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AN EVALUATION OF GEOPHYSICAL SURVEYS OVER THE EAST TYNDALL AND BASIN LAKE GRIDS, E.L. 9/66

for

THE MT. LYELL MINING & RAILWAY CO. LTD.

by

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ML/MG81/13

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SUMMARY

The Basin Lake and East Tyndall Grids cover a belt of the Mt. Read Volcanics, between the Henty River and the West Coast Range. For the purpose of this report, the northern limit of the East Tyndall Grid has been defined as line 40N, (where the Henty Fault pinches out the prospective sequence of volcanics against the Tyndall Group rocks.) Much of the area, particularly in the south, is covered by a glacially derived overburden: this varies in thickness from a thin veneer to several tens of metres.

Geophysical surveys of the area date back to the late 1950's when Rio Tinto carried out some EM, gravity and magnetic surveys in the vicinity of and along strike from the Tyndall Mine (a small Pb-Zn prospect on the East Tyndall Grid). Some EM anomalies were defined which were almost certainly due to shears and/or conductive overburden; no mineralised zones were detected. This was followed by IP surveys in 1962 (possibly for EZ, but carried out over the Rio Tinto Grid). Some anomalies were defined, but apparently were not followed up. The first surveys for Mt. Lyell were in 1967/68 when a regional dipole-dipole IP survey of the East Tyndall Grid was carried out. This defined an anomalous zone the length of the grid and other extensive zones were also detected. Since then, apart from magnetics, the geophysics has almost exclusively been detailed IP surveys over sections of the anomalous zones. Magnetic surveys have been carried out wherever there is IP coverage but so far, magnetic anomalies have not been associated with any sulphide mineralisation.

The Basin Lake area was first surveyed geophysically by Pickands Mather, who conducted dipole-dipole IP surveys in 1968/69 and an EM survey in 1970. Drilling, which was severely hampered by a thick glacial overburden, revealed black shales with minor mineralisation beneath the geophysical anomalies. A gradient array IP survey over the whole grid was carried out for Mt. Lyell in 1974: several anomalies were defined, some of which are likely to be southern extensions of the anomalous zones on the East Tyndall Grid.

Fourteen drill holes, several costeans and outcrops, etc., indicate that the IP responses from both grids are due to zones of disseminated pyrite and/or black shales, these two sources often occurring in close association. There have been no really encouraging base metal intersections or occurrences. The large number and extent of the IP anomalies has meant that many have had only a summary explanation, e.g. an outcrop of pyrite in the area of the anomaly. In most cases one drill hole, costean or outcrop is inadequate to explain several tens or hundred of metres of IP response. Further, more recent surveys (1981 dipole-dipole IP) have shown that some anomalies have been inadequately tested by drill holes, e.g. TYN2 and TYN 3. DDH TYN2 was collared on line 4N directly above a chargeability anomaly, with a much better anomaly 450m to the north, and DDH TYN3 only intersected one source (black shales) of a well-defined two source anomaly. Nevertheless a comparison of the older IP data with that from the 1981 surveys suggests that the strong anomalies and broad features are common to both, but that the older data may lose the more subtle responses. The presentation of much of the data as metal factor increases this problem, and the frequency effect must be calculated when looking at any of this data in detail. Despite the fact that many of the anomalies detected from the 1967/68 surveys are defined by 100ft, 200ft and 300ft surveys, it is not recommended that drill holes be sited using the old data: new surveys should be carried out for this purpose.

The 1967/68 regional IP survey defined anomalous zones using a 400m-500m line spacing. There are still sections of some zones which have not had detailed surveys over them. The regional survey has meant that the area of detailed surveys can be localised, however uncertainty about the structure of much of the area means that the extent of any such surveys should make allowance for unexpected structures. (For example, the interpretation of the regional survey by Hallof (1968) shows anomaly 'C4' as a continuous north-westerly trending zone, whereas work on the Henty Fault Zone to the north suggests that the mineralisation, down to at least line 36N trends approximately NE-SW.) The anomalies south of Howard's Anomaly appear to be prospective, and zone C1 (Figure 5) between line 10N and line 14N, must be surveyed in detail. The areas north of Howard's Anomaly appear to be less prospective from the 1967/68 data and it is not planned to do any surveys in the region in the 1981/82 field season. The recommended surveys and the extent of the coverage are given at the end of this Summary.

Electromagnetic surveys are among these recommendations. The IP surveys have detected several mineralised zones but have defined no base metal deposits: it is not suggested that EM methods will necessarily be able to detect base metal sulphides any better than the IP technique, however they should be able to define narrow, conductive zones within a broadly polarisable region much better than IP/resistivity. (Hopefully these are narrow zones of massive sulphides that lead to economic concentrations at depth.) Also EM should be able to much better resolve close chargeable/conductive sources detected by the IP surveys. Lastly, the IP surveys have detailed large areas of mineralised zones: testing of these areas (often superficially) has revealed disseminated (and occasionally massive) sulphides. It is possible that rapid reconnaissance of these areas by EM would define more local areas of higher conductivity within which further exploration could be concentrated. Unfortunately for all geophysical methods there are circumstances where the method may not be appropriate, and one such case for EM is in the detection of lead-zinc deposits. These deposits may be poor conductors, particularly those with low copper concentrations: Que River would not be detected by EM without its 'copper lens' and Rosebery is probably only weakly anomalous.

Why recommend EM if this is the case?

A further problem in the exploration of the Basin Lake-Tyndall Grids, is the presence of black shales throughout the area. These are usually polarisable and often conductive: they are also often in close association with sulphides. To discriminate and/or to resolve sulphides from shales, other than by drilling, particularly in areas with overburden where soil geochemistry can not be applied, the use of other geophysical methods should be considered; the gravity method in particular.

Has Tyndall Range proximity been allowed for?

It is noted that large prospective areas immediately east of the Henty River have not been covered by any geophysics. These areas have very steep topography and it is recommended that geology/geochemistry be used to outline locations for detailed geophysics.

Recommendations for further work on the Basin Lake and East Tyndall Grids (see Figure 25):

a) Basin Lake

Electromagnetic surveys (using a moving loop system, such as the 'Genie' or 'Max-Min' system).

Line	Coverage (feet)
0	1000'E - 4200'E
6S	1000'E - 4200'E
12S	1000'E - 4400'E
18S	1000'E - 8300'E (the road)
24S	1000'E - 8200'E (the road)
30S	1000'E - 9200'E (end of line)
36S	5300'E - 7600'E
42S	5400'E - 7800'E
48S	00 - 2600'E, 5400'E - 7800'E
54S	00 - 2600'E } black shale western sequence

It is probable that the gradient array IP survey has inadequately tested the eastern and southern areas of Basin Lake where 'thick' (undefined) sequences of glacial overburden occur, and deeper looking IP (dipole-dipole array) or EM (e.g. large loop time domain) should be considered. A single line of dipole-dipole IP over 78S is recommended. This survey would test the area around BL1 where a good down hole IP response was obtained, but no anomaly was recorded on either of two gradient array surveys. Such a small survey must not be thought of as a thorough test of the gradient array data over the glacial overburden.

b) East Tyndall

Zone A: EM surveys are recommended over the area covered by the 1981 dipole-dipole survey. This coverage is recommended partly to allow comparison with recent IP and partly to help resolve conductive zones (if such exist) within the polarisable area. The 'Genie' or 'Max-Min' method is suggested. The baseline for this zone, and all other East Tyndall zones, is Bradshaw's Road.

Line	Coverage (In Metres)
4N	100mW - 600mE
4.5N	100mW - 600mE
5N	200mW - 500mE
5.5N	100mW - 600mE
6N	300mW - 300mE
6.5N	500mW - 200mE
7N	400mW - 200mE
8N	500mW - 100mE

Zone B: adequately covered by the Basin Lake Grid and the gradient array survey over anomaly 'C1'.

Zone C1: a gradient array survey is recommended between lines 10N and 14.5N with approximately a 100m line spacing. Such a survey is expected to define the zone in more detail and dipole-dipole surveys are recommended over the better anomalies (and in any case over TYN1 on line 12N). A magnetometer survey is also recommended over the line intervals listed below:

Line	Coverage (In Metres)
10N	0 - 1400mE
10.5N	0 - 1200mE
11N	0 - 1200mE
11.5N	0 - 1050mE (between the two roads)
12N	0 - 1020mE (" " " ")
12.5N	0 - 1000mE (" " " ")
13N	0 - 950mE (" " " ")
13.5N	0 - 900mE (" " " ")
14N	0 - 850mE (" " " ")
14.5N	0 - 820mE (" " " ")

x.

Zone C2: Dipole-dipole surveys in 1981 showed that DDH TYN3 on line 16N had inadequately tested the anomaly and EM is recommended to resolve the two (or more) sources contributing to the IP anomaly. The 'Genie' or 'Max-Min' system is suggested.

Line	Coverage (In Metres)
15N	100mW - 600mE
15.5N	100mW - 600mE
16N	200mW - 600mE
16.5N	300mW - 400mE
17N	300mW - 400mE

Zone C3 (Howard's Anomaly): EM surveys are recommended over anomaly 'G', an untested anomaly that showed resistivity lows on two dipole-dipole pseudosections; this survey will also include anomaly 'F' which was inadequately tested by a costean. EM profiles are also recommended over HA2 on line 19N and over line 20.2N where a pole-dipole survey indicated a possible resistivity low at depth.

Line	Coverage (In Metres from Bradshaw's Road)
19.7N	900mW - 220mW
20.2N	830mW - 260mW
21.6N	850mW - 260mW
21.9N	900mW - 300mW
22N	920mW - 300mW
	(i.e. coverage of all the line is specified for all five lines.)

Zones C4 and E: Geophysical exploration will not be carried out over these zones in the 1981/82 field season and recommendations for the detailed surveys that should be made at some stage will be considered after an evaluation of the surveys recommended above. In the absence of any detailed mapping which may indicate otherwise, the following coverage is recommended (method not specified, but it is noted that gradient array IP has not identified the zone on some of the lines).

Line	Coverage*	Line	Coverage*
28N	1250mW-500mW	34.5N	1000mW-200mW
28.5N	1300mW-500mW	35N	1000mW-200mW
29N	1300mW-550mW	35.5N	1000mW-250mW
29.5N	1300mW-450mW	36N	1000mW-00
30N	1250mW-450mW	36.5N	900mW-00
30.5N	1250mW-400mW	37N	850mW-00
31N	1200mW-400mW	37.5N	750mW-00
31.5N	1100mW-300mW	38N	650mW-00
32N	1100mW-300mW	38.5N	600mW-00
32.5N	1150mW-350mW	39N	600mW-00
33N	1150mW-350mW	39.5N	600mW-00
33.5N	1150mW-350mW	40N	650mW-00
34N	1050mW-250mW		

*Coverage in metres from Bradshaw's Road.

1. AIM AND INTRODUCTION

The Basin Lake and East Tyndall Grids begin approximately 10km north of Queenstown and cover the Mt. Read Volcanics between the Henty River and West Coast Range. For this report, the northern limit is line 40N, where the Henty Fault pinches out the prospective sequence of volcanics (Figure 1).

Although part of a continuous geological belt, the two areas have, prior to this report, been treated separately; probably partly due to the fact that the licence to explore the Basin Lake area was granted to Mt. Lyell some years after the licence covering the Tyndall area.

The first exploration using geophysical methods was by RioTinto in the late 1950's. EM, gravity and magnetics were carried out over a grid centred on the Tyndall Mine, a small Pb/Zn prospect situated between (what is now) lines 26N and 28N of the East Tyndall Grid. Geophysical work over Basin Lake was initiated by Pickands Mather in 1970, and both grids have had a considerable number of geophysical surveys (mostly IP) since then. One section of the East Tyndall Grid has received particular attention and this area has become known as the Howard's Anomaly Area or Grid.

Howard's Anomaly has been defined in this report, as the area between lines 19N and 26N of the East Tyndall Grid. The line spacing at Howard's Anomaly is mostly less than 100m; this is in contrast to the 300m to 600m of the East Tyndall Grid (a few other areas have been infilled although not in as much detail as Howard's Anomaly), and the nearly 200m spacing of the Basin Lake Grid.

Past exploration has defined several mineralised areas as well as several occurrences of black shales; both have proved anomalous to the various IP surveys carried out over all three grids. Apart from very minor occurrences such as a thin vein at the Tyndall Mine, and some interesting silver values at Howard's Anomaly, there have been no encouraging precious or base metal occurrences or intersections, all sulphides being either disseminated or sub-massive pyrite.

This report evaluates all the geophysical work carried out over the Basin Lake and East Tyndall Grids (the latter including the detailed coverage of Howard's Anomaly) before June, 1980, as well as presenting the data for all surveys carried out since then (up to October, 1981). Recommendations for further work have been made for anomalies that have been inadequately tested, as well as for areas with too sparse a coverage. Many of the fourteen drill holes drilled by Mt. Lyell within the area covered by this report were sited on geophysical anomalies and the results of the drilling have been compared with these anomalies. A section of the report discusses the application of various geophysical techniques to the types of targets that might be expected within the Basin Lake and East Tyndall areas.

2. GEOLOGICAL TARGETS

Three types of orebodies have been sought by Mt. Lyell in the Basin Lake, East Tyndall areas. All three occur within the Mt. Read Volcanics, the mineralisation of which has been described by Corbett (1981), but which may be described here as an arcuate belt about 240km long by 10km wide of Cambrian calc-alkaline pyroclastics, lavas and intrusives.

The Basin Lake and Tyndall areas have been mapped using the nomenclature used by Corbett et al (1974) to describe the Mt. Read Volcanics around Queenstown. In the Basin Lake area, Sheppard (1975, fig. 7) shows a narrow wedge of the Queenstown Pyroclastics west of the grid with most of the north-western half of the grid occupied by the 'Central Lavas'. The inferred position of the (youngest) Tyndall group is shown (but Komyshan, Mt. Lyell exploration geologist, has changed this, see Figure 2).

The Tyndall geological map, Stevens-Hoare, 1975a (fig. 1), shows no Central Lavas, but a wide section of Queenstown Pyroclastics and Tyndall Group between the (Cambrian) Dundas Sediments west of the Henty Fault and the (Ordovican) Owen Conglomerate of the Tyndall Range to the east. Since these two maps overlap, it can be seen that this nomenclature has not been useful (or wisely used?) in this region*. Komyshan is remapping the area using petrological descriptions and Figure 2 shows the results so far. It is pointed out that much of the area is covered by glacially derived overburden: this varies in thickness from several tens of metres (e.g. the SE corner of the Basin Lake Grid) to a thin veneer of less than one metre.

The three ore-types mentioned above are: a massive sulphide Pb/Zn deposit; a disseminated copper deposit and a exhalative silver deposit. The characteristics of the first two types have been described

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* Corbett (1979) has noted that all the economic mineralisation at Mt. Lyell is restricted to the Central Lavas sequence. However the Queenstown Pyroclastics are considered to be as prospective; Tyndall Group rocks are generally thought to be unprospective.

by Reid and Meares (1981). Examples of mines of the first type are Rosebery and Que River; these are "typically narrow, tabular, stratiform bodies with a distinct mineralisation zonation from a footwall pyrite-chalcopyrite mineralisation toward the hangingwall". There has been nothing published about the geophysical responses of the Rosebery orebody, but Webster and Skey (1979) have written a detailed paper on the geochemical and geophysical responses of Que River: they show that excellent IP responses are obtained, particularly from the Pb/Zn rich lens (which is ten times larger than the copper rich lens). EM and SP responses were obtained from the copper rich lens only (the latter to -324mv). There was no magnetic anomaly associated with the orebody. Gravity is also effective (Leaman, 1981).

The disseminated copper bodies occur on the Mt. Lyell field. There are a range of deposits, but the end-types may be categorised as large deposits with low copper (e.g. the Prince Lyell, 30 million tonnes which averaged 1.45 percent copper) and small, high-grade bodies (e.g. Twelve West, 80,000 tonnes at 9.5 percent Cu). Although the sulphide content in all types is usually between 10-20 percent (The Blow at 85 percent being the exception), the former deposits are regarded as disseminated, while the latter are massive (Reid and Meares, 1981). Disseminated pyrite occurs around the disseminated orebodies and is common throughout the field.

There have been a number of geophysical surveys over the Mt. Lyell field, starting in the 1930's: two of the orebodies were geophysical discoveries (Crown Lyell 3 and Cape Horn). Until the recent (1980-81) IP survey, the largest coverage was from the applied potential and Turam methods (Blazey and Douglas, 1934-38; Rowston, 1957; Webb, 1958).

In both these methods, current was applied to the ground and its concentration in orebodies (or concentrations of pyrite) detected. IP is also applicable, but may not have the resolving capability of EM methods (including the galvanic/inductive application of the Turam technique) to define higher concentrations of sulphides in a sulphide-rich zone.

A strong response was obtained from a helicopter-borne EM survey on a test survey over one large disseminated-type deposit (Western Tharsis) and strong SP responses have been obtained (>600mv). Although some deposits contain magnetite, magnetics has not been a useful technique. The gravity method has been insufficiently tested, but is unlikely to prove useful over disseminated targets.

The third type of ore deposit sought, was for silver within an andesitic haematite-carbonate sequence of the Mt. Read Volcanics. It was originally hoped that magnetics would prove useful in helping to define the mineralised sequence, but this was not the case. Nevertheless, the silver was generally associated with haematite and in mineable concentrations and quantities, it is possible that magnetics and/or IP might prove useful.

While the responses of the various geophysical techniques over the known deposits in the area should be known and understood, it must also be appreciated that these are very few in number and that a wider range of ore deposit types are possible. Other factors include economic considerations, such as: at what distance from the mill is an 80,000 tonne orebody unprofitable? (i.e. to what distance should extremely detailed exploration be made?); would a disseminated type, low-grade deposit be profitable away from the mine lease?, etc.. The geophysical approach to exploration on the Basin Lake and East Tyndall Grids is discussed in Section 6.

3. GEOPHYSICAL SURVEYS PRIOR TO JUNE, 1980

Below is a summary of the geophysical surveys that have been carried out on the Basin Lake and East Tyndall Grids up to line 40N (including the Howard's Anomaly area from line 19N to line 26N) prior to June, 1980. Except for the aeromagnetics, this coverage is shown in Figures 3 and 4.

Basin Lake

Induced Polarisation:	Pickands Mather, dipole-dipole 1968-69. Scintrex, gradient 1974, 1978. Scintrex, pole-dipole, 1980.
Electrical Soundings:	Scintrex, 1974.
Magnetics - Airborne:	RioTinto (late 1950's).
- Ground:	Scintrex, 1974.
Electromagnetics:	Scintrex (for Pickands Mather), 1970.

East Tyndall

Induced Polarisation:	For (?)EZ (RioTinto Grid), dipole-dipole, 1962. McPhar, dipole-dipole, 1967, 1968. Scintrex, gradient, 1973, 1974.
Magnetics - Airborne:	RioTinto (late 1950's). Geoex, 1978 (part of area only).
- Ground:	Mt. Lyell, 1968-69.
Electromagnetics:	RioTinto, 1957-59. Geoterrex, 1981.
Gravity:	RioTinto, 1957-59.

Howard's Anomaly

Induced Polarisation: Scintrex, gradient, 1974, 1979.
Scintrex, pole-dipole, 1975, 1980.

Electrical Soundings: Scintrex, 1974.

3.1. Induced Polarisation; Gradient Array

3.1a Basin Lake

The Basin Lake Grid was surveyed with gradient array IP by Scintrex in 1974. A 100ft dipole was used and the survey covered the whole grid. The data was presented in TAS-025B (Howland-Rose, 1974a). Two additional small surveys were carried out in 1978. The data for these is in TAS-054c (Howland-Rose, 1978). Details of the surveys are given in Table 1.

Several well defined chargeability anomalies were detected by the 1974 survey; typically they had amplitudes of 30ms in a background of 10-15ms. Most anomalies also had an associated (usually weak) resistivity anomaly, around 1500 ohm-m, in a background of about 4000 ohm-m. Below are listed thirteen chargeability anomalies which are shown in Figure 5. The list is in geographical order in west and east columns.

West		East	
(2)	54S/1850'E	(1)	72S/5600'E; 78S/5500'E; 84S/5200'E
(3)	54S/1200'E	(5)	54S/7000'E; 48S/7000'E; 42S/7150'E
(4)	54S/850'E; 48S/750'E	(6)	36S/6150'E; 30S/6050'E
(7)	30S/3600'E; 24S/3700'E	(6a)	30S/6600'E
(8)	30S/3100'E	(9)	24S/7150'E; 18S/7100'E
(10)	18S/1700'-2300'E; 12S/2500'E; 6S/2250'E; 00/2600'E	(11)	3S/7100'E; 00/7350'E; 3N/7400'E
(12)	00/3200'E		

Anomalies on the eastern side which have probably been adequately investigated are: anomaly (1) has been explained by DDH BL801

3.1a (Cont.)

(drilled for Pickands Mather in 1970: Wuerch, 1971) which intersected black shales. Anomaly 5 was drilled by DDH BL2 and black shales were again intersected (see Section 5.2.). Anomalies (6) and (6a) were drilled by DDH BL4: the latter was over sub-massive and disseminated pyrite; while the former was over black shales (see Section 5.4.). A costean revealed black shales above anomaly (11). The cause of (9) is uncertain, but it may be on strike with (~~11~~.(6)(6a) On the western side, pyrite outcrops (in road cuttings, etc) at anomalies (7) and (8). It is possible that (10) has been tested by DDH TYN2 (although this is not indicated in Figure 5) since anomaly (10) is probably the same chargeable zone as 'A'; the target for DDH TYN2. (This spatial discrepancy between the two grids is also evident on the eastern side of the grid.) DDH TYN2 intersected pyritic black shales.

On the eastern side of the Basin Lake Grid, the occurrence of sulphides (e.g. massive pyrite in BL4) in close proximity to the black shales, emphasises the fact that the anomalies cannot be dismissed as being solely due to black shales. Since the glacial overburden means that geochemistry can not be used to help differentiate IP anomalies from shales or sulphides, anomalies either have to be drilled or further investigated by geophysics. Gravity may be used to distinguish massive mineralised zones from black shales, but the Mt. Lyell style of mineralisation (large-volume pyrite bodies with zones of 6-10% chalcopyrite) would not be expected to show a good gravity anomaly and would probably be difficult to recognise beneath an appreciable thickness of glacial moraine. Such a thickness of glacial moraine also means that it is likely that the gradient array IP survey has not adequately explored the underlying prospective volcanics (see below).

On the western side, the anomalies have not been so well investigated and with the probable exception of (10) (by DDH TYN2), none have been drilled. The broad zone of pyrite at (7) and (8) may indicate a Mt. Lyell style of mineralisation in which case an EM survey might be appropriate to try and locate any concentrations of chalcopyrite (unfortunately concentrations of pyrite would give the same response).

3.1a (Cont.)

The 1978 additional gradient array surveys over Basin Lake covered two small areas. In the NE corner of the grid, the survey better defined anomaly (11) (tested by a costean near line 00 which revealed black shales). A pole-dipole IP profile was also conducted along line 00 which confirmed the anomaly (see Section 3.2a). The anomaly could be further investigated, since black shales, often indicating an environment favourable for mineralisation, should be checked along their strike length for economic sulphides. Anomaly (9) appears to be on strike with these black shales but further work is recommended over this anomaly which has two adjacent chargeability 'highs'.

The second array of the 1978 survey was conducted to try and locate a surface expression for chargeable zones defined by a down hole IP survey of DDH BL1. (From 275m to 330m down hole, a very chargeable zone was intersected, max. values 90+ mv/v. From 360m to the end of the survey at 393m, high values were also recorded.) The second survey, like the first, showed no IP or resistivity response near BL1 which might explain the down hole results. Thus it seems likely that the gradient array IP has not penetrated the glacial overburden, and although the total sulphur assays (max. values 6%) appear to explain the down hole IP log, a dipole-dipole IP survey could perhaps be carried out over BL1 to detect and define what the gradient array is missing.

The gradient array survey has probably adequately explored beneath much of the glacials since anomalies were defined, which drilling has shown to be due to chargeable bodies. However it seems that here as elsewhere, the gradient array is unsuitable over thick glacial sequences (actual depth not defined, but BL1 was drilled through 30m of glacials). The geologist responsible for the area believes that the only area of thick moraine which might be worth re-investigating is between BL1 and the terminal moraine to the south, since to the north, the rocks beneath the 'too thick' moraine are probably Tyndall Group (Komyshan, pers. commun.).

3.1b East Tyndall

Parts of the East Tyndall Grid were surveyed with gradient array IP by Scintrex in 1973 and further work was done in 1974. This does not include surveys specifically over the Howard's Anomaly Grid (see Section 3.1c). The 1973 survey covered anomalies defined by the earlier (1967/68) McPhar dipole-dipole IP surveys (see Section 3.2b). Hallof (1967, 1968) defined these anomalies into zones (see Figure 5) and the 1973 Scintrex survey covered anomalies in zones 'A', 'B', 'C3' and 'C4'. (Zone 'C3' is within Howard's Anomaly and is discussed in the next section.) The 1974 survey extended the coverage of zone A and surveyed lines 34N and 36N. The data for the 1973 survey was presented in Scintrex Report TAS-018c (Howland-Rose, 1973) and the data for the later work in Scintrex Report TAS-025 (Howland-Rose, 1974b). Details of both surveys are given in Table 2.

Zone 'A':

The 1973 surveys over lines 6N + 400S, 6N, 6N + 400N confirmed the 1967/68 McPhar dipole-dipole anomaly location with a (~)60ms anomaly on line 6N. Four hundred feet to the north and south, the peak chargeabilities were within the zone defined by McPhar, but were offset from the centre. Resistivities were above 1000 ohm-m and weakly defined a low only on line 6N.

The 1974 survey extended the coverage from line 2N to line 10N and confirmed that the best anomaly occurred on line 6N. Except for line 6N this survey extended further to the west than either the 1968 dipole-dipole survey or the 1981 survey. On this western side of zone 'A' only minor variations in chargeability were recorded, except at the western end of line 8N where a very narrow, nearly 70ms, anomaly was recorded at 3150'W. The anomaly shape suggests a very narrow and limited source, however the surveys on lines 7N and 9N did not extend sufficiently far to the west to confidently state that 8N/3150'W is an isolated anomaly of no further interest. However at least one earlier interpretation has included it with other responses: Stevens-Hoare (1975), interpreted a series of NNW-SSE trending anomalies within zone 'A', one of which (B5A) included the above anomaly. The 1974 chargeability results have

3.1b (Cont.)
been replotted by Komyshan on the actual, rather than ideal grid, and the anomalies have been outlined in Figure 5.

DDH TYN2 is the only drill hole within zone 'A', and it can be seen from Figure 5 that it has inadequately tested the zone. It is pointed out in Section 4.2b (discussion of the 1981 dipole-dipole IP survey) that the best IP anomaly is on line 6N. This is Stevens-Hoare's (1975) B3* zone in which he noted disseminated pyrite was present, but which might be a halo to "more substantive mineralisation". Stevens-Hoare (1975) recommended investigation of other, weak IP anomalies in zone 'A' associated with geochemical anomalies, but generally assigns them a 'low priority'. Although only one of the 1981 survey extended sufficiently far to the west to test the lesser anomalies (see Section 4.2b), the results support Stevens-Hoare's interpretation of the zone's prospectiveness.

Zone 'B':
Only line 4N was surveyed (the zone was defined by Hallof (1968) to cover lines 4N to 10N). A 'step' response was recorded with low chargeabilities to the west, and higher values (>20ms) to the east of 5200'E. Figure 5 shows that this is the northern extension of Basin Lake anomaly 6, which has been adequately tested by DDH BL4.

Zone 'C2':
This zone was defined by Hallof (1968) as extending from line 15N to line 18N. Four lines (15N, 16N, 17N and 18N) were surveyed by gradient array IP in 1974 as part of a survey of Howard's Anomaly. Since this area has been defined as extending from line 19N to line 26N, lines 15N-18N from that survey are discussed here. Strong chargeability anomalies (50+ms) were recorded on lines 15N, 16N and

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* Stevens-Hoare (1975) divided the 'Mt. Tyndall' area (Henty-Yolande, East Tyndall, Henty Fault Zone and Red Hills) into five blocks, A to E. The East Tyndall Grid is within blocks A and B. Stevens-Hoare labelled IP anomalies within these blocks A1, A2, B1, B5 etc. This is a quite separate (and more detailed) labelling to that used in this report, which has used Hallof's (1968) labelling to broadly define the zones of interest.

3.1b (Cont.)
17N. Of particular interest is the anomaly over DDH TYN3 which suggests only a single source. The 1967/68 and the 1981 dipole-dipole surveys indicate two sources; the more easterly one not being intersected by TYN3. The (spatial) relationships of all the geophysics over TYN3 are discussed in Section 5.7. The 1981 dipole-dipole survey indicates a continuing interest in zone 'C2' and further work is recommended in Section 7.

Zones 'C4' and 'E':
Zone 'C4' was defined by Hallof (1968) from line 28N to the northernmost line of the dipole-dipole IP survey, 38N. The 1973 Scintrex gradient array IP survey checked this zone at lines 28N, 34N, 38N and 40N. No anomaly was recorded over the well defined dipole-dipole anomaly at 3000'W on line 28N (200ft dipole, Hallof, 1967, see Section 3.2b) nor on line 34N. On both lines, the frequency effects are low, but the anomalies are definite: they are considered to be real but subtle. The lack of corresponding gradient array anomalies is probably due to the inherently poorer signal to noise ratio of this array, which means that as an anomaly becomes weaker the gradient array will 'lose' it before the dipole-dipole array (see Section 6).

On line 38N anomalies were recorded coincident with 'C4' and 'E' as well as a response on the western end which suggests a broad chargeable rock unit. On line 40N, an anomaly at 600'W was coincident with 'E', while at 3400'W (which is north of the area covered by this report) a very diminished chargeability/resistivity anomaly was recorded which may be an extension of 'C4'. The 1974 survey extended the coverage of line 34N to the western end of the line and surveyed line 36N. A poor anomaly was recorded at 3150'W to the west of 'C4' on 34N, but on 36N an anomaly was recorded coincident with 'C4'. Both 'C4' and 'E' trend approximately NW-SE (see Figure 5). However work on the Henty Fault Zone to the north suggests that this may not be so. DDH HFZ7 was drilled into 'E' on line 40N and HFZ8 was drilled into 'C4' on line 38N: the log of HFZ8 states that the purpose of this hole was "to test the (southern) extension of the mineralisation intersected in HFZ7" (minor mineralisation only

3.1b (Cont.)
in both holes; see Section 5.14). Thus the mineralisation may trend approximately north-south at the northern end of the East Tyndall Grid. This interpretation was favoured by Stevens-Hoare (1975, figure 12), who defined two north-south trending anomalous zones between line 34N and line 40N. Howland-Rose (1974b) discussed a resistivity low between line 34N and line 40N which may "represent the manifestation of a fault zone", but this is not readily identifiable from the contour plan (Scintrex Report TAS-025, Plate 7). More detailed geophysics is required to define 'C4', but this should be preceeded by further mapping.

3.1c Howard's Anomaly (lines 19N-26N)

There have been three gradient array IP surveys within Howard's Anomaly (plus a fourth in 1981). The first survey in 1973 confirmed the earlier dipole-dipole anomalies around line 22N, which formed part of zone 'C3' (defined by Hallof (1968) over lines 22N and 24N). A 1974 survey, covered all the whole number lines (actual coverage was lines 15N to 26N). In 1979 a detailed survey repeated the original lines plus all the infill lines which now define the Howard's Anomaly Grid. The 1973 survey data is presented in Scintrex Report TAS-018c (Howland-Rose, 1973), the 1974 survey data in TAS-025 (Howland-Rose, 1974) and the 1979 data in TAS-073a (Howland-Rose, 1979). Details of all three surveys are given in Table 3. Since the coverage of the earlier two surveys has been re-covered by the 1979 survey, only anomalies from this last survey are discussed here.

