SCINTREX

A REPORT ON RECONNAISSANCE GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION SURVEY AGNEW GRID, TRIAL HARBOUR ROAD ZEEHAN, TASMANIA

ON BEHALF OF

RENISON LIMITED

000

975002

SCINTREX

PRIVATE AND CONFIDENTIAL

A REPORT ON RECONNAISSANCE GRADIENT ARRAY ELECTRICAL INDUCED POLARIZATION SURVEY AGNEW GRID, TRIAL HARBOUR ROAD ZEEHAN, TASMANIA

ON BEHALF OF

RENISON LIMITED

BY

A.W. HOWLAND-ROSE

MSC,DIC,AMAUSIMM,FGS.

GEOPHYSICIST

SYDNEY, N.S.W.

MAY, 1981

TAS - 081D

001

975003

SCINTREX

CONTENTS

975004

SCINTREX PTY. LTD.
GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

A gradient array electrical induced polarization survey carried out over some 42 kilometres of the Agnew grid on the Trial Harbour Road has defined a number of significant induced polarization anomalies whose characteristics are similar to the Sweeneys-Federation type alteration/mineralisation which in these areas carry tin.

In particular, anomaly A on lines 600E and 700E at 850N and Anomaly D on lines 300E and 400E at 600S are considered of particular interest.

Small gradient spreads on close spaced lines together with limited moving source arrays have been recommended over these and other zones of potential economic interest.

1031 WELLINGTON STREET,
WEST PERTH, 6005
WESTERN AUSTRALIA

TELEPHONE: 321 6934
TELEX: 92353
TELEGRAMS: SCINTREX, PERTH

6 TRAMORE PLACE,
KILLARNEY HEIGHTS, 2087
N.S.W. AUSTRALIA.

TELEPHONE: 451 5367
TELEX: 26859
TELEGRAMS: SCINTREX, SYDNEY

975005

SCINTREX

A REPORT ON
RECONNAISSANCE GRADIENT ARRAY
ELECTRICAL INDUCED POLARIZATION SURVEY
AGNEW GRID, TRIAL HARBOUR ROAD
ZEEHAN, TASMANIA
ON BEHALF OF
RENISON LIMITED

INTRODUCTION

At the request of Mr. L. Newnham Chief Geologist for Renison Limited, Scintrex Pty. Ltd. executed a reconnaissance electrical induced polarization survey using the gradient array over approximately 44 kilometres of line on the Agnew Grid, Trial Harbour Road, Zeehan, Tasmania. The work was carried out by a five man crew under the leadership of Mr. R. Bennett. The work was carried out over three triple, eight double and three single production days between 12th and 26th January, 1981. The weather was good, and the helicopter and ancillary support provided by Renison Limited was excellent, and as a consequence production was well above average in spite of the very steep terrain over the northern section of the grid.

On-site geological direction was undertaken by Renison Senior Geologist Mr. P. Roberts, while the author undertook such additional supervision as was required.

METHOD

The gradient array method is briefly described in the attached appendix.

In the case of the Agnew grid, some three current dipoles were laid out as set down below.

Line	Electrode locations	Dipole	Lines Surveyed
1800E	1540N and 1100S	2640 metres	1500E to 2300E
1050E	1500N and 1300S	2800 metres	1400E to 700E
400E	1600N and 1170S	2770 metres	600E to 00

A Scintrex 10/15 kilowatt time domain transmitter was used to energise the survey area, the current used varying between about 3 and 5 amps. The energising cycle was a standard two second square wave, with the Scintrex IPR-8 receiver monitoring this field on a two second three slice programme. Only the M_3 ('middle') slice has been used in the data profiles and contour maps. Throughout, a 20 metres potential dipole was employed.

All data was calculated using an HP-97 (printer) calculator.

DATA PRESENTATION

The chargeability (M_3 only) in millivolts/volt, and apparent resistivity in ohm-metres have been drafted onto standard Renison sheets at the scale of 1:2000. Chargeability and apparent resistivity have also been contoured at 1:5000 scale on Renison standard map sheets C212 and C214.

GEOLOGY

The geology is not known to the author in detail, however, to the north of the Trial Harbour Road (see map C214) the rocks are understood to be intrusive Devonian granites, while somewhere to the south of the road Crimson Creek Formation rocks are understood to be present. The former would be expected to be characterised by low chargeability background, and high apparent resistivities, while the latter invariably have high induced polarization and low apparent resistivities. There is, however, little evidence that the location of the southern electrodes, even if emplaced within rocks of Crimson Creek Formation, are distorted by the proximity of this unit.

DISCUSSION OF RESULTS

General

The chargeability backgrounds observed in the area show a general increase in background from the north (15 ±2½ millivolts/volt) to the south (27½ ±2½ millivolts/volt). The apparent resistivities show an increase from about 1000 ohm-metres (±), low for a granite, to 2500 ohm-metres(±) in the south, more normal for a granite. The general impression is that these changes have an arcuate form, being magnetic east west in the west, east-north-east west-south-west in the centre and north-east south-west in the east. There are, however, no specific 'contacts' as such, the observed changes being gradual. This suggests gradual compositional changes. The 15 millivolts/volt(±) levels seen in the north are similar to those seen on the Federation grid, and are considered to be within the range of values normal for granites. However, the 27 millivolts/volt (±) levels seen in the south are somewhat high for average granites. This suggests a higher mafic mineral content in the southern granites.

Significant Anomalies

The significant anomalies are discussed in respect of their *relative* anomalism with respect to the rocks which immediately enclose them, rather than in terms of their *absolute* level.

Anomalies within the low background areas north of the 00 baseline

A - Lines 600E and 700E at 850N(±)

This response occurs on the junction of two gradient blocks, but this has not affected the data to any major degree. The anomaly is one of (if not the most) significant responses recorded on this survey.

There is absolutely no sign of any anomalism on line 500E, however, on line 600E the anomaly is fully developed. The gradient array data implies two related sources, one at about 850N (over the old workings) which shows lower resistivities of about 400 ohm-metres (which are about 70% below background), and chargeabilities of about 25 millivolts/volt above the 15 millivolts/volt local background. A second source at about 890N shows 40 millivolts/volt, still within lower resistivity rocks. The maximum depths to source are about 40 metres. The decay forms observed were about normal.

On line 700E the resistivity low of 350 ohm-metres (also about 70% below background) was centred at 830N. The chargeability maximum of 55 millivolts/volts, some 40 millivolts/volt above background, was centred at 830N, with a secondary maximum inferred by a 'shoulder' response at about 870N. The maximum depth to source looks to be of the order of 50 to 60 metres. On this line the old workings coincide with the highest chargeabilities recorded.

