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GEOPHYSICAL SURVEYS

MARINER 1 & 3

BLACK BLUFF TASMANIA

78-1294 Vol 1/2

S. T. Mudge

August, 1978.

CONTENTS

ACCOMPANYING PLANS

DRAWING NUMBER	
3327 S/A	Contours of Total Magnetic Field Intensity
3334 S/A	Profiles of VLF-E.M. (MARINER 1)
3598 S/A	Profiles of Total Magnetic Field Intensity (MARINER 1)
3599 S/A	Profiles of Total Magnetic Field Intensity (MARINER 3)
3600 S/A	Profiles of Total Magnetic Field Intensity (MARINER 3)
3846 S/A	Profiles of Self Potential, Sheet 1
3847 S/A	Profiles of Self Potential, Sheet 2
3848 S/A	Profiles of Self Potential, Sheet 3
3849 S/A	Contours of Self Potential
3850 S/A	Profiles of VLF-E.M., (MARINER 3) Sheet 1
3851 S/A	Profiles of VLF-E.M., (MARINER 3) Sheet 2
3852 S/A	Profiles of VLF-E.M., (MARINER 3) Sheet 3
3853 S/A	Profiles of T.E.M. (MARINER 1)
3854 S/A	Profiles of T.E.M. (MARINER 3)
3855 S/A	Pseudosections of Dipole-Dipole I.P. Line 10 700E
3856 S/A	Pseudosections of Dipole-Dipole I.P. Line 9 800E
3857 S/A	Pseudosections of Dipole-Dipole I.P. Line 11 500E
3858 S/A	Pseudosections of Dipole-Dipole I.P. Line 10 900E
3859 S/A	Profiles of Gradient Array I.P. (MARINER 3)
3860 S/A	Profiles of Gradient Array Resistivity (MARINER 3)
3861 S/A	Contours of Filtered in-phase VLF-E.M.
3862 S/A	Diagrammatic Summary of Results
3863 S/A	MARINER prospects - Location Diagram.
3893 S/A	SP Interpretation (MARINER 3)
3894 S/A	Vertical Electrical Sounding

INTRODUCTION

The MARINER 1 and MARINER 3 prospects are located in E.L. 10/74 (Black Bluff) in north-west Tasmania, see Drawing No. 3863 S/A.

The area is held under licence by Geopeko as a joint venture with Union Oil Development Corporation.

Geophysical surveys conducted in late 1977 and mid-1978 are reported here.

Initial surveys on the MARINER 1 prospect included very low frequency E.M. (VLF-E.M.), self potential (S.P.), gradient array induced polarisation (I.P.), and magnetics. This work was reported by Deakin (1977). During the later part of 1977 the MARINER 1 grid was extended east to line 11 700E and south to 9 400N.

The portion of the grid bounded by lines 9 900E and 11 700E is known as MARINER 3. MARINER 1 remains that area west of line 9 900E.

Part A of this report summarises the results of work conducted up to December 1977.

Part B discusses the results of surveys conducted during May to June 1978.

GEOLOGY

The geology of the prospects consists of a NE-SW striking acid volcanic unit, part of the Cambrian Mt. Read volcanic suite. Tertiary basalt and alluvium unconformably overlie much of the E.L. area and about half of the gridded area.

The acid volcanic units are composed of relatively fresh tuffs and porphyries with many intersecting quartz veins. These quartz veins have associated pyrite and gossaneous material at the surface, particularly at MARINER 3.

The prospects originated because of favourable results obtained from a series of wide space (about 1km) reconnaissance pole-dipole I.P. traverses conducted by Union Oil in 1975. This survey detected the two major geophysical anomalies subsequently located at MARINER 1 & 3.

A massive base metal sulphide deposit, similar to those elsewhere in the Mt. Read volcanics (such as Mt. Lyell) is the exploration model. The geophysical methods appropriate for such a target have been applied i.e., VLF-E.M., S.P., I.P. and Magnetics.

PART A - 1977 SURVEYS

The magnetic and gradient array I.P. surveys were extended in December 1977. Poor weather conditions prevented continuation of the I.P. survey. Results of the extended surveys are reported here.

Magnetics

The MARINER 1 area has magnetic survey coverage between 9 600N and 10 300N. MARINER 3 has been surveyed on all lines (eastings) between 9 400N and 10 200N.

A Geometrics G816 total field proton precession magnetometer was used for the survey. Readings were taken at 12.5 metre intervals along the 100 metre spaced survey lines. The station 9 800E 10 000N was used to tie the surveys.

Profiles of total magnetic field intensity along each line are shown in Drawing Nos. 3598 S/A, 3599 S/A and 3600 S/A.

The "noisy" magnetic response is attributed to the tertiary basalt that covers a large portion of the grid. The survey has mapped the basalt/alluvium contact. The interpreted position of the basalt (magnetic) boundary is shown in the diagrammatic summary, Drawing No. 3862 S/A.

Gradient Array I.P.

A gradient array I.P./Resistivity survey was conducted at MARINER 3 on lines 9 900E, 10 000E, 10 100E and 10 200E between 9 400N and 10 200N. Current electrodes were located at 10 400E 8 800N and 10 400E 10 800N. A Scintrex 2 second time domain transmitter was used in conjunction with a Scintrex IPR-8 receiver.

The receiver dipole length was 25 metres. Chargeability profiles for the M_{232} portion of the Scintrex IPR-8 decay curve as shown in Drawing No. 3859 S/A.

Several weakly polarisable zones were detected. They are shown diagrammatically in Drawing No. 3862 S/A as full widths at half maximum amplitude. No major anomalies were detected. Results of the initial I.P. survey of MARINER 1 are also included in the diagrammatic summary.

Resistivities on lines 9 900E to 10 200E inclusive, are of the order of 1200 ohm-m for the basement rocks. The southern end of the lines show a fall in apparent resistivities to about 200 ohm-m, correlating with the magnetic interpretation of the position of the basalt cap.

The low resistivities at the northern end of lines 9 900E, 10 000E and 10 100E are probably due to the swamp covering this portion of the grid.

VLF-E.M.

VLF-E.M. data collected during the 1977 surveys of MARINER 1 has subsequently been reprocessed in accordance with the method outlined by Fraser (1969). A contour plan (incorporated into Drawing No. 3861 S/A) of this filtered component showed strong correlation with gradient array I.P. and geochemical anomalies.

Further discussion of the VLF results in contained in Part B of this report.

S.P.

The S.P. survey initially conducted in MARINER 1 revealed a -50mV anomaly on line 9 800E at 9 850N.

This anomaly correlated well with VLF, gradient array I.P. and geochemical anomalies.

The area was re-surveyed as part of the MARINER 3 survey in May 1978 and the later results are discussed in Part B of this report.

PART B - 1978 SURVEYS

Following the encouraging results previously obtained with VLF-E.M., S.P. and I.P., coverage of the MARINER 1 and 3 grids with VLF and S.P. was completed in May and June 1978.

Coincident VLF and S.P. anomalies were further tested with I.P. and T.E.M.

VLF-E.M.

A Geonics EM 16 VLF receiver was used in conjunction with the signal from the North West Cape (NWC) transmitter. NWC is the only source with a signal strength suitable for survey use in the area.

The survey was conducted on lines 10 000E to 11 700E inclusive, between 9 400N and 10 200N. Readings were taken at 25 metre intervals.

In order to complete the MARINER 1 coverage lines 9 500E and 9 750E were surveyed. Also, lines 9 200E to 9 900E inclusive were surveyed between 9 400N and 9 600N (grid extensions since January 1977).

Profiles of both in-phase and quadrature components are shown in Drawing Nos. 3334 S/A, 3850S/A, 3851 S/A and 3852 S/A. Plotting of the profiles is such that a northern dip of the in-phase component indicates the presence of a conductor. Orientation of the receiver with respect to the primary signal is also shown.

The in-phase component has been filtered in accordance with the method outlined by Fraser (1969). This filtering process phase shifts the profiles to produce a positive high at the point of maximum northerly dip. This positive high is a contourable parameter and is shown in Drawing No. 3861 S/A for the combined MARINER 1 and 3 area.

Contours of the filtered component show three linear anomalous zones crossing the grid diagonally at about 120°. They are:

1. that zone from 10 100E 9 500N to 9 200E 9 650N,

2. the zone from 10 100E 9 700N to 9 200E 10 150N,

and 3. the zone from 11 200E 9 600N to 9 900E 10 300N.

The first of these zones is over the basalt covered area of MARINER 1. The profiles are "noisy". Gradient array I.P. anomalies are coincident with the VLF anomalies on lines 9 900E and 10 000E. There is no correlation with magnetic and S.P. results.

The second zone is known to have good correlation with geochemical results. The profiles of line 9 800E show a prominent in-phase response at 9 750N, coincidenting with I.P. and S.P. anomalies. The in-phase profile is asymmetrical, tending to indicate a southern dip of the causative body.

The strong correlation with other geophysical methods gives this zone major importance as an anomalous area.

The third zone has a response along several profiles similar to that of a broad conductor. This zone is best developed on lines 10 700E, 10 800E and 10 900E. Contours of the filtered profiles show a pair of linear anomalies between lines 10 600E and 11 000E, due to the apparent wide body response.

The survey lines are not normal to the apparent strike of the causative body. As such, the observed profiles will be distorted in favour of a wide body response i.e., the peaks of the in-phase component will move apart thus generating two points of maximum slope on the profile.

In view of this, profiles normal to strike would probably cause the two linear zones between lines 10 600E and 11 000E to merge, thus indicating the centre of the causative body. (They would at least move toward each other - if not merging).

The in-phase anomalies on these lines may well be due to the effects of two close spaced conductors whose responses interfere to produce the anomaly observed. The observed profile of line 10 300E also shows two wide spaced in-phase peaks and two points of maximum northerly slope at about 9 860N and 10 110N.

Lines 9 900E to 10 200E inclusive show only positive in-phase peaks. The corresponding negative peaks are

further north of the grid.

In-phase and quadrature VLF profiles over a model conductor show both components crossing the zero level over the centre of the body. This cross-over is developed in the observed profiles on lines 10 000E to 10 600E inclusive.

This linear VLF zone indicates the presence of a linear conductor striking at about 120° (grid). It is either very broad (about 300 metres) or composed of several close spaced bodies between lines 10 600E and 11 000E.

Subsequent testing of this zone with I.P. produced favourable results, also correlating well with a strong S.P. anomaly.

The east-west striking linear VLF anomaly along 9 750N between lines 11 200E and 11 700E correlates strongly with magnetic contours. Subsequent testing with I.P. (line 11 500E) produced no I.P. anomaly. This anomaly is attributed to a zone thick (weathered ?) conductive basalt. The anomaly at 9 500N (striking about 120°) has an associated (but weak) I.P. response.

The linear VLF anomaly crossing line 11 500E at 10 075N has no I.P. response. The VLF anomaly is therefore attributed to the basalt.

The VLF results for the area have shown many large amplitude anomalies of high signal-to-noise ratio. Observed profiles over basalt covered areas do tend to be rather "noisy". This is attributed to the conductive

overburden effects of the basalt - a limiting factor in the usefulness of VLF in the area. Conductive overburden will reduce the signal level from an underlying conductor. Thus, a low amplitude in-phase response over basalt and swamp should not be rejected as "noise".

All the VLF anomalies required testing with other methods to select those of real importance. Apart from mineralisation, structural features can also generate strong VLF anomalies. It is for this reason that I.P. and T.E.M. surveys were conducted.

The axes of the filtered in-phase components are shown in the diagrammatic summary, Drawing No. 3862 S/A. As indicated earlier, this axis may indicate the apparent edges of a wide body and not the position of its true centre.

S.P.

The entire MARINER 1 and 3 area was surveyed using a Fluke 8020A digital voltmeter with a pair of non polarising copper in copper sulphate electrodes. Readings were made (with respect to a base station established at 10 000N) at 25 metre intervals along each grid line. Measurements were made along the base line (10 000N) to tie each line to the survey measurement base, 10 000E 10 000N (0 mV).

Profiles of self potential, reduced to the main survey base, are shown in Drawing Nos. 3846 S/A, 3847 S/A, and 3848 S/A. Contours are shown in Drawing No. 3849 S/A.

The survey detected one major anomaly of -180mV amplitude at 10 900E 9 775N (also an associated peak

of -140mV at 10 700E 9 840N). A smaller but prominent anomaly of -50mV amplitude was detected at 9 800E 9 850N (previously detected by the initial MARINER 1 survey.)

Several minor S.P. zones were detected: line 10 400E at 9 970N and 9 775N, 9 600E 10 100N, 9 550E 9 750N and a broad zone over basalt cover on line 9 200E at 9 750N. They are of low amplitude and would not normally be considered significant, but the zone between lines 9 500E and 9 600E at 10 150N has associated I.P. and VLF anomalies. These zones are shown in the diagrammatic summary, Drawing No. 3862 S/A . They do not necessarily imply the area or centre portions of the causative bodies.

The major -180mV anomaly located at MARINER 3 between lines 10 600E and 11 100E correlates well with VLF results. A profile (A'A) normal to the apparent strike of the anomaly (157^{o}) was interpreted for a point dipole source. The interpretation is shown in Drawing 3893 S/A. A best fit profile is that for a point dipole inclined 25^{o} to the vertical located 100 metres below 10 915E 9 775N and producing a -160mV anomaly at the surface (a shift in local zero level of the observed profile).

Difficulty was encountered in applying a suitable model fit to the -50mV anomaly on line 9 800E. This anomaly has associated I.P. and VLF anomalies.

The large zone of high potential between lines 9 600E and 10 000E and north of 9 850N may have an associated low north of the grid. This would then indicate the presence of a self polarised body north of 10 300N 9 900E. Further survey work is required in north of the grid.

The area of low electrical potential on line 9 200E centred at 9 750N may well be due to topographic effects. Surveys west of the grid are required to further define the zone; it is located over an area of thick basalt.

I .P.

The VLF and S.P. surveys delineated two areas of major importance:- MARINER 1 at 9 800E 9 800N and MARINER 3 between lines 10 600E and 11 000E.