The detailed coverage of Howard's Anomaly by the 1979 Scintrex survey defined several good anomalies, some of which were subsequently covered by pole-dipole surveys (the results of which were also presented in Scintrex Report TAS-073a and are discussed here in Section 3.2c). The gradient array chargeability anomalies have been labelled alphabetically by Howland-Rose (1979) with a sub division based on rock types: anomalies A to I within rock-types 'A' and 'B' and anomalies V to Z within rock-type 'C' ('A', 'B' and 'C' probably correspond with units II-III, V-VI-VII and VIII respectively of the geologic map, Figure 2). The better anomalies are shown in Figure 5 of this report, namely A, B, C, D, E, F, G, H and X. An unlabelled anomaly on line 19N is also shown in Figure 5. The bound-

3.1c (Cont.)
aries of these anomalies have been defined by the 30mv/v contour. The resistivity contours are shown in Figure 6.

The southern end of anomaly H has been tested by DDH HA2 which intersected disseminated pyrite (see Section 5.8) and minor base metals. Anomaly F on strike to the north of H has a costean (No. 4) across it, but apparently the costean above the chargeability anomaly is still in glacials (Komyshan in Meares et al, 1981). That is, the costean did not reach bedrock and has therefore inadequately tested IP zone F. The broad anomaly E, with no corresponding resistivity low is probably due to disseminated pyrite.

Anomaly G is a narrow, elongate anomaly with a maximum value of 35+ mv/v at 2150'W on line 22N. There is no coincident resistivity anomaly and there is no geological information about its possible cause. Coincident resistivity lows were defined by pole-dipole surveys (see Section 3.2c).

Anomaly X was tested by DDH HA3 which intersected black shales 61m east of the IP anomaly. However some pyrite mineralisation has since been found within the area covered by the anomaly (Meares, pers. commun.) and the elongate anomaly X is assumed to be caused by a narrow zone of disseminated pyrite.

Anomaly C is a one line anomaly (35+ mv/v) on line 23.4N, there is no geological or other information about the anomaly. Its limited size and narrow shape suggest a similar cause to anomaly X and it can perhaps be correlated with anomaly G.

Anomalies A and B are large in areal extent and have no corresponding resistivity anomalies. Pyrite has been found between A and B and disseminated pyrite is a likely source for both of these anomalies.

The unlabelled anomaly on line 19N has probably been tested by DDH HA5 which intersected a little disseminated pyrite in beds which, from the BCA's, probably underlie the chargeability anomalies at the surface. Thus the chargeability anomalies at

3.1c (Cont.)
Howard's Anomaly have been apparently explained with perhaps anomaly 'F' the one exception. However the lack of a resistivity low in gradient array results (taken to indicate only disseminated sulphides) should not be taken as final evidence, since this array often only poorly defines such lows (see Section 6).

3.2. Induced Polarisation: Dipole-Dipole & Pole-Dipole Arrays

3.2a Basin Lake

Dipole-dipole IP surveys were carried out by, and for, Pickands Mather over a portion of their E.L. 12/65, termed the Basin Lake Prospect. This is in the SW corner of Mt. Lyell's Basin Lake Grid. The data held by Mt. Lyell is very incomplete, being only plan maps of the n=4 values of the resistivity, percent frequency effect and metal factor. (Other IP surveys were apparently carried out in the vicinity (Wuerch, 1971), but Mt. Lyell has no copies of this data.) The coverage of the Pickands Mather survey is given in Table 4.

A good IP anomaly was recorded which is well defined on the metal factor plan. Two diamond drill holes (vertical, because of a very thick glacial moraine overburden) were drilled into the anomaly: BL801 was drilled to 228.5m and pyritic black shales were intersected; BL802, which was sited on the centre of the metal factor anomaly, reached only 67.7m before the drillers quit. The IP anomaly was inadequately tested by BL802 which "averaged 0.46% Pb, 0.18% Zn, 0.04% Cu and nearly ½oz of Ag" from 63.1m to 67.7m (Wuerch, 1971) and DDH BL1 was sited by Mt. Lyell in 1978 to intersect the southern extension of this mineralisation, some 30-40m south of BL802. The results were disappointing (see Section 5.1).

Figure 5 shows that BL801 was drilled into anomaly 1 of the 1974 gradient array IP survey (Section 3.1a) and it also shows that the gradient array survey did not detect the dipole-dipole anomaly, presumably because of the thick sequence of glacials (see comments end of Section 3.1a). However the anomaly defined by the Pickands Mather dipole-dipole IP survey has been adequately tested by DDH BL1

3.2a (Cont.)
which intersected a zone of strong alteration containing disseminated pyrite. The relationship of BL1 to the anomalies from various surveys is further discussed in Section 5.1.

A pole-dipole survey was carried out on one line, 00, during a follow-up IP survey over Basin Lake in 1978 (see Table 4). It is presumed that the dipole spacing was the same as the station spacing; i.e. 100ft (and not 100m as stated on the profile, Scintrex Report TAS-054c). The results show an excellent anomaly which, as Howland-Rose (1978) pointed out, is very similar to the response over an ideal sphere (i.e. the results are readily interpreted by matching to type curves and hence the likely position and extent of the source may be determined). Unfortunately a costean over the IP anomaly just north of line 00 uncovered black shales and no base metal mineralisation.

3.2b East Tyndall

A 1962 dipole-dipole survey for EZ over the RioTinto Grid (Figure 3) was probably one of the earliest uses of IP in Australia. The prospective sections of the RioTinto Grid (i.e. the western ends; the eastern ends being over Tyndall group or Owen Conglomerate) have been subsequently surveyed by various other IP surveys. The data is of historic value, and I have not examined it for any anomalies. However, Drake (1979), has included the data in his compilation and it is worthwhile pointing out that there are errors and ommissions in this recent report.

The (hopefully) correct coverage of the 1962 survey is listed in Table 5 and shown in Figure 3. (Drake's figure 14 has lines 6800S, 7200S and 7600S not plotted and has surveys missing on lines 4800S, 3200S and the eastern end of 3600S.) The anomalies from this survey have not been included in Figure 5, but on Drake's figure 12 anomalies on lines 6400S, 3600S, 2400S and 00 are missing (using his criterion of a PFE anomaly as being >45%), as well as on the lines mentioned above.

3.2b (Cont.)

McPhar carried out extensive surveys over the East Tyndall (and West Tyndall) Grid in 1967 and 1968. The 1967 survey covered the even numbered lines from 2N to 38N (at a line spacing of 400m to 500m) at a dipole interval of 300ft. Some 200ft and 100ft spreads were also carried out. The 1968 survey was mostly 100ft dipole spreads over the anomalies defined by the 1967 survey plus some spreads 200ft, 300ft or occasionally 400ft north and south of some of these anomalies.* The coverage of both surveys is listed in Table 5.

Hallof (1968) defined a number of anomalous zones and labelled them A, B, C1, C2, C3, C4, D and E. Hallof's plan map of these anomalies has been incorporated into Figure 5. A comparison of this map with the anomalies from subsequent IP surveys over the East Tyndall area shows that Hallof's interpretation was substantially correct and his labelling has been used in this report. (It has also been used in various Scintrex reports, but Stevens-Hoare (1975) used a different system; one which also used the early letters of the alphabet with numbers.) The results from each of these zones is summarised below.

Zone A:

Defined by Hallof (1968) as extending from line 2N to line 6N + 400N with the strongest anomaly on line 6N. The southern portion of this zone is also covered by the Basin Lake Grid. The mismatch between zone A and gradient array anomalies from a survey over Basin

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* The results of these surveys were presented as metal factors and resistivities, the latter as ohm-ft divided by 2π and plotted upside-down (mirror-image). To compare with later data, the IP effect (percent frequency effect) may be found by multiplying metal factor by resistivity and dividing by 1000. (For some reason %FE/2π has been pencilled on some results in Hallof, 1968.) To convert resistivities to ohm metres multiply by 1.92. Most later IP surveys for Mt. Lyell have been in the time domain; an approximate conversion is chargeability (mv/v) = 5x (%FE).

3.2b (Cont.)

Lake is probably due to location inaccuracies between the two grids: I consider that the gradient array '10' confirms the McPhar zone 'A'; although as shown in Figure 5, 'A' is actually a series of en echelon anomalies. It should be noted that in Hallof (1967) the 200ft dipole pseudo-section on line 6N (the best anomaly in zone A) has identical values plotted for resistivity and metal factor for data points defining the anomaly and that the two 1968 200ft dipole surveys over the area (800'W-800'E) considerably reduce its attractiveness.

One drill hole has been drilled into zone 'A', DDH TYN2 on line 4N (in 1975) on a high value, narrow gradient array anomaly: black shales and pyrite were intersected. Previous and subsequent dipole-dipole surveys have shown that there is no substance to the gradient array anomaly and thus TYN2 was (and is) considered an insufficient testing of the zone, therefore lines 2N and 8N were resurveyed with dipole-dipole IP in 1981 (see Section 4.2b). Zone 'A' is still considered to be a prospective area.

Zone 'B':

This zone of anomalies was defined by Hallof (1968) as extending from line 2N to line 10N (see Figure 5). The zone largely overlaps the Basin Lake Grid and follow-up of Basin Lake gradient array anomalies coincident with zone 'B' (any mismatch in Figure 5 is probably largely due to location inaccuracies between the two grids) by drilling (BL4) and costeaning (on line 00) has revealed black shale and pyrite but no base metals. Thus zone 'B' is not regarded as being highly prospective, but some EM work is recommended over anomaly 9 on line 18S; this is between E.T. lines 4N and 6N which recorded the best anomalies in zone 'B'. It is expected that the EM survey will better locate the anomaly and hopefully allow determination of its conductance, depth, etc.

Zone 'C1':

This is possibly the only (anomalous) section of the East Tyndall Grid which has not had more than one IP survey over it, probably

3.2b (Cont.)
because the first drill hole, TYN1 (in 1968) only intersected minor pyrite. The strongest anomalies were on line 10N and on line 12N, TYN1 being sited on the latter (for more detail see Section 5.5). Thus the coverage of 'C1' is only regional, the line spacing being nearly 500m.

Zone 'C2':
Zone 'C2' was defined by very good anomalies on lines 16N and 18N. On line 16N and nearby in-fill lines, the zone is seen to consist of two distinct bodies. It was drilled by DDH TYN3 in 1975. A 1981 dipole-dipole survey (lines 15N and 18N, see Section 4.2b) confirmed the two sources and suggested that the zone had only been partially explored. Thus zone 'C2' is still considered to be of interest.

Zone 'C3':
Defined by Hallof (1968) as covering lines 22N and 24N, and 'C3' is therefore discussed under Section 3.2c, Howard's Anomaly.

Zone 'C4':
This zone was defined by Hallof (1968) to extend from line 28N to 38N (the northern limit of the survey) through some weaker anomalies (i.e. anomalies weaker than those defined elsewhere on the East Tyndall Grid). The better anomalies, on lines 28N, 34N, 36N, 38N and 40N were surveyed by gradient array IP in 1973 and 1974 (see Section 3.1b). These surveys did not confirm the McPhar results on lines 28N and 34N, but did so on lines 36N and 38N. Nevertheless I consider the dipole-dipole results to represent genuine anomalies with the mostly weaker anomalies suggesting lower concentrations of sulphides or less graphitic/pyritic black shales. The results of the gradient array surveys and work in the Henty Fault Zone suggest that zone 'C4' does not represent the trend of the mineralisation, but rather it is (locally?) fault controlled and trends approximately N-S between lines 40N and 36N (34N?). However the zone, nearly

3.2b (Cont.)

3000m long, has only been regionally surveyed with lines approximately 500m apart. It now requires surveying in some detail, i.e. with lines about 100m apart (see Recommendations, Section 7).

Zone 'D':

A good response was obtained east of Bradshaw's Road on line 30N, with weaker responses on lines 32N and 34N. The zone is apparently over black shales (Komyshan, pers. commun.) within the Tyndall Group (Corbett et al, 1974). Zone 'D' is not considered to be prospective.

Zone 'E':

This zone was defined on one line only, line 38N, the northernmost line of the survey, and the indicated trend is presumably based only on that of the adjacent zone, 'C4'. It was mentioned above that later work suggested that the anomaly defining 'E' was correlated with anomalies on lines 38N, 36N and possibly 34N. For example, Stevens-Hoare (1975b) stated that the purpose of HFZ8 was to "test (the) extension of mineralisation in HFZ7". This hole (HFZ8), which tested Hallof's (1968) zone 'E', intersected only minor mineralisation (about 2% pyrite from 140m to nearly 200m). HFZ8 is considered to have adequately tested the anomaly (Section 5.14) and thus zone 'E' is possibly not prospective, but it is noted again, that the East Tyndall Grid line spacing of nearly 500m means that intermediate coverage is needed before definitely declaring the area to be of no further interest.

Thus the East Tyndall zones considered to be the most promising are those which were resurveyed in 1981, i.e. zones 'A' and 'C2'. And these are discussed in more detail later in this report.

3.2c Howard's Anomaly

Zone 'C3' defined by Hallof (1968) from the McPhar dipole-dipole IP survey in 1967 and 1968 over East Tyndall, lies within what is now called Howard's Anomaly. 'C3' was defined by good anomalies on lines 22N and 24N. Detail of the coverage is given in Table 6. A 1979 gradient array IP survey from line 19N to line 25N included all intermediate lines (see Figure 3). This survey resolved 'C3' into a series of discrete anomalies which were discussed in Section 3.1c. I stated in that Section that most anomalies had been explained as being due to either black shales or pyrite, but that one or two had been insufficiently tested.

Pole-dipole surveys were carried out over the more interesting gradient array anomalies defined in the 1979 survey. The work was done in Jan-Feb., 1980 and the coverage is given in Table 6. A brief summary of the survey results is given here some of which is repeated in the description of the gradient array survey given in Section 3.1c.

The survey over line 20N showed anomaly 'H' to be a broad diffuse anomaly with a poorly defined resistivity anomaly, indicative of the disseminated pyrite intersected in DDH HA2, 100m to the south. The gradient array survey on lines 20.2N and 20.6N, defined a weak anomaly, 'Y', not shown in Figure 5, and which the pole-dipole survey confirmed to be a small shallow source. Surveys on lines 21.3N and 22N defined anomaly 'G', but did not extend to the more (?) interesting 'F'. The chargeability anomaly over 'G' is more anomalous on line 21.3N than on line 22N and there is quite a good resistivity low (less than 600 ohm-m in a background of 2000-5000 ohm-m). As stated in Section 3.1c there is no other information about this anomaly (drill hole, costean,etc) and if covered by glacials (i.e. no geochemical response expected) may be worth further exploration.

The pole-dipole survey on line 23N defined a strong chargeable anomaly over gradient array anomaly 'X', but recorded no clear resistivity anomaly. A pole-dipole survey was carried out at right angles to line 23N at 1700'W in early 1975, (Howland-Rose, 1975). The traverse defined a moderate chargeability anomaly from about

3.2c (Cont.)
60m south of line 23N to nearly 150m north of the line. Anomaly 'X' appears to have a shallow source apparently missed by DDH HA3 (see Section 5.9). The zone is considered to be due to disseminated pyrite, a sample of which has been found above the anomaly (Meares, pers. commun.). Anomaly 'C' was poorly defined by a short survey on line 23.4N and was shown to extend to line 23.7N by a survey on that line. Neither survey (the former with a 300ft dipole, the latter with 50ft) has a corresponding resistivity anomaly and again with the absence of any geochemical anomalies (glacial cover?) a disseminated pyrite source seems likely. The interpretation from the gradient array results of anomalies A and B being due to disseminated pyrite and/or black shales was reinforced by the pole-dipole survey on line 24.5N: broad chargeability anomalies of poor contrast were defined with weak resistivity anomalies. Outcropping pyrite above the anomalies and the absence of geochemical responses (glacial cover?) suggest that anomalies A and B are not worth further investigation.

Thus the most promising anomaly from the pole-dipole survey is 'G' on line 21.3N, although from the gradient array survey, anomaly 'F' is probably at least as interesting.

3.3 Electrical Soundings

Electrical Soundings were taken at a few locations during three of the Scintrex IP surveys. The surveys were carried out either to determine the thickness of overburden (glacial moraine) or to try to determine the depth to a chargeable body. The locations of the various soundings are given in Table 7.

3.3a Basin Lake

Three soundings were carried out to determine the thickness of the moraine. The data was not presented in the report (Howland-Rose, 1974a), but apparently at two sites lateral inhomogeneities prevented a meaningful interpretation (sites 60S/6000'E and 96S/3500'E).

3.3a (Cont.)
A sounding at 18S/500'E was interpreted as showing a surface alluvial layer some 70ft (21m) thick with low resistivity (600 ohm-m) and chargeability (4.5ms), compared with the sub surface values of 2000+ ohm-m and 12-14 ms.

3.3b East Tyndall and Howard's Anomaly

Five electrical soundings were carried out in the Howard's Anomaly area and immediately to the south (lines 16N and 18N), to determine the depth to the chargeable zones. Howland-Rose (1974b) stated that "the electrical sounding confirms the depths as ascertained by the maximum depth method". It is not at all clear that that is so: data is only given for one sounding, 18N/1475'W, in which the chargeability decreases rapidly from the surface and the resisitivity increases.

At the four other soundings, lateral inhomogeneities effected the readings, preventing a quantitative interpretation. The results for 16N/950'W may be qualitatively interpreted as indicating a zone of low resistivity and higher chargeabilities at depth (perhaps 25 to 30m).

3.4 Magnetics

Most of the area being considered by this report has been covered by magnetic surveys, but much of the data apparently now only exists as profiles with no accompanying documentation.

The area has been partly covered by a 1978 Geoex helicopter aeromagnetic survey: the eastern limit of the survey was approximately Bradshaw's Road, with the southern boundary near line 15N on the East Tyndall Grid. Sensor height was approximately 100m, flight lines are not shown, and the line spacing is not stated on the plans. The data is shown on a 1:10,000 scale map with a 10 gamma contour interval. There are several strongly developed magnetic highs within the East Tyndall Grid, e.g. a 700 gamma anomaly on line 17N, but no interpretation has been attempted for this report. (Irvine, 1974a, has made some comments on a 1950's RioTinto aero-

3.4 (Cont.)
magnetic survey which included the area covered in this report. However this data is only regional, having been flown with a one mile line spacing.) Irvine's (1974a) report is in the same folder as his interpretation of the IP surveys over the Mt. Tyndall area (Irvine, 1974b).

I have made little comment below on the ground magnetic results, since there has been little correlation in this area between magnetic response and sulphide mineralisation. Whether this applies to any economic mineralisation remains to be seen. (Paterson (1967) writing about the Cambrian shield noted that most massive sulphide orebodies (as distinct from occurrences or deposits) in Canada, where copper or nickel was of prime interest, have a magnetic response, whereas those that were mainly lead-zinc did not.)

3.4a Basin Lake

The Basin Lake Grid was surveyed in 1974 by Scintrex (Howland-Rose, 1974b). The data is presented as a contour plan (at 1:6,000 scale) and as profiles (at 1:24,000 scale). No details of the survey are given in the report, the measurement of total field (by a proton precession magnetometer) is assumed and the station spacing of 100ft can be deduced from the profiles. Almost the whole grid was surveyed and the exact coverage is listed in Table 8. The anomalies are shown in Figure 7.

Howland-Rose (1974a) noted that "the highest magnetic fields and the zones of greatest potential sulphide content..... are mutually exclusive" and that therefore the magnetic survey of this grid had "little economic significance" and this can be seen in Figure 20.

3.4b East Tyndall

The first magnetic surveys were carried out by RioTinto over EM anomalies located from two surveys over (what is now) the East Tyndall area (including Howard's Anomaly). The surveys are of little use in isolation, covering only short sections of lines and therefore the coverage is not listed in Table 8. Boniwell (1959) gives the data (together with the EM anomalies and the follow-up gravity

3.4b (Cont.)
survey data) and notes that, with a few exceptions, the EM anomalies did not correlate with any magnetic responses. King (1960) considered that the magnetic anomaly at 6000'S/1450'W was a notable exception with others located at 6400'S/1475'W and at 4800'S/1325'W.

Magnetic profiles of the East Tyndall area have been plotted by L. Newnham on 1:6000 scale maps (undated). This data which encompasses Howard's Anomaly has been included in the 1974-75 report of the Mt. Tyndall area by Stevens-Hoare (1975a). Two sheets, entitled 'magnetic profiles and IP anomalies', show Newnham's (vertical field) data as well as some later (total field) data. The maps illustrate the lack of coincidence between IP anomalies and magnetic responses, and the very local nature of the latter, there being little correlation between the magnetic anomalies from line to lines.

Two 1:6000 scale maps accompanying Irvine's (1974b) interpretation of the McPhar IP data show magnetic anomalies in bar form. Some anomalies have been modelled, and other comments are written on the maps.

Newnham's maps show the station spacing of the fluxgate (vertical field) data as 100ft. The interval for the proton precession (total field) data, shown by Stevens-Hoare (1975a) as smoothed lines is possibly the same. The data covers the area from line 2N to line 40N and the line coverage is listed in Table 8. Figure 7 shows the profiles at a scale of 1:20,000 (profiles on short infill lines have not been plotted).

3.4c Howard's Anomaly

A map entitled 'Howard's Anomaly, Geophysical coverage' by L. Newnham dated 3.6.'69, shows the magnetic coverage from lines 18N to line 26N. With the exception of line 18N, this data has been superceded by the 1981 survey of Howard's Anomaly (see Section 4.3a) and can be disregarded.

3.5. Electromagnetics

3.5a Basin Lake

A Turam survey was carried out north of Basin Lake by Seigel and Associates (name later changed to Scintrex) in 1970 for Pickands Mather. The survey was based on IP and drilling results (BL801 and BL802). The anomalous zone resulting from the survey is indicated in Figure 8. Apparently the survey was done using four transmitting loops (Howland-Rose, 1970). Three frequencies were used, 200, 400 and 800 Hz, but the 200 Hz data was influenced by the power line which crossed the NW corner of the grid and this was not plotted. The survey coverage of the 400 and 800 Hz data is listed in Table 9. The coverage is taken from the profiles in Howland-Rose (1970): this data is somewhat at variance (by up to 300ft) with that shown on the plans of the survey.

The survey revealed one well-defined anomalous zone (defined on 8 lines) west of an IP anomaly which had been previously drilled by DDH BL801 and BL802. The zone is very close to BL801; a vertical hole which intersected a considerable section of black shales. Conductivity measurements of core from BL801 (by Seigel and Associates) showed the black shales to be quite conductive and a thickness of only 6-14m was needed to give a conductivity-thickness product (σt) comparable to those calculated from the Turam survey. Thus the black shales are probably the cause of the Turam anomaly, but they may not have been the cause of the IP anomaly, centred some 100-120m to the east (see Section 3.2a).

Another Turam response was obtained on the northern most line (24100N), along strike from the main response. This anomaly has probably been explained by BL2 (about 50m north of 24100N) which intersected black shales. This unit may therefore be presumed to extend intermittently (or with varying graphite content) from 84S to at least 48S.

3.5b East Tyndall (including Howard's Anomaly)

Electromagnetic surveying was possibly the prime geophysical method used by RioTinto in the exploration of their prospects in NW Tasmania in the late 1950's. Conductive zones were defined by EM and these were followed up with magnetics and gravity. The electromagnetic method used was Turam, with a grounded transmitting wire This method has lost favour mostly for operational reasons, not geophysical ones (e.g. constrained to a small area around the fixed transmitting loop). RioTinto's practice of using a grounded wire also meant that a large number of anomalies would be generated by (primary) current gatherings in shear zones and conductive overburden (e.g. glacials).

(The magnetics as a follow-up method was only ancilliary; the gravity method was the main technique used to discriminate massive sulphides from other responses such as black shales or shear zones. The rugged topography of the area means greater difficulty in obtaining gravity data and more processing of it (and hence a greater expense) but it does not make it impossible or even impracticable.)

The geophysical contribution to RioTinto's exploration of the "Howard" area is described by Boniwell (1959), and King (1960) made some relevant comments. Two grids were set up, one for each Turam survey. The southern grid extended from line 6400S to 00, the northern grid from 00 to 7200N. Line 00 passed through the Tyndall Mine: the baseline bearing was 342° "azimuth", i.e. magnetic. On each grid, a wire was laid along the baseline and grounded beyond the end of the grid. Lines were 400ft (120m) apart with 100ft (30m) station intervals. The coil separation of the two receivers was not specified, but was presumably 100ft. Profiles east and west of the transmitting wire were surveyed to a distance 500-600m away from the wire. The 250ft (76m) nearest the line was not surveyed because of the steep field strength gradient near the wire. The coverage is listed in Table 9.

Several anomalies were defined and these are indicated in Figure 8 as the 'Southern', 'Eastern', 'Tyndall' and 'Northern' anomalies.

3.5b (Cont.)
Each anomalous zone is better defined by the phase response; only the Southern and Eastern anomalies show reasonable ratio responses. This indicates that the zones are poor conductors. They are discussed individually below.

1. The Southern Anomaly:
This was considered to be the most promising of the anomalies (King, 1961, wrote "while there is evidence in places that schists of slatey composition may account for the anomalies... the presence of known mineralisation in the area has also to be considered. The copper-lead showings of the Tyndall Mine occur on the same structure 1200ft along strike beyond the northern limit of the anomaly, and sporadic occurrence of limonite and haematite gossans near some anomaly stations have already been reported").

The anomaly extends for over 1200m through Howard's Anomaly, closely following the course of Tyndall Creek, and is open to the south. The "marker horizon" in the gradient array resistivity contour plan of Howard's Anomaly (Howland-Rose, 1979, Plate 2) is coincident with the Southern Anomaly.

A gravity survey was carried out over the anomaly; the results, presented as profiles in Boniwell (1959) show no significant response. Geochemical sampling by RioTinto up to 1960 has revealed no significant anomalies and the area which King (1961) stated would "have a considerable influence in deciding upon any further work" gave, from later analysis of rock chip samples by Mt. Lyell, 1.1% Pb and 0.19% Zn. Further, the zone has since been intersected by three DDH's (HA3, HA4 and HA6), and a fourth (HA5) would probably have intersected any southern continuation of the zone.

Although there is some minor mineralisation associated with the zone, the 'Southern' anomaly is clearly not a response to massive sulphides: a fault or fracture is a more likely cause.

3.5b (Cont.)

2. The Eastern Anomaly:

This anomaly was favoured by Boniwell (1959) because of its (slight) positive gravity anomaly, and partly no doubt because of its proximity to the Cambrian Volcanic-Ordovician Conglomerate contact which was (is?) considered to be directly related to all mineralisation at Mt. Lyell.

The zone was resurveyed by a horizontal loop EM technique in 1981 and is the subject of two reports (Bishop, 1981a and 1981b). The results of the 1981 survey are briefly discussed in Section 4.4a where it is stated that the Eastern anomaly is most unlikely to be due to, or associated with, any mineralisation.

3. The Tyndall Anomaly:

King (1961) had little comment to make about this anomaly since no outcrop had been found. The southern part of the zone is about 120m west of the Tyndall Mine and was covered by the 1981 gradient array survey centred on these old workings. This survey (see Section 4.1a) revealed no sign of (potential) mineralisation apart from the isolated responses at the mine itself. The Tyndall anomaly is likely to be due to a northern continuation of the 'shear' zone defined by the Southern anomaly.

4. The Northern Anomaly:

The RioTinto reports (Boniwell, 1959 and King, 1960 and 1961) make no comment about the Turam responses north of, and west of the apparent trend of, the Tyndall Anomaly. The southern (and weaker) end of the Northern anomaly is near the line 30N pit, which gave "moderately anomalous" base metal values from rock chip samples (Komyshan in Meares et al 1981). Only poor responses were obtained over the zone from the 1967/68 dipole-dipole IP surveys and like the other EM responses, this 'Northern' anomaly is not considered prospective.

Line 40N:

A dip angle EM survey was carried out from line 40N to line 58N.

3.5b (Cont.)
This data is in the folder prepared by Newnham (1969), previously referred to in Section 3.3b. Only line 40N is within the area considered by this report. Some small variations occurred on this line ($<10^{o}$), none of which coincided with chargeability responses from the gradient array IP survey along this line (see Section 3.1b).

3.6 Gravity

Gravity surveys were carried out by RioTinto over their EM anomalies. On the East Tyndall Grid, the gravity "was confined to representative sampling of the major and more noteworthy electrical zones" (Boniwell, 1959).

Surveys were carried out over the 'Eastern', 'Southern', 'Tyndall' and 'Northern' Turam anomalies. The results were presented as Bouguer gravity profiles and apparently only the results from the Eastern anomaly were considered sufficiently interesting to show as residual gravity contours. (This anomaly has since been investigated by Mt. Lyell and is considered to be unprospective, see Section 4.4a). Boniwell (1959) noted that there was "minor gravimetric correlations....at 28S and 32S" on the Southern anomaly, but he considered that they probably did not represent mineralisation. Boniwell (1959) also noted that there was no gravimetric response over the Tyndall Mine.

Although I consider that the gravity has probably adequately tested the Turam anomalies, it is not very useful data for any subsequent (geophysical) interpretation of the area, such as this report; the data being a series of very short profiles. However the results over the Eastern anomaly do suggest that the Great Lyell Fault at the eastern edge of the grids has a considerable vertical throw, e.g. line 52S has a gradient of 1.26mgal per 100m, decreasing to the east. The survey coverage is given in Table 10.

4. GEOPHYSICAL SURVEYS AFTER JUNE, 1980

This section describes the geophysical surveys carried out over the Basin Lake and East Tyndall (including Howard's Anomaly) Grids between June, 1980 and September, 1981. The surveys are:-

Basin Lake

Induced Polarisation:	Dipole-dipole, lines 30S & 36S.

East Tyndall

Induced Polarisation:	Dipole-dipole, lines 2N-8N, 15N-18N. Gradient array, Tyndall Mine (lines 26N-28N).
Electromagnetics:	RioTinto 'Eastern' anomaly (lines 22N-26N).

Howard's Anomaly

Induced Polarisation:	Gradient array, lines 22N-23.4N infill.
Magnetics:	Lines 19N-26N.

4.1 Induced Polarisation: Gradient Array

4.1a Tyndall Mine

A small survey was carried out over the Tyndall Mine, a small, polymetallic (Pb/Zn/Cu) sulphide vein located on Tyndall Creek between lines 26N and 28N. The survey details are given in Table 2 and plans of the chargeability and resistivity contours are shown in Figure 9.

The results showed that there is no significant body of mineralisation: spot highs only were recorded (40+ mv/v in a background of 15-20 mv/v). Average resistivities are about 3000 ohm-m, but there is a <700 ohm-m zone extending from line 28N, SE to line 26.6N. This coincides with the Turam anomaly defined by RioTinto in 1959 (see Section 3.3b).

4.1b Howard's Anomaly In-fill (lines 22N-23.4N)

A gradient array IP survey of Howard's Anomaly was undertaken by Scintrex in 1979 (Howland-Rose, 1979, and see Section 3.1c): a small gap was left at the western ends of lines 22N to 23.4N. The coverage is listed in Table 3 and the plans of the chargeability and resistivity contours are shown in Figure 10.

No anomalies were defined: chargeabilities were obtained with values of 15-20 mv/v and resistivities increased westwards from about 2000 to 10,000 ohm-m. The survey closed off a resistivity low which extended from line 20.2N to line 23.7N.

4.2 Induced Polarisation: Dipole-Dipole

4.2a Basin Lake lines 36S & 30S

Two dipole-dipole surveys were carried out to verify and better define gradient array chargeability anomalies from the 1974 survey (see Section 3.1a). The survey details are given in Table 4 and shown in Figures 11 and 12. Anomalous chargeabilities and resistivities were recorded on both lines: on 36S a maximum chargeability of 97 mv/v was obtained at n=4, with 65+ mv/v defining a zone to the surface. On line 30S DDH BL4 was drilled into an anomaly of 60+ mv/v (max. value 77 mv/v at n=2). 8.5m of massive pyrite and then black shales were intersected (see Section 5.4).