On line 800E higher chargeabilities of 10 millivolts/volt(±) were recorded between 800N and 900N, together with two distinct resistivity lows each of about 400 ohm-metres at 830N and 890N. These two relatively minor anomalies may indicate an 'en echelon' pattern to the mineralisation.

Conclusions and Recommendations

The anomalies located on lines 600E and 700E are of primary geophysical interest. Obviously the mineralisation in the "old workings" will establish (or otherwise) the potential economic interest of the anomalies here defined.

The recommendation for further work is (a) carry out a gradient array detailed survey on 30/35 or 25 metre lines between lines 500E to 900E inclusive from about 750N to 950N - including re-reading the original lines. A smaller dipole of say 1 kilometre is recommended on line 700E. This should be able to give some detail of the form of the source which could consist of an en echelon series of zones. (b) one or two lines of 20 metres or 25 metres dipole-dipole, or for operational reasons pole-dipole is also recommended. This will assist in yielding more precise depth to source information.

B 1200E at 745N-820N, 1100E at 800N (and 1000E at 800N)

While there is no response on line 1300E, a small but significant anomaly on line 1200E of 15 millivolts/volt above background at 755N was defined coincident with a 350 ohm-metres resistivity minimum, some 80% below local background. A depth to source of about 20 metres is inferred. A second resistivity low of 600 ohm-metres against 1500 ohm-metres background was noted at 820N which coincides with a minor but perhaps significant 10 millivolts/volt increase above the low 7 millivolts/volt background to the north. On line 1100E a most significant resistivity low of 270 ohm-metres as against 1700 ohm-metres (±) to the south and 1300 ohm-metres(±) to the north was defined. Two related relatively low amplitude chargeability anomalies were found to be associated - 15 millivolts/volt at 790N and 10 millivolts/volt at 840N - basically on the flanks of the resistivity low. This may be due to the fact that the resistivity low may contain sulphides of greater grain size (the decay form, however, is normal), or greater alteration is associated with their presence within the resistivity low, and the flanking induced polarization anomalies are within more resistive rocks devoid of alteration. On line 1000E a very sharp resistivity low to 150 ohm-metres was recorded at 810N as against a background of 1300 ohm-metres. Also the chargeability was 7 millivolts/volt (±) higher than background either side of the relative low - no reading being able to be taken within the low itself. This response probably represents a shallow extension of the zone of interest located at about this coordinate on lines 1200E and 1100E.

Conclusions and Recommendations

This anomaly should also be considered for follow-up detailed gradient array work on 30/33 metre spaced lines for ±100 metres north and south of this zone. Also a pole-dipole 25 metre *a* spacing *n* = 1 to 5 should be considered.

This anomaly has similar indications of lower/moderate resistivity and low amplitude induced polarization anomalism seen over sericite alteration zones in the Federation grid and this can be considered of secondary to primary interest.

C - line 1400E at 850N

From the low local background of 10 millivolts/volt a 15 millivolts/volt response was defined at 850N which has a broad source, perhaps 20 metres. The maximum depth to source looks to be about 50 metres while the symmetry implies a south dip (with respect to surface - see appendix). A sharp resistivity low of 600 ohm-metres as against a 1100 ohm-metres background was defined at 870N. There is little to no response on either side on the adjacent lines.

Conclusions and Recommendations

1 Obviously the strike length of the source is limited, perhaps to about 150 metres at the very most. The form of the anomaly suggests a disseminated sulphide source within a less resistive host and at a maximum depth of 50 metres.

2 It is again suggested that 25/33 metre lines be surveyed between 1300E to 1500E ±75 metres of 850N using a 1 kilometre gradient dipole set up on line 1400E. Also one pole-dipole line could be considered.

D Lines 1800E at 1090N, 1900E at 1150N, 2000E at 1100N also 1700E at 1020N and 1800E at 1050N

A broad area of essentially en echelon responses on the extreme north-eastern flank of the area is due to chargeabilities of about 7 - 12 millivolts/volt above the local background. The gradual nature of the changes suggests that the change may merely be compositional.

The only truly signficant anomaly albeit of only moderate level of 12 millivolts/volt centred at 1100N on line 2000E. At this point the chargeability reaches about 10 to 12 millivolts/volt above background, while the apparent resistivity falls rapidly north of the anomaly. Considering the location of the current pole at 1540N on line 1800E, the observed decrease in resistivity is not an electrode effect. This may suggest a source just north of the line, therefore some additional work *may?* be warranted.

Conclusions and Recommendations

1 This anomalous zone is not considered to be of major significance in itself, but may imply the presence of alteration/mineralisation *between* the lines and perhaps to the north of 1130N on lines 2000E to 2300E.

2 The interest of this zone is considered secondary at best.

Anomalies in the South of the Area

E Line 400E at 610S (major) and 670S (moderate)

Line 300E at 590S (major) and 670S (shoulder)

This is one of the most significant anomalies located on the grid with substantial chargeabilities of 50 to 60 millivolts/volt on the above two lines, but with very little expression on the lines to the immediate east and west. Both the main peaks together with the subsidiary maxima are associated with relative resistivity lows, however, their amplitude suggests a source which is *less resistive* rather than *conductive* as such. The maximum depths to source of the anomalies at 610S on 400E and 590S on 300E are 60 metres and 50 metres respectively. The decay forms are normal in both cases. The inferred strike length is about 200 metres (±).

Conclusions and Recommendations

1 The most significant sections occurred on line 300E at 590S and 400E at 610S, where 60 millivolts/volt and 55 millivolts/volt induced polarization responses were defined from rocks showing a decline of 60% and 70% in background resistivity. The maximum depths to source are estimated at 50 metres and 60 metres respectively. A second sub-parallel zone was

defined at 670S on 300E and 670S on 400E, which on 300E is accompanied by a 60% reduction in resistivity, but on line 400E only a minor decrease was observed. In both cases the chargeabilities are about 20 millivolts/volt (±) above background. These anomalies are considered of primary interest.

2 It is recommended that a 1 kilometre gradient detail be surveyed over this anomaly on 25/33 metre line intervals between and including lines 200E to 500E, from 500S to 800S (±). Also a 25 metre dipole-dipole array is recommended centred over the anomaly on two of the lines.

F - 1500E at 430S, 1600E at 390S and 430S, 1700E at 420S, 1800E at 290S-420S 1900E at 400S ±40 metres

In the above cases the chargeability rises some 15 millivolts/volt(±) above the 25 millivolts/volt background, while with the exception of line 1700E, the apparent resistivity remains relatively unchanged from the 2000 to 3000 ohm-metre level. This implies the source to be wholly due to disseminated chargeable material either sulphides or perhaps an increase in mafic mineral content within the granites. The explanation to the disseminated sulphide/mafic mineral suggestion is seen on line 1700E. On this line, at 410S, a sharp resistivity low of 400 ohm-metres was recorded as against a background of 4500 ohm-metres(±). This may be due either to some interconnection between chargeable grains, or a less resistive rock type.

