WEST PINE CREEK JOINT VENTURE
TOLMER PROJECT
EL 4856 AND EL 4857
ANNUAL REPORT TO
THE DEPARTMENT OF MINES & ENERGY
1991
VOLUME 1 - TEXT AND APPENDICES
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1. SUMMARY

Exploration on the western margin of the Pine Creek Geosyncline was concentrated on the unconformable contact between the Lower Proterozoic Burrell Creek Formation and the overlying Middle Proterozoic Tolmer Group. This exploration has defined limited but significant chlorite and graphite schist, as well as pegmatite intrusives accompanied by strong folding and faulting in the Lower Proterozoic metasediments at or near the unconformity with the Tolmer Group. Some of these zones have also been found to contain uranium mineralisation.

A combination of geological mapping and certain geophysical surveying (alphacard, scintillometry, EM-37, VLF, mise à la masse) was used to define drilling targets.

In the Tolmer Group, although being highly resistant where tested, the basal units were strongly hematised and in places brecciated, which made interpretation of the loci of buried conductors difficult. Where the Tolmer Group was thick (>100m) none of the geophysical methods were satisfactory. The EM-37 Input method defined many false anomalies such as packed water tables, natural springs, hematite-rich horizons, etc., which, for a time, misled the exploration. Some anomalies did however lead to the discovery of significant amounts of chlorite and graphite schists being present in the Lower Proterozoic sedimentary pile which in some places contained uranium mineralisation.

Uranium mineralisation intersected at the ECCLES II Prospect was confined to small pods which are apparently partly stratiform and partly structurally controlled. This accumulation is definitely not of any economic significance.
2. INTRODUCTION

2.1 GENERAL

This report covers the 1991 exploration activities in EL 4856 and EL 4857 which were explored together as the "Tolmer Project" of the West Pine Creek Joint Venture. This Joint Venture is between TOTAL Mining Australia Pty Limited and PNC Exploration (Australia) Pty Ltd with TOTAL Mining being the manager in 1991.

2.2 DESCRIPTION OF THE AREA

The tenements EL 4856 (7 sub-blocks) and EL 4857 (2 sub-blocks) are located north of the Daly River Settlement in the Tolmer South area, approximately 110Km south of Darwin.

EL 4856 has recently been incorporated within the Litchfield State Park.

The 1991 tenement situation is illustrated in Figure 1.

2.3 LOGISTICS

EL 4856 and EL 4857 can be reached from the main Daly River road by a series of bush tracks and station roads in the dry season only. The area is generally accessible from mid-April to December. The access road to EL 4856 has become popular with tourists as it also gives access to the Surprise Creek Falls, now a popular weekend camping site. The campers also use the various exploration tracks, which is hindering the natural restoration and revegetation of the tenement area.

The principal watercourse is the northwest-flowing Reynolds River. This is fed by a number of large creeks and springs draining the Tolmer plateau. Savanna woodland predominates with areas of open black soil plains also occurring.
TOLMER PROJECT
Tenement Situation
1991

Figure 1.
2.4 TARGETS

The Joint Venture has been exploring the western margin of the Pine Creek Geosyncline for unconformity-type uranium deposits, believed to be located at or near the contact between the Lower Proterozoic sedimentary sequence mapped as Burrell Creek Formation and the Middle Proterozoic Tolmer Group.

Similarities are known to exist between the lithologies mapped in the Tolmer Project area and those of the Alligator Rivers Uranium Field. These, and the fact that uranium mineralisation, hydrothermal alteration, and both chlorite and graphite alteration zones have all been found within the Tolmer Project area, has reinforced the exploration model.

The Joint Venture's exploration activities, although based on the model developed in the Alligator Rivers and the Athabascan provinces, has been developed to suit variations in the geological, tectonic and morphological features specific to this project area.
3. GEOLOGY

3.1 REGIONAL SETTING AND STRATIGRAPHY

The Tolmer Project is on the western margin of the Pine Creek Geosyncline.