On line 30S, very high resistivities were recorded east of about 7900'E: the values increased towards the surface. This position approximately coincides with the increase in slope up the Tyndall Range and the high resistivities presumably reflect scree and/or moraine above the watertable, to a thickness greater than 100m.

4.2b East Tyndall, lines 2N-8N

The 1967/68 dipole-dipole survey had defined a zone of anomalies from 2N to 8N, trending approximately N-S crossing Bradshaw's Road at about 6N (Section 3.2b). A later gradient array survey confirmed the strong dipole-dipole anomalies as well as defining weaker anomalies to the west (Section 3.1b). All of these gradient array

4.2b (Cont.)
anomalies were interpreted as trending approximately NW-SE (parallel to geological strike). Anomalous base metal values from soil geochemical assays occur scattered throughout this zone (Stevens-Hoare, 1975, figure 16), but the area is partly covered by button grass swamps and/or glacial moraine.

Lines 2N and 4N to 8N were surveyed by 50m dipole-dipole IP (details in Table 5). This confirmed the very anomalous area centred on line 6N, at 00. The survey also defined an anomaly beneath the collar of DDH TYN2 on line 4N. The relationship of TYN2 to the geophysics is discussed in more detail in Section 5.6, but it is noted here that although the drill hole intersected a small zone of black pyritic shale and disseminated pyrite (in 1975), the 1981 dipole-dipole survey defined a chargeable zone beneath 170mE (i.e. approximately the drill hole collar), perhaps 75m deep and roughly vertical. The chargeabilities strengthen to the north, however Komyshan (pers. commun.) believes that the response on line 4N is a separate anomaly, and this confirms the 1974 gradient array IP results. These have been replotted by Komyshan and the reduction to 1:20,000 scale is shown in Figure 5.

On line 5N, the response is well developed and clearly defined. On line 6N, the anomaly has become less well defined, but has larger chargeabilities due to its increased volume. On lines 7N, the high values are maintained, the source is shallow and smaller than at 6N. On line 8N, the values have decreased, and the anomaly again suggests a disseminated source (see Figure 13). The resistivities on each line show poorly defined lows associated with the chargeable zones: these lows are <400 ohm-m or <250 ohm-m, in backgrounds of 1000-2000+ ohm-m (see Figure 13).

Only line 6N went close to the recommended coverage to the west (Bishop, 1981c), and on this line a lesser (than anomalies to the east) chargeability anomaly of 35+ mv/v was defined beneath 600mW. The poorly defined shape and moderate values do not suggest a worthwhile target. Thus this survey outlined two targets of interest:

4.2b (Cont.)

(i) a deep chargeable source beneath TYN2 at 170mE on line 4N; and (ii) a strong anomaly north of TYN2, particularly on lines 5N and 6N. The response from line 5N to at least line 7N may be a repetition of the black shales and disseminated pyrite in TYN2, but recommendations for further definition of these zones (by geophysics and drilling) is made in Section 7).

4.2c East Tyndall, lines 15N-18N

The IP zone 'C2' defined by Hallof (1968) was tested by DDH TYN3 which encountered slightly pyritic black shales. It was felt that this was an insufficient test of the zone (Bishop, 1981c) and it was also considered likely that TYN3 had not thoroughly tested its target on line 16N. Thus dipole-dipole IP surveys were conducted on lines 15N to 18N to confirm the original surveys (on lines 16N and 18N) and to provide a more detailed coverage (however line separation is still in excess of 200m).

Figure 15 shows that the chargeabilities varied systematically across the four lines, with line 16N probably the most interesting; TYN3 has been drilled on this line but as is mentioned in Section 5.7, this intersected only one of two polarisable sources.

On line 15N, the 65+ mv/v zone is shallow although high values persist to n=3 on the western edge of the survey (i.e. a second chargeable zone is likely to the west of the survey limits). On line 16N, the anomaly has deepened, become more clearly defined, and is apparently due to two sources, one beneath 125mE, the other probably beneath 250mE. On line 17N, the sources are deeper still, with the more easterly body only just registering. On line 18N, there is no anomaly, the chargeable source being either at a considerable depth, or having petered (faulted?) out: the first seems less likely. The resistivity pseudo-sections are much less diagnostic: on each line a central zone of low resistivities is defined with diffuse boundaries.

Various possible approaches to further exploration over areas such as 15N-18N are discussed in Section 6 with specific recommendations

4.2c (Cont.)
in Section 7.

4.3 Magnetics

4.3a Basin Lake

Two lines (36S and 30S) were surveyed at Basin Lake to verify the results and locations of previous results for DDH's BL4 (and more particularly) BL3. The coverage is given in Table 8 and the results are shown in Figures 10 and 11.

4.3b Howard's Anomaly

As outlined in Section 2, one of the targets at Howard's Anomaly has been silver, which occurs within a magnetite/haematite bearing unit: a detailed magnetic survey was undertaken to better define this unit. A proton precession magnetometer survey was carried out over lines 19N to 26N with a 50ft station interval: 25ft was used in areas of high magnetic gradient. The line coverage is listed in Table 8.

Although for much of the survey, the lines are 100m apart or less, there is very little obvious correlation from line to line although responses are large, of the order of several hundreds of gammas. As Komyshan (1981) has noted "local variability in the proportions of haematite and magnetite in tuffaceous sediments.... has not delineate(d) marker horizons". There is one apparently consistent 'high', within unit 'X' (pink-green feldspar quartz crystal lithic tuffs and agglomerates; feldspar quartz porphyry, see Figure 2), however this is to the east of the intermediate lines and the line spacing is >200m. It is quite possible that a more detailed coverage of this zone would define it as a number of separate zones. This zone is to the east of the rock unit of interest which is no. VIII.

The contour plan by Komyshan is shown in Figure 16. The coarse contour intervals of 500γ and 1000γ has meant that only the larger variations are shown, however the spatial and amplitude variability is such that a finer contour interval would not provide more useful information. The survey showed that the possibly prospective haematite zone would not be defined by a magnetic survey. Also it

4.3b (Cont.)
is shown in Section 5, that although the silver occurs within the haematite unit, there is no relationship between silver concentration and percent magnetite/haematite.

4.4 Electromagnetics

4.4a East Tyndall, the 'Eastern' Turam Anomaly

A well-defined Turam anomaly had been detected by RioTinto in 1958 (see Section 3.3b). Bishop (1981a) suggested that the cause was either the faulted contact between the Ordovician sediments and the Cambrian volcanics and/or a conductive layer within the overlying moraine. Nevertheless, for various reasons listed in Bishop (1981a), a follow-up survey was recommended to locate the anomaly on the Mt. Lyell Grid. The horizontal loop method Max-Min was used for the survey, the details of which are listed in Table 9.

The 'Eastern' anomaly was located by a series of weak and poorly defined anomalies, in sharp contrast to the Turam results. The cause of the differences between the two systems has been suggested by Bishop (1981b); namely that since the Turam survey used a grounded wire as a source, the return current would have concentrated in the fault and/or moraine. This current was readily detected by the Turam receivers. The Max-Min system is a purely inductive system (as are most EM techniques), and the fault/moraine is only weakly conductive (i.e. currents are poorly induced). The position of the EM response does not agree with the geological interpretation of the fault (mostly by air-photos, since the area is covered by glacial moraine): the discrepancy, upto 100m, may be due to the fault zone dipping shallowly to the west, or the fact that the glacial cover is the sole 'conductor'. The latter interpretation is assisted by the fact that the largest response was obtained at a coil spacing of 150m: a fault buried by probably less than 30m of overburden would have responded with a smaller spacing. Bishop (1981b) concluded that because of the poor results from the survey, and the lack of any other supporting evidence, no further work be done on the 'Eastern' anomaly.

5. DRILLING AND GEOPHYSICS

Ignoring HA1 which was halted because of excessive flattening, fourteen holes have been drilled by Mt. Lyell in the area encompassed by this report. These include four on the Basin Lake Grid; three have been designated TYN; five are in the Howard's Anomaly area; and two holes on the northernmost lines were part of the Henty Fault Zone (HFZ) project. Holes by earlier lease holders (e.g. Pickands Mather) have not been considered in this Section which compares the results of the drill holes with the geophysical results. This Section is included since for any exploration program it must be established whether the geophysical anomalies have been explained by the drill hole intersections. The list below is geographical (from the south) between areas and chronological within areas. Summaries of the drill hole details are given in Table 11.

It is appreciated that there are other factors besides geophysics when starting or stopping a drill hole (even if geophysical anomalies are the stated reason in the drill log). However the comments and criticisms made below are concerned only with the geophysical factors. Apologies are offered if they are too critical; it is much easier to write with the advantage of hindsight and without the pressures of deadlines, etc., than to be actually doing the job.

5.1 DDH BL1

BL1 was collared on line 72S 5900'E (in March, 1978); the bearing was about 095° magnetic (25° south of the grid lines) and the surface projection crosses lines 75S and 78S. The cross-section by Walter (1978, figure 7) shows the 1974 gradient array IP profile for line 72S; it does not indicate that the end of the hole is over 200m to the south of this data. The section does however show that BL1 was collared less than 100m east of the peak of an excellent chargeability anomaly. Magnetics data for line 72S are also shown in the drill profile; the results show nothing of prospective interest.

The purpose of BL1 was to test the down dip extension of the minor Pb-Zn mineralisation detected in the abandoned BL802 (drilled for Pickands Mather in 1970): a zone of strong alteration containing

5.1. (Cont.)
pyrite, was intersected, but no significant base-metal mineralisation.

The hole was surveyed by downhole IP from 125m to 390m and a chargeable zone (max. value 90+ mv/v) was defined over 55m from 275m to 330m (Meares, 1978, figure 8). This corresponds with assays of 3.5% sulphur in the drill log. The gradient array IP survey (Howland-Rose, 1974a) recorded no anomaly over this area, and this part of the survey (over the area intersected by BL1) was later repeated (Howland-Rose, 1978). Again no anomaly was recorded. This suggests that the gradient array IP was not penetrating the thick sequence of glacials (Walter's (1978) cross-section shows about 25m of overburden in BL1 and nearly 40m beneath BL802). A dipole-dipole IP survey over BL1 would provide information to help assess the usefulness of the gradient array survey over the glacial overburden.

5.2. DDH BL2

This hole was drilled at line 48S, 6600'E bearing 085° mag. (in March, 1978) to test the northern extension of the zone of strong alteration intersected in BL1. The cross-section (Walter, 1978, figure 9) shows that a rather poor chargeability anomaly was also tested. Figure 5 suggests that BL2 may not be on strike with BL1 and is testing a different horizon, further to the west. Like BL1, this DDH, drilled to the east, is east of, and close to, a prominent chargeability anomaly. The hole found less alteration and sulphides than BL1, but intersected black shales from 197m to 222.7m, and these may explain the small chargeability anomaly (22ms in a background level of about 11ms).

The hole was surveyed by down hole IP from 175m to 285m (and the data is recorded in Meares, 1978; figure 10). No chargeability readings could be made through the shales (which contained 1.1% sulphur from 195m to 225m): but high values were obtained at 235m and at 280m.

5.3. DDH BL3

This hole was drilled 30m north of line 30S, 7636'E bearing 087° mag. (in April, 1981) to test a magnetic anomaly (see Figure 7) which was possibly along strike from haematite-carbonate rocks encountered in BL1 some 500m to the south. No significant mineralisation was found.

Two comments may be made about this hole. Since the target rocks for BL3, hopefully along strike from BL1, were magnetic, the magnetic properties of the rocks at BL1 should have been established by a magnetic survey (the coverage of the original survey did not extend sufficiently far to the east, see Table 8). That is, a rock unit which is magnetic and is hopefully the same as a unit intersected in another drill hole should be correlated with magnetics prior to drilling. The magnetic properties of the unit (i.e. the haematite-carbonate sequence) should have been established from magnetic susceptibility measurements of the core from BL1 (which was not done) as well as by ground magnetometry. The second point to be made is that when drilling a magnetic target, it is good practice to do some simple modelling to assist in siting the drill hole.

Presumably it was hoped that the haematite-carbonate sequence in BL1 was a southern along-strike equivalent of the Howard's Anomaly sequence which has been investigated for silver: it was noted in Section 4.3b that Komyshan (1981) has concluded that at Howard's Anomaly the silver mineralisation is sporadic and is not necessarily associated with haematite/magnetite (although the presence of the latter suggests an environment which may be conducive to (this type of) silver mineralisation).

The glacial overburden at the collar is about 40m and the high resistivities on the eastern flanks of the dipole-dipole IP survey suggests that it (the moraine +?scree) may be well over 100m thick toward 9000'E. The IP survey recorded no chargeability anomalies over BL3, a result which was confirmed by the down hole IP logging which recorded only one value greater than 30 mv/v (see figure 57, Meares et al, 1981).

5.4. DDH BL4

The purpose of this hole drilled (in May, 1981) from 5m south of line 30S, 6700'E bearing 244° mag., was to investigate two chargeability anomalies defined in the 1974 gradient array IP survey of Basin Lake. Before drilling the hole, a dipole-dipole IP survey was (wisely) carried out over the target area. The dipole-dipole data confirmed the two sources defined by the gradient array survey, but with a more complex interaction of anomalies. Down hole IP logging recorded a series of chargeable zones down the hole with significant intervals of no readings (presumably too anomalous): 30m to 60m recorded a nearly continuous zone of 100 mv/v (Meares et al, 1981, figure 56). Magnetic susceptibilities of the core were nearly all effectively zero; exceptions were a 10m band at 40m (.0025 cgs) and another at 80m (.0005 cgs): from 130m to 160m was also above background.

BL4 intersected 8.5m of sub-massive pyrite beneath the smaller eastern gradient array chargeability anomaly and black shales beneath (the larger) western anomaly. However the dipole-dipole data suggests that the pyrite has a better defined resistivity low and higher chargeabilities than the black shale response to the west. (The resistivity anomaly of the gradient array IP survey appears to be associated with the black shale, but is offset towards the pyrite.) But neither array discriminates between the two types of anomaly source. Given the ubiquitous occurrence of black shales and the likelihood of a massive sulphide deposit in or near such an environment, some means of discrimination is required: this is further discussed in Section 6.

5.5. DDH TYN1

This hole drilled (in September, 1968) on line 12N, 2650'E bearing 270° mag., was designed to test zone C2, outlined by the 1968 McPhar dipole-dipole IP survey. Line 12N was covered by 100ft, 200ft and 300ft surveys (see Section 3.2b). The hole intersected minor pyrite between 40m and 80m.

5.5. (Cont.)
Figure 17 shows the super-position of the drill hole section onto a combined pseudo-section of all three dipole-dipole surveys. It can be seen that the hole was apparently well sited to test the anomaly. No IP logging was run, and no measurements of the magnetic susceptibility of the core have been made.

Since zone C1 has not been tested elsewhere along its length, and being glacially covered is a prospective zone in so far as any ore deposit in this zone would (probably) have remained undiscovered by the early prospectors, further surveys between 10N and 14N would be worthwhile (see Section 7).

5.6. DDH TYN2

This hole drilled (January, 1975) on line 4N, 1160'W bearing 090° mag., was designed to test a gradient array chargeability anomaly of about 50ms. The anomaly was in zone 'A' of the 1968 dipole-dipole survey which had shown the zone to be best developed on line 6N with much poorer anomalies to the south. This was confirmed by the 1981 dipole-dipole survey which also showed that the gradient array anomaly on line 4N coincided with a minor high on the n=1 readings and that the best zone was beneath the drill collar at about 175mE.

The 1981 dipole-dipole survey shows TYN2 not to have been directed at any geophysical target at all (Figure 13), but the drill hole did intersect some black shales, about 70m east of the gradient IP anomaly. No down hole IP survey was done to test the chargeability of these shales, or to look for mineralistion near the source of the (shallow) gradient anomaly (and neither has the core been logged for magnetic susceptibility).

5.7. DDH TYN3

The purpose of this hole drilled (in February, 1975) on line 16N,

5.7. (Cont.)

1700'W bearing 090° mag., was to test a "major IP anomaly" over what was apparently already known to be "a black shale sequence in the Howard Andesite". This anomaly was first defined in the 1968 dipole-dipole survey, and was labelled 'C2'. The 100ft dipole-dipole survey defined two separate anomalies: at 300'E and at 750'E. A 1974 gradient array IP survey defined one large (50+ ms) substantial anomaly nearly coincident with the western most anomaly. The 1981 dipole-dipole survey with a 50m dipole spacing also defined two sources. The single gradient array anomaly is unusual since the gradient array is often given credit for a better horizontal resolution: the probable reason this is not the case here, is that the dipole-dipole data shows the western zone to be apparently shallower (than the eastern source) and consequently to have much higher n=1 values, i.e. the gradient array has not detected the deeper, eastern zone. The 1981 data (Figure 18) shows that TYN3 has not intersected the eastern chargeable zone. The western anomaly was caused by black shales, some of which were pyritic.

5.8. DDH HA1/HA2

HA1, collared in February, 1971, was abandoned due to excessive flattening.

HA2 was collared on the same site (line 20 + 200'S, 1650'W bearing 250° mag.) in March, 1971, and its purpose was "to test in depth a zone of coincident IP, magnetic and geochemical anomalies and a surface gossan" (McKibben, 1971). The drill hole cross-section (Stevens-Hoare, 1975, figure 23) shows only the McPhar interpretation of the IP survey: the soil geochemical "anomalies" (Cu:Pb:Zn = 70:150:590 ppm) are apparently associated with a 'probable' IP anomaly to the west of a 'definite' one. The magnetic profile shows variations, but no significant anomaly.

The drill hole detected the cause of the definite anomaly, namely pyrite (upto 12%) with traces of copper (upto .23%). The western 'probable' anomaly appears, from an inspection of the pseudo-section (Hallof, 1968, drawing no. IP 5108-29) to be limited in

5.8. (Cont.)
extent and HA2 has possibly gone beneath the chargeable zone (and therefore not intersected the cause of the probable anomaly). A pencilled note on drawing IP 5108-29, states that there is a pyritic gossan above the probable anomaly (2300'W-2200'W). More recent mapping describes this as disseminated pyrite in an exposed road surface (Komyshan, pers. commun.).

5.9. DDH HA3

This hole drilled (in February, 1975) at line 23N, 1400'W bearing 270° mag., was designed to test "a weak IP anomaly and a non-coincident soil geochemistry anomaly (Mn, Zn, Pb)". The drill hole cross-section (Meares et al, 1980, figure 36) shows the geochemical response to be coincident with a resistivity low from the 1973 gradient array IP survey (Howland-Rose, 1973). This low was defined by RioTinto as a poorly conducting Turam anomaly (the 'Southern' anomaly, Boniwell, 1959); see Section 3.5b. A 1980 pole-dipole survey over HA3 (Howland-Rose, 1979) shows that the gradient chargeability anomaly is coincident with the maximum n=1 reading of an anomaly which suggests a shallow source. The anomaly was well-defined and labelled 'X' in the 1979 gradient array survey of Howard's Anomaly (Howland-Rose, 1979).

The drill log of HA3 notes that black shale was intersected 200ft east of the IP anomaly, but that "no other explanation of the IP anomaly was encountered in the hole". As suggested above, a shallow source seemed likely and since the drilling, pyrite has been found outcropping above the anomaly (Meares, pers. commun.).

Although (presumably) drilled primarily for base-metals, HA3 assayed 8g/t Ag over 38.7m. As mentioned in Section 4.3b, the silver occurs within a haematite-carbonate zone. Komyshan (1981) has concluded that there is no direct relationship between concentration of haematite/magnetite and silver content. (The magnetic susceptibilities are tabulated in the drill hole log book. There was no down-hole IP run.)

5.10. DDH HA4

This hole was specifically drilled for silver at 60ft south of line 20.2N 1250'W bearing 081° mag., (in February, 1981). The target had a magnetic anomaly, a weak gradient chargeability anomaly ('Y', Howland-Rose, 1979), a very narrow pole-dipole chargeability anomaly and, like HA3, high Mn soil geochemistry values over the 'Southern' Turam anomaly.

As in HA3, a comparison of the magnetic susceptibilities and silver values for HA4 shows little correlation between the two (see Figure 19); although the log notes that "a moderately large proportion of the silver bearing sulphides are closely associated with haematite and partially oxidised magnetite". The hole was logged for IP using a 2m three array: nearly all of the hole recorded above 40 mv/v with about half of it (in several zones) over 100 mv/v. Resistivities however were high, with only one zone, at 210m, below 1000 ohm-m.

5.11. DDH HA5

Like HA4 (and HA6), this hole drilled (in July, 1981) 10m south of line 19N 500'W bearing 270° mag., was sited for silver: to test high rock chip samples (max. 310 g/t) from the Tyndall Creek and a possible (and hopefully much richer) extension of the zones indicated by HA3 and HA4. The cross-section (Komyshan, 1981, figure 18) shows that the strongest magnetic anomaly (incompletely defined) is east of the collar of HA5 (see Section 4.3b) but that there are three smaller (300-1000γ) anomalies spaced out on the western half of the line (1500'W to 100'W). HA5 passed under the easternmost of these anomalies (at 750'W) and may have tested the next (at 1150'W). The magnetic susceptibility log shows two broad zones of magnetic rocks (75m-120m & 145m-245m) with a weak zone at 260-264m. The silver zones occurred within these magnetic sequences: 8.6m at 11g/t Ag from 66m to 74.6m and 6.6m at 4g/t from 193m to 199.6m.

5.11. (Cont.)
The 'Southern' Turam zone has also been tested by HA5. The (1979) gradient array survey (Howland-Rose, 1979) defined a marker zone which coincided with the EM anomaly; the resistivity profile on the drill hole cross-section shows the 'low' some 200ft east of Tyndall Creek. However, the high base metal and silver values from rock chip samples in the creek and the RioTinto reports (e.g. King, 1960) suggest that the creek may be the location. A fault breccia was recorded in HA5 at 50m, a second at about 175m and a third from 226m to 249m (King, 1961, notes that the 'Southern' anomaly may be due to several en echelon conductors). In summary, HA5 apparently intersected the target zone, but only low silver values were obtained. Minor pyrite was found in the core possibly sufficient to explain the low chargeability anomalies (base metal values were all less than 0.2%). No down hole IP was run.

5.12. DDH HA6

With HA4 and HA5, this hole was drilled for silver on line 21N, 950'W bearing 273° mag., (in July, 1981). Outcrop sampling in Tyndall Creek on this line (21N) averaged 73g/t over 10m. The intermediate ground between HA3 (to the north) and HA4 (to the south) was also tested.

The drill hole cross-section shows magnetic anomalies (500+ gammas) with coincident high silver (150g/t) and manganese soil assays. Like HA4 and HA5, this geochemically anomalous zone appears to coincide with the 'Southern' Turam zone detected by RioTinto (Boniwell, 1959) although there is no resistivity low from the gradient array survey over this line. Although haematite zones were intersected, no significant silver values were obtained (4.5m at 7.6g/t Ag was the best intersection).

5.13. DDH HFZ7

The northern limit of the area considered by this report (line 40N) is where the Henty Fault pinches out the Queenstown Pyroclastics against the Tyndall Group (see Stevens-Hoare, 1975, figure 1). North of this area is the Henty Fault Zone Grid (see Figure 1). HFZ7 was part of the exploration program on this grid. The hole was sited (in January, 1975) on line 40N, 300'W bearing 270° mag., to test a combined geophysical and geochemical anomaly. The cross-section (Stevens-Hoare, 1975, figure 32) shows a 30+ ms chargeability anomaly with resistivities around 3000 ohm-m. Some disseminated sulphides (best intersection 1.5m of .31% Cu: .25% Zn and 8.1% Fe S_2, Stevens-Hoare, 1975a) in acid pyroclastic rocks, and 14m of pyritic black shales were intersected in Dundas Sediments. Although a dipole-dipole IP survey would have given more information about the anomaly, and hence permitted a more confident positioning, the hole was adequately sited to test the anomaly: the pyritic black shales are the most likely cause. No magnetic susceptibility or down-hole IP measurements were made.

5.14. DDH HFZ8

This hole drilled (in January, 1975) on line 38N 1500'W bearing 090° mag., was sited to test a possible southern extension of the mineralisation intersected in HFZ7. The gradient array IP (Howland-Rose, 1973) defined a substantial 40+ms chargeability anomaly and a slight lowering of the high resistivities (from around 5000 ohm-m to nearly 2000 ohm-m). The magnetic profile shows a narrow, well defined anomaly (no scale shown) over the Henty Fault and a broad high possibly defining the extent of the Queenstown Pyroclastics. The hole intersected minor mineralisation, "probably related to a minor fault" (Stevens-Hoare, 1975b): disseminated pyrite (around 2%) was intersected between 140m and 197m. No magnetic susceptibility or down-hole IP measurements were made.

Obviously HFZ7 and HFZ8 were considered to be along strike; this is at variance with Hallof's (1968) interpretation. Stevens-

5.14. (Cont.)

Hoare (1975a, figure 13) shows a north-south anomalous zone from line 34N to line 40N which encompasses anomalies from Hallof's (1968) 'C4' and 'E' zones. It is likely that this reflects mineralisation in the Henty Fault, but more detailed work is required to accurately map the attitudes of the mineralised zones.

6. DISCUSSION

The IP surveys have defined several anomalous zones. One of these zones, Howard's Anomaly, has been explored in some detail; although only one drill hole, HA2, intersects the 'main' zone of sulphides (see Figure 5). Elsewhere on the East Tyndall Grid the coverage is less detailed, with some areas covered only by the 400m to 500m line spacing of the earliest surveys. Where anomalies have been investigated, all drill holes, costeans, outcrops, etc., have suggested that the causes of the IP responses have been pyrite and/or black shales; there have been no encouraging base metal intersections.

Several questions may be posed about the exploration over the area, e.g. have the drill holes intersected the cause of the anomalies?; are costeans and outcrop adequate tests of IP responses?; is the old IP data adequate?; is the IP method an appropriate, and sufficient, test of an area?; can black shales or pyrite zones be obscuring a base metal deposit?; if a base metal deposit is present, at what distance (if at all) might pyritic haloes be expected to show above-background base metal values?; can any sulphide zones be declared barren (e.g. by isotope studies)?; etc.. Some of these questions are discussed below.

The 1981 dipole-dipole survey over TYN2 and TYN3 showed that these drill holes were not correctly sited to properly test the IP anomalies. In the former case, TYN2 on line 4N was collared directly over a deep, well-defined chargeability anomaly and in the latter case, TYN3 on line 16N only intersected one source in what is clearly a two source anomaly.

The adequacy of the drill holes on lines which have not been recently resurveyed is not so readily determined. For example, some drill hole sections show only the interpreted geophysical anomaly positions (e.g. HA2, Stevens-Hoare, 1975, figure 23) or a very poor representation of the geophysics is shown (e.g. TYN1, Stevens-Hoare, 1975a figure 20). Figure 17, a composite of the 1967/68 surveys on line 12N with TYN1 superimposed, shows that in fact TYN1 was well

6 (Cont.)

sited to test the IP anomaly. However only a minor amount of pyrite was intersected between 40m and 80m. The anomaly suggests a more polarisable source than less than 2% pyrite and a resurveying of this line is recommended. A comparison of the old and new data over TYN3 shows that, although the pseudo-sections are very similar, the centre of the eastern anomaly is some 40m further to the east on the 1981 data (possibly due in part to the coarser data spacing of the later survey). Thus some drill holes have not adequately tested anomalies and it is possible that others have been accurately sited on inaccurate (i.e. old and thus 'insensitive') data. Further, not all drill holes were based on such a large amount of data as was available for TYN1. Those based only on gradient array data are particularly suspect, e.g. HA3, which was partly based on a 1974 gradient array anomaly, which a 1980 pole-dipole survey suggested was due to a very shallow and limited source (Meares et al, 1980, figure 36). Nevertheless all holes have intersected a polarisable source and thus if not perfectly targeted, they have certainly approached the source (discounting such holes as TYN2 which intersected minor sources well away from the main anomaly). The question of how close the drill hole must be is discussed further below.

Most of those anomalies which have not been drilled, have been 'explained' by either a costean or by pyrite and/or black shales outcropping near the anomaly. Obviously these are very superficial examinations, particularly the latter. In areas of good soil development, the lack of any corroborating geochemical anomaly is certainly a good additional criterion for down grading the anomaly, but in areas of exposed rock, base metals may not necessarily occur at the surface: examples on Mt. Lyell's mine lease suggest (for copper) that leaching may occur for upto 5m from the surface (although the pyrite may remain) and thus a shallow costean may also be inadequate. However it is recognised and appreciated that, in an area such as Basin Lake-East Tyndall, where there are a large number of IP anomalies, a ready method of grading is needed, and that therefore, quick and relatively cheap tests on the less promising geophysical anomalies are justified. But it must also be appreciated that in any area less mineralised than the west coast of Tasmania, any geo-

6 (Cont.)
physical anomaly comparable to those on the Basin Lake or East Tyndall grids would probably be tested by several drill holes.

Figure 18 shows that the 1967/68 data and 1981 data over TYN3 are very similar, although it was pointed out above that there was approximately a 40m discrepancy between the centres of their respective eastern anomalies. This comparison and others, suggest that strong responses and broad features are common to both the 1967/68 and 1981 data, but that the older data probably does not show the more subtle responses (which may nevertheless be important). Thus although the old data is considered adequate for definition of mineralised zones, before siting any drill hole, a resurvey would be recommended. A tentative drill hole is shown on Figure 18 to intersect the eastern anomaly (although an EM survey is recommended first). The drill hole section is shown on the 1981 chargeability and metal factor pseudo-sections and the latter, in contrast to the chargeability, shows the eastern anomaly to be more prospective. Since the 1967/68 data accounts for much of the IP coverage and it is presented as metal factor, some discussion of this parameter is appropriate.

In the early days of IP (the late 1950's and 1960's), the metal factor parameter* was considered to be as important as the frequency effect if not more so, e.g. the 1967/68 data referred to above, where the frequency effect has not been plotted. Although equally applicable to time domain (chargeability divided by resistivity) it appears to have fallen into general disfavour. Madden and Cantwell (1967) wrote that in zones of lower resistivity (but with the same metallic content), the frequency effect will be less since the 'blocking' action of the sulphide grains becomes relatively less important. And hence "the metal conduction factor ... appears a truer measure of the importance of metallic mineralisation within the rock". Sumner (1976) has stated that "the metal factor must be used with considerable caution in interpretation, especially in low resistivity areas. Where there is a high background of polarisation, the sign-

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* Originally defined as $\frac{\text{percent frequency effect}}{\text{resistivity}} \times 2\pi$ x 1,000 with resistivity in ohm-ft.

6 (Cont.)
ificance of the metal factor as a polarisation parameter is also questionable". As mentioned above, the metal factor pseudo-section in Figure 18 suggests that the eastern anomaly is the better target, and in Figure 17 it has helped simplify a fairly complex frequency effect pseudo-section. In any detailed evaluation of data, the metal factor parameter is worth calculating (I have used the formula $M.F. = \frac{\%F.E.\ (\text{or chargeability})}{\text{Resistivity (ohm-m)}} \times 1000$ in the example given in this report).

The IP method has certainly defined mineralised zones and it can be expected to respond to any large base-metal deposit near the surface; but has the method as used here adequately tested the areas surveyed? And, if when the entire area has been covered at say a 100m line spacing and has defined similar anomalies to those already tested, can it then be stated that the area has been sufficiently explored? Relevant to the first question is of course, the question of array geometry: all the commonly used arrays (gradient, dipole-dipole and pole-dipole) have been used over the Basin Lake-East Tyndall areas and all have defined anomalies.

