondary (-)	Primary
17N	1737E	13/9	L	50 metres	Secondary/primary	Secondary
	2037E	5/10	L	25 metres	Tertiary	Secondary
	2762E	5/12	L	50 metres	Secondary/primary	Secondary (-)
	2788E	10/12	R	50 metres	Secondary/primary	Primary
16.5N	2100E	8/6	L	50 metres	Tertiary	Secondary
16N	1812E	12/6	R	25 metres	Secondary (-)	Secondary (-)
	1862E	12/6	R	25 metres	Secondary (-)	Secondary (-)
	1650E	8/12	R	75 metres?	Secondary/tertiary	Secondary/tertiary
15.5N	1600E	10/10	R	50 metres	Secondary/tertiary	Secondary/tertiary
	1762E	10/10	L(M)	25-50 metres	Primary/secondary	Primary
	2020E	Soil tin and magnetic 'negative'		80 metres		Primary/secondary
15N	1462E	8/16	L	25 metres	Secondary/tertiary	Secondary
	1650E & 1760E	Soil tin and magnetic response		50-60 metres	Tertiary/secondary	Secondary (+)
14.5N	1400E-1588E	12/10	R	50 metres?	Secondary (-)	Secondary (+)(??)
14N	1288E	6/11	R	25-35 metres	Tertiary	Secondary
	1337E	6/11	R	25-35 metres	Tertiary	Secondary
	1650E	6/11	R	35-50 metres	Tertiary	Secondary
	1712E	6/11	R	35-50 metres	Tertiary	Tertiary
	1888E	6/11	L	50 metres	Tertiary	Tertiary
	1950E	6/11	L	50 metres	Tertiary	Tertiary
13N	2037E	72/12	L	25 metres	Primary/secondary	Secondary
	1588E	5/12	R	50 metres		Secondary
12.5N	1737E	?	L	35 metres	Secondary/tertiary	-

R = resistive, L = less resistive

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Respectfully submitted on behalf of:

SCINTREX PTY. LTD.



A.W. HOWLAND-ROSE

MSc, DIC, FIMM, MAus IMM, MAIG, FGS.

Geophysicist

SCINTREX

PERSONNEL AND TIMING

The work was carried out under Scintrex crewleader Mr. R. Bennett between 19th and 31st January, 1982. Second operators/field hands included G. Kennedy, P. Eagleton and A. Hudson.

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METHOD AND EQUIPMENT

The method employed was the gradient array. Energisation was effected by a large spaced current dipole placed across strike powered by a Scintrex time domain transmitter employing a 2 second square wave. The power unit was an 8HP 400Hz motor generator.

The resultant primary (resistivity) and secondary (chargeability) electric fields were measured using Scintrex IPR-8 time domain receivers on a two second programme measuring three separate slices under the decay curve as follows:

Slice 1 (M_1) 130 to 650 milliseconds

Slice 3 (M_3) 650 to 1170 milliseconds

Slice 5 (M_5) 1170 to 1430 milliseconds

(Note: each section is of 520 milliseconds duration)

Each integration has been normalised with respect to the standard induced polarization decay curve established by Newmont Exploration Limited (Dolan, W.M., McLaughlin, G.H. (1967) "Considerations Concerning Measurement Standards and Design of IP equipment" Proceedings of the Symposium on Induced Electrical Polarization, Berkley, University of California, pp. 2-31)

Two gradient blocks were employed to cover the survey area as follows:

Electrodes at 1300E and 3350E on line 18N

Line 18N 1900E to 3550E

Line 17N 1600E to 3060E

Line 16.5N 1600E to 2240E

Line 16N 1150E to 2550E

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Electrodes at 650E and 2800E on 14N-14.5N