Dipole-dipole I.P. surveys were conducted to further test these anomalous areas. A Huntec 2.5kw 2 second time domain I.P. transmitter was used in conjunction with a Scintrex IPR-8 receiver. A dipole length of 100 metres was used for the four lines surveyed, (9 800E, 10 700E, 10 900E and 11 500E). This was considered suitable for the target size and depth extent sought. Results are presented as pseudosections of apparent resistivity, chargeability and metal factors.

Line 9 800E was initially surveyed with gradient array I.P., reported previously by Deakin (1977). The results from the survey have been interpreted by matching with computer generated model curves to

indicate a southerly dipping body with a near surface expression at 9 850N. This line was also surveyed with a dipole-dipole array centred at 9 800E.

Lines 10 700E and 10 900E required two overlapping arrays to ensure adequate survey coverage. The arrays were centred at 9 500N and 10 200N.

Pseudosections for line 10 900E are shown in Drawing No. 3858 S/A. Matching the observed pseudosections with those of computer generated models has produced some uncertainty as to the nature of the polarisable source. A single wide body (of about 3 to 3.5 dipole lengths wide) centred at 9 750N with a depth to top of the order of ½ a dipole length could produce the pseudosections observed. An alternative interpretation is two close spaced (1 to 2 dipole lengths) steeply dipping bodies.

The zone of high chargeability lies between the pair of linear VLF anomalies and is coincident with the major S.P. anomaly, see Drawing No. 3862 S/A. The low values of resistivity and chargeability south of 9 200N are attributed to the basalt cover. Difficulty was encountered in obtaining sufficiently "noise free" signals north of 10 400N.

Pseudosections for line 10 700E are shown in Drawing No. 3855 S/A. A zone of high chargeability was detected lying between the pair of linear VLF anomalies. No suitable match was found with computer generated models. (Note:- a suitable match implies matching the observed contour patterns of all three parameters to those of a given model).

A smaller dipole length (50 metres) on lines 10 700E and 10 900E would have assisted in determining the nature of the causative bodies, i.e. increased resolution.

Line 11 500E was surveyed (array centred at 9 800N) in order to test the linear VLF anomalies crossing this line at 9 750N, 9 500N, and 10 075N. Pseudo-sections are shown in Drawing No. 3857 S/A. Chargeabilities, resistivities and metal factors are low in the region of 9 750N indicating that no polarisable source is present. The VLF anomaly is thus attributed to a thick zone of conductive (low resistivity) basalt, supporting the previous interpretation of magnetic data.

At 9 550N chargeabilities and resistivities increase above those considered typical of basalt. This may indicate that the VLF anomaly at 9 550N is possibly due to a polarisable source below the basalt. This linear anomaly also strikes at about 120^{o}.

The linear VLF anomaly crossing line 11 500E at 10 075N has no associated I.P. response. It too is attributed to the basalt.

Resistivity

A Schlumberger array resistivity sounding was expanded along line 10 000N at 11 100E in order to determine the true resistivity of the basalt. The Huntec 2.5kw 2 second time domain I.P. transmitter was used as the current source. The Fluke 8020A digital

voltmeter was used to measure potentials.

The sounding curve is shown in Drawing No. 3894 S/A. The basalt has a true resistivity of about 60 ohm-m.

The sounding curve included effects from lateral inhomogeneities. Interpretation of the sounding in terms of layer thickness was considered inappropriate.

T.E.M.

Transient electromagnetic surveys were conducted on lines 9 750E, 10 750E and 10 850E to further test the two major VLF/S.P. anomalies. The surveys also served as an evaluation of the T.E.M. method in this environment.

The L.A.R. Mk 1 T.E.M. instrument was used with a 100 metre square loop centred between two grid lines. The instrument transmits a 5 millisecond current pulse through the loop. Readings of induced voltage are made at 10 selectable times after current turn off. The results are presented as profiles of decay voltages normalised to unit current.

Profiles for lines 9 750E are shown in Drawing No. 3853 S/A. The area north of 10 000N is covered by swamp. Signal levels were very low, and no useful data was obtained. The increased signal levels to the south are due to the basalt.

No T.E.M. anomaly was detected over the area of the S.P./VLF anomaly at 9 800N.

Profiles for loops centred on lines 10 750E and 10 850E are shown in Drawing No. 3854 S/A. The coincident VLF/S.P./I.P. anomalies produced no T.E.M. anomaly. Signal levels for the early decay times increased over the basalt.

The lack of a T.E.M. anomaly over these two major geophysical anomalies indicates that the causative bodies are not massive electrical conductors. Alternatively their geometry may be such to impair good E.M. and coupling with the single horizontal loop.

SUMMARY OF RESULTS

Magnetics

1. The magnetic survey has mapped the basalt contact.

2. No magnetic anomalies were detected outside the basalt covered area.

VLF-E.M.

1. The VLF survey has provided information of local strike direction, generally 120° grid.

2. Two zones of interest (having coincident S.P. and I.P. anomalies) have been delineated. MARINER 1 on line 9 800E at 9 750N and MARINER 3 between lines 10 600E and 11 000E.

3. Uncertainty exists as to whether a broad body or two close spaced conductors are the cause of the anomalies at MARINER 3.

4. The linear anomalies along 9 750N and 10 075N between 11 200E and 11 700E are attributed to the basalt.

5. A strong VLF response north of 10 200N on lines 9 900E and 10 000E and along strike from the MARINER 3 anomaly requires further survey to the north.

6. The linear VLF anomaly from about 9 200E 9 650N

to 10 100E 9 550N has weak but coincident I.P. response where gradient array I.P. surveys have been conducted.

S.P.

1. The survey located two anomalies: at MARINER 1 on line 9 800E at 9 800N (50mV) and at MARINER 3 between lines 10 600E and 11 100E (180mV).

2. A large area of low electrical potential was detected on line 9 200E between 9 600N and 9 950N. Further survey is required west of the grid to adequately define this zone.

3. An additional four small zones of low electrical potential were located but are considered of little importance.

4. The 180mV anomaly at MARINER 3 was interpreted for a point dipole source. A best fit model indicates a source centred 100 metres below 9 775N 10 915E on line A'A Drawing No. 3893 S/A.

5. The large zone of high electrical potential between lines 9 600E and 10 000E and north of 9 850N may have an associated 'low' north of 10 300N indicating the presence of a self polarised source in that area. Further survey work is required.

I.P. and Resistivity

1. Gradient array surveys located two areas of interest on MARINER 1: line 9 800E at 9 825N and north of 10 000N on lines 9 700E and 9 600E.

2. The anomaly on line 9 800E suggests that the causative body dips to the south with a near surface expression at 9 850N. This interpretation agrees with that of the VLF survey.

3. Dipole-dipole survey on line 9 800E confirmed the interpretation of the gradient array survey.

4. Gradient array surveys on lines 9 900E to line 10 200E showed several weakly polarisable zones, but these are considered to be of little importance.

5. Dipole-dipole surveys on lines 10 700E and 10 900E located broad zones of high chargeability, coincident with VLF and S.P. results. Uncertainty exists as to whether the polarisable source is a single wide body or two closely spaced steeply dipping bodies.

6. Dipole-dipole survey on line 11 500E (over basalt) indicated no polarisable sources at 9 750N and 10 075N (VLF anomaly). The results indicate a polarisable zone at 9 500N (VLF anomaly).

7. Resistivities for the basement rocks are of the order of 1200 ohm-m. The basalt has a resistivity of about 60 ohm-m.

T.E.M.

1. The coincident VLF/S.P./I.P. anomalies on MARINER 3 and MARINER 1 produced no T.E.M. anomaly.

2. The basalt produced a significant T.E.M. response at early decay times.

3. No useful data was obtainable over swamp areas.

A diagrammatic summary of the results for the combined MARINER 1 and MARINER 3 area is shown in Drawing No. 3862 S/A.

CONCLUSIONS

The VLF survey has located three linear anomalies crossing the grid diagonally at about 120° (grid). The S.P. survey has located two anomalies. They are coincident with portions of 2 of the linear VLF anomalies. These anomalies have been tested with I.P. and T.E.M. and recommendations are made elsewhere in this report for their testing with diamond drill holes.

The VLF has proved most useful as a complete coverage survey tool. In conjunction with S.P., it has located the areas worthy of further testing with I.P. and T.E.M. It has also indicated the strike direction and probable extent of the major anomalies.

The usefulness of VLF over the basalt can only be determined by comparison with magnetic data and testing anomalies with I.P.

The low resistivity of the overlying basalt is a severe limitation to any electrical and E.M. methods. In areas of thick cover VLF, T.E.M. and I.P. will be ineffective in "seeing through" this conductive overburden. Noisy and low amplitude T.E.M. signals over swampy areas may restrict the use of T.E.M. in this environment.

RECOMMENDATIONS

Should the prospect warrant testing by drilling, on the basis of contrived geological, geochemical and geophysical considerations, the following drill hole specifications should adequately test the major geophysical anomalies.

MARINER 1:- A diamond drill hole inclined at about 60° in a direction north (grid) on line 9 800E to pass through a point 100 metres below 9 800E 9 825N ought to test this coincident VLF/S.P./I.P. anomalies.

MARINER 3:- A diamond drill hole inclined at about 60° in the direction 247° (grid) (on cross section A'A, Drawing No. 3893 S/A) to pass through a point 100 metres below 9 775N 10 915E ought to test the S.P. anomaly.

No further geophysical work is recommended for the presently gridded area.

If further work is warranted (because of encouraging geological, and geochemical results) it is recommended that S.P. and VLF surveys be extended north. These surveys should establish the extent of the S.P. and VLF responses on that side of the grid.

Magnetic surveys should also be conducted to locate the basalt contact and to assist, if necessary, in delineating those VLF anomalies caused by the basalt.

Extensions of the grid west to further examine the area of low electrical potential at 9 200E 9 750N should also be subject to the results of geology and geochemistry.

Pending the results of geochemistry and drilling, surveys may be required to the south between lines 11 000E and 11 700E to determine the extent of the MARINER 3 anomaly. In the light of previous discussions, VLF and S.P. may well prove ineffective over this area of (possibly) thick basalt.

APPENDICES & REFERENCES

I.P. Metal Factors

Metal factors for the I.P. survey were calculated using:-

$$MF = \frac{M_{232}}{\rho a} \times t \times 2000 \quad \left[\Omega^{-1} \; m^{-1}\right]$$

where

M_{232} = M_{232} portion of the Scintrex IPR-8 decay curve $\left[mVV^{-1}\right]$

ρa = apparent resistivity $\left[\Omega m\right]$

t = integration period for the Scintrex IPR-8 M_{232} component, 520ms.

2000 is a scaling factor to obtain the units $\Omega^{-1}m^{-1}$

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DEAKIN, R. C. 1977: Geophysical Progress Report on MARINER 1, Tasmania, L. A. Richardson & Assoc. Company Report.

S. T. Mudge

E.L. 10/79

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3858 S/A	Pseudosections of Dipole-Dipole I.P. Line 10 900E
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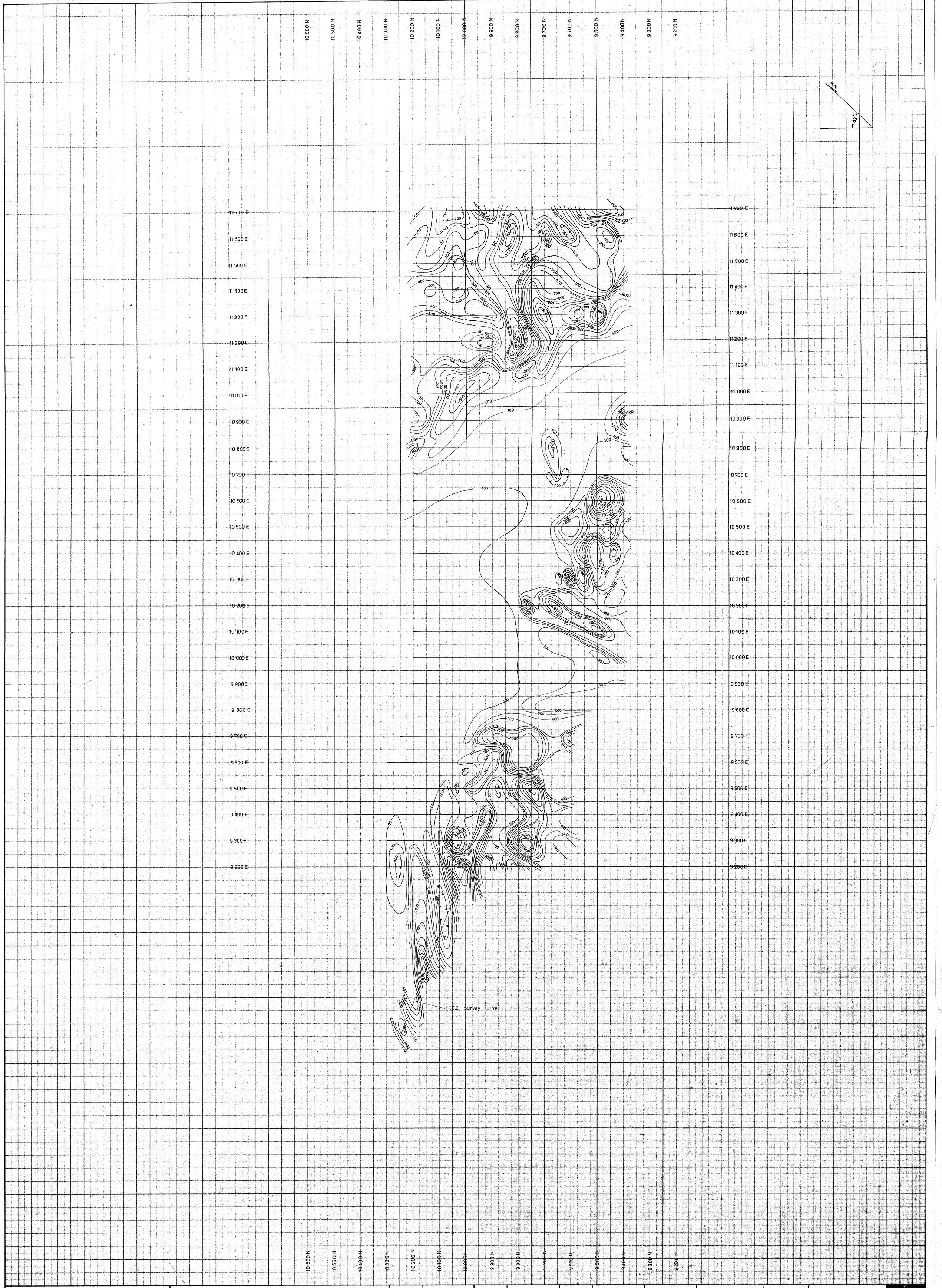

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	5 cm	Observer	S. Mudge & I. Ogilvie	Base Reg	9 800 E / 10 000 N	Vert Scale	———	PROSPECT.	MARINER 1. 78-1294
		Scale Fact	———	Date	December 1977	Cont Int	100 nT. & 400 nT.	PLAN SHOWS.	Geomagnetic Total Force Contours.

