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A BRIEF REPORT ON A
GRADIENT ARRAY INDUCED POLARIZATION TEST SURVEY
OVER THE ANCHOR MINE
NEAR ST. HELENS, N.E. TASMANIA
ON BEHALF OF
RENISON LIMITED

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OVER THE ANCHOR MINE
NEAR ST. HELENS, N.E. TASMANIA
ON BEHALF OF
RENISON LIMITED

BY

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SYDNEY, N.S.W.

FEBRUARY, 1978
(REVISED)
TAS-053

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ANCHOR MINE, NR, ST HELENS, TASMANIA.



SCINTREX PTY. LTD.

GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

A gradient array test survey over the Anchor Mine, near St. Helens, north-eastern Tasmania, indicated extremely low background chargeabilities of 2($\pm$) milliseconds. The gradient array when surveyed close to the electrodes, acts as an electrical sounding. This data clearly infers the greisen to be chargeable with respect to the enclosing granites (10 milliseconds versus 2 ($\pm$) milliseconds).

Low background resistivities which lie in the range 200 to 500 ohm-metres were recorded from the granites. This compares with average granite resistivities of the order of 5000 ohm-metres. It is suggested that kaolinisation may be more widespread than recognised, and also that the granite is more porous than normal.

The horizontal bodies would not be readily detected by the gradient array, therefore Schlumberger electrical soundings are recommended as a further test, and if successful, as the preferred exploration technique.

"At hole" down hole tests are also recommended, and again, if they successfully show the sulphides associated with the cassiterite as a significant above background response, a down hole exploration technique is recommended using a large (to 100 metres) three electrode array system.

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INTRODUCTION

At the request of Mr. K. Wells, Senior Exploration Geologist for Renison Limited, Scintrex Pty. Ltd. executed three gradient array electrical induced polarization traverses in the Anchor Mine area, near St. Helens, north-eastern Tasmania.

The field work was executed by Scintrex Party Leader, Mr. R. Bennett on one and a half production days between 29th and 30th November, 1977. The positioning of the lines together with the general supervision of the survey, was undertaken by Renison Exploration Geologist Mr. A. Ross, while the author provided such geophysical supervision as was necessary.

The object of the test was to ascertain whether the known cassiterite zones could be identified by observing the chargeability from the disseminated sulphides which are found associated with the cassiterite.

BACKGROUND

The author is indebted for the provision of an International Mining Corporation N.L. report dated 30th June 1970 by E. Krajnc of E.A. Webb & Associates, and a comprehensive article from the Institute of Mining and Metallurgy (London) Vol. 82, B135-146, 1973 by Groves and Taylor.

Work carried out by Renison clearly indicates that in general, trace amounts of sulphides, including chalcopyrite, bornite/chalcocite, molybdenite and pyrite occur within the cassiterite bearing greisen. However, two distinct stages of mineral emplacement are recognised, namely:-

Stage 1 Introduction of cassiterite

Stage 2 Introduction of sulphides

The recognition of two emplacement stages is of great significance with respect to induced polarization signature, for, although cassiterite can give an induced polarization response, the quantity and grain size thereof is generally such as to give only a minimal response. This means that sulphides occurring within the greisen (or even within the granite as in the Sweeney's Mine deposit) may not necessarily carry associated cassiterite.

One further point worth commenting on is that should the mineralisation be derived from the crystallisation process, i.e. from the residual

hydrothermal fluids, this would infer that the granite mass would be expected to be *poor in mafic minerals*, while rocks derived from the residual hydrothermal fluids would be *relatively richer in mafic minerals*. This has important geophysical implications, because the chargeability (IP effect) of a rock unit is related to mafic mineral content. Thus granites which have undergone fractionation during crystallisation would be expected to have *abnormally low chargeability backgrounds*, and the result of the actions of the residual hydrothermal fluids would be expected to increase the chargeability. (In this respect it is worth noting that the unaltered Sweeney's Mine granite has *abnormally low chargeability*). Should this be general, then it follows that *because the backgrounds are low the contrast between them and the mineralisation, even though the latter be of low percentage volume, would be greater than normal, and thus make this type of deposit easier to locate than the absolute sulphide content itself would infer.*

DISCUSSION OF RESULTS

The horizontal nature of the greisen mentioned in the Groves/Taylor article would in fact not be the ideal configuration to be readily detected by a gradient array in an exploration programme. In such a case, soundings or pole-dipole would be superior.

Each line is discussed below.

LINE 1 Current electrodes were placed at 00 and at 500W,

and a potential dipole of 20 metres was read to within 20 metres of each electrode. Thus the centre section between 100W and 400W can be considered to be a "true gradient array", while the sections between 00 and 100W, and between 400W and 500W can be considered pole-dipole soundings.

The gradient section:- The resistivity data shows a dramatic change in resistivity at about 160W with lower 200 ohm-metres resistivities to the east and higher (500 ohm-metres+) to the west. The cause of this sharp change is not evident from the geological maps and sections provides as the geology marked thereon does not extend sufficiently far east to cover this section.

The background chargeabilities are an abnormally low 2 to 3 milliseconds and super-imposed thereon are a number of twice background chargeability responses at about 130W, 175W, 275W and 310W. The maximum depth to source is estimated in all cases to be between 20 and 30 metres.

The western sounding:- The pole-dipole sounding executed as the western electrode was approached at 500W, shows the electrode to have been emplaced in or in very close proximity to material which is both *resistive* and some six times as chargeable as the background within granite.

The eastern sounding:- The pole-dipole soundings carried out

towards the electrode emplaced at 00, shows *low resistivities* to be present at, or in very close proximity to the electrode, together with chargeabilities some 4 times background. "Recent" alluvium could be the cause of the observed phenomenon.

LINE 2 A 1000 metre array was set-up and surveyed from the current electrode at 00 to 800S. The section between 00 and 075S can be regarded as a sounding, while between 075S and 800S can be regarded as a true gradient array.

The gradient array:- The observed backgrounds are again an extremely low 2 to 3 milliseconds while resistivities range about the 250 ohm-metres mark. Numerous small chargeability highs to twice and three times background give maximum depths of 20 to 25 metres and possibly relate to changes in composition of the overlying granites.

The sounding:- As current electrode at 00 was approached, a significant increase in resistivity was noted at 025S, which infers a chargeable source at about this point and at a depth of 10 metres or so. This would put it within the coarse grained porphyritic granite.

LINE 3 A 1000 metre gradient array was laid out between 00 and 1000S and read with a 20 metre potential dipole between 275S and 525S. (The position of DDH-30 on the data profile is at 275S, whereas it is at 00 on the geological section provided.)

The observed background chargeability is an extremely low 2 milliseconds, with a distinct high at 110 metres south of DDH-30 (410S on data profile, 110 metres on geologic section). This high is about $2\frac{1}{2}$ times local background and reaches 6 milliseconds. The maximum depth to source at this point is less than 20 metres.

CONCLUSIONS

- carefully provided beforehand?*
1. After studying the reports kindly provided by Renison Limited, it is concluded that as the lodes are essentially horizontal, electrical induced polarization soundings, which are more sensitive to horizontal layered changes, would have been a far superior method to investigate the distribution of these horizontally layered systems.

For exploration purposes either soundings or multi-spaced dipole-dipole, pole-dipole or three-array soundings could be used.

2. The data shows the granite units to have extremely low chargeabilities of 2 milliseconds (+). In this, they are similar to the Sweeney's Mine granite. This is particularly significant as the large effective penetration afforded by the large current dipoles (500 to 1000 metres) employed would have "bulk sampled" the granites to substantial (hundreds of metres) depths. This means that the chargeability of the granites, even *below* the greisen, is of low chargeability.

3. The apparent resistivities recorded were also abnormally low, ranging between 200 and 500 ohm-metres in the gradient array sections of all lines. This shows that the bulk resistivity is low, not just the surface layer. Thus this granite is only 2% to 5% of the resistivity of the Sweeney's granite. Kaolinisation may, at depth, be more widespread than noted to date, and would account for the lower resistivities encountered.

It is also possible that the lower resistivities may in part be accounted for by a "looser crystal matrix" within the granite, and therefore a more porous rock. It is certainly the author's impression that the Sweeney's granite is more "massive" and "tight" than the Anchor granites are.

4. From the "sounding" sections of line 1, it is inferred that the cassiterite zone is in fact chargeable. However, as mentioned in (1) above, the gradient array will not effectively investigate horizontally layered bodies such as those over Anchor Mine.
5. It is concluded that low sulphides present within the host granite *should be* detectable given the very low granite backgrounds. It is therefore recommended that:-
- a) Down hole three-array IP and resistivity logs be done through the ore zone and enclosing granites.

- b) Electrical soundings be carried out to investigate the *vertical* layering of the system.
6. Should the sulphide zones show up as the low backgrounds within the granites as suggested, and the results to date infer; two distinct exploration techniques present themselves.
- a) for exploration for essentially horizontal bodies, Schlumberger electrical soundings for *chargeability* should be carried out on a systematic basis over areas of interest. In the circumstances encountered at the Anchor Mine, the spacings of the soundings need only go out to about $1\frac{1}{2}$ times the depth to which you require information, i.e. if a depth penetration of 100 metres is required, then soundings should have electrode separations to $a = 150$ metres ($AB = 300$ metres).

An alternative method would be surface three-array, dipole-dipole or pole-dipole traversing which is a "mobile" sounding system. However, these methods would be slower (and therefore more expensive) and not as precise or diagnostic as electrical soundings.

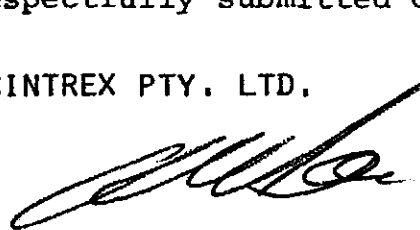
- b) Due to the very low background chargeabilities within the host granites, exploration *around* deep diamond drill holes using large three-array down hole tools would make it possible to extend the influence of the drill holes out to

a distance "a" from the hole, down to a distance "a" from the bottom of the hole. For example, in a 300 metre hole a distance of 100 metres can be investigated around the hole to a depth of about 200 metres, or 50 metres around the hole to a depth of 250 metres.

I look forward to discussing this survey with you in the near future.

Respectfully submitted on behalf of:

SCINTREX PTY. LTD.

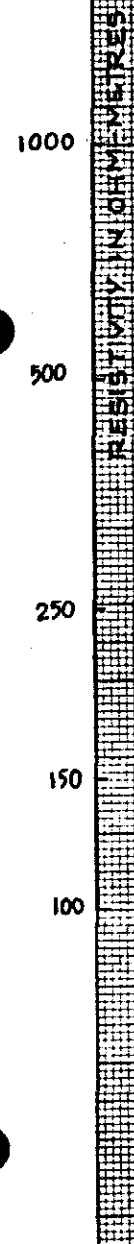


A.W. HOWLAND-ROSE, MSc, DIC, AMASuIMM, FGS.

