MITRE GEOPHYSICS PTY LTD
MINERAL EXPLORATION AND ENGINEERING CONSULTANTS
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# COMMENTS ON DOWN-HOLE ELECTROMAGNETIC SURVEYS WITHIN E.L. 9/66, 1986-1987.

for

Gold Fields Exploration Pty Ltd

by

Dr J.R. Bishop



GF/MG87/01
Jan., 1987

697002

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**SUMMARY**

A number of down-hole electromagnetic (DHEM) surveys were carried out down diamond drill holes within E.L. 9/66 during the 1986/87 field season. The results from some of the holes have been interpreted with more than the usual uncertainty, however none are considered to indicate a prospective conductor.

**INTRODUCTION**

A number of DHEM surveys were carried out within E.L. 9/66 during the 1986/87 field season. These included the routine surveying of all of the recently drilled holes, plus the surveying of one old hole (WSP1) which was reamed out and cased for the purpose and the attempted surveying of another previously drilled hole, BL4. The surveys were carried out by Solo Geophysics using Sirotem.

All of the holes were drilled to locate base metal massive sulphides within the Mt Read Volcanics. This report presents the DHEM data and offers some comments on the results and on the criteria upon which some of the holes were placed. Some petrophysical results are also given.

**(1) DDH TYN4.**

This hole was drilled to test a well-defined, but short time-constant UTEM anomaly overlying Pleistocene moraine. The hole was correctly targeted, but failed to intersect any mineralisation. The lack of IP responses on adjacent lines was a strong negative factor for the area, however the (interpreted) prospective geology and adjacent anomalous base metal geochemistry were overriding positive factors. The lack of any down-hole response suggests that the UTEM anomaly was most likely due to current gathering at the base of the glacials. This phenomena of current channelling from the host rock into a 'conductor', rather than by induction from within the body often occurs when large transmitting loops are placed adjacent to faults, weathered zones, conductive strata, etc. It appears to be more frequent at longer distances from the loop.

The DHEM survey used a single 125m x 125m transmitting loop to the east of the collar (see Figure 1) and reached to 240m in the 250m long hole. Response levels were high, but no discrete conductors were defined (Figure 2). The rather high noise levels can probably be attributed to the adjacent power line. However the large fluctuations at the top of the hole are due to steel casing between 10.5 and 37.5m. The migration of the positive to negative cross-over in the DHEM profile is considered to be consistent with a conductive overburden. The glacials intersected by this hole, were unusual in that they consisted almost entirely of sand and the hole 'made water' at the base of the glacials. Thus a porous, weakly conductive environment is indicated which reinforces the above interpretation. That is, the smaller loop used for the DHEM survey has not 'energised' the source of the original response (see further comments in Conclusions and Recommendations).

**(2) DDH TYN5**

This hole was drilled following a recommendation by Bishop (1982) who had suggested that the dipole-dipole IP surveys on line 16N had defined two separate sources. The IP coverage on this line consisted of 30.5m, 61m and 91.5m (ie, 100ft, 200ft & 300ft) dipole surveys carried out in 1968 and a 50m dipole survey carried out in 1981: the latter survey confirming the results of the earlier ones. The metal factor parameter clearly shows two sources, with the better response on the eastern side (Figure 3). IP surveys were carried out on the adjacent lines 15N, 17N and 18N by Scintrex in 1981 (Bishop, 1982). This data shows two separate sources on lines 17N as well as 16N; both sources plunging to the north. DDH TYN3 on line 16N had tested the western anomaly only and had intersected black shales. The 1985 UTEM survey responded to the black shales, but not to the eastern IP anomaly (Bishop, 1986). Although this indicated that the source was not massive sulphides, it was considered that the possibility of disseminated sulphides beneath the glacial cover should be investigated and DDH TYN5 was drilled to test the anomaly. The hole failed to intersect any mineralisation, or other source for the IP response (ie, black shales). It also failed to intersect the black shales located by DDH TYN3, which were expected at the end of the hole. A DHEM survey was carried out, using early times, which logged to 370m of the 373m hole. The results for channels 7 to 15 are given in Figure 4a (log-linear) and 4b (linear-linear). The strong response near the top of the hole is due to casing stuck between 14.3 and 26.3m. The well-defined, off-hole anomaly at the bottom of the hole is interpreted to be due to the expected black shales. The profile shows slightly more than half of the width of the response, suggesting that the source is adjacent to the hole, not beyond it (?suggesting faulting).

The DHEM log also shows a series of 'depressions' at early times (channels 7 to 10) at 170m, 230m and at 290m. These are not well defined, but are believed to be real, indicating the presence of weak, off-hole conductors. The down-hole depth of the shallowest response agrees with the expected position of a poor UTEM anomaly recorded on line 16N at 325E, assuming a steep dip and is presumably due to a fault or contact. The location of the second response is in agreement with the interpreted source of the eastern IP anomaly. Only a small body is indicated and it seems likely that the IP source is a depth limited body between the hole and the surface. It is also possible that the hole (and the IP survey) are off the southern end of the body. This latter suggestion is perhaps supported by the cross-cutting fault indicated on the geological map (Figure 1) and which was intersected in the upper part of the drill hole. Much of the above is conjecture: computer modelling should confirm that a polarisable source of limited depth or off-line, would give results comparable to the observed data. In retrospect, such modelling should have been done prior to the drilling. Given the limited room left for an economic deposit, there is now little interest in the source of this anomaly.

**(3) GRADIENT ARRAY IP ZONE 10.5N/1100E TO 12N/1000E.**

This anomalous chargeability zone was broadly along strike from the UTEM and IP responses subsequently tested by DDH's TYN4 and TYN5 respectively. It has not been drilled, but has associated anomalous base metal geochemistry. The coincident high resistivities indicate that massive sulphides are not the cause of the IP response, but the presence of a power line (Figure 1) meant that this area was not investigated for a deep seated deposit by the UTEM survey. A number of samples were taken from outcrop in the area to find the source of the IP. The results, which are given in Table 1, indicate that the source has not been determined.

**(4) DDH BL4**

This hole was surveyed to see if a significant conductor existed within the 'pyritic sequence' intersected by the hole. Unfortunately the DHEM survey was only able to log the top 62m of this 289m hole. One loop was used for the survey (see Figure 1) and the results are complex and probably noisy (see Figure 5). The migration down the hole of the negative trough from early to later times, is comparable to the results recorded down DDH TYN4 and a poorly conducting glacial overburden is again suggested as the cause of this behaviour. The sudden positive gradient defined by the last two stations on the log is consistent with the probe at the edge of an intersected conductor; ie, the massive to semi-massive pyrite.

