

TOTAL Mining Australia Pty. Limited

E.L. 4858 COLLIER
TOLMER PROJECT, NORTHERN TERRITORY

RELINQUISHMENT REPORT TO THE
DEPARTMENT OF MINES AND ENERGY

R/88-22-U

D. HARROP
MAY, 1989

TOTAL Mining Australia Pty. Limited

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1.

I. INTRODUCTION

E.L. 4858 Collier was granted in March 1986. It is located in the Fish River area of the Northern Territory around 150 km southwest of Darwin.

The tenement was explored as part of a joint venture agreement between TOTAL Mining Australia Pty. Limited (TMA) and PNC Exploration (Australia) Pty. Ltd. (PNC). This joint venture incorporated the exploration of eight Exploration Licences which, combined, make up the Tolmer Project.

The geological similarities of the Tolmer Project area to those of the Alligator Rivers Uranium Field prompted TMA to mount an exploration programme for uranium, based on the unconformity model defined there.

The tenement was situated in the Daly River region, located 55 km southeast of the Daly River Settlement. The land comprising this tenement was part of the Fish River Pastoral Lease controlled by Tipperary Station. The tenement was bounded by latitudes 14°06' and 14°22' and longitudes 130°51' and 131°05'.

Access to the licence area was restricted to the dry season, May to October. Station tracks from either Tipperary or Claravale Homesteads cross the Daly River, both the crossings being impassable for 5-6 months each year. Much of the area is covered by woodland and scrub and is of generally low relief making vehicular traversing possible most of the time.

The principal drainage is the north-flowing Fish River, a major tributary of the Daly River. This watercourse only flows during the wet season.

II. GEOLOGY

2.1 REGIONAL SETTING AND STRATIGRAPHY

The Joint Venture Licences are located on the western edge of the Pine Creek Geosyncline. The main rock types are sediments ranging in age from Lower Proterozoic to Adelaidean; Carpentarian granites intrude these sediments. The Litchfield Complex of ?Archaean to Lower Proterozoic age occurs to the northwest. The Cambrian Daly River Group obscures much of the Lower Proterozoic-Adelaidean rocks both west and east of the tenement area.

The stratigraphy is as follows (from N.T.G.S., 1983):

ARCHAean-EARLY PROTEROZOIC: Litchfield Complex comprising high grade metamorphics which appear to include sediments, basic to intermediate rocks and anatectic granites.

EARLY PROTEROZOIC: Burrell Creek Formation comprising variable metamorphosed sandstones and siltstones. Includes pebble and conglomeratic facies, graphitic shales/schists and some carbonate rocks (Pfb).

LATE PROTEROZOIC:

- (i) Carpentarian syn-orogenic to post-orogenic granites. Represented by the Mt. Litchfield, Allia Creek and Jamine granites and the Soldiers Creek granite at Collia (Pxgl, Pxga, Pxgi and Pgs).
- (ii) ?Early Adelaidean Tolmer Group. Comprises four formations:
 - + Depot Creek Sandstone: thickly bedded medium to coarse quartz arenite (450 m) (Ptd).
 - + Stray Creek Sandstone: flaggy micaceous, ripple marked quartz arenite (300 m) (Pts).
 - + Hinde Dolomite: dolomite, dolomitic shales and arenites, quartz arenites (+ 314 m) (Pth).
 - + Waterbag Creek Formation: red mudstone with thin arenite layers (non-outcropping) (+ 134 m) (PtW).
- (iii) Late Adelaidean Uniya Tillite (0 - 30 m) (Put).

PALAEOZOIC: Cambrian Daly River Group. Basal conglomerates, Antrim Plateau Volcanics (basalts) and the Tindall Limestone (Ela)

2.2 STRUCTURE

The principal structural feature of the region is the Giants Reef Fault which has caused obvious displacement to the various rock units it traverses. The zone extends some 30 km NE of Rum Jungle where it loses its identity under alluvial cover; southwards it extends well outside the Company's area of interest. The Giants Reef Fault is considered to be the northern extension of the Hall's Creek Mobile Zone. Parallel structures, the largest being the Stapleton and Rock Candy Range Faults and many minor ones traverse both the Burrell Creek Formation and Tolmer Group rocks.

Folding is present both on a small and large scale. The Burrell Creek sediments are tightly folded with fold axes striking generally N-S. The overlying Tolmer Group dips gently eastwards forming the extensive Daly River Basin. Folding occurs in the Tolmer adjacent to the Rock Candy Fault forming an elongated domal structure thought to be underlain by Carpentarian granite. The Cambrian sediments are nearly flat lying.

Regional dips are moderate to steep westerly for the Burrell Creek Formation and gently eastwards for the Tolmer Group. Strikes are N-S to NW-SE.

2.3 GEOLOGY OF E.L. 4858

In conjunction with the radiometric traversing geological observations were made at each station noting the lithology and any other relevant data. The position of the unconformity (or faulted contact) was always noted and plotted on the aerial photographs; some minor variations were found to exist from that plotted on existing geological maps.

This stretch of contact extends from the Daly River south to a point where the radiometric traversing was terminated for the season. The survey was commenced approximately 2 km south of the river, more or less coinciding with the first outcrop of Burrell Creek sediments.

Coverage of the contact extended 21 km terminating about 9 km north of the Fletchers Gully gold mine. With some exceptions, many of the traverses were short: 200-500 m. This was governed by the very limited zone of Burrell Creek outcrop adjacent to the unconformity. A total of 528 traverses were completed for 244 km of ground covered.

+ **Burrell Creek Formation**

Much of the contact zone is characterized by a thin strip of outcrop which extends for approximately 15 km; width of the outcrop ranges from 100 m in the far north to about 500 m. A thick sand cover which occupies a broad flat valley (Chilling Creek) is responsible for obscuring the rocks. Exposure improves where a set of variously oriented faults and granite intrusions has created a large outcropping mass of altered sediments and granitic rocks; uplift and erosional resistance would account for this feature.

Structure of the Burrell Creek is simple with the strike northerly and dips steeply to the west and east as dictated by tight folding. Faulting does not appear to have played a role in disruption of the Lower Proterozoic rocks apart from limiting the outcrop. The strike fault which forms the Lower/Middle Proterozoic contact together with the Giants Reef Fault Zone appear to have produced a graben-like effect with the formation of the N-S trending Chilling Creek valley.

Three principal lithologies are present in E.L. 4858: meta-sandstones, meta-siltstone and schist. Sandstones of various grain size are present throughout and occur interbedded with other rock types. Textures are usually medium grained though coarser gritty variants are present. Rarely, beds of conglomerate are exposed. Meta-siltstones are identical in texture and composition to elsewhere. Mica and andalusite schists become increasingly predominant progressing southwards; this feature would be directly related to the presence of outcropping bodies of granite which are far more widespread than indicated by NTGS mapping. Mica, quartz-mica and andalusite schists are the principal types observed.

A unique sequence of sediments extend for perhaps 2.0 km discontinuously, more or less paralleling the base line. The uniqueness is due to the presence of carbonaceous-graphitic shales interbedded with unusual quartz veins (?silicified dolomites), ferruginous schists and meta-sandstone beds. The black shale strata are repeated several times, presumably due to tight folding though this is not evident on the photographs. Some low order 'hot spots' were encountered, up to 300 c/s SPP2, in a micaceous, strongly altered ferruginous rock occurring as pods (?or veins) in the black shale. Elsewhere outcrops up to 50 m along strike consist of a white, saccharoidal textured material resembling the Allamby silicified dolomites. These outcrops show fairly extensive surficial ferruginization, leach cavities and an unusual bladed structure on freshly broken surfaces. Although initially no widespread anomalous zones were located it is suggested that these rocks be looked at more closely during the next field season.

The effects of the intrusives on the Burrell Creek Formation has been widespread and variable. Very strong metamorphism has created hornfelsing throughout the sediments; argillaceous facies have given rise to coarse textured andalusite schists exhibiting a 'knotty' appearance or containing large spear-shaped crystals. Arenaceous rocks have developed a characteristic 'spotty' texture and strong silicification. In places the hornfelsing is not so apparent with weaker andalusite development in the schists and no visible alteration in the arenites.

5.

It is thought that some of the sediments exhibit granitization; what appeared to be sheets of granite-like material within the sediments could be beds of coarse meta-sandstone which have been altered. Elsewhere, identifiable granites have very diffuse contacts implying partial granite replacement of the invaded sediment.

The alteration effects die out rapidly southward with generally unaltered meta-sandstone and some andalusite schists occurring.

