20.1
20.2 /

TOTAL Mining Australia Pty. Limited

E.L. 4858 COLLIER

TOLMER PROJECT

ANNUAL REPORT

1987

R/87-17-U

P. MELVILLE
MARCH, 1988

CR88/219A

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I. INTRODUCTION

1.1 GENERAL

This report encompasses the exploration activities carried out on E.L. 4858 during the 1987 field period. The tenement is being explored by a joint venture agreement between TOTAL Mining Australia Pty. Ltd. (T.M.A.) and the Power Nuclear Corporation of Japan (PNC).

The geological similarities of the region to that of the Alligator Rivers Uranium Field prompted T.M.A. to mount an exploration programme based on that model.

1.2 DESCRIPTION OF AREA

The tenement is situated in the Daly River region located 55 km southeast of the Daly River settlement and centred about 150 km south of Darwin. The land covered is part of the Fish River Pastoral Lease controlled by Tipperary Station. The E.L. is bounded by latitudes 14°06' and 14°22' and longitudes 130°51' and 131°05' and comprises 156 sub-blocks.

1.3 LOGISTICS

Access to the licence area is restricted to dry season conditions. Station tracks from either Tipperary or Claravale homesteads cross the Daly River which is usually impassable for 5-6 months. Much of the area is covered by woodland and scrub and is of generally low relief making vehicular traversing possible in most cases.

