JJ

TOTAL Mining Australia Pty. Limited

E.L. 4856 - TOLMER PROJECT
PINE CREEK GEOSYNCLINE, N.T.

TOTAL MINING AUSTRALIA PTY. LIMITED
AND
PNC EXPLORATION (AUSTRALIA) PTY. LTD
JOINT VENTURE

ANNUAL REPORT FOR 1986 TO THE
N.T. DEPARTMENT OF MINES AND ENERGY

VOLUME I

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P. MELVILLE
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SUMMARY

Field work commenced in early July comprising detailed radiometric and geological traversing of the Lower Proterozoic/Middle Proterozoic unconformity.

During the course of this work several radiometrically anomalous zones were discovered, two of which were later investigated in more detail.

Detailed interpretation of N.T.G.S. geophysical data, including magnetometry and radiometry, was performed by company geological and geophysical staff. A helicopter-borne gravity survey was conducted prior to the commencement of ground work. All the geophysical data has been integrated to produce a series of interpretative plans which will be utilized to target specific areas for further detailed exploration.

I. INTRODUCTION

1.1 GENERAL

This report describes the exploration and associated activities carried out by the TOTAL Mining Australia Pty. Limited (T.M.A.)/PNC Exploration (Australia) Pty. Ltd (PNC) Joint Venture on E.L. 4856 for 1986.

Plates 1 and 2 illustrate the location of the E.L. geographically in relation to the regional geology.

1.2 DESCRIPTION OF AREA

The tenement is located in the Reynolds River area centred approximately 35 km NNE of the Daly River settlement and 110 km south of Darwin (Reynolds River 1:100000 topographic map). The southern limit of the licence lies just north of the Daly River-Adelaide River road. The Litchfield State Park abuts the E.L. northwards. All land is part of the Forster pastoral lease owned by Tipperary Station.

1.3 LOGISTICS

Access is by way of the main Adelaide River-Daly River road and then by a series of established "tourist" tracks and bush tracks. The wet season severely restricts vehicular traffic for about 5 months of the year. Vegetation consists principally of savannah woodland with many open tracts of black soil country; patches of tropical forest line creeks draining the Tolmer Sandstone country. The Reynolds River is the main watercourse flowing north within the E.L.; several large west flowing tributaries, e.g. Mistake, Surprise and Tableland Creeks, join the Reynolds.

II. PERSONNEL AND CONTRACTORS

The 1986 programme was supervised by Darwin-based T.M.A. Project Geologist P. Melville. He was assisted from time to time by the Sydney-based T.M.A. Chief Geologist, D. Harrop, and Exploration Director, B. Berthault. A consultant geophysicist, L. Acimovic, was hired to organize, conduct and interpret the heli-borne gravity survey. One field assistant assisted the geologist for most of the field work period with an extra assistant for the last 2 months.

Visitors included Paris office geological staff C. Valsardieu and M. Mennerat and PNC geologists M. Suginohara and G. McKay.

Contracting work was performed by the following:

- Rotor Services, Darwin supplied a helicopter for the gravity survey and a short reconnaissance trip.

- Geospex Associates Pty. Ltd. translated on to a series of maps and to T.M.A.'s specifications, the N.T.G.S. Geophysical Data.

- Geochemical analysis of rock and stream sediment samples by ANALABS.

- Thermoluminescent studies on Tolmer Sandstone samples were carried out at Adelaide University by Professor P. Ypma and Mr. Mark Hochman.

- Petrographical work was done on contract in Bordeaux, France.

III. GEOLOGICAL SETTING

3.1 REGIONAL GEOLOGY

The tenement is located on the western edge of the Pine Creek Geosyncline. The main rock units are sediments ranging in age from Lower Proterozoic to Adelaidean; Carpentarian granites intrude these sediments. The Litchfield complex of Lower Proterozoic to ?Archaean 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.

STRATIGRAPHY (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 and Reynolds River Granite (Pxgl and Pge).

(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 (+ 134 m) (Ptw).

(iii) Late Adelaidean Uniya tillite (0 - 30 m). Occurs only at the Hayward Creek Prospect (Put).

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

3.2 LOCAL GEOLOGY

+ Lower Proterozoic Burrell Creek Formation comprising north-south striking sandstones, siltstones and minor schists with moderate to steep westerly dips. Non-outcropping lithologies comprise mica schists with some carbonaceous, graphitic and dolomitic lenses. Quartz and greisen veining is of widespread but generally minor occurrence. Small scale tight folding occurs throughout.

+ Middle Proterozoic Tolmer Sandstone has both unconformable and faulted contacts with the Burrell Creek Formation. Two formations are present: the massive Depot creek Sandstone as the basal member and the overlying Stray Creek Sandstone. The former is a massive quartz arenite with isolated pebble bands, the latter a more flaggy, thinly bedded quartz arenite with interbedded shale lenses. Dips vary from gentle east (Ptd) to variable north and west (Pts), the latter forming a localized circular structure abutting the Giants Reef Fault.

+ Reynolds River Granite intrudes the Burrell Creek Formation on the eastern edge of the E.L. Variants include a pink medium porphyritic adamellite and a grey medium grained hornblende-biotite granite.

3.3 STRUCTURE

The principal structural feature is the Giants Reef Fault which forms, in part, a faulted contact between the Lower and Middle Proterozoic rocks. Many parallel and converging structures traverse the licence area. The Burrell Creek Formation is tightly folded, whereas the Tolmer is principally undisturbed; strong jointing patterns exist in the latter.

IV. EXPLORATION ACTIVITIES

4.1 MODELS AND TARGETS

The presence of Lower Proterozoic sediments in unconformable contact with overlying Middle Proterozoic sandstone provides a comparable geological setting to the Alligator River Uranium Field. The general aim of the exploration is to locate suitable facies within the Burrell Creek Formation adjacent to the unconformity by intensive ground radiometric prospection and by the use of various airborne geophysical methods. A second model being employed relates to possible uranium concentrations around the periphery of granite intrusions, again in suitable host rocks of the Burrell Creek Formation. Identical exploration techniques are being employed for location of these types of occurrences, perhaps with an emphasis on geophysics to locate possible buried granitic "domes", i.e. beneath the sandstone cover.

No specific targets have, as yet, been positively defined. At this stage the outcropping unconformable contact between the Tolmer Group and the Burrell Creek Formation is in the process of being intensively prospected by ground methods. There are areas which will receive priority for the 1987 field season.

4.2 RADIOMETRIC AND GEOLOGICAL TRAVERSING

Ground prospecting commenced in July 1986 using SRAT SPP2 scintillometers. This comprised traversing the unconformity at 50 m intervals taking radiometric readings and making geological observations at 25 m stations. Traverse length varied from about 800 m to 2.0 km; average traverse length was planned at about 1 km to give adequate coverage over the exposed Burrell Creek facies, say 800 m with the balance covering the basal Tolmer. A base reference line was pegged at 50 m intervals to parallel the contact, the traverses extending at right angles to this line. It was commenced at Mistake Creek (Reynolds River 1:100000 sheet AMG 943231) and pegged progressively south as the traversing advanced. The line was extended for approximately 4.0 km south of the Adelaide River-Daly River Road and here the traversing was terminated for the year. The base line length extended to the southern boundary of the E.L., i.e. about 19 km, giving 380 km of traversing; this was achieved for the most part with two field personnel.