GEOPEKO LTD Geophysical Surveys. Plan No. 3334 1025	Instrument	Geonics EM 16	Datum	0 %	Hor Scale	1:5 000	AREA	Black Bluff - Tasmania
	Observer	S. Mudge	Base Peg		Vert. Scale	1 cm = 5 %	PROSPECT	MARINER 1
	Scale Fact.	———	Date	January 1977	Cont. Int.	———	PLAN SHOWS	VLF EM Profiles.

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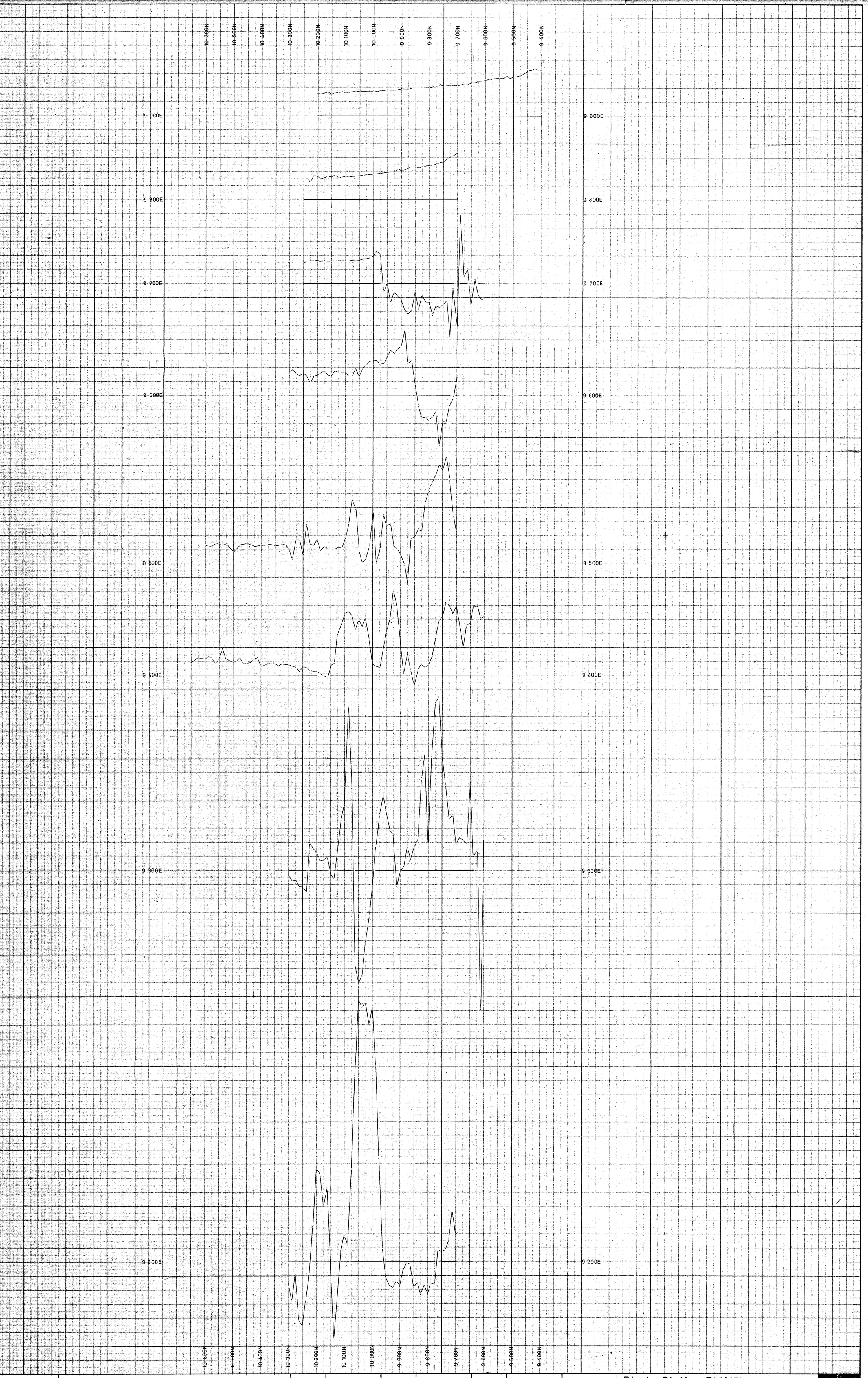
232031



GEOPEKO LTD. 232032 Geophysical Surveys. Plan No. 3598 S/A 1026						AREA	Black Bluff EL10/74 78-1294
	5 cm	Instrument	Geometrics 816	Datum	62 000nT	Hor Scale	1cm = 50metres	PROSPECT.	MARINER 13
		Observer	S. Mudge I. Ogilvie	Base Peg	9 800E/10 000N	Vert Scale	200nT	PLAN SHOWS.	Geomagnetic Total Force Profiles - Sheet 1
		Scale Fact		Date	December 1977	Cont Int			

10 200N | 10 100N | 10 000N | 9 900N | 9 800N | 9 700N | 9 600N | 9 500N | 9 400N

11 200E

11 100E

11 000E

10 900E

10 800E

10 700E

10 600E

10 500E

10 400E

10 300E

10 200E

10 100E

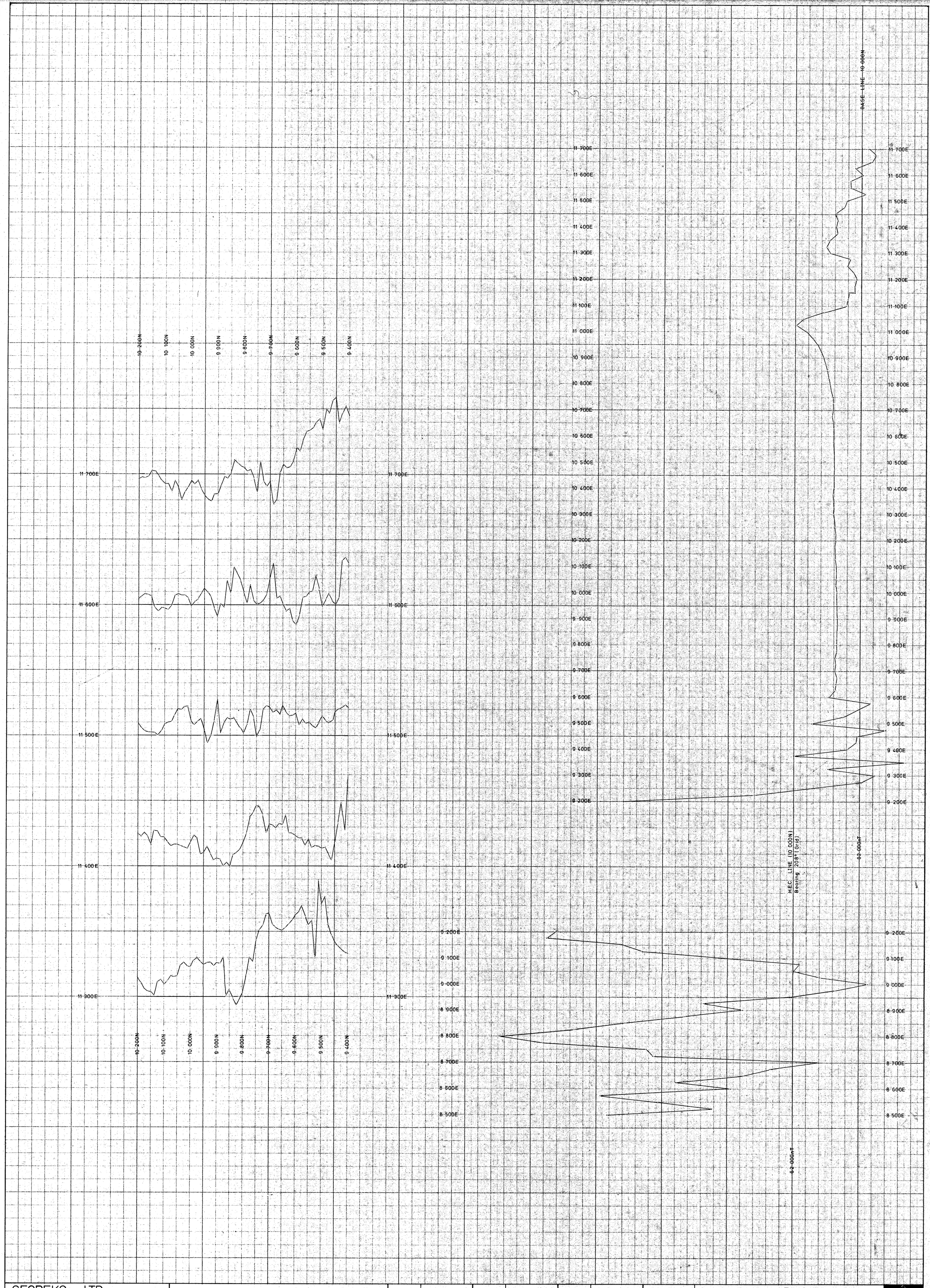
10 000E

10 200N | 10 100N | 10 000N | 9 900N | 9 800N | 9 700N | 9 600N | 9 500N | 9 400N

GEOPEKO LTD. 232033
Geophysical Surveys.
Plan No. 3599 S/A 1027

5 cm

Instrument	Geometrics 816	Datum	62 000nT	Hor Scale	1cm = 50metres	AREA	Black Bluff EL10/74 78-1294
Observer	S Mudge I Ogilvie	Base Pag	9 800E/10 000N	Vert Scale	200nT	PROSPECT.	MARINER 3
Scale Fact		Date	December 1977	Cont Int		PLAN SHOWS.	Geomagnetic Total Force Profiles - Sheet 2