GEOPHYSICIST

Anchor Mine Gradient Array EIP

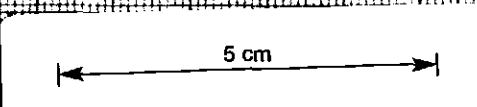
1A6-Q58



Sounding

Gradient Array

Sounding



013

270015

LINE 2

Anchor Mine
Gradient Array EIP

TAS-053

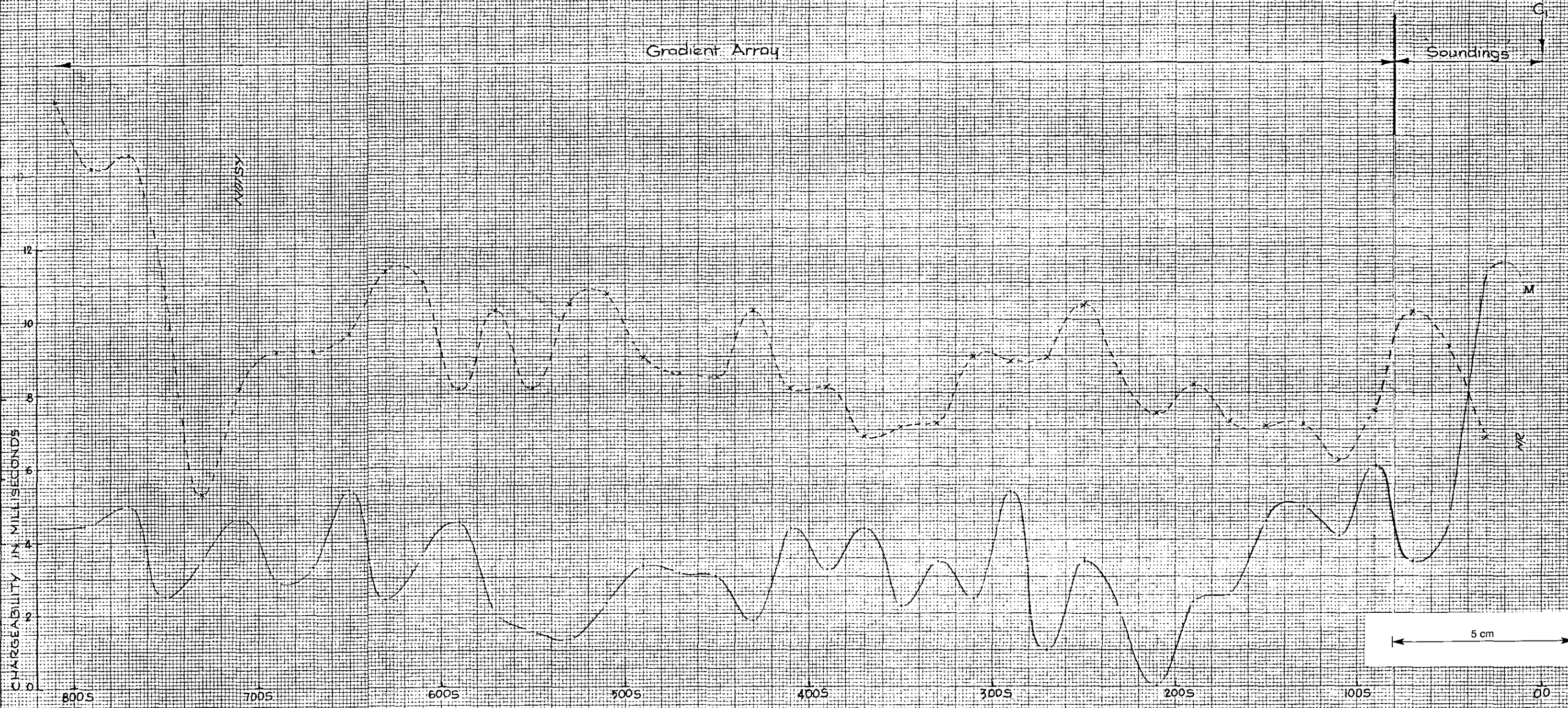
KEITH & ESSEX CO. MODEL R 2 A
10 X 10 TO THE CENTIMETER 25 X 30 CM

Gradient Array

Soundings

RESISTIVITY IN OHM-METRES

CHARGEABILITY IN MILLISECONDS



014

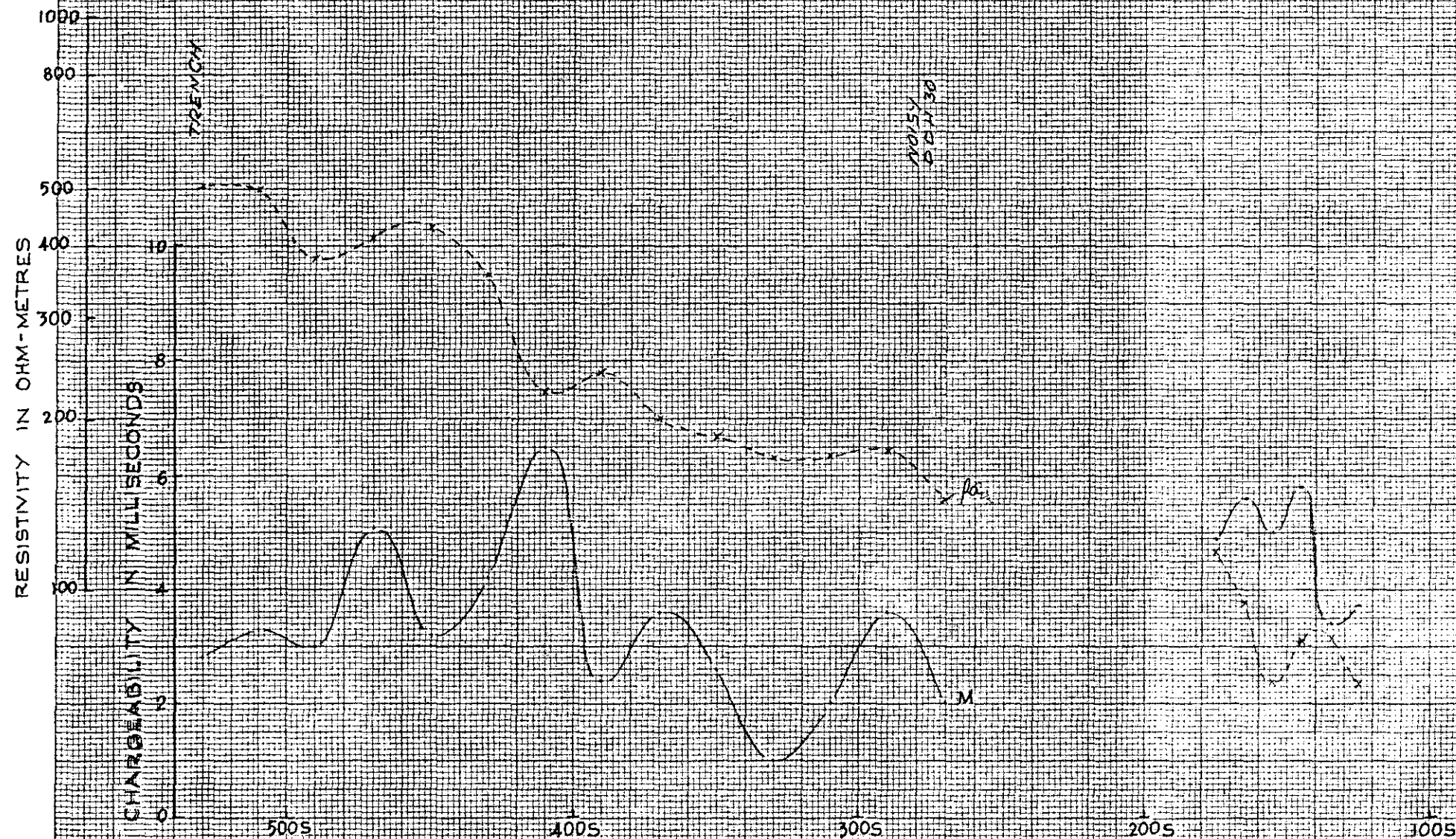
270016 LINE 3

Anchor Mine
Gradient Array EIP

TAS-053

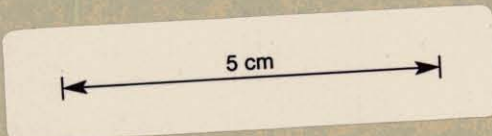
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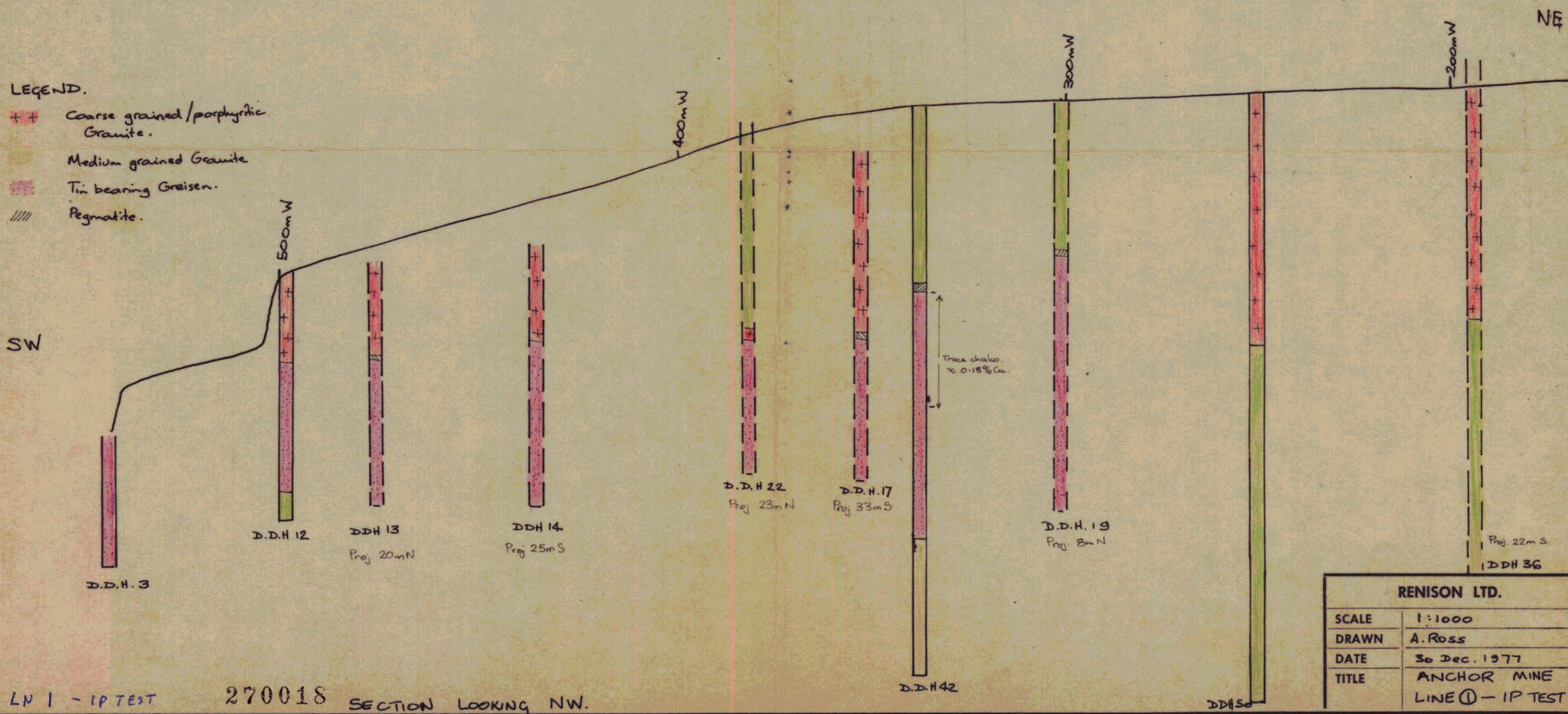
5 cm





LEGEND.

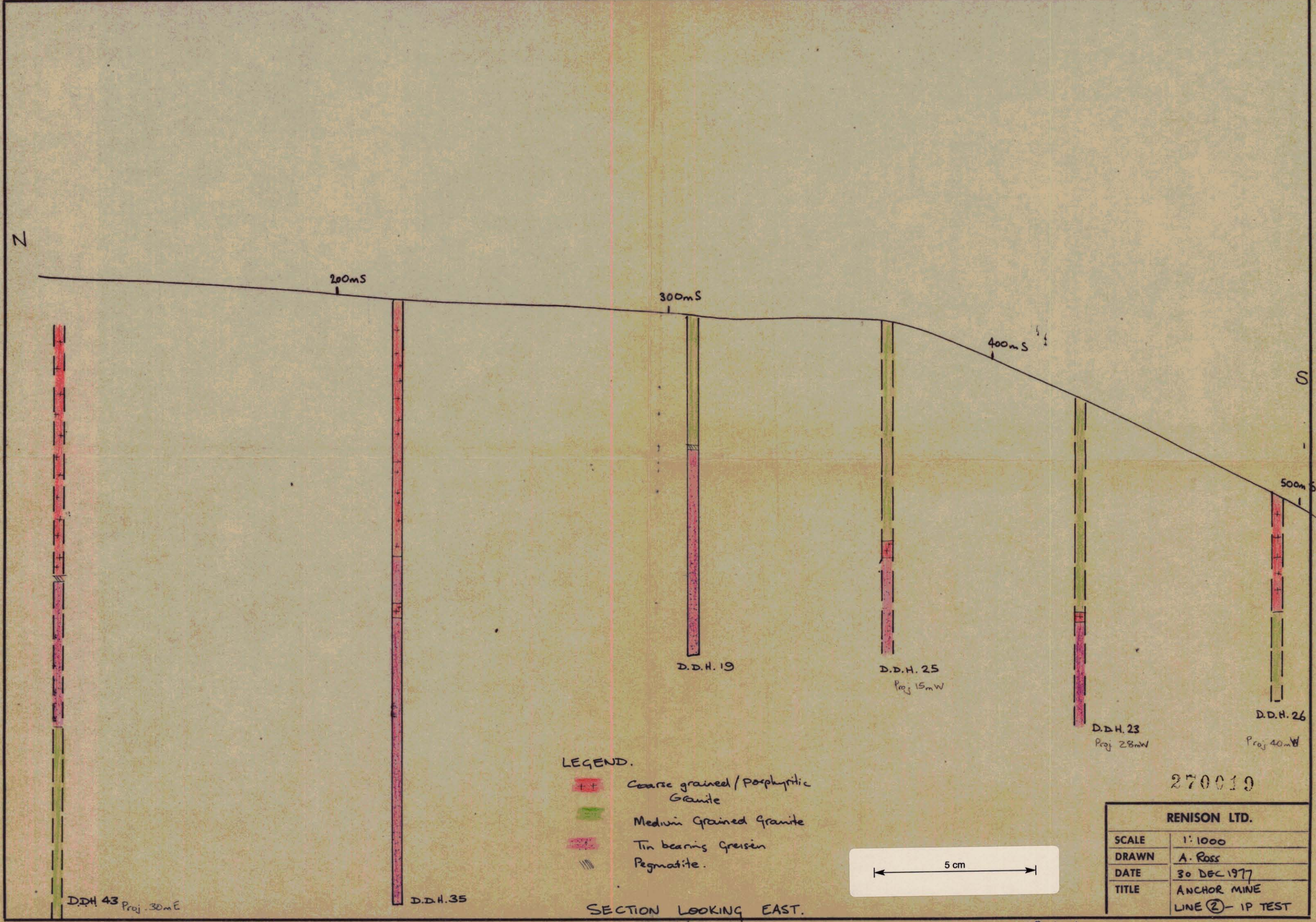
- ++ Coarse grained / porphyritic Granite.
- Medium grained Granite
- /// Tin bearing Greisen.
- //// Pegmatite.