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

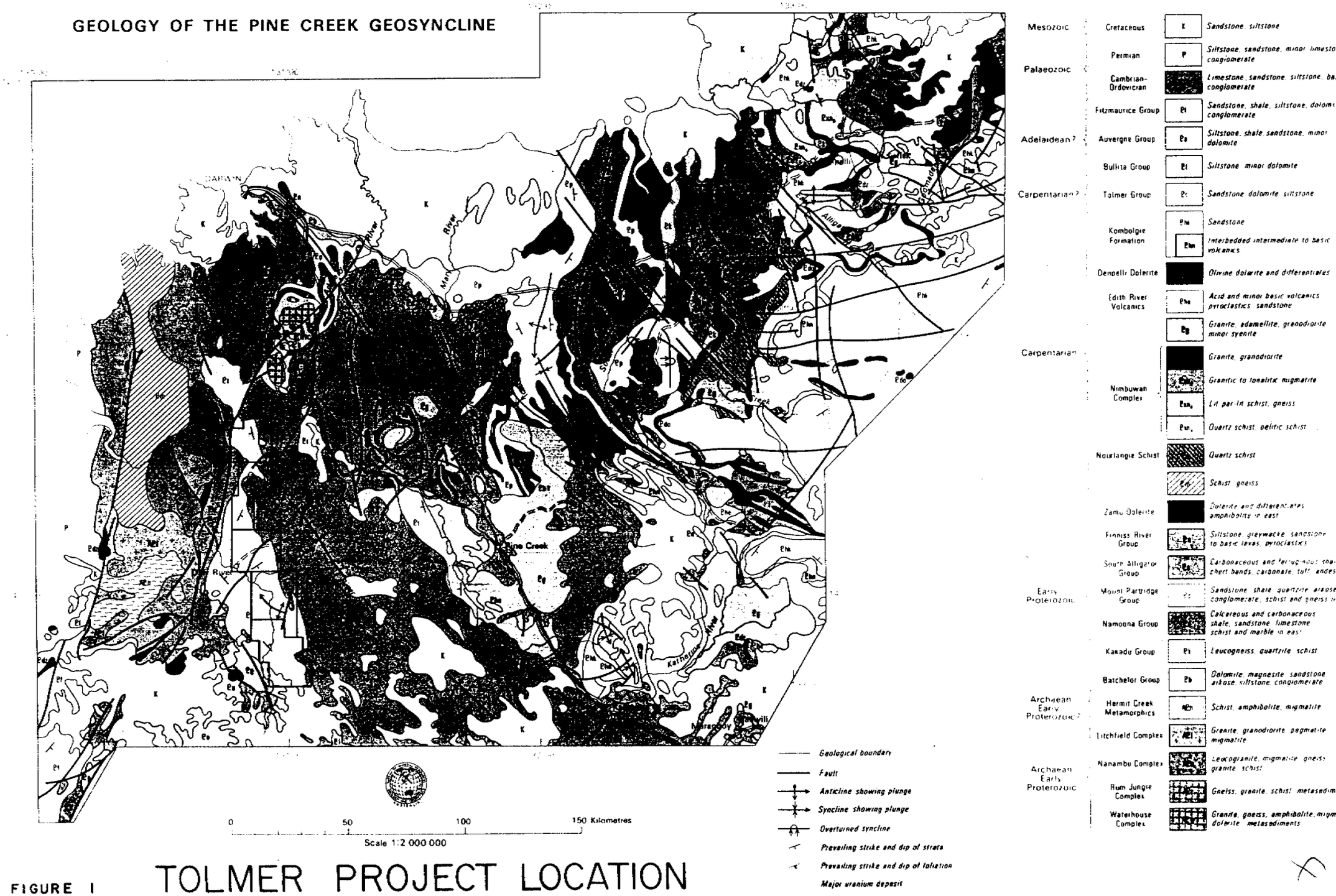
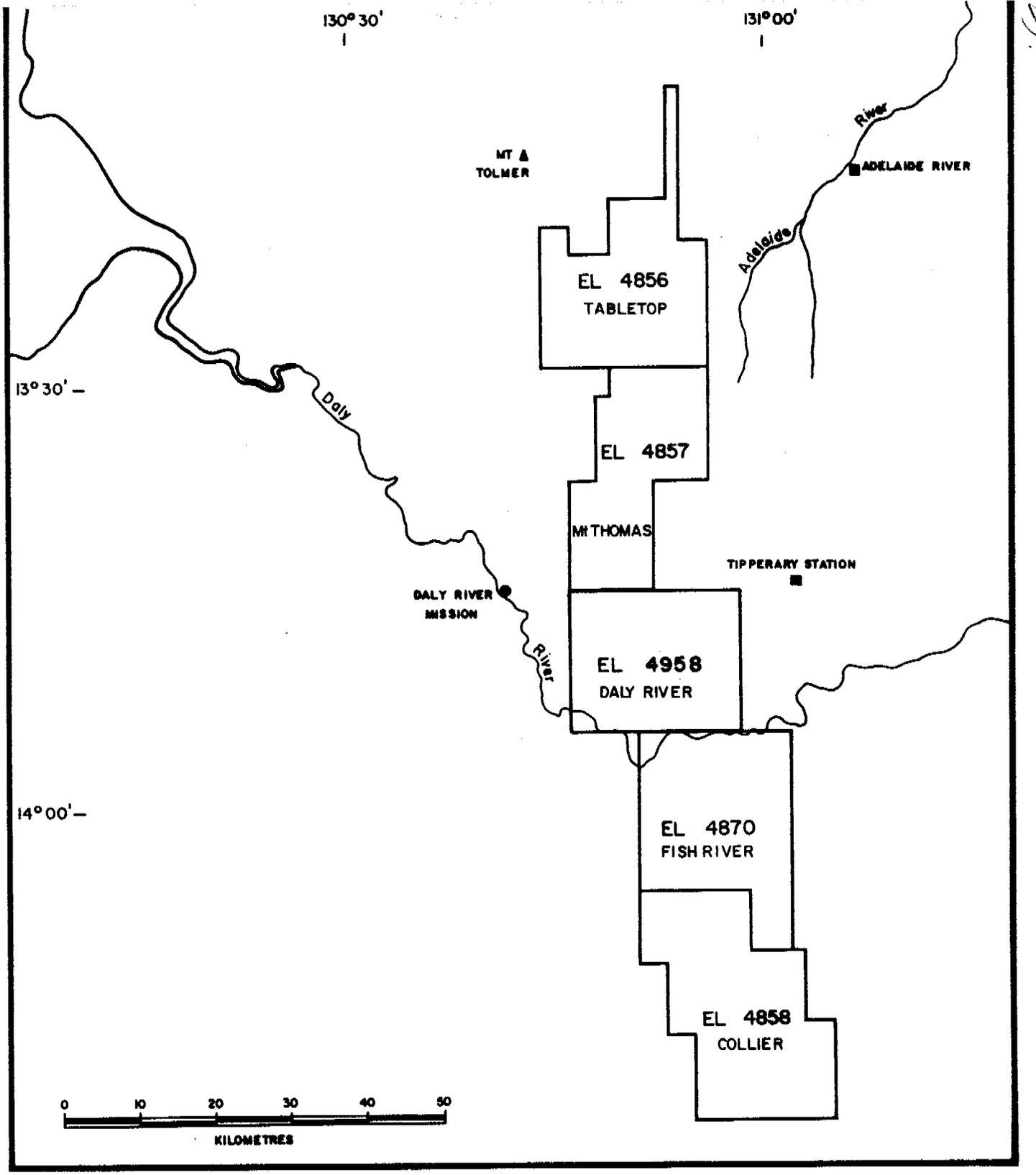


