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REPORT ON A
TURAM ELECTROMAGNETIC SURVEY
BASIN LAKE PROSPECT, QUEENSTOWN, TASMANIA
ON BEHALF OF
PICKANDS MATHER & CO., ENGINEERS

GEOPHYSICS

by
SEIGEL ASSOCIATES *And P.L.*

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PRELIMINARY

PRIVATE AND CONFIDENTIAL

REPORT ON
TURAM ELECTROMAGNETIC SURVEY
BASIN LAKE PROSPECT, QUEENSTOWN, TASMANIA
ON BEHALF OF
PICKANDS MATHER & CO., INTERNATIONAL

by

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Geophysicist.

SYDNEY, NEW SOUTH WALES.

NOVEMBER, 1970.
TAS-001.

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SUMMARY

An electromagnetic anomaly having good to moderate conduction was located on the Basin Lake Prospect of Pickands Mather & Co., International.

Black shales located on the property are being tested to ascertain their conduction properties. Should these shales prove to be non-conductive, two diamond drill holes have been recommended.

Any further work should await the core tests.

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REPORT ON A
TURAM ELECTROMAGNETIC SURVEY
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INTRODUCTION

During October 1970 a Turam electromagnetic survey was carried out on behalf of Pickands Mather & Co. International on their Basin Lake Prospect near Queenstown - Tasmania, at the request of Mr. V. Wuerch of Pickands Mather & Co., International. The area surveyed forms a portion of E.L. 12/65.

The field survey was under the direction of E. C. Hope of Seigel Associates Australasia Pty.Ltd., with technical supervision by A. W. Howland-Rose, MSc.

The project was hampered by extremely bad weather conditions; only some 8½ productions being worked between the 5th and 26th October 1970.

The method and equipment used are described briefly in Appendix-1.

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GEOLOGY AND EXPLORATION HISTORY

The area surveyed is entirely covered by glacial moraine. However, the supposed contact between the Ordovician conglomerates and the Cambrian volcanics crosses the extreme east of the geophysical grid, as in Plate-1.

The dip of the contact between the slates and conglomerates is thought to be steep west. There is no firm evidence as to the position of the contact. However, it must lie to the east of drill holes BL801 and BL802 which were drilled at co-ordinates 2093N/2653W and 22100N/2300W respectively, as rocks typical of the volcanic sequence were located in these holes.

20930N ?

McPhar Geophysics and Pickands Mather & Co., International both ran some dipole-dipole Induced Polarization traverses. These show generally high resistivities of the order of 250 ohm ft./2 π and above, with some evidence of horizontal layering, reflecting the more resistive moraine above.

The Induced Polarization work located two distinct anomalous zones as follows:-

- a) Between lines 20500N and 22500N along the 2400W base line, and
- b) At about 3000W and 3600W on lines 23800N and 24200N respectively.

It was to test the former that two diamond drill holes; BL801 and BL802 were drilled. In the former,

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disseminated pyrite was located along thin beds within the shales and also in the Porphyritic quartz andesites below. Although the slates looked carbonaceous, the author understands that mineralogical examination revealed no graphite.

The second hole (BL802) was drilled to a vertical depth of 222-feet only, but from 201 - 217-feet assayed some 0.46% Pb and 0.18% Zn.

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DISCUSSION OF RESULTS

The profiles are displayed on Plate-2., and are plotted to a horizontal scale of 1-inch = 200-feet, and vertical scales of 1-inch = 10° phase-shift and 1-inch = 0.2 field strength ratio. The depth and r/d values of all conductors are listed in Table 1.

Plate-1. shows the geophysical anomalies marked on the grid plan indicating their conducting axes together with the maximum depths to the top of the conductor and their r/d value.

ZONE-A.

The conductor is seen from line 22100N at 2730W in the north to line 20500N at 2710W in the south. The location depth and r/d values of the conductor axes are outlined in Table-1.

The Turam electromagnetic anomaly occurs on the western flank of the $n=4$ 300-foot dipole 5PFE contour, and has the same strike and length as the frequency effect anomaly. The dissemination located in the diamond drill holes may well explain much, if not all, of the anomalous Induced Polarization response. It should be noted that the I.P. effect is a volume averaging phenomenon, whereas the electromagnetic method locates conducting sheets. For the former appreciable width is required, whereas with electromagnetics quite narrow widths of conducting material can be readily located.

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The r/d values calculated from the field data indicate a good to moderate conductor as the source of the electromagnetic anomaly. The response was clearly seen on both the 400 cps and 800 cps frequencies used. Unfortunately however the 200 cps frequencies were effected by the proximity of the power line which runs semi-parallel to the grid.

Diamond drill hole DDH 801 was drilled some 60 - 70-feet west of a conductor axes located at approximately 2710W on 20900N. This hole was drilled to some 750-feet beneath the glacial moraine which forms the top 70-feet of this hole; black slates occur to a depth of 431-feet. These slates are not considered a possible source for the electromagnetic anomaly, however conductivity tests are being undertaken some samples to confirm this.

The author considers the source to be a moderate to good conductor with either sulphides or graphite as the source material.

Comparisons with the Cape Horn anomalies:

The Bureau of Mineral Resources in their 1965/66 surveys in the Comstock and Cape Horn areas used Turam Electromagnetic surveys, utilising a grounded cable at frequencies of 220 cps and 660 cps. Unfortunately on the 220 cps results are not available to the author. The present survey used loops and frequencies of 400 cps and 800 cps.

Quantitative evaluation of the qualify^{ty} of the conductor is difficult with a grounded cable system, however the anomalies located on the two surveys are very similar.

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On one of the B.M.R. surveys, the anomaly was located some 200-feet from the volcanic/conglomerate contact, however in the present case the supposed contact is thought to be of the order of 600-feet to the east of the conductor.