The anomaly is best seen on line 1700E at 410S, and should drilling be contemplated withour further work, this is the suggested line.

Conclusions and Recommendations

1 The zone could represent either introduced sulphides, or merely a compositional change. At this stage the response is considered of secondary geophysical interest.

2 As a second priority, pole-dipole or dipole-dipole is suggested on line 1500E and 1700E to further investigate the source.

G - Line 1800E at 510S

A most significant single line induced polarization anomaly of 25 millivolts/volt above background was recorded at 510S. Apparent resistivities of 6000 ohm-metres coincide with this response as against 2500 ohm-metres ($\pm$). The maximum depth to source is estimated at 40 to 50 metres. The decay form is normal.

The source of the chargeability is certainly either disseminated or, alternatively if 'massive', must be electrically discontinuous. The strike length is limited, certainly no greater than 150 metres as there is no significant response on either of the adjacent lines.

Conclusions and Recommendations

1 The form of the anomaly being *resistive* and chargeable is different to that seen on the Federation grid. It suggests a sulphide source which requires geological confirmation as to its possible meaning. The interest in the absence of any corroborative information from local geology or geochemistry is secondary.

2 Should this be of interest, then a small 1 kilometre gradient array is suggested, with lines at 25/33 metre intervals being surveyed between 1700E and 1900E from about 400S to 600S.

H Line 2100E at 300S, Line 2200E at 300S

A significant induced polarization response was defined at 300S on line 2100E. Here, a 15 to 20 millivolts/volt response was recorded from a source whose maximum depth appears to be of the order of 35 to 45 metres, and which dips to the north. A depression in the apparent resistivity to 1700 ohm-metres from 3500 ohm-metres implies a host to the mineralisation which is less resistive (sericite alteration?)

On line 2000E there is no significant induced polarization response, however a 30% drop in the apparent resistivity to 2200 ohm-metres was recorded at 300S. This response (may?) mark the location of a possible alteration zone associated with the anomaly at 300S on 2100E.

To the east on line 2200E at 300S(±25 metres), a broad 10 to 15 millivolts/volt response was recorded from a zone midway between a most resistive section at 330S and a resistivity low of just over 1000 ohm-metres at 270S (The 'background' being perhaps 1700 ohm-metres ±).

Conclusions and Recommendations

1 While a significant response was recorded only on line 2100E at 300S, the zone is *implied* to extend close to line 2200E, and *perhaps* to line 2000E at 300S. A depth to source of 35 to 45 metres is interpreted, while the dip of the source is inferred to be to the north.

2 The zone is recommended for further work as a zone of secondary geophysical interest. As with other anomalies, additional lines at 25/33 metre intervals are recommended for 75 metres± the anomaly centre at 300S between lines 2000E and 2200E.

I Line 2300E at 270N

On line 2300E at 270N a most significant anomaly of 75 millivolts/volt was defined from a distinct resistivity low of less than 600 ohm-metres, some 75% below local background. The source must have a maximum depth of 20 metres. The anomaly occurs on the edge of a slight increase in chargeability to that observed to the south of 150N, and a second distcint resistivity low at 230N. Thus the alteration(?) and mineralisation(?) may be more pervasive than would at first appear to be the case.

No response is seen on line 2200E.

Conclusions and Recommendations

1 As there are alluvial workings in the area it is assumed that the geological significance of this sub-alluvial anomaly must be known. From a geophysical point of view it is considered of primary interest. The anomaly is open to the east but is not seen 100 metres to the west.

2 If of geological interest, 25/33 metre gradient lines are again the recommended follow-up method.

Other Anomalies of Possible Interest

Some four other zones may be of interest. These are essentially small single line responses which must lie on, or at least within, some 40 metres of the survey line. In summary their location and characteristics are as follows:

Location	Anomaly/ Background	Relative Resistivity	Maximum Depth	Priority
200E/410S	15/20 mv/v	no change	40 metres	secondary
900E/860N	10/15 mv/v	resistive	35 metres	tertiary
1300E/710S	15/25 mv/v	lower	40 metres	tertiary
1700E/1010N	10/17 mv/v	lower	50 metres	tertiary

Conclusions and Recommendations

Should any of the above either coincide with anomalous geochemistry, or lie along the strike thereof, it is recommended that mini-gradient arrays be set up to investigate strike continuity.

Respectfully submitted on behalf of:

SCINTREX PTY. LTD.