The subject of the relative merits of the different arrays is still an emotional one among geophysicists, but there are now several published papers which show that although the gradient array has better horizontal resolution (and is superior logistically) it has inferior penetration and depth discrimination. For example Dodds (1976) made a parametric study of IP models, i.e. he studied the effect, for dipole-dipole, pole-dipole and gradient arrays, of altering the target depth, the target-host resistivity contrast, the overburden-host resistivity contrast, and the overburden thickness. The target was a horizontal cylinder. Dodds' theoretical results showed that the gradient array response weakened in comparison to the other arrays as the target got deeper. He considered that this may have been due to the relatively small current electrode separation used (but other workers, e.g. Lajoie and Klein, 1979, have found gradient anomalies to be enhanced as the current electrode spacing was shortened, and in several comparisons of 'regional' and 'detailed' gradient I have not noticed any reduction in the latter).

6 (Cont.)

With a conductive overburden (such as might occur with some clay-rich glacial moraine) "the gradient array always yields a weaker response, the difference becoming more marked as the overburden thickens" (depth constant, overburden substituted for upper layers of host rock)(Dodds, 1976). Coggan (1973) testing a series of tabular bodies with and without overburden, concluded that the dipole-dipole array (out of dipole-dipole, pole-dipole and gradient) gave the largest anomalies and the best resolution.

An equally important shortcoming of the gradient array is its apparent inability to respond to conductive zones. The lack of a co-incident resistivity low with a chargeability anomaly suggests that only disseminated sulphides are present and there are several instances on record where the gradient array has failed to define a conductive zone. For example, this has been noted over the eastern pyrite body of Selina (Bishop, 1981e). A comparison of array types over Woodlawn by Tyne and Whiteley (1981) showed that the dipole-dipole array was far superior to the gradient at defining resistivity and chargeability anomalies (see table below).

Summary of Electrical Responses of the Woodlawn Orebody
(Tyne and Whiteley, 1981)

Features of response over the Woodlawn Orebody	ARRAY Gradient	Pole-Dipole	Dipole-Dipole	Wenner
Min. app. resistivity (ohm-m)	60	3.6	2	10
Min. resistivity anomaly to background	1:9	1:16	1:25	1:7
Max IP anomaly (ms)	43	40	38	27
Max. IP anomaly to background	2:1	5:1	15:1	4:1

The second part of the question asked above was whether the IP surveys are sufficient to test the area. Part of the answer to this question lies in the type and density of the testing of the anomalies. Although a potential orebody might be missed, e.g. by a gradient array survey over thick glacial sequences, one might

6 (Cont.)

also occur indistinguishable, within an IP anomaly, and might therefore be missed by superficial testing or by widely spaced drilling. Such an orebody might be a buried (e.g. 50m) narrow base-metal deposit adjacent to a wide sequence of conductive black shales (e.g. Rosebery). Another example might be narrow zones of (low) copper concentration within broad zones of disseminated pyrite (e.g. a Prince Lyell style of mineralisation). It is a moot point as to whether a body like the latter example would be economic, however it should be detectable by electromagnetic techniques. The first example is particularly difficult to detect; not only would it be difficult or impossible to distinguish from the black shales response by IP, but also, it may, if it is high in zinc and low in copper, be less conductive than the black shales, and even if more conductive, its σt (conductivity-thickness product which determines the size of the EM response) may be such that little or no contrast is seen between the black shales and the sulphides. Neither would gravity detect a narrow body; for example a Rosebery style body nearly 2000m long, up to 1000m deep, but only 6m wide (see Burton, 1975), buried to 50m, would have less than half a milligal anomaly. It is highly unlikely that such a small anomaly would be recognised in field data, particularly with the large adjacent gravity anomaly over the Great Lyell Fault. The above describes perhaps the geophysically unresolvable body, but less extreme examples should be detectable with a combination of EM and gravity surveys (over mineralised zones defined by IP surveys). To summarise the above, it is unlikely that an orebody would exist in the Mt. Read Volcanics that would not give rise to an IP effect (lead-zinc mineralisation in this environment, unlike Mississipi-valley type replacement orebodies appear to have an intrinsic IP effect and they also have associated pyrite, e.g. Rosebery (Burton, 1975) and Que River (Webster and Skey, 1979)), and thus the IP method is the first choice however if the IP surveys have not detected a base-metal deposit, then other methods e.g. EM and possibly gravity should be tried: this is probably particularly true where the gradient array has been used to define the mineralised zones.

The last questions asked at the beginning of this section are geochemical and I can make little comment about them other than that

6 (Cont.)

as the geophysical responses of known ore deposits are used to try to detect unknown deposits, it would be useful to know what the base-metal values and distributions are around various volcanogenic targets, and what base metal values there are in pyritic zones along strike from orebodies. Answers to these questions would assist in reducing the number of anomalies for more detailed testing. The question of declaring pyrite zones 'barren' or mineralised is being looked at by various workers including Eastoe (University of Tasmania) using alteration and sulphur isotopes, and Gulson and Whitford (Mineralogy, CSIRO) using lead isotopes.

7. CONCLUSIONS AND RECOMMENDATIONS

Four anomaly compilation maps at 1:5,000 scale cover the Basin Lake and East Tyndall Grids (Figures 20 to 24). These show that, apart from magnetics, IP has been used almost exclusively (among the geophysical techniques) to explore for ore deposits. The results have defined a series of anomalies which are associated with pyritic zones and/or black shale bands throughout the area. Sections of these zones have been surveyed in some detail, in particular Howard's Anomaly, where nearly 1500m of strike length has been covered with a grid of line spacing 60m to 100m. Other areas (e.g. zone 'A') have been covered by less detailed surveys, 150m to 200m; and a large portion of the East Tyndall Grid (north of line 28N) is only covered by the original 1967/68 dipole-dipole data with its 400m to 500m line spacing.

Hallof (1968) interpreted this original survey as a series of anomalous zones (caused by sulphides and black shales) occurring across the grid. The individual zones were labelled alphabetically while zones along strike were given the same letter but a different number. Subsequent, more detailed surveys, have shown that several anomalous areas may occur within the one original zone and at the northern end of the area, it is likely that the strike of the mineralisation is north-east rather than north-west, but Hallof's (1968) interpretation is substantially correct and his labelling was used in this report. A brief summary of these zones, and conclusions about their prospectiveness are given below, starting from the north.

Zone 'E' has been drilled by HFZ8 (minor pyrite, possibly associated with a fault) and it is likely that this zone strikes north through HFZ7 on line 40N and possibly south through zone 'C4' anomaly on line 36N. The structure on these northern lines is not well understood and more detailed mapping is needed. Depending on the outcome of this, more detailed geophysics may be planned. This would probably be in conjunction with a survey over zone 'C4' (see below).

7. (Cont.)
Zone 'D' is over black shales and is not considered prospective. The black shales are part of the Newton Creek sandstone and shale sequence which have been shown by fossil evidence to be Lower Ordovician (Komyshan, pers. commun.).

Zone 'C4'. The southern end of this zone has been covered by a detailed gradient array survey over the Tyndall Mine; no anomalies were defined, nevertheless, the various dipole-dipole anomalies defining the zone between line 28N and line 38N are considered to be real. These anomalies are generally poorer than those south of Howard's Anomaly and the zone is less prospective than other areas on the two grids. But the IP coverage is only regional and more detailed surveys are required. The southern part of this area was covered by the RioTinto EM survey; the anomalies defined by this survey were apparently due to shear zones as the mineralised zones were not detected. This suggests that 'C4' is not anomalously conductive over the area tested by the Turam survey (see Figure 8). Nevertheless more detailed surveys (probably dipole-dipole IP) must be carried out to thoroughly test an area which a regional survey has shown to be definitely anomalous.

Zone 'C3' and its extension to the south is within the area now known as Howard's Anomaly. The area has been covered by gradient array IP at a 60m to 100m line spacing and selected lines have also been surveyed by pole-dipole IP. The gradient array survey defined a large number of chargeability anomalies and these have mostly been explained by disseminated pyrite in outcrops, costeans or drill hole intersection. The pole-dipole survey suggested two and possibly three zones where (poorly defined) resistivity lows coincident with chargeability anomalies might indicate more massive mineralisation. Two are beneath anomaly 'G' on lines 21.3N and 22N (there was no indication of a resistivity low from the gradient array survey). The third low is on line 20.2N beneath the collar of HA4 (drilled before the pole-dipole survey): the low may be caused by a topographic effect where the actual volume of ground 'measured' is less than the theoretical amount (e.g. a hill crest; the situation here is a change in slope). Thus the pole-dipole surveys over the better gradient

7. (Cont.)
array anomalies generally confirmed the disseminated nature of the mineralisation, but lower resistivities associated with anomaly 'G' which have not been explained are worth further examination. EM surveys are recommended to outline the more conductive areas. The area was probably covered by the RioTinto Turam survey (the exact location of the RioTinto Grid is not known, particularly since only the idealised grid was shown), but the lack of Turam anomalies over what is now anomaly 'G' is not conclusive. A grounded loop in to a long shear zone (the Southern anomaly) might well prevent the detection of subtle changes in conductivity. Also, a costean over anomaly 'F' did not penetrate the glacial overburden and this anomaly needs further investigation.

Zone 'C2' was drilled by TYN 3 on line 16N in 1975 and pyritic black shales were intersected. A resurvey of the zone in 1981 (at a 200m+ line spacing) confirmed that the most prospective anomaly occurred on line 16N and like the 1967/68 data, it suggested that two sources contributed to the response. TYN3 only intersected the western source. The eastern arm of the anomaly is very similar to the western side and black shales may again be the cause, however this should be determined. An EM survey is recommended to better resolve the two sources: the line spacing should be reduced to about 100m.

Zone 'C1' was the first to be drilled (TYN1 in 1968) but there have been no detailed surveys since, presumably because of the disappointing drilling results from TYN1 (minor pyrite over 40m). A detailed coverage is recommended from line 10N to line 14.5N. A series of dipole-dipole spreads would be recommended, however Komyshan has interpreted several faults in the area and he believes that such surveys, based on interpolations of anomalies across 400m or 500m might not adequately define the zones, therefore a gradient array survey is recommended, with dipole-dipole surveys over the better anomalies.

The northern section of zone 'B' will be covered by the proposed gradient array survey over 'C1' and the southern section has been adequately detailed by the gradient array and (single) pole-dipole

7. (Cont.)
profile on the Basin Lake Grid. A costean over the pole-dipole anomaly on line 00 revealed black shales.

Further to the south, anomalies '9', '6' and possibly '5' define zone 'B'. DDH BL4 showed that '6', made up of two highs, was due to black shales to the west and massive pyrite to the east. Anomaly '9' also consists of two highs and an EM survey is recommended to better resolve them. This survey should extend over BL4 (for comparison) and its extension to BL2 on line 48S is also recommended.

Zone 'A' was tested by TYN2, but resurveying of the area (including a dipole-dipole survey in 1981) showed that the most prospective area was to the north on line 6N. This is a very broad anomaly and an EM survey is also recommended here to look for a conductive zone within the anomaly prior to drilling. The more recent dipole-dipole survey also showed that TYN2 which intersected black shales was poorly placed to test the IP anomaly, the centre of the anomaly being beneath the drill hole collar.

On the Basin Lake Grid, anomalies 7 and 8 may be a southern extension of zone 'A': these anomalies are over a large area of pyritic rocks (Komyshan, pers. commun.) and an EM survey is recommended to detect massive zones within the disseminated sulphides.

→ black shales in Western Sequence

Anomalies 4, 3 and 2 are further to the south (grid south west) and may define a separate horizon; they are however very narrow, local gradient anomalies: an EM survey will confirm if there is anything of interest.

Further to the south the glacial overburden thickens and the gradient survey may not have penetrated to the volcanics: this suggestion is reinforced by the lack of a gradient array anomaly over BL1 which showed high chargeabilities in a down-hole IP survey. A deep looking dipole-dipole survey is recommended over BL1 and the line could be extended west to the baseline, to provide a comparison with the gradient array results.

7. (Cont.)
The IP method has been used extensively and almost exclusively over the grids. I have suggested that the application of the method may not be sufficient to find an orebody, but that in any first-pass survey it is probably the most appropriate method. Despite the long history of geophysical search in the area spanning some fourteen years, exploration is still, in some areas, at this first-pass stage with some zones insufficiently surveyed (e.g. zones C2 and C4) and others insufficiently tested (e.g. zones A and C1). Since the regional data has suggested that the area south of Howard's Anomaly is more mineralised than the area north, exploration in the 1981/82 season will concentrate on the Basin Lake Grid and East Tyndall Grid south of and including Howard's Anomaly. The recommendations are listed below.

Recommendations for further work over the Basin Lake and East Tyndall Grids (see Figure 25).

7a Basin Lake

i) A dipole-dipole IP survey on line 78S: a dipole spacing of 60 or 80m and coverage 00 to 7200'E.

ii) EM surveys over the following lines, using a moving coil system.

Line	Coverage (in feet)
0	1,000'E - 4,200'E
6S	1,000'E - 4,200'E
12S	1,000'E - 4,400'E
18S	1,000'E - 8,300'E (the road)
24S	1,000'E - 8,200'E (the road)
30S	1,000'E - 9,200'E (end of line)
36S	5,300'E - 7,600'E
42S	5,400'E - 7,800'E
48S	00 - 2,600'E, 5,400'E - 7,800'E
54S	00 - 2,600'E

7b East Tyndall

i) Zone A. Moving coil EM surveys at approximately a 100m line spacing, centred on 6N.

7b (Cont.)

Line	Coverage (in metres)
4N	100mW - 600mE
4.5N	100mW - 600mE
5N	200mW - 500mE
5.5N	100mW - 600mE
6N	300mW - 300mE
6.5N	500mW - 200mE
7N	400mW - 200mE
8N	500mW - 100mE

ii) Zone C1. A gradient array IP survey to better define the zone. Dipole-dipole surveys should be carried out over the better anomalies, and in any case over TYN1 on 12N.

Line	Coverage (in metres)
10N	0 - 1,400mE
10.5N	0 - 1,200mE
11N	0 - 1,200mE
11.5N	0 - 1,050mE (between the two roads)
12N	0 - 1,020mE " " " "
12.5N	0 - 1,000mE " " " "
13N	0 - 950mE " " " "
13.5N	0 - 950mE " " " "
14N	0 - 850mE " " " "
14.5N	0 - 820mE " " " "

iii) Zone C2. A moving coil EM survey centred on 16N.

Line	Coverage (in metres)
15N	100mW - 600mE
15.5N	100mW - 600mE
16N	200mW - 600mE
16.5N	300mW - 400mE
17N	300mW - 400mE

A drill hole can be sited without this survey: Collar at 365mE on line 16N, bearing grid west, inclination -60°, but the EM information is desirable.

7b (Cont.)

iv) Zones C4 and E. Surveys are not planned over these zones in the 1981/82 field season, however the regional coverage needs to be followed up. It was noted in Section 3.1b that exploration of the Henty Fault Zone had suggested that the strike of the mineralisation might be nearly N-S, rather than NW-SE as interpreted by Hallof (1968), and detailed mapping is required in the area. Such mapping may indicate a different coverage to that listed below.

Dipole-dipole IP is probably the best method, since it has been shown that the gradient array has not detected sections of the zone, and the RioTinto Turam survey suggests that at least the southern half of C4 is not conductive. There may be some reluctance to carry out such a relatively extensive survey over what appears to be, regionally, a less mineralised area, and it may be argued that gradient array responses would be obtained over (shallow) more prospective sections of the zone. A more informed recommendation can be made following evaluation of the surveys to be carried out this (1981/82) field season. Thus no particular method is recommended over the coverage listed below (in metres from Bradshaw's Road).

Line	Coverage	Line	Coverage
28N	1,250mW-500mW	34.5N	1,000mW-200mW
28.5N	1,300mW-550mW	35N	1,000mW-200mW
29N	1,300mW-550mW	35.5N	1,000mW-250mW
29.5N	1,300mW-450mW	36N	1,000mW- 00
30N	1,250mW-450mW	36.5N	900mW- 00
30.5N	1,250mW-400mW	37N	850mW- 00
31N	1,200mW-400mW	37.5N	750mW- 00
31.5N	1,100mW-300mW	38N	600mW- 00
32N	1,100mW-300mW	38.5N	600mW- 00
32.5N	1,150mW-350mW	39N	600mW- 00
33N	1,150mW-350mW	39.5N	600mW- 00
33.5N	1,150mW-350mW	40N	600mW- 00
34N	1,050mW-250mW		

7. (Cont.)
7c Howard's Anomaly

EM surveys over anomalies 'G' and 'F', plus one profile over 'H'.

Line	Coverage (in metres from Bradshaw's Road)
20.2N	830mW - 220mW
21.6N	850mW - 260mW
21.9N	900mW - 300mW
22N	920mW - 350mW

(i.e. coverage of all the line is specified for all four lines.)

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MARCH, 1982.

JRB/amd

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Table 1:	Basin Lake gradient array IP.
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2)	Scintrex, report no. TAS-054c, 1978 lines 82S-66S, 6S-9N.
Table 2:	East Tyndall gradient array IP.
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Table 4:	Basin Lake dipole-dipole and pole-dipole IP
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2)	Scintrex, report no. TAS-054c, 1978 line 00.
3)	Scintrex, report no. ML/MG81/13, 1981 lines 30S and 36S.
Table 5:	East Tyndall dipole-dipole IP
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3)	McPhar, report by Hallof, 1968 lines 4N to 38N (detailed survey).
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	2)	Basin Lake, Scintrex, report no. ML/MG81/13, lines 36S and 30S.
	3)	East Tyndall, Stevens-Hoare (1975) Annual Report, lines 2N-40N including Howard's Anomaly.
	4)	East Tyndall, Howard's Anomaly, Scintrex, report no. TAS-025, lines 15N to 26N.
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Table 9:		Electromagnetics.
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	2)	East Tyndall, RioTinto, report by Boniwell, 1959. lines 64S to 00, 8S to 72N.
	3)	East Tyndall, Geoterrex, report no. ML/MG81/05, lines 22N to 26N.
Table 10:		Gravity.
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Table 11:	Diamond drill hole summaries.
1 - 4)	BL1, BL2, BL3 & BL4.
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14 - 15)	HFZ7 & HFZ8.

TABLE 1: BASIN LAKE GRADIENT ARRAY IP.

1)	Surveyed by:	Scintrex
	Date:	Nov-Dec., 1974
	Data in:	Scintrex report TAS-025B (Mt. Lyell no. 27)
	Dipole spacing:	100ft; station spacing 100ft, and 50ft "where necessary".
	IP receiver :	IPR-7

Grid in imperial units. Baseline (00) is western edge of grid.

Line	Current electrodes coverage		
	950W - 5050E(L15S)	3050E-9050E(L15S)	4050S-10050E(L15S)
3N			7050E-7750E
00	50E-4250E*	3950E-8150E	7850E-8950E
3S		6750E-7750E	
6S	50W-750E, 1750E-4150E	3850E-8150E	7950E-9250E
12S	50E-4150E*	3850E-8150E	7850E-8950E
18S	50E-4150E*	3850E-8150E*	7850E-8950E
24S	50E-4150E*	3850E-8150E	7850E-8950E
30S	50E-4150E*	3850E-8150E	7850E-9050E
	950W-5050E(L45S)	3050E-9050E(L45S)	5050E-10050E(L45S)
30S	50E-4150E	3850E-8150E	7850E-9050E(?)
36S	50E-4150E	3850E-8050E	7750E-8850E
42S	50E-4150E	3850E-8150E	7850E-8650E
48S	50E-4150E*	3850E-8050E	7750E-8350E
54S	50E-3750E*	3750E-8050E	
60S	50E-4050E	3850E-7750E	

* line contains anomaly(s) worthy of further consideration.

TABLE 1 (Cont.)

Line	Current electrodes coverage	
	950W-5050E(L81S)	3050E-9050E(L81S)
66S	50E-4150E	3850E-7750E
72S	50E-4150E	3850E-6850E
78S	50E-4150E	3850E-6550E
84S	50E-4150E	3850E-6050E
90S	50E-4150E	3850E-6150E
95/96S	50E-4150E	3850E-5850E

Line	950W-9050E(L81S)
95/96S	50E-5850E(?)

2) Survey by: Scintrex
Date : Jan-Feb., 1978
Data in : Scintrex report TAS-054c (Mt. Lyell no 43)
Dipole spacing : 100ft
IP receiver : IPR-7
Grid in imperial units.

a) NE extension (6S to 9N)

Line	Current electrode positions not stated
9N	7050E-7950E
6N	7050E-7950E
3N	7050E-7850E
0	6550E-7950E
3S	6850E-7850E
6S	6300E-7700E

c) BL1 repeat

66S	6050E-7650E
69S	6050E-7650E
75S	5850E-7550E
78S	6050E-7550E
80S	6050E-7250E
82S	5750E-7550E

TABLE 2: EAST TYNDALL GRADIENT ARRAY IP (excluding the area covered by Howard's Anomaly, Lines 19N-26N)

1) Survey by : Scintrex
Date : December, 1973
Data in : Scintrex report TAS-018c (Mt. Lyell no. 25)
Dipole spacing : 100ft
IP receiver : IPR-7
Grid in imperial units. Bradshaw's Rd is 00.

Line	Current Electrodes Coverage
Zone 'A'	100W-1000E (6N)
6N + 400S	50E-950E*
6N	650W-550E*
6+400N	450W-750E*
Zone 'B'	4600E-6600E (4N)
4N	4950E-6050E
Zone 'C4'	4000W-2000W (28N)
28N	3350W-2350W
	2900W-900W (34N)
34N	2550W-1550W
	5000W-1000E (40N)
38N	4800W-00
40N	4650W-00

* line contains anomaly(s) worthy of further consideration.

TABLE 2 (Cont.)

2) Survey by : Scintrex

Date : Oct-Nov., 1974

Data in : Scintrex report TAS-025 (Mt. Lyell no. 28)

Dipole spacing : Zone 'A', 50ft
HFZ (south), 100ft

IP receiver : IPR-7

Grid in imperial units. Zone 'A' baseline (00) is a line approx. north-south through Bradshaw's Rd at 8N. Lines 15N-18N, baseline (00) is approx. a straight line which includes Bradshaw's Rd from 20N to 22N.

Line	Current Electrodes Coverage
Zone 'A'	Current electrode positions at
2N	2500W-100E
4N	2800W-00*
5N	3000W-00*
6N	3300W-00*
7N	3400W-00*
8N	3300W-00*
9N	3500W-00*
10N	3500W-00*
Zone 'C2'	850E-3150E (16N)
15N	2250W-50W*
16N	1850W-50W*
17N	2050W-50W*
	4450W-1550E (20N)
18N	2150W-50W*
	4450W-5500W (36N)
34N	4000W-50W
36N	4000W-50W

* line contains anomaly(s) worthy of further consideration.

TABLE 2 (Cont.)

3) Tyndall Mine

Survey by	:	Scintrex
Date	:	April, 1981
Data in	:	This report.
Dipole spacing	:	50ft
IP receiver	:	IPR-8, 2 secs on - 2 secs off, M3 plotted.

Grid in imperial units.

Line	Current Electrodes Coverage
	4400'W(400S)-50'W on line 28N
26.4N	3050W-1300W
26.6N	3050W-1400W
26.8N	3200W-1500W
27N	3300W-1600W
27.3N	3400W-1800W
27.6N	3500W-1800W
28N	3600W-1800W

TABLE 3: HOWARD'S ANOMALY (19N-26N) GRADIENT ARRAY IP

1) Survey by : Scintrex
Date : December, 1973
Data in : Scintrex report TAS-018c (Mt. Lyell no. 25)
Dipole spacing : 100ft.
IP receiver : IPR-7
Grid in imperial units. Bradshaw's Rd is 00.

Line	Current Electrodes Coverage
Zone 'C3'	3200W-1200W (22N)
22N + 200S	2550W-1700W*
22N	2650W-1650W*
22N + 200N	2650W-1750W

2) Survey by : Scintrex
Date : Oct-Nov., 1974
Data in : Scintrex report TAS-025 (Mt. Lyell no. 28)
Dipole spacing : 100ft
IP receiver : IPR-7
Grid in imperial units. Baseline (00) is an approx. straight line which includes Bradshaw's Rd from 20N to 22N.

	4450W-1550E (20N)
19N	2450W-50W
20N	2450W-50W
21N	2950W-50W
22N	2950W-50W*
	4950W-1050E (24N)
23N	3450W-50W
24N	3350W-50W
25N	2950W-50W

* line contains anomaly(s) worth of further consideration.

TABLE 3 (Cont.)

3)	Survey by	:	Scintrex
	Date	:	November, 1979
	Data in	:	Scintrex report TAS-073a (Mt. Lyell no. 49)
	Dipole spacing	:	100ft
	IP receiver	:	IPR-8

Grid in imperial units. Baseline (00) is an approx. straight line which includes Bradshaw's Rd from 20N to 22N.

Line	Current Electrodes Coverage
	4750W-1250E (20N)
19N	2450W-150W
19.4N	2450W-550W
19.7N	2550W-650W
20N	2950W-750W
20.2N	2550W-750W
20.6N	2350W-750W
21N	2950W-750W
21.3N	3050W-950W
21.6N	2650W-1150W
	6250W-750W (250ft south of 24N)
21.9N	3050W- 850W*
22N	3450W-1150W*
22.2N	3350W-1350W
22.5N	2950W-1450W
23N	3250W-1250W
23.4N	3950W-1350W
23.7N	3950W(?)-1550W
24N	4150W-1350W
24.5N	4150W-2650W
25N	4550W-1450W

* line contains anomaly(s) worthy of further consideration.

TABLE 3 (Cont.)

4) Survey by : Scintrex

Date : March, 1981

Data in : This report

Dipole spacing : 100ft

IP receiver : IPR-8, 2 secs on, 2 secs off, M3 plotted.

Grid in imperial units.

Line	Current Electrodes Coverage
	5600W-1000W on Line 22N
22N	4200W-2300W
22.2N	4500W-2900W
22.5N	4100W-2400W
23N	4000W-2600W
23.4N	4100W-2900W

TABLE 4: BASIN LAKE DIPOLE-DIPOLE & POLE-DIPOLE IP

1)

Dipole-dipole survey by	:	Pickands Mather (& McPhar for Pickands Mather)
Date	:	1968-69
Data in	:	A folder containing 2 reports: 1) Turam over Basin Lake (Scintrex report TAS-001) and 2) Basin Lake prospect, EL 12/65, history & recommendations for further work by Wuerch (1971) for Pickands Mather. The data is n=4 contour maps of resis. PFExMF (No Mt. Lyell file no.)
IP receiver	:	(?), frequency domain

Grid in imperial units.

Line	(approx) Coverage defined by the n=4 data points
20100N	3750W-1650W
20500N	3750W-1650W
20900N	4650W-1650W
21300N	4250W-1250W
21700N	4050W-1050W
22100N	4250W-1250W
22500N	3800W-2300W
22900N	4050W-1050W
23300N	3450W-1950W
23800N	4250W-1250W
24200N	4250W-1250W

2)

Pole-dipole survey by	:	Scintrex
Date	:	Jan-Feb., 1978
Data in	:	Scintrex report TAS054c (Mt. Lyell no. 43)
Dipole spacing	:	100ft
IP receiver	:	IPR-7

Grid in imperial units.

Line 00 6800E-8225E read to n=4

TABLE 4 (Cont.)

3) Dipole-dipole survey by : Scintrex
   Date : February, 1981
   Data in : This report
   Dipole spacing : 200ft
   IP receiver : IPR-8, 2 secs on, 2 secs off
   M_3 plotted

Grid in imperial units.

Line	Coverage (defined by extreme data points)	Comments
30S	5500E-9100E	Read to n=4: data points 100ft apart (i.e. 2 surveys carried out offset by half a dipole spacing).
36S	5700E-7100E	As above.

TABLE 5: EAST TYNDALL DIPOLE-DIPOLE IP

1)

Survey over RioTinto Grid for E.Z.

Survey by : McPhar?

Date : 1962

Data in : Large manilla folder (no Mt. Lyell file no).

IP receiver : Frequency domain, .25Hz & 2.5Hz

Grid in imperial units.

dipole spacing (all surveys to n=4)

Line	100ft	200ft	300ft
	Coverage (defined by extreme data points)		
00		2300W-900W	
400S		2100W-700W	
2400S		1700W-300W	
3200S		700E-2100E	
3600S		1700W- 300W	
3600S		700E-2100E	
4800S		1700W-1700E	
6000S		1900W- 500W	
6400S	1550W-850W	1700W-300W	2050W-100W
7200S	1450W-800W		
7600S	1350W-650W		

2) Survey by : McPhar

Date : 1967

Data in : Report by Hallof (1967).(Mt. Lyell file no. 4)

IP receiver : frequency domain

Grid in imperial units. Baseline (00) is Bradshaw's Rd.

Dipole spacing (all surveys to n=4)

Line	100ft	200ft	300ft
	Coverage (defined by extreme data points)		
2N			450W-8850E
4N	6800E-8100E	4400E-6200E	300W-7500E
6N		800W-1000E[1]	1200W-6150E*

TABLE 5 (Cont.)

Line	100ft	200ft	300ft
6N		2400E-5400E	
8N	4400E-5700E		1800W-5100E
10N		700E-2300E	2700W-4350E
10N		3000E-4550E	
12N	3000E-3900E	1600E-3200E	2250W-3450E
14N			3300W-3000E
16N	2100E-3000E	300W-1500E*	3450W-2400E*
18N		600W-1200E	3900W-2100E

For coverage of lines 20N - 26N see Table 6, Howard's Anomaly

Line	100ft	200ft	300ft
28N		3800W-2200W	6900W-2100E
30N		3800W-2200W	5100W-2700E
30N		600W-1000E	
32N		0 -1600E	4800W-2850W
34N		2700W-1100W	3600W- 800W
34N		100W-1500E	3600W-2700E
36N		3100W-1600W	6900W-2700E
36N		800W-1800E	
38N			6750W-2700E

[1] Plotting error, metal factor anomaly incorrect.

* Line contains anomaly(s) worthy of further consideration

TABLE 5 (Cont.)

3) Survey by : McPhar
Date : 1968
Data in : Report by Hallof (1968)(Mt. lyell file no. 6)

Grid in imperial units. Baseline 00 is Bradshaw's Rd.
Dipole spacing (all surveys to n=4)

Line	100ft	200ft
	Coverage (defined by extreme data points)	
4N	4700E-6100E*	
6N+400S		1200W-100E
6N+200S	4200E-5000E*	
6N	4200E-5000E	900W-700E, 300W-800E(?)
6N+200N	4250E-5000E	
6N+400N		800W-700E
8N	1300E-2700E(?)	
10N+200S	3300E-4050E	
10N	3300E-4100E	
10N+200N	3300E-4100E	
12N+300S		1900E-3200E
12N+200S	2000E-2800E	
12N	2000E-2800E	
12N+200N	2050E-2800E	
12N+300N	1900E-2900E	
14N+300S	1000E-2500E	
16N+200S	300W-1050E*	
16N+200S	1900E-2550E*	
16N+100S	1900E-2700E*	
16N	300W-1100E*	
16N+100N	1950E-2650E	
16N+200N	300W-1050E	
16N+200N	1950E-2600E	
18N+200S	450W- 200E	
18N	1100W- 300E	
18N+200N	500W- 150E	

TABLE 5 (Cont.)

	100ft	200ft
For coverage of lines 20N-24N see Table 6, Howard's Anomaly.		
28N+200S	3400W-2600W	
28N	3400W-2600W	
28N+200N	3400W-2700W	
30N	3300W-2500W	
30N	00 - 800E	
32N	400E-1200E	
34N	2400W-1600W	
36N	2700W-1900W	
38N	4200W-3400W	4600W-3000W, 1900W-400W

* Line contains anomaly(s) worthy of further consideration.

TABLE 5 (Cont.)

4)

Survey by	:	Scintrex
Date	:	May, 1981
Data in	:	This report
Dipole spacing	:	50m, read to n=6
IP receiver	:	IPR-8, 2 secs on, 2 secs off, M3 plotted.

Metric grid: baseline (00) Bradshaw's Rd.