ZONE B.

A single conducting axis was located at 2880N on line 24100N. This conductor was not seen on line 23800N and is open to the north. The r/d value of 4.0 indicates it to be a good to moderate conductor and similar to that located to the south. As it occurs only some 400-feet to the west of the supposed volcanics/conglomerate contact it may be of significance.

T A B L E 1.

LINE	CENTRE	DEPTH	r/d ratio	
			800 cps	400 cps
<u>ZONE-"A"</u>				
22100N	2730W	200-ft.+	16.0	6.4
21700N	2770W	200-ft.+	22.0	6.0
21500N	2820W	240-ft.	4.2	4.8
21300N	2800W	130-ft.	8.0	10.0
21100N	2770W	160-ft.	8.0	8.0
20900N	2710W	200-ft.	7.6	8.4
20700N	2730W	120-ft.	4.8	10.0
20500N	2710W	260-ft.	10.0	6.0
<u>ZONE-"B" (Open to the North)</u>				
24100N	2880N	250-ft.	4.0	-

CONCLUSIONS AND RECOMMENDATIONS

The anomalies located on the present survey show good to moderate conduction. The quality of the conductor is similar to that located over known economic mineralisation in the Cape Horn area.

Providing the slates located in the diamond drill hole BL801 are confirmed not to be the source of the anomalies located on the present survey, then the following recommendations are made: -

1. A further Turam electromagnetic survey should be carried out to the north of the present survey, concentrating on an area 1500-feet west of the conglomerate/volcanic contact.

The area to be surveyed should be defined by geology, but should certainly close off the anomaly located on line 24100N.

2. Two inclined diamond drill holes should be drilled to ascertain the source of the conductor located on the present survey, with further recommendations to be made on any conductors located on the survey recommended in (1) above.

The recommended holes should be inclined 60°E , as the geology is thought to dip 80°W .

DDH A

2910W/21500N -60°E 250-feet.

This hole is designed to intersect the target at a vertical depth of about 140-feet or 170-feet to 210-feet down the hole. This allows for an east or west dip of 80° to the zone of interest.

DDH B

2840W/20900N -60°E 350-feet (minimum)

This hole is designed to intersect the target at a vertical depth of about 200-feet or about 225-feet to 255-feet down the hole. This allows for an 80°E or 80°W dip to the zone of interest.

APPENDIX A

Core tests made on the samples of Black Slates taken from diamond drill hole 801 at Basin Lake Prospect gave the following results:-

NO. OF SAMPLES	FREQUENCY	RESISTIVITY
6	DC	1.20
7	400 cps	0.67
6	800 cps	0.66 ohm-meters

The significant r/d ratios located in the present survey were in the range 4.2 to 10.0, which for the resistivities of the slates would require only a thickness of the order of 20-feet - 45-feet to produce the anomalies located on the present survey. The diamond drill results certainly indicate at least this amount of slates.

These results certainly reduce the significance of the conductors located, however, it should still be noted that the Cape Horn orebody has a very similar signature, and the anomaly located on the present survey is located some 70-feet west of the known position of the shales.

Due to the excessive cost of moving a drilling rig into the area, I cannot now recommend diamond drilling on purely geophysical grounds, in spite of the fact that the electromagnetic anomaly has not been tested by DDH BL801.

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APPENDIX "T"

APPENDIX "T"

BRIEF DESCRIPTION OF THE
TURAM ELECTROMAGNETIC SYSTEMGENERAL

The Turam method can be classified as a fixed source compensation method. The primary or source field consists of a large energizing layout in the form of a long wire or a large loop laid out on the terrain, to which an audio frequency alternating current is fed by means of a motor generator. The resulting current pattern is investigated inductively, with two identical receiving coils connected to a bridge compensator which compares the signal received in each coil in relative phase and amplitude. When grounded cable is used, the energization is both galvanic and inductive; when the primary layout consists of a closed loop, the energization is purely inductive. Under most conditions the presence of galvanic current is undesirable and inductive energization is, as a rule, preferred.

Although the system allows the comparison of any two components of the resultant field, it is standard procedure in systematic surveys to measure the gradient of the vertical component.

The pattern for a typical Turam survey is shown in Fig. 1. A large rectangular loop is used as primary layout and the field gradients are measured with horizontal receiving coils along profiles perpendicular to a long side of the transmitting loop.

DATA REDUCTION

The relative strength of the undisturbed primary field is dependent on the loop dimensions and the location of the observation points, and can be determined by calculation. The measured field strength ratios are normalized through division by these calculated free space ratios.

The primary field causes eddy current to flow in subsurface conductors. As a result the resultant field will be distorted in both amplitude and phase. The presence of conductors will thus be indicated by abnormal strength ratios and phase differences.

PRESENTATION

The measuring results are usually presented in profile form as (reduced) field strength ratio and phase difference curves, with the observed values plotted at the midpoint between coil positions.

Occasionally one of the two parameters is presented in contour form, but contour plans are generally inadequate to express the full significance of the data.

INTERPRETATION

Where field distortion occurs the curves indicate the location and the depth of burial of the main current flow. The "current axis" is well defined when the current is concentrated as, for instance, in thin, steeply dipping conductors. In wide, banded conductors or in horizontal conductors such as, for instance, overburden, the current is usually more dispersed and the anomalies will yield less positive information.

As a rule the current axis is located right below the maximum field strength ratio deflection or the maximum negative phase shift. Its depth under the traverse is indicated by the shape of the anomaly.

The relative amplitudes of field strength and phase distortions are a measure of the conductivity of the conducting bodies, i.e. good conductors are characterized by field strength distortion combined with relatively little phase shifting, whereas poor conductors affect the phase, rather than the strength of the resultant field.