Line 16N 2500E to 3050E

Line 15.5N 1462E to 2412E

Line 15N 912E to 2337E

Line 14.5N 1412E to 2537E

Line 14N 1012E to 2187E

Line 13N 1112E to 2137E

Line 12.5N 1262E to 1887E

Line 12.25N 1212E to 1887E

Line 12N 1037E to 1887E

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APPENDIX

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

INTRODUCTION

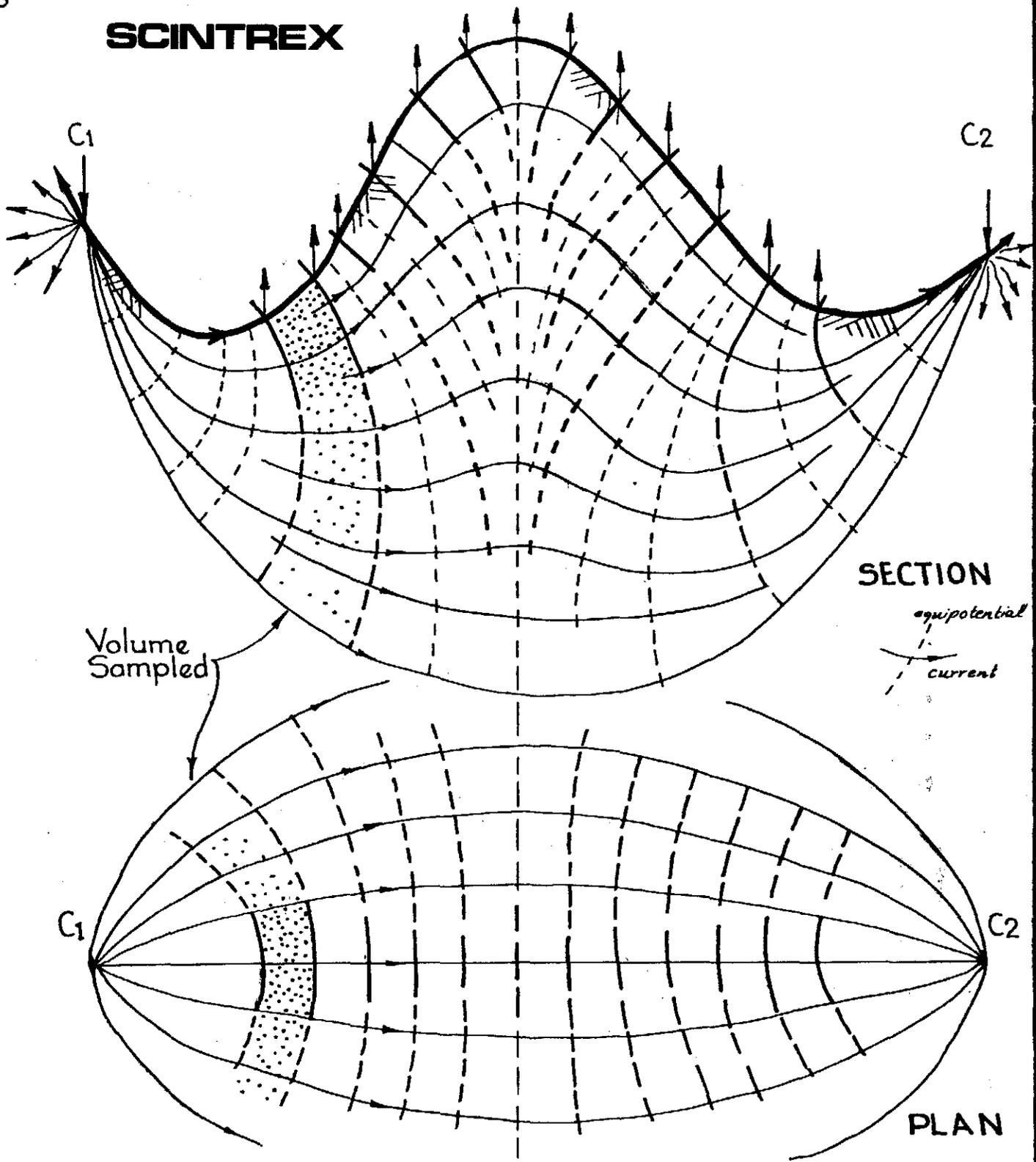
In the case of the surveys discussed in this report, it is important that the geologist can relate the geophysical data to the underlying geology if he is to make the best use of this data. It is the author's opinion that *only* the geologist will be able to relate the data to geology. For this reason 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.

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 ρ_a) is not necessarily the same volume as is the secondary potential field (apparent chargeability Ma). This is, of course, true for *any* array.

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

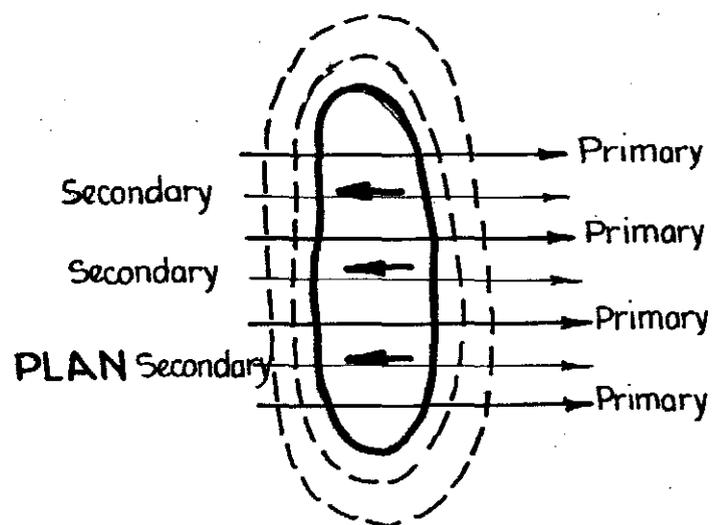
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SECTION