RENISON LTD.	
SCALE	1:1000
DRAWN	A. Ross
DATE	30 Dec. 1977
TITLE	ANCHOR MINE LINE ① - IP TEST

LN 1 - IP TEST 270018 SECTION LOOKING NW.

015



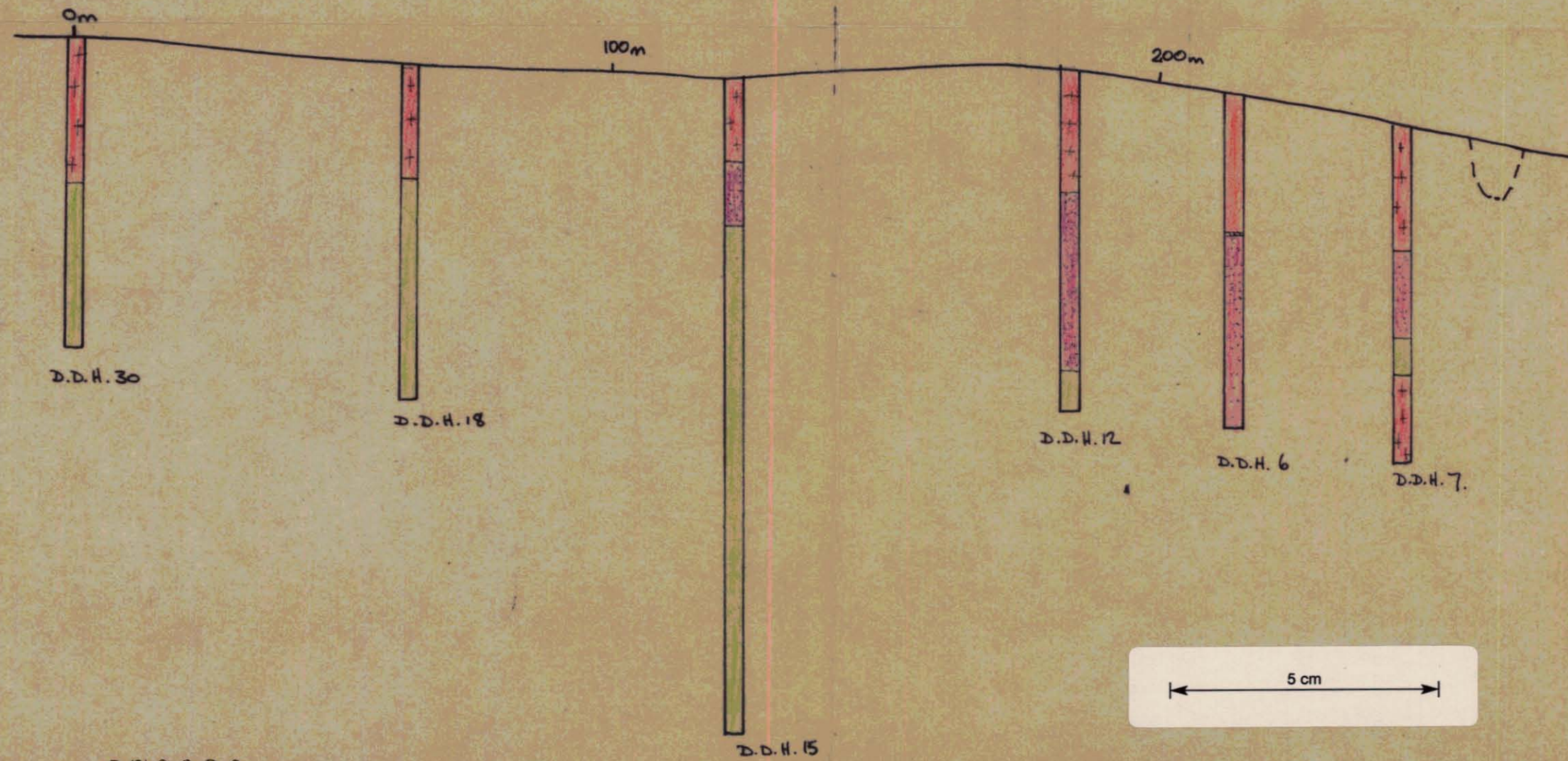
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RENISON LTD.	
SCALE	1:1000
DRAWN	A. Ross
DATE	30 DEC 1977
TITLE	ANCHOR MINE LINE ② - IP TEST

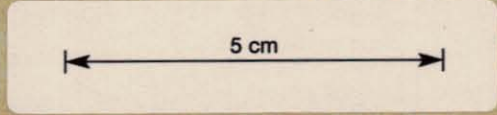
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- LEGEND.
- Coarse Grained/Porphyritic Granite
 - Medium Grained Granite
 - Tin Bearing Greisen
 - Pegmatite.



LN3-IP TEST 270020

SECTION LOOKING EAST

RENISON LTD.	
SCALE	1:1000
DRAWN	A. ROSS
DATE	30 DEC 1977
TITLE	ANCHOR MINE LINE ③ - IP TEST.

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COMMENTS ON
DOWN HOLE EIP AND RESISTIVITY 'AT HOLE' LOGS
ANCHOR MINE, NR. ST. HELENS, TASMANIA
ON BEHALF OF
RENISON LIMITED

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PRIVATE AND CONFIDENTIAL

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DOWN HOLE EIP AND RESISTIVITY 'AT HOLE' LOGS
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NOVEMBER, 1978
TAS-061

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Drawings Nos BT 301, 302, 303.

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GEOPHYSICAL CONSULTANTS AND CONTRACTORS

SUMMARY

Down hole three-array logs in holes BT-42, BT-44, BT-46 and BT-50 have yielded a variety of characteristics in each of the units required to be determined. It is suggested that perhaps the logs have had too high a resolution for small volumes and that the bulk characteristics measured by a large sampling method, such as soundings, over known geological conditions would give better, and more characteristic results.

A possible method of DIRECT detection rests on the observation in BT-44 between 27 and 34 metres that the mineralisation was both highly resistive at 30,000 ohm-metres and highly chargeable. Non-mineralised greisen was generally of lower resistivity and of low chargeability background.

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COMMENTS ON
DOWN HOLE EIP AND RESISTIVITY 'AT HOLE' LOGS
ANCHOR MINE, NR. ST. HELENS, TASMANIA
ON BEHALF OF
RENISON LIMITED

INTRODUCTION

Scintrex operator, Mr. R. Sims, assisted by Renison Limited Project Geologist, Mr. A. Ross, logged holes in the Anchor Mine area. These surveys were carried out at the request of Mr. L.A. Newnham Chief Geologist for Renison Limited, on 8th and 9th September, 1978.

The primary objective of these surveys was to determine the electrical characteristics of the granites and the associated mineralisation, while a secondary objective was to train Renison Limited personnel in the use of the logging equipment.

EQUIPMENT

The equipment consisted of a Scintrex IPC7-25W time domain transmitter and a Scintrex IPR-8 time domain induced polarization receiver.

METHOD

General Comments:- A brief description of the method, equipment and meaning of the data is set down below. In summary, small electrode spacings give the bulk characteristics of the rocks in the immediate vicinity of the drill hole. This is far superior to analysing small samples of drill core on two major grounds: i) such core is an

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extremely small sample and may or may not be characteristic of the rock unit (or mineralisation) and ii) small samples are extremely difficult to measure in the laboratory with the *original pore fluid* emplaced. *(The chance of acquiring characteristic data from core once dessication has taken place are remote, particularly within "tight" rocks.)*

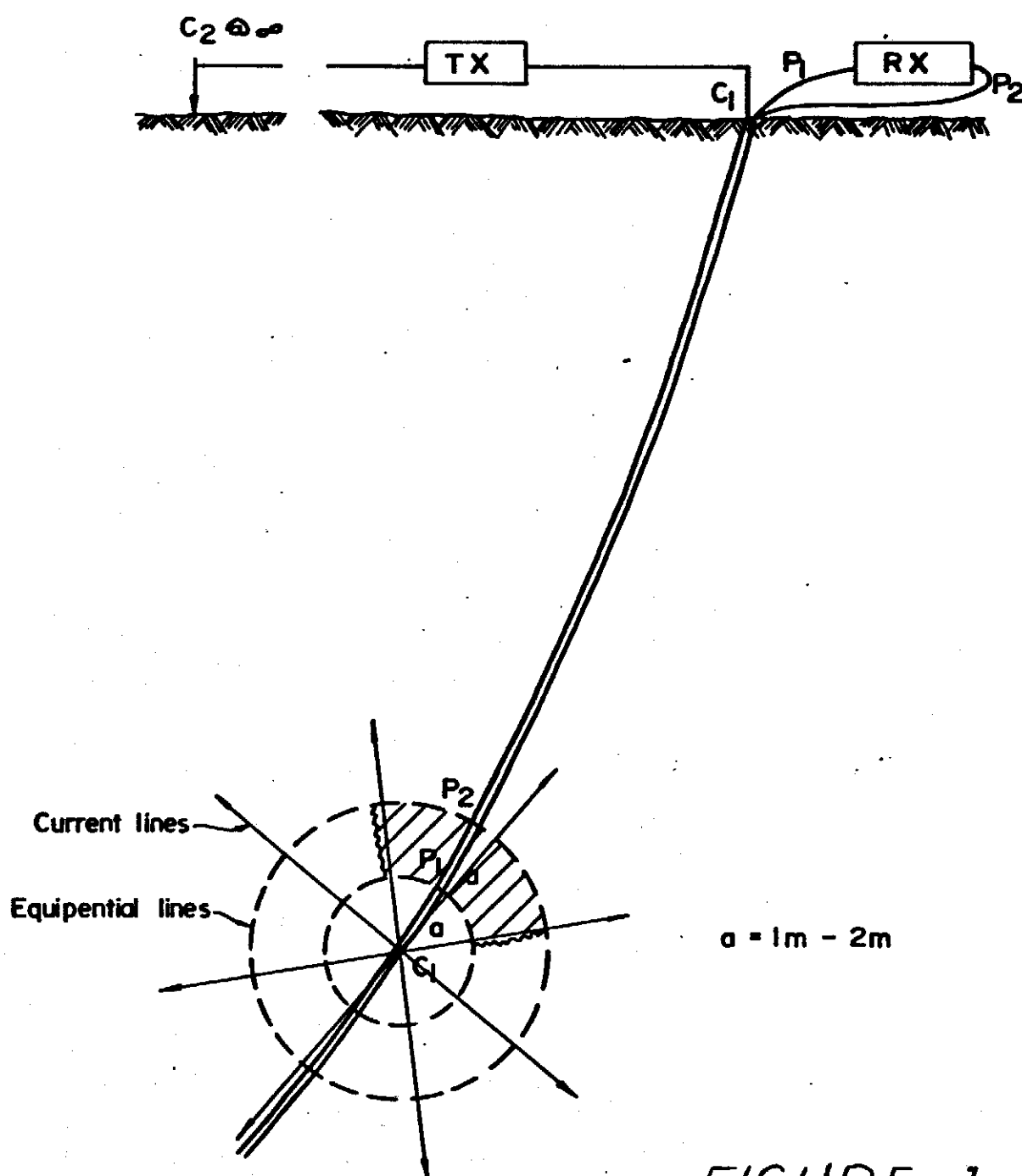
Comments on the Method:- The objective of the down hole surveys under discussion was to ascertain the properties of the rocks 'at hole' where they can be correlated to the core intersected. For such surveys a three-array log having a small *a* spacing, less than $2\frac{1}{2}$ metres, is usually employed. In this case 1 metre and 2 metres were used. The current from electrode C_1 moves to C_2 at infinity in three dimensions as shown in Figure 1. A series of equipotentials having spherical surfaces whose centre is the electrode C_1 , will be formed about the hole. The two potential electrodes at P_1 and P_2 will 'tap' a volume between the two spheres passing through P_1 and P_2 . This can be regarded as a measurement of the physical properties of chargeability and resistivity around a cylinder having a radius of about '*a*' around the hole, and a length of '*a*' down the hole. This samples from 40 to 80 tons of rock for a $2\frac{1}{2}$ metre *a* spacing.