Table 1 lists resistivity, IP and conductivity measurements for core samples of pyrite and the adjacent black shales. The measurements suggest that the pyrite is reasonably chargeable and moderately conductive and that the shales are quite resistive. This is somewhat in contrast to the field IP and TEM surveys both of which responded to the black shales (ie, conductive and chargeable), but which did not record a resistivity response over the pyrite (ie, resistive and (?)moderately chargeable). A down-hole IP survey (Meares et al, 1981) recorded no values between 60m and 120m, presumably because of extreme (too conductive; too chargeable) values associated with the pyrite. These results suggest that although the sulphides are chargeable and (probably) moderately conductive, there may be an insufficient volume to be detected from large-scale surface IP and EM surveys.

**(5) DDH WSP1**

This hole, on the White Spur grid, was drilled in 1979 to test an IP response with associated anomalous geochemistry. No significant mineralisation was intersected, but promising Pb and Zn values were obtained from sections of the core. The hole was reamed and a DHEM survey carried out to test for off-hole mineralisation below the level of investigation of the (disappointing) 1985 UTEM survey (Bishop, 1985). The survey extended down to 280m where the probe stopped (end of hole at 382m). A loop size of approximately 100m x 350m was used (Figure 6), the longer side length being employed to energise any along-strike mineralisation. The results are shown in Figure 7. A weak, single point high was recorded at 100m. A strong, single point low was recorded at 150m. The latter, which is part of a broader, early time low is coincident with the best Pb & Zn values assayed from the core and the results are consistent with a small and very local off-hole occurrence of sulphides. The broader trough (140m to 180m) defined by the early time channels 2, 3 & 4 indicates a very weakly conductive zone below or around the mineralization.

The single peak positive high at 100m is indicative of a very local in-hole conductor. This is not supported by the geological log or by the down-hole IP (which extended to only 140m; Howland-Rose, 1979), although slightly higher than average total sulphide values were assayed here. The 'response' may be due to instrumental noise.

## (6) DDH WSP3

This hole was designed to test the favourable geological horizon north of DDH WSP1. Since this area had previously been surveyed with UTEM without locating any significant responses (Bishop, 1985), a deep hole was planned. WSP3 intersected weakly altered epiclastics in the upper section of the hole, with barren, unmineralised rocks in the lower part. The latter consist of felsic pyroclastics and basaltic intrusives similar to the unprospective hanging wall rocks at the Henty Prospect 1.5kms further east (ie, no mineralisation is predicted between the lower sections of WSP3 and the Henty Prospect). The DHEM survey used a single loop (see Figure 6 for location) and was logged to the end of the hole at 360m (Figure 7). A piece of casing between 24 and 33m produced a large amplitude response at shallow depth. A strong negative response was tantalisingly recorded on the last reading at the bottom of the hole. This could be the beginning of an anomaly due to a conductor beyond the hole, but the gradient suggests a close source and the geology is unfavourable. Therefore, the response is interpreted to be due to an unexplained and unexpected piece of metal at the end of the hole .

## CONCLUSIONS AND RECOMMENDATIONS

A number of DHEM surveys have been carried out to test the ground around the holes for massive sulphides: a search radius of 100-150m is expected for a deposit of economic size in a resistive host. Problems were encountered surveying two of the holes. No attempt was made to clear BL4 prior to survey and only the top 62m were logged. WSP1 was reamed out seven years after drilling and cased with PVC piping. The probe inexplicably jammed at 280m down the 382m hole. Because of the problems with WSP1, the probe was pumped down the last section of WSP3 using the drill's water supply pump with a stuffing box attached. Although not necessary in this case, the operation was successful and demonstrated that horizontal or perhaps even up-dipping holes could be logged using this technique.

Two of the holes discussed above, TYN4 and TYN5, were drilled on geophysical criteria. Neither hole intersected the source of the geophysical anomaly. TYN4 was drilled on a UTEM anomaly. No conductor was intersected by the hole, nor was one located by the DHEM survey. It is therefore likely that the source of the TEM anomaly is a large formational, weak conductor such as a fault or contact. In this case I have suggested the base of the glacials. Such features will respond to TEM surveys using large fixed transmitting loops. While this layout is needed for depth penetration and for reasonable productivity, the experience gained from this and other surveys indicates that anomalies of this type should be checked prior to drilling with a single traverse of moving loop TEM; since the smaller loop used by this technique will generally not induce a response from a weak formational conductor.

DDH TYN5 was drilled to test a proposed second IP source adjacent to (drilled) black shales. No coincident UTEM anomaly was recorded over the IP anomaly, but the site was considered geologically favourable. The lack of a UTEM anomaly was rationalised by postulating a low concentration of sulphides (although there was a well defined resistivity anomaly). The DHEM survey recorded a 'response' at the expected location, but its amplitude was much less than one would expect from a substantial body of sulphides. Thus the geophysical results from this region have not been thoroughly explained by the drilling. I do not believe that the second source is fictitious and merely the misinterpretation of the distorted eastern arm of a single 'pants leg' anomaly, since this would put the source at least 100m to the east of its recorded position on the Anthony Road. Also, a similar pattern occurs on the next line to the north. I suggested above that the IP traverse and drill hole may be off the end of the body. The lesson re-learnt from this experience, is to check for continuity of an anomaly by detailed surveying on either side of the proposed target. Further, computer modelling prior to drilling, would give better constraints on the drill target.

J.R. Bishop
Jan., 1987.

**REFERENCES**

Bishop, J.R., 1982. An evaluation of the geophysical surveys over the East Tyndall and Basin Lake grids, E.L. 9/66. Mitre geophysics report 81/13 for Mt Lyell.

Bishop, J.R., 1985. Interpretation of the White Spur UTEM survey (E.L. 9/66). Mitre Geophysics report 85/06 for Gold Fields.

Bishop, J.R., 1986. Interpretation of fixed-loop, time-domain electromagnetic surveys on the Basin Lake & East Tyndall grids. Mitre Geophysics report 86/04 for Gold Fields.

Howland-Rose, A.W., 1979. A report on additional geophysical surveys over the White Spur grid (E.L. 9/66). Scintrex report TAS-054B for Mt Lyell.

Meares, R.M.D., Hutton, M.J. & Komyshan, P., 1981. E.L. 9/66 annual report 1980-81. Mt Lyell company report.