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

GEOPHYSICIST

APPENDIX

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

INTRODUCTION

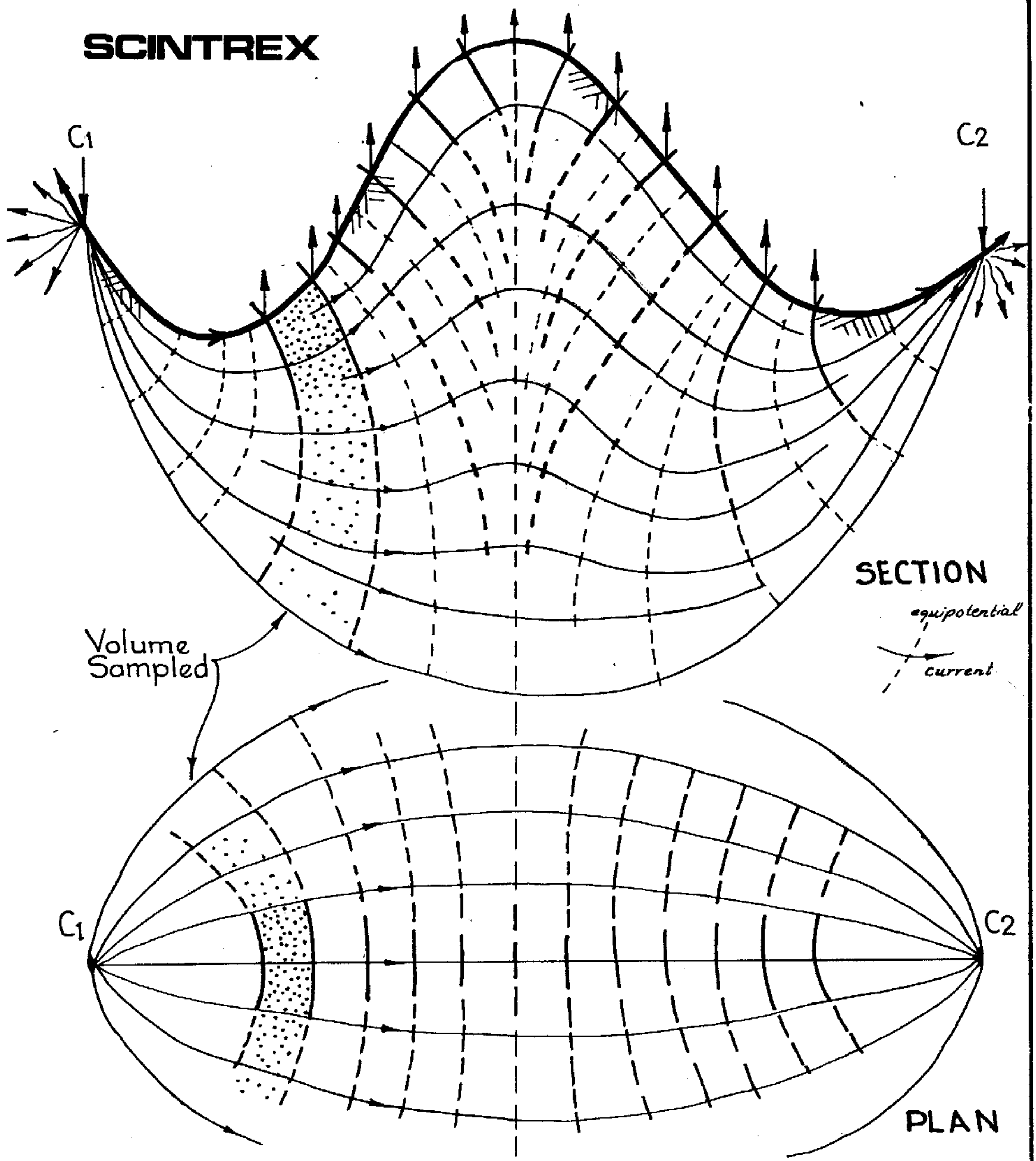
In the case of the surveys discussed in this report, it is important that the geologist can relate the geophysical data to the underlying geology if he is to make the best use of this data. It is the author's opinion that *only* the geologist will be able to relate the data to geology. For this reason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

975019



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

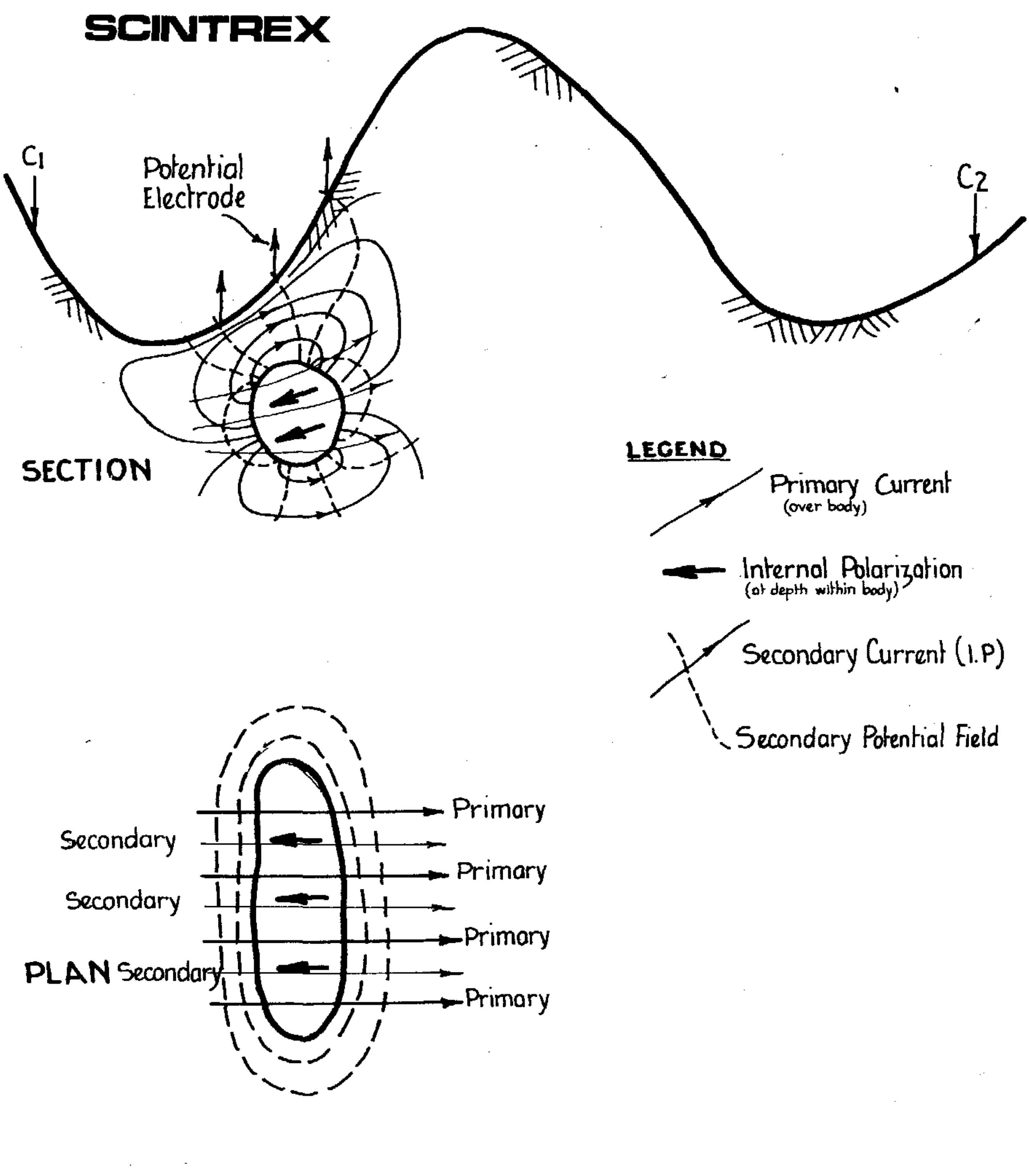
FIGURE 1.