+ Tolmer Group

The Depot Creek Sandstone forms a gradually widening area of outcrop from north to south; much of its surface distribution is fault controlled both with the Burrell Creek Formation and Stray Creek Sandstone. Contacts are basically north-south though variations occur, e.g. where fault-controlled 'embayments' have developed. These features are characterized by granite intrusions.

As mentioned, faulting plays a major role in the distribution of all rock units in the area. A strike fault forms the Lower/Middle Proterozoic contact and a less extensive structure striking obliquely forms, in part, the Depot Creek-Stray Creek Sandstone contact. Several E-W faults cross-cut both sandstone units creating minor lateral offsets up to 0.5 km and unknown vertical displacement.

A series of cross-folds, i.e. perpendicular to strike, are illustrated in the more ductile Stray Creek Sandstone, the axes being sub-parallel to the direction of fault movement.

The structural development of this faulted-folded section is thought to be due to emplacement of the various granitic bodies which outcrop in the Chilling and Muldiva Creek valleys. The Rock Candy Range, north of the Daly River, forms part of this structure trend.

The Depot Creek Sandstone comprises the usual monotonous quartz arenite with thin pebbly bands and some conglomeratic lenses. Strong brecciation with silica replacement occurs along a thin zone adjacent to the contact fault - it is quite extensive. Ground observations of dips along the contact suggest a monoclinial structure with shallow dips at first, -10° - 20° E and increasing up to 80° E within 100 m.

+ Granite

Two granitic phases outcrop, both classified as synorogenic:

- Jammie Granite, a tourmaline muscovite leucogranite,
- Allia Creek Granite, a coarse porphyritic muscovite-biotite granite, granodiorite and tonalite (BMR/NTGS).

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6.

The MaxMin survey was performed only on two INPUT anomalies located on thin Cretaceous sediments overlying the Depot Creek Member of the Tolmer Sandstone. It was ascertained that the method was unable to define a target below a thickness of overlying facies greater than that of the Depot Creek. The latter, with a maximum thickness in excess of 400 m, is already the absolute maximum through which the MaxMin can "see" even when considering the most favourable hypothesis.

The purpose of the ground EM MaxMin survey was to determine the presence and location of conductive belts, possibly corresponding to facies of graphite-chlorite schists within the Burrell Creek Formation below the overlying Depot Creek Sandstone. Our detailed survey of the Burrell Creek Formation outcropping near the Depot creek unconformity has confirmed the presence of such favourable facies, most often accompanied by uranium mineralization or anomalous radioactivity (e.g. Eccles I and II) in the northern licences of the project area.

The MaxMin survey has provided two types of anomaly:

- some responses corresponding to wide, shallow poor quality conductors,
- some responses which could correspond to more deeply seated conductors.

The interpretation of the MaxMin anomalies has been made taking into account the mapped geological facies and/or the structural features recorded during the systematic survey of the gridded area.

VLF was run over as many lines as possible on each grid; its purpose was to define the presence of shallow conductive zones such as overburden, to help in the interpretation of the MaxMin responses, and to outline structures which affect both the Tolmer Sandstone and underlying Burrell Creek Formation. The equipment used is a Geonics EM16 unit, manually operated.

The survey was run using both the Japanese (NDT) and North West Cape (NWC) transmitters to obtain information on both N-S and E-W sets of faults. Unfortunately, the North West Cape Station emitted very irregularly which did not enable us to obtain values on every reading location of the grid and so get systematic information on the E-W oriented faults.

The results of both EM surveys are presented together with their interpretation in the various plates.

III. GEOPHYSICS

3.1 INPUT SURVEY

3.1.1 Timetable

The INPUT survey over Tolmer area, commissioned to Geoterrex in April, 1987 was carried out during the first two weeks of July.

Approximately 840 line-km comprising 88 flight lines were flown over E.L. 4858, followed by infill lines for about 80 km.

3.1.2 Procedure - General Comments

After each flight, the tracking camera films were developed and the analog charts were sorted and annotated. After locating the charts in relation to the navigation photo stripes, anomalies were selected and marked on flight-line overlays at 1:25,000 scale.

The data quality has been excellent throughout the survey; efficient work from the ground crew allowed the revision of the complete survey and the selection of infill areas one day after the end of the last flight.

During the survey, the manager of Tipperary Station was kept informed of the whereabouts and purpose of the aircraft.

3.1.3 Results

The preliminary results were based on the field evaluation of the anomalies. The plots on the 1:100,000 map are approximate only.

Three models were followed during the field interpretation: two indicating horizontal surface conductors (thin sheet and half-space) and one indicating a sub-vertical conductor. Only the "vertical" anomalies were plotted.

On the overlays, the ratio between channel 2 and channel 10 amplitudes and the altitude from the ground were also given.

Spatially close anomalies were grouped in "areas", generally reflecting a particular geological environment. A total of 61 areas was thus defined. A test flight was carried out over a known graphitic conductor in the Rum Jungle area, in order to compare the amplitude and persistency of the anomalies.

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8.

The areas fall broadly into four categories:

- . Conductors in exposed Burrell Creek Formation ("basement").
- . Conductors along faults.
- . Conductors in the Tolmer Group.
- . Conductors in the Cambrian Volcanics and/or Cretaceous.

The anomalies that occur in the Cretaceous sediments are generally located near the edge of a cliff, which could indicate the presence of a thin layer of Antrim Plateau Volcanics in the pediment between Cretaceous and Proterozoic sandstones.

Some anomalies appear to line up or coincide with rivers and billabongs and are therefore probably related to faults.

The anomalies occurring within E.L. 4858 are listed below:

Anomaly No.

41)	Appear to be on-strike with an E-W fault traversing
42)	the Stray Creek Sandstone. The structure is probably
	conductive.
SV-8	Occurs within the Depot Creek. Structural or
	?lithological conductor. Approximately 1.5 km from
	the unconformity.
50	Occurs within shaley beds of the Stray Creek
	Sandstone.
51	Is a conductive fault zone between arenaceous and
	argillaceous facies of the Stray Creek Sandstone.
SV9-52	Group occurs on a major N-S fault within Depot Creek
	Sandstone.
53	Occurs within the mass of the Soldiers Creek Granite.
54	Occurs within ?Cambrian limestone in faulted contact
	with the Soldiers Creek Granite.
55	Occurs on the contact between lateritic Mesozoic
	sediment and Stray Creek Sandstone.

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9.

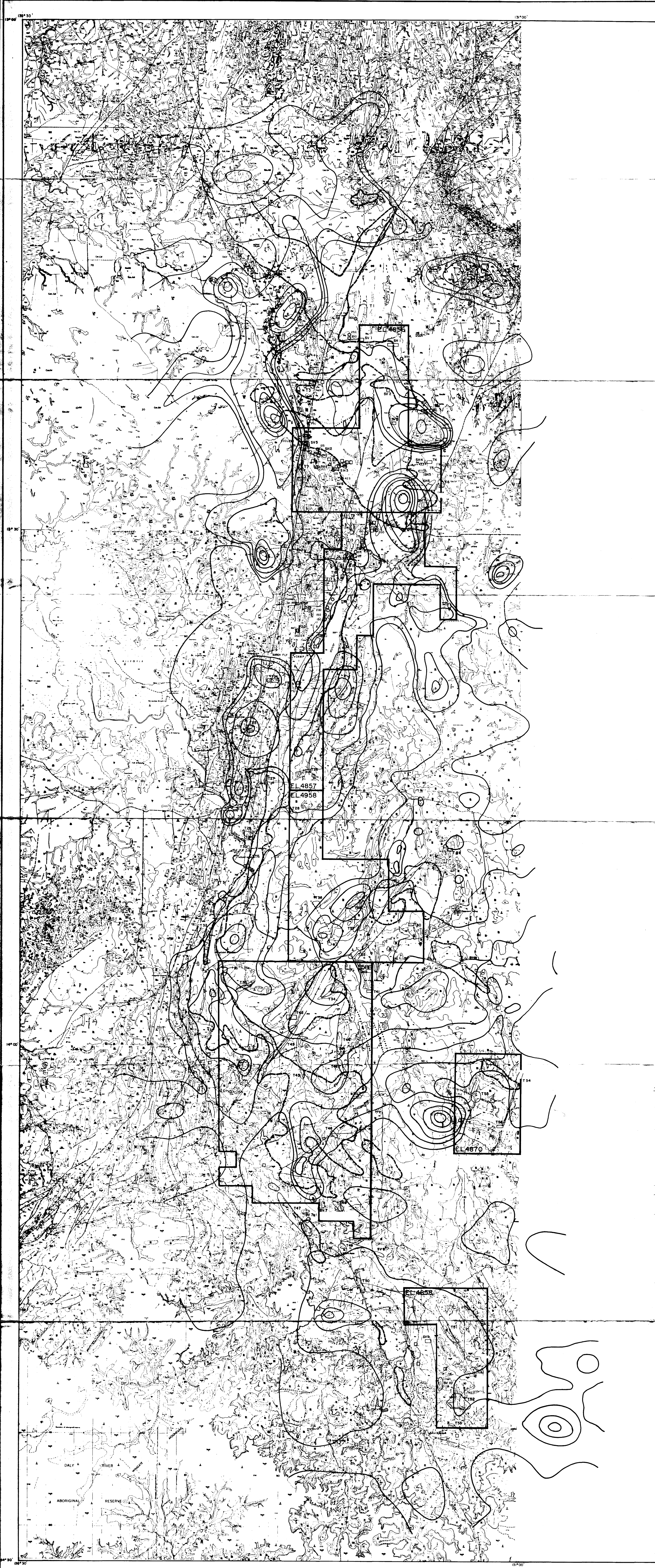
- 56 Is probably due to basalt cappings forming flat-topped hills within the Stray Creek Sandstone.
- 57 As above.
- 58 Occurs in a local outcrop of Burrell Creek sediments - phyllite and quartz mica schist. Adjacent to Soldiers Creek Granite.