FIGURE 1 TOLMER PROJECT LOCATION



TOLMER PROJECT
TENEMENT SITUATION

FIGURE 2

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 variably 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 Jammine 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 axis 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 Allamber 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.

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 monoclinal 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:

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

The two granitoids outcrop within several kilometres of each other; the various field observations suggest that the Jammine Granite could be a contaminated phase of the other, probably with a high-volatile content. There is no doubt that the former intrusive has affected the country rock to a far greater degree. In fact, no other granite in the project area has created an alteration phenomenon in the Burrell Creek sediments as pronounced as this.

The Jammine Granite outcrop distribution was found to be far more widespread than is indicated on the NTGS 1:25000 sheets (see revised geology, Plate 3). The difficulty in places of distinguishing granite from altered sediments has already been discussed; also the photo pattern of the granite is not obvious. Where not outcropping, the alteration effects are obvious: hornfelsing, andalusite development, pervasive tourmalinization in places, greisen and pegmatite vein swarms, quartz and quartz-tourmaline veins. Granitization of the arenaceous sediments has also taken place.

Where the Jammine Granite terminates and the Allia Creek intrusion commences is difficult to determine. In the field, near continuous outcrop has been mapped during the traversing, much of this outcrop being exposed adjacent to the Lower-Middle Proterozoic unconformity. In weathered exposures, variations in granitic type cannot be distinguished.

Summary

The scarcity of Lower Proterozoic outcrop over much of the traverse area has diminished the chances of locating anomalies by ground traversing. The various granitic intrusives and their effects on the country rock however have created an interesting geological environment which could have positive implications for the development of uranium deposits. Minor uranium mineralization was located by Mobil within the Allia Creek Granite during their programmes in the early 1980's. This ground, together with further extensions southward of the unconformity, has yet to be prospected by the Joint Venture.

The discovery of the carbonaceous-rich sequence containing possible dolomites is encouraging; the associated radiometric anomalies and intrusive veining give it some priority for further investigation.

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. As the charts are on thermal paper, which tends to fade with time, it is recommended to take a more permanent photocopy as soon as the recordings become available. After locating the charts in relation to the navigation photo strips, 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 are based on the field evaluation of the anomalies. The plots on the 1:100,000 map are approximate only; more accurate are the anomaly locations on the colour photographs set.

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 colour photographs.

The symbols used on the photo set to indicate the anomalies are:

Response in channels 11 or 12: type A
Response in channels 9 or 10: type B
Response in channels 7 or 8: type C
Response in channels 1 to 6: type D
Minor anomalies.

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. Unfortunately, none of them indicates the expected occurrences of graphitic schist beneath the sandstone cover. 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.

The areas fall broadly into four categories:

. Conductors in exposed Burrell Creek Formation ("basement").

. Conductors along faults.

. Conductors in Tolmer Group.

. Conductors in Cambrian Volcanics and/or Cretaceous.

The anomalies that occur in Cretaceous are generally located near the edge of a cliff; they 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.

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

<u>E.L. 4858 and adjacent</u>

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

57 As above

58 Local outcrop of Burrell Creek sediments - phyllite and quartz mica schist. Adjacent to Soldiers Creek Granite.

Follow-up ground EM is planned for a series of anomalies chosen for further investigation. These are plotted on Plates 2, 3 and 4. No ground EM was performed in 1987