Line	Subsurface Coverage (as defined by the extreme data points)
2N	100W - 575E
4N	100W - 600E
5N	200W - 500E
6N	875W - 300E
7N	400W - 300E
8N	600W - 100E
15N	100E - 700E
16N	250W - 600E
17N	250W - 450E
18N	600W - 500E

TABLE 6: HOWARD'S ANOMALY DIPOLE-DIPOLE & POLE-DIPOLE IP

1) Dipole-dipole survey by : McPhar
Date : 1967
Data in : Report by Hallof (1967)(Mt. Lyell file no. 4)
IP receiver : Frequency domain

Grid in imperial units. Baseline (00) is Bradshaw's Rd.
Dipole spacing (all surveys to n=4)

Line	100ft	200ft	300ft
	Coverage (defined by extreme data points)		
20N	600E-1500E		5400W-900E
22N		2800W-1200W	3600W-400W*
22N			3900W-600E*
24N		3000W-1400W	6100W-750E
24N		2300W- 700W	
26N			6600W-750E

2) Dipole-dipole survey by : McPhar
Date : 1968
Data in : Report by Hallof (1968)(Mt. Lyell file no. 6)
IP receiver : Frequency domain

Grid in imperial units. Baseline (00) is Bradshaw's Rd.
Dipole spacing (all surveys to n=4)

Line	100ft Coverage (defined by extreme data points)
20N + 200S	2600W-1200W
20N	2500W-1200W
20N + 200N	2600W-1250W
22N + 400S	1200W- 400W
22N + 200S	3450W-1250W
22N	3700W-1200W
22N + 200N	3550W-1150W
22N + 400N	900W- 250W

TABLE 6 (Cont.)

	100ft
24N + 200S	2700W-1900W
24N	2700W-1900W
24N + 200N	2700W-1900W

3) Pole-dipole survey by : Scintrex
Date : Jan-Feb., 1975
Data in : Scintrex report no. TAS-025c (Mt Lyell file no. 31)
Dipole spacing : (?) 100ft

Grid is in imperial units.

Line: A north-south line through L23N at 1700W
Coverage: 300ft south to 700ft north of 23N.

4) Pole-dipole survey by : Scintrex
Date : Jan-Feb, 1980
Data in : Scintrex report no. TAS-073a (Mt. Lyell file no. 49).
IP receiver : IPR-8

Grid in imperial units. Baseline (00) is an approx. straight line which includes Bradshaw's Rd from 20N to 22N.

Line	Coverage (defined by extreme data points)	Dipole spacing (ft) (all surveys read to n=6)
20N	2625W- 775W	50
20.2N	1575W- 825W	50
20.6N	1525W- 725W	50
21.3N	2850W-1050W*	300
22N	2850W- 750W	300
23N	3275W-2150W	50
23N	2100W-1375W	50
23.4N	3550W-1450W	300
23.7N	3950W-2000W	100
24.5N	3975W-3025W	50

TABLE 7: ELECTRICAL SOUNDINGS

1) Basin Lake:

Survey by	:	Scintrex
Date	:	Nov. - Dec., 1974
Data in	:	Data reported but not presented in Scintrex report TAS-025B (Mt. Lyell file no. 27)

Grid in imperial units.

a)	96S/2500E	Data not interpretable
b)	60S/6000E	Data not interpretable
c)	18S/500E	Alluvial thickness 21m. Overburden: lower resistivity and chargeability. Subsurface: higher resistivity and chargeability.

2) East Tyndall & Howard's Anomaly:

Survey by	:	Scintrex
Date	;	Oct. - Nov., 1974
Data in	:	Data reported but not presented for 4 out of 5 soundings in Scintrex report TAS-025 (Mt. Lyell file no. 28)

Grid in imperial units.

a)	16N/950W	Less resistive, chargeable layer at depth (25-30m)
b)	18N/1475W	Interpreted in the report as indicating "the major zone has an estimated depth of about 40ft (12m) at about 1450W". However the data shows a decreasing chargeability and an increasing resistivity from the surface.
c)	22N/1500W	Little variation in chargeability, not interpretable
d)	22N/2150W	Little variation in chargeability, not interpretable
e)	23N/1750W	Large variation in chargeability (lateral changes?), not interpretable.

TABLE 8: MAGNETICS

1) Basin Lake:

Survey by	:	Scintrex
Date	:	Nov. - Dec., 1974
Data in	:	Scintrex report TAS-025b (Mt. Lyell file no. 27)
Station spacing	:	100ft
Magnetometer	:	?

Line	Coverage
00	0-8900E
6S	0-800E, 1200E-9300E
12S	0-9000E
18S	0-9000E
24S	0-8800E
30S	0-8700E
36S	0-8900E
42S	0-8700E
48S	0-8500E
54S	0-8100E
60S	0-7800E
66S	0-7800E
72S	0-6400E
78S	0-6600E
84S	0-5600E
90S	0-6100E
95/96S	0-5900E

TABLE 8 (Cont.)

2) Basin Lake:

Survey by	:	Scintrex
Date	:	Feb., 1981
Data in	:	This report.
Station spacing	:	25ft
Magnetometer	:	Geometrics ppm G816

Line	Coverage
30S	4500E-9000E
36S	4300E-9000E

3) East Tyndall (including Howard's Anomaly);

Survey by	:	?
Date	:	? 1968-69
Data in	:	Annual report of Mt. Tyndall area, Stevens-Hoare (1975)
Magnetometer	:	see below

Line	Coverage: Vertical field (fluxgate) station spacing 100ft	Coverage: Total field (proton precession) station spacing (?) 100ft
2N		500W-1900E
4N		1100W-1700WE
5N		1600W-1400E
6N	00 -6600E	3000W- 400E
7N		3200W- 400E
8N	00 -6000E	3500W- 00
9N		3500W- 00
10N	00 -5000E	
12N+200S	1800E-3000E	
12N	00 -4100E	
12N+200N	1800E-3000E	
14N+200S	600E-2100E	

TABLE 8 (Cont.)

Line	Coverage	
14N	00 -3900E	
14N+200N	600E-2100E	
15N		500W-1900E
16N	00 -3300E	700W- 300E
17N		1100W-1300E
18N+200S	1200W- 600E	
18N	7000W-3000E	1100W-1200E
18N+200N	1500W-1000E	
19N		2500W- 00
20N+200S	3700W- 700E	
20N	5500W-1200E	
20N+200N	3100W- 700E	
21N		(?)3000W- 00
22N+400S	2600W-1300W	
22N+200S	2700W-1300W	
22N	7600W-1200E	
22N+200N	3400W-1300W	
22N+400N	2700W-1300W	
23N		3200W- 00
24N	7200W-1300E	
25N		2200W- 800E
26N	7800W-1000E	
28N	-	-
30N	6000W-3600E	
32N	5800W- 00	
34N		3800W- 00
36N	00 -3600E	3300W- 100E
38N		2300W- 700E
40N	4900W-1600E	

TABLE 8 (Cont.)

4) East Tyndall/Howard's Anomaly

Survey by	:	Scintrex
Date	:	1974
Data in	:	Scintrex report TAS-025 (Mt. Lyell file no. 28)
Station spacing	:	50ft
Magnetometer	:	Proton precession

Line	Coverage (in ft)
15N	2450W to 00
16N	2150W to 00
17N	2400W to 00
18N	2350W to 00
19N	2500W to 00
20N	2500W to 00
21N	3000W tp 00
22N	3000W to 00
23N	3500W to 00
24N	3450W to 00
25N	3000W to 00
26N	3125W to 100W

TABLE 8 (Cont.)

5) Howard's Anomaly:

Survey by	:	Scintrex
Date	:	Feb., 1981
Data in	:	Contour plan this report, data on plan in vault
Station spacing	:	50ft, reducing to 25ft at high gradients
Magnetometer	:	Geometrics ppm G816

Line	Coverage (in ft)
19N	2500W- 00W
19.4N	2500W- 500W
19.7N	3000W- 600W
20N	4400W- 00
20.2N	2750W- 600W
20.6N	2400W- 700W
21N	3000W-1300E
21.3N	3100W-1000W
21.6N	2700W-1100W
21.9N	3100W-1150W
22N	5200W-1700E
22.2N	4500W-1300W
22.5N	4000W-1400W
23N	4000W-1300E
23.4N	4000W-1300W
23.7N	4300W-1450W
23.7N (A)	3400W-3000W
23.7N (B)	3400W-3000W
23.7N (C)	3400W-3000W
23.7N (D)	3400W-3000W
24N	3500W-1100E
24.5N	4200W-1500W
25N	4600W-1100E
26N	8200W- 900E

TABLE 9: ELECTROMAGNETICS

1) Basin Lake Turam Survey

Survey by : Seigel & Associates
Date : October, 1970
Data in : Seigel report TAS-001 (no Mt. Lyell file no.)
Receiver spacing : (?) 100ft
Grid is in imperial units.

Line	Coverage[1] 400Hz	800Hz
20100N		4250W-2750W
20500N	3050W-2550W	4250W-2700W
20700N	3050W-2550W	3250W-2750W
20900N	3050W-2550W	4250W-1550W
21100N	3050W-2550W	3250W-2700W
21300N	3150W-2550W	4250W-1550W
21500N	3150W-2550W	3250W-2700W
21700N	3150W-2550W	4250W-1550W
22100N	3150W-2550W	4250W-1550W
22500N	3850W-2550W	3850W-1450W
22900N	4050W-3950W	4050W-3850W
22900N	3650W-2550W	3650W-1400W
23300N	4050W-3750W	4050W-3750W
23300N	3400W-2550W	3400W-1500W
23700N	4050W-3550W	4050W-3650W
23700N	3250W-2550W	3550W-1550W
24100N	4050W-3650W	4050W-3650W
24100N	3550W-2550W	3550W-1550W

1 Coverage taken from profiles: this is somewhat at variance with the plan presentation of the data.

TABLE 9 (Cont.)

2) East Tyndall Turam Survey

Survey by : RioTinto
Date : 1957-59
Data in : Geophysical surveys, Howard, Tasmania. Report by Boniwell (1959)

Grid is in imperial units (Baselines are about 1750ft apart).
(The survey used a grounded cable: 440Hz was plotted)

EASTERN BASELINE

Line		Coverage	
64S	1850W- 350W	250E- 950E	
60S	1700W- 250W	250E-1250E	
56S	1800W- 250W	250E-1450E	
52S	1800W- 250W	450E-1550E	
48S	1700W- 250W	450E-1550E	
44S	1700W- 250W	750E-1650E	
40S	1700W- 200W	250E- 350E	850E-1650E
36S	1700W- 250W	250E- 450E	950E-1650E
32S	1550W- 250W	250E- 450E	950E-1750E
28S	1700W- 250W	250E- 450E	950E-1650E
24S	1600W- 250W	250E, 350E	1050E-1550E
20S	1700W- 250W	250E- 650E	1050E-1650E
16S	1700W- 250W	300E- 800E	1250E-1950E
12S	1700W- 250W	250E- 650E	1050E-1750E
8S	1700W- 250W	250E- 850E	1350E-1950E
4S	1750W- 250W	250E- 850E	1250E-1950E
00	1750W- 250W	250E- 850E	1350E-1950E

TABLE 9 (Cont.)

WESTERN BASELINE

Line		Coverage
8S	1400W-200W	
4S	1750W-200W	
00	1850W-250W	
4N	1850W-250W	200E-1750E
8N	1850W-250W	250E-1750E
12N	1650W-250W	250E-1750E
16N	2050W-250W	300E-1750E
20N	1950W-250W	250E-1950E
24N	1950W-250W	250E-1950E
28N	1950W-250W	250E-1950E
32N	1950W-250W	250E-1950E
36N	1950W-250W	250E-1950E
40N	1050W-250W	250E-1950E
44N	1150W-250W	250E-1950E
48N	700W-250W	250E-1950E
52N	650W-250W	250E-1950E
56N	550W-250W	250E-1950E
60N	550W-250W	250E-1950E
64N	450W-250W	250E-1950E
68N	450W-250W	250E-1200E
72N		250E-2050E

TABLE 9 (Cont.)

3) East Tyndall ('Eastern' Turam anomaly)

Survey by	:	Geoterrex
Date	:	January, 1981
Data in	:	Mitre Geophysics report 81/05 (Mt. Lyell file no 56)
Coil spacing	:	150m
Instrument	:	Max-Min; coil axes vertical

Line	Coverage				
	222Hz	444Hz	888Hz	1777Hz	3555Hz
22N			250E-1700E		250E-1700E
23N	250E-1100E		250E-1100E		250E-1100E
24N		250E-950E	250E-950E	250E-950E	250E-950E
25N			250E-1100E		250E-1100E
26N			250E-900E		250E-900E

TABLE 10: GRAVITY

Survey by : RioTinto

Date : 1954

Data in : 'Geophysical surveys, Howard, Tasmania'. Report by Boniwell (1959).

Grid is in imperial units.

Line	Coverage 'Southern' Anomaly	'Eastern' Anomaly
52S		700E-1600E
48S	1600W-800W	700E-1600E
44S	1550W-700W	700E-1600E
40S		700E-1600E
36S		700E-1600E
32S	1550W-650W	
28S	1600W-800W	700E-1500E

Line	'Northern' Anomaly	'Tyndall' Anomaly
4S		150W-650E
00		300W-700E
4N		
8N		
12N		325W-750E
16N		300W-800E
20N	1200W-100E	
24N	1200W-100E	
28N	1200W-100E	
32N	1200W-100E	
36N	1200W-100E	
40N	1100W-100E	

TABLE 11: DIAMOND DRILL HOLE SUMMARIES

(From the drill hole logs)

1) BL1

Co-Ords : line 72S, 5900E Date: Feb.-March, 1978

Length : 484m

Bearing : 095° mag Dip: -70°

Purpose: "To test the down dip extension of the galena mineralisation intersected in the Pickands Mather DDH, BL802 (stopped in weak mineralisation) and to test the moderate Pb soil geochem. anomaly immediately up-slope from the BL802 collar."

Results: "

	Cu	Pb	Zn (percent)
296-300m	.01	.135	.46
303.5-308m	.018	.12	.44"

Comments: A down-hole IP survey was run from 125-390m, high chargeabilities (80-100+ms) were obtained at 203-212m (.6%, total S), 294.7m to 303.5m (3.5% total S) and 360-390m (total S not determined). Magnetic susceptibilities have not been logged.

2) BL2

Co-Ords : Line 48S, 6600E Date: March, 1978

Length : 296M

Bearing : 085° mag Dip : -60°

Purpose: "To test the northern extension of the zone of strong alteration (pyrite, sericite) intersected in BL1; this zone is considered to correspond with a low order linear chargeability/resistivity anomaly located at L48S, 7000E."

Results: "black shale from 197-222.7m: this unit assayed 7ppm Cu, 63ppm Pb, 108ppm Zn and probably explains the IP geophysical anomaly."

TABLE 11 (Cont.)

"160-167.5m: 157ppm Cu, 1500ppm Pb, 588ppm Zn in altered m-cg crystal lithic tuffs. Less alteration than in BL1."

Comments: A down-hole IP survey was run from 175m to 285m; no chargeability readings were obtained over the black shales (resistivities down to 5 ohm-m); high chargeabilities (65-80ms) were obtained 230-240m, 275- Magnetic susceptibilities have not been logged.

3) BL3

Co-Ords : 30m north of line 30S, 7636E
Length : 451m Date: Mar-April, 1981
Bearing : 087° mag Dip: -55°

Purpose: "to test a broad magnetic anomaly centred at L30S, 8200E which was possibly on strike with haematite-carbonate rocks encountered in BL1 some 500m to the south."

Results: "no significant mineralisation, magnetic anomaly due to disseminated magnetite within massive andesitic tuffs."

Comments: Magnetic susceptibility measurements recorded a background level of about .001cgs units to 400m, then effectively zero:peak values were up to .003cgs units. Down-hole IP logging (array spacing?) recorded only one value of more than 30mv/v. Local highs were at 335m and 390m.

4) BL4

Co-Ords : 5m south of line 30S, 6700E. Date : May, 1981
Length : 289m
Bearing : 244° mag. Dip: -50°

Purpose: "to test a gradient array IP twin peak chargeability high with corresponding resistivity lows, coincident dipole-dipole IP chargeability anomalies and corresponding resistivity lows and low order Pb-Zn soil geochemical anomalies".

TABLE 11 (Cont.)

Results: (from period report): The hole intersected a broad zone (8m) of massive to disseminated pyrite within andesitic tuffs and another zone (34m) of interbedded pyritic black shales and andesitic tuffs.

Comments: Magnetic susceptibilities were nearly all (effectively) zero except for 10m bands at 40m (.0025cgs) and at 80m (.0005 cgs). Down-hole IP logging recorded a series of narrow highs and lows with long intervals of no readings. The most anomalous (recorded) area was between 30 and 60m (100+mv/v).

5) TYN1

Co-Ords	: Line 12N, 2650E		Date: June-Sept, 1968
Length	: 734ft (223.8m)		
Bearing	: 270°		Dip: -40°

Purpose: "to test the strong IP anomaly on line 12N between 2300E and 2500E."

Results: "minor pyrite between 40 and 80m"

Comments: no down-hole IP on logging of magnetic susceptibility. The hole appears to have been well-targeted from the 1967/68 data, see Figure 17.

6) TYN2

Co-Ords	: Line 4N, 1160W		Date: Jan., 1975
Length	: 855ft (260.7m)		
Bearing	: 090°		Dip: - 65°

Purpose: "to test an IP anomaly in the lower clastics and pyroclastics of the Howard Andesite."

Results: "mineralisation associated with black shales, carbonates and ignimbrites."

Comments: No down-hole IP or logging of magnetic susceptibility. A 1981 dipole-dipole survey suggests that the strongest anomaly is beneath the drill hole collar.

TABLE 11 (Cont.)

7) TYN3

Co-Ords : Line 16N, 1700W Date: Feb., 1975
Length : 1200ft (365.9m)
Bearing : 090° mag. Dip: -60°

Purpose: "to test a major IP anomaly associated with a black shale sequence in the Howard Andesite."

Results: "The black shales were encountered on target and were slightly pyritic (848-1083', interbedded black shales). No mineralisation was present."

Comments: No down-hole IP or logging of magnetic susceptibility. A 1981 dipole-dipole survey suggests that there are two distinct sources causing the anomaly and that TYN3 has only intersected the western source.

8) HA1

Co-Ords : Line 20+200S, 1650W Date: Feb., 1971
Length : 450.5ft (137.3m)
Bearing : 250° mag. Dip: -55°

Purpose: "to test in depth, a zone of coincident IP, magnetic and geochemical anomalies and a surface gossan."

Results: The hole was stopped due to excessive flattening. HA2 was collared at the same site.

9) HA2

Co-Ords : Line 20+200S, 1650W Date: Feb-March, 1971
Length : 850ft (259.2m)
Bearing : 250° mag. Dip: -58.5°

Purpose: "to test in depth a zone of coincident IP, magnetic and geochemical anomalies and a surface gossan."

Results:

10-23m	4-20%	Py
53-63m	1-6%	Py
100-123m	1-12%	Py

Comments: This hole was collared at HA1 which was aborted due to excessive flattening. There was no down-hole IP or logging of magnetic susceptibility.

TABLE 11 (Cont.)

10) HA3

Co-Ords : Line 23N, 1400W Date: Feb., 1975
Length : 800ft (243.9m)
Bearing : 270° mag. Dip: -60°

Purpose: "to test a weak (gradient) IP anomaly and a non-coincident soil geochem. anomaly; also a surface outcrop of MnO_2 carrying barite.

Results: "a black shale was intersected about 200ft east of the IP anomaly. No other explanation of the IP anomaly was encountered in the hole.

Comments: A 1980 pole-dipole survey suggests that the source of the gradient IP anomaly was very shallow: the drill hole would have passed beneath it. Magnetic susceptibilities (recorded in the log book) show some magnetic sequences. Although primarily drilled for base metals, HA3 intersected 49m (60-109m) averaging 8 g/t of silver. There was no down-hole IP log.

11) HA4 Date: Feb., 1981

Co-Ords : 60ft south of line 20.2N, 1250W
Length : 403.1m
Bearing : 081° mag Dip: -53°

Purpose: "to test coincident soil geochem, IP, and magnetic anomalies on line 20.2N, 1000-1100'W near a pit containing haematite-barite" (drilled for silver).

Results: 14m (55-69m) averaged 4 g/t Ag and
34m (175=209m) averaging 35 g/t Ag.

Comments: it is noted in the log that "a moderately large proportion of the silver bearing sulphides are closely associated with haematite and partially oxidised magnetite", however Figure 19 suggests that magnetite susceptibility is a poor indicator of silver content. The hole was logged with down-hole IP and several zones of high chargeability (100+mv/v) were recorded.

TABLE 11 (Cont.)

12) HA5 Date: June-July, 1981

Co-Ords : 10m south of line 19N, 500'W
Length : 297.5m
Bearing : 270° mag. Dip: -50°

Purpose: "to test the southern extension of Ag bearing haematite-carbonate rich rocks located in DDH's HA3 & HA4 to the north and silver bearing outcrops on line 19N in Tyndall Creek. A minor gradient chargeability anomaly located at line 19N, 1250'W was also tested".

Results: "The drill hole was probably collared just west of the Tyndall Group contact within the older andesitic volcanics. A significant assay of 8.6m of 11 g/t Ag occurs at 66-74.6m. Syngenetic pyrite located at 248-275m with no associated base metal mineralisation, explains the minor chargeability anomaly."

Comments: The magnetic susceptibility of the core was measured, the 8.6m of silver corresponding with values .0001 to .0015cgs: these were relatively low for the log. No down-hole IP was run.

13) HA6

Co-Ords : Line 21N, 950'W Date: July, 1981
Length : 250m
Bearing : 273° mag. Dip: -60°

Purpose: " To test Ag bearing rocks in HA4 (to the south) HA3 (to the north) and outcrops in Tyndall Creek on line 21N which assayed 10m at 73 g/t.

Results: 6.3 g/t of Ag were recorded over 4.1m (94.4m to 98.5m). It was noted that the silver "was not directly related to haematite, but was associated with it."

Comments: The magnetic susceptibilities are flat down to 112m, after which they vary between 0 and .005cgs: thus the silver values are not associated with any magnetic response. There was no down-hole IP run.

TABLE 11 (Cont.)

14) HFZ7

Co-Ords : Line 40N, 300W Date: January, 1975
Length : 855ft (260.7m)
Bearing : 270° mag. Dip: - 45°

Purpose: "to test a combined geophysical and geochemical anomaly at the top of the Queenstown pyroclastics."

Results: "minor mineralisation encountered in acid pyroclastic rocks." Black shales were recorded in the log between 434 and 480'

Comments: Magnetic susceptibilities were not logged and no down-hole IP was run.

15) HFZ8

Co-Ords : Line 38N, 1500'W Date: January, 1975
Length : 710ft (216.5m)
Bearing : 090° mag. Dip: -55°

Purpose: "to test extension of mineralisation in HFZ7, and a similar IP anomaly.

Results: "Minor mineralisation was encountered at the stratigraphic top of the Queenstown pyroclastics, probably related to a minor fault." The log recorded about 2% pyrite between 460ft and 645ft".

Comments: Magnetic susceptibilities were not logged and no down-hole IP was run.

AN EVALUATION OF GEOPHYSICAL SURVEYS OVER THE EAST TYNDALL & BASIN LAKE GRIDS, E.L. 9/66

VOLUME 2

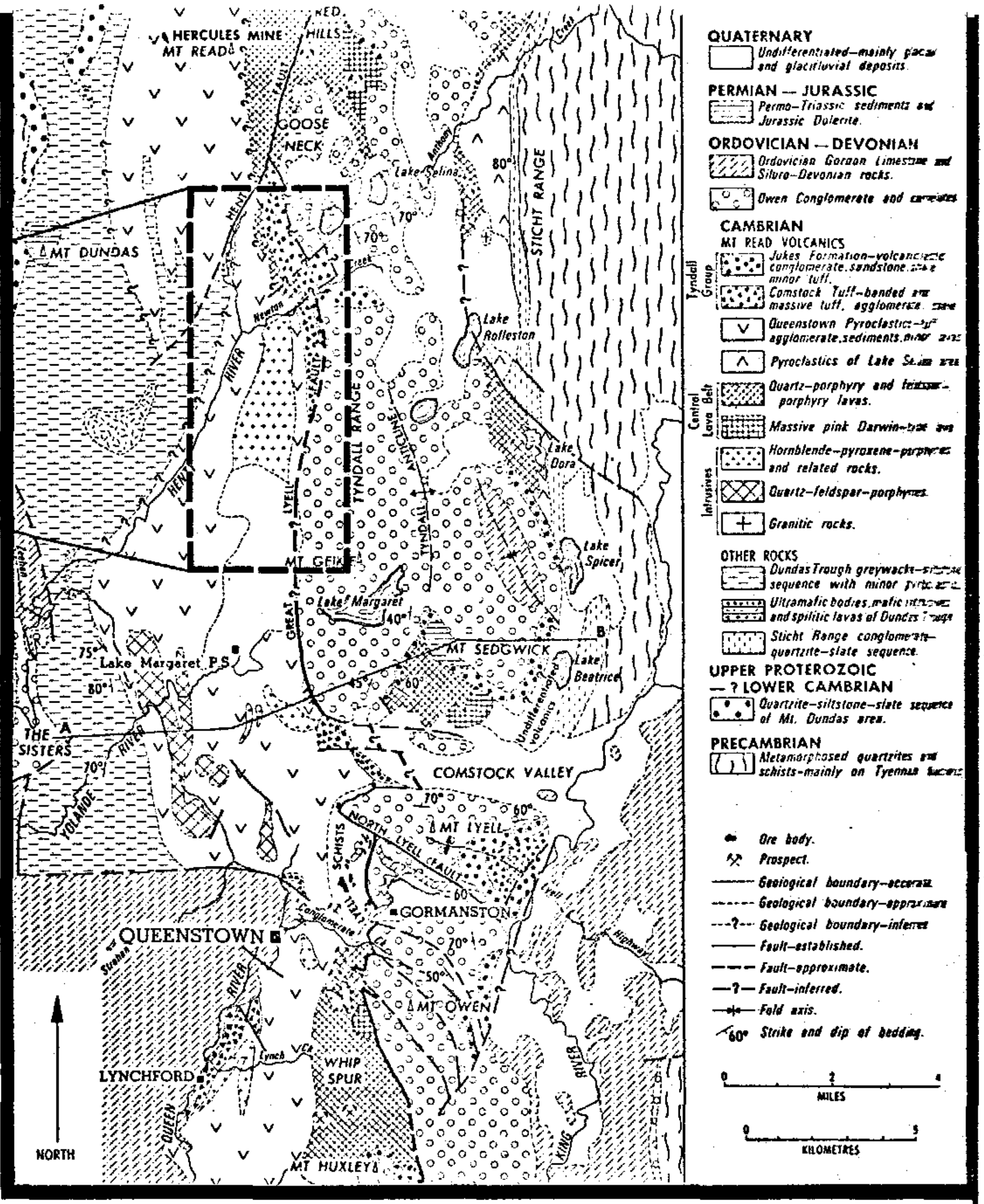
ML/MG81/13

303120

FIGURES

002

EAST TYNDALL AND BASIN LAKE AREA



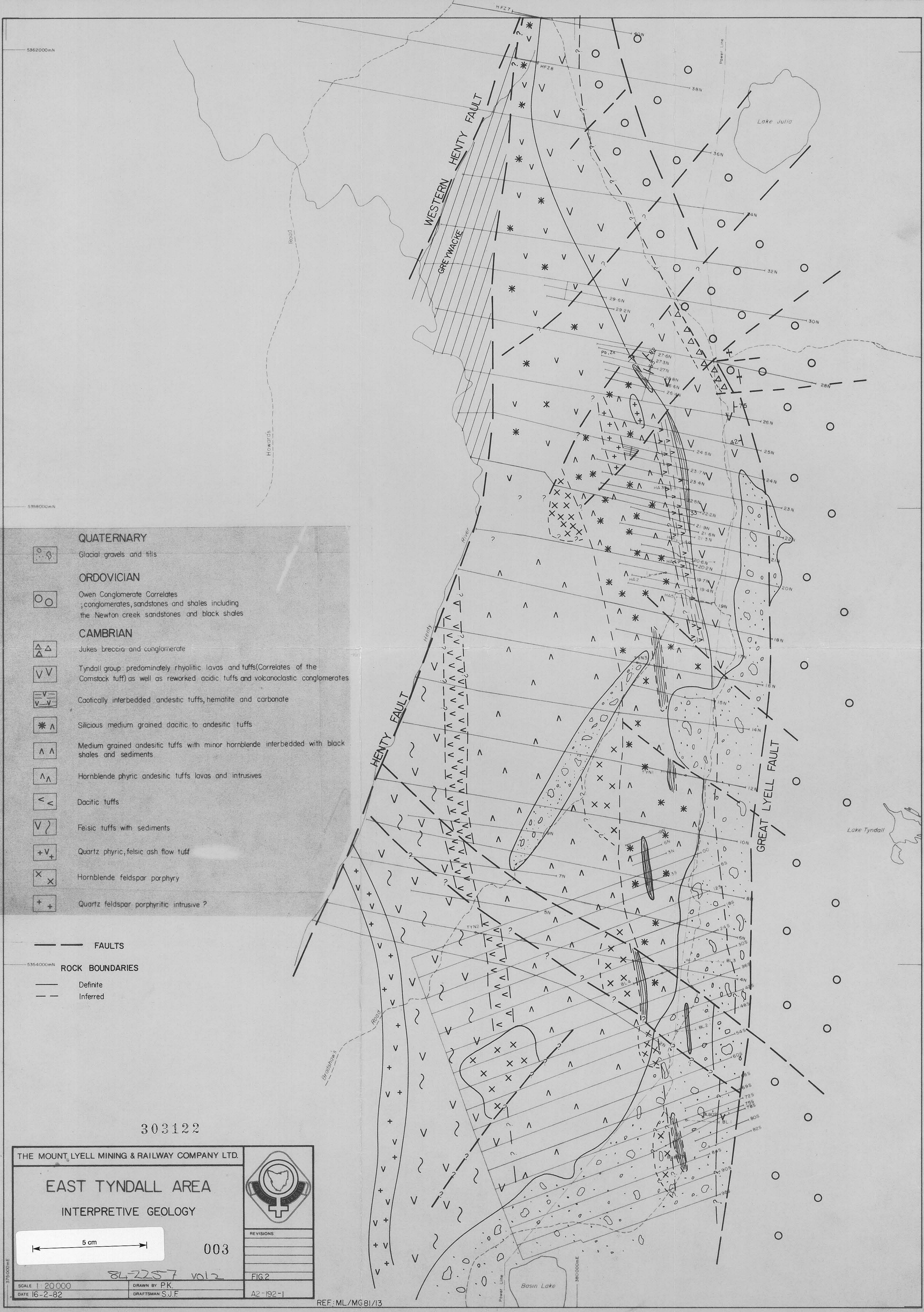
5 cm

Ref: ML/MG81/13

MITRE GEOPHYSICS PTY. LTD.	
East Tyndall and Basin Lake Grids **Location Plan**	
A4-202	
Drawn: J.B. / Traced: T.G.D.S.	Scale: 1:200,000 / Date: MAY 1982 — FIG. 1

303121

from Corbett et al (1974)



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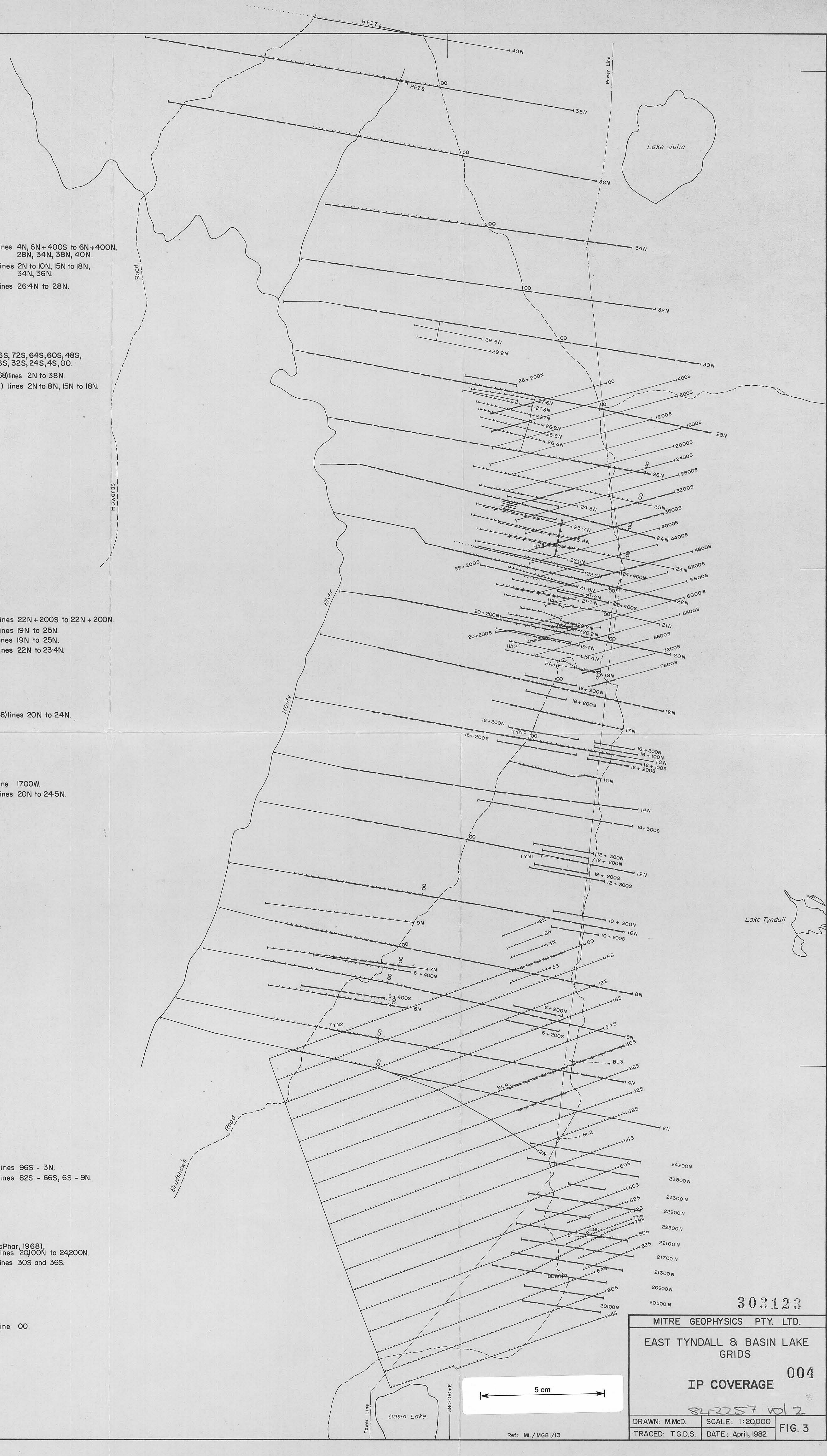


East Tyndall

gradient array ....