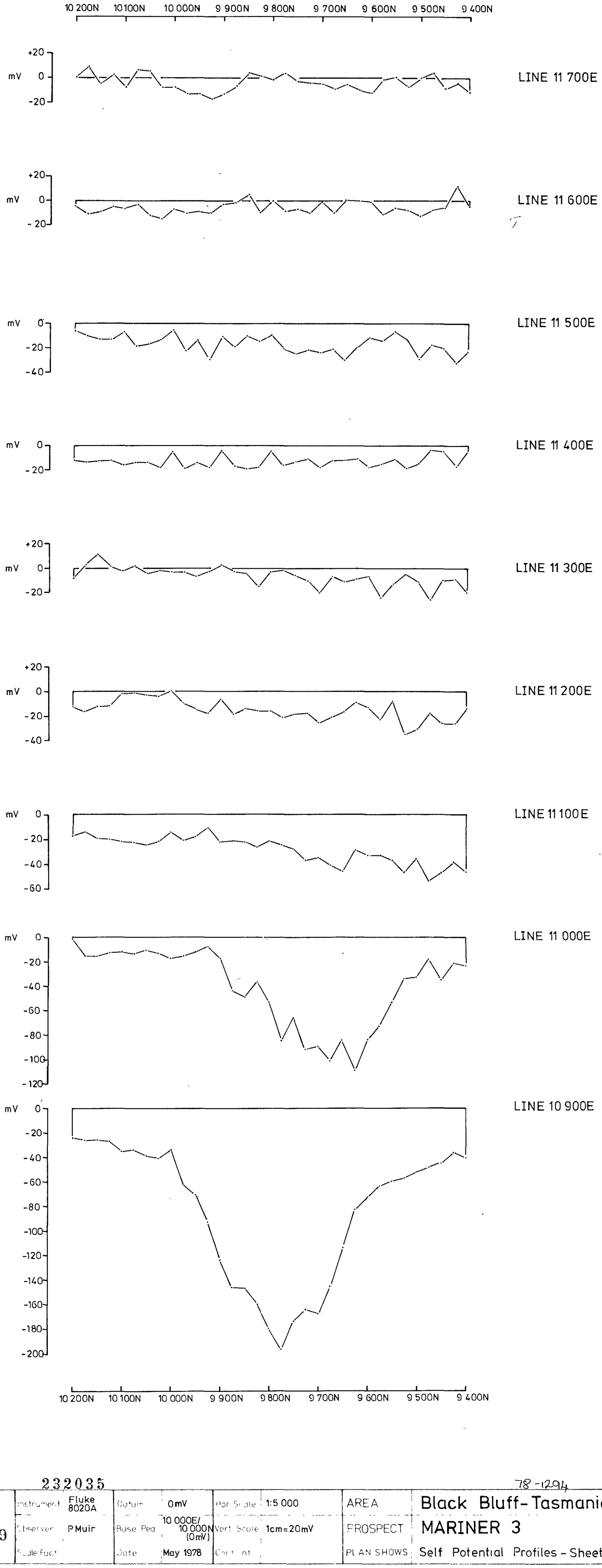


GEOPEKO LTD.
Geophysical Surveys.
Plan No. 3600S/A

232034 1028

5 cm

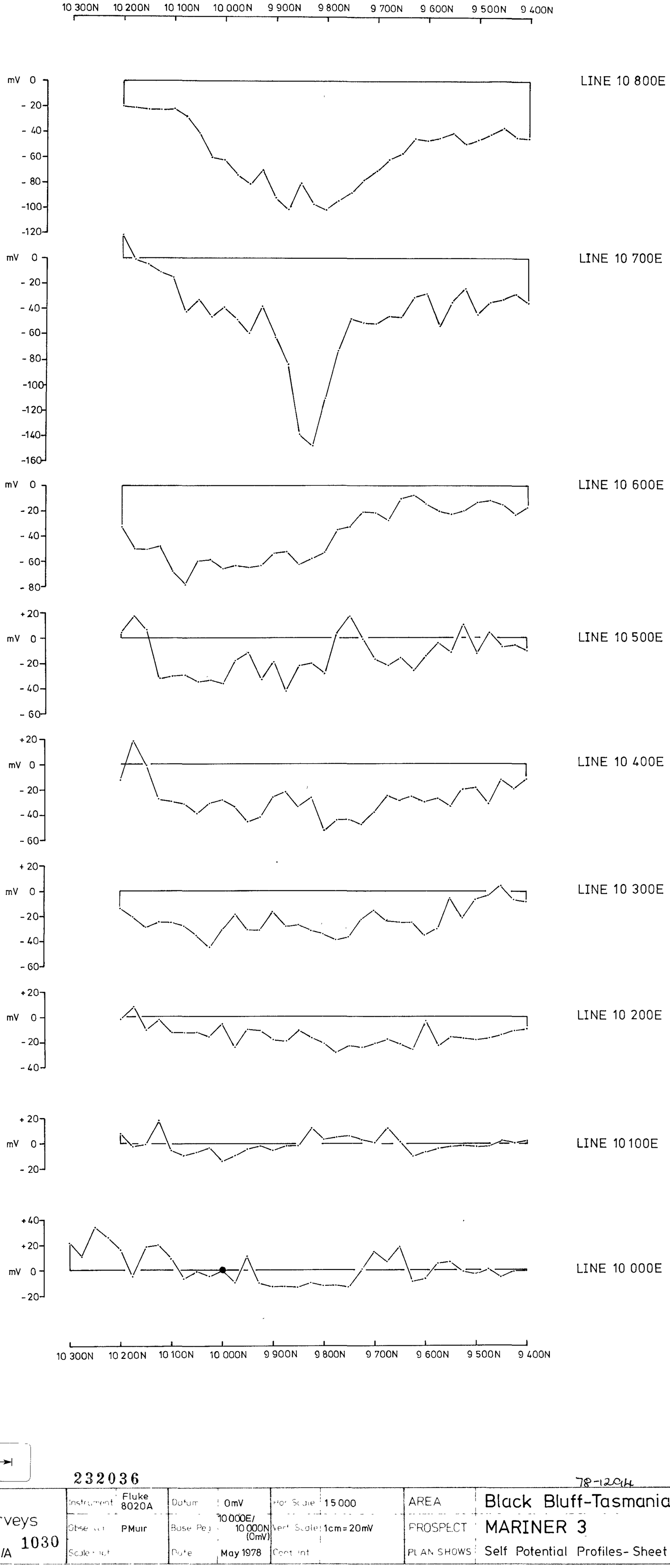
Instrument	Geometrics 816	Datum	62 000 nT	Hor Scale	1cm = 50metres	AREA	Black Bluff EL10/74 78-1294
Observer	S. Mudge I. Ogilvie	Base Pag	9 800E/10 000N	Vert Scale	200nT	PROSPECT.	MARINER 3
Scale Fact		Date	December 1977	Cont Int		PLAN SHOWS.	Geomagnetic Total Force Profiles Sheet 3



232035

78-1294

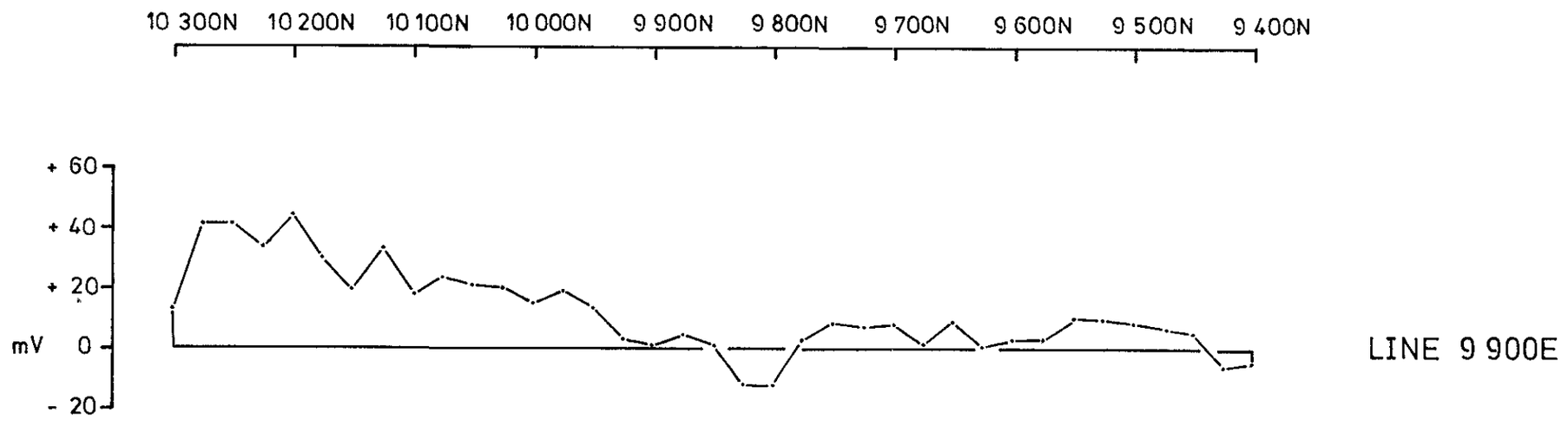
GEOPEKO LTD Geophysical Surveys 1029 Plan No 3846 S/A	Instrument: Fluke 8020A	Datum: 0mV	Hor Scale: 1:5 000	AREA	Black Bluff-Tasmania
	Observer: P Muir	Base Pea: 10 000E/ 10 000N (0mV)	Vert Scale: 1cm=20mV	PROSPECT	MARINER 3
	Scale Fact:	Date: May 1978	Contour:	PLAN SHOWS	Self Potential Profiles - Sheet 1 of 3



232036

78-129H

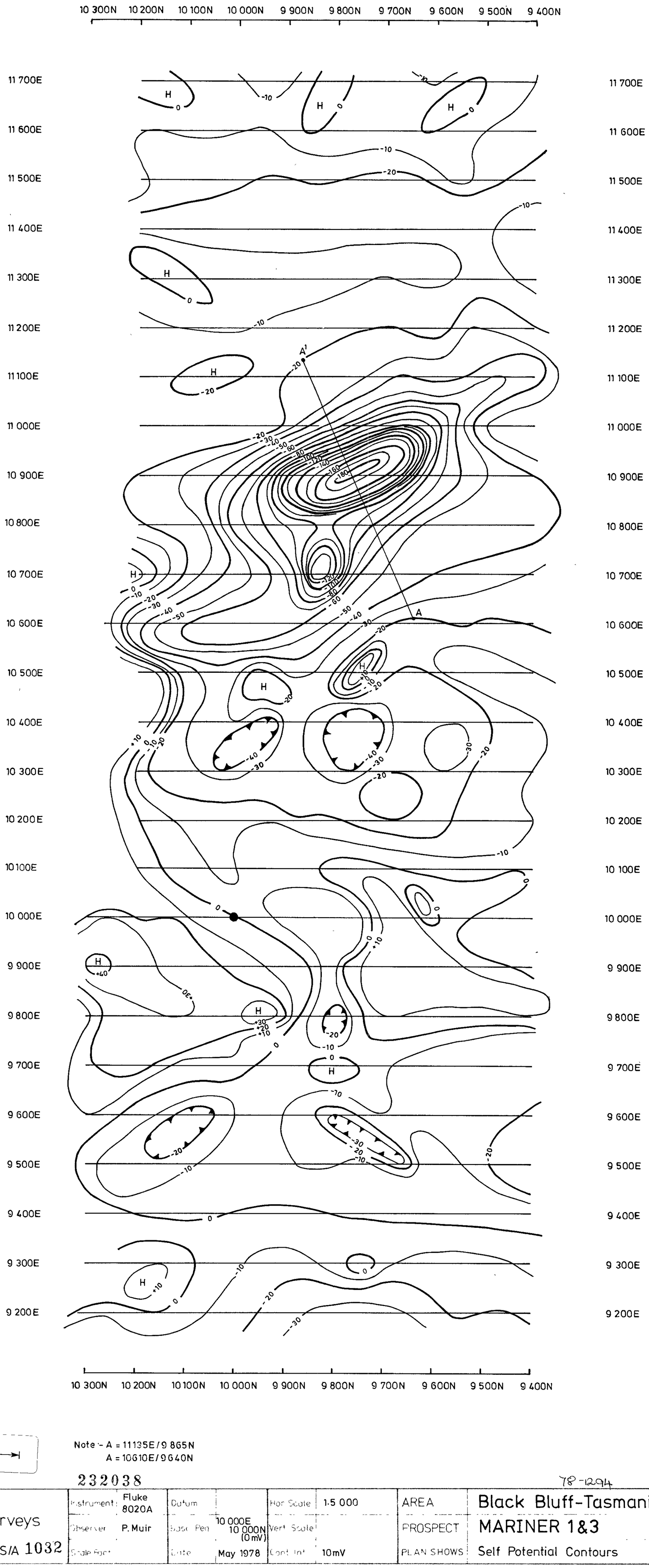
GEOPEKO LTD Geophysical Surveys Plan No 3847 S/A 1030	Instrument: Fluke 8020A	Datum: 0mV	Hor Scale: 1:5 000	AREA	Black Bluff-Tasmania	
	Observer: PMuir	Base Peg: 10 000E/ 10 000N (0mV)	Vert Scale: 1cm=20mV	PROSPECT	MARINER 3	
	Scale: not	Date: May 1978	Contour Int:	PLAN SHOWS	Self Potential Profiles- Sheet 2 of 3	



232037

78-1294

GEOPEKO LTD. Geophysical Surveys 1031	Instrument	Fluke 8020A	Datum	0 mV	Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	P.Muir	Base Peg	10 000E/ 10 000N (0mV)	Vert Scale	1cm = 20mV	PROSPECT	MARINER 1
Plan No 3848 S/A	Scale Fact		Date	May 1978	Cont Int		PLAN SHOWS	Self Potential Profiles - Sheet 3 of 3



5 cm

Note :- A = 11135E/9 865N
A = 10610E/9640N

232038

78-1294

GEOPEKO LTD Geophysical Surveys	Instrument	Fluke 8020A	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	P. Muir	Base Peg	10 000E 10 000N (0 mV)	Vert Scale		PROSPECT	MARINER 1&3
Plan No 3849 S/A 1032	Scale Fact		Date	May 1978	Cont Int	10mV	PLAN SHOWS	Self Potential Contours

10 200N 10 100N 10 000N 9 900N 9 800N 9 700N 9 600N 9 500N 9 400N

+10 + 5 % 0 - 5 -10 -15

LINE 11 700E

LINE 11 600E

+10 + 5 0 % -5 -10 -15 -20

+ 5 % 0 - 5 -10 -15 -20 -25

LINE 11 500E

LINE 11 400E

+ 15 + 10 + 5 0 % -5 -10 -15 -20 -25 -30 -35 -40

+15 +10 + 5 % 0 - 5 -10 -15 - 20 - 25

LINE 11 300E

LINE 11 200E

+15 +10 + 5 0 % -5 -10 -15

+ 15 + 10 + 5 % 0 - 5 -10 -15 -20 -25 -30 -35

LINE 11 100E

10 000N Line (Base Line)

N(Mag) 47°(Mag.) 317°(Mag.) Survey Line NWC 290°(Mag) 227°(Mag.) Direction of readings

-IN-PHASE

QUADRATURE

Sheet 1

Sheet 2

Sheet 3

10 200N 10 100N 10 000N 9 900N 9 800N 9 700N 9 600N 9 500N 9 400N

232039

Note - Transmitter - North West Cape (NWC)

5 cm

78-1294

GEOPEKO LTD. Geophysical Surveys	Instrument	EM16	Datum	0%	Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S Mudge	Base Peg		Vert Scale	1cm = 5%	PROSPECT	MARINER 3
Plan No 3850 S/A 1033	Scale Fact		Date	May 1978	Cont Int		PLAN SHOWS	Profiles of VLF-EM - Sheet 1 of 3

LINE 11 000E

LINE 10 900E

LINE 10 800E

LINE 10 700E

LINE 10 600E

LINE 10 500E

10 200N 10 100N 10 000N 9 900N 9 800N 9 700N 9 600N 9 500N 9 400N

+15 +10 +5 0 % -5 -10 -15 -20 -25 -30

+25 +20 +15 +10 +5 % 0 -5 -10 -15 -20 -25 -30 -35

+20 +15 +10 +5 0 % -5 -10 -15 -20 -25 -30

+15 +10 +5 % 0 -5 -10 -15 -20 -25 -30

+20 +15 +10 +5 0 % -5 -10 -15 -20

+30 +25 +20 +15 +10 +5 % 0 -5 -10 -15 -20 -25

——IN-PHASE
------QUADRATURE

Sheet 1
Sheet 2
Sheet 3

232040

Note - Transmitter - North West Cape (NWC)

5 cm

10 000N Line (Base Line)

N (Mag) 47° (Mag.)