For an accurate grading the resistivity thickness (r/d) ratio of the individual conductors can be derived from the calculated in-phase and out-of-phase components, taking further into consideration the exciting frequency and the strike length of the conductor. The relations are shown in Fig.2 and Fig.3. The obtained r/d values are marked on the upper right side of the anomalies, in units of ohmcm/m. On the lower left side the depth of the current axis (ft.) is marked. It is normally located 30-40 ft. within the body and the indicated depth should be regarded as the maximum depth to the upper surface of the conductor.

To obtain the projection of the current pattern, the anomalies are connected between lines, whereby depth and r/d values, as well as other characteristics of the curves are used as criteria. The strike of the formations, if known, is also taken into consideration.

Fig. 4 and Fig. 5 show a plan and section of a typical Turam survey and interpretation.

- REFERENCES: 1937 Hedstrom, E.H. Phase Measurements in
Electrical prospecting.
AIME Techn. Publ. 827.
- 1964 Bosschart, R.A. Analytical Interpretation
of Fixed Source Electro-
magnetic Prospecting
data. Delft.

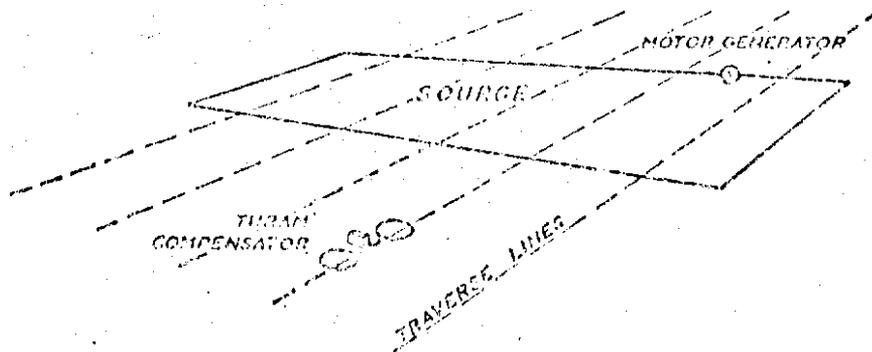


Fig. 1 The Turam method. General layout

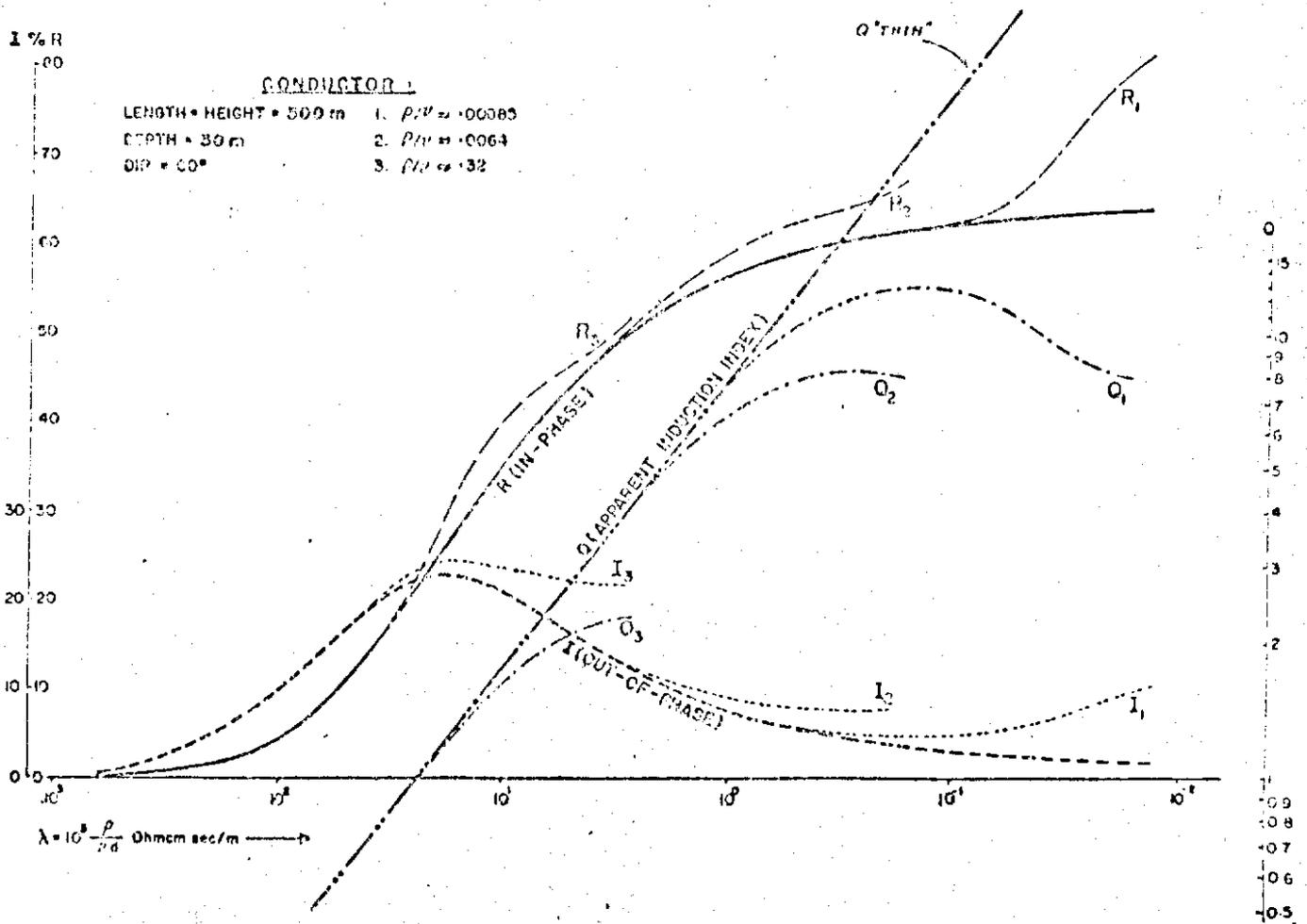


FIG. 2 RESPONSE OF A FINITE TABULAR CONDUCTOR. (R.A. Bosschart 1964)