CONCLUSIONS

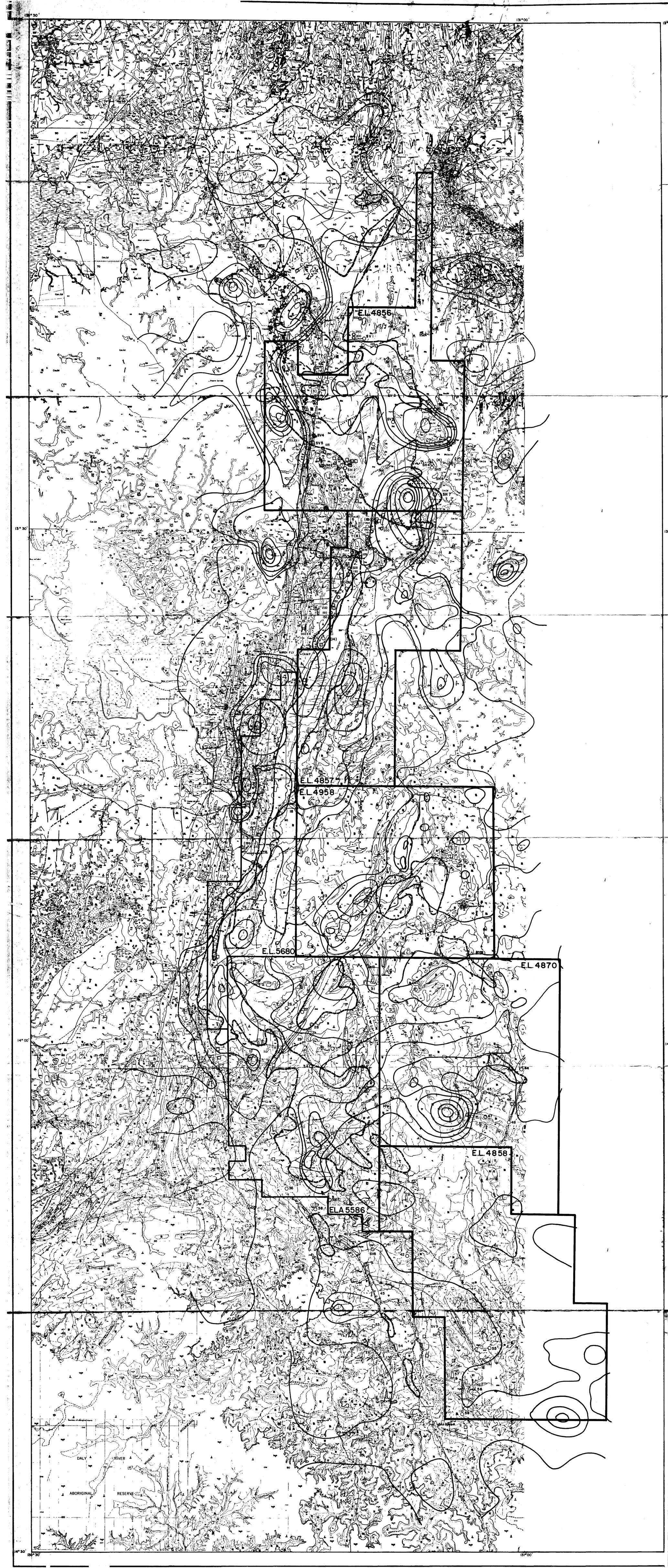
Several input conductor anomalies have been defined which are considered to warrant ground follow-up. Several localized zones where the geology is favourable have been targeted for radiometric traversing.

EXPENDITURE STATEMENT

EXPENDITURE STATEMENT - TOLMER PROJECT

1/1/87 - 31/12/87

DESCRIPTION	EXPENDITURE RELATING TO ALL TOLMER EL'S	E.L. 4856	E.L. 4857	E.L. 4858	E.L. 4870	TOTAL
1. OUTSIDE SERVICES						
Bulldozing	8,458					8,458
Laboratory	1,820					1,820
Ground Geophysics		13,861	13,861			27,722
Airborne Geophysics	186,549					186,549
SUBTOTAL 1	196,827	13,861	13,861			224,549
2. OPERATING EXPENSES						
Purchases	8,382	2,970	2,030			13,382
Personnel	88,356	46,178	39,048	12,139	6,515	192,236
Supplies & Services	2,446	536	122			3,104
Transport & Accommodation	20,343	8,845	5,144	827		35,159
Administrative Costs	4,386	187	16			4,589
General Administration	8,141	4,961	4,339	1,142	624	19,207
Depreciation	4,226					4,226
SUBTOTAL 2	136,280	63,677	50,699	14,108	7,139	271,903
PROJECT TOTAL	333,107	77,538	64,560	14,108	7,139	496,452