Survey Line

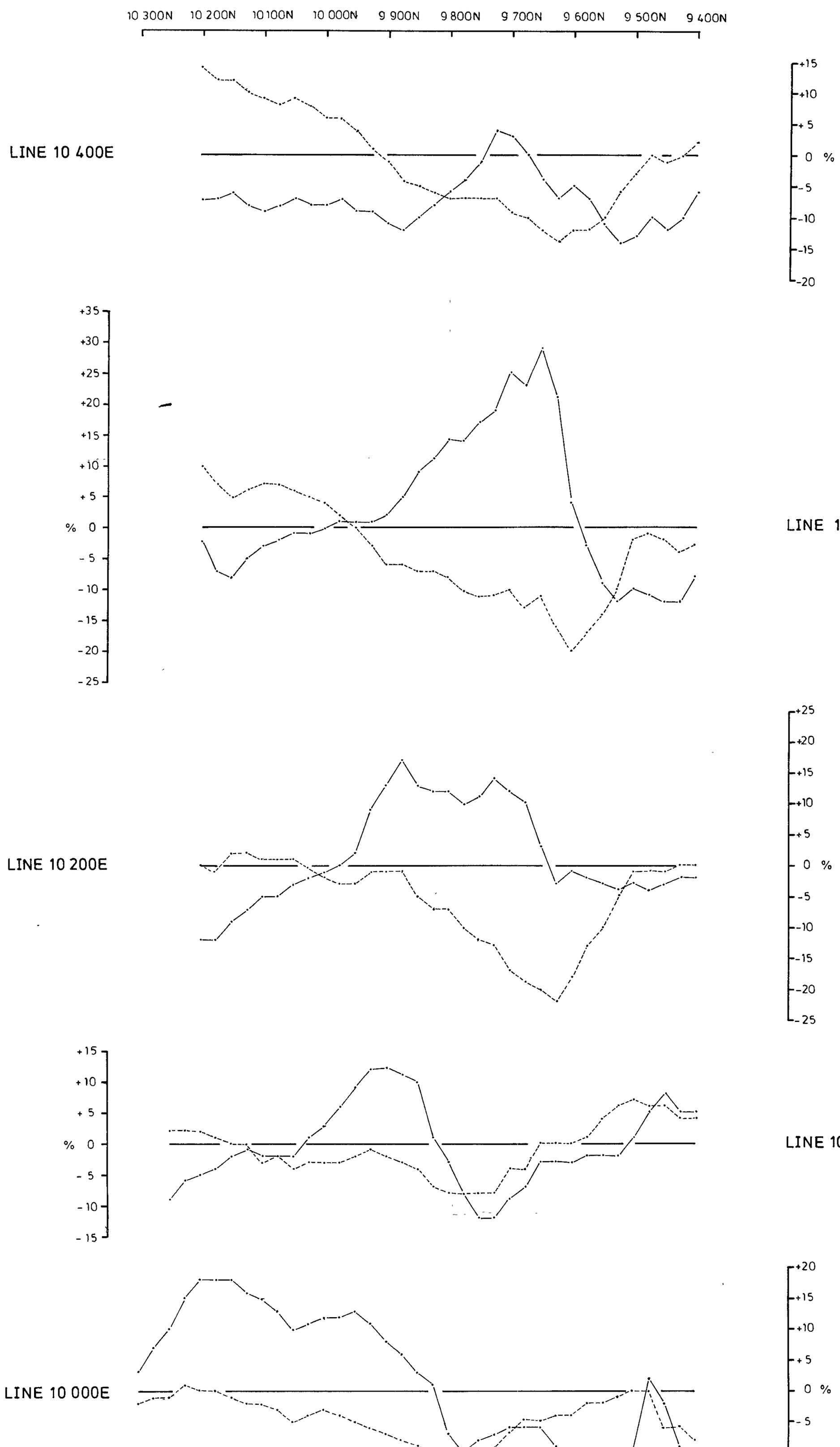
317° (Mag.)

NWC 290° (Mag.)

227° (Mag.) Direction of readings

78-1294

GEOPEKO LTD Geophysical Surveys	Instrument	EM16	Datum	0%	Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S Mudge	Base Peg		Vert Scale	1cm=5%	PROSPECT	MARINER 3
Plan No 3851 S/A 1034	Scale Fact		Date	May 1978	Cont Int		PLAN SHOWS	Profiles of VLF-EM - Sheet 2 of 3

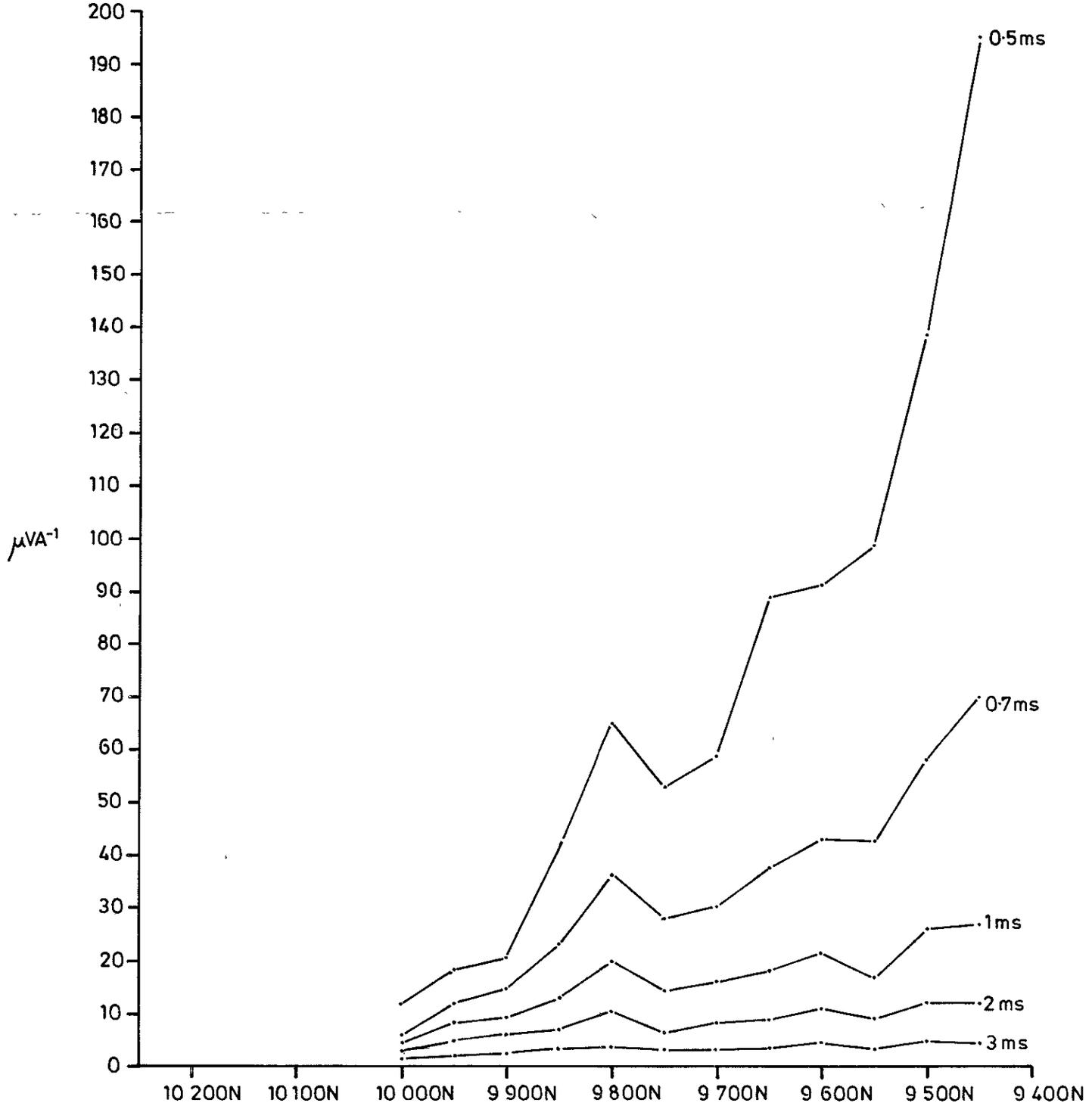


232041

Note - Transmitter - North West Cape (NWC)

78-1294

GEOPEKO LTD Geophysical Surveys 1035	Instrument EM16	Datum	0%	Hor Scale	1 5 000	AREA	Black Bluff-Tasmania
	Observer S Mudge	Base Peg		Vert Scale	1cm=5%	PROSPECT	MARINER 1&3
Plan No 3852 S/A	Scale Fact	Date	May 1978	Cont Int		PLAN SHOWS	Profiles of VLF-EM - Sheet 3 of 3

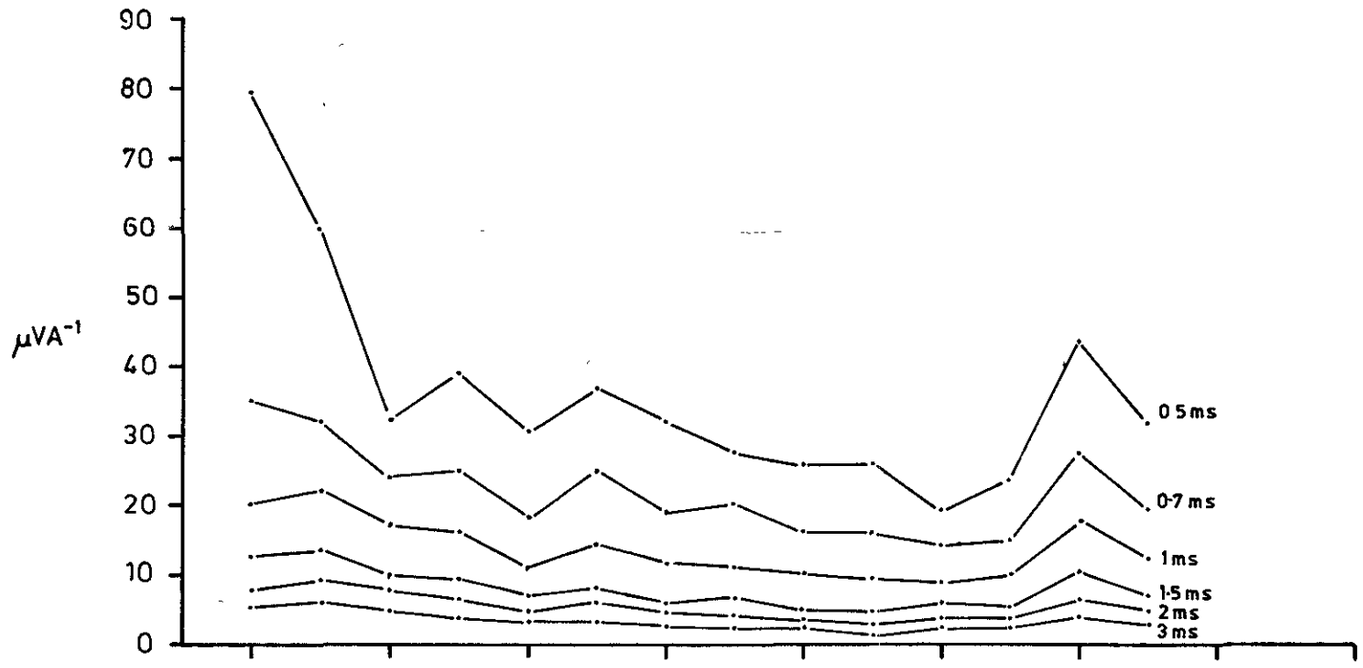


232042

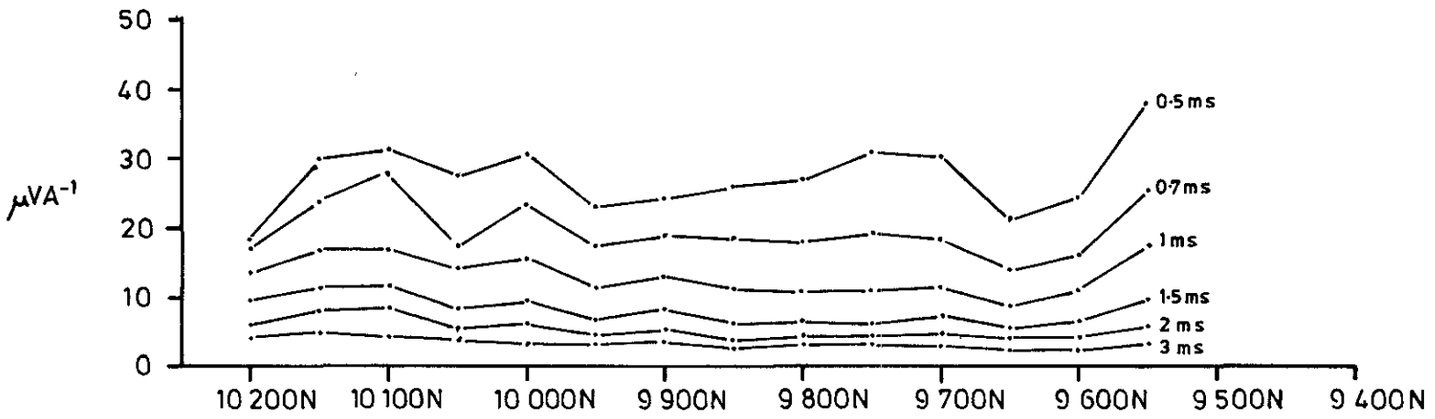
78-1294

Note-Single 100m Square Loops

GEOPEKO LTD. Geophysical Surveys. Plan No. 3853 S/A 1036	Instrument	LAR MK1	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S.Mudge	Base Peg		Vert Scale	1cm=10μVA⁻¹	PROSPECT	MARINER 1 - LINE 9 750E
	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	TEM Profiles