697011

## Table 1

## PETROPHYSICAL MEASUREMENTS

### (1) Gradient array IP zone 10.5N/1100E to 12N/1000E.

| SAMPLE NO. | LOCATION | MAGNETIC SUSCEPTIBILITY $\times 10^{-6}$ cgs | DRY BULK DENSITY (t/c.m.) | RESISTIVITY (ohm-m) | PHASE (milliradians) | PETROLOGY |
|---|---|---|---|---|---|---|
| 29/1 (T2621) | 50m sth of 1050E/11N | 800 - 1500 | 2.73 - 2.78 | 4,370 | 14. | Tyndall Grp; wkly altered felsic lava; magnetic; trace py. |
| 29/2 (T2622) | 75m sth of 1050E/12N | 600 - 2500 | 2.78 | 3,518 | 14 | Tyndall Grp felsic lava; wk pervasive chlorite; magnetic. |
| 29/3 (T2623) | " | 2900 - 3500 | 2.72 | 6,514 | 10 | Tyndall Grp felsic lava; pervasive chlorite-epidote alteration; magnetic. |

n.b. The IP effect obtained from these samples does not explain the anomaly recorded in the field.

### (2) DDH BL4

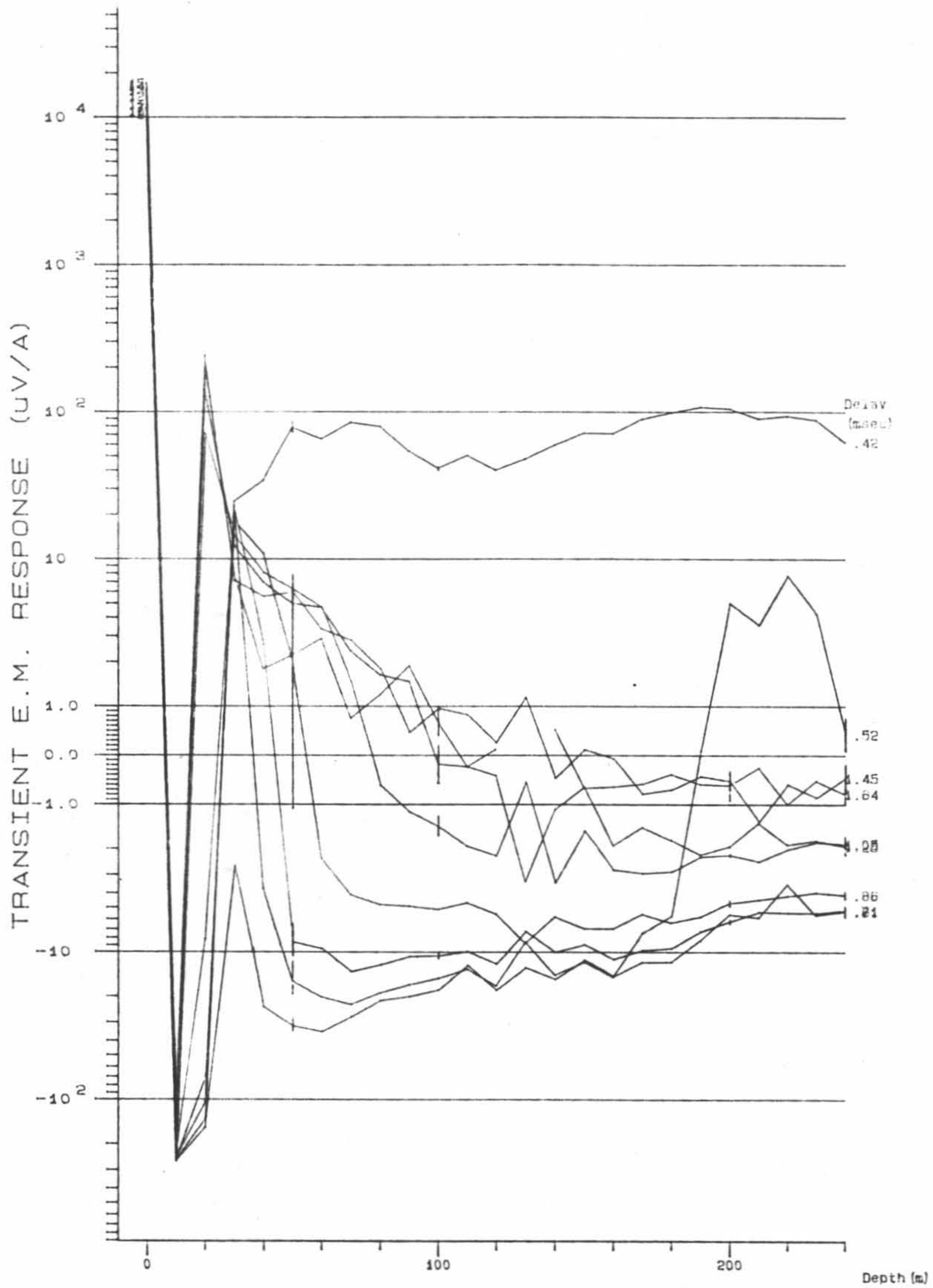
| SAMPLE NO. | DEPTH DOWN HOLE (m) | ----------WATER BATH----------- | | -------SURFACE SCAN-------- | | CONDUCTIVITY (S/m @ 2.5MHz) | PETROLOGY |
|---|---|---|---|---|---|---|---|
| | | RESISTIVITY) (ohm-m) | PHASE (milliradians) | RESISTIVITY (ohm-m) | PHASE (milliradians) | | |
| 30/1 | 65.3 | 94. | 423. | 0.4 | 0.0 | 2.7 | massive py. |
| 30/2 | 69.7 | 127. | 67. | 7. | 115. | 1.7 | " |

n.b. Dry bulk density measurements of 4.2 & 4.1 t/c.m. suggest about 65% pyrite.
Low IP effects with surface scan due to direct contact with sulphides.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32/1 | 118.9 | | | 416. | 48. | ~0 | black shales |
| 32/2 | 142.3 | | | 3.1 (1Hz) | 3. (1Hz) | ~0 | " " |
| 32/3 | 153.4 | | | 28. | 0. | ~0 | |

Resistivity/IP measurements made at 0.1Hz. 1milliradian =~1mv/v.


EAST
TYNDALL
GRID
BASIN
LAKE
GRID
E.L.9/66
E.L.9/66
Tx1
Tx2
Tx3
16N
14N
12N
9N
8N
7N
6N
5N
4N
2N
18N
17N
16.5N
16N
15.5N
15N
14.5N
14N
13.5N
13N
12.5N
12N
11.5N
11N
10.5N
10N
9N
8N
6N
3N
00
3S
6S
12S
18S
24S
30S
36S
42S
48S
54S
60S
66S
69S
72S
75S
78S
80S
82S
84S
90S
95S
RIVER
Road
Anthony
H.E.C.
X LOCATION PETROPHYSICAL SAMPLE. Ref. Bishop GF/MG87/01
SHEET REFERENCE
HALL 1:5000
BASIN LAKE AREA
TYNDALL 1:5000
LANGDON 1:5000
GEIKIE 1:5000
GOLD FIELDS EXPLORATION PTY. LIMITED
E.L.9/66 - TYNDALL PROJECT
BASIN LAKE AREA
DOWN HOLE EM LOOP LOCATIONS
DRAWN BY :
DRAFTSMAN :
DATE :
REVISIONS :
FILE NO.
SCALE 1:5000
METRES
FIG. 1
5351 300mN
378000mE