INPUT SURVEY

2
SV9
SH7
(3) Selected first priority targets

Areas of significant conductors

Mg sample location & value

Input Survey Conductor location

Surveyed Baseline

U/Th Anomaly

Gravity - Bouguer Anomaly

Thermoluminescence Sample

Highly Anomalous Thermoluminescence Sample

Radiometric Anomaly

Magnetic Trend

Tolmer Sandstone

Granite

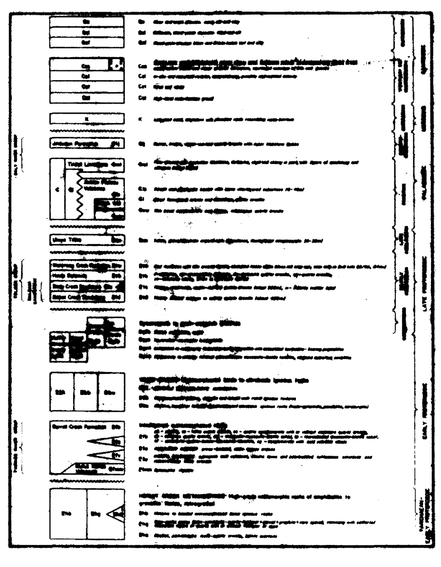


PLATE 1

SCALE 0 1 2 3 4 5 10 KM

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.

SYNTHESIS MAP

CR88/219A

REV	DESCRIPTION	PREP	DRAWN	CHECKED	DATE
		D.H.	G.R.	D.H.	MAR 87

SCALE	1:100 000	SHEET	OF	DRG. No.	847-046

700000E 702000E 704000E 706000E 708000E 710000E 712000E 714000E 716000E

8436000N 8434000N 8432000N 8430000N 8428000N 8426000N 8424000N 8422000N 8420000N

14 7 30S 14 10 00S 14 12 30S 14 15 00S 14 17 30S

130 50 30E 130 52 30E 130 55 00E 130 57 30E 131 0 00E 131 0 30E

E.L.5586

E.L 4858

Pts Pth Ptd Qa

T-50 T-51 SV-8 SV-9 SV-3 SH-3

AIRBORNE SURVEY SPECIFICATIONS

EM SYSTEM :	INPUT MARK V/12 Channel centres:280.380.480.580.680 780.930.1080.1280.1480.1780. and 2080 microseconds after transmitter turn off
RECORDING INTERVAL :	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 :	Geoterrex 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
NOMINAL LINE SPACING :	Traverse lines 500 metres No Tie lines
FLIGHT PATH RECORD :	Geocam 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
Digitised from 1:25.000 black and white
enlargements of low level photography

Anomaly Peak Position ◇

Anomaly Width [ ]

Terrain Clearance (metres) [◇ 120]

Channel Response [7 ◇]

Selected Conductor Outline

Zone Identification number (T-3)

Weak zones in resistive areas
- Vertical source (SV-3)
- Flat-lying source (SH-3)