LINE 10 850E



LINE 10 750E

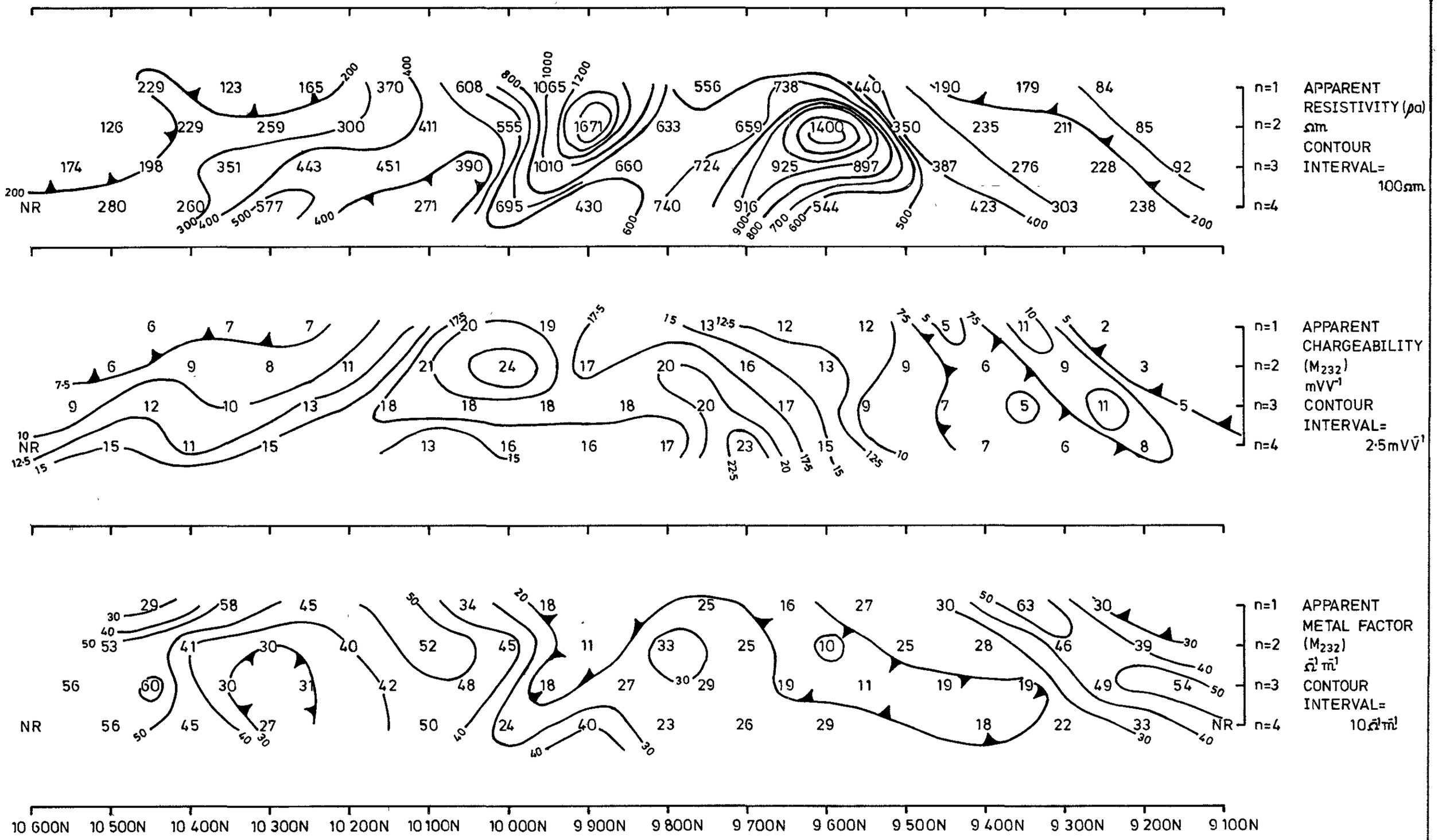
232043

5 cm

Note:-Single 100m Square Loops

78- 1294

GEOPEKO LTD Geophysical Surveys 1037 Plan No. 3854 S/A	Instrument	LAR MK1	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S Mudge	Base Peg		Vert Scale	1cm=10μVA⁻¹	PROSPECT	MARINER 3
	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	TEM Profiles



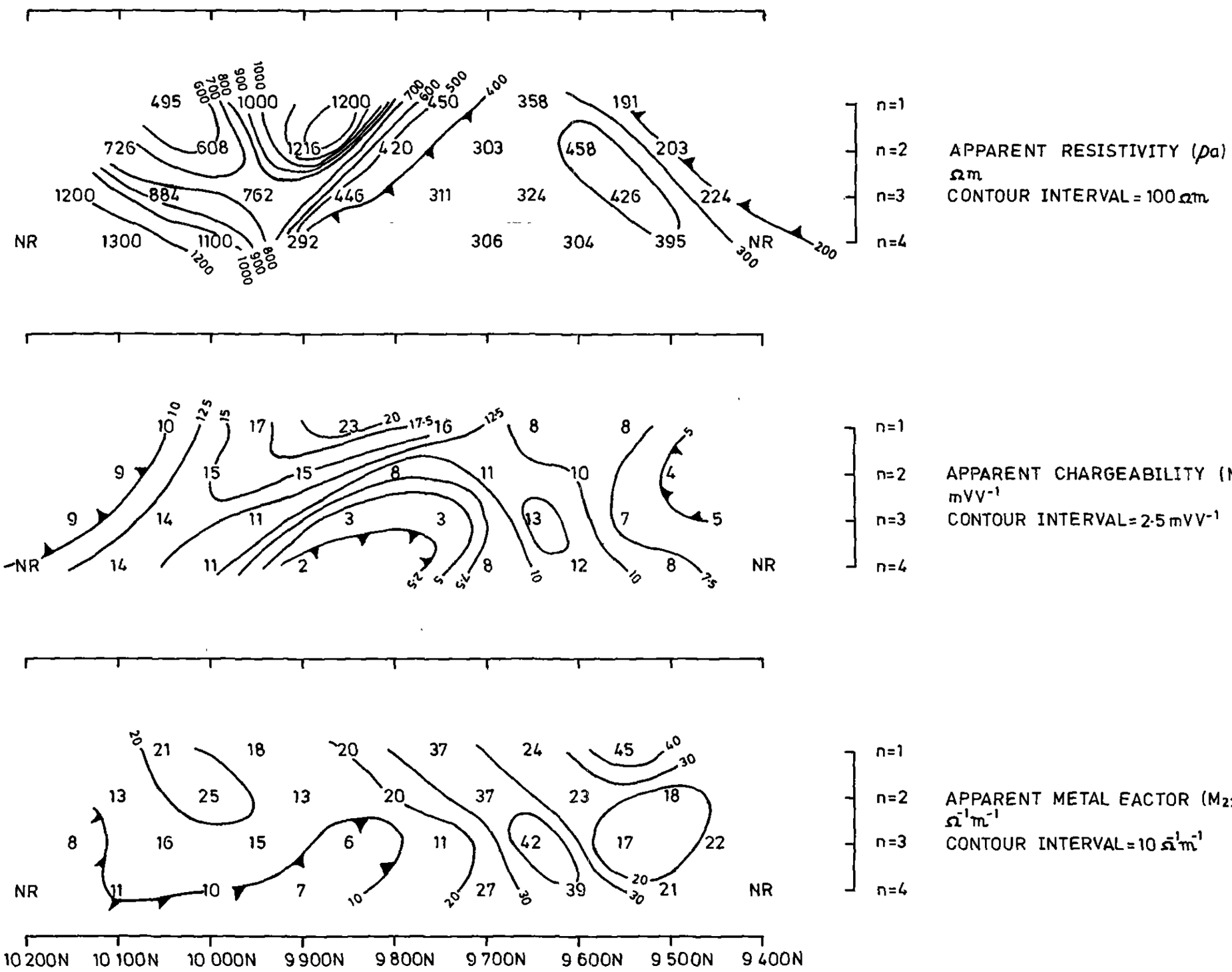
232044

Note:- Dipole Length = 100m
NR = No Reading

5 cm

78-12C14

GEOPEKO LTD. Geophysical Surveys. 1039 Plan No. 3855 S/A	Instrument	IPR-8	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S Mudge P.Muir	Base Peg		Vert Scale		PROSPECT	MARINER 3 LINE 10 700E
	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	Pseudosections of Dipole-Dipole IP/Resistivity



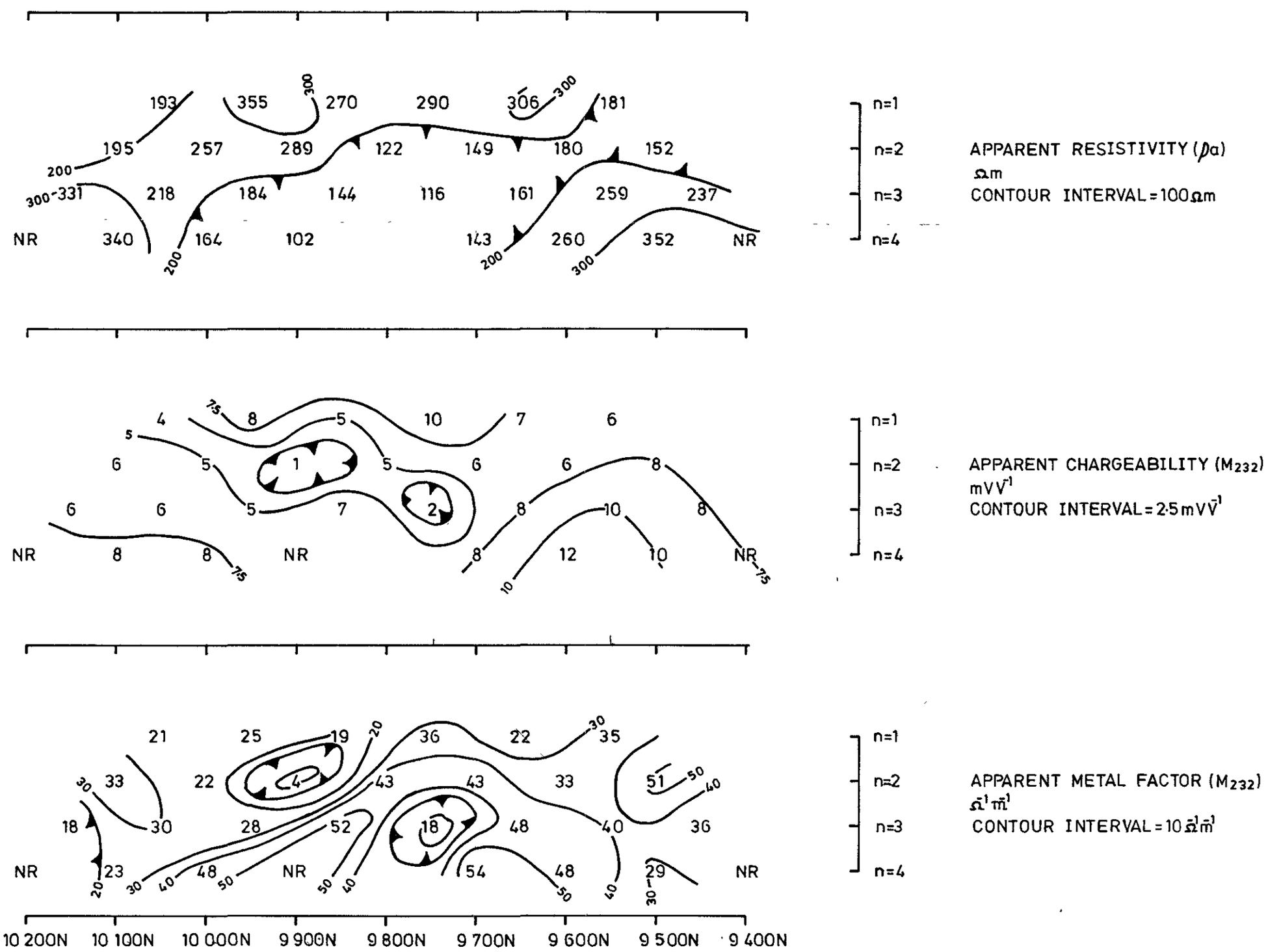
232045

Note:- NR = No Reading
Dipole Length = 100 m

5 cm

78-1294

GEOPEKO LTD. Geophysical Surveys. Plan No. 3856 S/A 1038	Instrument	IPR-8	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	P.Muir S Mudge	Base Peg		Vert Scale		PROSPECT	MARINER 1 LINE 9 800E
	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	Pseudosections of Dipole-Dipole IP/Resistivity