Scintrex , 1974 (TAS 018c) lines 4N, 6N + 400S to 6N + 400N, 28N, 34N, 38N, 40N.

Scintrex , 1974 (TAS 025) lines 2N to 10N, 15N to 18N, 34N, 36N.

Scintrex , 1981 (ML/MG81/13) lines 26·4N to 28N.

dipole - dipole – – – – –

McPhar (for Rio Tinto) 1962, lines 76S, 72S, 64S, 60S, 48S, 36S, 32S, 24S, 4S, 00.

McPhar , 1967 & 68 (Hallof, 1967 & 68) lines 2N to 38N.

Scintrex , 1981 (ML/MG81/13) lines 2N to 8N, 15N to 18N.

Howard's Anomaly (19N to 26N)

gradient array ....

Scintrex , 1973 (TAS 018c) lines 22N + 200S to 22N + 200N.

Scintrex , 1975 (TAS 025c) lines 19N to 25N.

Scintrex , 1979 (TAS 073a) lines 19N to 25N.

Scintrex , 1981 (ML/MG81/13) lines 22N to 23·4N.

dipole - dipole – – – – –

McPhar , 1967 & 68 (Hallof, 1967 & 68) lines 20N to 24N.

pole - dipole –+–+–+–

Scintrex , 1975 (TAS 025c) line 1700W.

Scintrex , 1980 (TAS 025c) lines 20N to 24·5N.

Basin Lake

gradient array ....

Scintrex , 1974 (TAS 025B) lines 96S - 3N.

Scintrex , 1978 (TAS 054c) lines 82S - 66S, 6S - 9N.

dipole - dipole – – – – –

Pickands Mather, 1968-9 (including McPhar, 1968), lines 20,100N to 24,200N.

Scintrex , 1981 (ML/MG81/13) lines 30S and 36S.

pole - dipole –+–+–+–

Scintrex , 1978 (TAS 054c) line 00.

303123

MITRE GEOPHYSICS PTY. LTD.

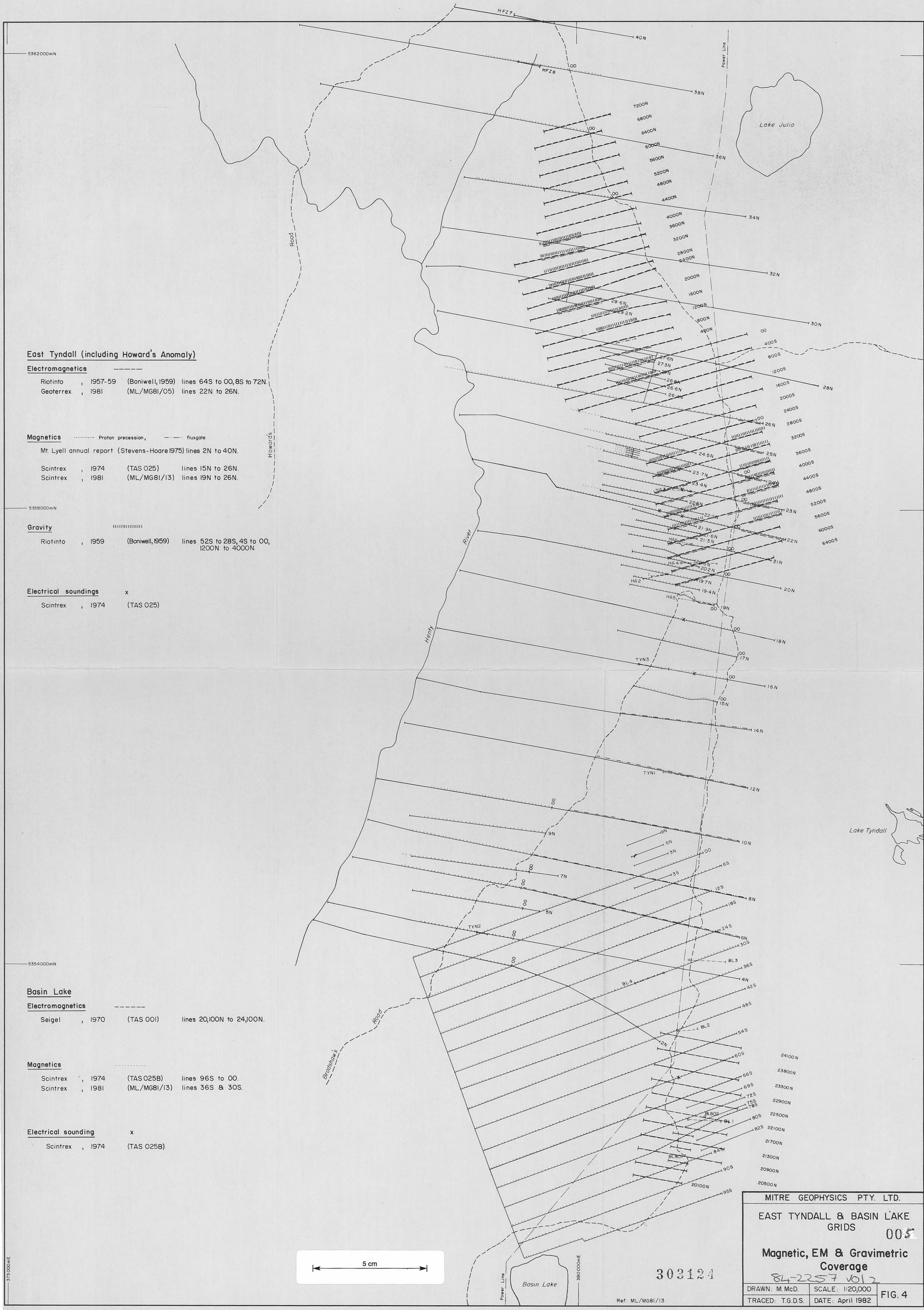
EAST TYNDALL & BASIN LAKE GRIDS

IP COVERAGE

004

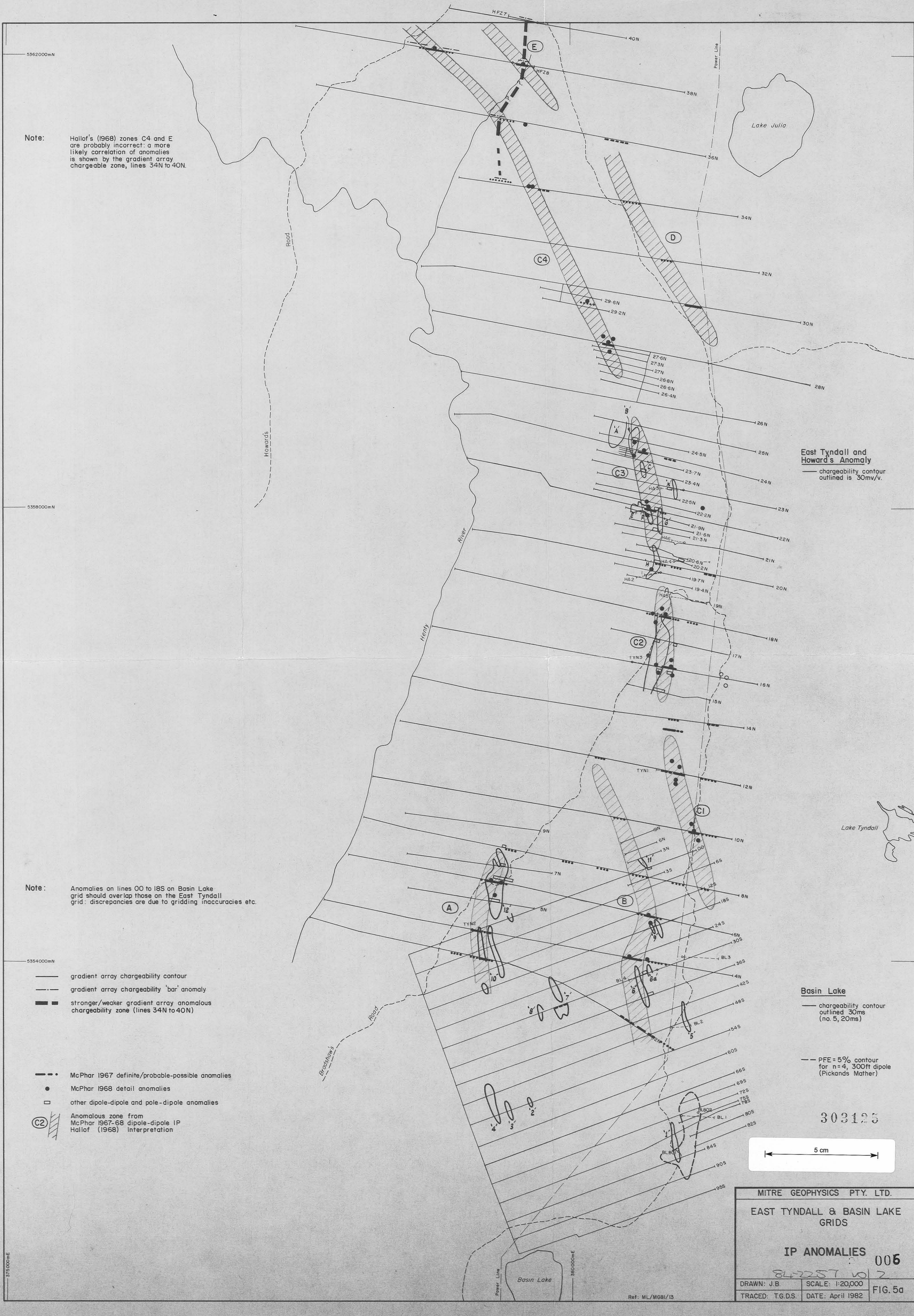
84-2257 vol 2

DRAWN: M.McD.	SCALE: 1:20,000	FIG. 3
TRACED: T.G.D.S.	DATE: April, 1982	

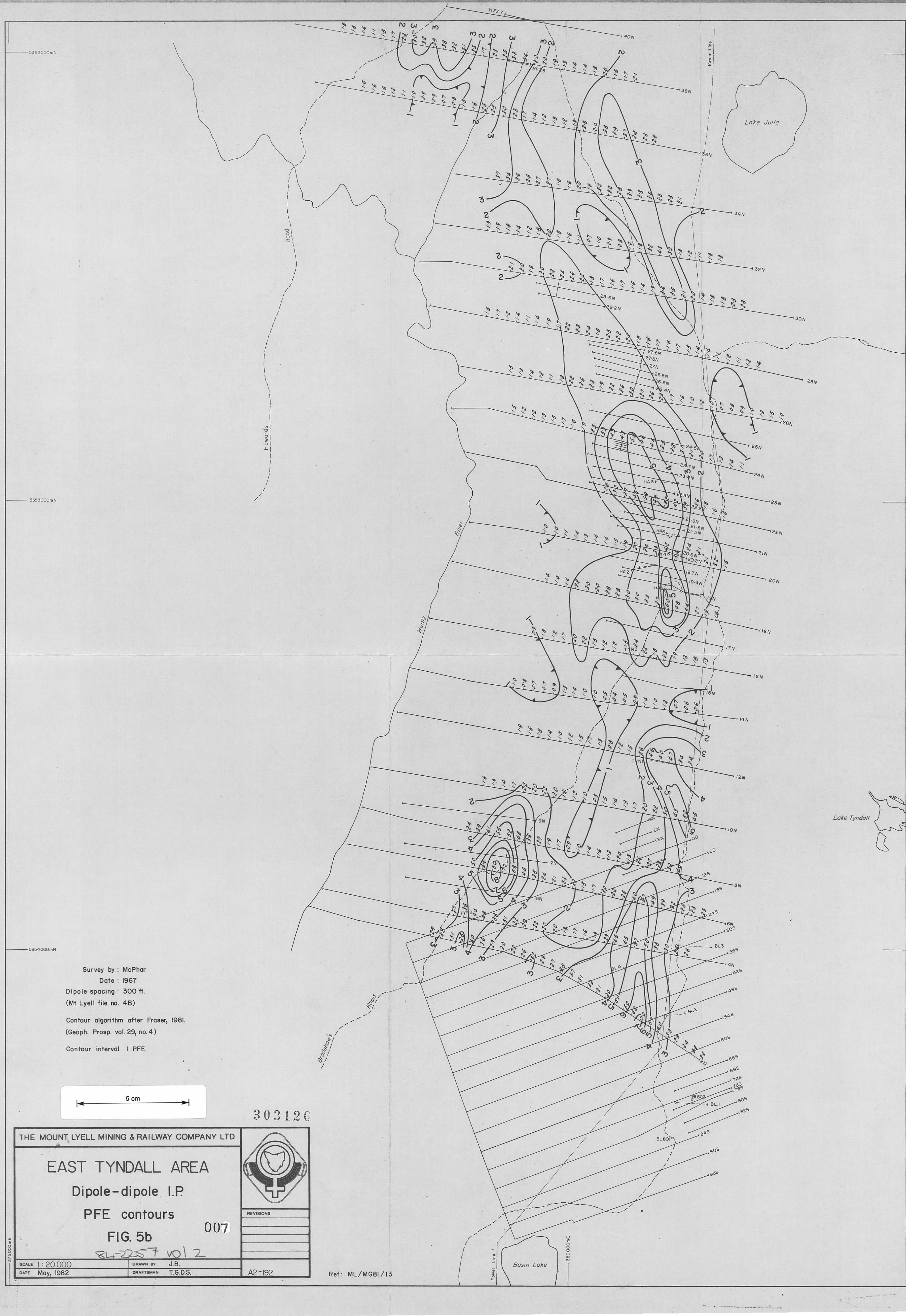


303124

84-2257 vol 2 005



Note: Hallof's (1968) zones C4 and E are probably incorrect: a more likely correlation of anomalies is shown by the gradient array chargeable zone, lines 34N to 40N.
Note: Anomalies on lines 00 to 18S on Basin Lake grid should overlap those on the East Tyndall grid: discrepancies are due to gridding inaccuracies etc.
5362000mN
5358000mN
5354000mN
375000mE
380000mE
HFZ7
HFZ8
40N
38N
36N
34N
32N
30N
29·6N
29·2N
28N
27·6N
27·3N
27N
26·8N
26·6N
26·4N
26N
25N
24·5N
24N
23·7N
23·4N
23N
22·6N
22·2N
22N
21·9N
21·6N
21·3N
21N
20·6N
20·2N
20N
19·7N
19·4N
19N
18N
17N
16N
15N
14N
12N
10N
9N
7N
5N
8N
6N
4N
2N
Lake Julia
Power Line
Howard's Road
Henty River
Bradshaw's Road
Lake Tyndall
Basin Lake
E
D
C4
C3
C2
C1
A
B
HA1
HA2
HA3
HA4
HA5
HA6
TYN1
TYN2
TYN3
BL1
BL2
BL3
BL4
BL8
BL802
East Tyndall and Howard's Anomaly
chargeability contour outlined is 30mv/v.
Basin Lake
chargeability contour outlined 30ms (no. 5, 20ms)
PFE = 5% contour for n=4, 300ft dipole (Pickands Mather)
gradient array chargeability contour
gradient array chargeability 'bar' anomaly
stronger/weaker gradient array anomalous chargeability zone (lines 34N to 40N)
McPhar 1967 definite/probable-possible anomalies
McPhar 1968 detail anomalies
other dipole-dipole and pole-dipole anomalies
C2 Anomalous zone from McPhar 1967-68 dipole-dipole IP Hallof (1968) interpretation
303125
5 cm
MITRE GEOPHYSICS PTY. LTD.
EAST TYNDALL & BASIN LAKE GRIDS
IP ANOMALIES
005
84-2257 vol 2
DRAWN: J.B.
SCALE: 1:20,000
TRACED: T.G.D.S.
DATE: April 1982
FIG. 5a
Ref: ML/MG81/13



Survey by : McPhar
Date : 1967
Dipole spacing : 300 ft.
(Mt. Lyell file no. 4B)

Contour algorithm after Fraser, 1981.
(Geoph. Prosp. vol. 29, no. 4)

Contour interval 1 PFE

5 cm

303120

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL AREA

Dipole-dipole I.P.

PFE contours

FIG. 5b

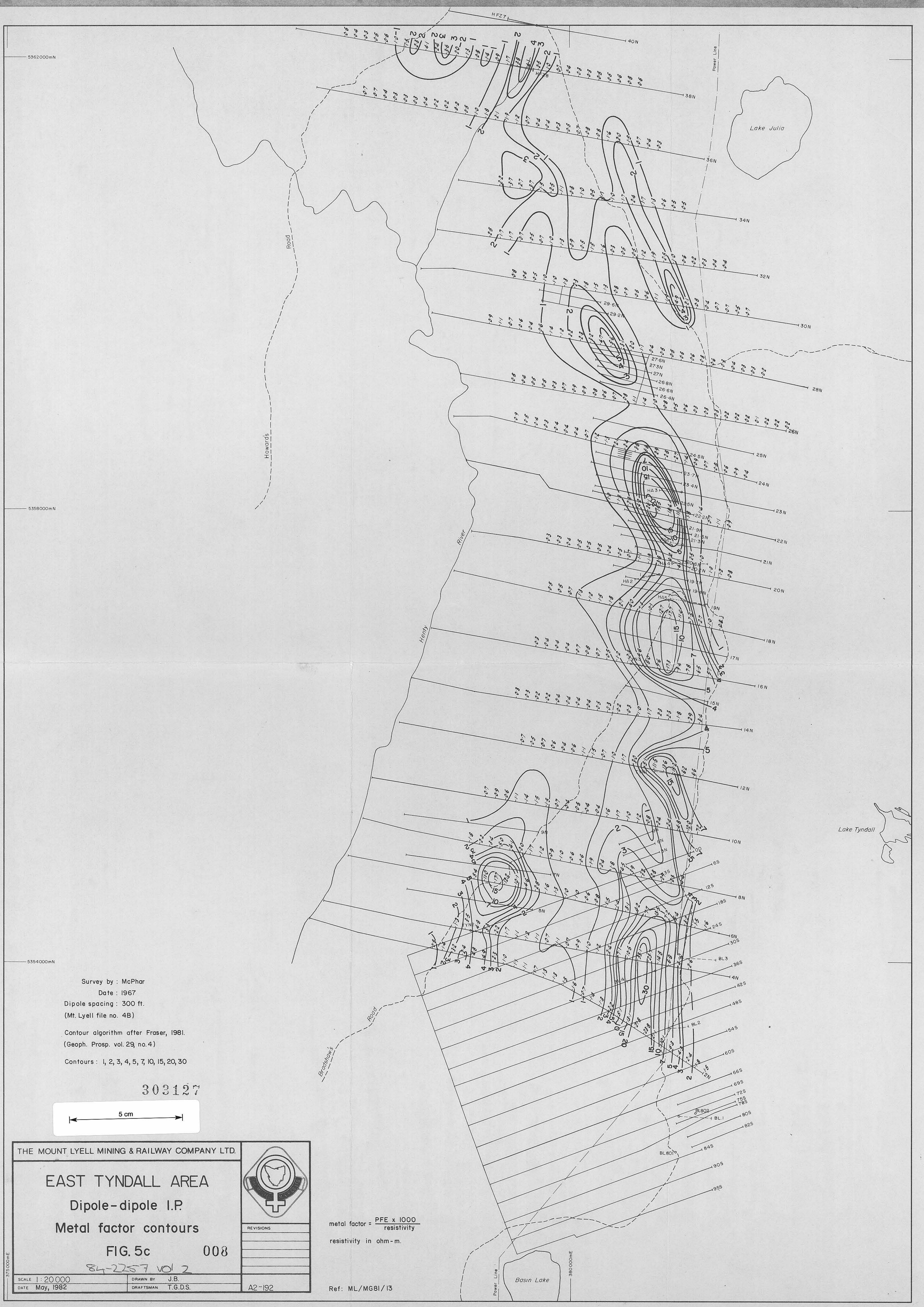
007

BL-2257 vol 2

SCALE 1 : 20 000	DRAWN BY J.B.		
DATE May, 1982	DRAFTSMAN T.G.D.S.		A2-192

REVISIONS

Ref: ML/MG81/13



Survey by : McPhar
Date : 1967
Dipole spacing : 300 ft.
(Mt. Lyell file no. 4B)

Contour algorithm after Fraser, 1981.
(Geoph. Prosp. vol. 29, no. 4)

Contours : 1, 2, 3, 4, 5, 7, 10, 15, 20, 30

303127

5 cm

metal factor = $\frac{PFE \times 1000}{resistivity}$

resistivity in ohm-m.

Ref: ML/MG81/13

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL AREA
Dipole-dipole I.P.
Metal factor contours

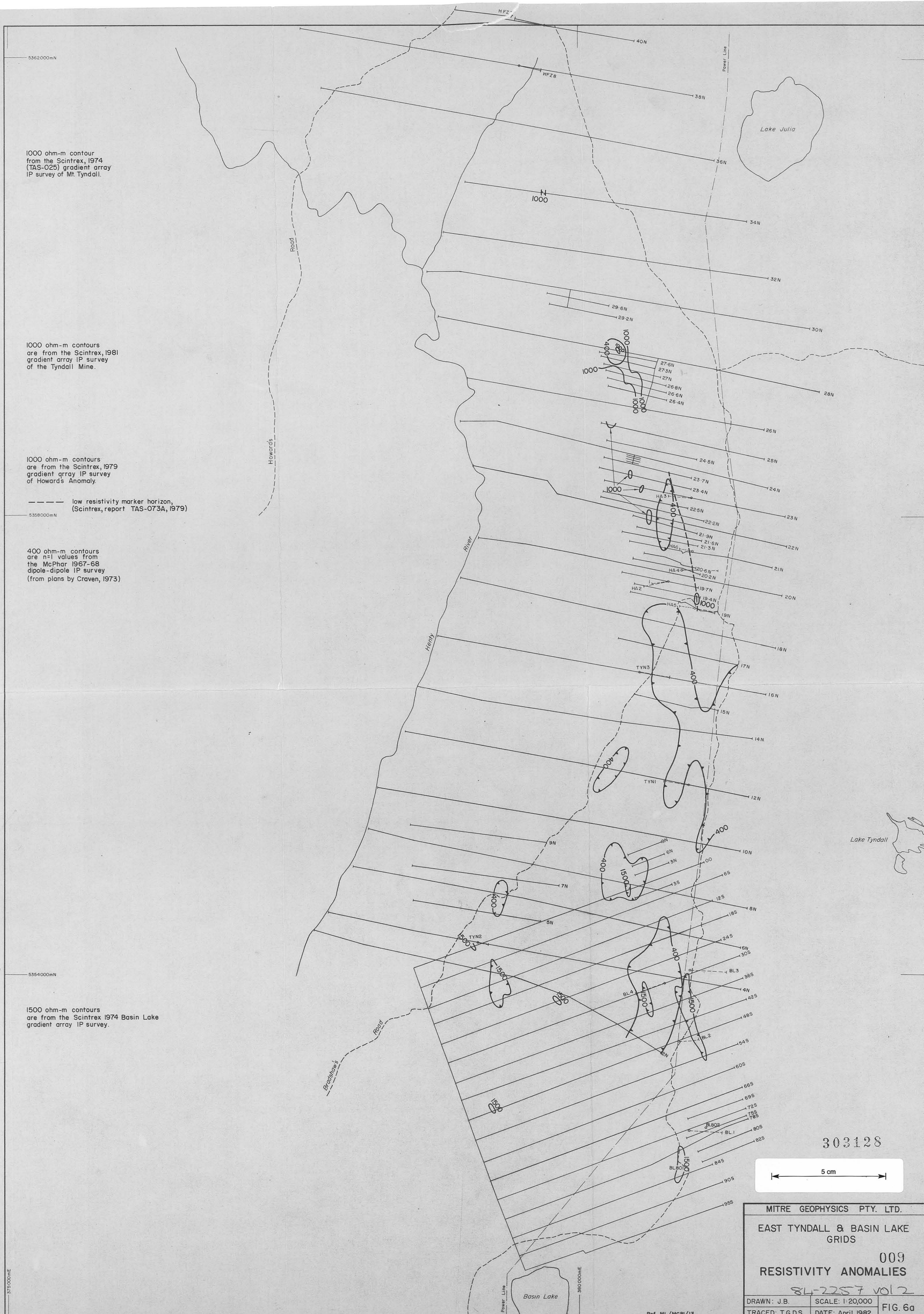
FIG. 5c 008

84-2257 VOL 2

REVISIONS

SCALE	1 : 20000	DRAWN BY	J.B.
DATE	May, 1982	DRAFTSMAN	T.G.D.S.

A2-192


1000 ohm-m contour from the Scintrex, 1974 (TAS-025) gradient array IP survey of Mt. Tyndall.
1000 ohm-m contours are from the Scintrex, 1981 gradient array IP survey of the Tyndall Mine.
1000 ohm-m contours are from the Scintrex, 1979 gradient array IP survey of Howard's Anomaly.
low resistivity marker horizon, (Scintrex, report TAS-073A, 1979)
400 ohm-m contours are n=1 values from the McPhar 1967-68 dipole-dipole IP survey (from plans by Craven, 1973)
1500 ohm-m contours are from the Scintrex 1974 Basin Lake gradient array IP survey.
5362000mN
5358000mN
5354000mN
375000mE
380000mE
Lake Julia
Lake Tyndall
Basin Lake
Power Line
Howard's Road
Henty River
Bradshaw's Road
HFZ7
HFZ8
40N
38N
36N
34N
32N
30N
29·6N
29·2N
28N
27·6N
27·3N
27N
26·8N
26·6N
26·4N
26N
25N
24·5N
24N
23·7N
23·4N
23N
22·5N
22·2N
22N
21·9N
21·6N
21·3N
21N
20·6N
20·2N
20N
19·7N
19·4N
19N
18N
17N
16N
15N
14N
12N
10N
9N
8N
7N
6N
5N
4N
TYN1
TYN2
TYN3
HA1
HA2
HA4
HA5
HA6
BL1
BL2
BL3
BL4
BL601
BL602
1000
400
1500
00
3N
6N
9N
6S
12S
13S
18S
24S
30S
36S
42S
48S
54S
60S
66S
69S
72S
75S
78S
80S
82S
84S
90S
95S
303128
5 cm
MITRE GEOPHYSICS PTY. LTD.
EAST TYNDALL & BASIN LAKE GRIDS
009
RESISTIVITY ANOMALIES
84-2257 vol 2
DRAWN: J.B.
SCALE: 1:20,000
TRACED: T.G.D.S.
DATE: April 1982
FIG. 6a
Ref. ML/MG81/13

Survey by : McPhar
Date : 1967
Dipole spacing : 300 ft.
(Mt. Lyell file no. 4B)

Contour algorithm after Fraser, 1981.
(Geoph. Prosp. vol. 29, no. 4)

Contours : 400, 640, 810, 1000, 1600, 2500, 4000 ohm-m.

303129

5 cm

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL AREA

Dipole-dipole I.P.
Resistivity contours

010

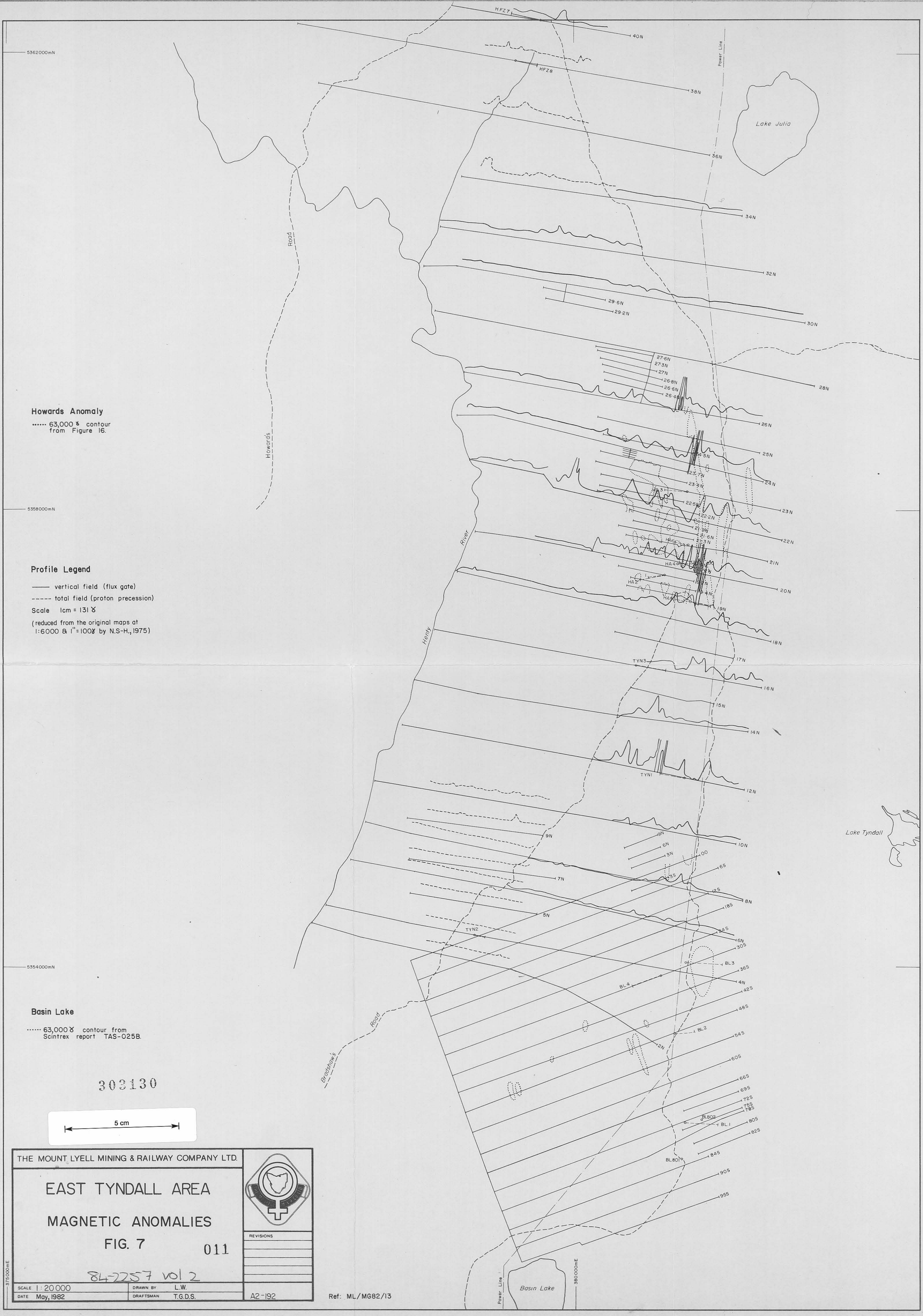
FIG. 6b

84-2257 Vol 2

SCALE	1 : 20 000	DRAWN BY	J.B.
DATE	May, 1982	DRAFTSMAN	T.G.D.S.