To date three anomalies of any significance have been located: two previously known and one new discovery - these will be described below in more detail. The radiometric signature of the various rock types has been used to construct the detailed geological maps (Plates 3, 4, and 5). In areas of little or no outcrop radiometry aided in the identification of the various lithologies. Typical values are:

- Burrell Creek Formation

  . Sandstone 90 - 110 c/s
  . Conglomerate 80 - 90 c/s
  . Siltstone 110 - 160 c/s

- Tolmer Group

  . Depot creek Sandstone 15 - 55 c/s

Siltstone exhibiting reddish hematitic alteration tends to give a higher radiometric count - usually the upper end of the range given for siltstone. Similarly the mica schists within the Burrell Creek tend to be high. The limited occurrences of carbonaceous shales tend to give variable readings, e.g. near an anomaly 300 - 500 c/s, elsewhere 110 - 160 c/s. Passing over the unconformity, the radiometric background drops considerable, sometimes suddenly, sometimes gradually depending upon the nature of the contact.

Description of anomalies:

(i) Surprise Creek North (See Plate 8)

Located about 1 km north of the Surprise Creek Campsite on the Reynolds River 1:100,000 topographic sheet (AMG 930/190). An area of both open black soil country and paperbark woodland. The main anomaly becomes periodically flooded after heavy local rain. The anomaly is bounded by the Tolmer Sandstone eastwards and low hills of Burrell Creek sandstone and siltstone to the west.

Previous investigations, including trenching and drilling, were made by the Nord/AGIP joint venture in the late 1970's. Various facies previously described were intersected. The final report for Nord (1981) states that 1 rotary percussion hole in the "Surprise Creek area" gave a radiometric anomaly x 8 background and that another hole gave a U assay of 160 ppm in fresh graphitic schist (background values 20-39 ppm U). Precise locations were not given.

T.M.A. conducted a resistivity survey over the anomaly in late 1986, but this was unsuccessful due to ground conditions.

(ii) Eccles I

Located adjacent to the base line approximately 1.3 km SSW of Surprise Creek campsite within N-S striking Burrell Creek Formation (Reynolds River 1:100,000 Sheet AMG 927160). The anomaly of 4000 c/s SPP2 was apparently first discovered by Keewanee Oil (Aust.) Pty Ltd. in 1970; the anomaly has been excavated, probably with the aid of explosives. The host rock is a medium grained quartzite, sheared and veined by quartz. The quartzite is a thin bed about 1 m wide having a very steep west dip, and is part of a sequence composed essentially of thin alternating beds of schist, siltstone and carbonaceous shales.

The Tolmer contact is 400 m to the east. The anomaly is an isolated occurrence with no apparent extensions.

(iii) Eccles II (See Plate 9)

Located at AMG 955140, Reynolds River 1:100,000 topographic sheet. Discovered by T.M.A. geologists in mid-1986 during a creek traverse. The anomaly is contained within the Burrell Creek Formation about 700 m from the Tolmer unconformity. Geology: the surrounding rocks consist of moderate west to southwest dipping sandstones, conglomerates and meta-siltstones; a ?fault zone represented by intense quartz veining appears to limit the anomaly to the north. Southwards the anomaly gradually diminishes, however unusually high background pebbly and gritty sandstones are present, outcropping on the creek bank (up to 210 c/s SPP2). The anomalous zone is interpreted as being stratabound, confined to well bedded brown and reddish micaceous meta-siltstones with maximum SPP2 readings of 4200 c/s. Overlying the main anomalous zone are thin alternating beds of siltstone and graphitic shale giving up to 500 c/s. These are in turn overlain by the abovementioned arenaceous facies. Along strike the anomaly tails of upslope and is obscured by alluvium and gravel in the other direction. No further anomalies were found in the area from the regional traversing. A spectrometer reading taken on the 'hot spot' indicates a uranium anomaly.

4.3 GEOPHYSICS

Various airborne geophysical surveys have been conducted over the region, the most recent being done by the Northern Territory Geological Survey. This included multispectral radiation (U, Th, K, T.C.) and high resolution, total intensity magnetics surveys on flight lines 500 m apart. In mid-1986 T.M.A. carried out a heliborne gravity survey, the data being integrated with previous BMR work.

The N.T.G.S. survey data was acquired by T.M.A. and passed on to a Sydney-based geophysical consultant group, Geospex Associates Pty. Ltd. for presentation as specified by the company. Consulting geophysicist for T.M.A., L. Acimovic, directed this work and the following plans have been produced:

- Flight line diagrams.

- Stacked profiles of all flight lines covering the joint venture tenements and the area covered by the Tolmer Sandstone. These show the following parameters.

  + Total (cps)
  + U (cps)
  + U corrected (cps)
  + Thorium (ppm)
  + Potassium (%)
  + U/Th

+ U/K x 1000
+ Altimeter (m)
+ Magnetic gradient (nT/m)
+ Total magnetic (nT)

- Stacked profiles of the Magnetic Gradient per 100,000 sheet, i.e. the Reynolds River, Daly River and Wingate Mountains sheets.

- Stacked and shaded profiles of the U/Th.

Detailed interpretation of all geophysical data has been made by T.M.A. geologists; this work has been illustrated in a synthesized form on Plate 7. A brief account is given below:

+ Magnetics: a series of ?dykes are indicated trending subparallel to the Giants Reef Fault. The background magnetic intensity shows no variation between the Burrell Creek and Tolmer lithologies; this could indicate that the Tolmer Sandstone is "transparent".

+ U/Th: anomalies are widespread, not being confined to any one lithology; there is obvious structural control in places, but elsewhere other factor(s) must be involved. Known ground anomalies, e.g. Eccles II, have not been picked up, however the Surprise Creek North area has.

+ Gravity (Plate 6): carried out on a 4 km x 4 km grid with "fill-in" stations where necessary. There are several vague anomalies outlined with a pronounced NW-SE trend - these are thought to be granite intrusions. The results of the gravity survey were also presented, after proper treatment, as regional anomaly and residual anomaly contour maps.

RESIDUAL ANOMALY CONTOUR MAP

In order to obtain more information from the gravity survey, an interpretation has been attempted using the residual anomaly contour map. This map provides Bouguer anomaly data corrected from the regional anomaly. Therefore any influence from deep seated sources has been eliminated.

The residual anomaly contour data have been represented along E-W profiles along which have been plotted in ordinate the gravity residual values. The plotting shows a certain number of positive and negative values organised in various shapes, the meaning of which are hereafter tentatively explained in connection with the knowledge we have about the general regional lithostratigraphy.

THE E.L.S 4856, 4857

Area I Increased Tolmer thickness as lower and middle Tolmer are present.

Area II Northern part (IIN): could correspond to the deepest part of the Tolmer Basin and thickest portion of the lower Tolmer Formation.

Southern part (IIS): could represent the signature of a granitic intrusive; one portion of it is outcropping to the SE.

Area III Reflect the Tolmer sequence filled together but with the outcropping Hinde Dolomite diminishing the amplitude of the low.

Area IV Northern part (IVN): could correspond, as (IIN), to the deepest part of the Tolmer Basin with the lower Tolmer only present, but also one can envisage the presence of a granitic intrusive in the underlying Burrell Creek.

Southern part (IVS): could correspond to the thickest portion of the Tolmer sequence.

The highs are interpreted as follows:

Area A: Reflect eventually an upthrow of Burrell Creek of an eastern block along a N-S to N10E network of fractures and faults observed on the air photo interpretation.

Area B: Could correspond to the Cambrian basaltic layers overlying the upper Tolmer unit.

Area C: Could reflect the beginning of the Cambrian limestone.

+ Radiometry: a marked contrast exists between the Tolmer Sandstone and other lithologies. The Giants Reef Fault is clearly shown where it exists as the contact between the Tolmer and Burrell Creek.

+ Resistivity: a ground survey over the Surprise Creek North prospect gave erroneous results due to equipment problems and insufficient moisture at the electrode sites. The survey will be repeated in 1987.

4.4 AIR PHOTO INTERPRETATION

Detailed interpretation of both geology and structure has been made by several T.M.A. geologists utilizing the 1:25,000 colour photo coverage. This work will be required to help interpret the various geophysical-radiometric-geochemical data and to target areas worthy of more intensive ground work.