It is important that the current densities be kept low, preferably of the same order as those used on the surface surveys. As the rock resistivity *increases*, the current density must be *decreased*. It is important to keep the current low. Either small battery operated 25 watt transmitters are used, or if larger units are used, suitable modifications are made to enable the transmission of low current.

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EQUIPOTENTIAL DIAGRAM

DOWN HOLE THREE ARRAY LOGGER

**FIGURE 1**

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This problem can be best envisaged as 'turbulence' as when water is forced to flow down a stream at a rate above the steady flow rate where no turbulence occurs.

Down hole decay form information has been found to be most helpful in distinguishing chargeable materials. Generally *grain size* is the most predominant influence within a mineral assemblage - coarser grained mineral assemblages decay more slowly than average, while finer grained sources decay more rapidly. Magnetite of an equal grain size to sulphides will decay *more rapidly*, magnetite being a less efficient holder of charge. Similarly low chargeability backgrounds in certain acid volcanic rocks are often accompanied by rapid decay forms.

Fine grained mineralisation absorbs the charge *rapidly*, and once the passage of the energising current is stopped, the stored charge is *rapidly* discharged. If the mineralisation is *effectively* coarse grained (i.e. either coarse grained as such, or agglomerates of finer grain), the charging and consequent discharging will be much *slower*. Only with MIP or in small spaced EIP down-hole logs is the actual decay *within* the source monitored, therefore major differences in decay form can be observed. However, in EIP these differences in decay form can also be observed when the body is 'shallow'. However, with MIP the origin of the decay is *INTERNAL*, while with EIP it is *EXTERNAL*, and the latter is subject to change by the environment.

While the above comments refer to 'mineralisation' they are also

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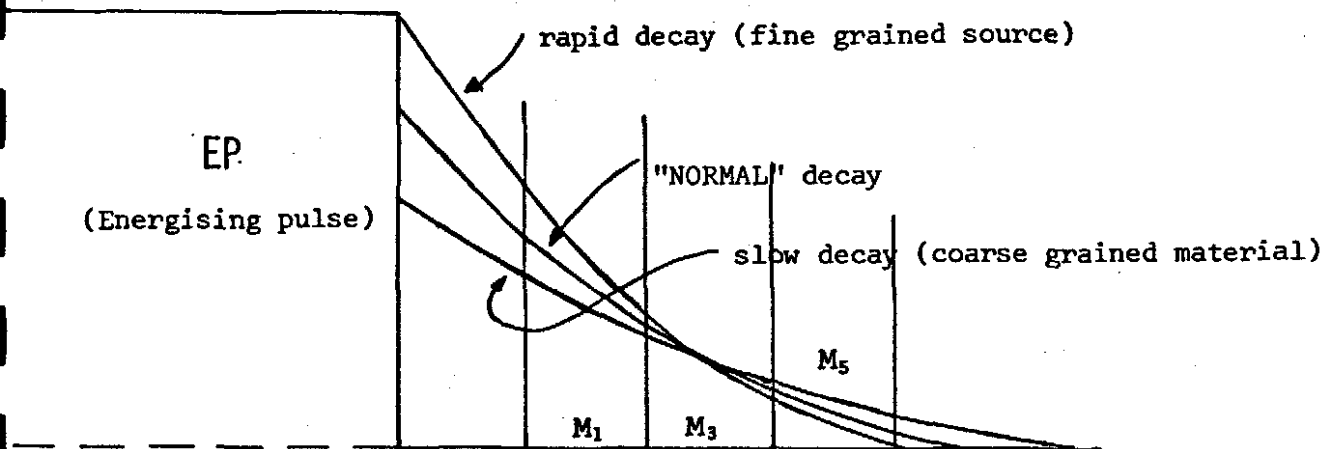
true of chargeability background. The background in rocks is usually determined by mafic mineral content, while the decay form appears often to be dependent on the rock grain size.

Both for 'mineralisation' and 'background' the mechanism is similar. Figure 2 shows how this is accomplished using the IPR-8 time domain receiver. In sketch (A) EP represents the energising pulse, while the rapid decay form is due to fine grained material discharge, and the slow decay form is due to coarse grained mineralisation. You will note from the diagram that the rapid decay form has a greater amplitude to start with. This is due to the fact that as the IP effect depends on the total surface area of the sulphides presented, the disseminated material per sulphide volume present will give a greater IP effect.

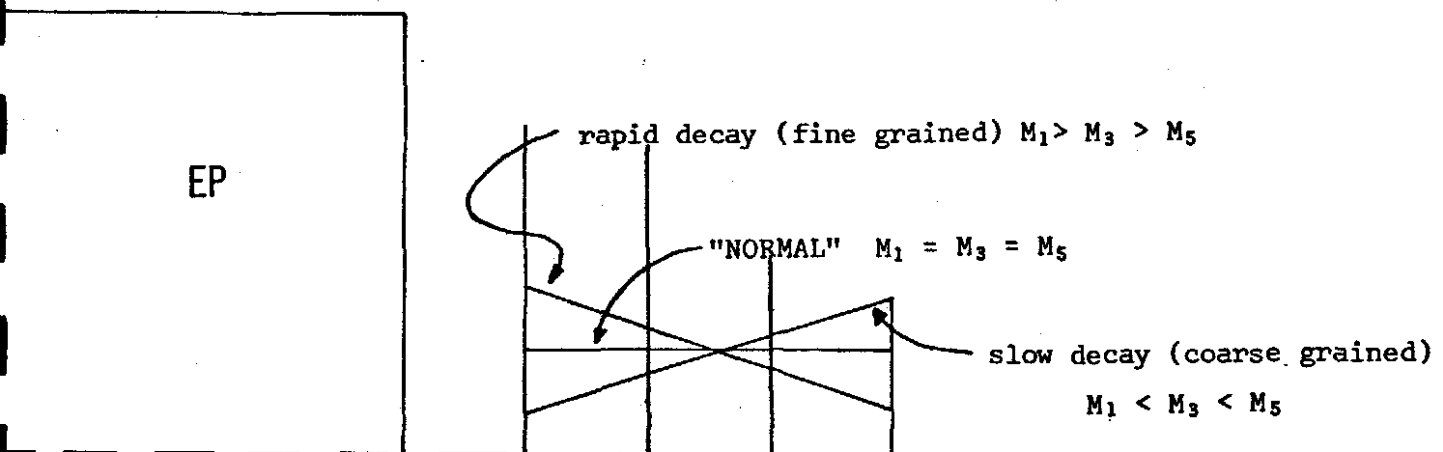
The three decay slices are shown in the diagram as M_1 , M_3 and M_5 . The red decay form included in Figure 2A is the 'normal' or 'average' decay form usually observed over normal rocks. The IPR-8 processes the data by dividing this normal decay into each of the slices M_1 , M_3 and M_5 . This is done so that any deviation from 'normal' is readily apparent. Figure 2 B displays the result of this processing of data. The rapid decay form (e.g. fine grained disseminated) will result in $M_1 > M_3 > M_5$, while the slow decay form (e.g. coarse grained massive, but not necessarily electrically continuous) will result in $M_1 < M_3 < M_5$.

On EIP surface surveys this data is usually presented as ΔM ,

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(A) DECAY AS OBSERVED BY IPR-8 MIP RECEIVER PRIOR TO PROCESSING



(B) DECAY AS OBSERVED BY IPR-8 MIP RECEIVER AFTER NORMALISATION
FOR A "NORMAL" DECAY FORM

FIGURE 2

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$|M_5| - |M_1|$, which displays the difference in amplitude of the first and last slice. However, due to the large variation in the amplitudes of the chargeability (M_3) down hole, it is here presented as ΔM_n , the *normalised decay form* in percent.

$$\Delta M_n\% = \frac{\Delta M}{M_3} \times 100 = \frac{M_5 - M_1}{M_3} \times 100$$

ΔM_n , when positive, infers a 'coarser than normal' grain size, and when negative, a 'finer than normal' grain size. The amplitude (in percent) variation from normal will give some indication of the departure of the decay from normal.

DATA PRESENTATION

The four drill holes logged are displayed at a down hole scale of 1 centimetre = 1 metre (1:100), resistivity on a 5 centimetre log scale, and chargeability at a scale of 1 centimetre = $2\frac{1}{2}$ millivolts/volt. The decay form ΔM_n is shown as 1 centimetre = 5%.

DISCUSSION OF RESULTS

DDH #BT-42 This hole was logged using a 1 metre α spacing between 30 metres and 80 metres, and a 2 metre α spacing between 82 metres and 90 metres. No significant chargeability data was obtained above 80 metres, presumably due to dry hole conditions.

$\alpha = 1$ METRE

30 - 36 metres:- Resistivities above 34 metres varied between 2000 and 4000 ohm-metres. This zone coincides with the zone described

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as *Fine grained granite, weakly altered but without tin mineralisation.*

36 - 48 metres:- Resistivities range between 500 and 1000 ohm-metres, but can be subdivided into a 600 ± 100 ohm-metres between 36 and 41 metres and a 1000 ohm-metres zone between 41 and 48 metres. The former appears to be associated with *fine grained greenish granites* while the latter with *pinkish fine grained granite*.

50 metres (± 2 metres):- A rise in resistivity to over 10,000 ohm-metres was recorded. The log shows the presence of *greisenised granites* over this section and trace minerals were also recorded.

56 metres (± 3 metres):- A resistivity maximum of over 20,000 ohm-metres, with high 5000 ohm-metres(+) resistivities between the 50 and 56 metres maxima. *Greisen and greisenised granites* are again recorded over this section.

59 - 80 metres:- A steady decline in resistivities from 5000 ohm-metres to about 1000 ohm-metres was recorded over this section. While this is a change in the resistivity which is clearly discernible, the geological shows a continuation of greisenisation to about 74 metres below which it grades into *weakly altered granites*.

$a = 2$ METRES

80 - 84 metres:- Between 80 and 84 metres the resistivities fall to the order of 100 ohm-metres. *Clays* recorded about the 81 metre mark are the likely source.

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86 metres:- A local resistivity high of 600 ohm-metres is not reflected by material difference in the geological log. Chargeabilities remain background and decay form slow.

90 - 94 metres:- Higher resistivities of 1700 ohm-metres as against 600 ohm-metres above and below, are accompanied by a 50% increase in chargeability to 15 millivolts/volt. Decay forms are about normal.

94 - 100 metres:- The resistivity falls to 700 ohm-metres while the chargeability recorded was around 11 millivolts/volt

SUMMARY:- Unfortunately the upper portion of this hole may have been dry, and the resultant resistivities excessive. In general, the greisenisation appears to be of greater resistivity than the overlying granites, while the intermediate zone (35 to 49 metres) was of lower resistivity. In the small section logged for EIP, mineralisation was accompanied by an increase in background to 15 millivolts/volt from 10 millivolts/volt.

DDH #BT-44 This hole was logged using a 1 metre a spacing.

19 - 25 metres:- Over this section the resistivities increase from 600 ohm-metres to 4500 ohm-metres at 23.5 metres and then decrease to 1200 ohm-metres at 25 metres. Generally, the chargeability remains low over this section. This zone coincides with the pinkish granite unit.

25 metres:- This low marks the boundary between the pinkish granite above and greisen below.

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27 - 35 metres:- This zone is the most significant in the hole. Between the limits, the resistivity rises to reach over 10,000 ohm-metres from 28 to 35 metres, with some intermediate readings being as high as 30,000 ohm-metres. The background above and below this unit is about 1200 to 2000 ohm-metres. The chargeability increases from a low near zero background to over 37 millivolts/volt between about 27 and 34 metres. The decay form infers a coarsening of grain size of the chargeable source down hole through the intersection. This zone appears to coincide well with the 'trace' sulphides recorded over this section, however, bearing in mind the normal decay form, at least 1% to 1½% chargeable sulphides would be expected to be the source of this response. Also, silicification within this zone is not recorded by the log. The very high resistivities certainly infer this.

36.5 metres (±1 metre):- A distinct low was situated at this point, as was a low chargeability section. No reason for these features was noted in the geological log.

38 - 65 metres:- Between these co-ordinates the resistivity varies 2000 to 6000 ohm-metres. This can be regarded as a base level of about 6000± ohm-metres with more resistive sections at 47½ metres ± 1 metre, 51½ metres ± 1 metres, 58 metres ± 2 metres and 63 metres ± 1 metre. No definite reason for these increases can be seen in the geological log, however, aplite was recorded at 58 metres and 63 metres..

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The chargeability data shows a background between 3 and 6 millivolts/volt. Superimposed on these chargeabilities the following zones were located:-

44 metres:- A single station 15 millivolts/volt reading was located superimposed on the 5 millivolts/volt background at this point. The decay form is 5% slower than normal inferring a coarse grained source. The geological log shows no sulphide source to be present.

48 metres:- A single station (with supporting readings) of 10 millivolts/volt, associated with normal decay forms. Again no sulphides were recorded in the geological log.

53 metres:- A 12 millivolts/volt chargeability high with a normal decay form has no sulphide source in the geological log.