CONCLUSIONS

After ground checking the above INPUT-EM anomalies occurring within E.L. 4858 it was concluded that all the anomalies could be explained by obvious geological structures or formation boundaries which are not favourable to the formation of a uranium ore deposit.

This ground investigation included geological checking and scintillometric prospection. It was determined that most of the conductors were related to the contact zone between the Cretaceous sedimentary capping and the Middle Proterozoic sandstone and hence of no exploration interest to T.M.A.

It was decided to relinquish the tenement in May, 1989.



INPUT SURVEY

T2 Both vertical and horizontal conductors

SV9 Vertical conductors

SH4 Horizontal conductors

○²⁰⁰ Mg sample location & value

○ Input Survey Conductor location

— Surveyed Baseline

----- U/Th Anomaly

— Gravity - Bouguer Anomaly

□ Thermoluminescence Sample

□ Anomalous Thermoluminescence Sample

△ Radiometric Anomaly

..... Magnetic Trend

□ Tolmer Sandstone

□ Granite

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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PLATE 1

0 1 2 3 4 5 6 7 8 9 10 11 12 KM

SCALE

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TOLMER PROJECT - N.T.

SYNTHESIS MAP

REV	DESCRIPTION	PREP	DRAWN	CHECKED	DATE
1		D.H.	S.R.	D.H.	MAR 87
2					
3					
4					
5					
6					
7					
8					
9					
10					

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OFFICE SCALE 1:100 000 SHEET 87 DRG NO 547-046

14 7 36S

E.L. 5586

Pts

Pth

Pth

Pth

Pts

Pth

Pts

Pth

Ptd

Pts

Pts

Ptd

Pts

Pts

Pts

Pts

E.L. 4858

14 17 36S

130 50 30E

130 52 30E

130 54 30E

130 56 30E

131 0 30E

131 0 30E

AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM : INPUT MARK V/12
Channel centre: 280, 380, 480, 580, 680, 780, 830, 1080, 1280, 1480, 1780, and 2080 microseconds after transmitter turn off
0.2 sec (approx 13 metres at 220 kph)
MAGNETOMETER : Cesium Vapour optical absorption.
Sensitivity 0.1 nT
RECORDING INTERVAL : 1.0 sec (approx 60 metres at 220 kph)
DATA RECORDING : Geotrex MADACS acquisition system.
Digital to magnetic tape.
Magnetometer sensor in aircraft at 120 m
NOMINAL TERRAIN CLEARANCE : EM transmitter in aircraft at 120 m
EM receiver in towed bird at 60 m
Traverse lines 500 metres
NOMINAL LINE SPACING : No Tie lines
Geotrex 35mm continuous tracking camera.
Visually to 1:25,000 black and white enlargements of low level photography.
FLIGHT PATH RECORD :
FLIGHT PATH RECOVERY :

SELECTED INPUT CONDUCTOR MAP

Grid notation refers to Australian Map Grid Zone 52
Digitised from 1:25,000 black and white enlargements of low level photography

Anomaly Peak Position
Anomaly Width
Terrain Clearance (metres)
Channel Response
Selected Conductor Outline
Zone Identification number
Weak zones in relative areas
- Vertical source
- Flat-lying source
Fault
Conductive areas
Areas of increased conductivity

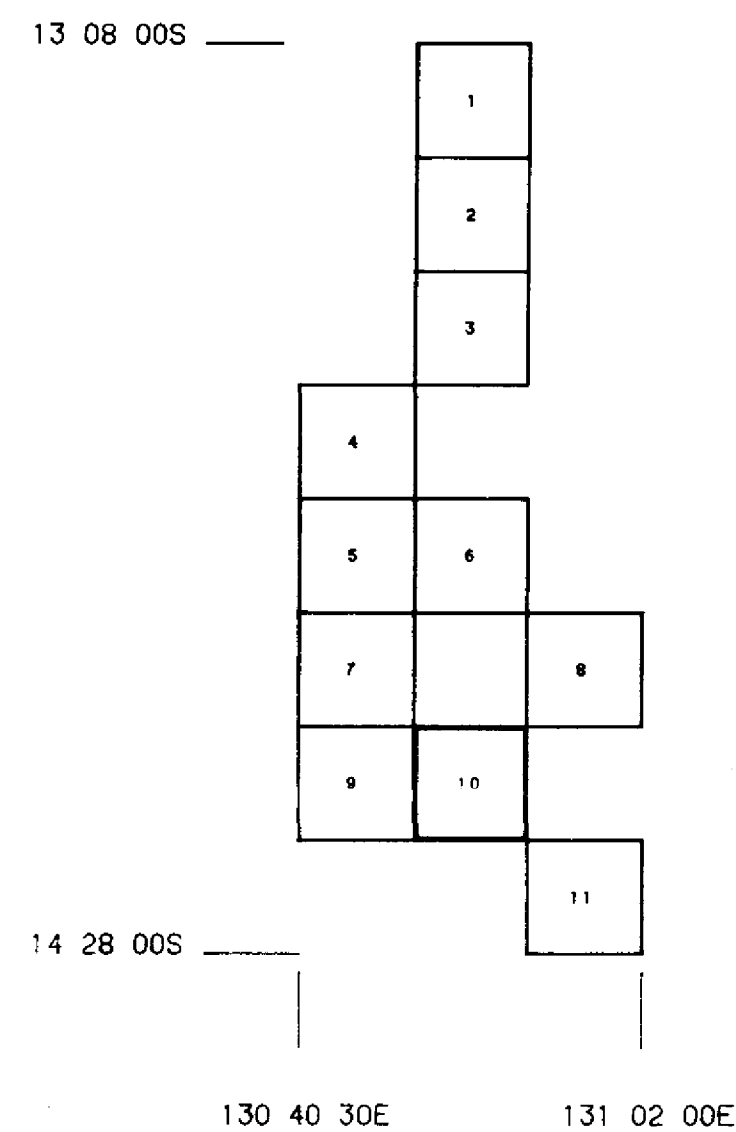
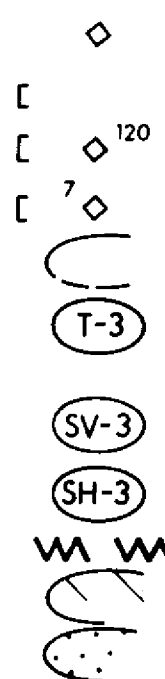
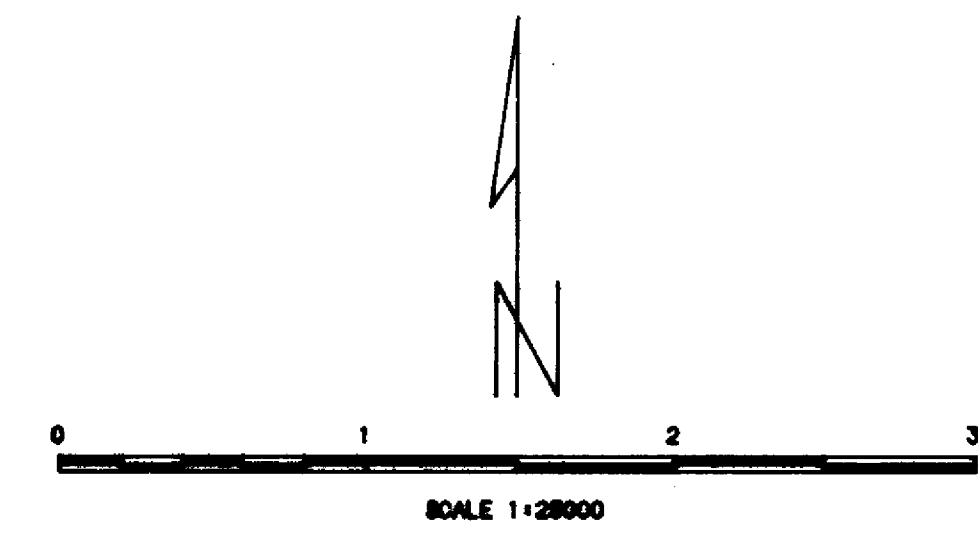