The following stratigraphy is based on work published by the N.T.G.S. (1983).

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

LOWER PROTEROZOIC: Burrell Creek Formation (Pfb) consists of variably metamorphosed sandstones and siltstones, and includes pebble and conglomerate facies, graphitic and chloritic shales/schists and some carbonate rocks.

MIDDLE PROTEROZOIC:

i) Carpentarian synorogenic to post orogenic granites represented by the Mt. Litchfield, Allia Creek and Jamine Granites and the Soldiers Creek Granite at Collia (Pxml, Pxga, Pxgi, and Pgs). The Reynolds River and Alligator Creek Granite located in the northern section of the Tolmer Project area are also Carpentarian (Middle Proterozoic) in age.

ii) The ?Early Adelaidean Tolmer Group is made up of four separate formations.

+ Depot Creek Sandstone: (Ptd) thickly-bedded medium to coarse quartz arenite (450m).
+ Stray Creek Sandstone: (Pts) flaggy, micaceous, ripple marked quartz arenite (300m).
+ Hinde dolomite: (Pth) dolomite, dolomitic shales and arenites, quartz arenites (+314m).
+ Waterbag Creek Formation: (Ptw) red mudstone with thin arenite layers (non outcropping ) (+134m).
iii) Late Adelaidean *Univa Tilita* (0-30m) (Puu)

PALAEZOIC: Cambrian *Daly River Group*. Basal conglomerates, Antrim Plateau Volcanics (basalts) and the Tindall Limestone (6la).

MESOZOIC: Flat-lying sediments occur as residuals, forming "flat-top" hills and overlying either the Tolmer Group or the Cambrian. They comprise grey, silicified, laminated siltstones, sandstones and conglomeratic sandstones, and laterite.

3.2 STRUCTURE

3.2.1 Faulting

The principal structural feature of the region is the Giants Reef Fault which is a major tectonic feature that can be traced for over 200km. The Giants Reef Fault has been apparently active over a long period of time. It was active until after the deposition of the Depot Creek Sandstone in the Middle Proterozoic and has produced substantial lateral movement, up to 8km which is shown by displacement of the various units of the Tolmer Group. Major conjugal splay faults such as the Stapleton and Rock Candy Range faults, and many other minor ones traverse both the Lower Proterozoic and Middle Proterozoic Formations. Major low-angle thrust faulting has occurred in some areas associated with the Giants Reef Fault.

3.2.2 Folding

Folding of the Lower Proterozoic Burrell Creek Formation is generally fairly intense, with north-south fold areas trending between 340° and 30° and with steep fold limbs. Axial plane lineaments form the major deformational feature, and hence produce the most prominent cleavage. This has been complicated by the intrusion of granitic domes in some areas and by pegmatites in others. The
Pegmatites generally are concordant with the foliation but may also be controlled at least in part by the bedding.

The overlying Tolmer Group dips gently eastwards forming the extensive Daly River Basin. There are local variations to this regional dip which are probably due to an undulating depositional surface.

Folding is known to occur in the Tolmer Group adjacent to the Rock Candy Fault where it forms an elongated domal structure thought to be underlain by an intrusion of Carpentarian granite.

The Cambrian sediments are nearly flat lying within the prospect area.

Regional dips are moderate to steep westerly for the Burrell Creek Formation and gently towards the east for the Tolmer Group. The regional strike is N-S to NW-SE.
4. ECCLES II PROSPECT EVALUATION

4.1 METHODS AND STATISTICS

+ Drilling

The 1991 Tolmer drilling programme commenced on 8th August 1991 and was completed on 3rd September 1991 after drilling 21 holes for 1716m of rotary percussion drilling.

Table 1, Drilling Statistics, gives the details of this drilling programme.