Over the above section, the majority of decay forms are fast [$\Delta M = -20\%(+10\%)$] inferring the absence of efficient chargeable material.

SUMMARY:- The overlying pinkish granite in this case has lower bulk resistivity of 3000 ohm-metres (± 1000 ohm-metres) and low chargeability. The mineralised greisen section has both high (35 to 40 millivolts/volt) chargeability and very high ($30,000 \pm$ ohm-metres) resistivities. This body section (27 to 35 metres) would be directly detectable by virtue of EITHER its resistivity OR its chargeability. The underlying greisen granites show uniform 2500 to 6000 ohm-metres resistivity over low chargeability background punctuated by isolated and un-

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explained resistivity highs.

DDH #BT-46 This hole was logged at an $a = 1$ metre spacing.

10 - 20 metres:- Apparent resistivity varies between about 4000 and 12,000 ohm-metres, while chargeability remains a relatively high 16 to 17 millivolts/volt. *Greenish alteration* was recorded and also *iron-staining* which may infer presence of pyrite causing the higher than normal background IP effect for this unit.

20 - 28 metres:- A sharp decline in resistivity from 12,000 ohm-metres at 20 metres to less than 220 ohm-metres at 28 metres was recorded. A sympathetic fall in chargeability was also observed. *Greisenisation* was recorded over this section in the log.

27 - 33 metres:- The lowest resistivity recorded of 220 ohm-metres (see above) at 28 metres, and 350 ohm-metres at 31 metres are accompanied by negative induced polarization values. This may infer some internal polarization, however, no sulphides were recorded on the geological log.

33 - 38($\pm$) metres:- Apparent resistivities increased from the low 350 ohm-metres at 31 metres to 1500 ohm-metres over this section, while background chargeability remains at about 5+ millivolts/volt. The geological log reports *greisen with trace cassiterite*.

38 - 46 metres:- Apparent resistivities over this section remain

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between 2000 and 3000 ohm-metres, while chargeabilities remain at about 10 millivolts/volt and have normal decay forms. The geological log records a gradual decrease in alteration over this section.

47 - 50 metres:- A sharp fall in resistivity to 200 ohm-metres together with a fall in chargeability coincides with alteration of greisenisation.

SUMMARY:- In this case the greisenisation appears to be related to low resistivities, while in holes #42 and #44 it appears to be associated with higher resistivities. The absence of mineralisation in this hole, however, is perhaps important in that the introduction of significant mineralisation may increase the resistance of the rock (by silicification?).

DDH #BT-50 This hole was logged using an $a = 1$ metre spacing.

53 - 64(± 1) metres:- The average resistivities over this section were about 10,000 ohm-metres, with a marked low of 1000 ohm-metres at 55 metres and a relative high of 30,000 ohm-metres at 62 metres. The associated chargeabilities are low, varying from 0 to 5 millivolts/volt. This zone marks the pink granite which was logged at 64 metres.

65 $\pm$ metres:- A significant decrease in resistivity to 150 ohm-metres combined with an increase in chargeability to 54 millivolts/volt at this point, with supporting high values of 33 millivolts/volt above and 60 millivolts/volt below within resistive (2000 +

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ohm-metres) rocks, infer sulphides to be present. However, the geological log records no sulphides over this section, nor is there any increase in any trace elements. The source therefore is a mystery!

64 - 74 metres:- Average resistivities of about 5000 ohm-metres but ranging from 2500 to 14,000 ohm-metres were recorded over this section. No chargeabilities were able to be recorded over this section except at 71 and 73 metres where single high chargeability readings were noted. This zone is associated with *pink to white aplite within minor greisen*. As with the unit at 65 metres, no source to the chargeability was noted in the log.

75 metres (± 1 metre):- A marked resistivity low of about 100 ohm-metres marks the break between the *weakly greisenised unit* above, and *fine grained granite etc.*, below. No geological marker in the log explains this low as such.

77 - 85 metres:- The resistivities remain a relatively low 600 ohm-metres(+) through this *granite-greisen* zone. In the upper section, between 75 metres and 79 metres, chargeabilities remain a high 30 millivolts/volt, then fall rapidly to 5 millivolts/volt at 83 to 85 metres. Sulphides are inferred in the upper section to 1%, but only traces thereof are inferred in the geological log.

SUMMARY:- The most significant event in this hole, namely the series of high chargeability anomalies within the 'weakly greisen' zone from 64 to 74

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metres is not explained by the observations in the log. The three main sections however, pink granite, weakly greisen, and more strongly greisen section, are shown up as separate units, the latter as LOW resistivity with some chargeability in the upper section.

GENERAL CONCLUSIONS

- 1 - The logs of these holes are somewhat confusing as the units show marked variation in character.
- 2 - It would seem to the author that the greisen zone when weakly mineralised is of *low* resistivity, but when strongly mineralised, is of *high* resistivity (20,000 ohm-metres) and of high chargeability. Should geological evaluation of these points be found to support this, this *may* be a method of locating the zones of major interest *directly* by virtue of their extremely high resistivity and high chargeability. This assumes 27 to 34 metres in #BT-44 to be typical of the mineralisation sought.
- 3 - Perhaps the logging sampled too small a volume of each unit and was therefore not typical of it. It is therefore recommended that a number of soundings be carried out:-
 - a) over the upper and lower granites where no mineralisation is present, and
 - b) over section where mineralisation is known.The latter will also test the possibility of bulk testing zones of interest such as 27-34 metres in #BT-44 directly.

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The author looks forward to further discussion on these results. While the data observed does not give a clear, definite course to follow, the direct detection possibility does offer promise and should be studied further.

Respectfully submitted on behalf of:

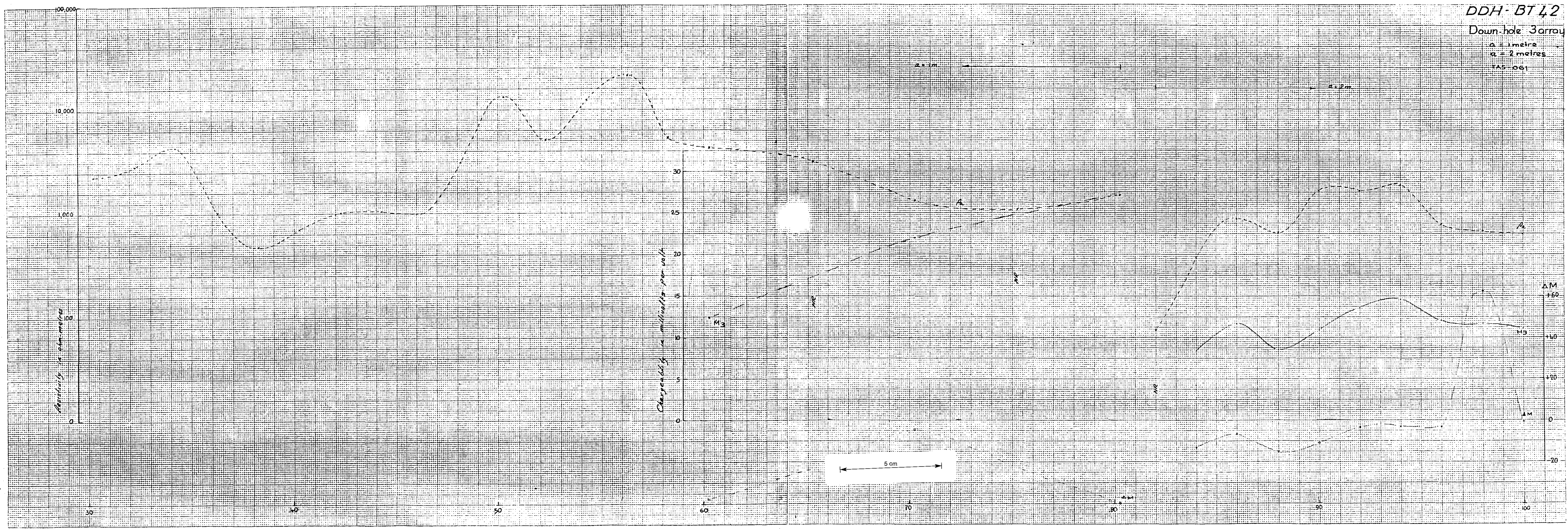
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A.W. HOWLAND-ROSE, MSc, DIC, AMAusIMM, FGS.

GEOPHYSICIST

DDH-BT 42
Down-hole array

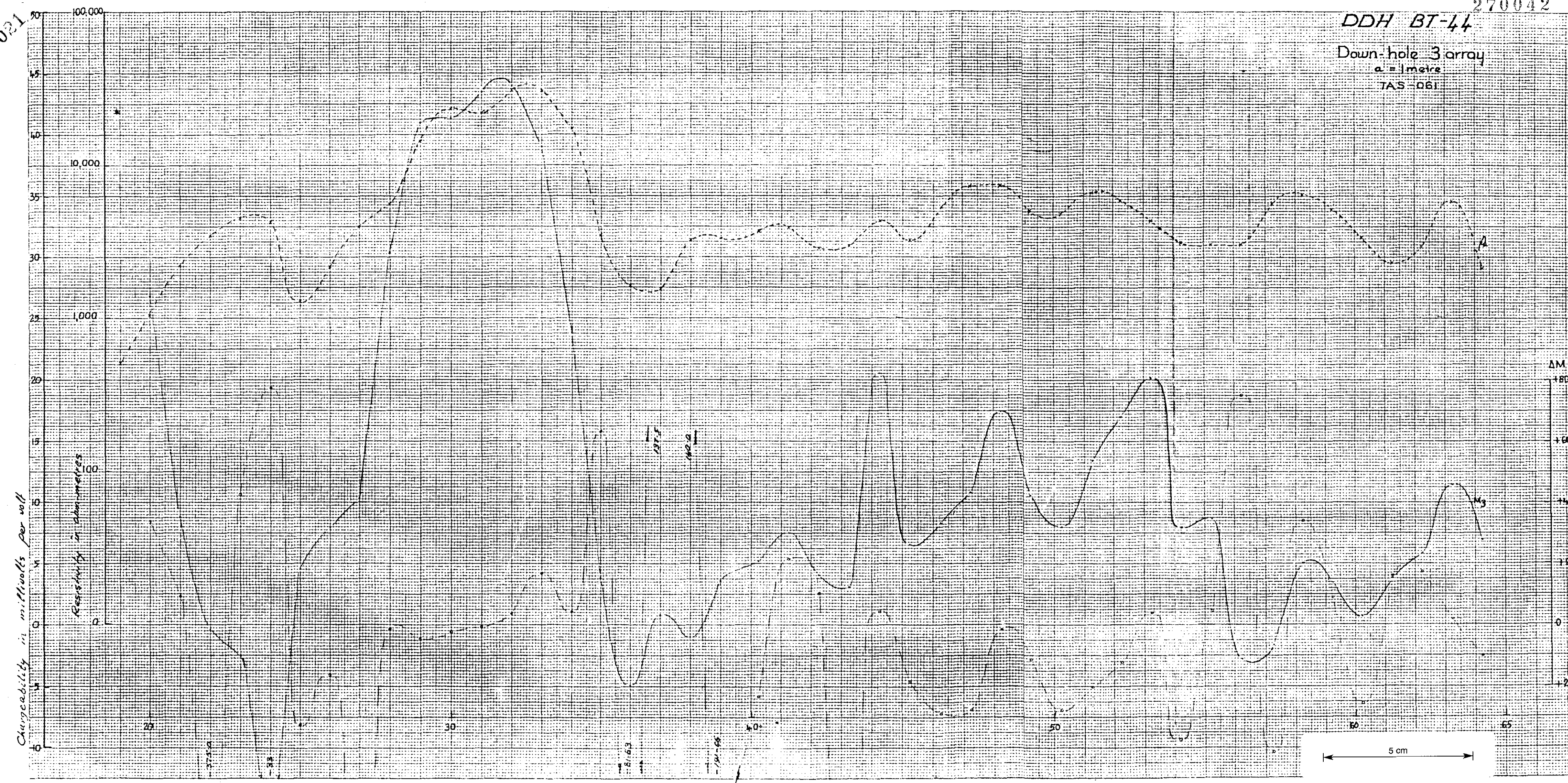
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a = 2 metres
TAS-061