This interpretation was carried out in order to define in detail the structural system affecting the sandstone as the expected ore concentrations are known to be closely linked with faults having affected the Lower Proterozoic basement as well as the Tolmer Sandstone cover. The photo study noted also the general structural pattern of both the basement and the Tolmer Sandstone cover, as well as the major lithological changes within this formation.

Both the faults and major fractures have been reported without being differentiated.

The dip of the beds has been reported as often as possible, and the outcropping beds outlined, in order to materialise as clearly as possible the folded structures.

The 3 units of the Tolmer Sandstone have been annotated from base to top, T1, T2, T3; the Burrell Creek, Be, the granite intrusions and the facies interpreted as younger than upper Tolmer T3 labelled C, whether being Cambrian or Cretaceous.

The Burrell Creek

It appears to be much more silty to the east than to the west, where it seems to contain more numerous prominent sandstone ridges.

The strike is a general regional N10-20W and the beds steeply dipping.

The tectonic pattern is much better observed to the west than to the east.

The western Burrell Creek is affected:

- by the N10E Giants Reef Fault (A) and other faults having the same orientation, which crosses over the Tolmer Sandstone,
- by numerous N70E faults which affect also the Tolmer Sandstone,
- by less numerous N45 faults in the southern half,
- by rare E-W faults in the northern part.

The Tolmer Sandstone

Most of the E.L. is underlain by the lower Tolmer unit T1, but in the NW an area is present with the middle Tolmer T2 affected by a 30 to 40° westerly dip, differing from the general regional 5 to 15° easterly dip of T1 which exists on the western side of the E.L. If the dips are well noticeable on air photo in the T2 unit, this is not the case in the T1 unit. But, to the contrary, and certainly due to competence difference between those 2 units, the fractures and faults are well reflected in T1 unit while they are more faint in unit T2 (and this will be even fainter on the upper unit T3 when present to the south).

The T1 unit is heavily fractured and shows the following fault and fracture families:

- The NE10-15E, parallel to the Giants Reef Fault: major continuous accidents. Four can be noted, in addition to the Giants Reef Fault, (B, C, D, F).

- Numerous N70E to N100E accidents, especially well represented in the northern half and much less in the southern half. (The EW faults seem to be well marked in the T2 unit.) A major N70E fault (E) marks the northern boundary of the Tolmer with the Burrell Creek.

- Several N45 to N60 well represented in the centre and in the south of the E.L. (G, H, J, L). Some of them extend into E.L. 4857.

- Some N-S to N20W are noted all over the E.L.

4.5 GEOCHEMISTRY AND THERMOLUMINESCENCE

Analytical work comprised U, Th and Mg determinations on selected samples of basal Tolmer Sandstone and mobile U on sediments from streams draining the contact. Duplicate rock samples were sent to Adelaide University for thermoluminescence studies. This method uses artificial thermoluminescence to detect palaeoradiation or cumulative radiation effects within the quartz grains of the sandstone. If significant amounts of uranium (more than 10 ppm) have resided in the sandstone over a sufficient length of time (upward of 100 Ma) then this will result in major radiation damage to the host quartz lattice which will still be present even if the causative uranium has been leached. These studies have been performed on several Middle Proterozoic basal sandstones including the Athabasca and Kombolgie.

The presence of magnesium metasomatism has been recognized at Jabiluka both in the Cahill Formation and the Kombolgie. The source of the magnesium is considered to be the Mg-containing carbonate facies within the Cahill; the Mg has been leached and redistributed probably during metamorphism and hydrothermal events. The application of this method as an exploration tool at Tolmer assumes the presence of Mg-carbonate. Although none have been recorded in outcrop, such facies could exist beneath the Tolmer Sandstone cover. So far only 19 samples have been analysed, which represent approximately 130 km strike length of sandstone cover, 10 of these being from E.L. 4856. Much more intensive sampling is planned for the 1987 field season which will give a good understanding of the distribution of the Mg content and its possible relation to geological and geophysical factors.

A similar situation exists with the uranium analyses. Insufficient samples have been collected for any concrete conclusions to be drawn. Further stream sampling is planned.

4.6 PETROGRAPHY

Several rock specimens from the Eccles I and II anomalies were described by T.M.A. petrologists in Sydney and Bordeaux. These comprised representative lithologies from the Burrell Creek Formation.

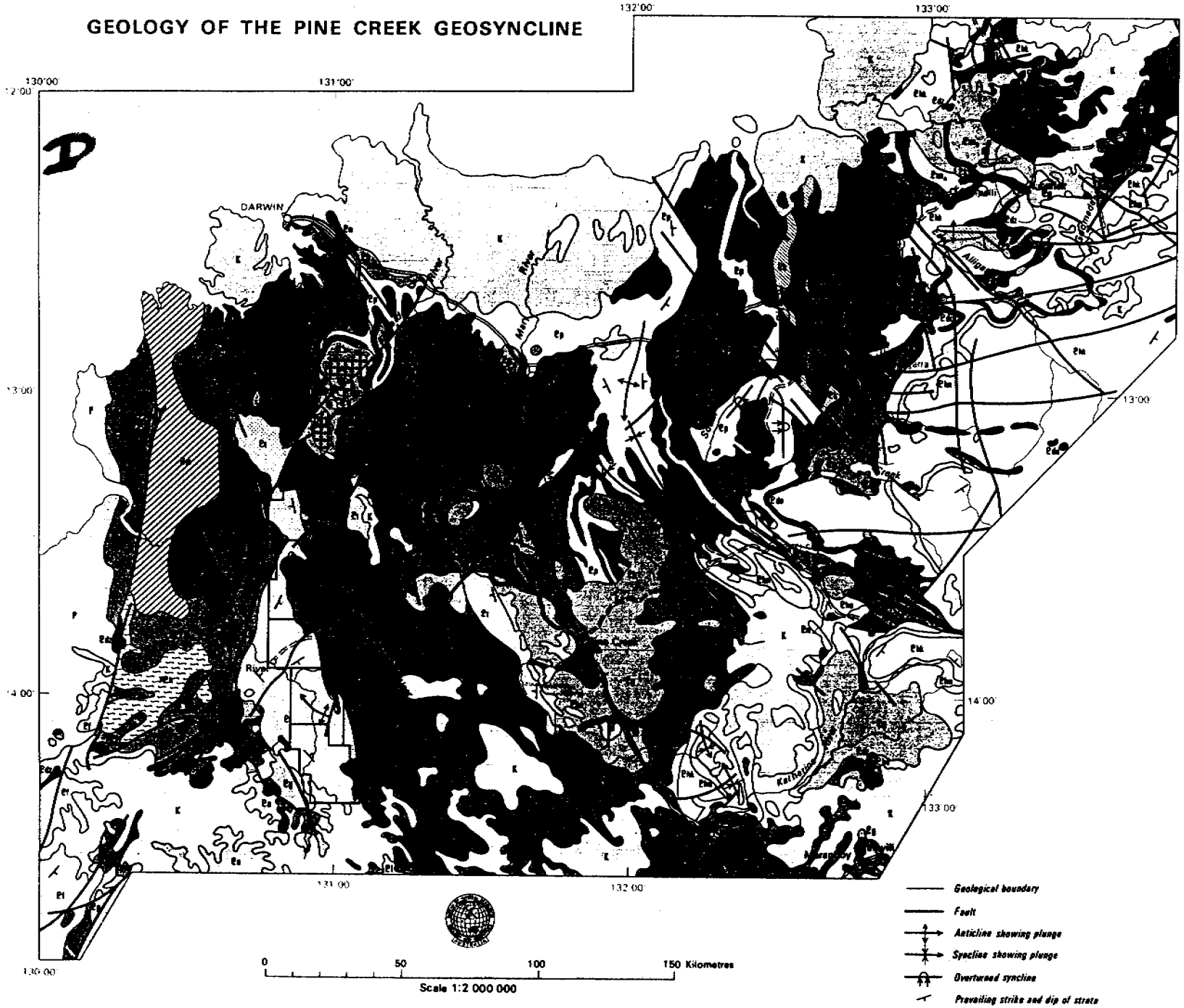
4.7 HELICOPTER RECONNAISSANCE

Prior to the commencement of field work a helicopter was used to assess the accessibility of the licence area for vehicles, to check the terrain for landing sites for the planned gravity survey and to gain an overview of the geology.