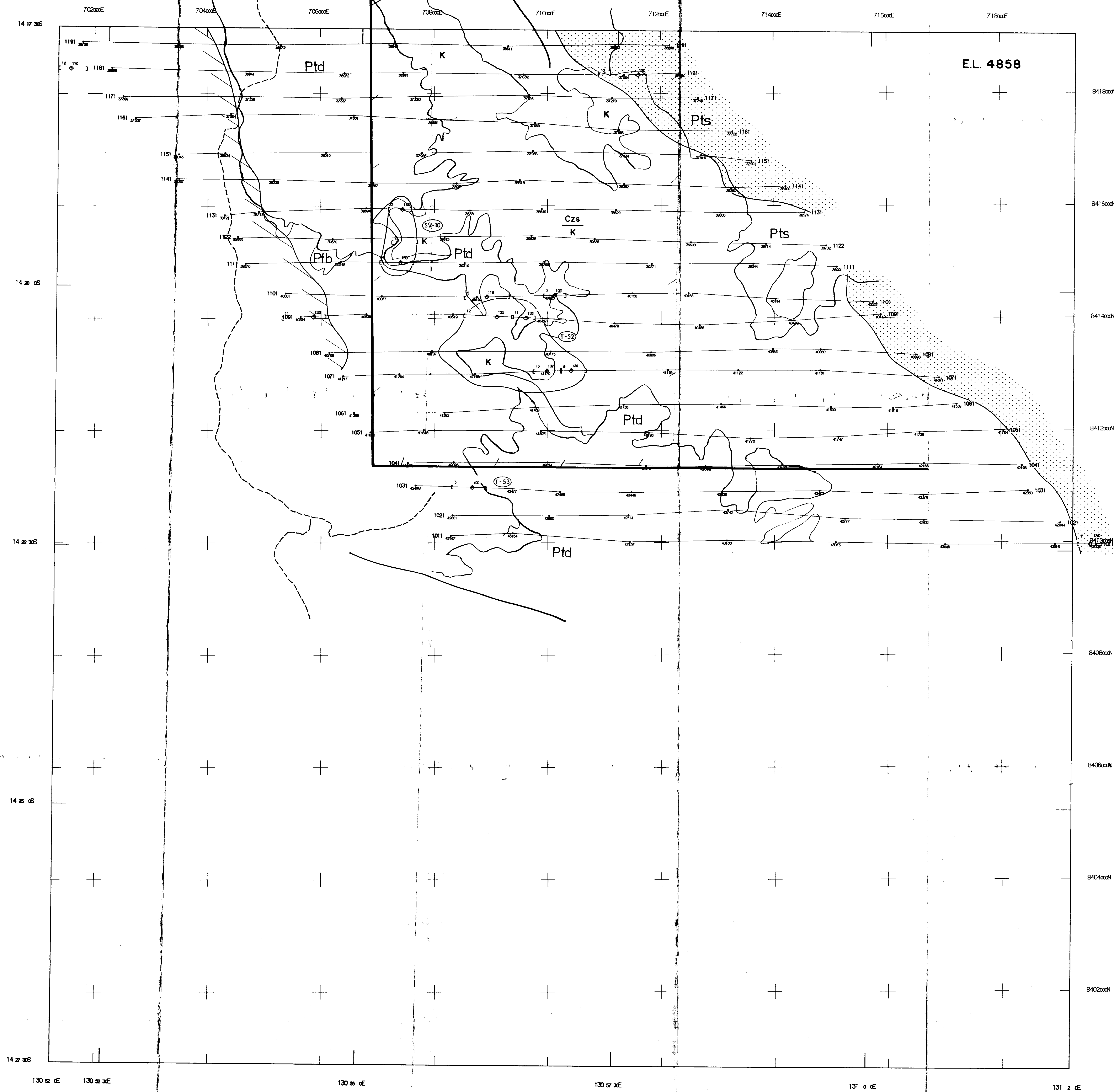
PLATE 2



JOB NO : 2-587
Flown by GEOTREX PTY LTD : JULY 1987
Compiled by GEOTREX PTY LTD, Sydney, NSW.
Processed using the ECS GEOMET system

TOTAL MINING AUSTRALIA
PTY LIMITED.

TOLMER N.T.
SELECTED INPUT CONDUCTOR MAP
SHEET 10 OF 11



AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM : INPUT MARK V/12
Channel centre: 280, 380, 480, 580, 680, 780, 830, 1080, 1280, 1480, 1780, and 2080
microseconds after transmitter turn off

RECORDING INTERVAL : 0.2 sec (approx 13 metres at 220 kph)

MAGNETOMETER : Geoscan Vespene optical absorption
Sensitivity: 0.1 nT

RECORDING INTERVAL : 1.0 sec (approx 60 metres at 220 kph)

DATA RECORDING : Geotrex MADACS acquisition system
Digital to magnetic tape

NOMINAL TERRAIN CLEARANCE : Magnetometer sensor in aircraft at 120 m
EM transmitter in aircraft at 120 m
EM receiver in towed bird at 60 m
Traverse lines 500 metres

NOMINAL LINE SPACING : No Tie lines

FLIGHT PATH RECORD : Geoscan 35mm continuous tracking camera

FLIGHT PATH RECOVERY : Visually to 1:25,000 black and white enlargements of low level photography.

SELECTED INPUT CONDUCTOR MAP

Grid notation refers to Australian Map Grid Zone 52
Digitized from 1:25,000 black and white enlargements of low level photography

Anomaly Peak Position

Anomaly Width

Terrain Clearance (metres)