Rockdrill Contractors Pty Ltd of Brisbane was contracted to carry out the drilling in 1991 using a Versatile 1000 rig (modified Foxmobile) mounted on a 6x6-WD Leader truck. A 6x6-WD support truck was also required. The programme consisted of down-hole percussion drilling of angle holes, 5 1/2" in diameter, dipping 60°. Samples representative of each 1m were collected and laid out on the ground for geological logging and radiometric recording.

+ Gamma Logging

On completion, each hole was systematically logged through the drill stem using an SIE 450E portable logging unit and a calibrated NaI scintillometric probe. Analog charts were recorded and these were used to produce the drill logs and sections which accompany this report. The logging parameters used were as follows:

- Logging Speed: 3m/min
- Chart Scale: 1:100
- Integration Time: 1 sec
- Chart Full Scale Reading: 100, 500, 5,000 c/s depending on the radioactivity encountered.
+ Drill Hole Sampling

Each meter was checked using a hand held scintillometer (SPP-2) and the reading recorded. Anomalous values were sampled for analyses for uranium and thorium by XRF and the samples with the maximum radioactivity were also analysed for mobile uranium by acid digestion and ICP analyses. The results are shown in Appendix 1 of this report. Systematic analyses of percussion samples was not thought warranted this year because of dilution and pollution problems caused by both the drilling and the sampling techniques. The radiometric (gamma) logging using a calibrated probe is sufficient to determine the presence and grade of any uranium intersected in the drilling.

+ Surveying

The collars of all drill holes have been related to the local grid co-ordinate as had the geological and geophysical mapping carried out previously.

+ Rehabilitation

A total of 16 line kilometres of grid pegs have been removed from the former T10 prospect. The remaining pegs from T10, SH2, ECCLES II, Mistake Creek and March Fly will have to be removed in 1992. This is a requirement of the Department of Mines and Energy for EL 4856 and EL 4857 and is being enforced partly because the tenement area had become a Northern Territory State park.

Officers from the Conservation Commission of the Northern Territory have visited the SH2, ECCLES II and T10 prospects to inspect the natural regrowth on the various drill pads and access routes. Natural vegetation is well established at SH2, T10 and Mistake Creek after one season. Inspection in 1992 with officers of the Conversation Commission will determine what, if any, additional bulldozing is required. The Conservation Commission will also indicate which, if any, of the exploration roads they wish to remain open.
All drill holes have been capped to prevent fauna entering and being trapped. The casing has been left in place to prevent the hole caving in at the surface, and so the hole can be considered effectively blocked.

4.2 GEOLOGY

The ECCLES II Prospect was discovered as part of the regional systematic radiometric and geologic traversing of the unconformable contact between the Lower Proterozoic metasedimentary units and the Middle Proterozoic sandstone cover. This survey with traverses every 50m extended several hundred metres into the sandstone and up to one Km into the Lower Proterozoic. A significant radiometric anomaly was recorded on the bank of a creek close to an outcrop of graphite and chlorite schist. A pegmatite/greisen with a muscovite quartz composition and minor tourmaline was also mapped close to the radiometric anomaly. This anomaly was called ECCLES II.

The area was mapped and detailed alphacard, radiometric and VLF surveys were carried out over the entire area from the SH2 prospect in the north through the ECCLES II Prospect to SH3 in the south. Both SH2 and SH3 were EM37-Input electromagnetic anomalies. This work has shown that the Lower Proterozoic metasedimentary units (Burrell Creek Formation) in the vicinity of the ECCLES II Prospect is relatively tightly folded, sometimes with isoclinal folds, with a well developed cleavage parallel to the axial plane of the folding, which is here approximately north south.

The predominately psammitic units are intruded by narrow pegmatite and quartz veins which preferentially follow the strike and dip of the regional cleavage.

+ Lower Proterozoic

The Lower Proterozoic in the area surrounding the ECCLES II Prospect is the Burrell Creek Formation. This formation forms steep-sided hills, has a regional strike of 330° magnetic and
is tightly folded with steep dips to both the east and the west, i.e. there is a series of synclines and anticlines at the local scale. The regional dip, however, is towards the west at around 60°.