V. CONCLUSIONS

Exploration activities within the tenement are ongoing. Several localized areas of interest have been defined from the traversing and these will be followed up in 1987. To date no firm conclusions can be drawn from the work completed.

GEOLOGY OF THE PINE CREEK GEOSYNCLINE

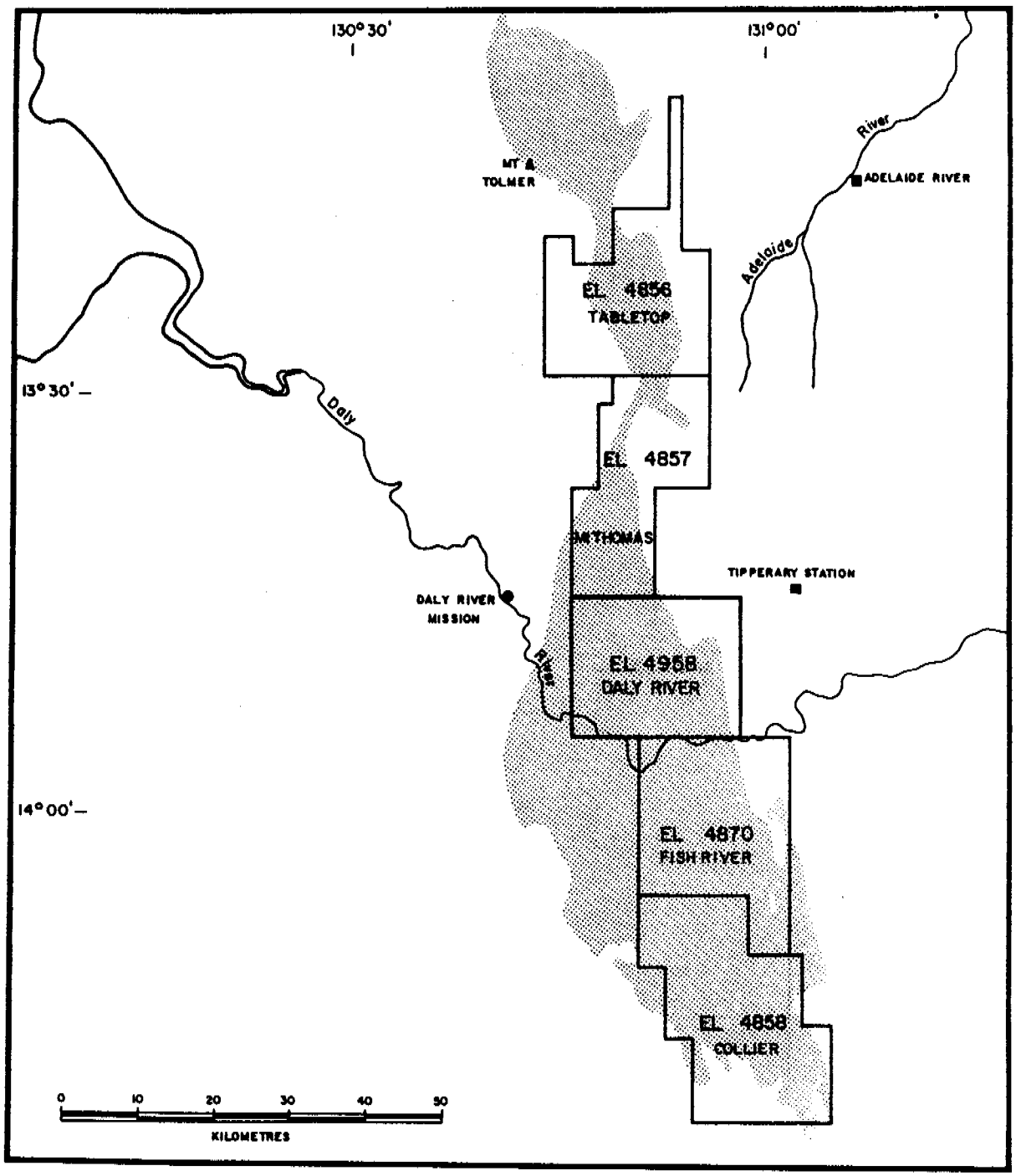


Mesozoic	Cretaceous	K	Sandstone, siltstone
Palaeozoic	Permian	P	Siltstone, sandstone, minor limestone, conglomerate
	Cambrian–Ordovician		Limestone, sandstone, siltstone, basalt conglomerate
Adelaidean?	Fitzmaurice Group	Ef	Sandstone, shale, siltstone, dolomite, conglomerate
	Auvergne Group	Ea	Siltstone, shale, sandstone, minor dolomite
	Bullita Group	Et	Siltstone, minor dolomite
Carpentarian?	Tolmer Group	Pt	Sandstone, dolomite, siltstone
Carpentarian	Kombolgie Formation	Pkm	Sandstone
		Pkm	Interbedded intermediate to basic volcanics
	Derpelli Dolerite		Olivine dolerite and differentiates
	Edith River Volcanics	Pem	Acid and minor basic volcanics, pyroclastics, sandstone
		Pg	Granite, adamellite, granodiorite, minor syenite
	Nimbuwah Complex		Granite, granodiorite
			Granitic to tonalitic migmatite
		Pnm$_a$	Lit-par-lit schist, gneiss
		Pnm$_s$	Quartz schist, pelitic schist
	Nourlangie Schist		Quartz schist
		Pn	Schist, gneiss
Early Proterozoic	Zamu Dolerite		Dolerite and differentiates, amphibolite in east
	Finniss River Group		Siltstone, greywacke, sandstone, acid to basic lavas, pyroclastics
	South Alligator Group		Carbonaceous and ferruginous shale w chert bands, carbonate, tuff, andesite,
	Mount Partridge Group	Ep	Sandstone, shale, quartzite, arkose, conglomerate; schist and gneiss in eas
	Namoona Group		Calcareous and carbonaceous shale, sandstone, limestone; schist and marble in east
	Kakadu Group	Pk	Leucogneiss, quartzite, schist
	Batchelor Group	Pb	Dolomite, magnesite, sandstone, arkose, siltstone, conglomerate
Archaean – Early Proterozoic?	Hermit Creek Metamorphics		Schist, amphibolite, migmatite
Archaean – Early Proterozoic	Litchfield Complex		Granite, granodiorite, pegmatite, migmatite
	Nanambu Complex		Leucogranite, migmatite, gneiss, granite, schist
	Rum Jungle Complex		Gneiss, granite, schist, metasediment
	Waterhouse Complex		Granite, gneiss, amphibolite, migmatite dolerite, metasediments

- Geological boundary
- Fault
- Anticline showing plunge
- Syncline showing plunge
- Overturned syncline
- Prevailing strike and dip of strata
- Prevailing strike and dip of foliation
- Major uranium deposit

PLATE 1

TOLMER PROJECT LOCATION



TOLMER SANDSTONE

N

TOLMER PROJECT

TENEMENT SITUATION

PLATE 2

MISTAKE CREEK

0555(-)

150000

Pts

Pts

148300

147400

0556 (0.4)