REVISIONS

A2-192



303130

5 cm

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL AREA

MAGNETIC ANOMALIES

FIG. 7

011

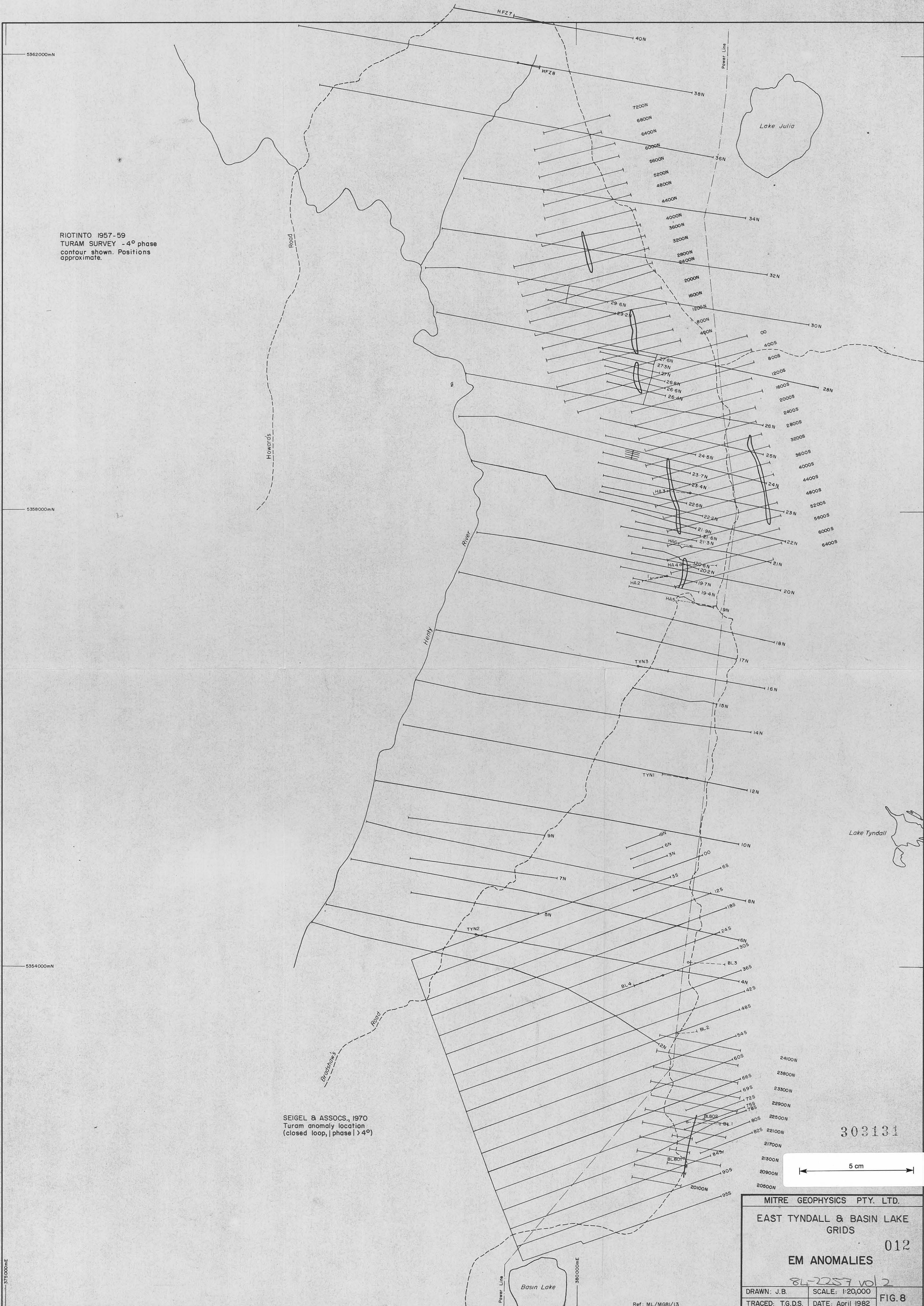
84-2257 vol 2

REVISIONS

SCALE	1:20 000	DRAWN BY	L.W.
DATE	May, 1982	DRAFTSMAN	T.G.D.S.

A2-192

Ref: ML/MG82/13



303131

MITRE GEOPHYSICS PTY. LTD.

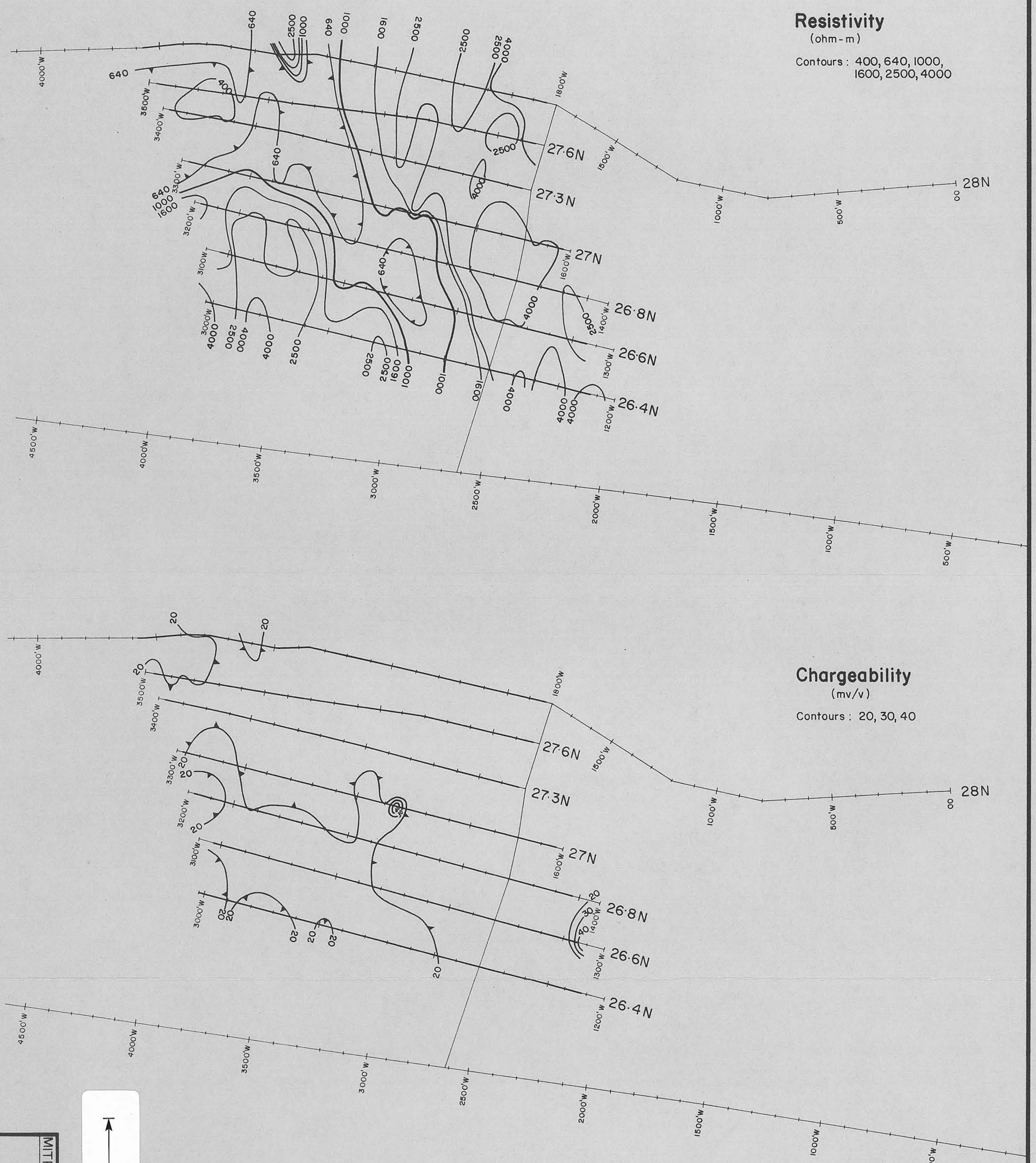
EAST TYNDALL & BASIN LAKE GRIDS

012

EM ANOMALIES

84-2257 vol 2

DRAWN: J.B.	SCALE: 1:20,000	FIG. 8
TRACED: T.G.D.S.	DATE: April 1982	



Ref: ML/MG81/13

5 cm

303132

Survey by : Scintrex
Date : April, 1981
Dipole spacing : 50ft.
IP receiver : IPR-8, 2 secs. on, 2 secs. off

LEGEND

——— IP Coverage

MITRE GEOPHYSICS PTY. LTD.

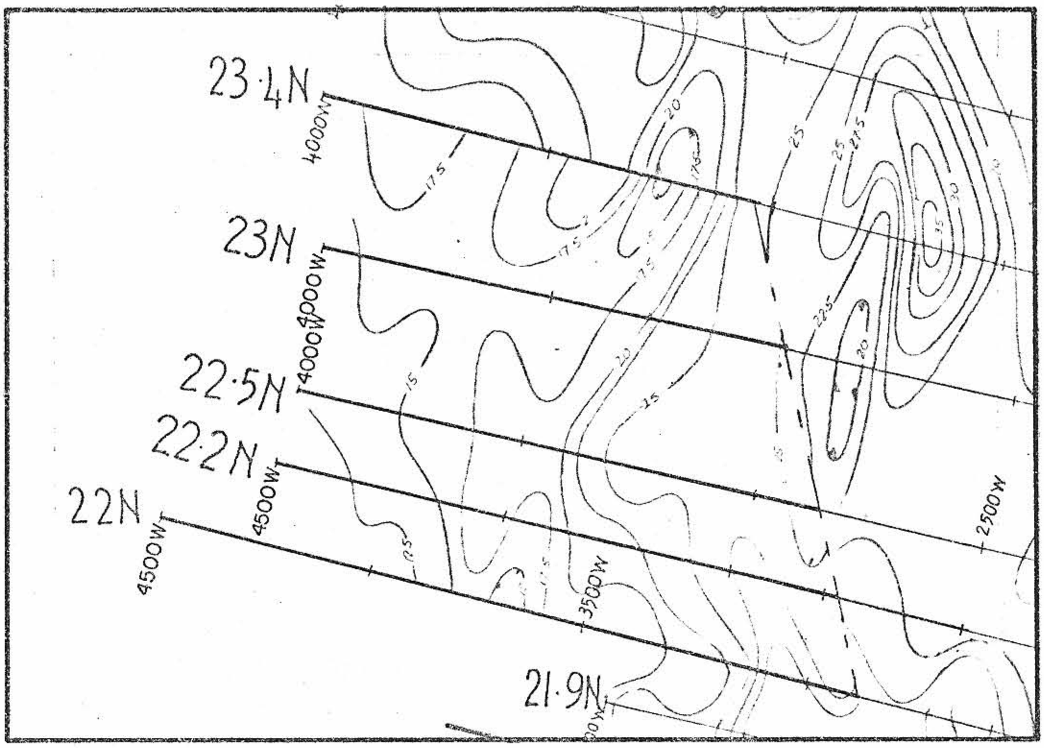
EAST TYNDALL GRID

TYNDALL MINE
GRADIENT ARRAY
IP RESULTS

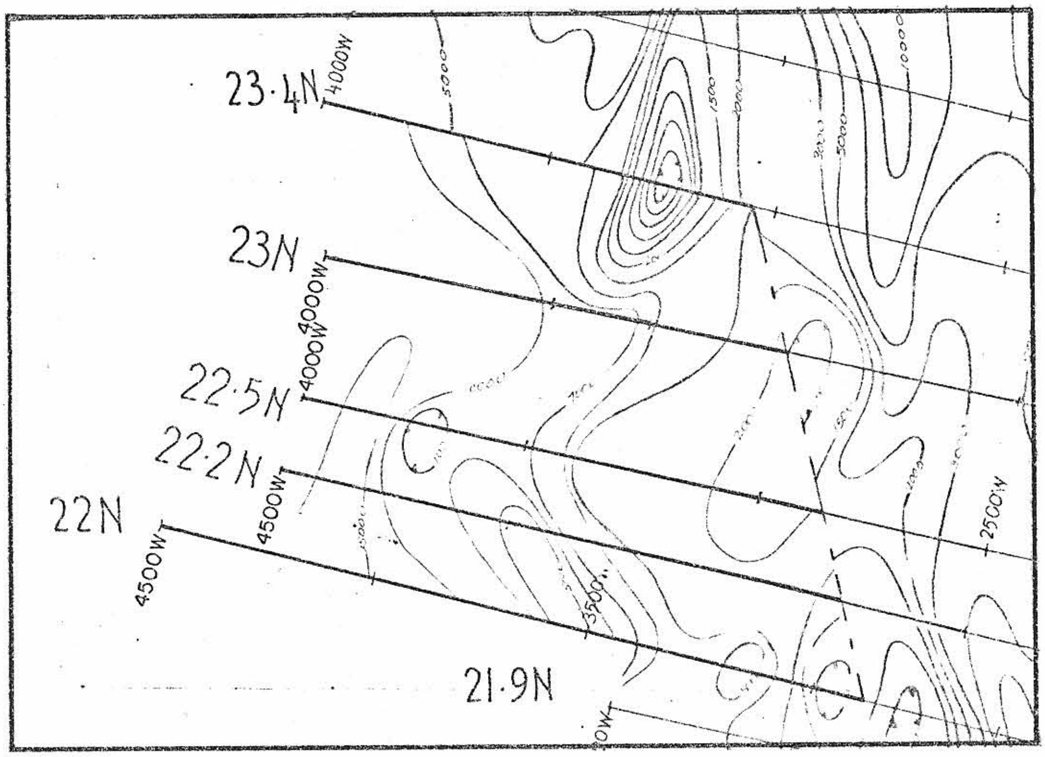
DRAWN: J.B.	SCALE: 1:5000	FIG. 9
TRACED: T.G.D.S.	DATE: April, 1982	

013

022



Chargeability (mV/V)



Resistivity (ohm.m.)

303133

5 cm

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

HOWARD'S ANOMALY

GRADIENT ARRAY E.I.P. SURVEY 1981

CHARGEABILITY & RESISTIVITY CONTOURS

ADDITION TO 1980 SURVEY - SCINTREX Job No TAS 073A

L 23·4 N - L 22 N Extensions

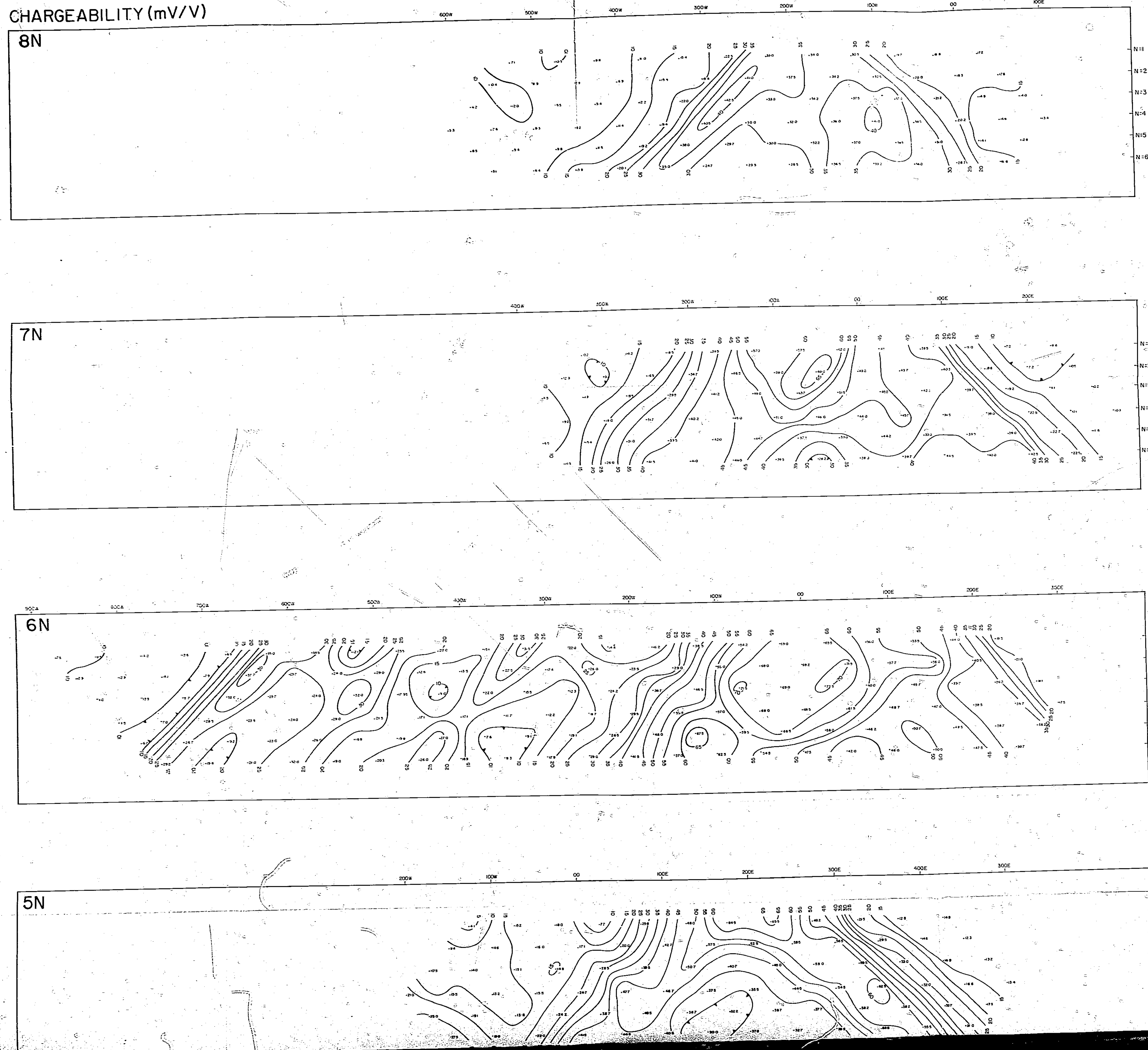
A4-144

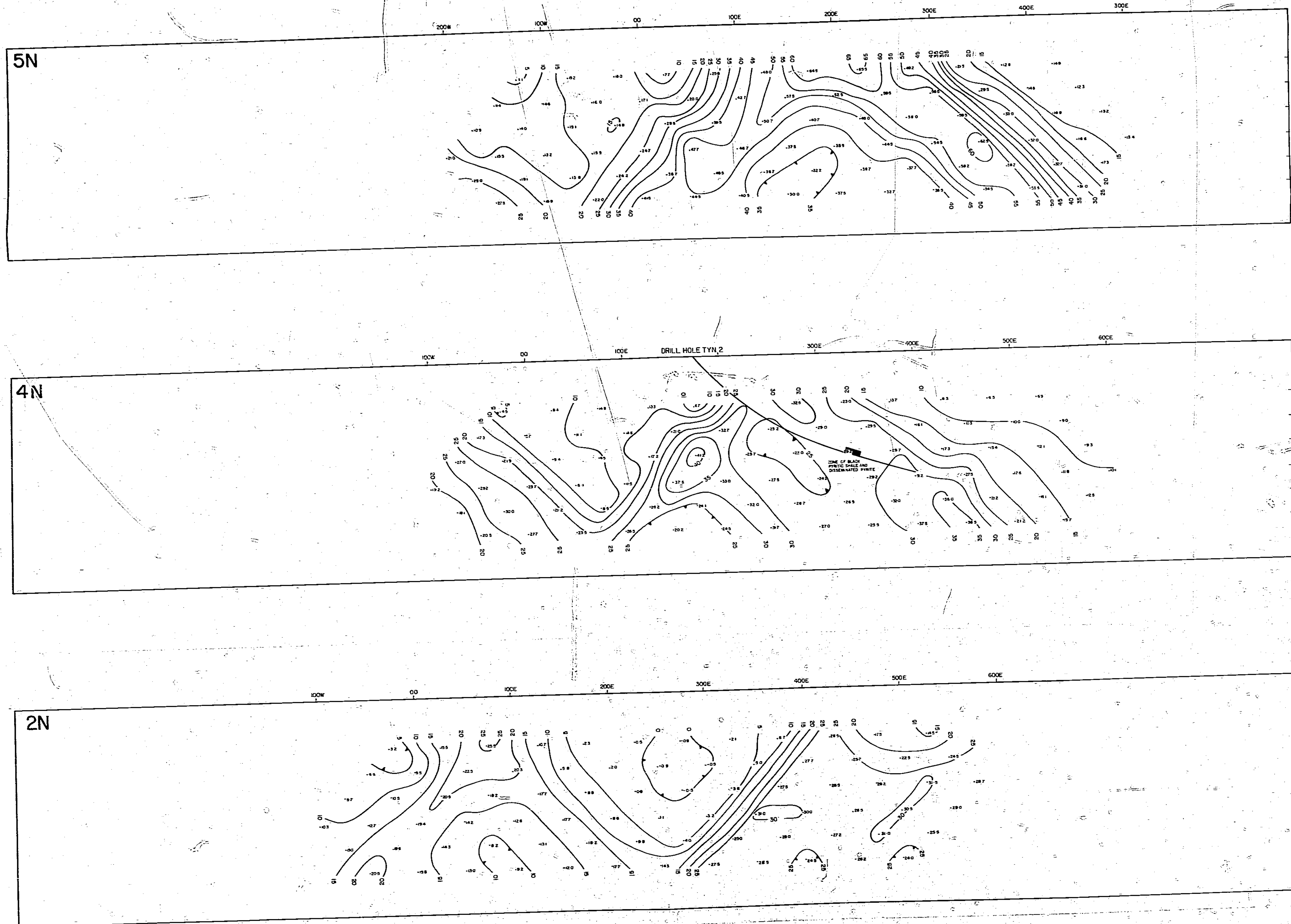
SCALE 1:5000	DRAWN BY SCINTREX Pty Ltd.	
DATE JULY, 1981	DRAFTSMAN	FIG. 10

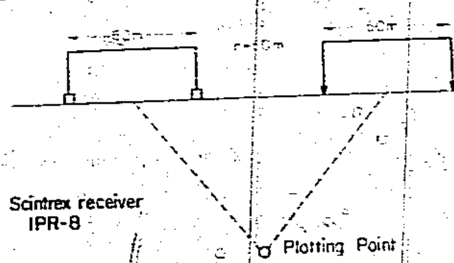
REF: ML/MG81/13


LINE 30S
(FIG. 12)
MAGNETICS
(Total field - gammas)
POWER LINES
ROAD
CHARGEABILITY
(mv/v)
RESISTIVITY
(ohm-m)
LINE 36S
(FIG. 11)
N.R.
Scintrex IPR-8 receiver
Plotting point
a = 200ft (61m)
Survey date : FEB-MARCH, 1981
Survey by Scintrex Pty. Ltd.
303134
5 cm
MITRE GEOPHYSICS PTY. LTD.
BASIN LAKE GRID
DIPOLE-DIPOLE IP & MAGNETIC RESULTS
LINES 36S & 30S
014
84-2257 vol 2
SCALE: 1:2000
DATE: MAY 1982
DRAWN BY: P.K./L.W.
DRAFTSMAN: T.G.D.S.
FIGURES 11 & 12
REF: ML/MG81/13

CHARGEABILITY (mV/V)







Profiles positioned relative to regional strike of 004°GN

Surveyed by Scintrex Pty Ltd
Survey dates May 1981

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD

EAST TYNDALL DIPOLE - DIPOLE E.I.P. L 2N-8N CHARGEABILITY PSEUDO SECTIONS

015

Chargeability C.I.= 5mv/v

84-2257 vol 2

1:2000

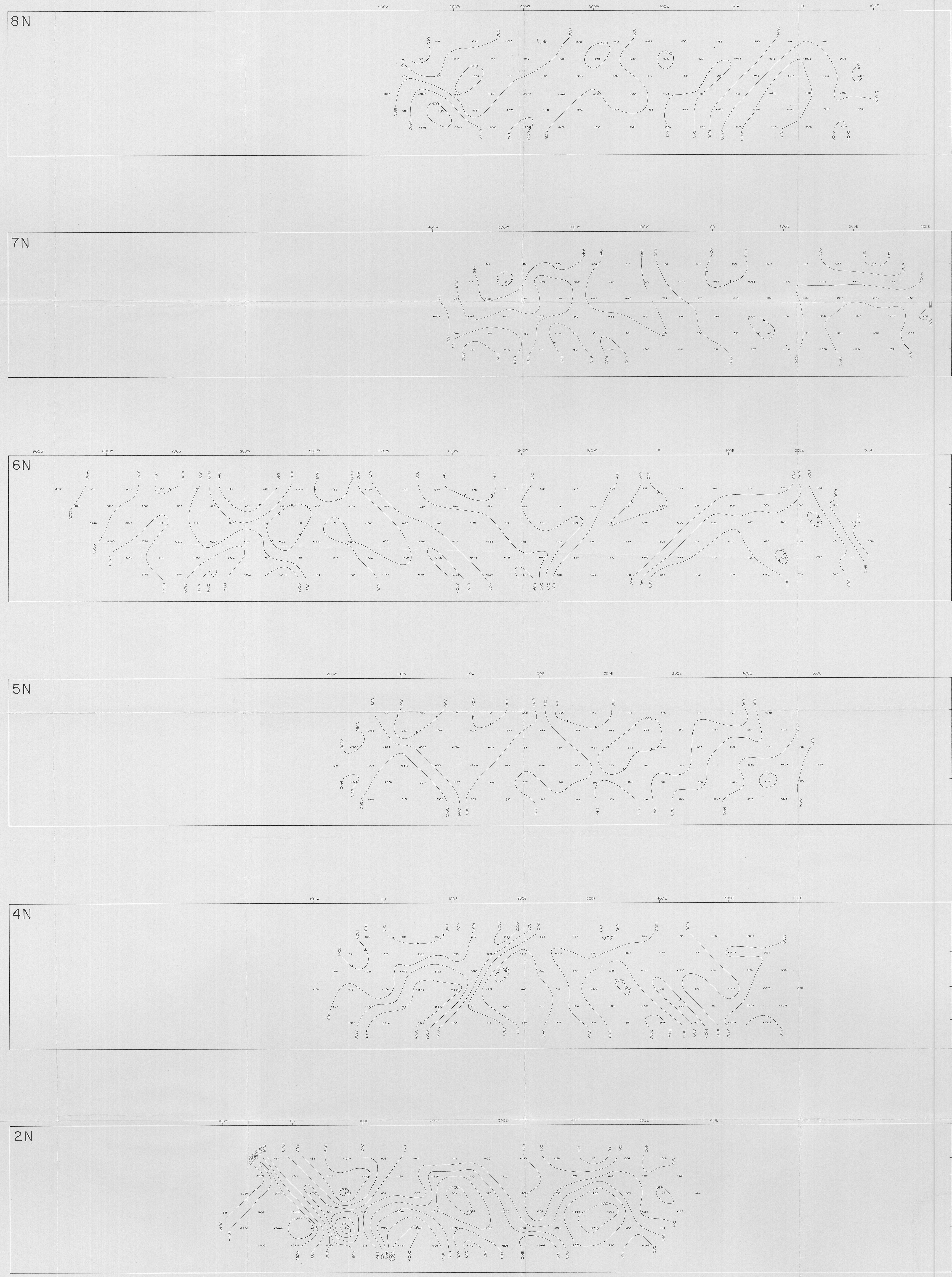
P.K.

H.D.

FIG 13

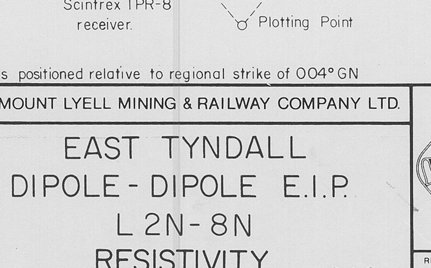
A0-160-2

016



303136

5 cm



Profiles positioned relative to regional strike of 004° GN

Surveyed by Scintrex Pty Ltd
Survey dates May 1981

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL
DIPOLE - DIPOLE E.I.P.
L 2N - 8N
RESISTIVITY PSEUDO SECTIONS

016

Units - ohm metres. Contours logarithmic

84-2257 vol 2

SCALE 1:2000	DRAWN BY P.K.
DATE 25.8.1981	DRAFTSMAN P.J.R.