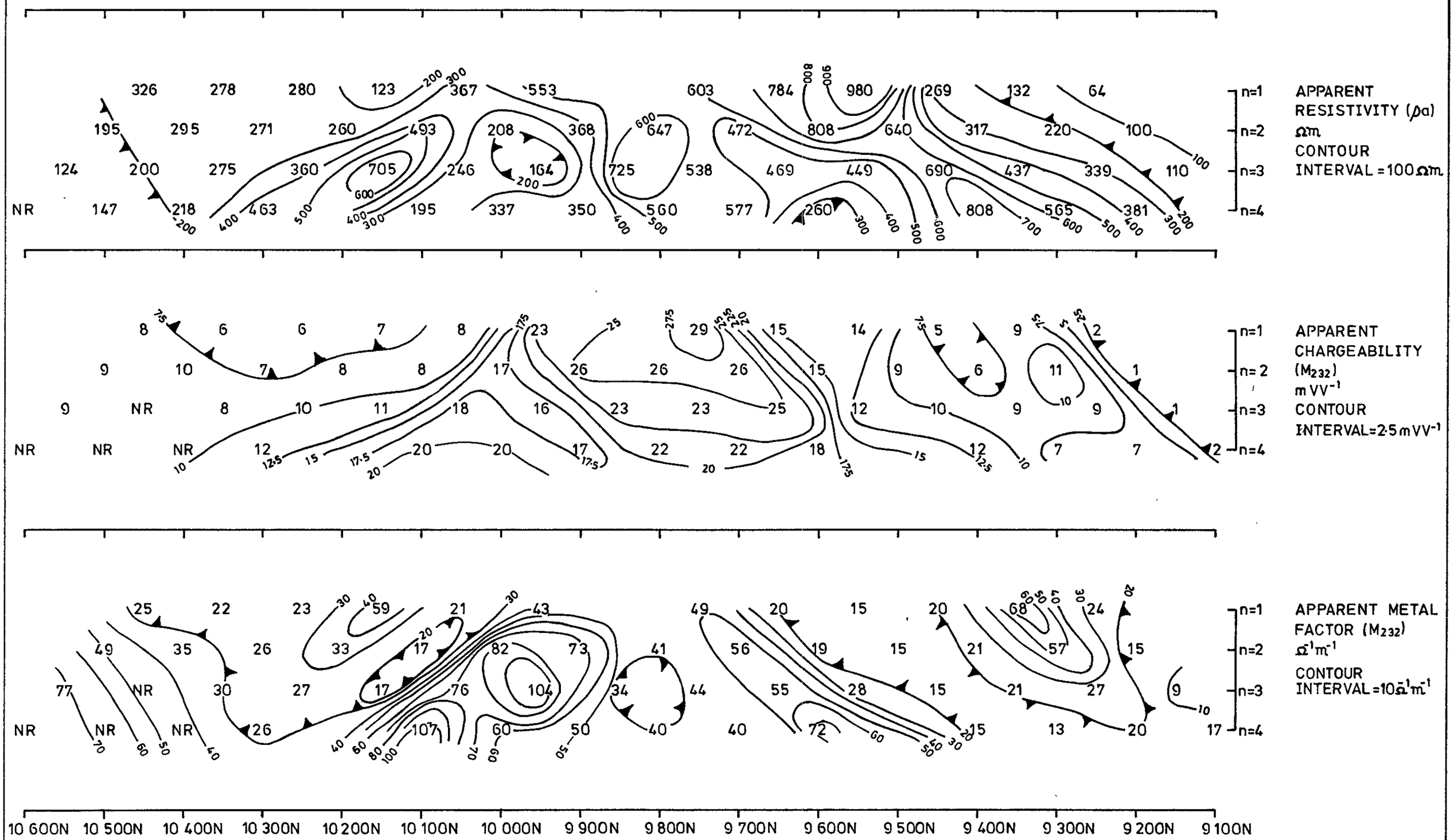
232046

5 cm

Note:- Dipole Length = 100 m
NR = No Reading

78-1294

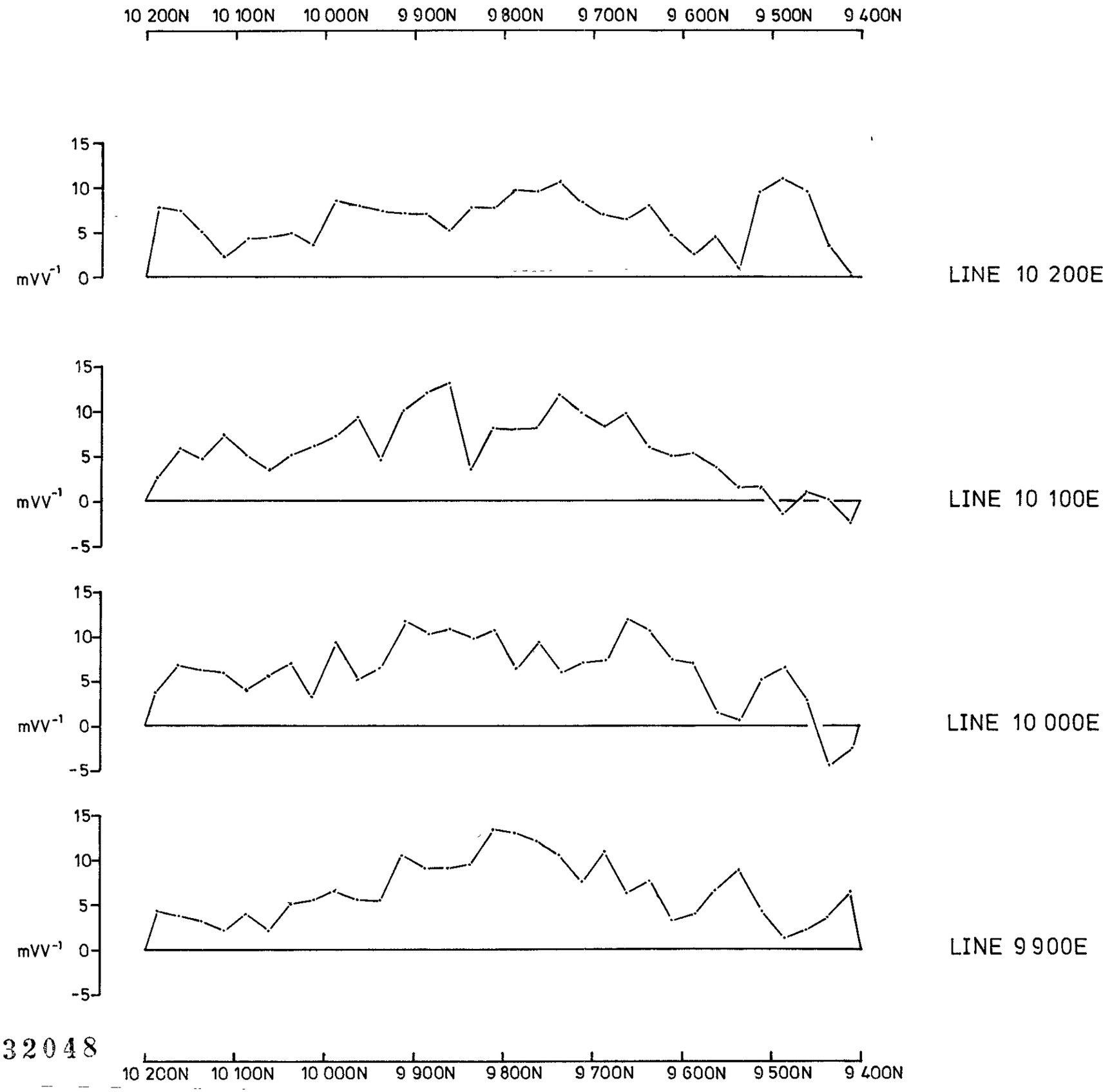
GEOPEKO LTD. Geophysical Surveys	Instrument	IPR-8	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S.Mudge P.Muir	Base Peg		Vert Scale		PROSPECT	MARINER 3 LINE 11 500E
Plan No 3857 S/A 1040	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	Pseudosections of Dipole-Dipole IP/Resistivity



232047

78-1294

GEOPEKO LTD. Geophysical Surveys. 1041 Plan No. 3858 S/A	Instrument	IPR-8	Datum		Hor Scale	1·5 000	AREA	Black Bluff-Tasmania
	Observer	S. Mudge P Muir	Base Peg		Vert Scale		PROSPECT	MARINER 3 LINE 10 900E
	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	Pseudosections of Dipole-Dipole IP/Resistivity

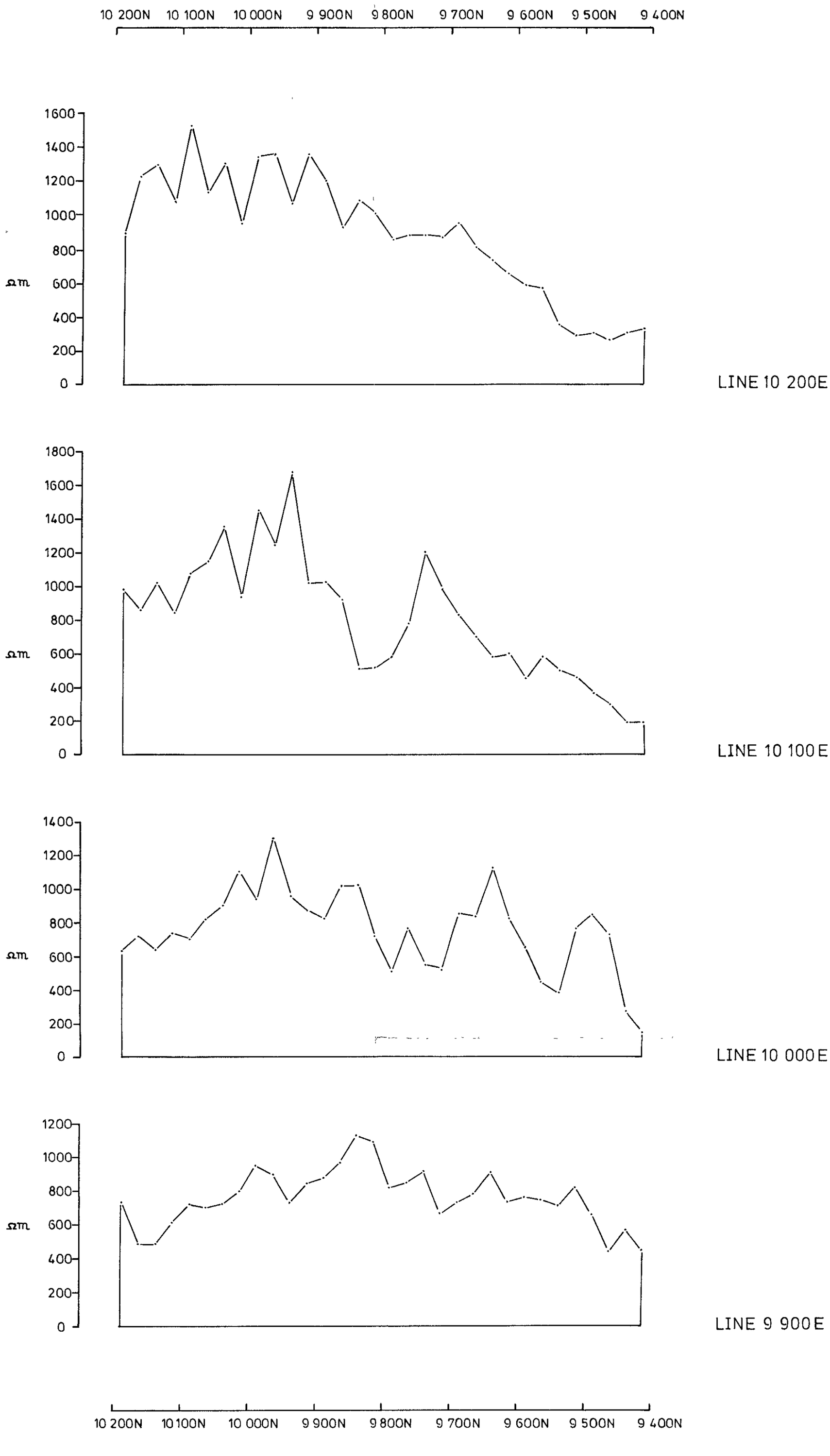


Note:- Receiver Dipole=25m
Current Electrodes at
10 400E/10 800N and
10 400E/ 8 800N

232048

78-1294

GEOPEKO LTD Geophysical Surveys 1042 Plan No 3859 S/A	Instrument IPR-8	Datum	0mVV⁻¹	Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer I.Ogilvie	Base Peg		Vert Scale	1cm=5mVV⁻¹	PROSPECT	MARINER 3
	Scale Fact	Date	Dec. 1977	Cont Int		PLAN SHOWS	Profiles of Gradient Array IP-Apparent Chargeability (M_{232})



Note Current Electrodes at 10 400E/10 800N and 10 400E/8 800N
Receiver Dipole = 25m

5 cm

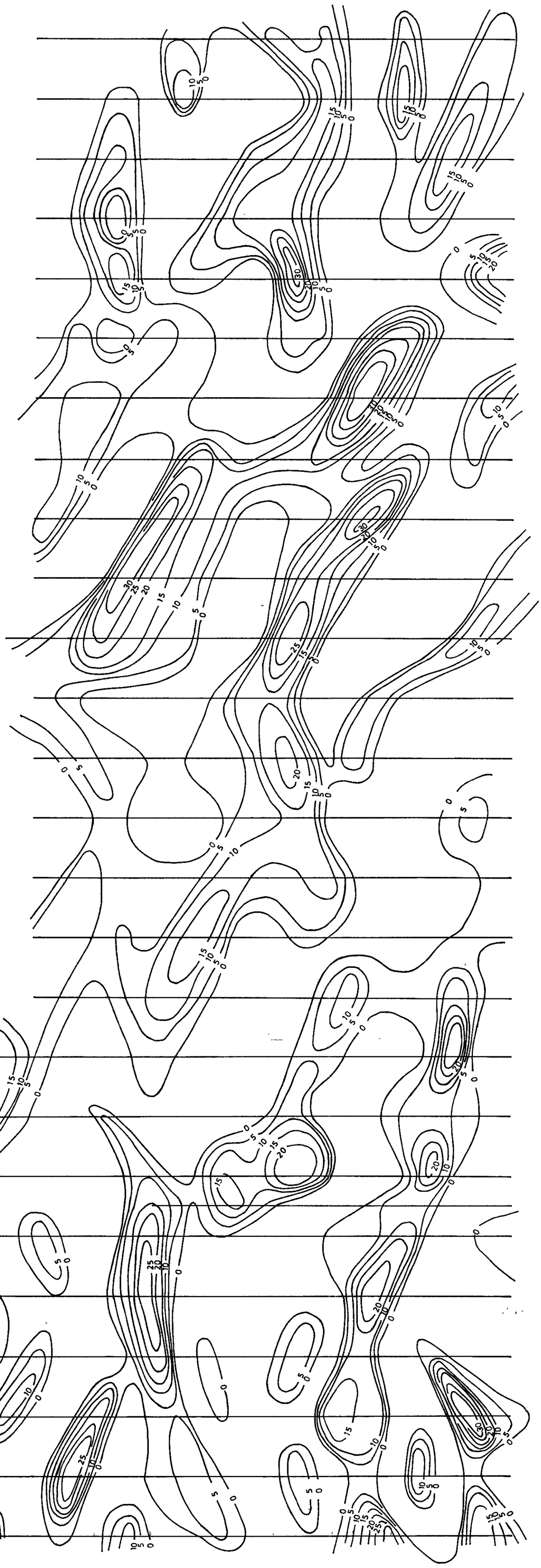
232049

78-1294

GEOPEKO LTD Geophysical Surveys 1043 Plan No 3860 S/A	IPR-8 I Ogilvie	0Ωm Dec 1977	1 5 000 1cm = 200Ωm	AREA Black Bluff-Tasmania PROSPECT MARINER 3 PLAN SHOWS Profiles of Gradient Array Apparent Resistivity

10 300N 10 200N 10 100N 10 000N 9 900N 9 800N 9 700N 9 600N 9 500N 9 400N

11 700E
11 600E
11 500E
11 400E
11 300E
11 200E
11 100E
11 000E
10 900E
10 800E
10 700E
10 600E
10 500E
10 400E
10 300E
10 200E
10 100E
10 000E
9 900E
9 800E
9 750E
9 700E
9 600E
9 500E
9 400E
9 300E
9 200E



N(Mag)
BASE LINE
SURVEY LINES
NWC
290°(Mag)