TO

COSTEANS

0 PDH light grey mica schist

0 PDH 1600/24 mica schist chloritic

PDH 0

0 PDH 1600/27 radical sandstone

PDH 0 1600/33 PDH grey schist and quartzite chloritic

Pts

0 557(1.1)

Pts

380 c/s

PDH 0 1600/45 micaceous siltstone

PDH 0 1600/46

PDH 0 1600/47 micaceous siltstone quartzite

146000

SURPRISE CREEK ANOMALY

146000

0 PDH Silver sandstone

0 PDH Light grey very fine micaceous schist

Pts

0 PDH

TL5

SURPRISE CREEK 558(0.1) NORTH

0559(-)

0 PDH ferruginous mica schist

Ptd

SURPRISE CREEK

0 PDH grey chloritic schist

0 PDH

TL6 radioactive spring 350c/s

CAMP SITE

5519 (0.5)

0 PDH chloritic micaceous siltstone

30°

5521 (-)

5518 (-)

TL66 radioactive spring up to 1900c/s

0 PDH

0 PDH grey chloritic schist

Ptd

TL7

60°

radioactive spring TL8 750c/s

ECCLES 1

graphitic shales

TO

142100

142100

0 PDH Silver sandstone

Ptd

Pfb

0 PDH

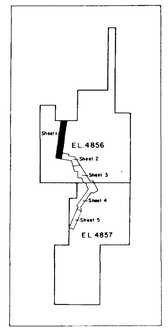
TL5

0 5516 (-) 141500

Pfb

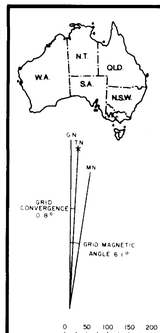
141300

141100



PTD	DEPOT CREEK SANDSTONE	
PTS	STRAY CREEK SANDSTONE	
SS	SANDSTONE	BURRELL CREEK FORMATION
SL	SILTSTONE	
SCH	SCHIST	
G	GRAPHITIC SHALE/SCHIST	
	DENOTES AREAS OF QUARTZ VEINING	
TL	THERMOLUMINESCENCE SAMPLE	
SS5(1)	STREAM SEDIMENT SAMPLE AND VALUE	
------	ACCESS TRACKS	

PLATE 3



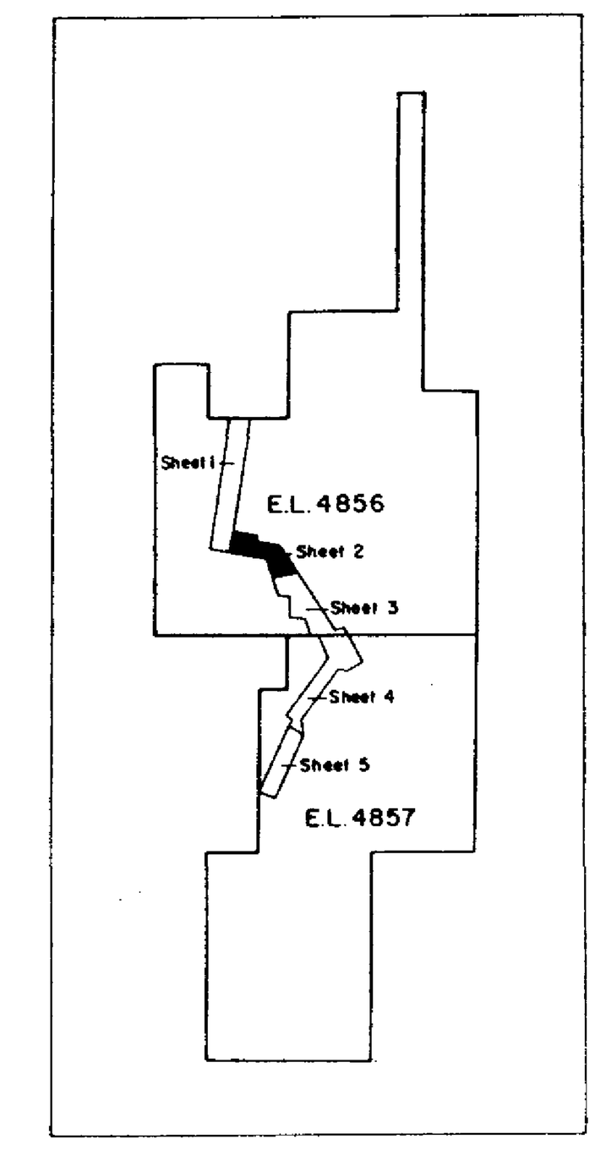
TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.
EL 4856
GEOLOGICAL COMPILATION SHEET 1

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
		P.M.	P.M.		APR 87

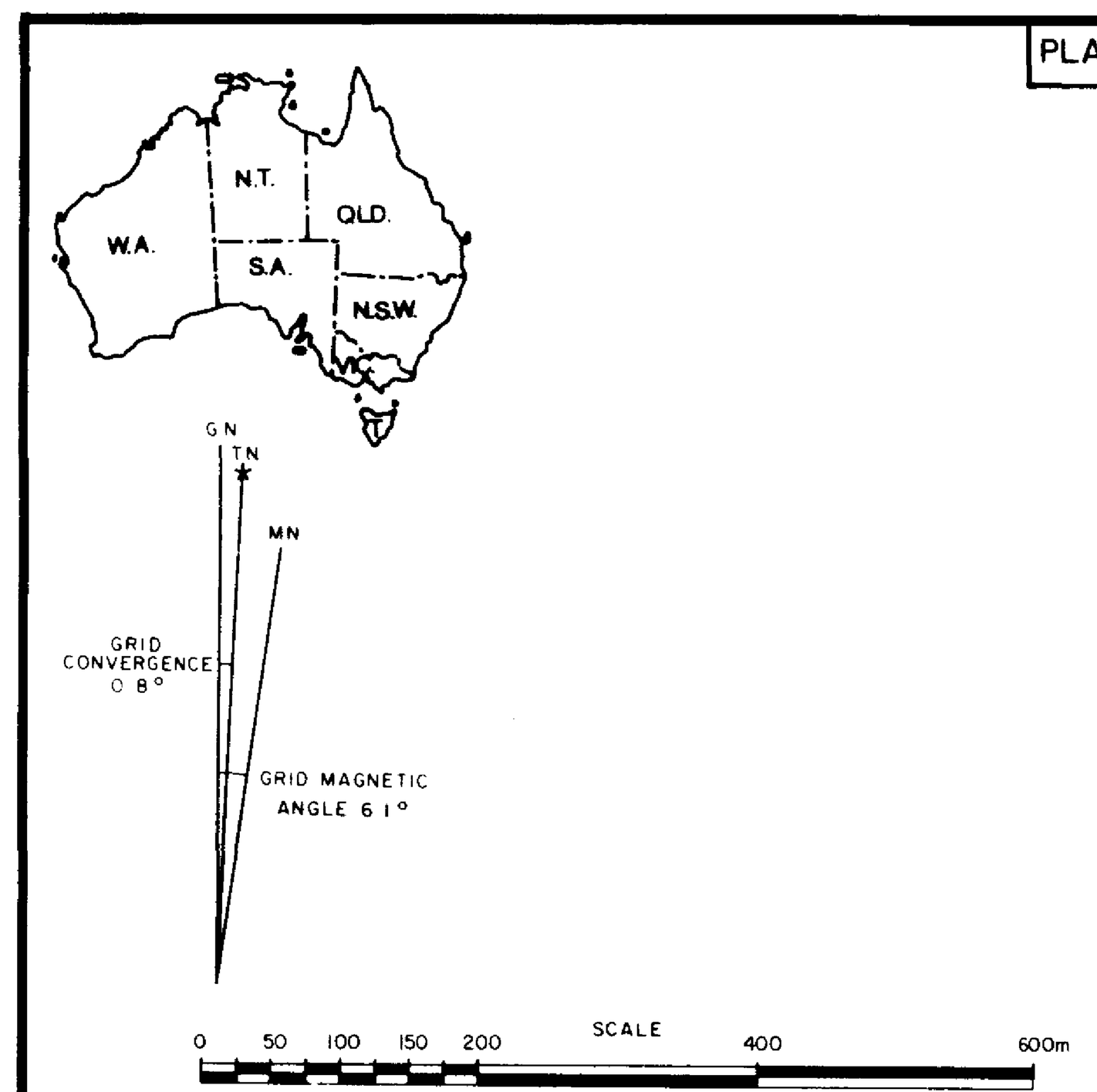
NORTHERN TERRITORY GEOLOGICAL SURVEY
CR87/1314