GOLDFIELDS EXPLORATION PTY.LTD.
TASMANIA
WEST COAST LOGGING (JOB NO. 639A ) E/T
HOLE TYNDAL #4 EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co. 11/ 9/86
SOLO hole ref.502 Reading interval 10.0 m
SCALE 1 : 2000 Loop size : 100 m
LOOP configuration : Drill hole
Plotted : 10:51 AM 12/ 1/87

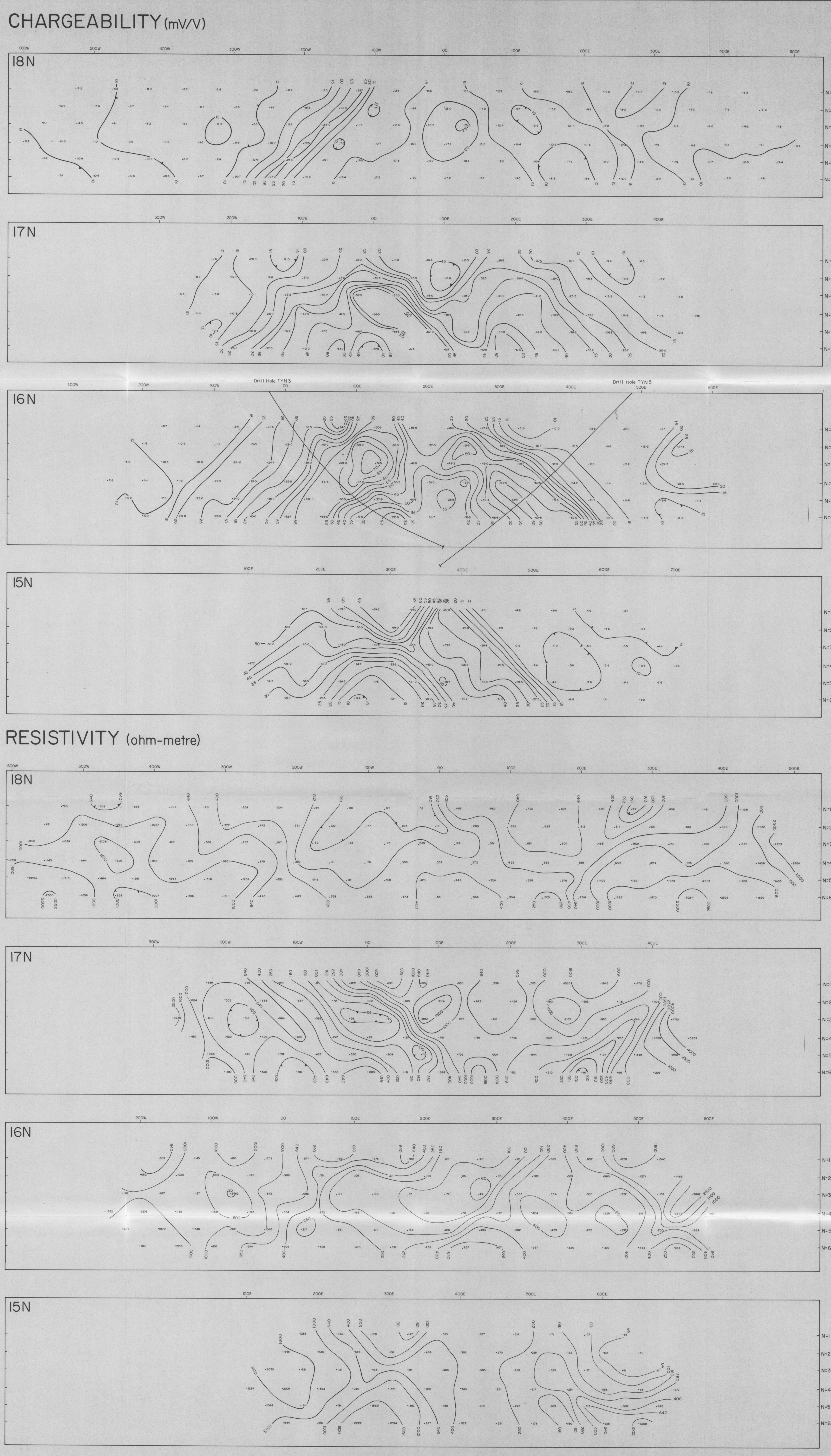
SOLO

697013

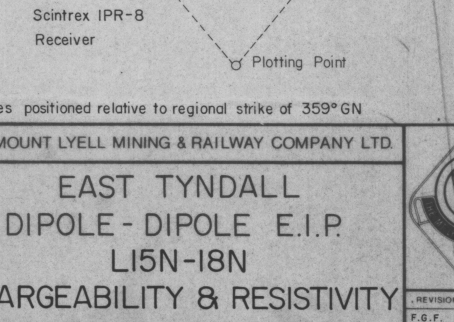
5 cm

| GOLD FIELDS EXPLORATION PTY. LIMITED | |
|---|---|
| EL9/66 TYNDALL | DRAWN BY : SOLO |
| TYN 4 | DRAFTSMAN: |
| DHEM PLOT | DATE Jan'87 |
| | REVISIONS : |
| Ref: GF/MG87/01 | FILE NO. |
| SCALE 1:2000 Metres | FIG. 2 |