LEGEND

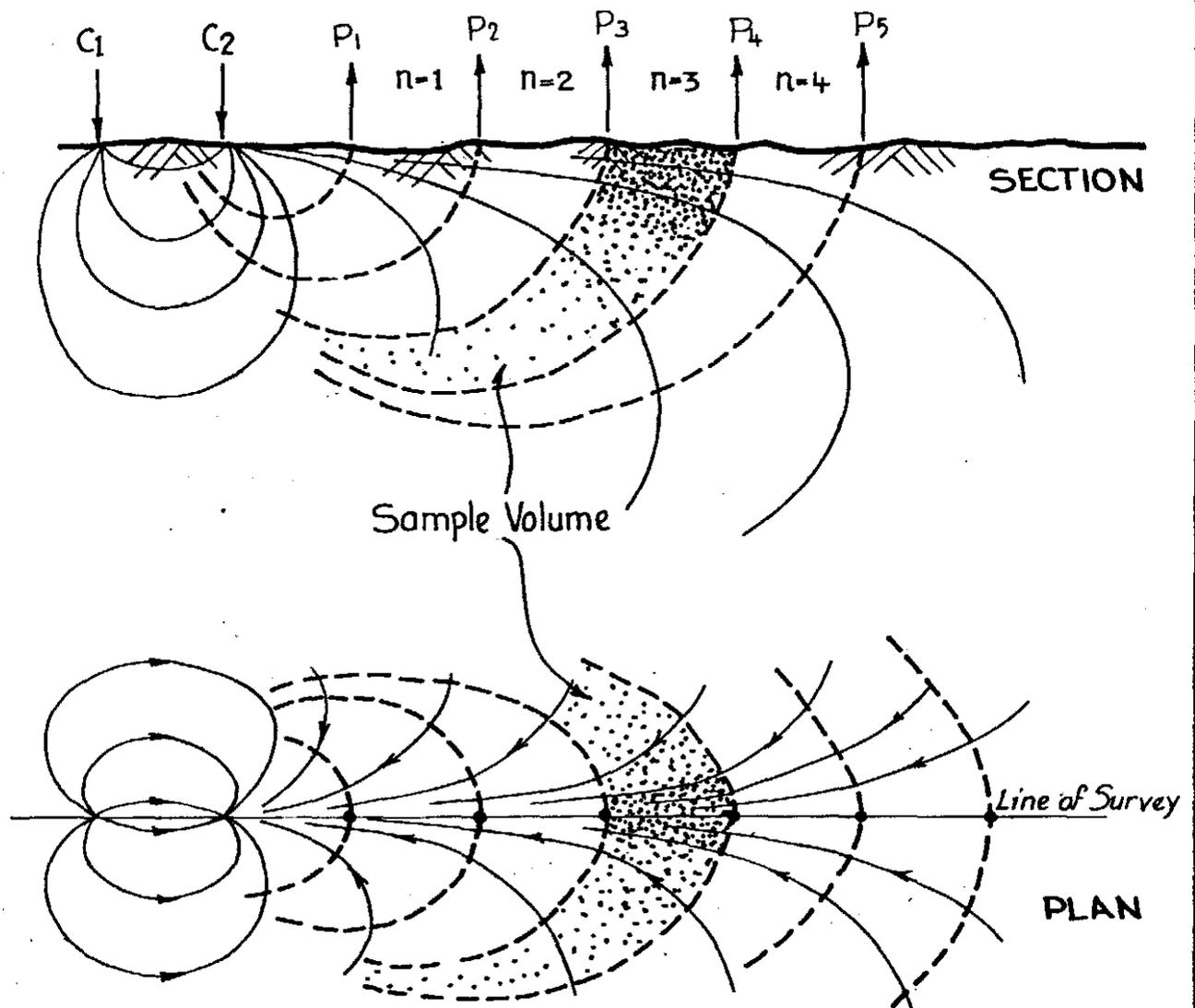
- Primary Current (over body)
- Internal Polarization (at depth within body)
- Secondary Current (I.P)
- Secondary Potential Field



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

FIGURE 2.

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

FIGURE 3

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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° 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 .