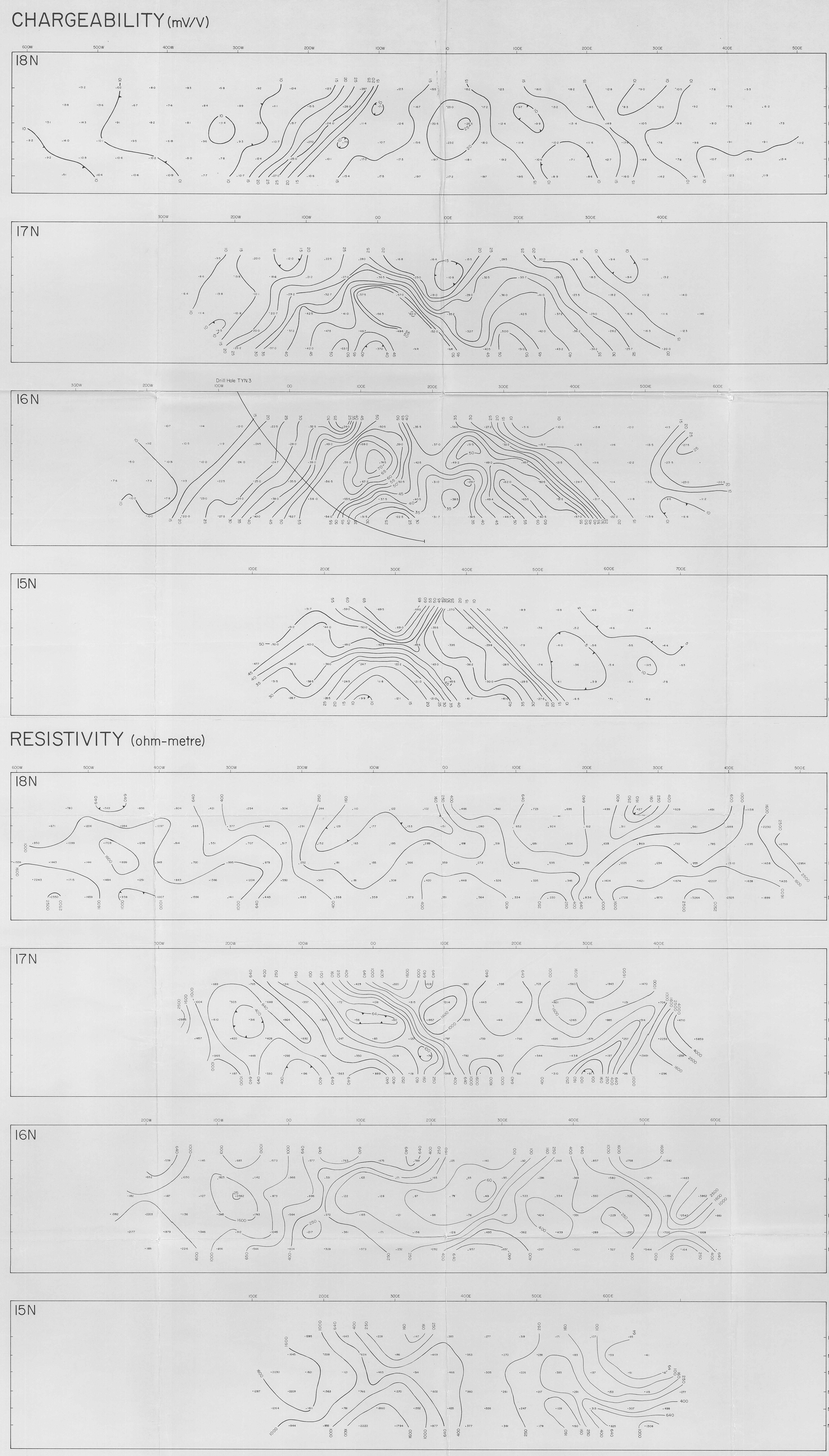
REVISIONS:

FIG. 14

A0-160-1

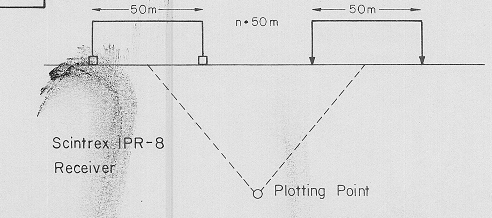
REF: ML/MG81/13

017



303137

5 cm



Profiles positioned relative to regional strike of 359° GN

Survey by Scintrex Pty Ltd
Survey dates May 1981

THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.

EAST TYNDALL
DIPOLE - DIPOLE E.I.P.
L15N-18N
CHARGEABILITY & RESISTIVITY
PSEUDO SECTIONS

017

84-2257 vol 2

Chargeability C.I.=5mv Resistivity C.I.=Logarithmic

SCALE 1:2000 DRAWN BY P.K.
DATE 25·8·1981 DRAFTSMAN H.D.J.

REVISIONS

FIG. 15

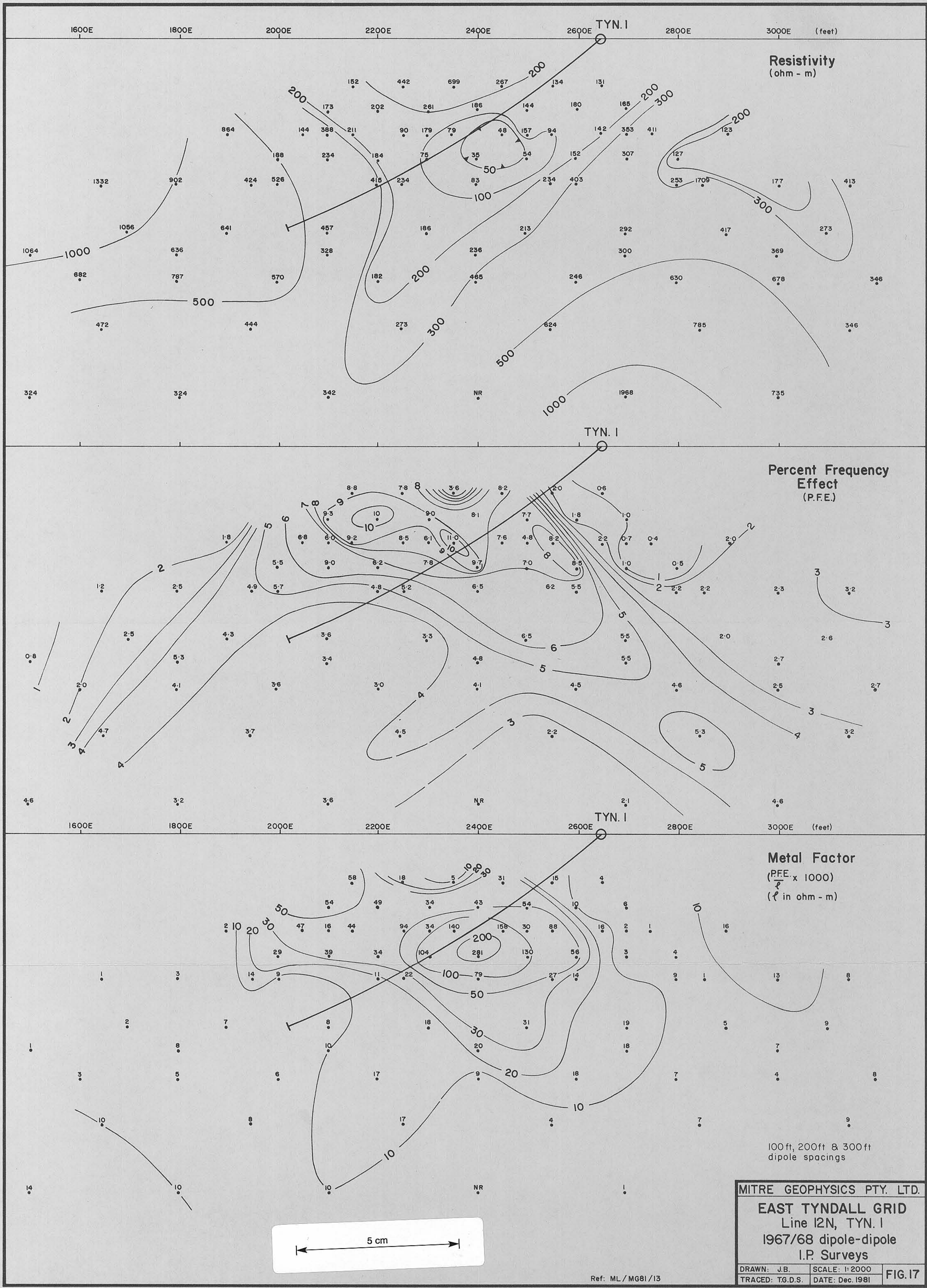
A0-160-

REF. ML/MG81/13

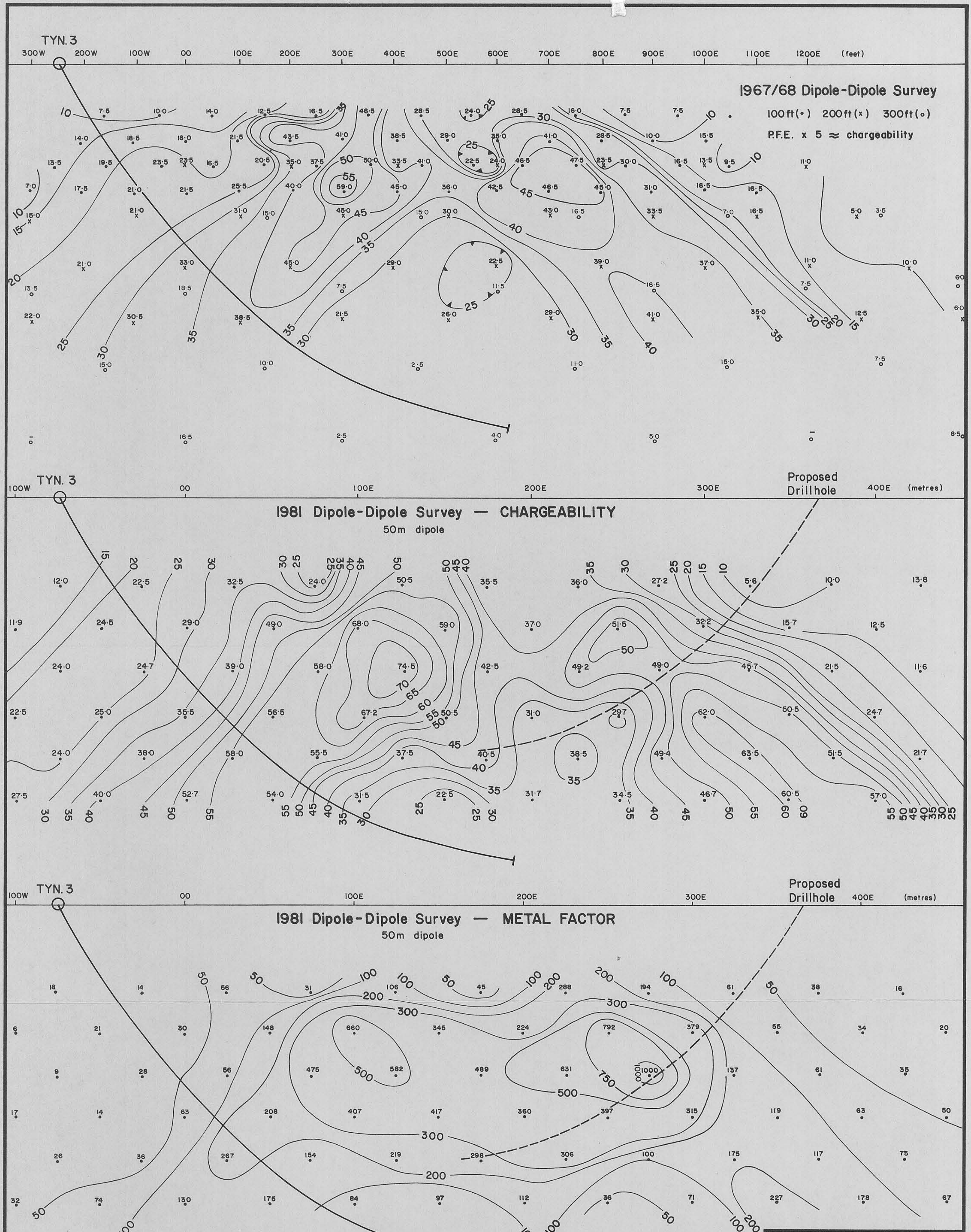

018
30N
29.6N
29.2N
28N
27.6N
27.3N
27N
26.8N
26.6N
26.4N
26N
25N
24.5N
24N
23.7N
23.4N
23N
22.5N
22N
21N
20.6N
20.2N
20N
19.7N
19.4N
19N
18N
17N
16N
15N
14N
12N
10N
9N
8N
7N
6N
5N
4N
2N
RIVER
5354000mN
380000mE
HOWARD'S ANOMALY
GROUND MAGNETICS DATA
Contractor : Scintrex
Date : Feb' 1981
Instruments: Geometrics G 816, Scrintrex MP-2
Base station : 500m N of Queenstown town boundary 5341847mN 380572mE
Contour Interval: 62000, 62500, 63000, 64000. γ
SEALED ROAD BRIDGE
VEHICULAR TRACK
LOGGING TRACK BULLDOZER SCAR
WALKING TRACK
RAILWAY TRAMWAY ABANDONED
PROMINENT PEAK
TRIG STATION
BENCH MARK
SPOT ELEVATIONS
RIVER CREEK
LAKE
SWAMP
POWER LINE & PYLONS
BUILDING
FLYING FOX
PIT
COSTEAN TRENCH
ADIT
SHAFT (Depth metre)
OPEN CUT
ALLUVIAL WORKINGS
DUMP
303138
5 cm
100 0 100 200 300 400 500
Metres
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.
EAST TYNDALL
HOWARD'S ANOMALY
GROUND MAGNETICS
018
84-2257 vol 2
SCALE 1:5000
DATE NOV' 1981
DRAWN BY
DRAFTSMAN H.D.J.
THE MT LYELL M & R CO LTD
REVISIONS
E.L.9/66
FIG. 16
AO-171-4

303139

023



5 cm



303140

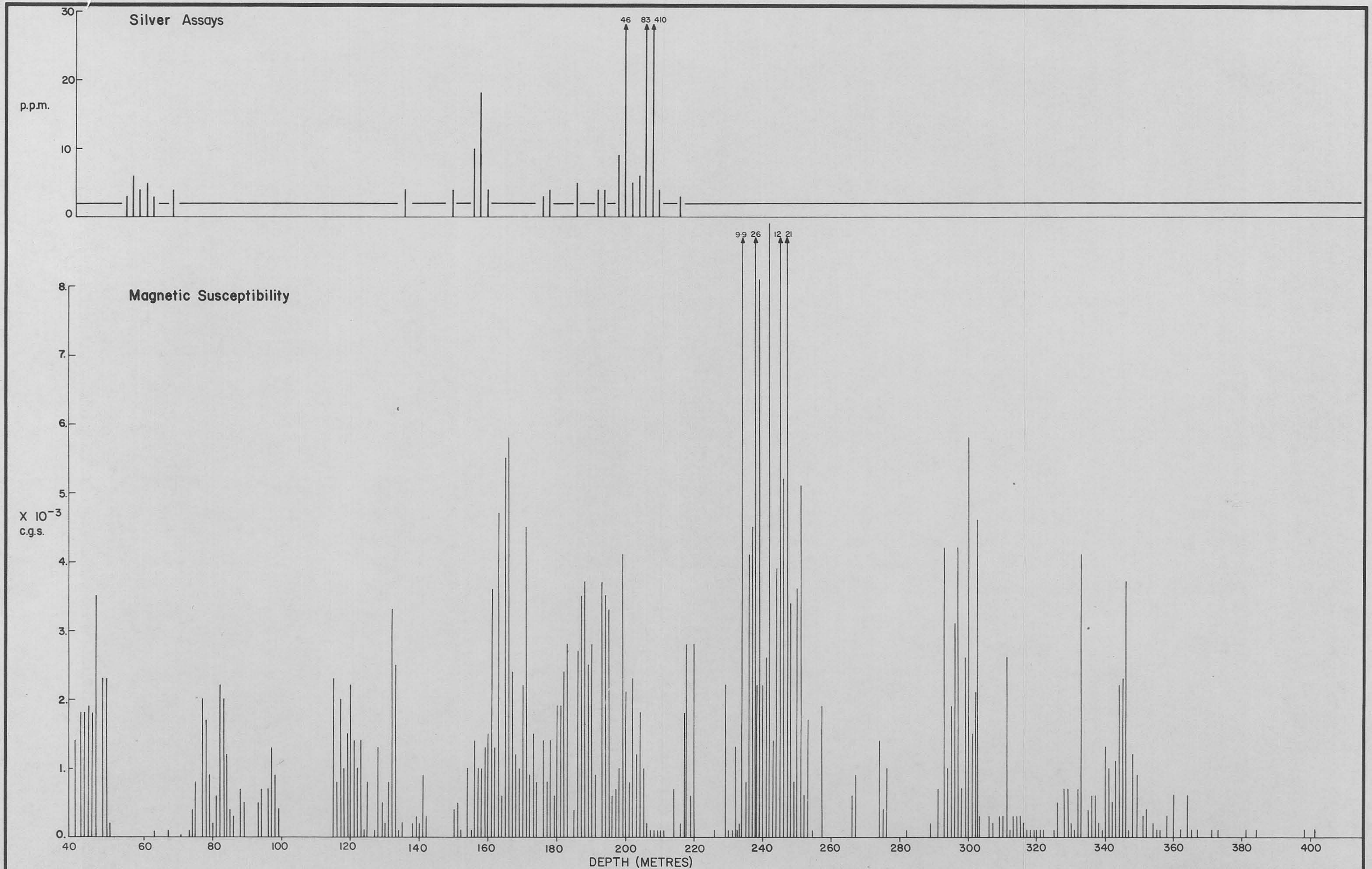
Ref: ML/MG81/13

MITRE GEOPHYSICS PTY. LTD.

EAST TYNDALL GRID
Line 16N, TYN. 3
1967/68 & 1981 dipole-dipole
I.P. Surveys

DRAWN: J.B.	SCALE: 1:2000	FIG. 18
TRACED: T.G.D.S.	DATE: Jan. 1982	

025

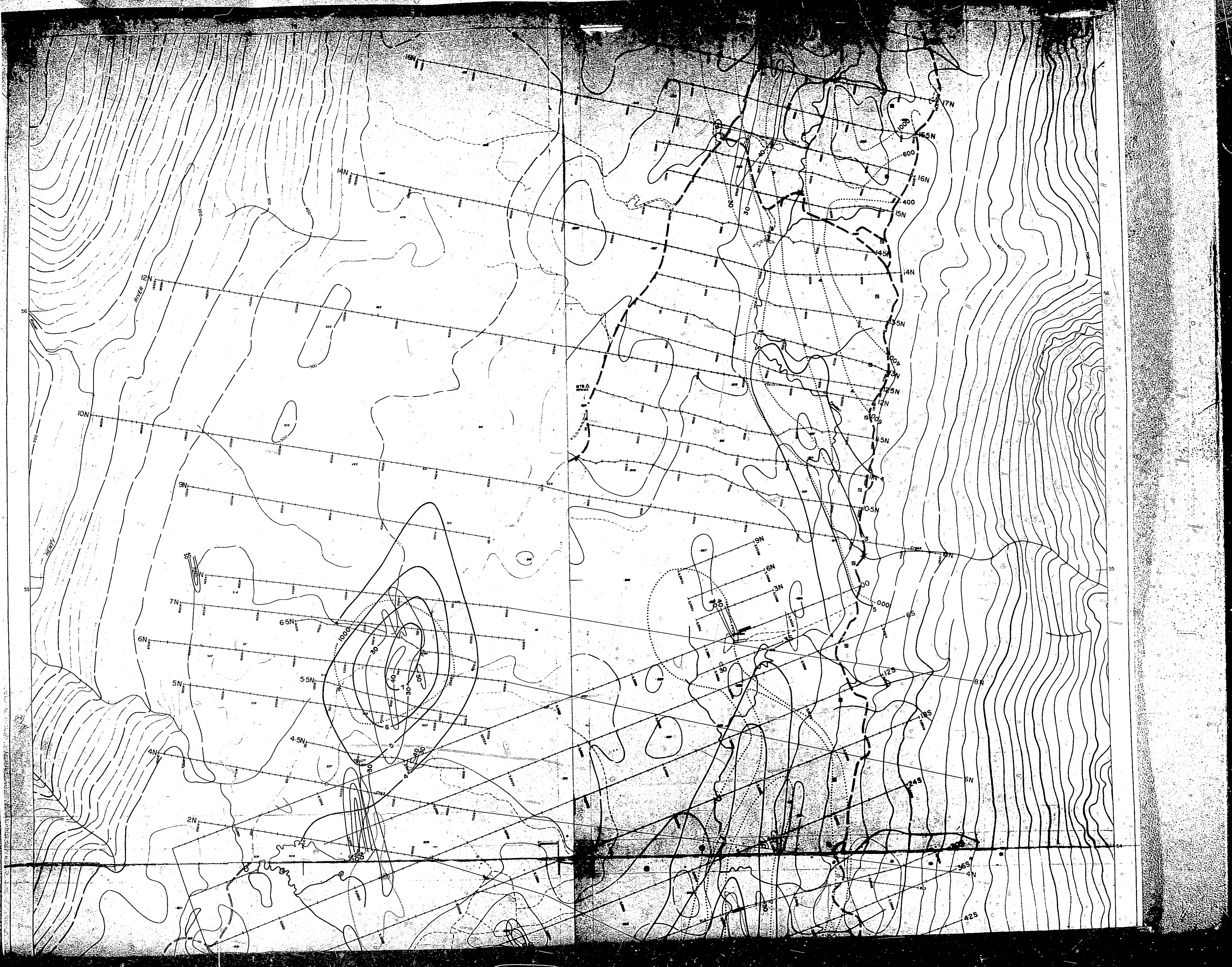


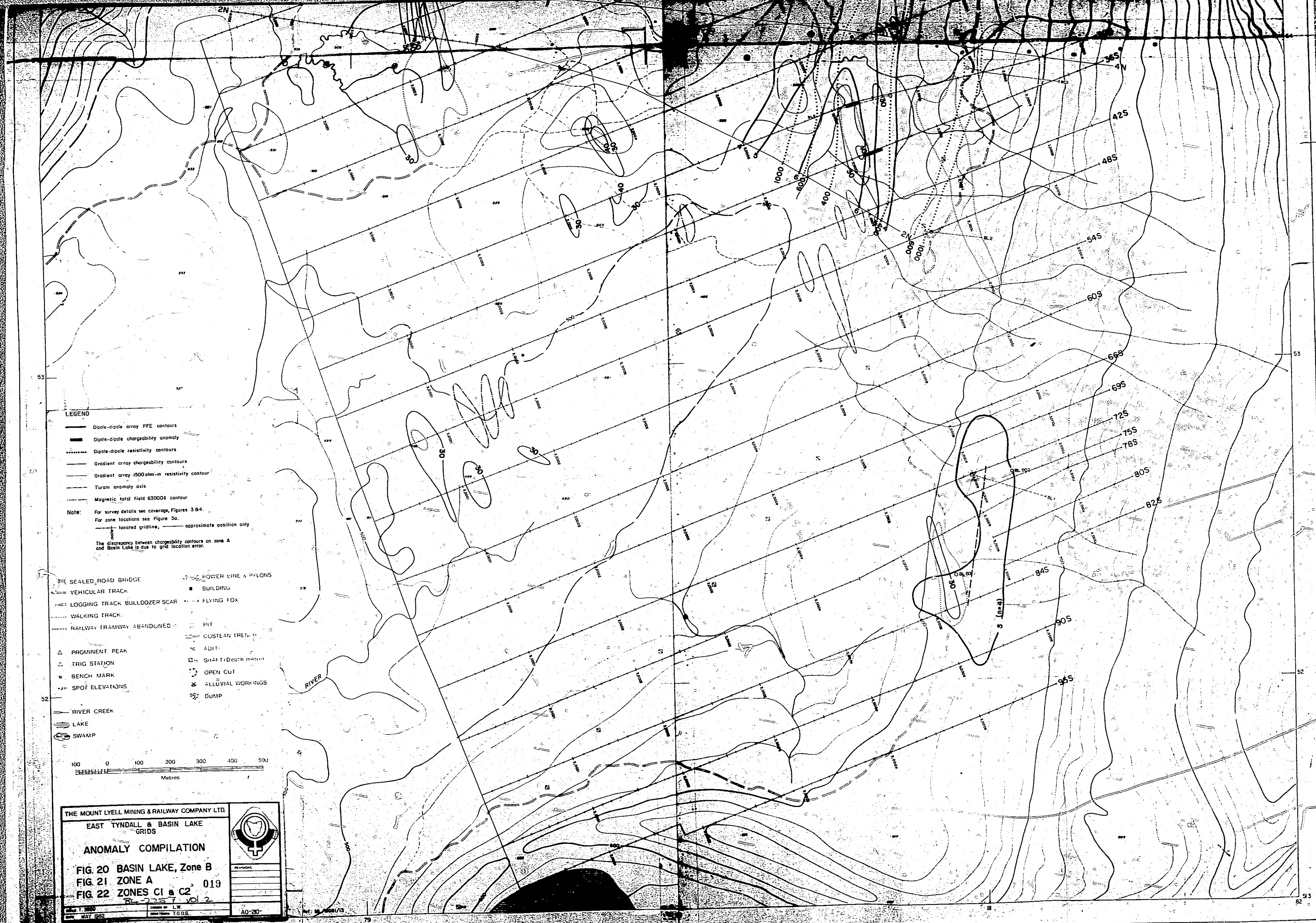
5 cm

303141

Ref: ML/MG81/13

MITRE GEOPHYSICS PTY. LTD.	
Magnetic Susceptibility and Silver Values	
DDH HA4	
DRAWN: J.B. / TRACED: T.G.D.S.	SCALE: 1:1000 / DATE: Jan. 1982
FIG. 19	


16N
14N
12N
10N
9N
8N
7N
6.5N
6N
5.5N
5N
4.5N
4N
2N
RIVER
HENRY
17N
16.5N
16N
15N
14.5N
14N
13.5N
13N
12.5N
12N
11.5N
11N
10.5N
10N
9N
6N
3N
Creek
6S
12S
18S
24S
36S
42S
8N
6N
4N
1000
600
400
30
40



LEGEND
Dipole-dipole array PFE contours
Dipole-dipole chargeability anomaly
Dipole-dipole resistivity contours
Gradient array chargeability contours
Gradient array 1500 ohm-m resistivity contour
Turam anomaly axis
Magnetic total field 63000δ contour
Note: For survey details see coverage, Figures 3 & 4.
For zone locations see Figure 5a.
located gridline, approximate position only
The discrepancy between chargeability contours on zone A and Basin Lake is due to grid location error.
SEALED ROAD BRIDGE
VEHICULAR TRACK
LOGGING TRACK BULLDOZER SCAR
WALKING TRACK
RAILWAY TRAMWAY ABANDONED
PROMINENT PEAK
TRIG STATION
BENCH MARK
SPOT ELEVATIONS
RIVER CREEK
LAKE
SWAMP
POWER LINE & PYLONS
BUILDING
FLYING FOX
PIT
COSTEAN TRENCH
ADIT
OPEN CUT
ALLUVIAL WORKINGS
DUMP
100 0 100 200 300 400 500
Metres
RIVER
2N
4N
36S
42S
48S
54S
60S
66S
69S
72S
75S
78S
80S
82S
84S
90S
96S
53
52
79
81
82
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.
EAST TYNDALL & BASIN LAKE GRIDS
ANOMALY COMPILATION
FIG. 20 BASIN LAKE, Zone B
FIG. 21 ZONE A
FIG. 22 ZONES C1 & C2
019
84-2257 vol 2
DRAWN BY L.W.
T.G.D.S.
MAY 1982
REVISIONS
A0-210-


84-2257
020
LAKE JULIA
Mount Julia
40N
38N
36N
34N
32N
30N
29.6N
28N
27.6N
27.3N
27N
26.8N
26.6N
26.4N
26N
25N
24.5N
24N
23.7N
23.4N
23N
22.5N
22.2N
22N
21.9N
21.6N
21.3N
21N
20.6N
20.2N
20N
19.7N
19.4N
19N
18N
LEGEND
Dipole-dipole array PFE contours
Dipole-dipole resistivity contours
Gradient array chargeability contours
Gradient array 1000 ohm-m resistivity contour
Turam -4° phase difference contour (exact position uncertain)
Magnetic total field 63000γ contour
Note: For survey details see coverage, Figures 3 & 4.
For zone locations see Figure 5a.
located gridline, approximate position only
1500W
SEALED ROAD BRIDGE
VEHICULAR TRACK
LOGGING TRACK, BULLDOZER SCAR
WALKING TRACK
RAILWAY TRAMWAY ABANDONED
PROMINENT PEAK
TRIG STATION
BENCH MARK
SPOT ELEVATIONS
RIVER CREEK
LAKE
SWAMP
POWER LINE & PYLONS
BUILDING
FLYING FOX
PIT
COSTEAN TRENCH
ADIT
SHAFT (Depth metre)
OPEN CUT
ALLUVIAL WORKINGS
DUMP
5 cm
100 0 100 200 300 400 500
Metres
303143
THE MOUNT LYELL MINING & RAILWAY COMPANY LTD.
EAST TYNDALL & BASIN LAKE GRIDS
020
ANOMALY COMPILATION
FIG. 23 ZONE C2 & Howard's Anomaly.
FIG. 24 ZONES C4, D & E.
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REVISIONS
SCALE 1:5000
DATE MAY 1982
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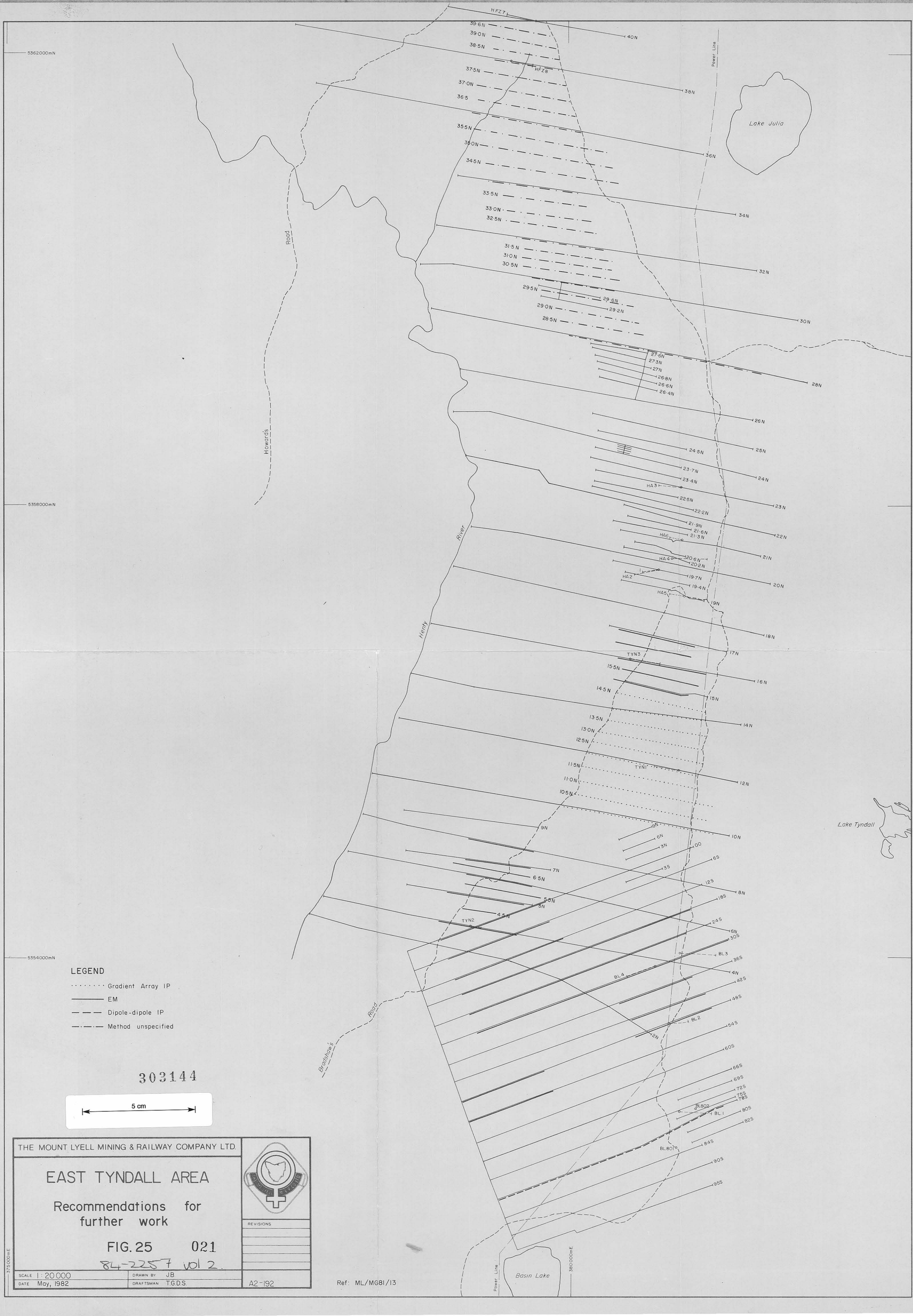
DRAFTSMAN T.G.D.S.
AO-209-2
5357000mN
378000mN



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EAST TYNDALL AREA

Recommendations for further work

FIG. 25 021

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