A 12548






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

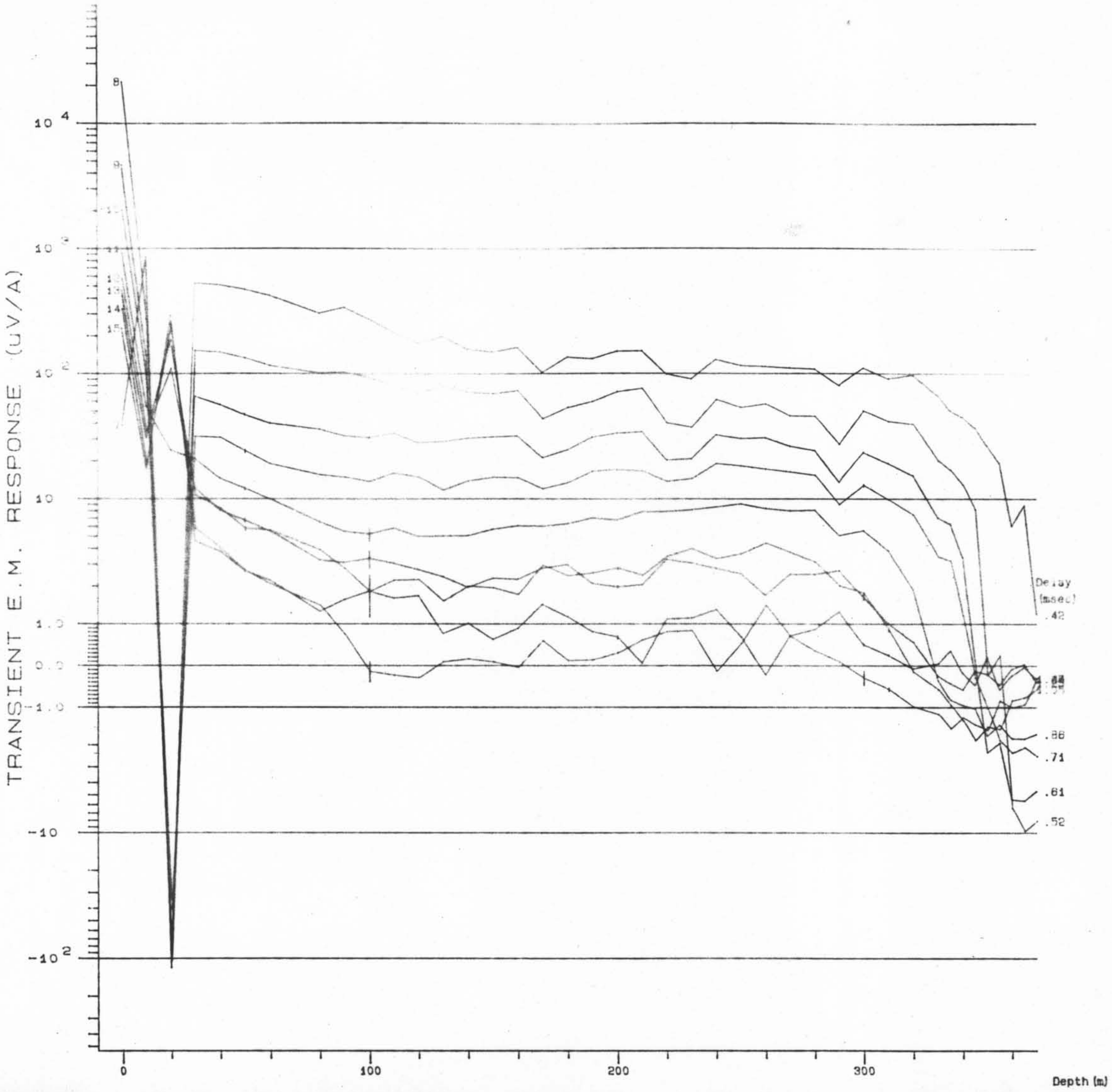
Chargeability C.I.=5mv Resistivity C.I.= Logarithmic

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

REVISIONS
F.G.F. MAY '87

FIG.3
A0-160-

Refs: GF/MG87/01,
ML/MG81/13




697015

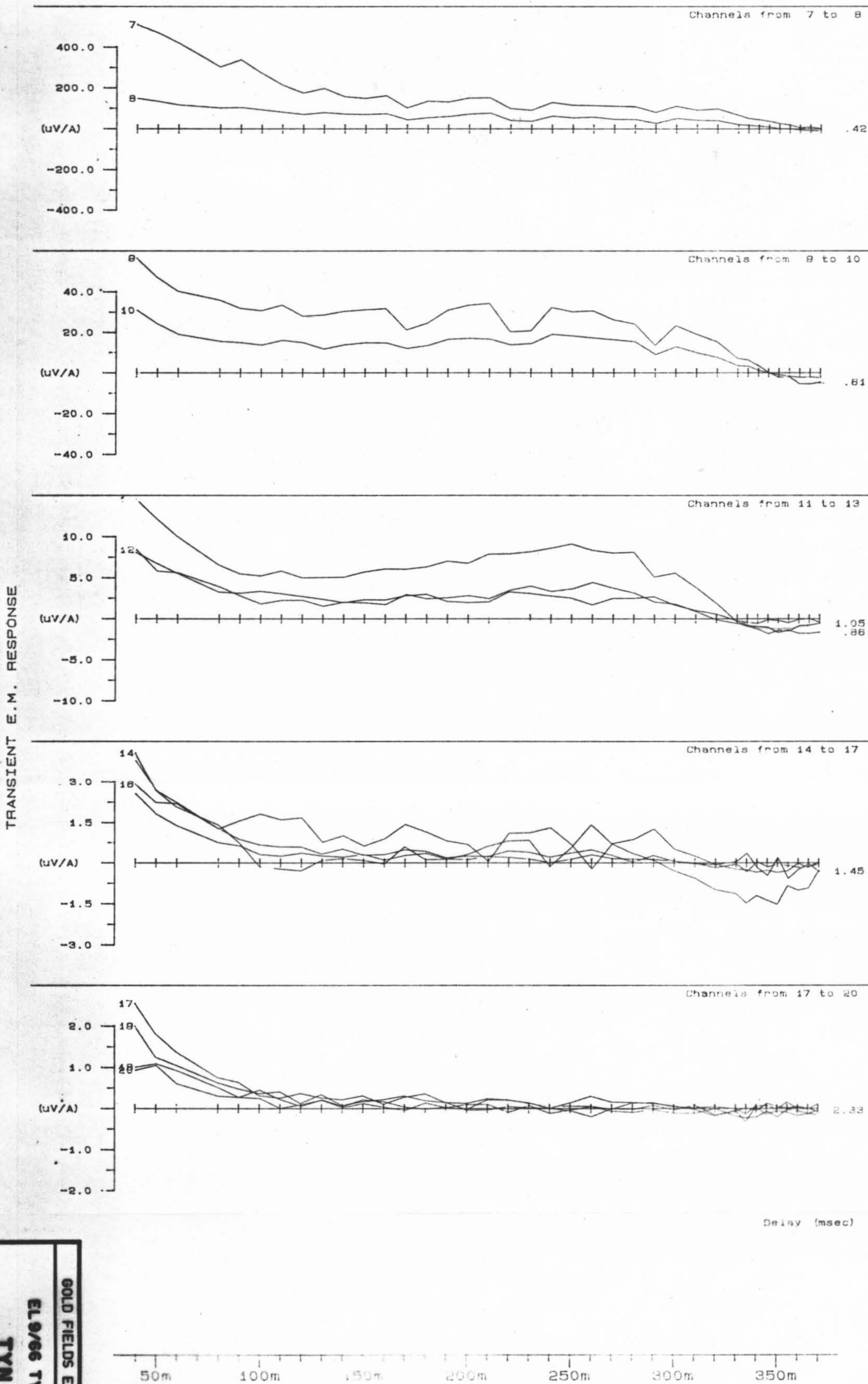
5 cm

GOLDFIELDS EXPLORATION PTY.LTD.
TASMANIA
WEST COAST LOGGING (JOB NO. 639A ) E/T
HOLE TYN #5 EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co. 11/ 9/86
SOLO hole ref.504 Reading interval 5.0 m
SCALE 1 : 2000 Loop size : 100 m
LOOP configuration : Drill hole
Plotted : 10:56 AM 12/ 1/87