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

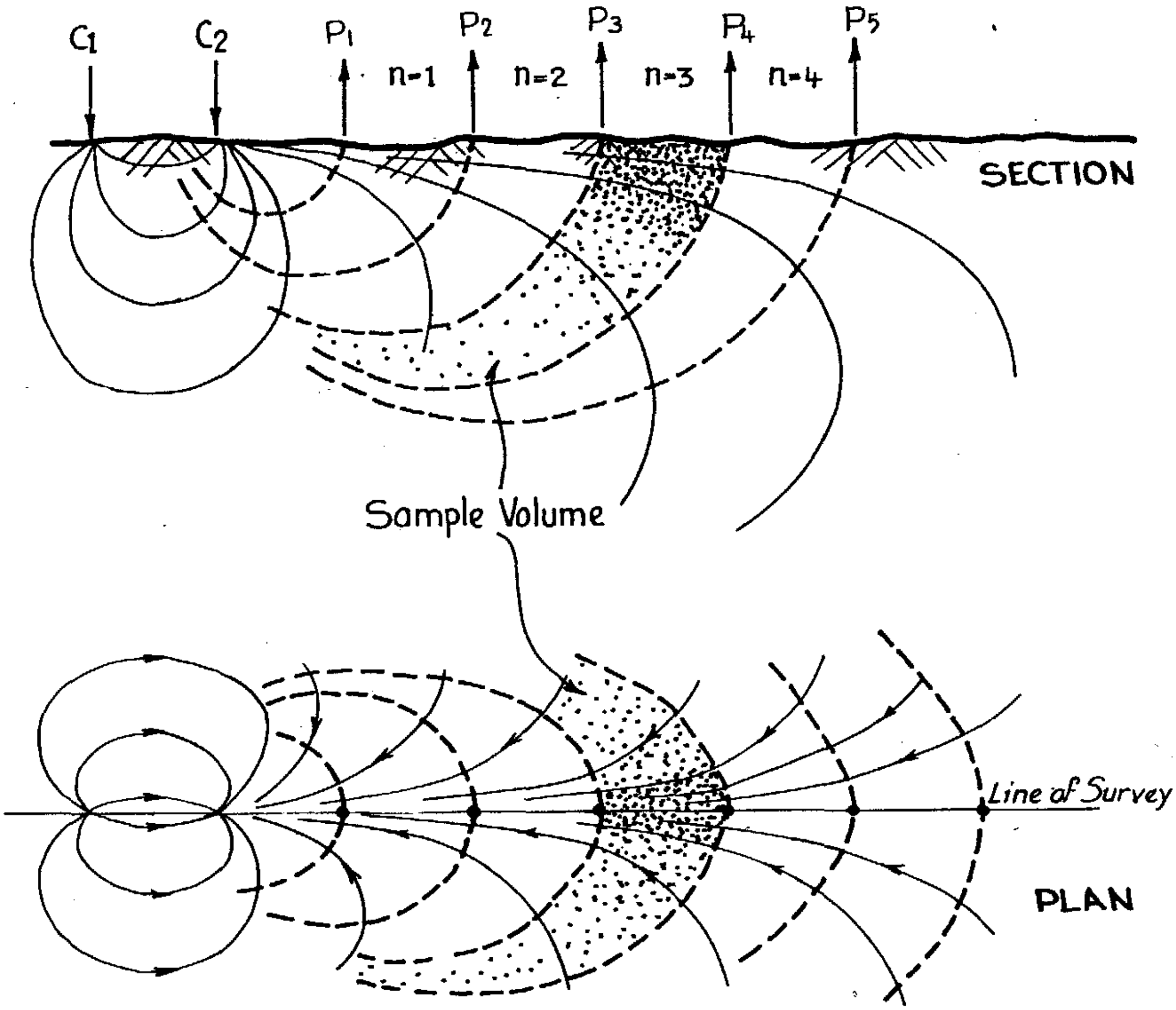
Dipole-Dipole:- In this array the current dipole is generally small, generally 20 to 100 metres. Figure 3 displays the current pattern in section and in plan for a dipole-dipole array. The equipotential P_1 and P_2 tap a volume as shown in this diagram whose characteristics are read on the $n = 1$ station 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



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

FIGURE 2.

SCINTREX



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

FIGURE 3

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

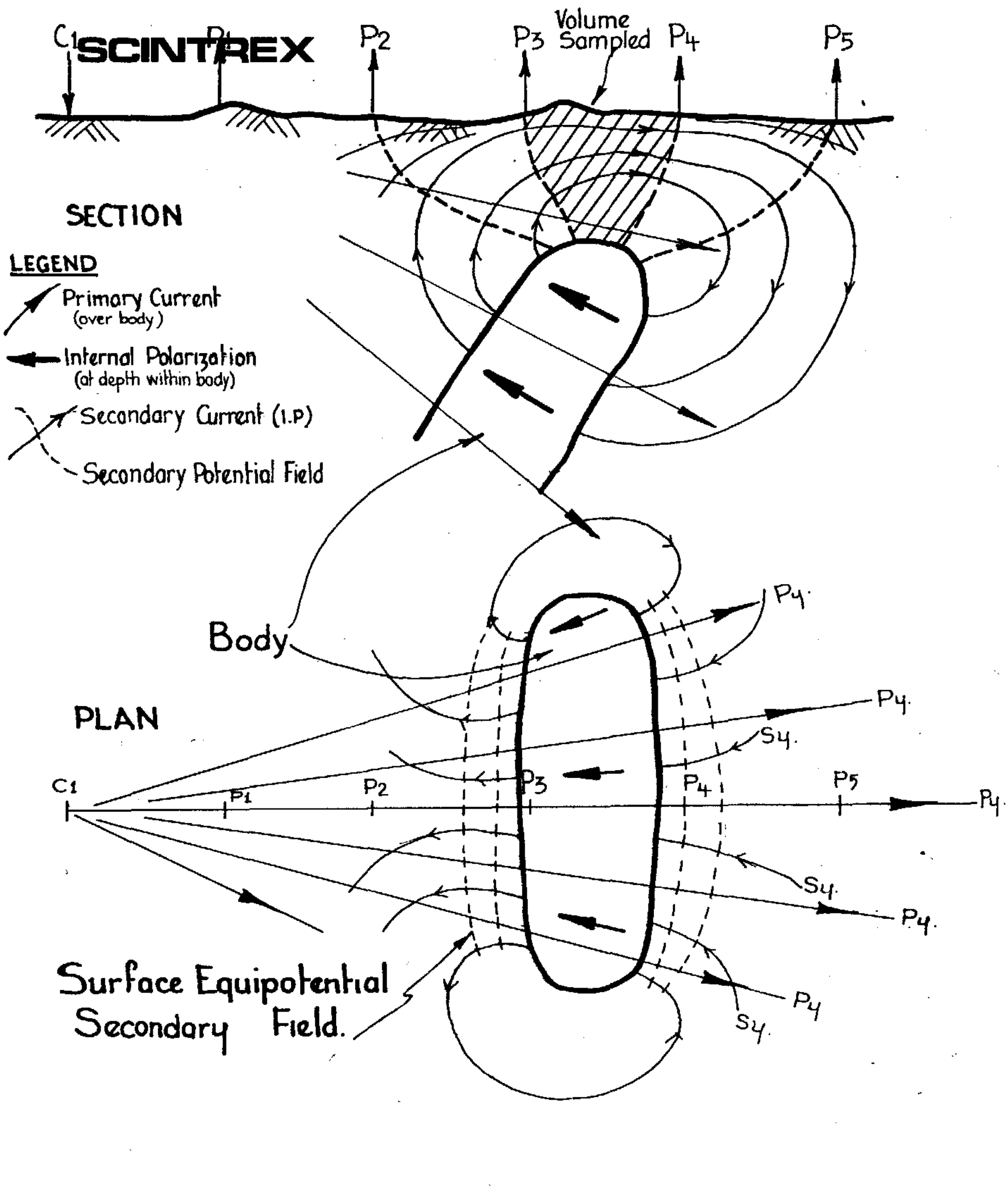
A further characteristic of the array is that where the effective spacing ($n \times a$) is greater than the depth to the source, a 'high' (or 'low', depending on characteristics) will occur as each of the dipoles (i.e. transmitting C_1 and C_2 and potential P_1 and P_2) pass over the source of that 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 necesssarily 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 theyrepresent 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 dpoles, 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).