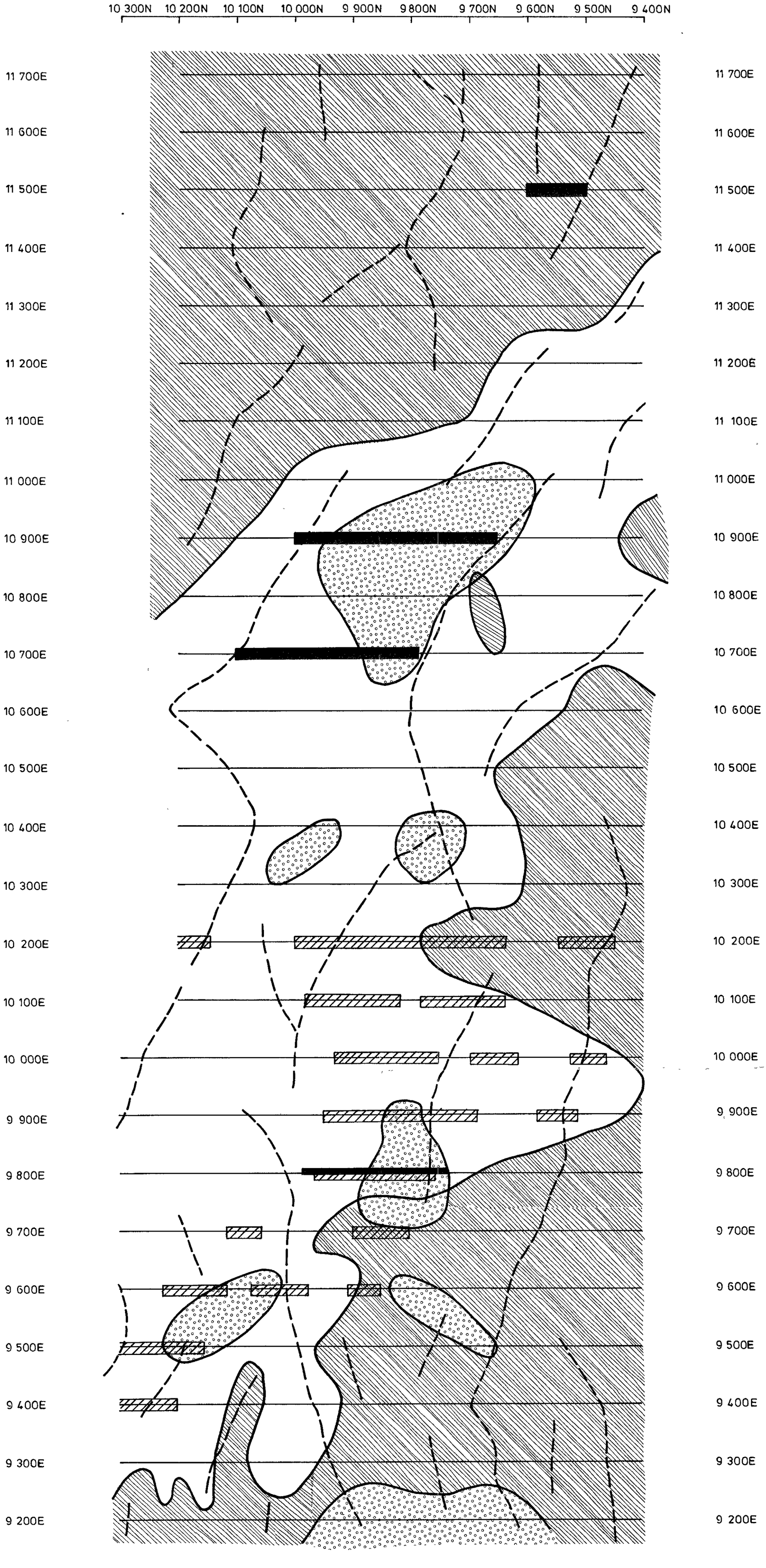
5 cm

Note:-Transmitter North West Cape (NWC)

232050

78-1294

GEOPEKO LTD. Geophysical Surveys.	Instrument	EM 16	Datum		Hor Scale	1:5 000	AREA	Black Bluff-Tasmania
	Observer	S.Mudge	Base Peg		Vert Scale		PROSPECT	MARINER 1&3
Plan No. 3861 S/A 1044	Scale Fact		Date	May 1978	Cont Int	5%	PLAN SHOWS	Contours of Filtered In-phase VLF-EM



78-1294

GEOPEKO LTD 1045 Geophysical Surveys	Instrument		Datum		Hor Scale	1:5 000	AREA	Black- Bluff-Tasmania
	Observer	S.Mudge	Base Peg		Vert Scale		PROSPECT	MARINER 1&3
Plan No 3862 S/A	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	Diagrammatic Interpretation Summary

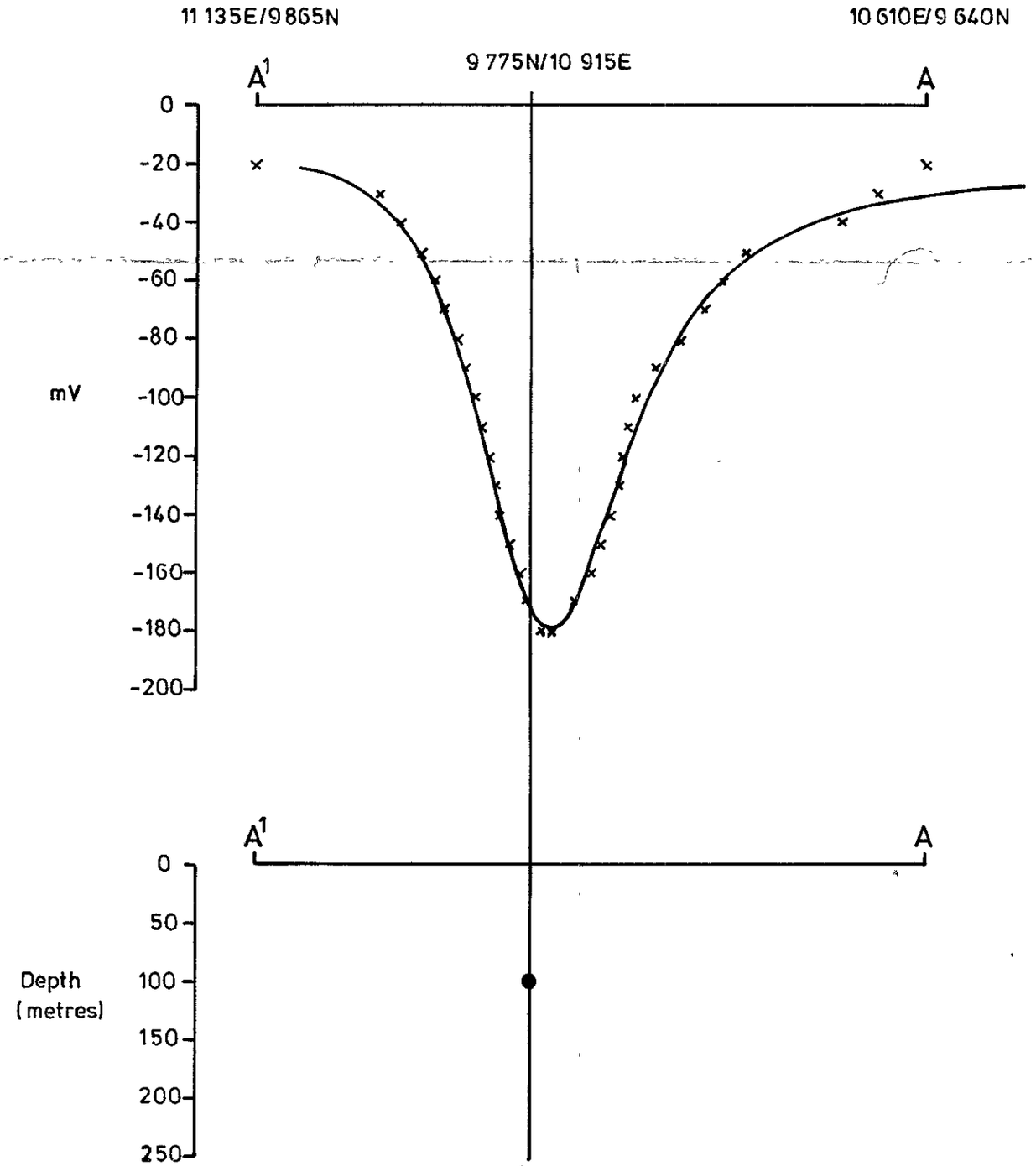
400000mE
5420000mN
410
146°00'
420
430
5420000mN
LOONGANA ROAD
LOONGANA ROAD
SIR HIETTA RD
TO WILMONT
WILMOT RIVER
MASONS ROAD
SMITHS PLAINS
5410
BLACK BLUFF
5410
LAKE GAIRDNER
ROAD
TO SHEFFIELD
MOINA ROAD
MOINA
41°30
41°30
MOUNT CATTLEY
BLACK BLUFF RANGE
LEA RIVER
LEA RIVER
LAKE LEA
BONDS RANGE
MOUNTAIN
LAKE CETHANA
IRIS RIVER
MARINER 1
FALL RIVER
MARINER 3
CRADLE
5400
MARINER 2
ROAD
MIDDLESEX PLAINS
5400
MAYDAY MOUNT
MOUNTAIN
DOVE RIVER
PENCIL PINE
CRADLE
FORTH RIVER
National Park Boundary
5390
5390
CRADLE VALLEY
CRATER LAKE
LAKE DOVE
CRADLE MTN- LAKE ST CLAIR NATIONAL PARK
National Park Boundary
CRADLE MTN.
GN
TN
MN
GRID CONVERGENCE 0.8°
GRID/MAGNETIC ANGLE 11.5°
SURVEY AREA
TASMANIA
5480
400
410
146°00'
420
430
5380

5 cm

232052

78-1294

GEOPEKO LTD Geophysical Surveys Plan No: 3863 S/A 1046		Instrument		Datum		Hor Scale 1:100 000	AREA Black Bluff-Tasmania
		Observer		Base Peg		Vert Scale	PROSPECT MARINER PROSPECTS
		Scale Factor		Date August 1978		Cont Int	PLAN SHOWS Location Diagram



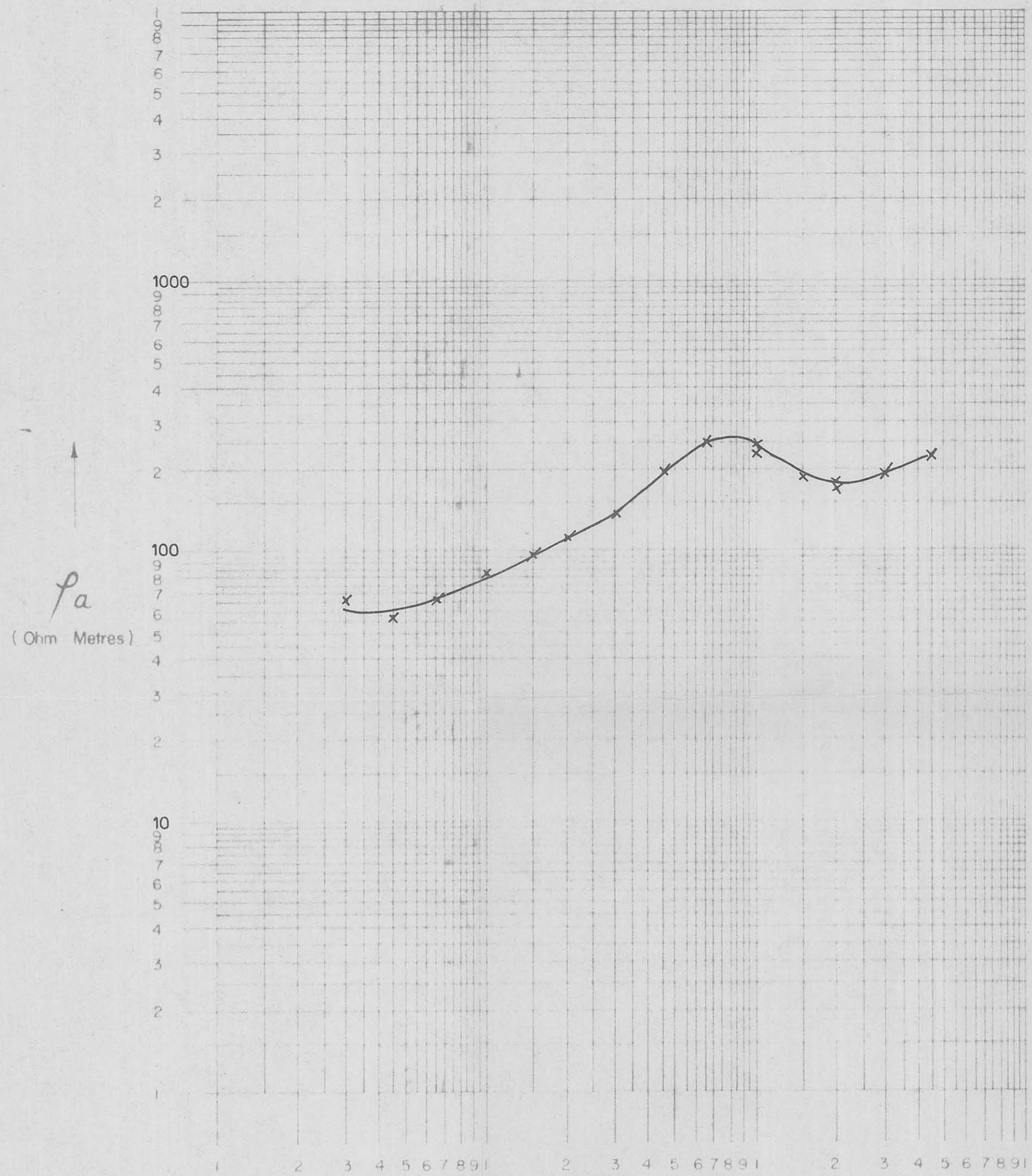
Note:- Inclination = 25°
Depth = 100m
Amplitude = 160mV
× Observed field curve
— Model curve

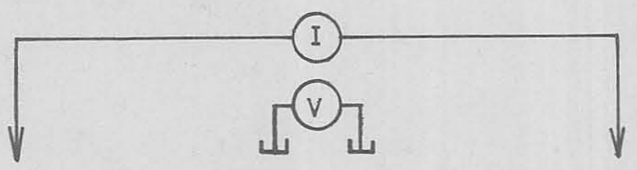
5 cm

232053

78-1294

GEOPEKO LTD. 1047 Geophysical Surveys.	Instrument		Datum		Hor Scale	1:5 000	AREA	Black Bluff - Tasmania
	Observer	S. Mudge	Base Peg	10 000E 10 000N (0mV)	Vert Scale	1cm = 20mV	PROSPECT	MARINER 3 - Section A¹A
Plan No. 3893 S/A	Scale Fact		Date	June 1978	Cont Int		PLAN SHOWS	S P Interpretation Point Dipole Source





ELECTRODE CONFIGURATION

Note:- × Observed Field Curve

5 cm

232054

78-1294

REVISION		GEOFEX LIMITED
		Black Bluff-Tasmania MARINER 3 VERTICAL ELECTRICAL SOUNDING SCHLUMBERGER ARRAY Expanded About 11 300E Along Line 10 000N — 1048
		SCALE / GEOL S. Mudge / DATE June 1978
		CHECKED / DRAWN / ORG No 3894 S/A