SOLO

| GOLD FIELDS EXPLORATION PTY. LIMITED | |
|---|---|
| EL9/66 TYNDALL | DRAWN BY : SOLO |
| TYN 5 | DRAFTSMAN: |
| DHEM PLOT | DATE Jan.'87 |
| | REVISIONS : |
| Ref: GF/MG87/01 | FILE NO. |
| SCALE 1: 2000 Metres | FIG. 4a |

A 12548




GOLDFIELDS EXPLORATION PTY.LTD.
TASMANIA
WEST COAST LOGGING (JOB NO. 639A ) E/T
HOLE TYN #5 EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co.
SOLO hole ref.504 Reading interval 5 m
SCALE 1 : 2000 Loop size 100 m
LOOP configuration : Drill hole
Plotted : 2:52 PM 16/ 1/87

5 cm

SOLO

GOLD FIELDS EXPLORATION PTY. LIMITED

EL 9/66 TYNDALL

TYN 5

DMEM PLOT

Ref. GF/MG87/01

SCALE 1: 2000 Metres

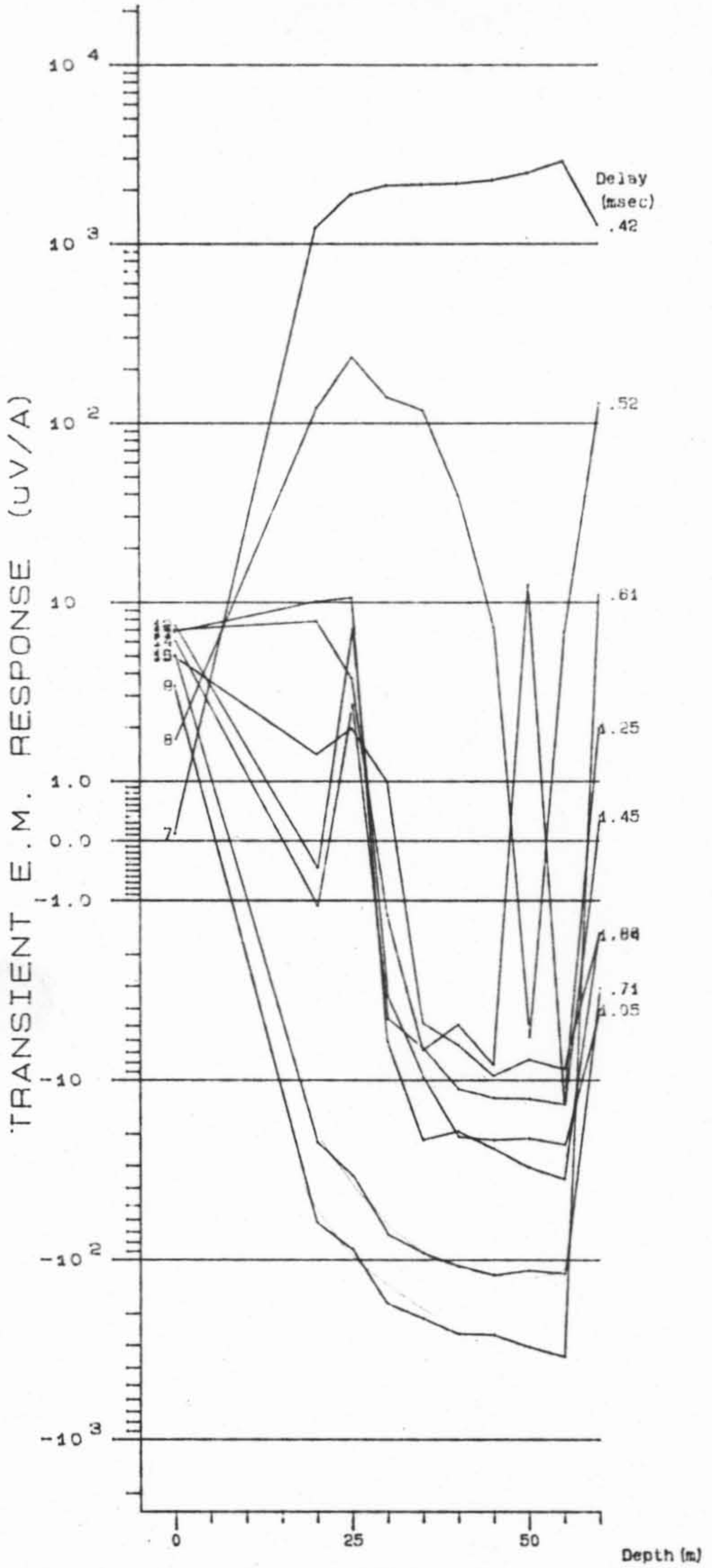
DRAWN BY : SOLO
DRAFTSMAN:
DATE Jan '87
REVISIONS :

FILE NO.