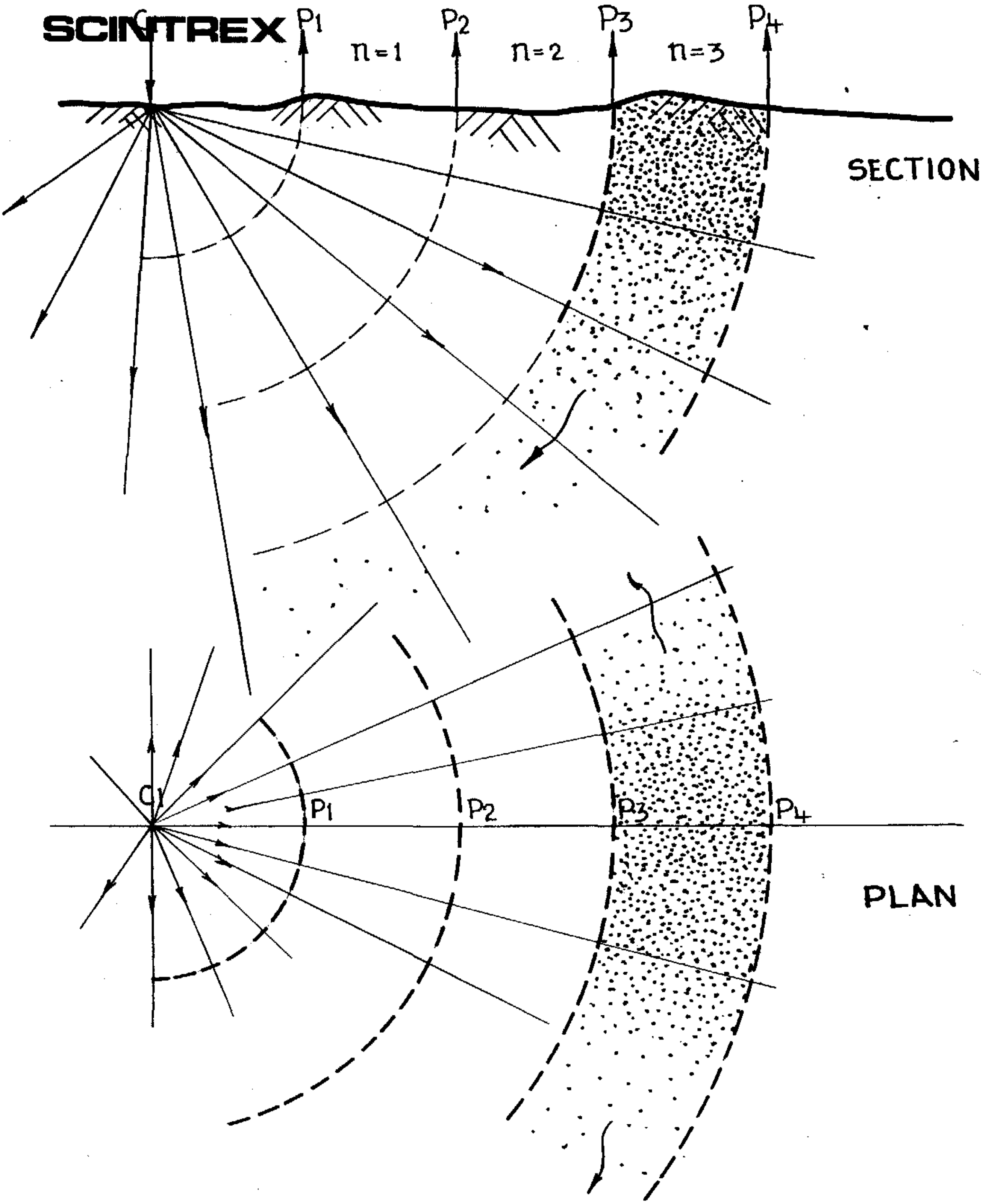
As with the dipole-dipole array, a double peak will result when $n \times a$ is greater than the depth to source, however, with pole-dipole it will be asymmetric. This will be true for both major resistivity features as well as for chargeability features. An example of this asymmetry for different depth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



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.