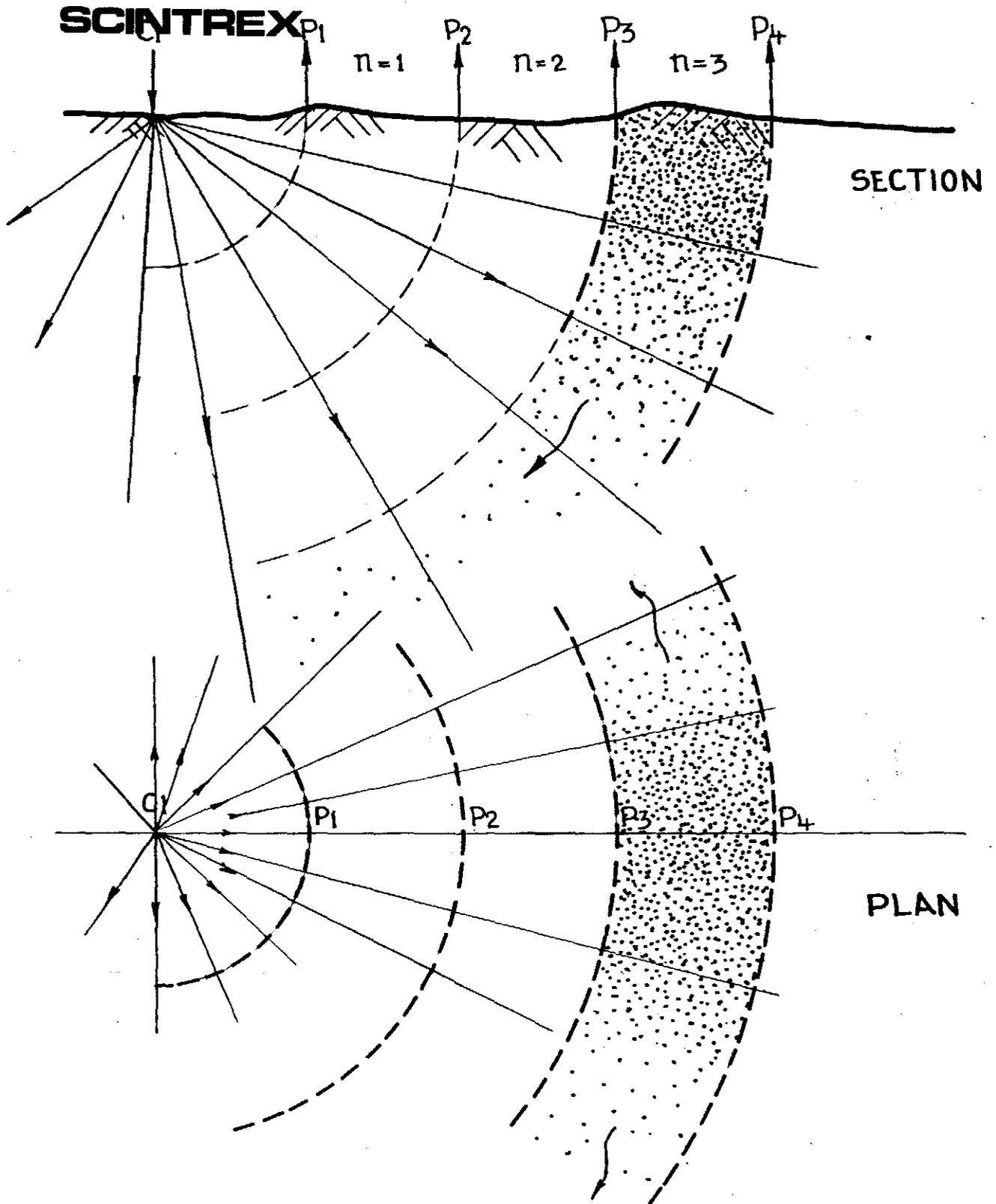
Pole-Dipole:- This array is similar in principle to the dipole-dipole array,

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° 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

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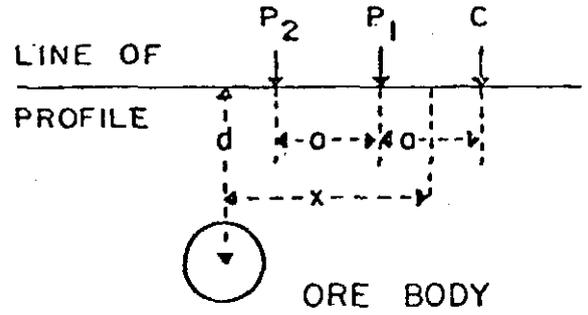
Current Path and Primary Equipotential Field
from Pole-Dipole Array

FIGURE 5

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**SPHERE RESPONSE
THREE ELECTRODE
ARRAY**