Fault

Conductive areas

Areas of increased conductivity

13 08 00S

14 28 00S

130 40 30E 131 02 00E

1 2 3 4 5 6 7 8 9 10 11

Plate 2

0 1 2 3 Km
SCALE 1:25000

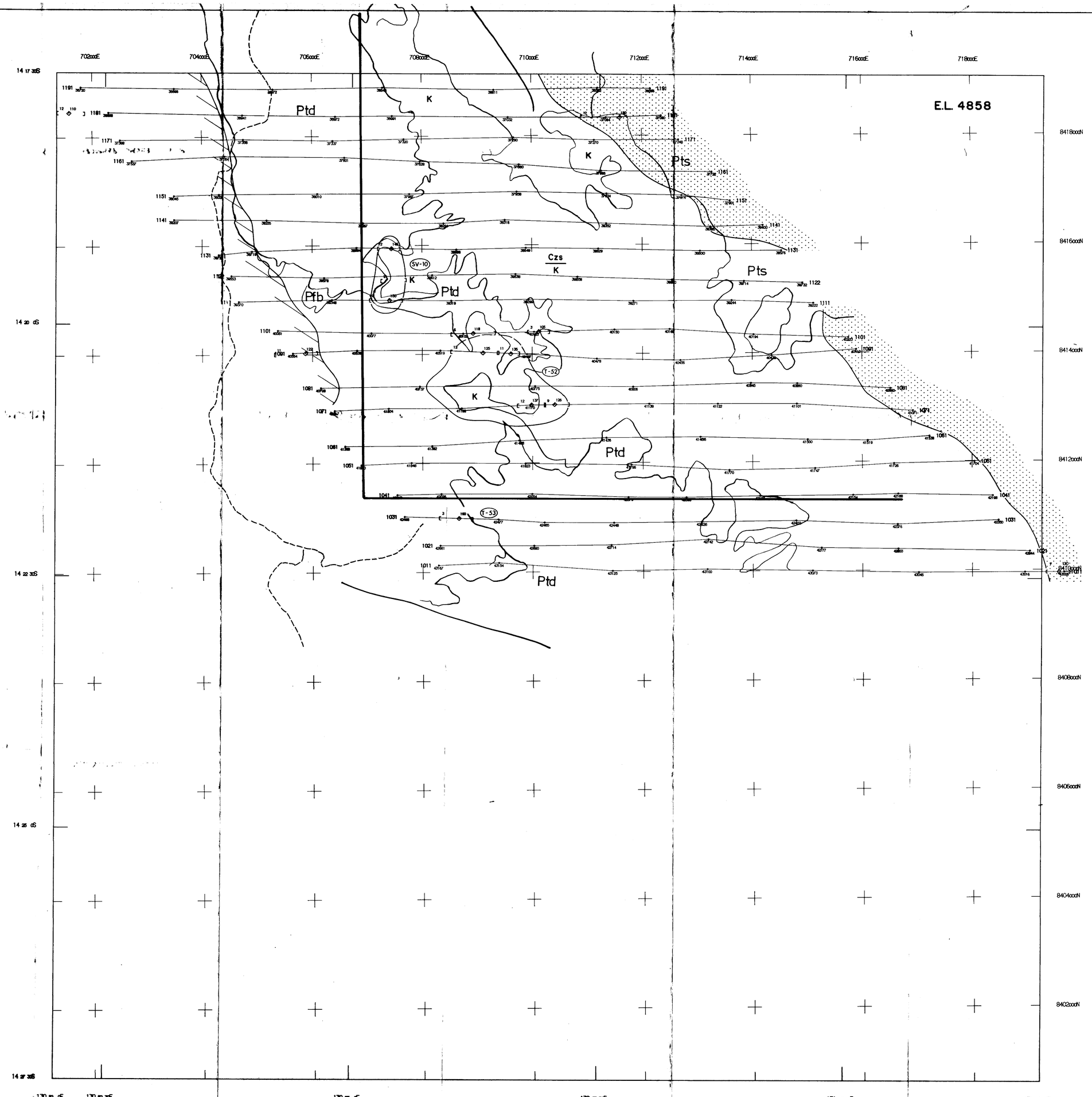
JOB NO : 2-597
Flown by GEOTERREX PTY LTD : JULY 1987
Compiled by GEOTERREX PTY LTD. Sydney NSW.
Processed using the ECS GEONET system

CR 88/219

TOTAL MINING AUSTRALIA PTY LIMITED.

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

DATE: 15-OCT-87 547-103



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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
Digitised from 1:25,000 black and white
enlargements of low level photography

Anomaly Peak Position ◇
Anomaly Width [ ]
Terrain Clearance (metres) [◇ 120]
Channel Response [7 ◇]
Selected Conductor Outline
Zone Identification number (T-3)
Weak zones in resistive areas
- Vertical source (SV-3)
- Flat-lying source (SH-3)
Fault
Conductive areas
Areas of increased conductivity

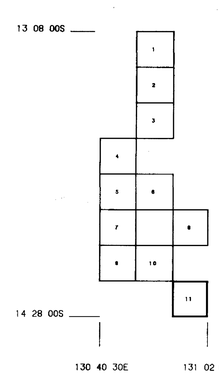
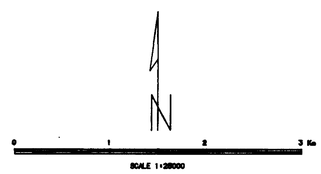


Plate 5



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CR 88/219

TOTAL MINING AUSTRAILA PTY LIMITED.

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

DATE: 15-OCT-87 547 - 104