Current Path and Primary Equipotential Field from Pole-Dipole Array

FIGURE 5

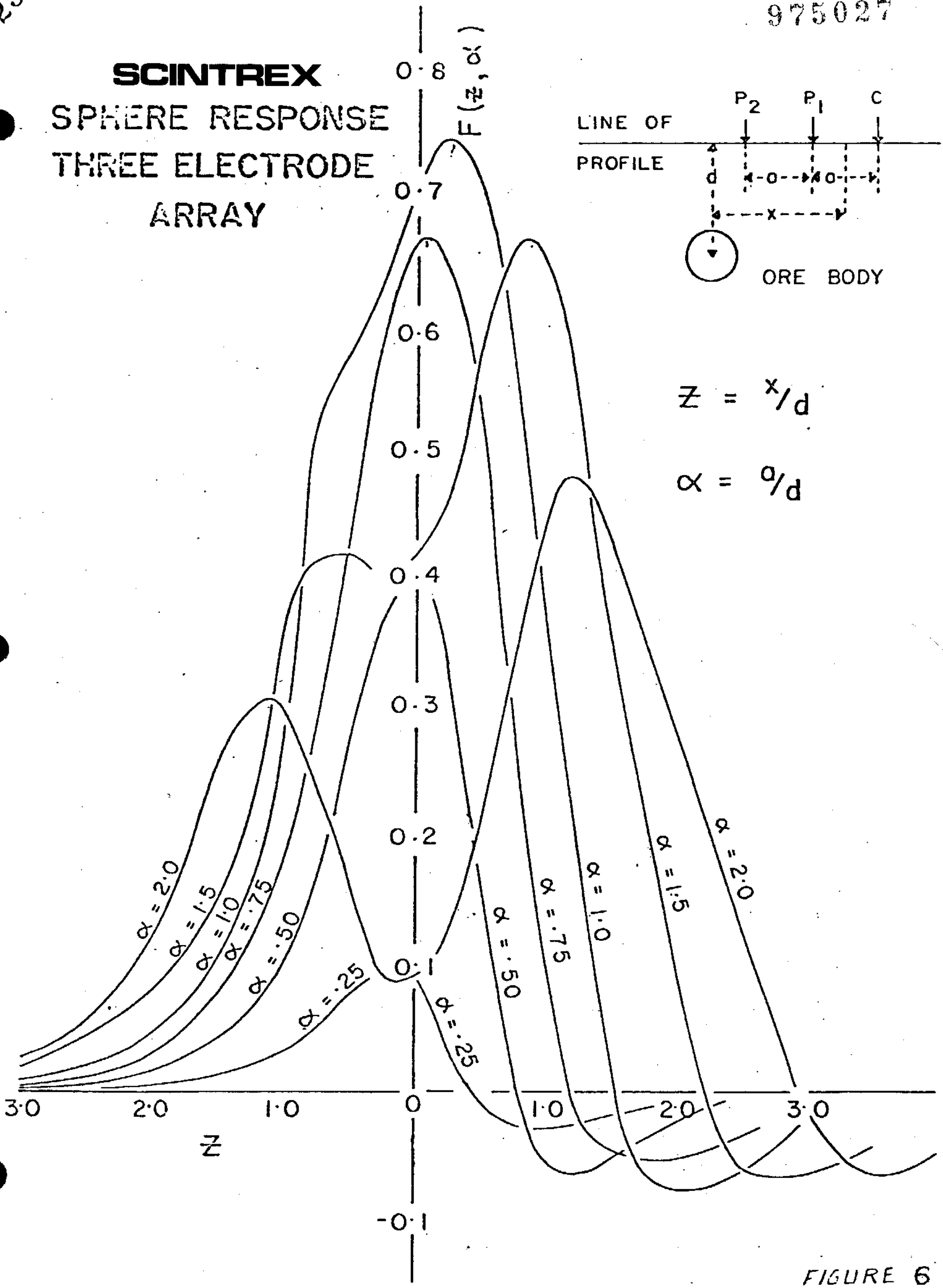

SCINTREX
SPHERE RESPONSE
THREE ELECTRODE
ARRAY
F(Z, α)
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
-0·1
LINE OF
PROFILE
P2
P1
C
d
a
a
x
ORE BODY
Z = x/d
α = a/d
α = 2·0
α = 1·5
α = 1·0
α = ·75
α = ·50
α = ·25
α = ·25
α = ·50
α = ·75
α = 1·0
α = 1·5
α = 2·0
3·0
2·0
1·0
0
1·0
2·0
3·0
Z

FIGURE 6

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 muliptle 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 reponse 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 ΔMn where

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

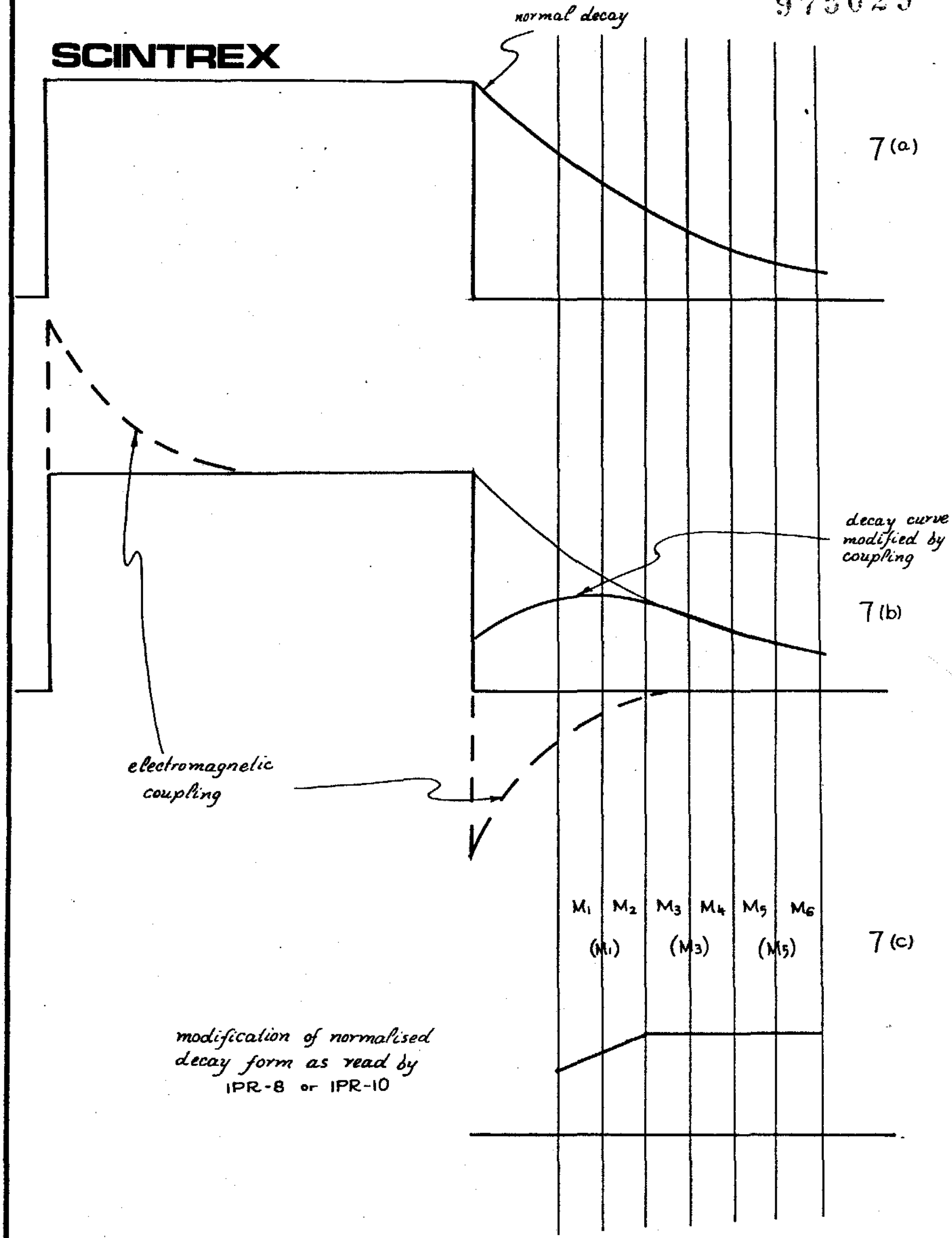
which is essentially ΔM normalised for the amplitude of the decay. ΔM and ΔMn are merely short hand ways to profile changes in decay form and are essentially qualitative and relative.