FIG. 4b

697016

A 12548

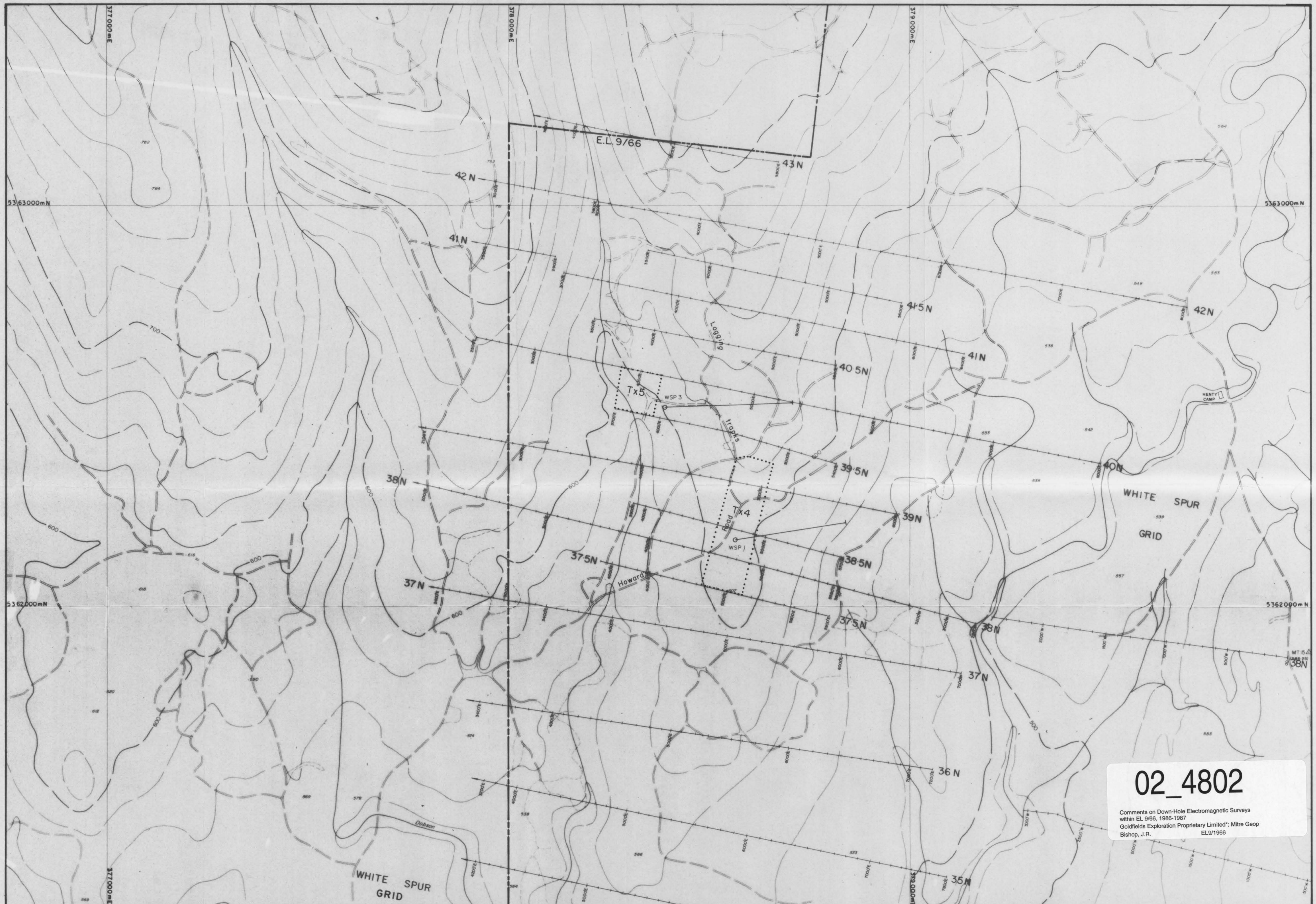



GOLDFIELDS EXPLORATION PTY.LTD.
TASMANIA
WEST COAST LOGGING (JOB NO. 639A ) E/T
HOLE BL #4 EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co. 12/ 9/86
SOLO hole ref.505 Reading interval 5.0 m
SCALE 1 : 1000 Loop size : 100 m
LOOP configuration : Drill hole
Plotted : 11:03 AM 12/ 1/87

SOLO

5 cm

| GOLD FIELDS EXPLORATION PTY. LIMITED | |
|---|---|
| EL9/66 TYNDALL | DRAWN BY : SOLO |
| BL4 | DRAFTSMAN: |
| DHEM PLOT | DATE Jan '87 |
| | REVISIONS : |
| Ref : GF/MG87/01 | FILE NO. |
| SCALE 1:1000 Metres | FIG. 5 |






NOTE: Some discrepancies between A.M.G. location of drill holes and topographic/cut grids data.

GOLD FIELDS EXPLORATION PTY. LIMITED

E.L. 9/66 – TYNDALL PROJECT

WHITE SPUR

**DOWN-HOLE EM LOOP LOCATIONS**

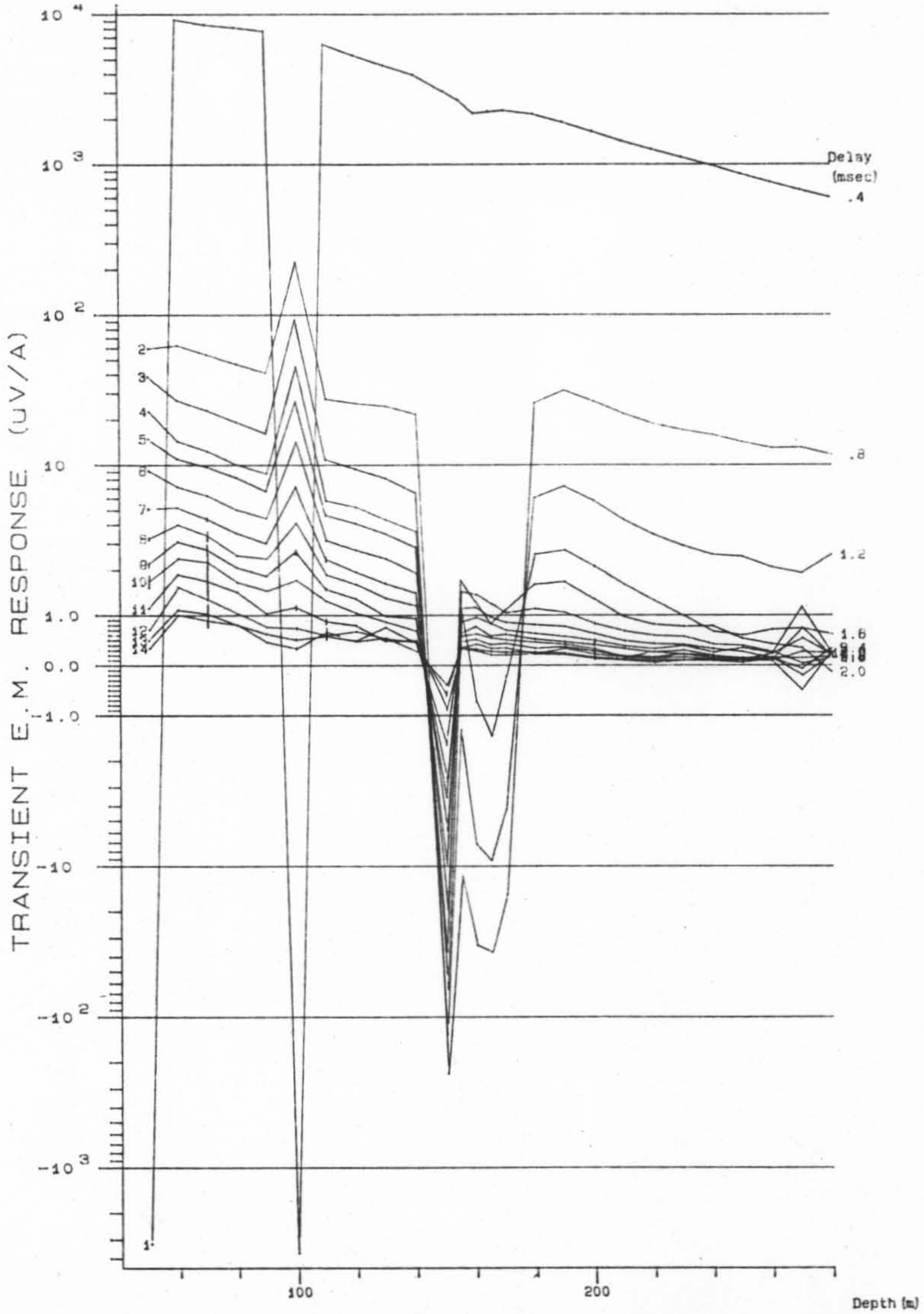
5 cm

| | |
|---|---|
| DRAWN BY | F.G.F. |
| DRAFTSMAN | G.M.B. |
| DATE | May '87 |
| REVISIONS | F.G.F. May '87 |
| FILE NO. | |