OFFICE | SCALE 1:5000 | SHEET OF | DRG. No. 547 - 051



PTD	DEPOT CREEK SANDSTONE	
PTS	STRAY CREEK SANDSTONE	
SS	SANDSTONE	BURRELL CREEK FORMATION
SL	SILTSTONE	
SCH	SCHIST	
G	GRAPHITIC SHALE/SCHIST	
(hatching)	DENOTES AREAS OF QUARTZ VEINING	
TL	THERMOLUMINESCENCE SAMPLE	
SS5(1)	STREAM SEDIMENT SAMPLE AND VALUE	
------	ACCESS TRACKS	

PLATE 4



TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.
E.L.4856
GEOLOGICAL COMPILATION
SHEET 2

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
		P.M	P.M		APR 87
	NORTHERN TERRITORY GEOLOGICAL SURVEY				
	CR87/131A				

OFFICE	SCALE 1:5000	SHEET OF	DRG. Nº 547 - 052

137000

5526(0.4)

5527(0.8)

136650

136100

135100

132200

SS

SI

Ptd

Fault

g.c.f. sandstone contact

AREA NOT TRAVERSED

GRANDY CREEK

BENTICO

5531 (-)

5532 (-)

5530 (-)

5528 (2.0)

TL9

EL 4856

Sheet 1

Sheet 2

Sheet 3

Sheet 4

Sheet 5

EL 4857

PTD	DEPOT CREEK SANDSTONE
PTS	STRAY CREEK SANDSTONE
SS	SANDSTONE
SL	SILTSTONE
SCH	SCHIST
G	GRAPHITIC SHALE/SCHIST

} BURRELL CREEK FORMATION

DENOTES AREAS OF QUARTZ VEINING

TL THERMOLUMINESCENCE SAMPLE

SS5(1) STREAM SEDIMENT SAMPLE AND VALUE

ACCESS TRACKS

PLATE 5

N.T. QLD. W.A. S.A. NSW

G.N. T.N. MN

GRID CONVERGENCE 0.8°

GRID MAGNETIC ANGLE 6.1°

0 50 100 150 200 SCALE 400 600m

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.
EL4856
GEOLOGICAL COMPILATION
SHEET 3

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
		P. M	P. M		APR. 87

NORTHERN TERRITORY GEOLOGICAL SURVEY
CR87/1314

OFFICE	SCALE	SHEET	DRG. No.
	1 : 5000	OF	547 - 053

130°30'
130°40'
130°50'
131°0'
13°0'
13°10'
13°20'
13°30'
13°40'
8560000
8550000
8540000
8530000
8520000
8510000
8500000
8490000
660000
670000
680000
690000
700000
710000
720000
730000
N

LEGEND

Instrument : WORDEN No 274

Bouguer density : 2.67 g/cc

Contour interval: 2 gu (0.2 mGal)

Gravity datum : IGSN71 (Isogal84)

Base station : N.T. Geological Survey gravity station N.8555-2037 located at Daly River opposite the Police station, with observed gravity value of 9783241.16 gu

No topographic correction applied

▲ Gravity station: BMR gravity data base
o Gravity station: TMA survey 1986
+ Gravity station: NTGS survey 1985

SCALE

1:100000

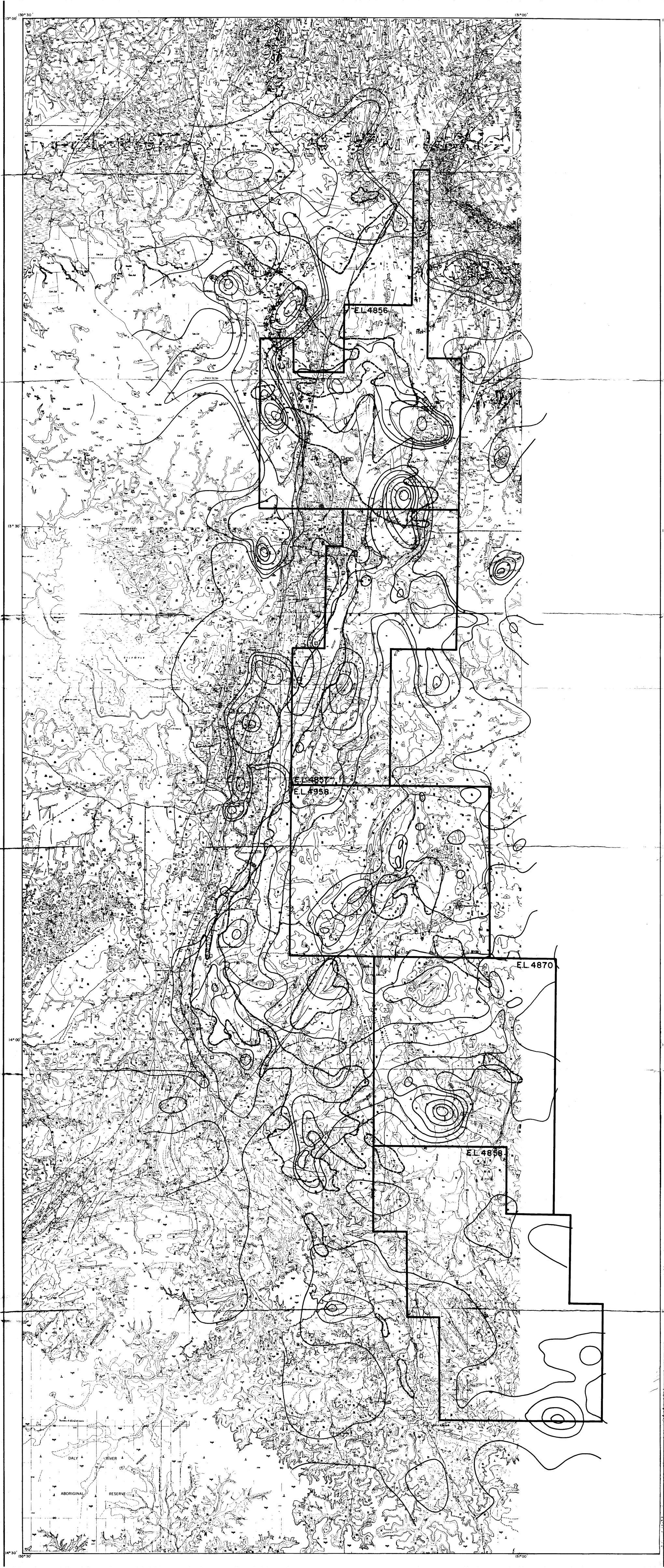
0 1 2 3 4 5 6 7 8 9 KM

Plate 6

TOTAL MINING AUSTRALIA PTY. LTD.