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

027

975029

SCINTREX



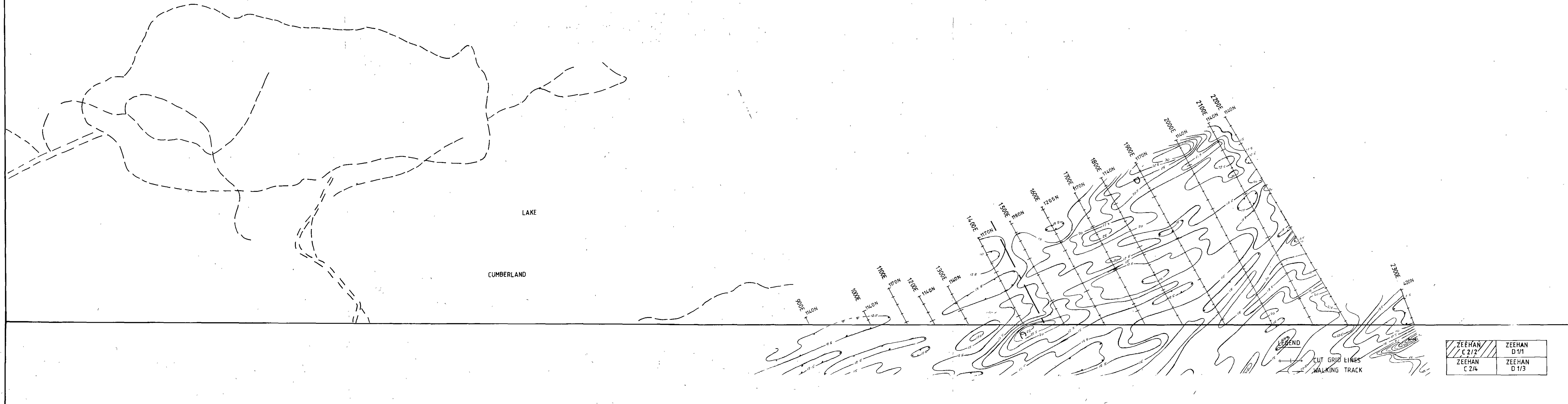
EFFECTS OF ELECTROMAGNETIC COUPLING ON IPR-8 / 10

Fig. 7

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, AMAusIMM, FGS.



3146

975001

RENISON LIMITED

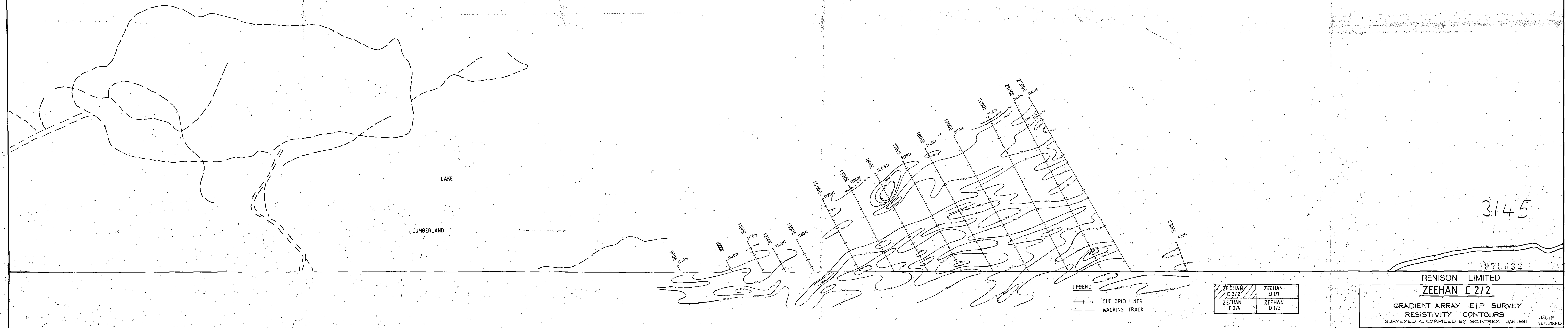
ZEEHAN C 2/2

GRADIENT ARRAY EIP SURVEY
CHARGEABILITY CONTOURS
SURVEYED & COMPILED BY SCINTREX JAN 1981

Job No TAS-081-D

GEOLOGIST	SCALE 1:5000 METRES (0, 100, 200, 300)
DRAUGHTSMAN	
DATE	
REVISIONS (5 cm)	DRAWING No 3146

81-1550



LEGEND

- CUT GRID LINES
- WALKING TRACK

ZEEHAN C 2/2	ZEEHAN D 1/1
ZEEHAN C 2/4	ZEEHAN D 1/3

3145

975032

RENISON LIMITED

ZEEHAN C 2/2

GRADIENT ARRAY E I P SURVEY
RESISTIVITY CONTOURS

SURVEYED & COMPILED BY SCINTREX JAN 1981

Job No TAS-081-D

GEOLOGIST	SCALE 1:5000 METRES (0, 100, 200, 300)
DRAUGHTSMAN	
DATE	
REVISIONS (5 cm)	DRAWING No

81-1550 3145

5 cm

975033

LEGEND

- CUT GRID LINES
- WALKING TRACK

ZEEHAN C 2/2	ZEEHAN D 1/1
ZEEHAN C 2/4	ZEEHAN D1/3

RENISON LIMITED	
ZEEHAN C 2/4	
GRADIENT ARRAY EIP SURVEY CHARGEABILITY CONTOURS SURVEYED & COMPILED BY SCINTREX JAN 1981	Job Nº TAS 081-D
GEOLOGIST	SCALE 1:5,000 METRES
DRAUGHTSMAN	0 100 200 300
DATE	
REVISIONS 3143	DRAWING No

81-1550

3147

81-1550

5 cm

975034

LEGEND

CUT GRID LINES
WALKING TRACK

ZEEHAN C 2/2	ZEEHAN D 1/1
ZEEHAN C 2/4	ZEEHAN D 1/3

RENISON LIMITED

ZEEHAN C 2/4

GRADIENT ARRAY EIP SURVEY
RESISTIVITY CONTOURS

SURVEYED & COMPILED BY SCINTREX JAN 1981

Job No TAS-081-D

GEOLOGIST
DRAUGHTSMAN
DATE
REVISIONS

SCALE 1:5,000 METRES
0 100 200 300

DRAWING No 3147

81-1550.