$$z = x/d$$

$$\alpha = a/d$$

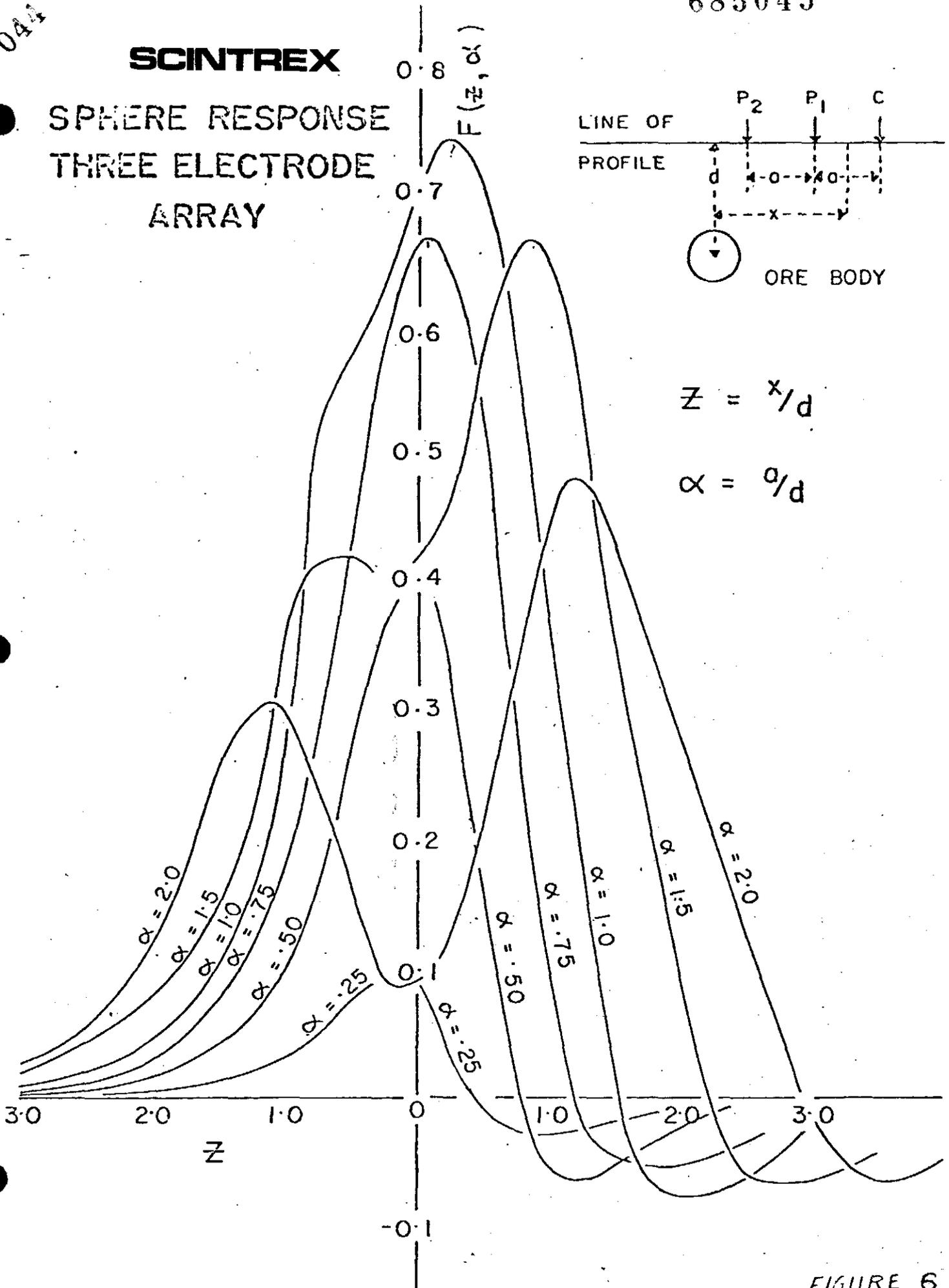


FIGURE 6

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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 ΔM infers *slow* decay form and negative ΔM *fast* decay form. A superior parameter is ΔM_n where