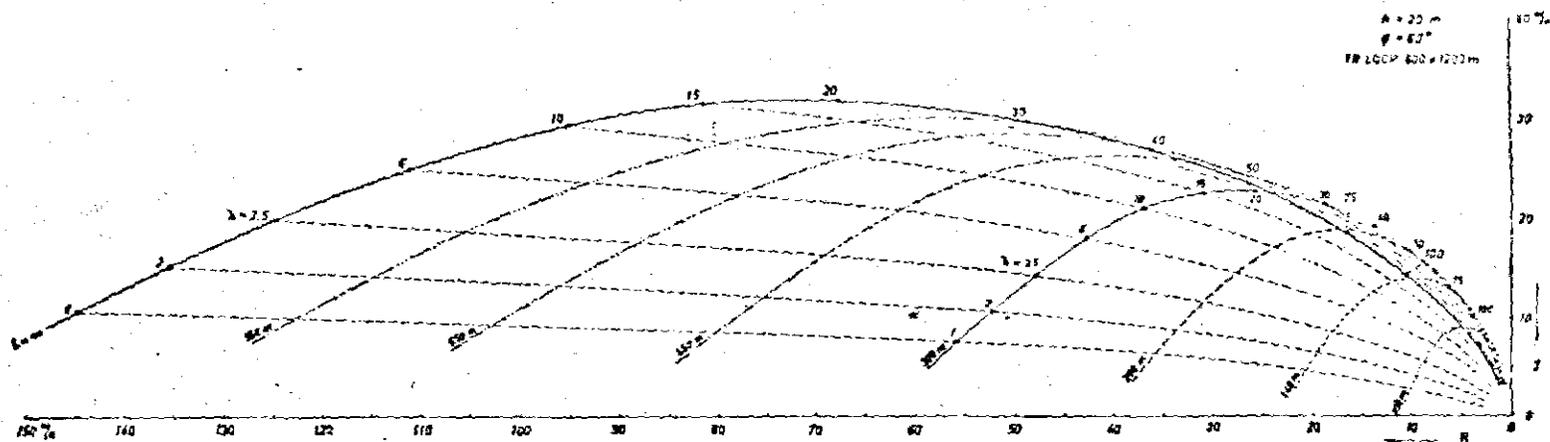
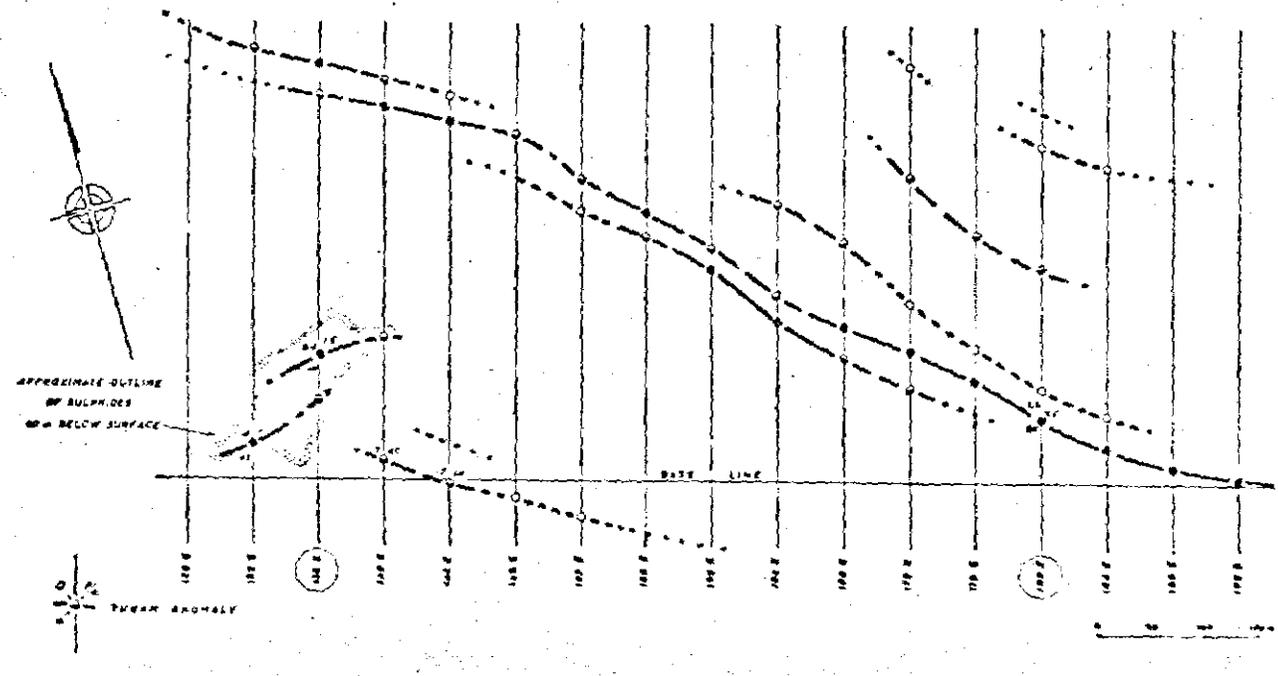


FIG. 3 RESPONSE DIAGRAM FOR CONDUCTORS OF VARYING STRIKE LENGTHS.