Faulting undoubtedly occurs in the area, but is difficult to recognise except where it has become the locus of intrusion. The tight folding combined with the constant repetition of beds and also the lithologic similarity giving no specific marker beds to follow, makes the mapping of structures difficult. Much of the ECCLES II prospect area is either on steep scree-covered slopes, or covered by thick black sandy alluvium, both of which mask the outcrop geology and to some extent the radioactivity.

The lithologies at the ECCLES II Prospect consist of argillaceous through to rudaceous types with the most common being:

i) Reddish, sericitic metasiltstone and fine-grained sandstone, generally intimately interbedded with each other.

ii) Darker coloured sericite schists and sericitic andalusite schists. The latter has crystals up to several centimetres in length. Graphitic and chloritic schists are limited to specific horizons. They appear to be limited in both their width and their strike length, i.e. lenses within an otherwise monotonous sericitic sandstone unit.

iii) Fine to medium-grained sericitic metasandstones (quartzite), ranging from impure to fairly pure quartz-rich variants. Gritty to conglomeritic facies outcrop more commonly near the present contact with the Middle Proterozoic cover rocks.
Late stage quartz veining is prominent especially adjacent to fold axes. Greisen veins are also fairly common and can be quite intensive - up to several hundred metres in length. In places they grade into quartz with only subordinate mica. The vein systems, as shown by the drilling, proved to be far more widespread than expected from the surface mapping carried out on the ECCLES II Prospect area.

The effects on the country rock as a result of these intrusives are as follows:

i) The metasandstones have a higher mica (sericite) content and are generally more silicified near the intrusion.

ii) Hematite staining and alteration due to weathering increases towards the intrusion.

iii) The development of andalusite and tourmaline seems to be stronger adjacent to the intrusion in the more pelitic units.

iv) There appears to be a special relationship between the intensive intrusive veining and the presence of graphite/carbonaceous rocks. There is also an apparent special relationship in some cases between uranium, graphite and these intrusive pegmatites, ECCLES II and March Fly are examples, although there are numerous examples in which both pegmatite and graphite exist with no apparent uranium mineralisation, e.g. anomaly T20, and Mistake Creek.

Much of the ECCLES II Prospect area is covered by thick boulder scree from Depot Creek Sandstone that masks both the geology and to a certain extent, the radiometry. The drill pads and road access have provided good surface geological control for the mapping and now the various drill holes have increased the geological knowledge of the prospect area considerably.
The prospect area consists of a predominately fine to medium grained, poorly sorted sericitic sandstone with interbeds and lenses of schist. The schists vary in lithology with the sericitic, chloritic and graphitic types occurring in decreasing order of abundance. There is also a high density of pegmatite/greisen intrusives which appear to be cleavage rather than stratabout controlled. These intrusive pegmatites, in the direct vicinity of the mineralisation, vary from several metres (3-5m) to centimetres in thickness, and their accompanying alteration effects vary in proportion to their thicknesses.

The mineralisation sequence consists of fine to medium-grained sericitic schist, graphite schist, Mg-chlorite schist, and interbedded metasandstone all intruded by the above mentioned pegmatites and/or greisen bodies. The mineralised zone occurs on the west-dipping limb of a local anticlinal structure the axis of which is defined by numerous quartz-filled cleavage planes. There is a major east-west trending fault now defined by the Eccles creek. This dextral block-fault has had a significant effect on the continuity of the mineralised pod intersected at ECCLES II as no mineralisation was noted to the south of this fault. Here was only minor graphite and chlorite schists interbedded in a predominately sericitic fine to medium-grained poorly sorted sandstone which is less intensely intruded by pegmatite and/or greisen.

It seems that mineralisation at the ECCLES II Prospect is not continuous but occurs as a number of small irregular pods probably structurally as well as lithologically controlled, as mineralisation occurs in several different lithologies.