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

which is essentially ΔM normalised for the amplitude of the decay. ΔM and ΔM_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

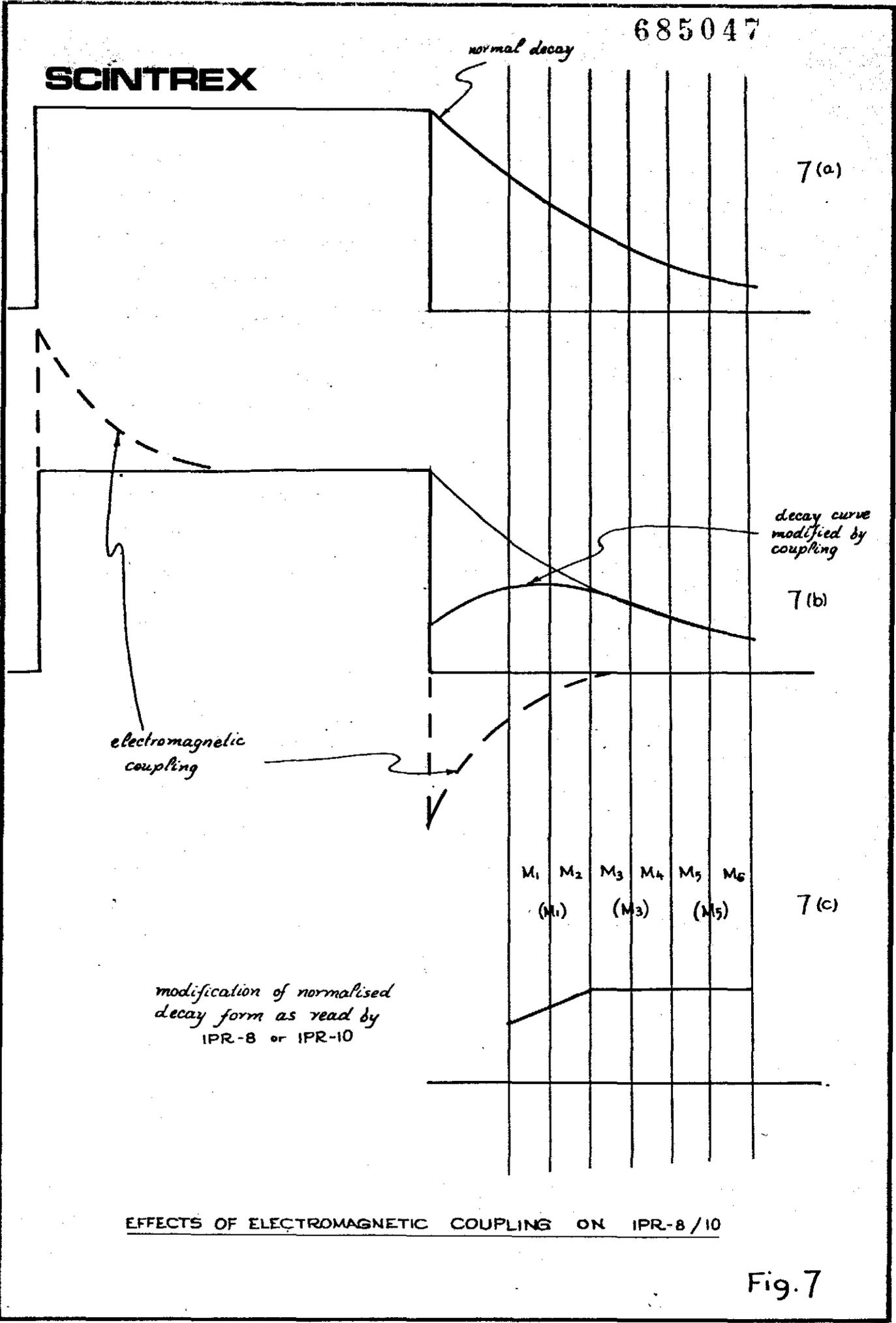
M ₁	M ₂	M ₃	M ₄	M ₅	M ₆
(M ₁)		(M ₃)		(M ₅)	