FIG. 4 TURAM SURVEY ON THE MURRAY GROUP, NEW-BRUNSWICK. (R.A. Bosschart 1964)



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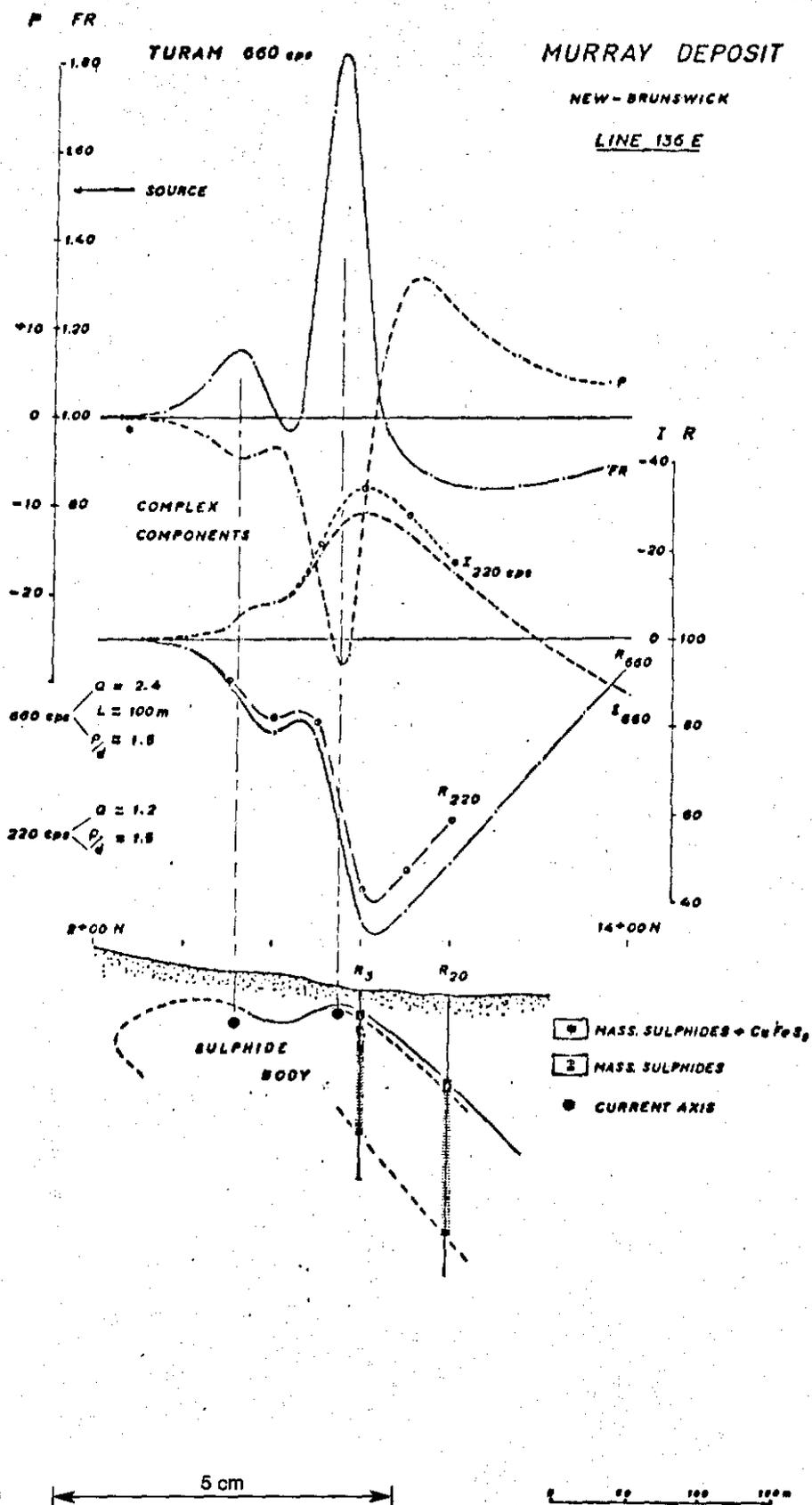
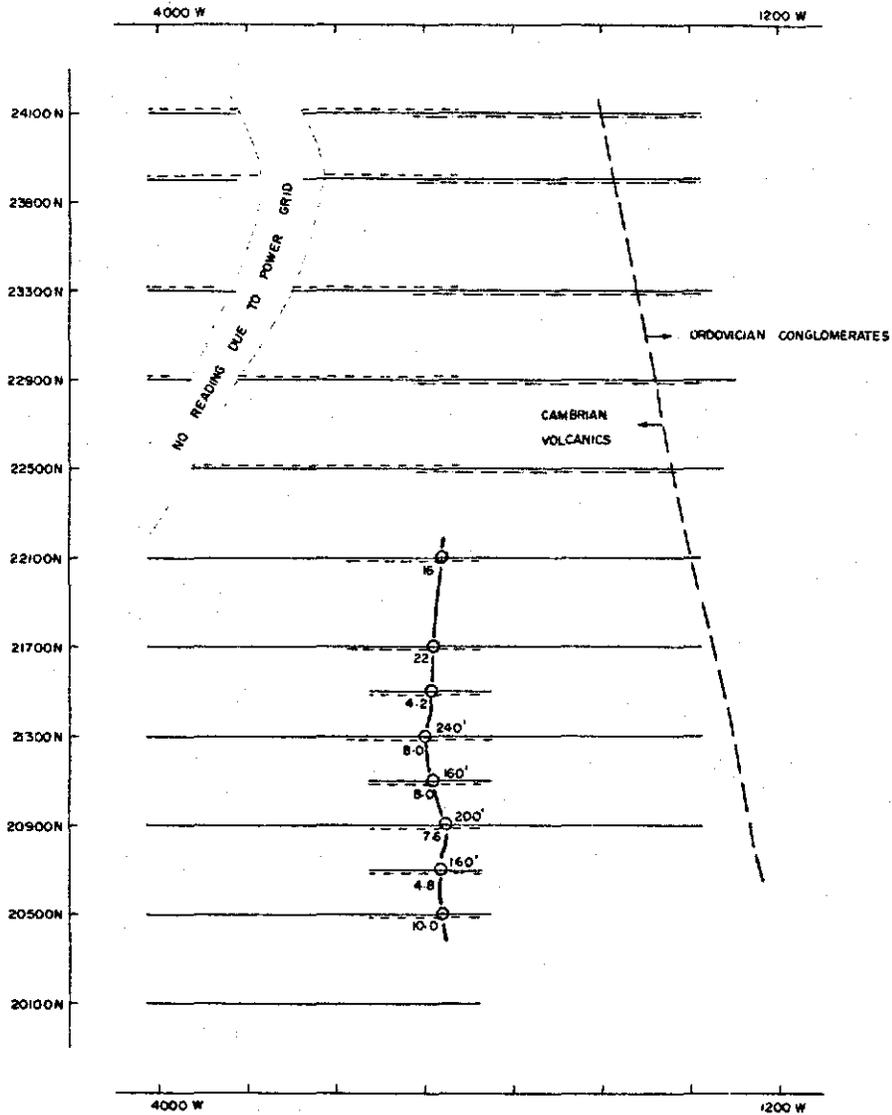