+ Middle Proterozoic

The Tolmer Group represented at the ECCLES II prospect area comprises mainly the basal "laminated" sandstone with some hematitic breccia also occurring. The contact between the Middle and Lower Proterozoic is usually unconformable but may be faulted.
A subdivision has been made of the Tolmer Group based on lithologic variation and this is summarised below.

i) "Laminated" facies: banded, thinly bedded, red/white sandstone, generally fine grained and free of pebble laminae.

ii) + Very ferruginous, ?lateritised, fine to medium grained pebble sandstone. This unit is strongly brecciated in places.
   + A pink to white sandstone which is further divided into two subfacies.
   - Pink to white, fine to medium grained, silicified sandstone.
   - As above but with abundant lenses of pebbly, conglomeratic and grit material. This subfacies shows many features associated with a turbid sedimentary environment.

4.3 DRILLING

4.3.1 Introduction

Positive exploration results in 1990 at the SH2-ECCLES II prospect led to the definition of a small drilling programme in 1991. The aim of the 1991 exploration programme was to evaluate by drilling the mineralised trend known to exist at ECCLES II in order to apply for an Exploration Retention Lease, if warranted, in 1992. This programme was based on the results of previous drilling, geological mapping, and geophysical (VLF, radiometric and alphacard) surveying. The pattern of drill holes was planned to identify and evaluate the potential of the known mineralisation at the ECCLES II prospect and to extend the exploration knowledge at the Palm Valley and SH2 prospects (particularly in the vicinity of the mise à la masse anomaly around hole TOL-P-82).

A summary of the 1991 drilling is given in Table 1 overleaf.
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Two holes were drilled in 1991 on cross section 7800N: TOL-P-103, 25m east, and TOL-P-104, 25m west of the 1990 mineralised hole, TOL-P-96. These holes were sited to test both up-dip and down-dip extension of mineralisation already known to exist.

+ TOL-P-103
Co-ordinates 7800N 9934E
Azimuth 045° magnetic
Declination -60°
Depth 90m
Radioactivity:
At 23.4m Peak 1: maximum 160cps 0.4m >100cps
At 35.8m Peak 2 maximum 172cps 1.1m >100cps
Total >100cps 2.4m cumulative

Note: This hole was logged through the drill stem in a dry hole.

The hole intersected mainly sericitic sandstone/quartzite with two minor intersections of pegmatite/greisen. Minor carbonaceous sandstone was also intersected, no chloritic alteration was noted.

There was a low order radiometric anomaly intersected from the surface to 15m. This corresponds to the up dip extension of the broad but low-grade mineralisation found in hole TOL-P-96 in 1990.

+ TOL-P-104
Co-ordinates 7800N 9884E
Azimuth 045° magnetic
Declination -60°
Depth 90m
Radioactivity:
At 46.4m Peak 1: maximum 1150cps
At 40.7m Peak 2: maximum 970cps
Total >500cps 3.9m cumulative between 39.4 - 46.7m
Note: This hole was logged through the drill stem in a dry hole.

See Appendix 1 for results of analyses of percussions chips taken from this hole.

This hole was drilled 25m west of TOL-P-96 to test the down-dip extension of mineralisation intersected in that hole. TOL-P-95 was drilled essentially down-dip in an unmineralised unit.

The hole intersected abundant carbonaceous and chloritic units which were intruded by greisen or pegmatite veins.

The radioactive anomaly occurs in a strongly carbonaceous and black chlorite-rich hornfels or indurated fine grained sandstone. It is thought to be the down-dip extension of mineralisation found in hole TOL-P-103. It is a stronger, more defined radioactive anomaly than the near-surface anomaly in TOL-P-103 and there are numerous intrusive pegmatite veins. It is interesting to note that immediately west of hole TOL-P-104 a lens of black graphite schist, exposed in the fresh bulldozed cut, only has background radioactivity. This lens of graphite schist is approximately 2m wide and can be traced for around 10m only and is illustrative of the nature of the facies variations in the area.

Because of the steepness of the hill it was not possible to drill further to the west without major earthworks.