TOLMER PROJECT - N.T.
1986 Gravity Helicopter Survey
RESIDUAL ANOMALY CONTOUR MAP
Filter wavelength = 10 km
Northern Area
Prepared by TERRA GEOPHYSICS

Compiled by:	Date: 01-SEP-86
Drawn by: Geospex	Drawing No.: 547-019



U/Th Anomaly

Gravity - Bouguer Anomaly

Thermoluminescence Sample

Highly Anomalous Thermoluminescence Sample

Radiometric Anomaly

Magnetic Trend

Tolmer Sandstone

Granite

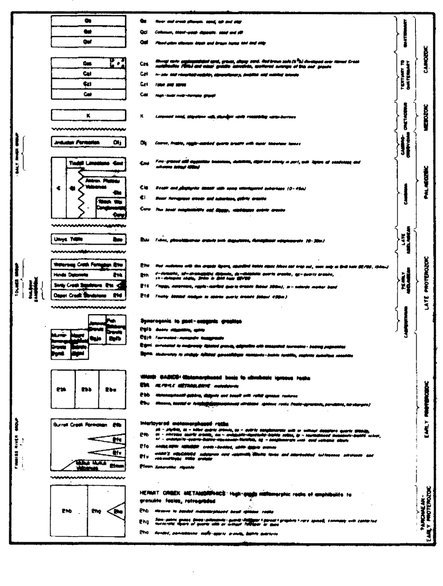
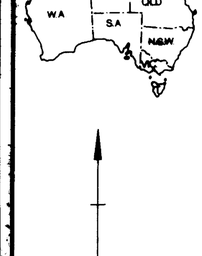


PLATE 7



SCALE 0 1 2 3 4 6 12 KM

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.

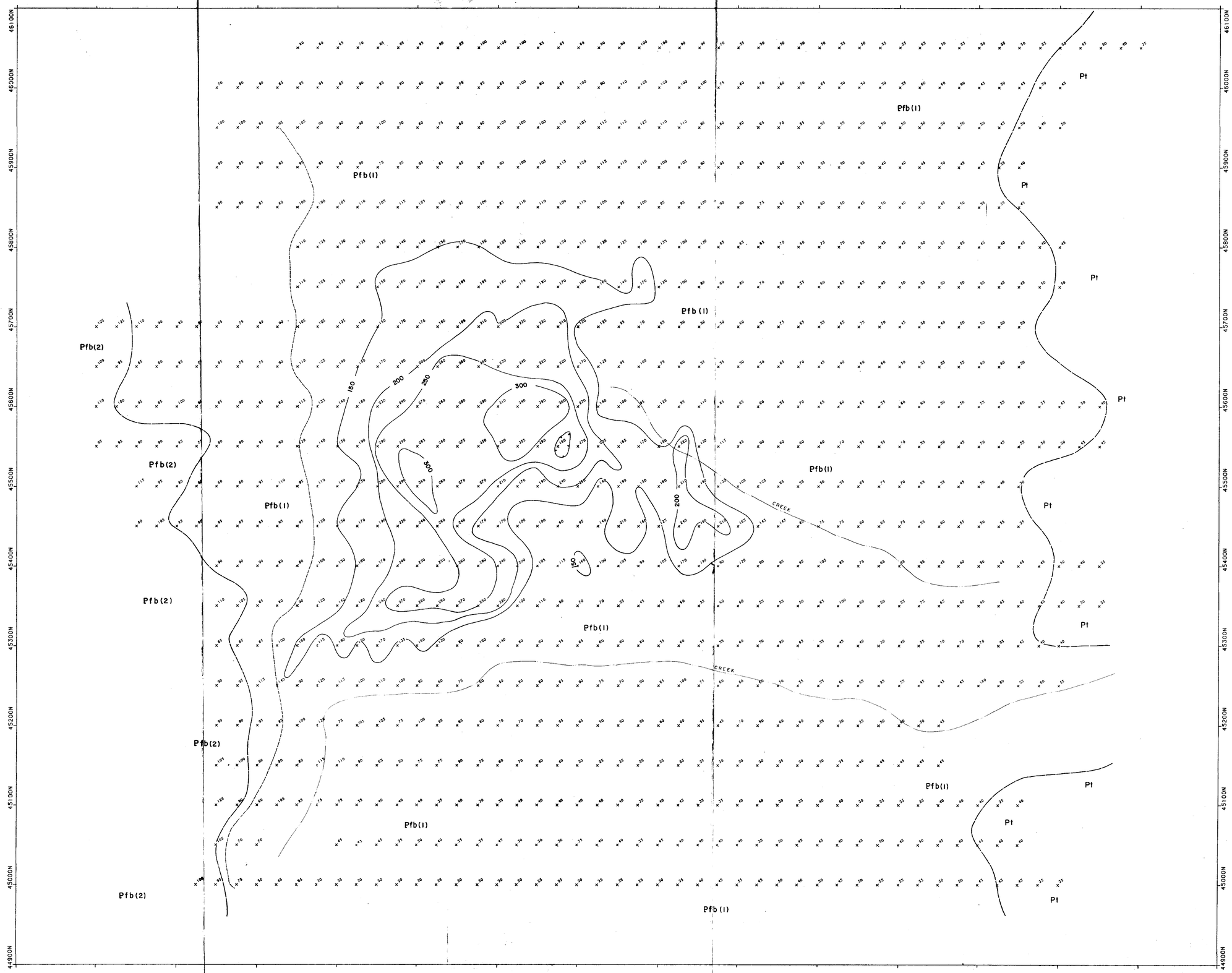
SYNTHESIS MAP

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

NORTHERN TERRITORY GEOLOGICAL SURVEY

CR87/1316

OFFICE	SCALE	1 : 100 000	SHEET	OF	DRG Nº 547 - 046



RADIOMETRICS

Readings taken waist height SPP 2 (881,2103).

Contours (150 - 300cps) at 50cps intervals.

GEOLOGICAL LEGEND

- Pt — TOLMER GROUP - Depot Creek Sandstone
- Pfb(1) — BURRELL CREEK FORMATION — Non Outcropping Schists - graphitic, chloritic, pyritic
- Pfb(2) — BURRELL CREEK FORMATION — Quartzites, Schist, Siltstone
- —— Outcrop Limit
- ------ Track

PLATE 8

MN

SCALE =

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.