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



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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.

TABLE 1
(Table 3. 1)

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SCINTREX Comparison of IP Survey Electrode Arrays

(after Sumner, 1972)

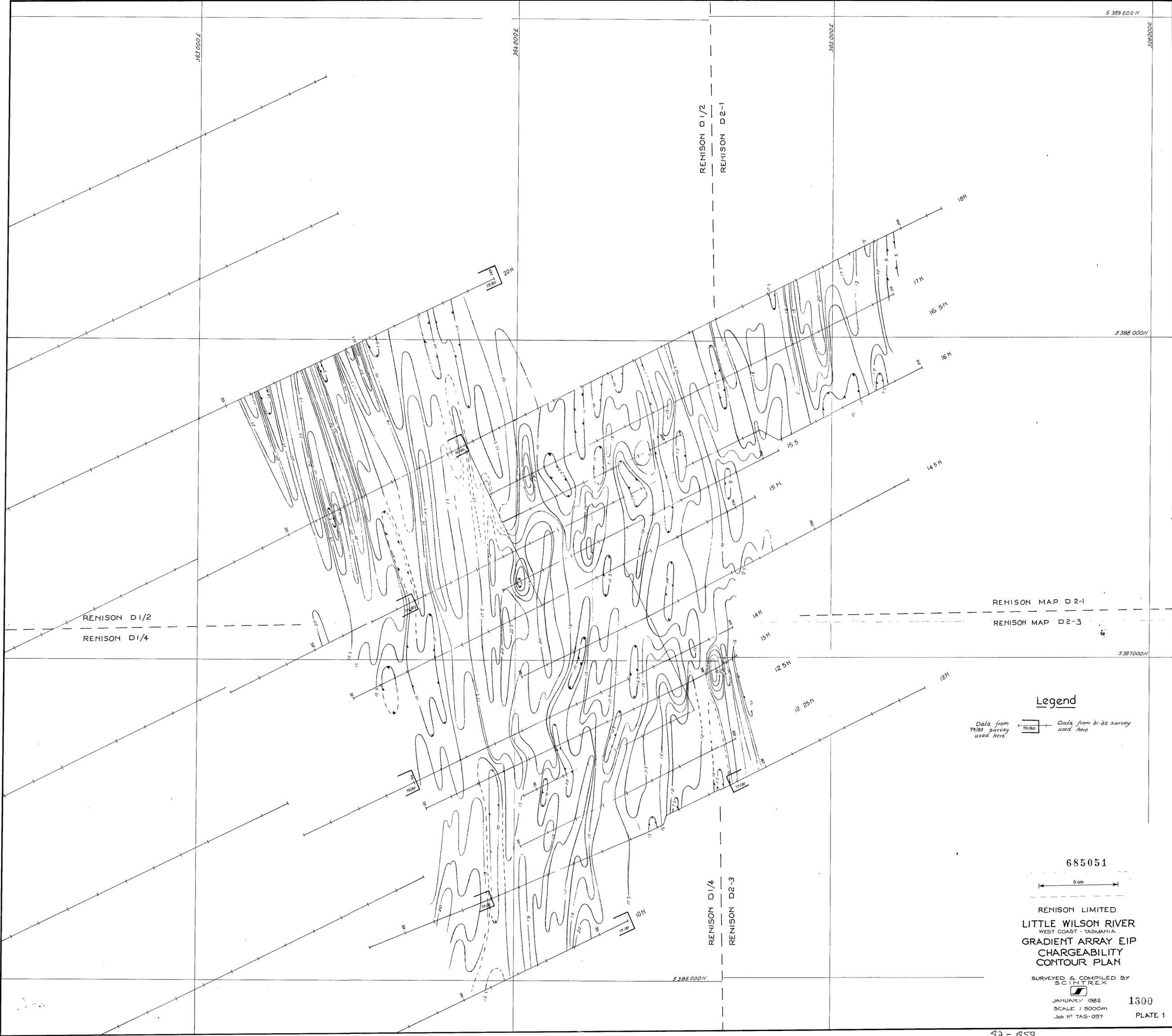
	Advantages	Disadvantages	Survey Speed	Signal to-Noise	EM Coupling Rejection
Parallel Field Arrays Wenner	Anomalies symmetrical Synchronous detector possible Many case histories available	Requires more wire: larger field crew Poor resolution Unfavourable in capacitive coupling situations	Fair	Good	Fair
→ Schlumberger	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
→ Gradient	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
Potential-About-a-Point Three-Array	Good reconnaissance array Fairly good resolution	Asymmetrical More wire needed	Fair	Good	Good
→ Pole-Dipole, Collinear	Good resolution Good subsurface coverage	Asymmetrical Asymmetrical	Fair	Fair	Fair
Perpendicular Three-Array, Pole-Dipole, Pole-Pole Pole-Pole (Two-Array)	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
PDR (Potential Drop Ratio)	Sensitive to lateral variations "Common mode" noise rejection	Complex interpretation	Fair	Good	Fair
Dipole Field Array					
→ Dipole-Dipole, Collinear	Symmetrical, good resolution Good penetration Less survey wire needed	Slow unless equipment is portable Resistivity topographic effects Interpretation somewhat involved	Fair	Poor	Fair
Dipole-Dipole, Parallel	Special use for EM coupling interpretation	Not used for routine surveying	Poor	Poor	Fair
Down-the-Hole Arrays					
Azimuthal Array (One Potential Electrode Down the Hole)	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
Radial Array (One Current Electrode Down the Hole, mise-à-la-masse)	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
In-Hole Arrays (More than One Electrode in the Hole)	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"