Channel Response

Selected Conductor Outline

Zone Identification number

Weak zones in relative areas

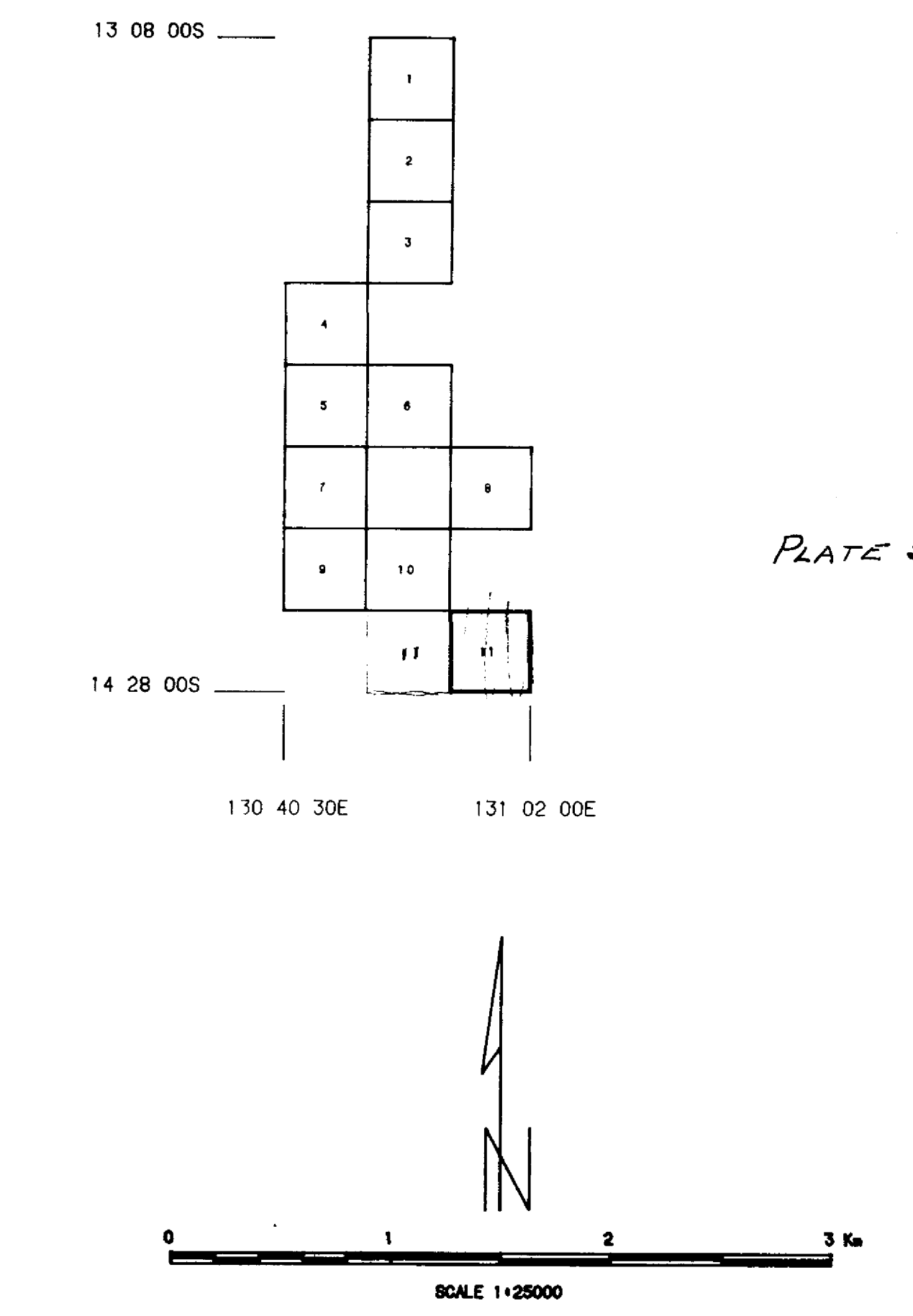
- Vertical source

- Flat-lying source

Fault

Conductive areas

Areas of increased conductivity



JOB NO 2-597
Flown by GEOTREX PTY LTD JULY 1987
Compiled by GEOTREX PTY LTD, Sydney, NSW.
Processed using the ECS GEONET system

**TOTAL MINING AUSTRALIA
PTY LIMITED.**

**TOLMER N.T.
SELECTED INPUT CONDUCTOR MAP
SHEET 11 OF 11**

DATE: 15-OCT-87 547-104

600E 700E 800E 900E 1000E 1100E 1200E 1300E 1400E 1500E 1600E

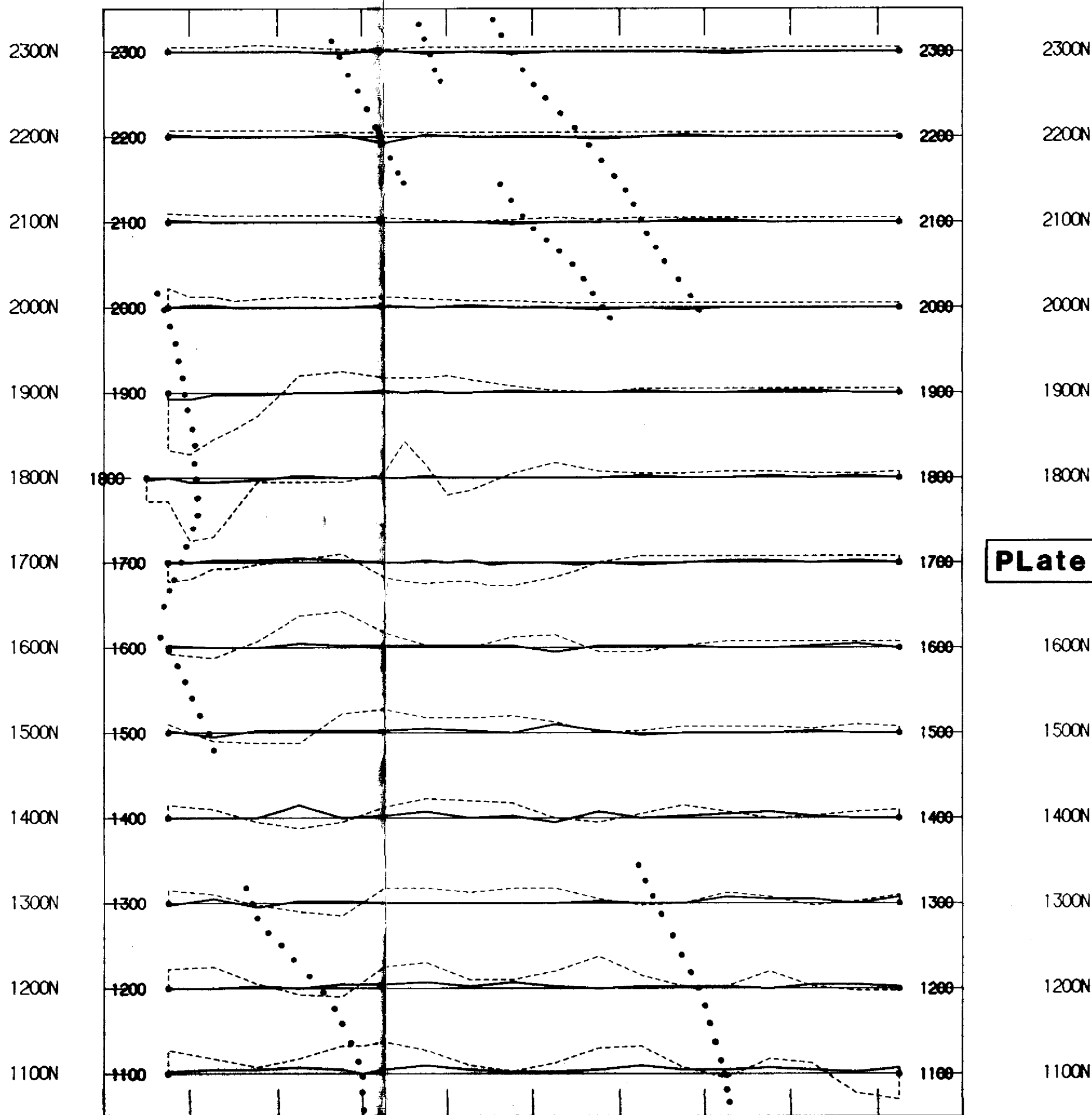


PLate 5

600E 700E 800E 900E 1000E 1100E 1200E 1300E 1400E 1500E 1600E

..... **Max Min Conductor**

GROUND SURVEY SPECIFICATIONS

EM SYSTEM : Apex MAXMIN II
 3555 Hz
 1777 Hz
 888 Hz
 444 Hz
 COIL SEPARATION : 150 metres
 STATION SPACING : 25 and 50 metres

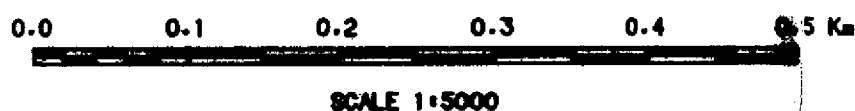
MAXMIN 888 HZ PROFILES

Grid notation refers to Local Grid
 Vertical scale ± 10 percent per cm
 Base value ± 0 percent
 Out of phase - - - - -

JOB NO : 4-984



Surveyed by GEOTREX PTY LTD, MAY-JUNE 1988
 Compiled by GEOTREX PTY LTD, Sydney, NSW.
 Processed using the ECS GEONET system