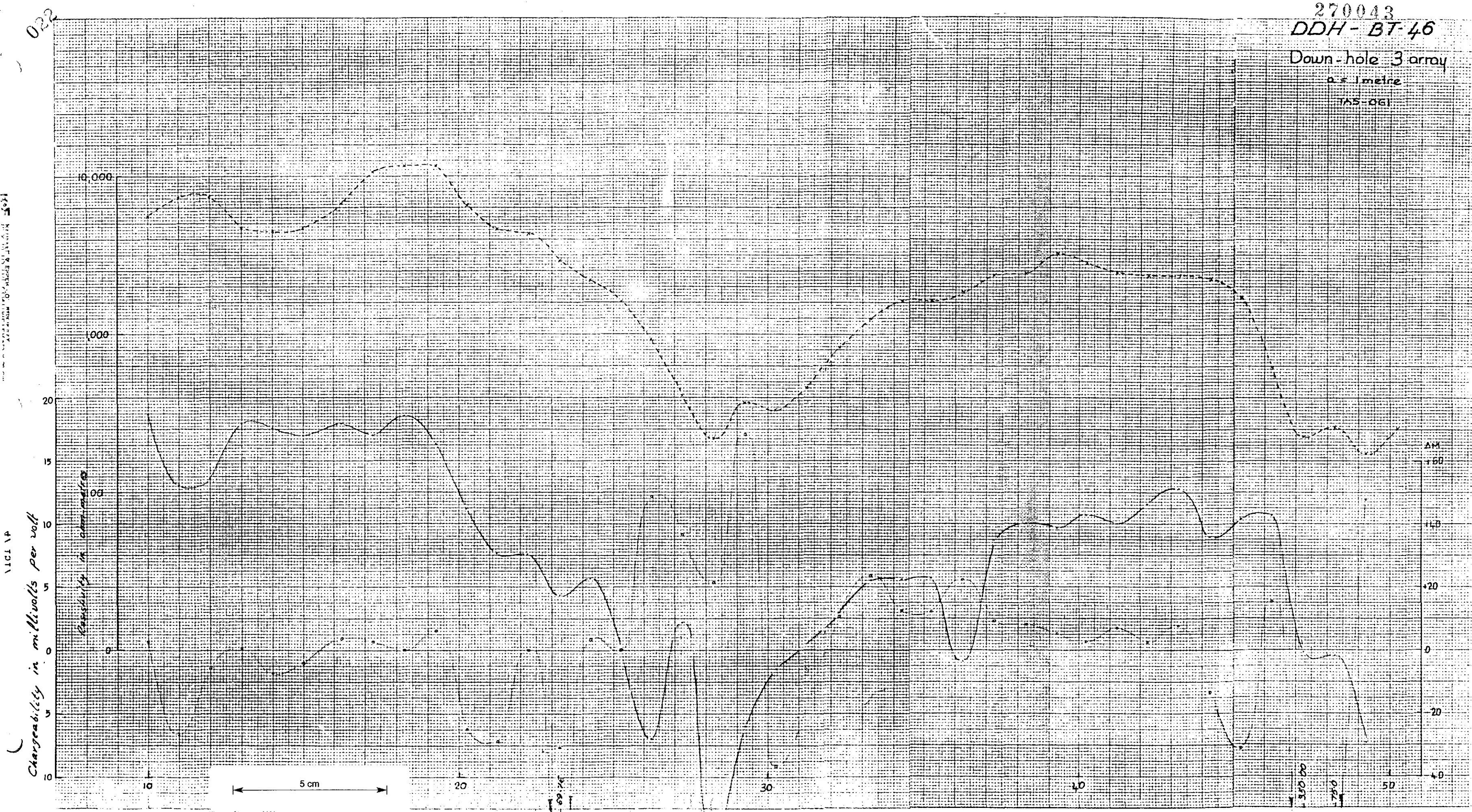
DDH BT-44

Down-hole 3 array
a = 1 metre
TAS-061

021

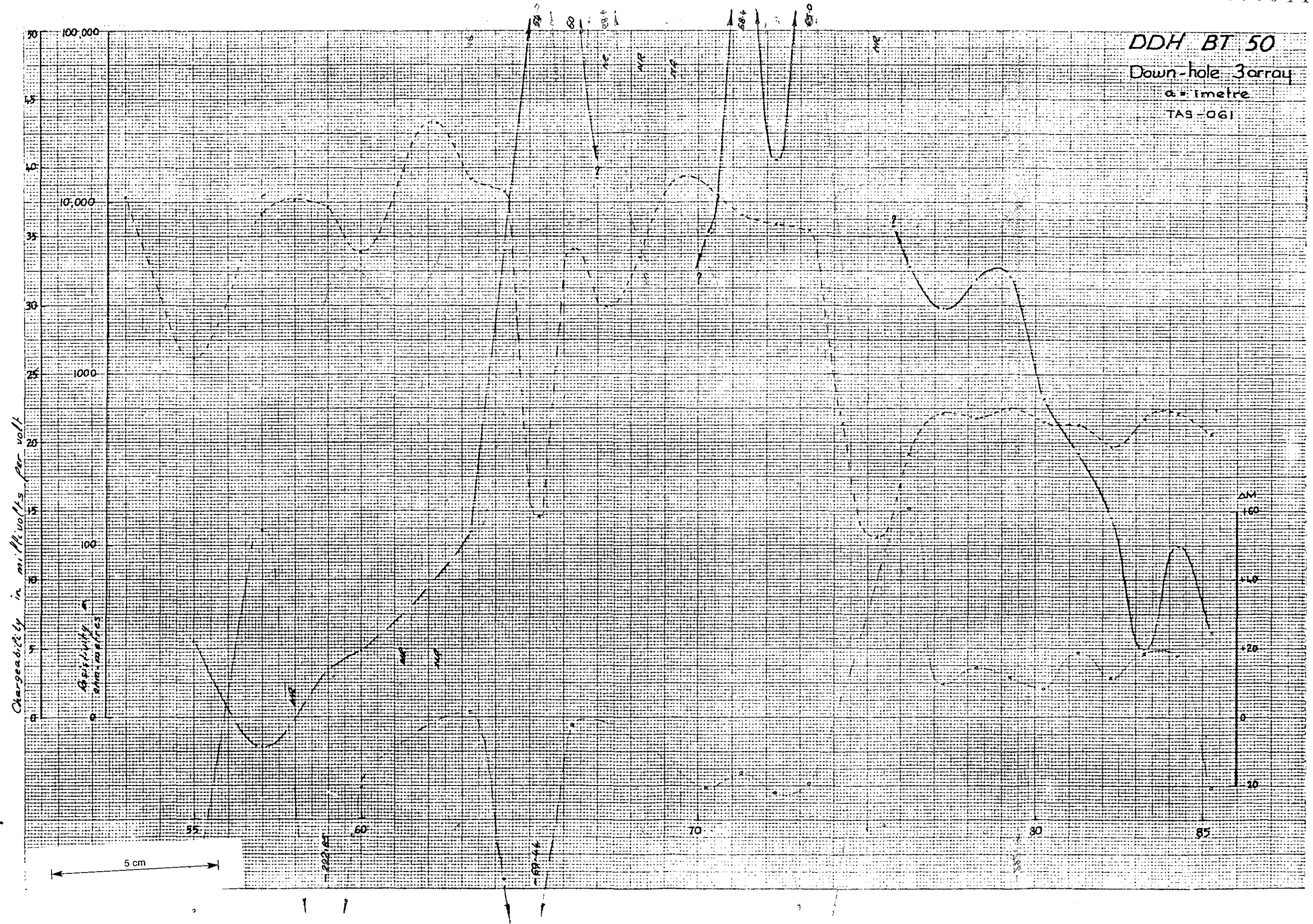


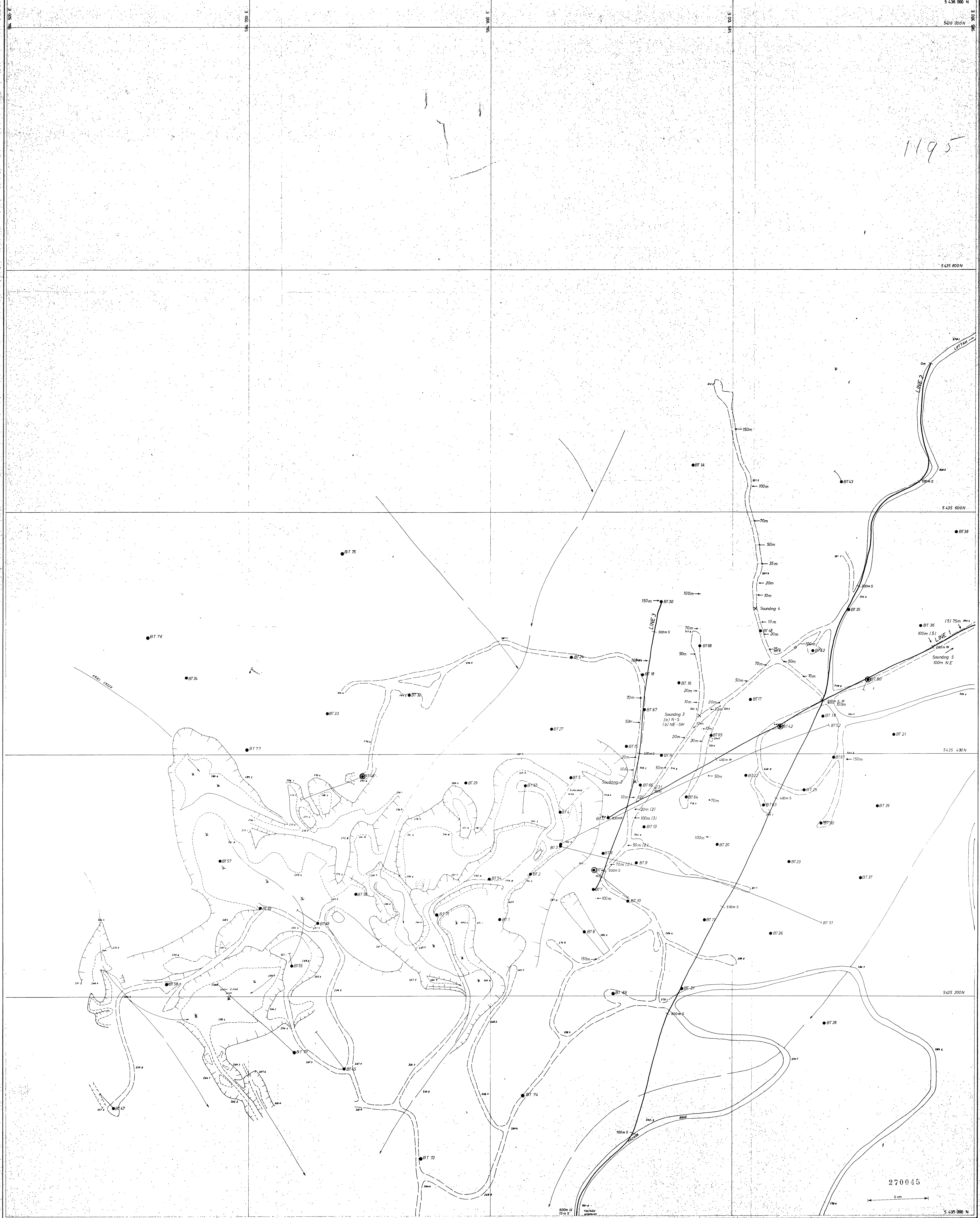
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EL. 9/76 - ANCHOR MINE AREA
GEOPHYSICAL ORIENTATION SURVEYS

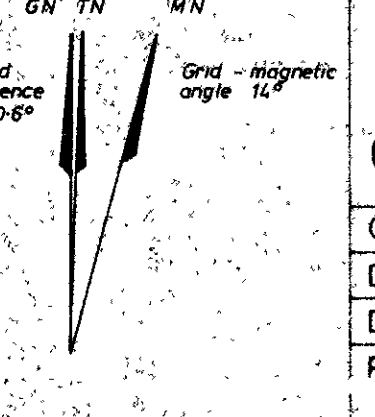
GEOLOGIST	A. ROSS	SCALE	1:1000 METRES
DRAUGHTSMAN	J. MATTHEWS	DATE	FEB 1979
DATE	FEB 1979	REVISIONS	
REVISIONS			