SCINTREX**DATA PRESENTATION**

The chargeability and resistivity data has been plotted (by Renison) together with magnetic field, topographic profile, geology and soil geochemistry at the scale of 1:5000 and is not included with this report.

The chargeability, resistivity and total magnetic field have been contoured onto the four standard Renison sheets, Corinna D1/2, D1/4, D2/1 and D2/3. However, for convenience this report contains contour composites covering the survey area, and showing such survey boundary discontinuities which exist on the map edges.



5 388 000 N

5 387 000 N

5 386 000 N

RENISON MAP D 2-1
 RENISON MAP D 2-3

Legend

Data from 79/80 survey used here  Data from 81-82 survey used here 

685051

5 cm

RENISON LIMITED
 LITTLE WILSON RIVER
 WEST COAST - TASMANIA
 GRADIENT ARRAY EIP
 CHARGEABILITY
 CONTOUR PLAN

SURVEYED & COMPILED BY
 SCINTREX

JANUARY 1982
 SCALE 1:5000m
 Job N° TAS-037

1300
 PLATE 1

363 000 E

364 000 E

365 000 E

RENISON D 1/2
RENISON D 2-1

18 N

17 N

16 5 N

5 388 000 N

16 N

15 5 N

15 N

14 5 N

RENISON D 1/2

RENISON D 1/4

RENISON MAP D 2-1

RENISON MAP D 2-3

5 387 000 N

14 N

13 N

12 5

12 25 N

12 N

Legend

Data from 79/80 survey used here



Data from 81/82 survey used here



RENISON LIMITED
LITTLE WILSON RIVER
WEST COAST-TASMANIA
GRADIENT ARRAY EIP
RESISTIVITY
CONTOUR PLAN

SURVEYED & COMPILED BY
SCINTREX

JANUARY 1982
SCALE 1:5000m
Job # TAS-087

1301
PLATE 2

685052

82-1859

5 386 000 N

RENISON D 1/4
RENISON D 2-3

10 N

9 N

8 N

7 N

6 N

5 N

4 N

3 N

2 N

1 N

0 N

0 N

0 N

0 N

0 N

0 N

0 N

0 N

0 N

0 N

5 389 000N

365 000E

363 000E

364 000E

365 000E

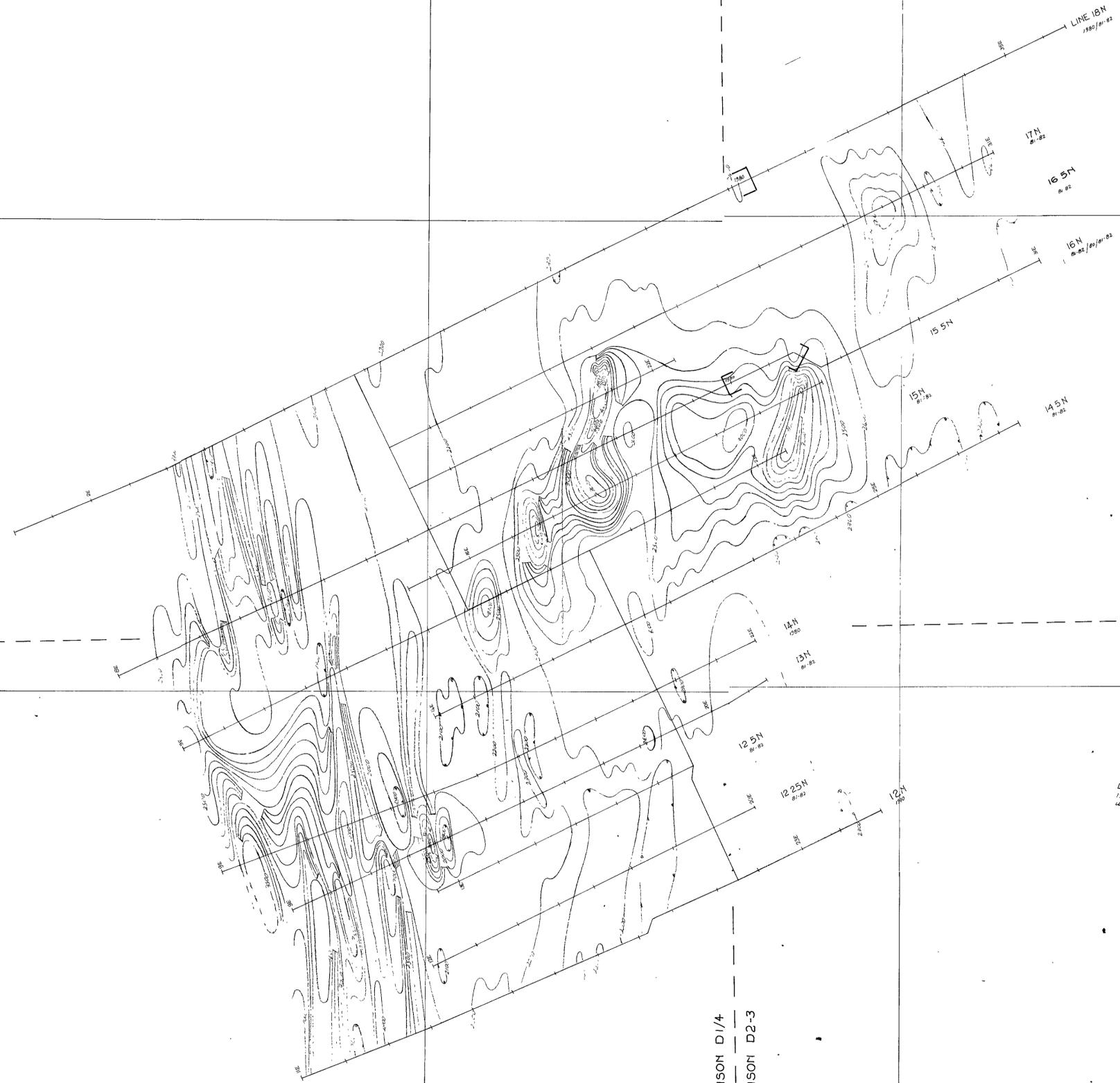
RENISON D1/2
RENISON D2-1

5 388 000N

5 387 000N

RENISON D1/2
RENISON D1/4

RENISON MAP D2-1
RENISON MAP D2-3



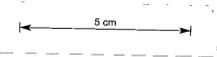
Legend

Data from 1980 survey used here
 Data from 81-82 survey used here

 12N (adjusted) This data adjusted by 75 gamma

NOTE For total magnetic field add 60000 gamma to all values

685053



RENISON LIMITED
 LITTLE WILSON RIVER
 WEST COAST - TASMANIA
**TOTAL
 MAGNETIC FIELD
 CONTOUR PLAN**

COMPILED BY
 SCINTREX

 JANUARY 1982
 SCALE 1:5000m
 Job 11 TAS-097

1302
PLATE 3

5 386 000N

5 385 000N

363 000 E

364 000 E

365 000 E

RENISON D 1/2
RENISON D 2-1

18N

17N

16.5N

5 388 000 N

16N

14.5N

Legend

-  conductor axis
-  resistor axis
-  chargeability axis
-  magnetic axis
-  possible stanniferous
-  mapped extent of granite
-  granite at shallow depth
-  possible extent of limestone as seen from geophysics

RENISON MAP D 2-1
RENISON MAP D 2-3

5 387 000 N

RENISON D 1/2
RENISON D 1/4

14N

13N

12.5N

12.25N

12N

10N

RENISON D 1/4
RENISON D 2-3

5 386 000 N

685054



RENISON LIMITED
LITTLE WILSON RIVER
WEST COAST - TASMANIA
GRADIENT ARRAY EIP
TOTAL MAGNETIC FIELD
INTERPRETATION PLAN

SURVEYED & COMPILED BY
SCINTREX

JANUARY 1982
SCALE 1:5000m
Job # TAS-097D

1303
PLATE 4

82-1859