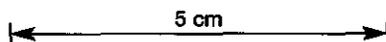
FIG. 5

TURAM SURVEY ON THE MURRAY GROUP, NEW BRUNSWICK.
INTERPRETATION OF A TYPICAL SECTION.
(R.A. Bosschart 1964)



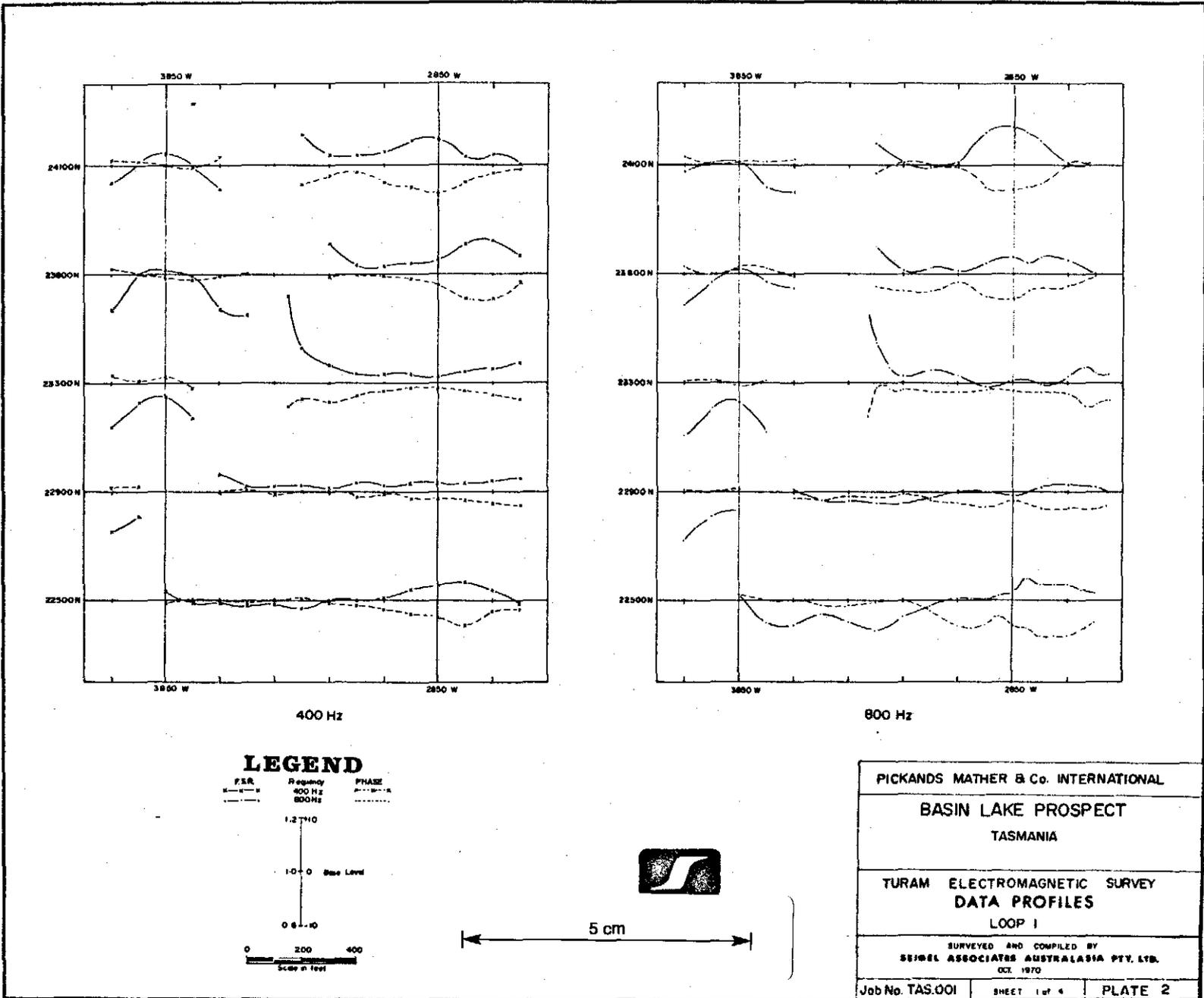
LEGEND

- SURVEYED AT 800 Hz
- - - SURVEYED AT 400 Hz
- · - SURVEYED AT 200 Hz
- ANOMALY LOCATION
- 40' Depth in feet
- 60' r/d Ohm-cm/m
- - - GEOLOGICAL CONTACT