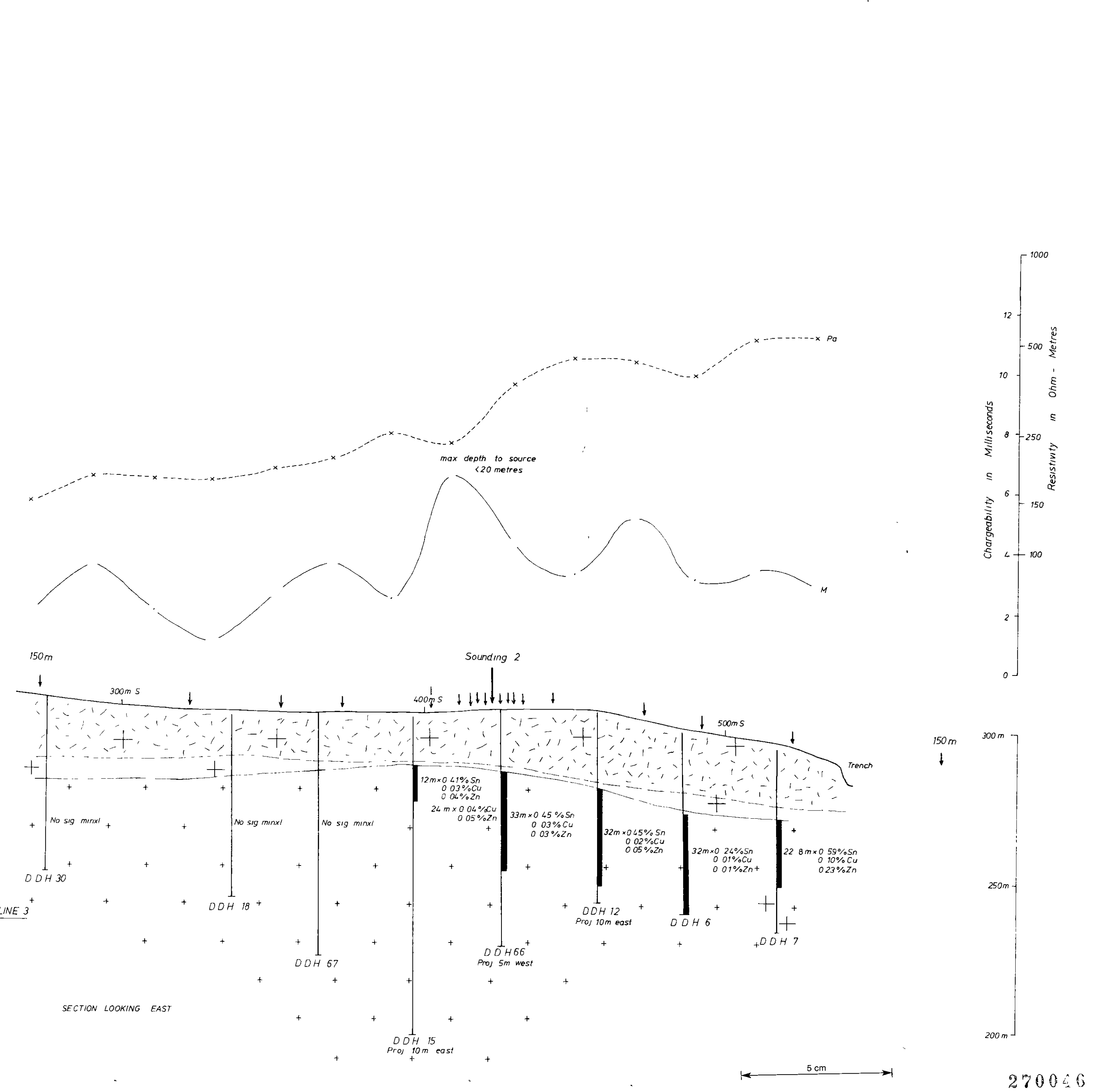
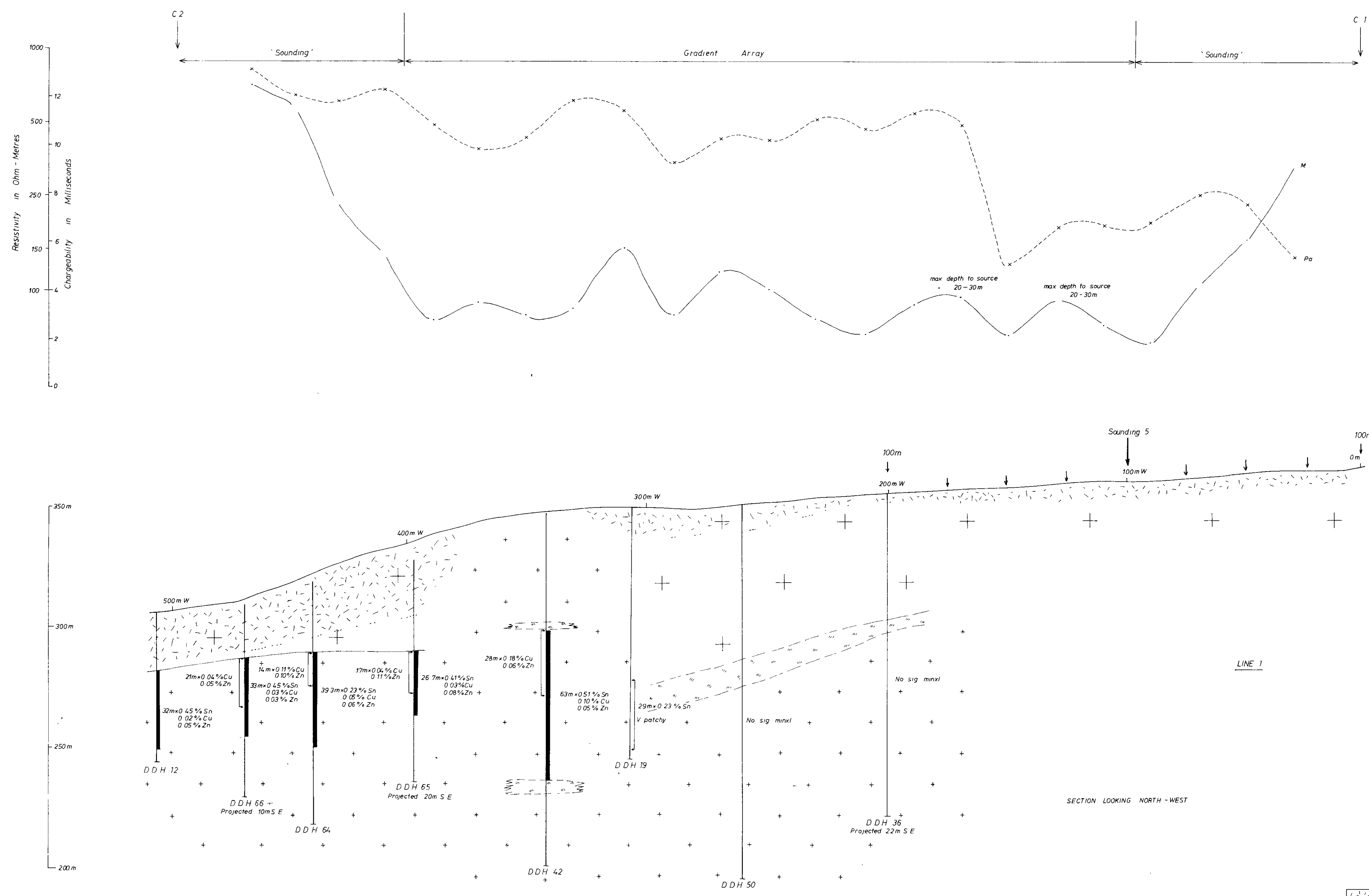
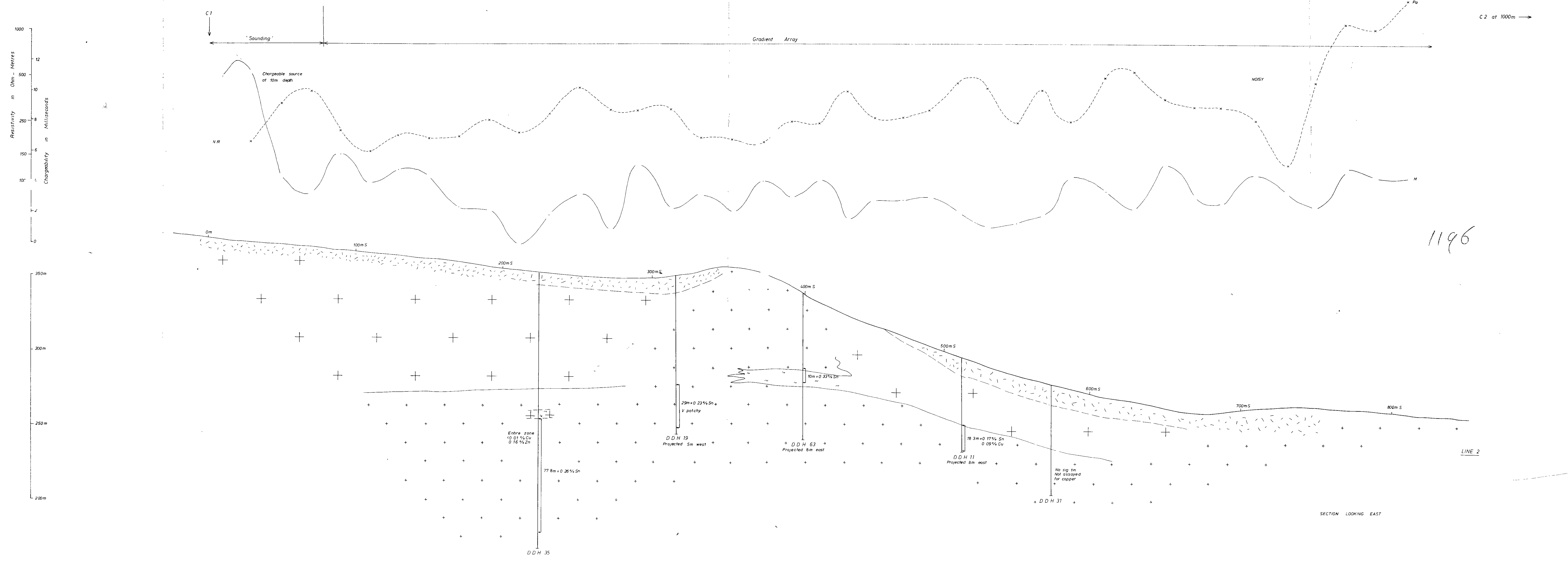
BT 301

LEGEND

- X Sounding
- Current electrode
- Secondary drift road
- Drill access track
- Drainage
- Open cut workings
- Geophysical traverse line
- Down-hole survey

The relationship between True North, Grid North and Magnetic North is shown diagrammatically for the centre of this map. Magnetic value is correct for 1975, annual change is 0.1° Eastward.