SCALE 1: 100 50 0 100 200 METRES

FIG. 6

697018




697019

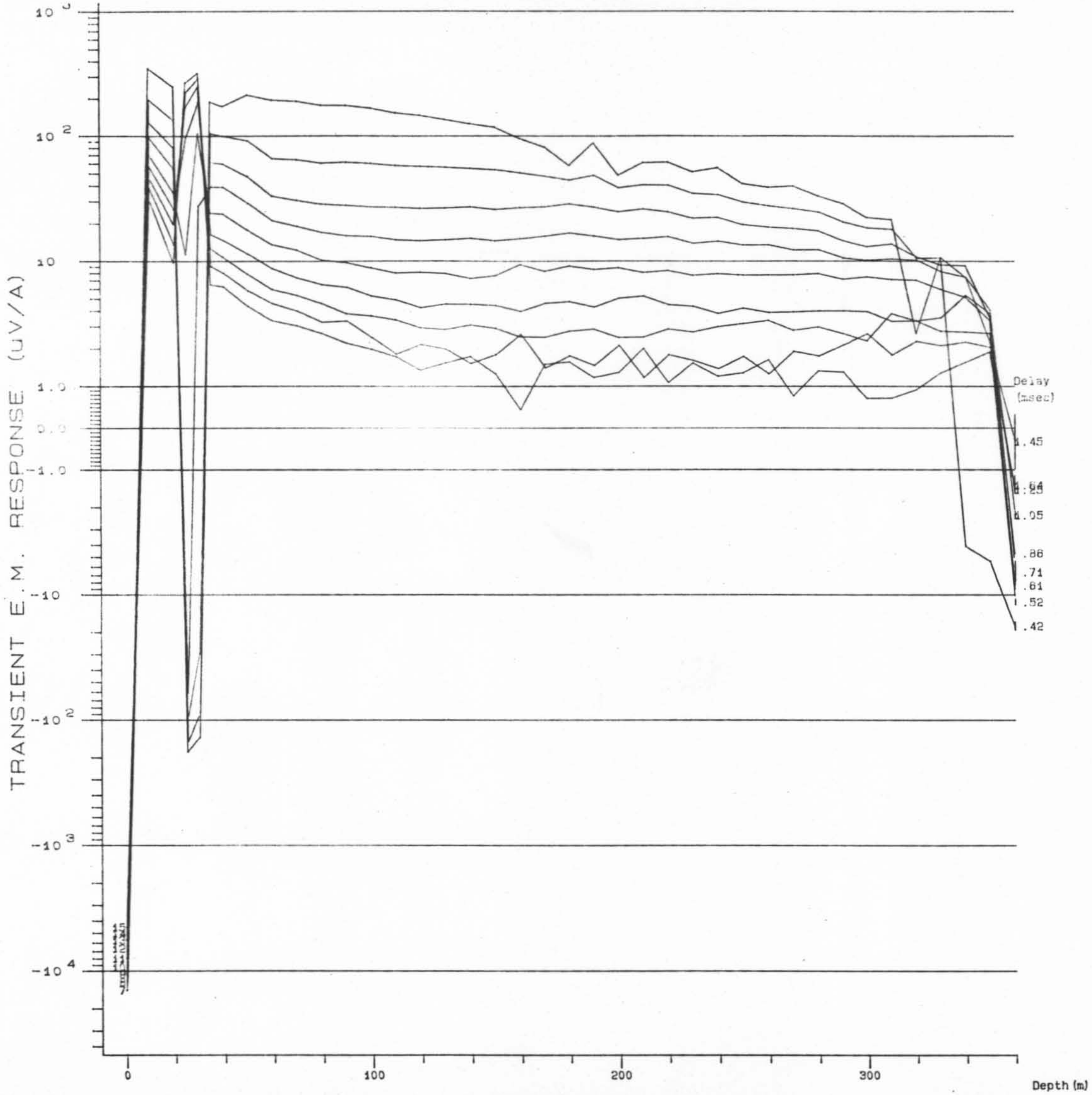
5 cm

GOLDFIELDS EXPLORATION PTY.LTD.
TASMANIA
WEST COAST LOGGING (JOB NO.639B) S/T
HOLE WHITE-SPUR #1 STANDARD TIMES
SIROTEM Survey by SOLO Geophysics & Co. 10/ 9/86
SOLO hole ref.501 Reading interval 5.0 m
SCALE 1 : 2000 LOOP 200X100M
LOOP configuration : Drill hole
Plotted : 11:25 AM 12/ 1/87

SOLO

| GOLD FIELDS EXPLORATION PTY. LIMITED | |
|---|---|
| EL9/66 TYNDALL | DRAWN BY : SOLO |
| WSP I | DRAFTSMAN: |
| DHEM PLOT | DATE Jan '87 |
| | REVISIONS : |
| Ref GF/MG87/01 | FILE NO. |
| SCALE 1: 2000 Metres | FIG. 7 |

A 12546




697020

5 cm

GOLDFIELDS EXPLORATION PTY. LTD.
TASMANIA
WEST COAST LOGGING (JOB NO.651B)
HOLE WHITE-SPUR # 3 EARLY TIMES
SIROTEM Survey by SOLO Geophysics & Co. 21/11/86
SOLO hole ref.201 Reading interval 5.0 m
SCALE 1 : 2000 Loop size : 100 m
LOOP configuration : Drill hole
Plotted : 11:40 AM 12/ 1/87

SOLO

| GOLD FIELDS EXPLORATION PTY. LIMITED | |
|---|---|
| EL9/66 TYNDALL | DRAWN BY : SOLO |
| WSP 3 | DRAFTSMAN: |
| DHEM PLOT | DATE Jan '87 |
| | REVISIONS : |
| Ref GF/MG87/01 | FILE NO. |
| SCALE 1: 2000 Metres | FIG. 8 |

A 12548