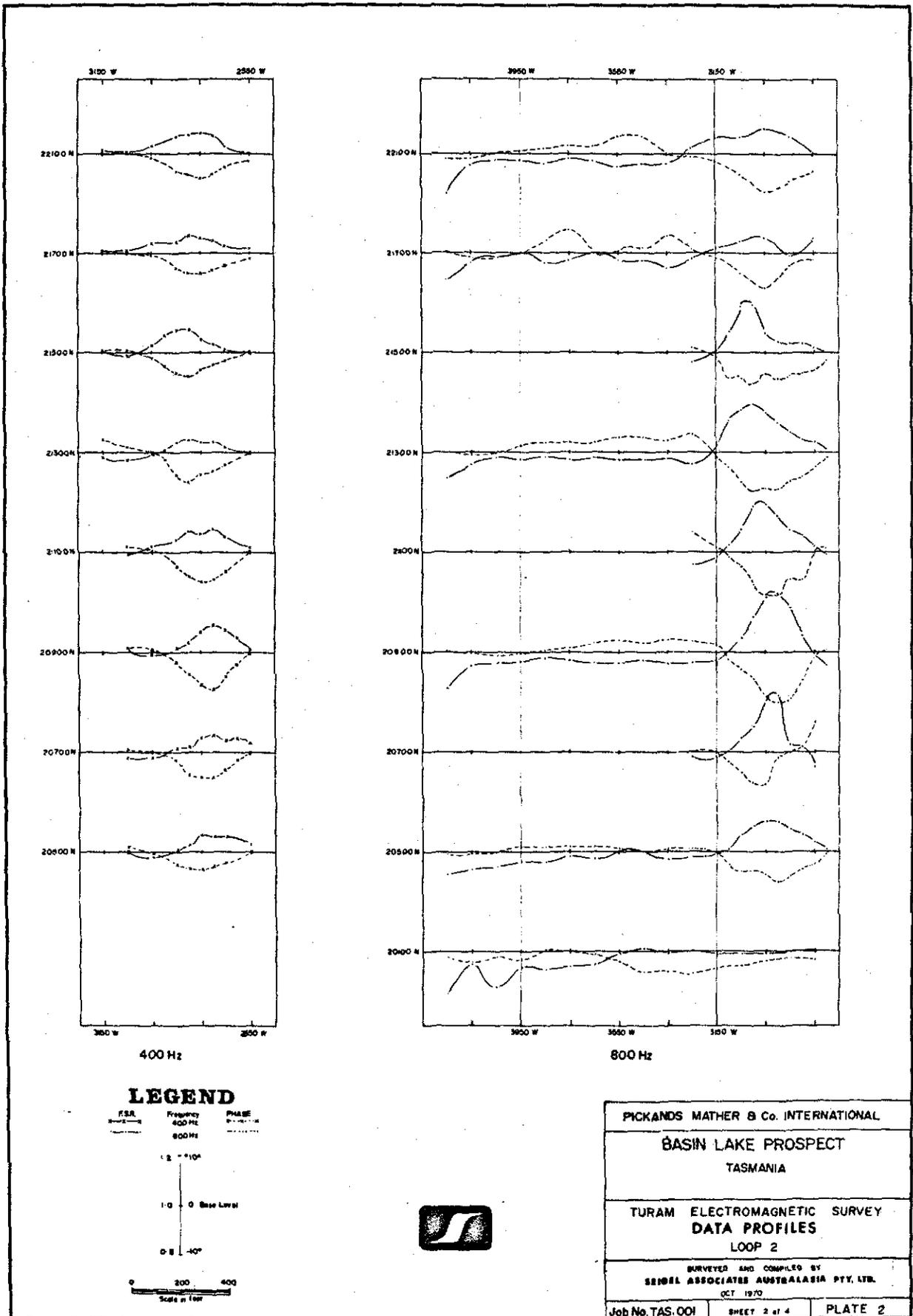


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BASIN LAKE PROSPECT		
TASMANIA		
TURAM ELECTROMAGNETIC SURVEY		
GRID & ANOMALY PLAN		
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Job No. TAS. 001	SHEET 1 of 1	PLATE 1