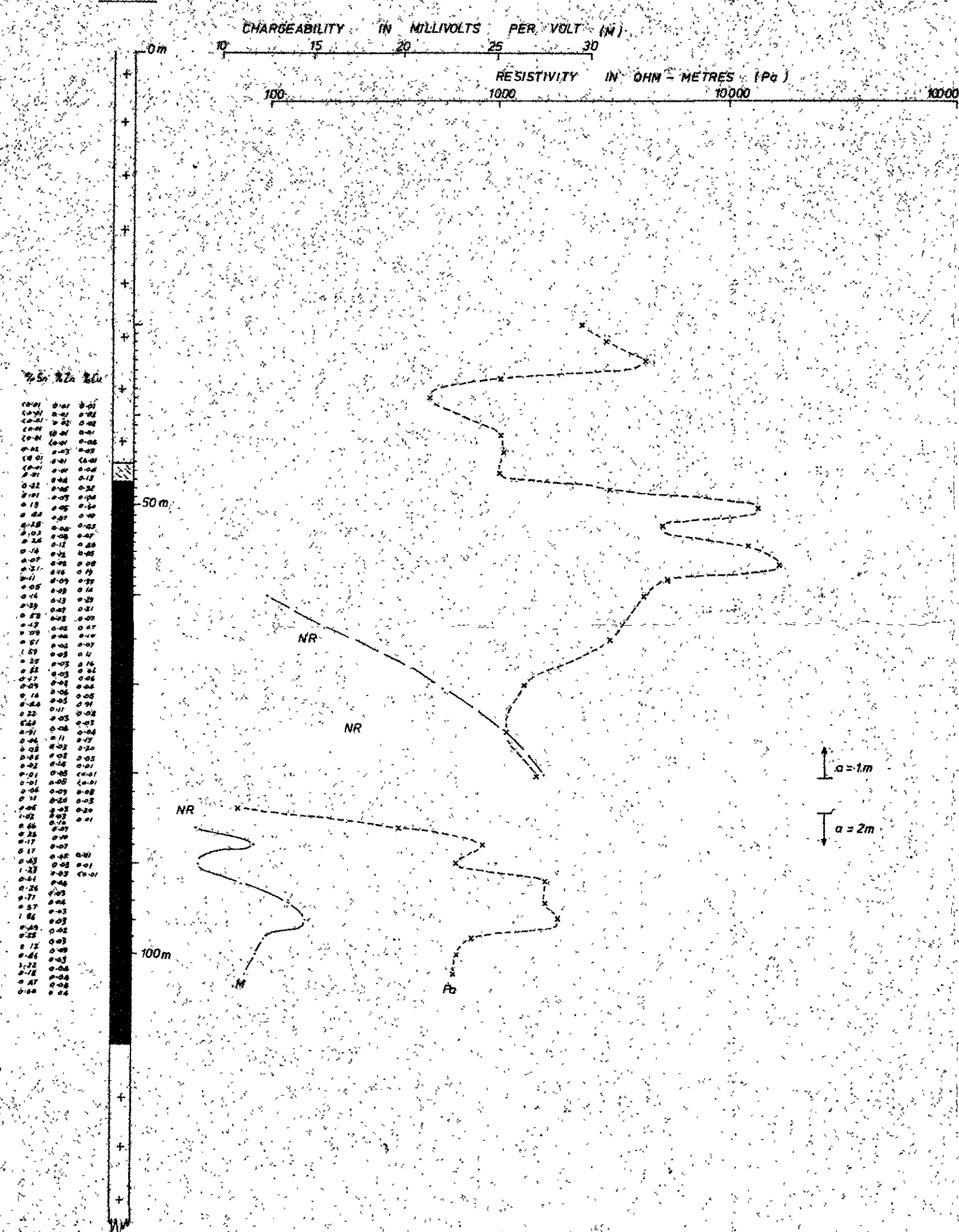




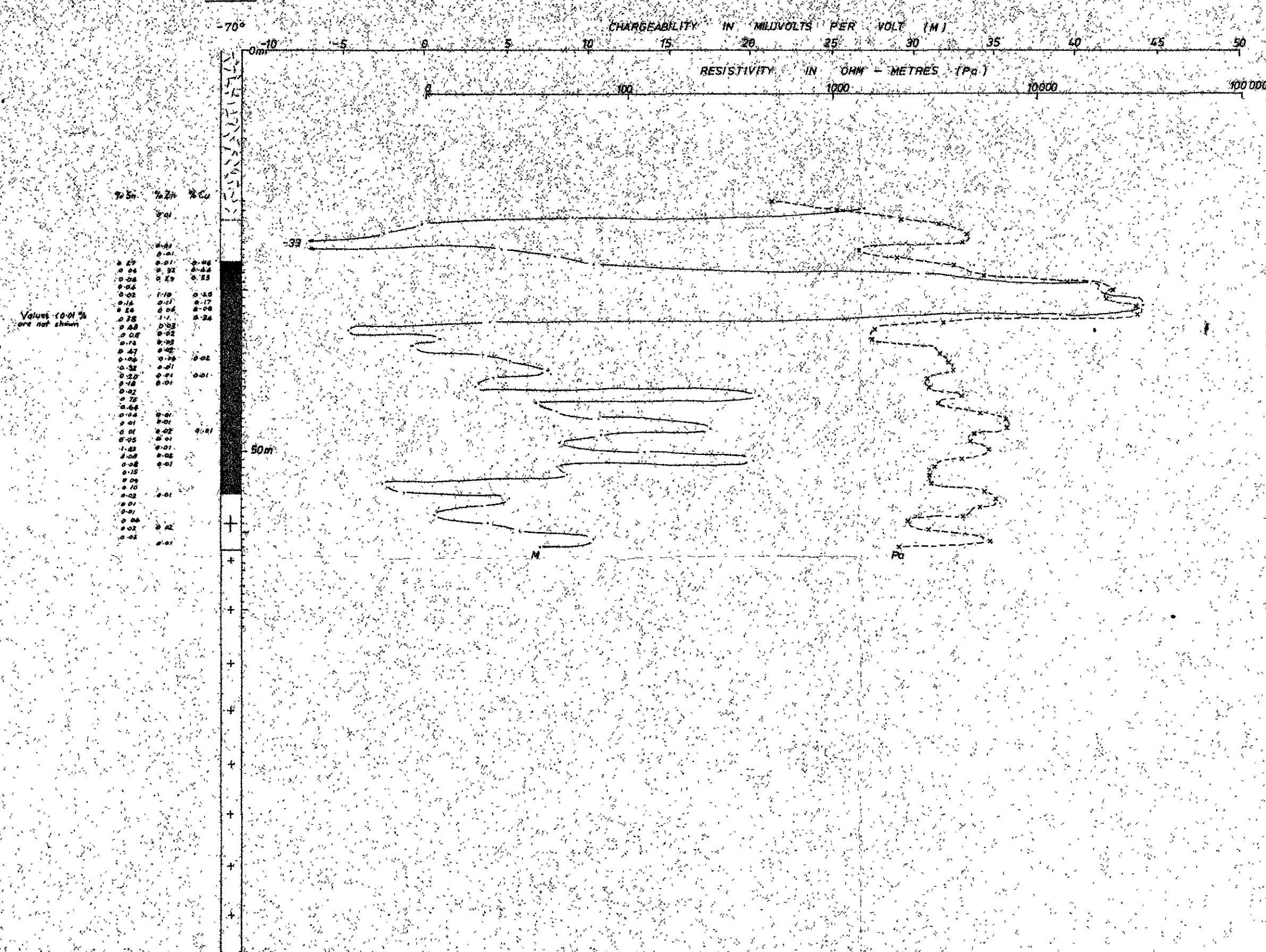
- LEGEND**
- Weathered granite and soil
 - Coarse grained granite
 - Transition zone
 - Pyrochlore-rich horizon
 - Fine grained granite
 - Tin - greisen
 - Sounding set-up
 - Current electrode

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ANCHOR MINE AREA E.L. 9/76
INDUCED POLARISATION - RESISTIVITY ORIENTATION SURVEY
GEOLOGIST: A. ROSS
DRAUGHTSMAN: J. MATTHEWS
DATE: FEB 1979
REVISIONS:
SCALE 1:1000 METRES
DRAWING No. BT 302

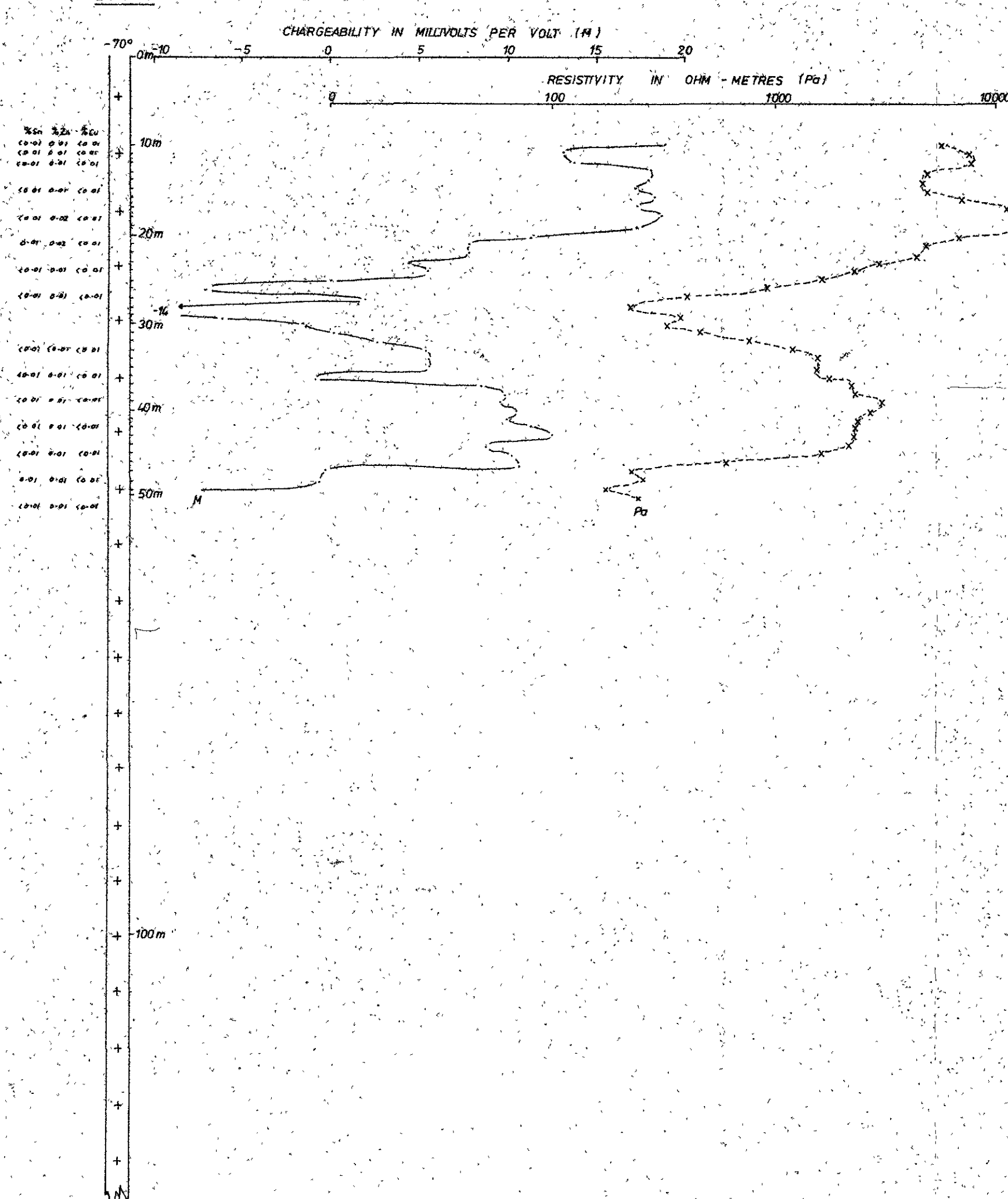
DDH 42



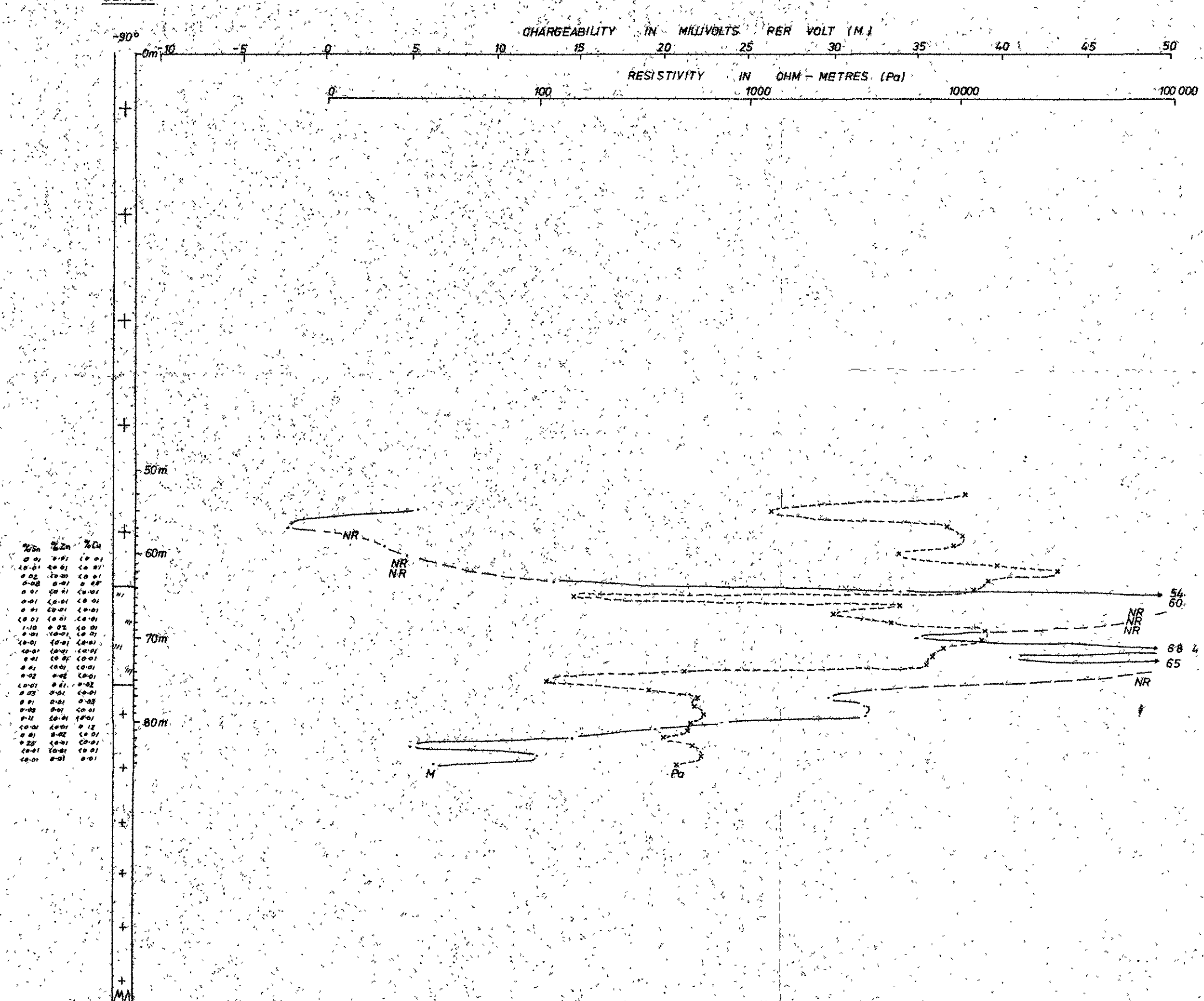
DDH 44



DDH 46



DDH 50



LEGEND

- Weathered granite and soil
- Coarse grained granite
- Transition zone
- Pegmatite-rich horizon
- Fine grained granite
- Tin-greisen

270047

5 cm

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E.L. 9/76 ANCHOR MINE

DOWN HOLE 3-ARRAY
I.P. RESISTIVITY LOGS

GEOLOGIST : A. ROSS

DRAUGHTSMAN : J. MATTHEWS

DATE : FEB 1979

REVISIONS

SCALE 1:500 METRES

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DRAWING No.

BT 303

1197
78-1256 (a)