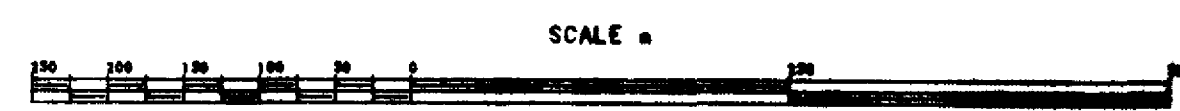
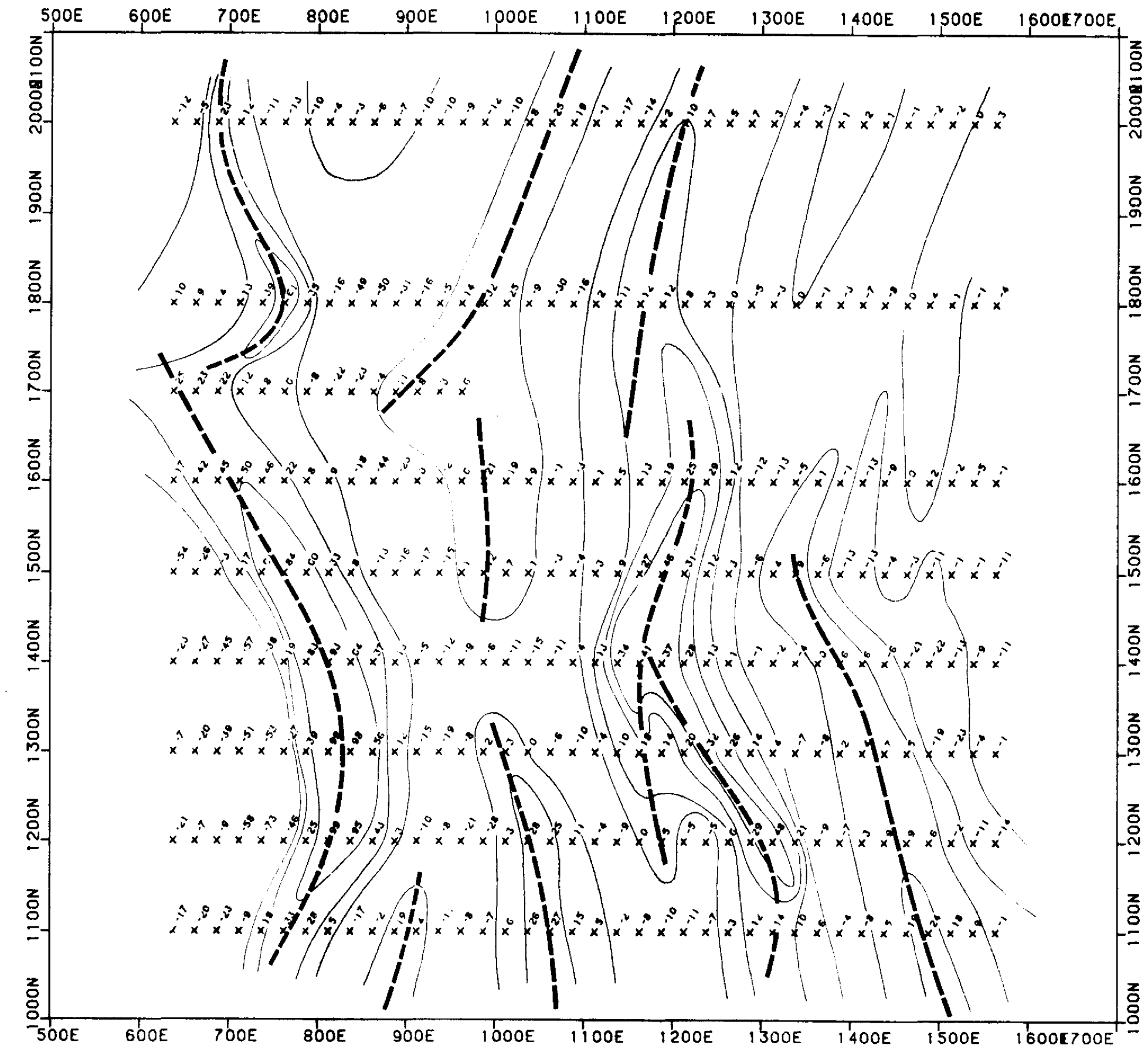
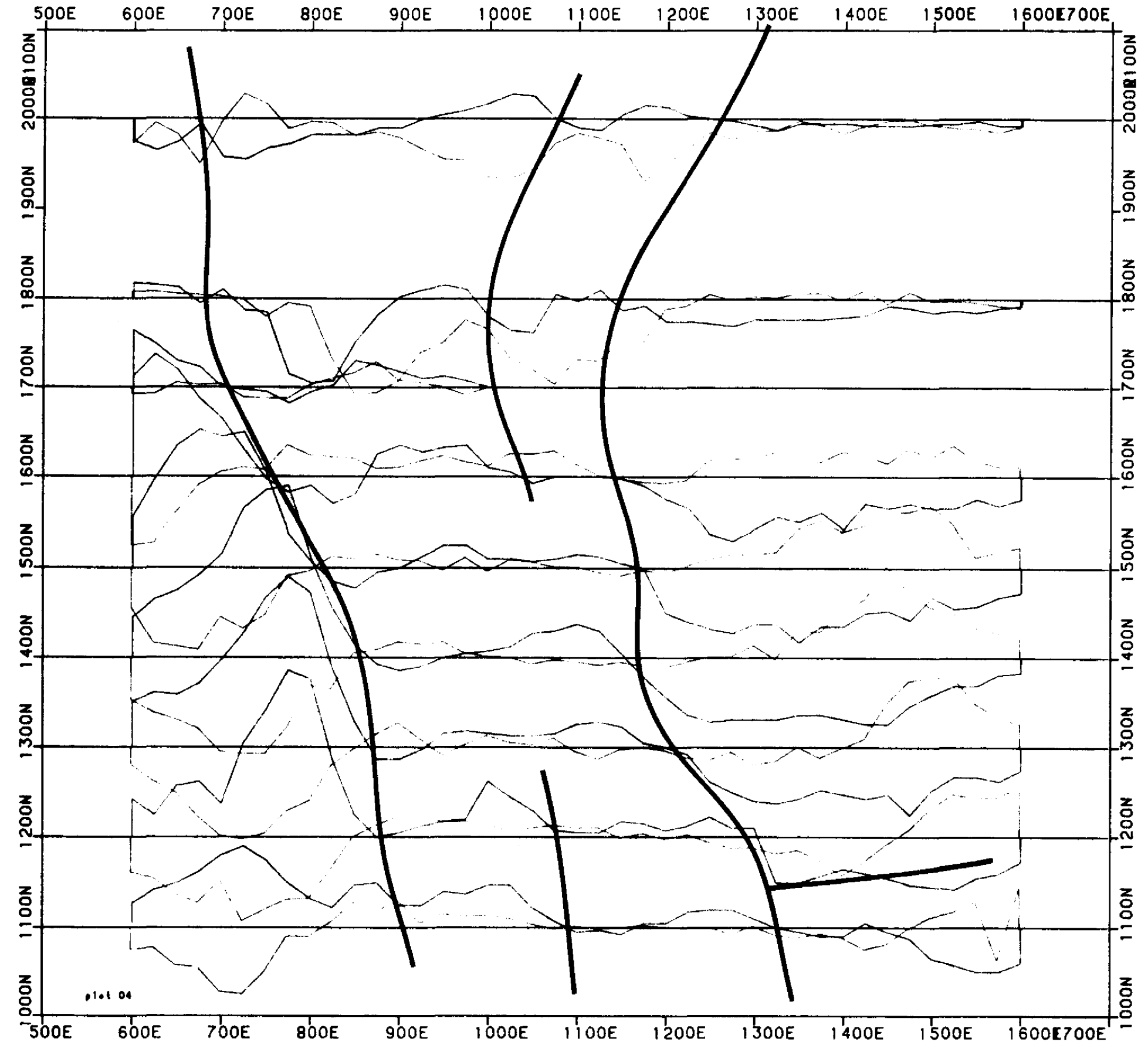
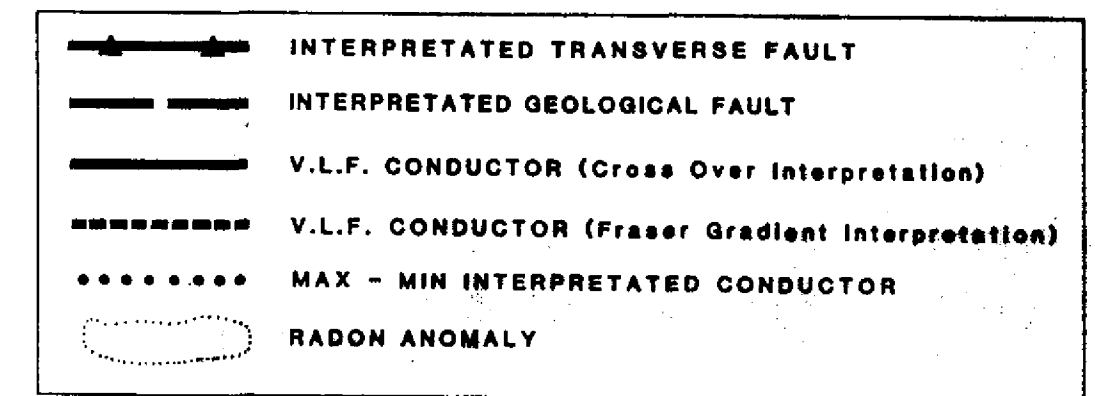