Conclusion
There is an apparent stratigraphic control to the mineralisation intersected on cross section 7800N. The mineralisation occurs on the west limb of an anticline, hosted by an alternance of chlorite/graphite schist and chlorite sandstone, with numerous pegmatite/greisen veins intruding the sequence.
4.3.3 Drill Cross Section 7850N (Plate 3)

Two holes (TOL-P105 and 106) were drilled on cross section 7850N to test the northward extension of the mineralisation noted on cross section 7800N.

+ TOL-P-105
Co-ordinates 7840N 9904E
Azimuth 034° magnetic
Declination -60°
Depth 90m
Radioactivity maximum at 50.3m 300cps
Total 1.1m >100cps between 50.2 - 64m

This hole was planned to be collared further to the west, but the topography was too steep to allow this without extensive earthmoving works.

The hole intersected an interbedded sequence of carbonaceous sandstone with minor chlorite and sericitic sandstone intruded by pegmatite/greisen veins. The minor mineralisation intersected was hosted by a sericitic sandstone containing small euhedral authigenic tourmaline crystals. The presence of tourmaline implies the near proximity of an intrusive greisen/pegmatite vein.

As indicated above, only minor radioactivity was found associated with a sericite schist. Although this is anomalous it is not of economic significance.

+ TOL-P-106
Co-ordinates 7850N 9936E
Azimuth 041° magnetic
Declination -60°
Depth 90m
Radioactivity maximum at 39.8m 165cps
Total 2.9m >100cps cumulative
This hole intersected mainly a fine to medium-grained sericitic sandstone similar to the lithology described in hole TOL-P-103.

A mineralised phenomenon was intersected associated with grey chloritised sericite schist with minor hematite staining.

Conclusion
Weak uranium mineralisation was again intersected on the west dipping limb of an anticline. The host lithologies were interbedded graphite/carbonaceous schist and sandstones intruded by numerous pegmatite/greisen veins.

4.3.4 Drill Cross Section 7700N (Plate 4)

Two holes were drilled on cross section 7700N in 1991 to test the southern extension of the mineralisation intersected in holes TOL-P-8 and 9 as well as a major VLF anomaly (see plate 14). It was planned to drill further to the west but this was prevented by the Eccles Creek itself. The drill samples from hole TOL-P-108 were strongly contaminated due to the collar blowing out as the hole was collared in creek alluvium.

It is thought that a major dextral block fault centred on Eccles Creek may have lateral movement of around 50m although this is not evident from the geological plan.

+ TOL-P-107
Co-ordinates 7700N 9875E
Azimuth 047° magnetic
Declination -60°
Depth 84m
Radioactivity maximum at 7.3m of 285cps.
Total 4.5m >100cps between 3.8 - 104m
Hole TOL-P-107 intersected mainly a sericitic sandstone and chlorite sericite schist. There was a small low-grade radiometric anomaly hosted by an iron-stained sericitic schist between 0 and 12m. This anomaly was broad, but of low grade.

+ TOL-P-108
  Co-ordinates  7700N  9000E
  Azimuth       045° magnetic
  Declination   -60°
  Depth         66m
  Radioactivity Nil

This hole was drilled almost entirely in a green sericite/chlorite schist. It is thought to have intersected the anticlinal axis and continued down the east-dipping limb as shown on the section (plate 4).

No radioactive anomaly was intersected and there was not even a lithologic variation in the radioactivity down the hole. Changes to the lithology noted were quite subtle however.

Conclusion
It is thought that a dextral block-fault represented by Eccles Creek has moved the southern block towards the west by around 50m. Hole TOL-P-108 has a similar lithology to TOL-P-103.