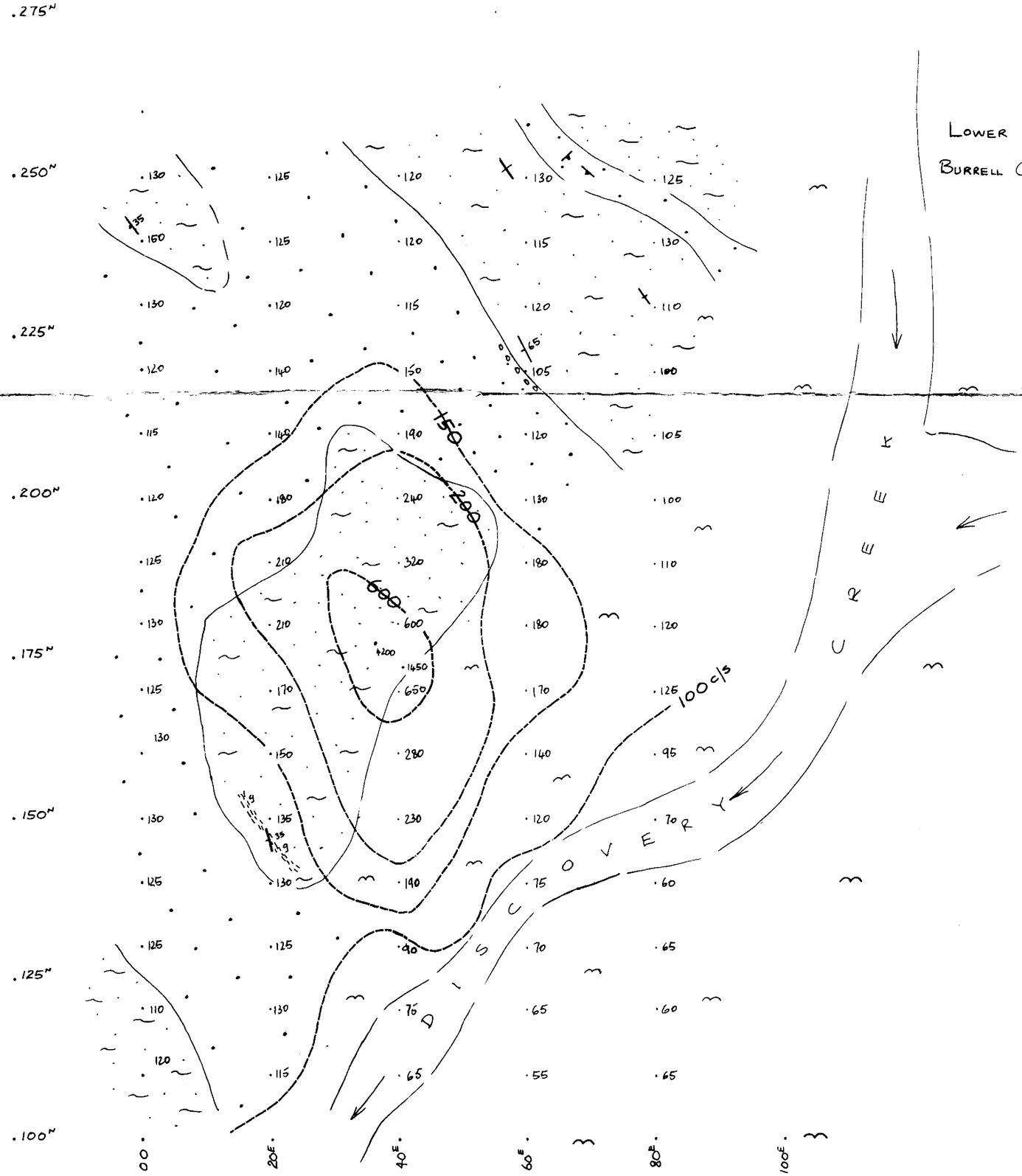
E.L. 4856

SURPRISE CREEK NORTH

RADIOMETRIC SURVEY

REV.	DESCRIPTION	PREP.	DRAWN	CHECKED	DATE
		P.M	G.R.	P.M	MAR 87

OFFICE: SYD | SCALE 1/2000 | SHEET 1 OF 1 | DRG. No 547-043



TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - E.L. 4856
ECCLES II PROSPECT
OUTCROP GEOLOGY & RADIOMETRICS

REV	DESCRIPTION	PREP	DRAWN	CHECKED	DATE
	[redacted]				
	NORTHERN TERRITORY GEOLOGICAL SURVEY. CR87/131B	P.M	P.M	P.M	APR 87

OFFICE	SCALE 1 : 500	SHEET OF	DRG No 547 - 047

BC BURRELL CREEK FORMATION

OUTCROPPING BURRELL CREEK BEDS

T1 LOWER TOLMER UNIT

T2 MIDDLE TOLMER UNIT

T3 UPPER TOLMER UNIT

OUTCROPPING BEDS

GRANITE OUTCROP

C CAMBRIAN TO CRETACEOUS UNDIFFERENTIATED FORMATION

ROAD AND TRACK

RIVER

FAULT OR FRACTURE

SYNCLINE AXIS

ANTICLINE AXIS

DIP

HORIZONTAL

+1234 AIR PHOTO NUMBER AND CENTRE

PLATE 10

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T.

E.L. 4856

AIR PHOTO STRUCTURAL INTERPRETATION

REV	DESCRIPTION	PREP	DRAWN	CHECKED	DATE
		B.B	G.R		APR. 87

NORTHERN TERRITORY GEOLOGICAL SURVEY

CR87/131B

OFFICE	SCALE	SHEET	OF	ORG. Nº
	1: 25000			547 - 066

E.L. 4856

E.L. 4857

E.L. 4958

E.L. 4870

E.L. 4858

I

II n

γ

A

C

IV n

III

B

IV s

I'

B'

C

A'

III'

II'

C'

IV'

D'

E'

V'w

V'e

γ

OUTCROPPING GRANITE

OUTSIDE LIMIT OF TOLMER SANDSTONE

RESIDUAL GRAVITY LOW

RESIDUAL GRAVITY HIGH

PROFILE SHOWING GRAVITY RESIDUAL OUTLINE FROM THE RESIDUAL ANOMALY CONTOUR MAP

MAPPED FAULT

POSSIBLE GRANITE BELOW TOLMER SANDSTONE

PLATE 11

N.T

QLD

W.A

S.A

N.S.W

N

SCALE

0 1 2 3 4 8 12 KM

TOTAL Mining Australia Pty. Limited

TOLMER PROJECT - N.T

GRAVIMETRIC INTERPRETATION
FROM RESIDUAL GRAVITY ANOMALY PROFILE

REV	DESCRIPTION	PREP	DRAWN	CHECKED	DATE
		B.B	G.R		APR.87

NORTHERN TERRITORY GEOLOGICAL SURVEY

CR87/1316

OFFICE | SCALE 1 : 100 000 | SHEET OF | DRG Nº 547 - 062

130°30' 130°40' 130°50' 131°0'

13°0' 13°10' 13°20' 13°30' 13°40'

8660000 8650000 8640000 8630000 8620000 8610000 8600000 8590000

8650000 8670000 8680000 8690000 8700000 8710000 8720000 8730000

E.L 4856

E.L 4857

N

LEGEND

Instrument : WORDEN No 274

Bouguer density : 2.67 g/cc

Contour interval: 10 gu (1 mGal)

Gravity datum : IGSN71 (Isogal84)

Base station : N.T. Geological Survey gravity station N.8555-2037 located at Daly River opposite the Police station, with observed gravity value of 9783241.18 gu

No topographic correction applied

▲ Gravity station: BMR gravity data base
▫ Gravity station: TMA survey 1986
+ Gravity station: NTGS survey 1985

SCALE

1: 100000

0 1 2 3 4 5 6 7 8 9 km

Plate 12

TOTAL MINING AUSTRALIA PTY. LTD.

TOLMER PROJECT - N.T.

1986 Gravity Helicopter Survey

BOUGUER ANOMALY CONTOUR MAP

Northern Area

Prepared by TERRA GEOPHYSICS

Compiled by:	Date: 18-AUG-86
Drawn by: Geospex	Drawing No.: 547 - 018

130°30'
130°40'
130°50'
131°0'
13°0'
13°10'
13°20'
13°40'
8560000
8550000
8540000
8530000
8520000
8510000
8500000
8490000
650000
670000
680000
690000
700000
710000
720000
730000
E.L 4856
E.L 4857
N

LEGEND

Instrument : WORDEN No 274

Bouguer density : 2.67 g/cc

Contour interval: 10 gu (1 mGal)

Gravity datum : IGSN71 (Ieoga184)

Base station : N.T. Geological Survey gravity station N.8555-2037 located at Daly River opposite the Police station, with observed gravity value of 9783241.18 gu

No topographic correction applied

Gravity station: BMR gravity data base
Gravity station: TMA survey 1986
Gravity station: NTGS survey 1985

SCALE

1:100000

0 1 2 3 4 5 6 7 8 9 km

Plate 15

TOTAL MINING AUSTRALIA PTY. LTD.

TOLMER PROJECT - N.T.
1986 Gravity Helicopter Survey
REGIONAL ANOMALY CONTOUR MAP
Filter wavelength = 10 km
Northern Area
Prepared by TERRA GEOPHYSICS

Compiled by:	Date: 19-AUG-86
Drawn by: Geospex	Drawing No.: 547-021