TOTAL MINING AUSTRALIA PTY LTD

**TOLMER NT
 MAXMIN 888HZ PROFILES
 SV10 PROSPECT**

547-200

DATE: 13-FEB-89



TOTAL Mining Australia Pty. Limited					
TOLMER PROJECT - N.T.					
INPUT ANOMALY - SV10					
V.L.F. SURVEY					
(NDT Transmitter)					
REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
	XXXXXXXXXXXXXXXXXXXX		FOR.		12/12/88
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OFFICE:SYD	SCALE 1/5000	SHEET 1 OF 1	DRG. No 547-190		

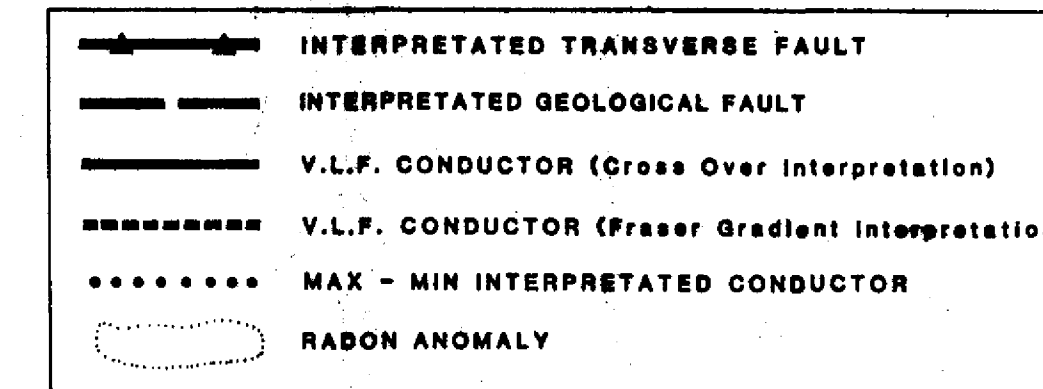
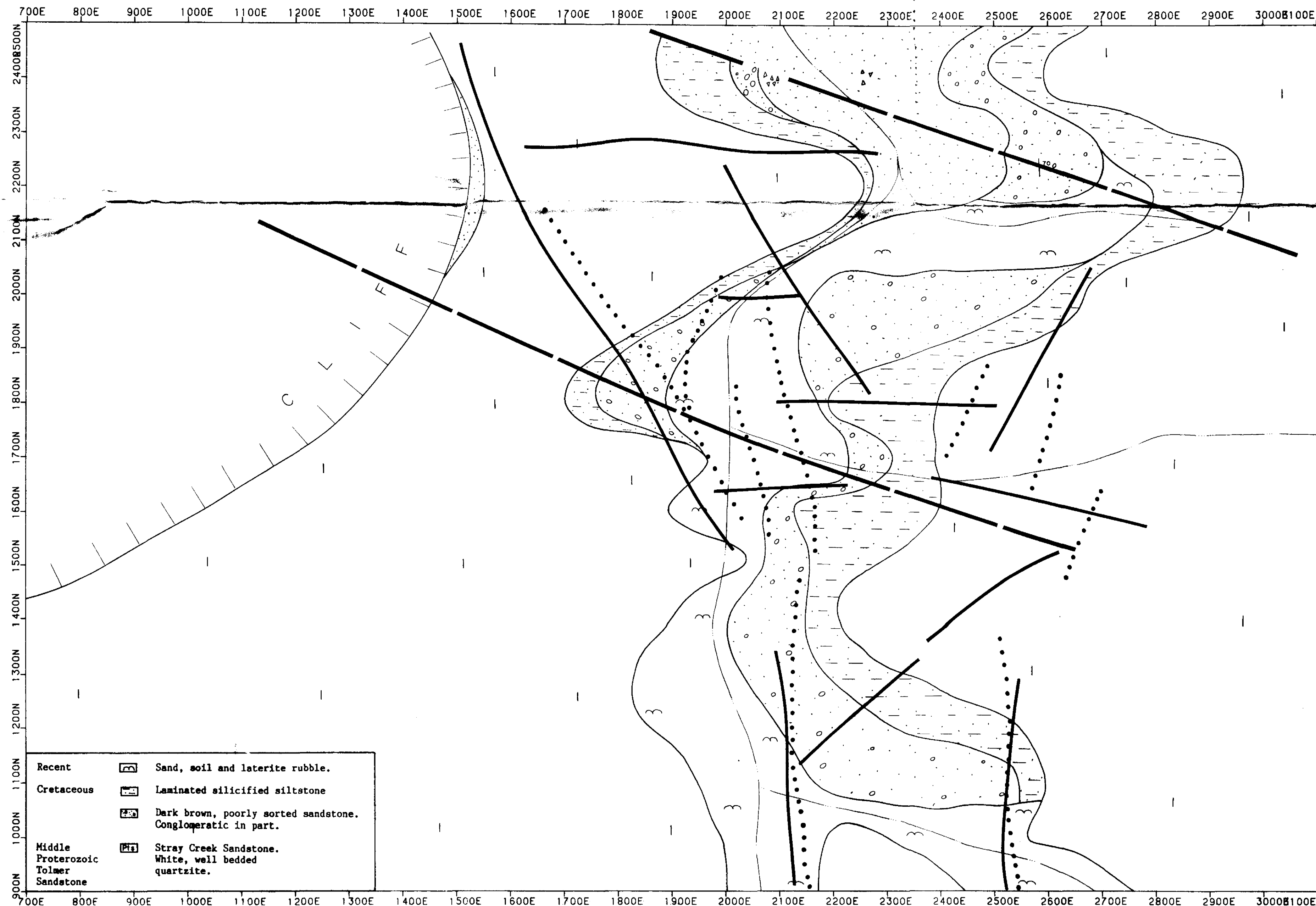


PLATE 7



TOTAL Mining Australia Pty. Limited
TOLMER PROJECT - N.T.
INPUT ANOMALY - T52
GEOLOGY

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
XXX	XXXXXXXXXXXXXXXXXXXXXXX		FOR.		12/12/88

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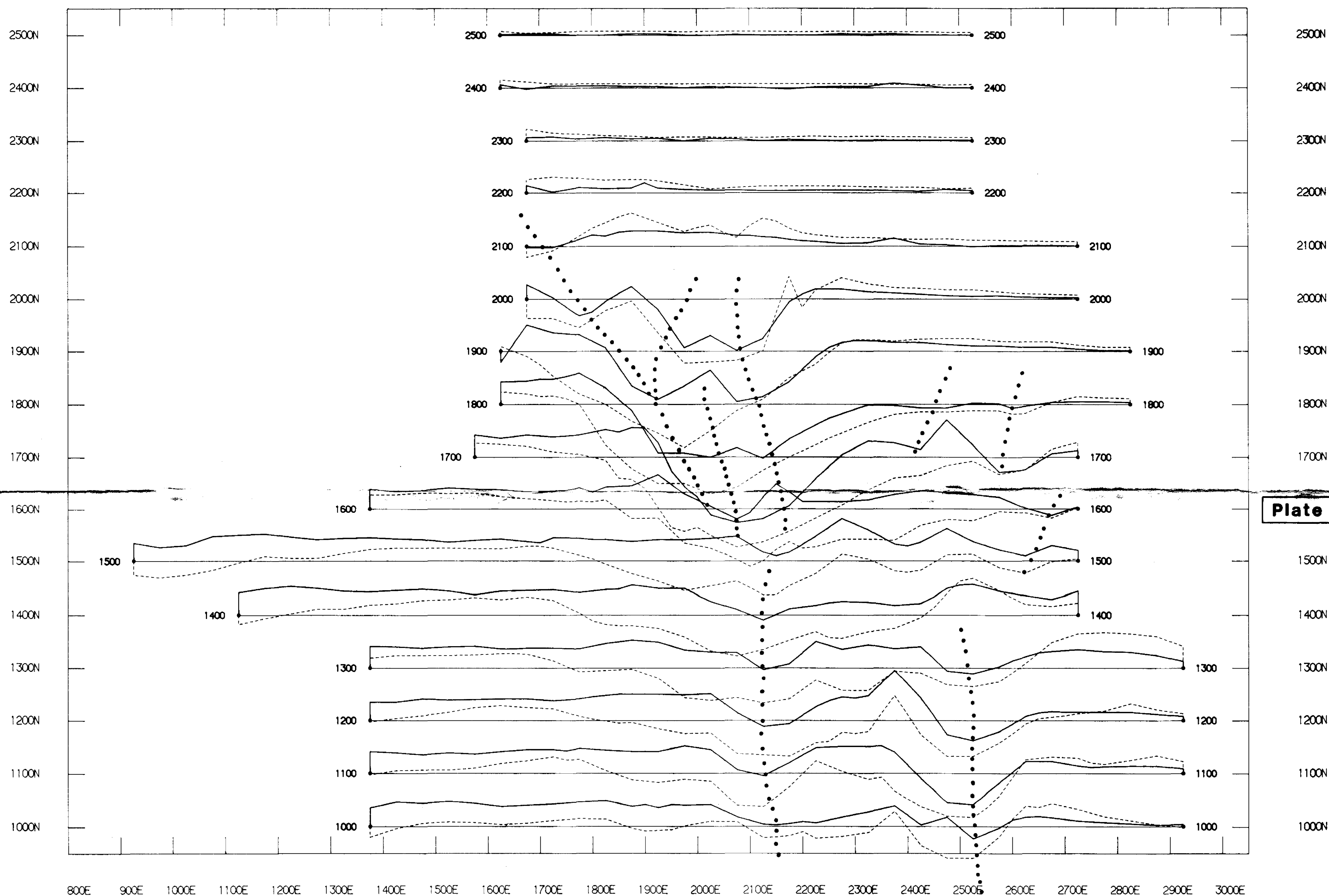