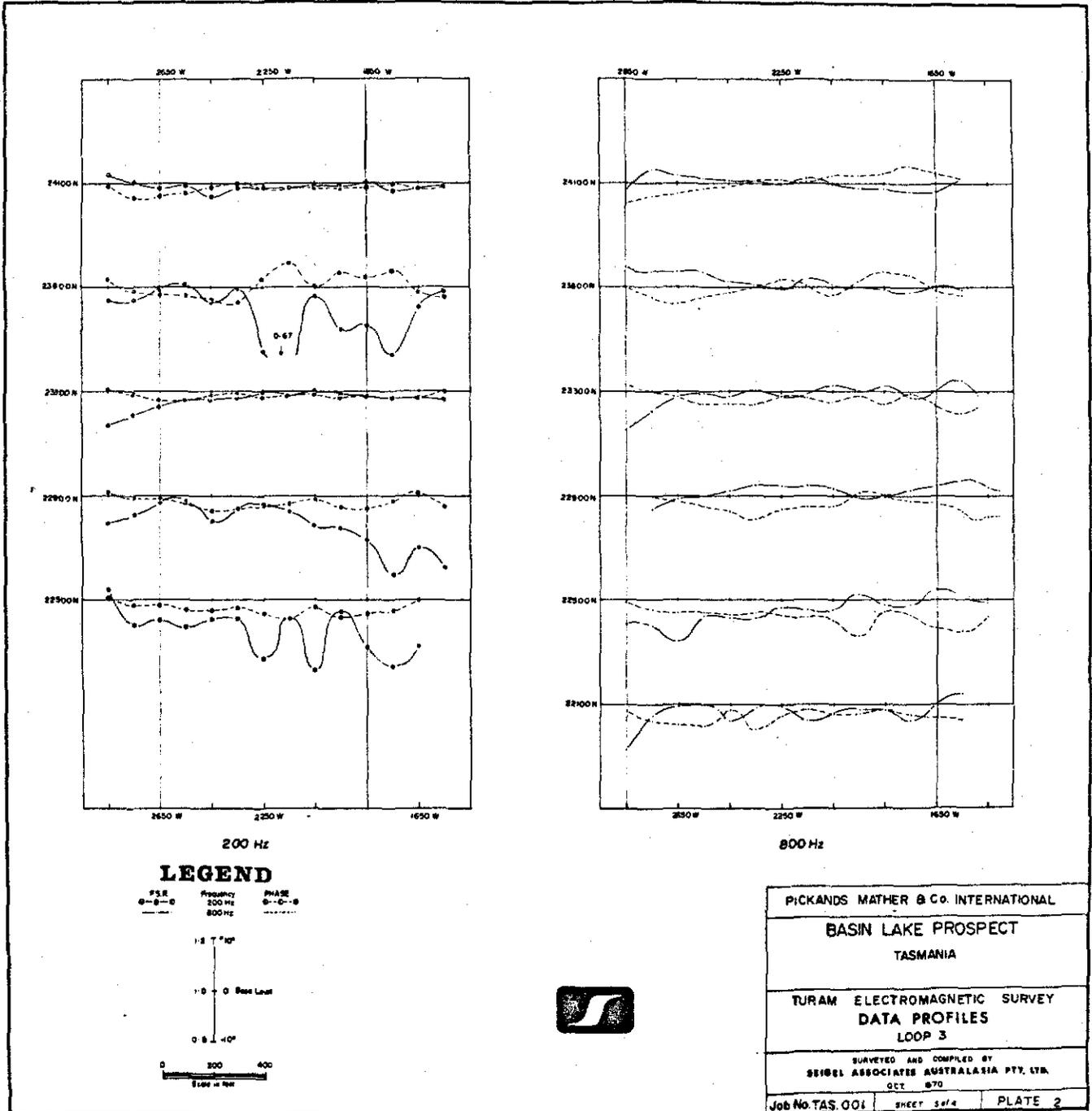
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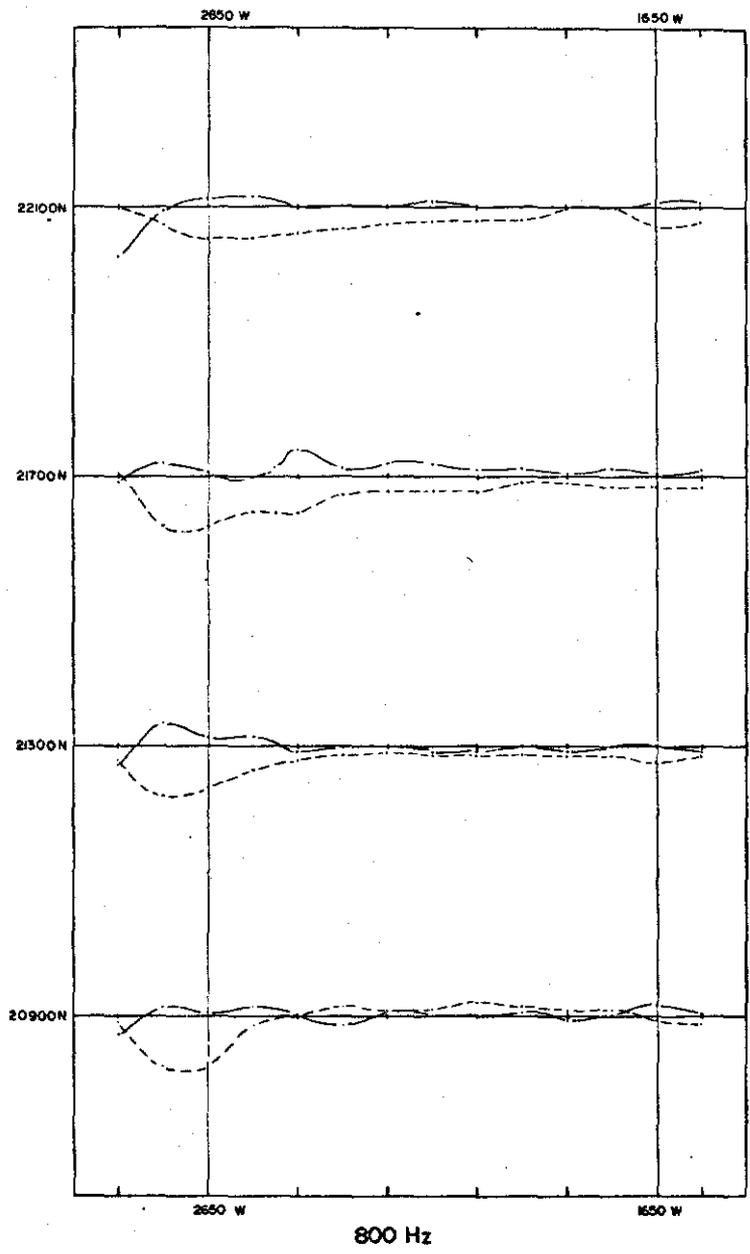
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5 cm



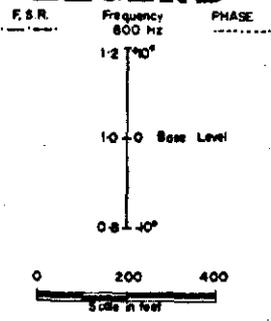
5 cm



800 Hz



LEGEND



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BASIN LAKE PROSPECT TASMANIA		
TURAM ELECTROMAGNETIC SURVEY DATA PROFILES LOOP 4		
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Job No. TAS 001	SHEET 4 of 4	PLATE 2