Plate 8

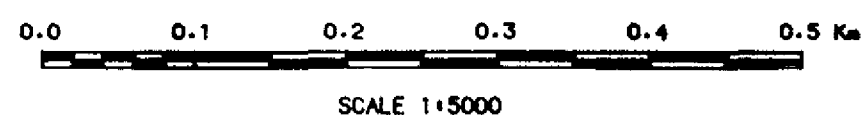
GROUND SURVEY SPECIFICATIONS

EM SYSTEM : Apex MAXMIN II
 3555 Hz
 1777 Hz
 888 Hz
 444 Hz
 COIL SEPARATION : 150 metres
 STATION SPACING : 25 and 50 metres

MAXMIN 888 HZ PROFILES

Grid notation refers to Local Grid
 Vertical scale : 20 percent per cm
 Base value : 0 percent
 Out of phase : - - - - -

..... Max Min Conductor



JOB NO : 4-984
 Surveyed by GEOTERREX PTY LTD, MAY-JUNE 1988
 Compiled by GEOTERREX PTY LTD, Sydney, NSW.
 Processed using the ECS GEONET system

TOTAL MINING AUSTRALIA PTY LTD

TOLMER NT
 MAXMIN 888HZ PROFILES
 T52 PROSPECT

547-203

DATE: 11-OCT-88

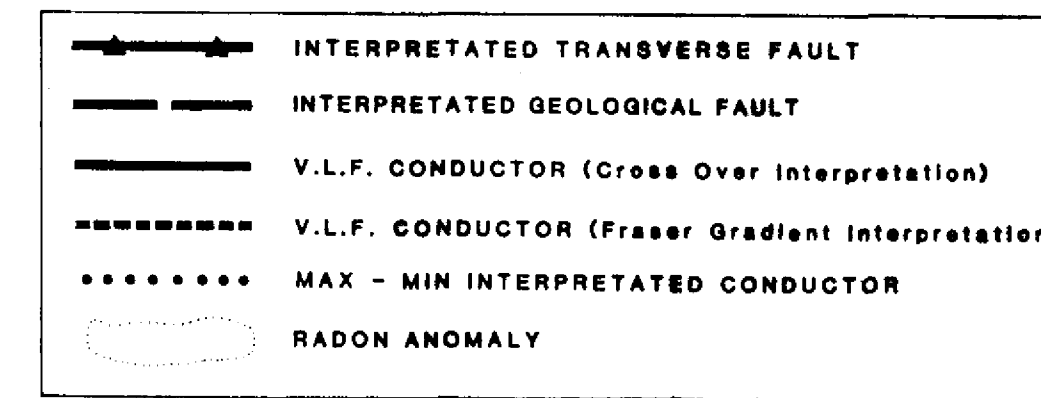
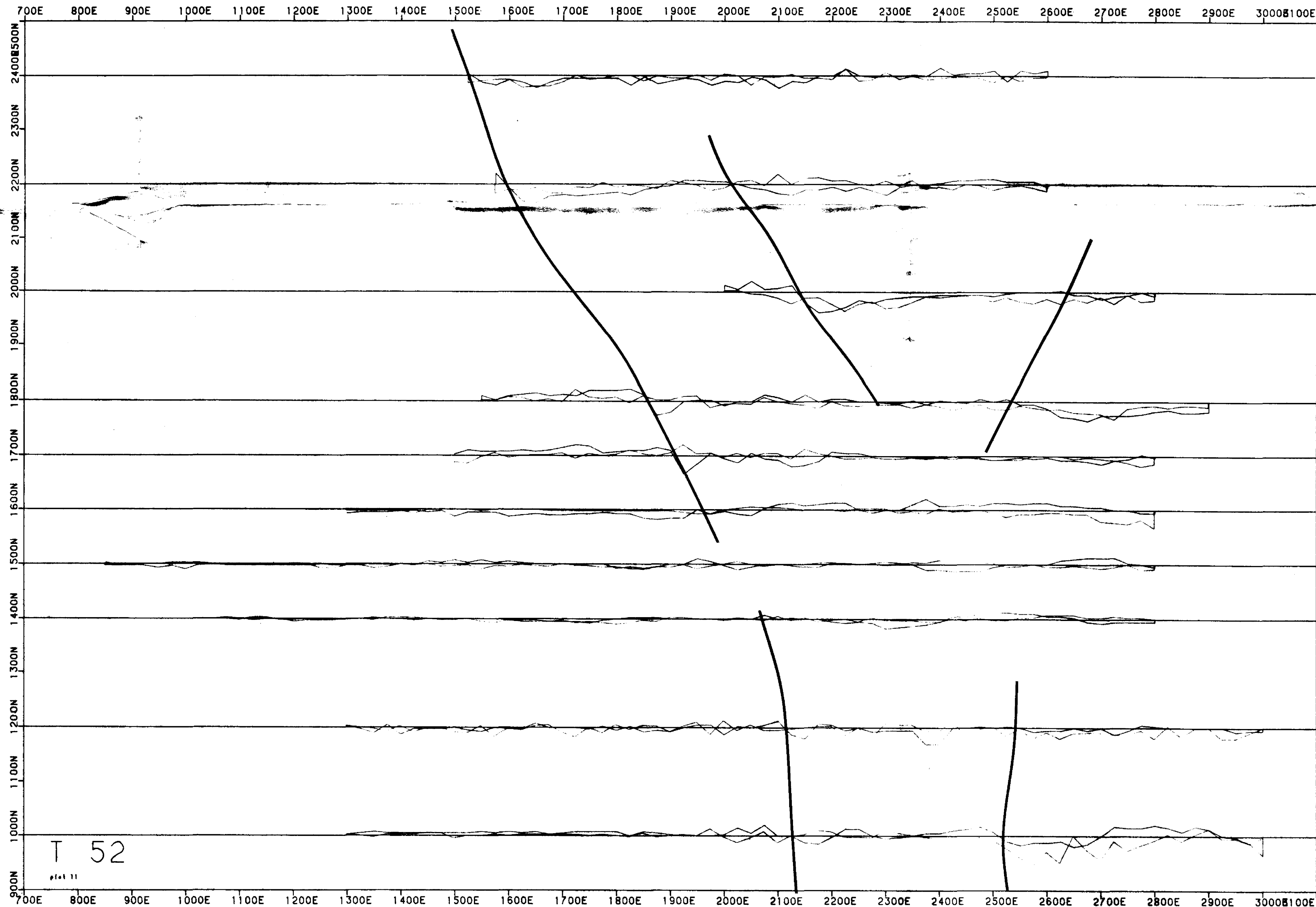
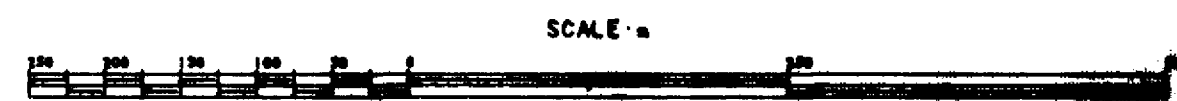


PLATE 9



TOTAL Mining Australia Pty. Limited

TOLMER PROJECT N.T.

INPUT ANOMALY - T52

V.L.F. SURVEY

(NDT Transmitter)

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
XXX	XXXXXXXXXXXXXXXXXXXXXXX		FUR.		12/12/88

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OFFICE: SYD SCALE 1/5000 SHEET 1 OF 1 DRG. No 647-193