4.3.5 Drill Cross Section 7650N (Plate 5)

Only one hole was successful on cross section 7650N. Hole TOL-P-109 failed because it was collared in the thick alluvium of Eccles Creek which kept caving in. Hole TOL-P-114 was drilled, however the sample recovery was very poor due to caving in within the thick alluvium at the collar. The hole itself was successful and a radiometric log was possible.
+ TOL-P-109
Co-ordinates 7650N 9840E
Azimuth 045° magnetic
Declination -60°
Depth Abandoned due to caving at the collar

+ TOL-P-114
Co-ordinates 7650N 9865E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

This hole was drilled to test any possible southern extension to mineralisation known at the ECCLES II Prospect. The hole intersected a monotonous sequence of sericite sandstone and sericite schist intruded by minor pegmatite/greisen veins. There was no variation in the background radioactivity recorded throughout this hole.

Conclusion
TOL-P-114 tested the west dipping limb of an anticline which, north of the Eccles Creek, was variously mineralised but here exhibited no trace of anomalous uranium mineralisation. It was intended to drill further to the west to test the strong VLF anomaly but the thick unconsolidated alluvial sand made setting a collar pipe successfully almost impossible without great expense.

4.3.6 Drill Cross Section 7600N (Plate 6)

Two drill holes (TOL-P-110 and 111) were drilled on cross section 7600N to test a graphite/chlorite sandstone and schist facies thought to occur in the same stratigraphic horizon as the mineralisation at ECCLES II as well as the cause of a strong northeast-trending VLF anomaly.
These two holes, together with TOL-P-97 drilled in 1990, test the west-dipping limb of an anticline in which the lithofacies is rich in graphite and chlorite, and is intruded by numerous pegmatite/greisen veins.

No radioactive anomalism was noted in these holes.

+ TOL-P-110
  Co-ordinates   7600N  9840E
  Azimuth        043° magnetic
  Declination    -60°
  Depth          66m
  Radioactivity  Nil

This hole intersected a sequence of graphite and chlorite-rich schists and sandstones which were silicified in places. It is now thought this hole may have drilled the east limb of the anticline, which would explain the monotonous lithologic sequence.

+ TOL-P-111
  Co-ordinates   7600N  9790E
  Azimuth        045° magnetic
  Declination    -60°
  Depth          78m
  Radioactivity  Nil

The hole intersected broad sequences of graphitic sandstone and schists on the west dipping limb of an anticline. This would adequately explain the strong VLF anomaly in the area. However, there was no increase in the radiometric signature even where the sequence was cut by intruding pegmatites and/or greisens.
Conclusion

Cross section 7600N has adequately tested the very strong VLF anomaly which traverses the alluvium of Eccles Creek and passes through the ECCLES II Prospect (see plate 14). Unfortunately there was no evidence of any enrichment in uranium above the background levels associated with this lithological unit on the southern side of Eccles Creek (fault).

4.3.7 Drill Cross Section 7350N (Plate 7)

This hole was drilled from the same drill pad of the 1990 hole TOL-P-97, but with an azimuth of 045° to intersect the strike of the sequence at right angles. This hole was to test the strike extension of the mineralisation intersected in TOL-P-97.

+ TOL-P-112

<table>
<thead>
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<th>Co-ordinates</th>
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</thead>
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<td>Azimuth</td>
<td>045° magnetic</td>
</tr>
<tr>
<td>Declination</td>
<td>-60°</td>
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<tr>
<td>Depth</td>
<td>72m</td>
</tr>
<tr>
<td>Radioactivity</td>
<td>Nil</td>
</tr>
</tbody>
</table>

The hole intersected abundant rich carbonaceous/graphitic and chloritic schists but there was no increase in the background radioactivity. Pegmatite/greisen was intersected intruding the graphitic sandstone and schists.

4.3.8 Drill Cross Section 7400N (Plate 8)

Two holes were originally planned for this area but due to the disappointing results in holes TOL-P-112 and 113 the hole at 7375N 10275E was cancelled.
+ TOL-P-113
Co-ordinates  7397N  10300E
Azimuth  045° magnetic
Declination -60°
Depth  66m
Radioactivity Nil

This hole was drilled to test the along strike extension to a sharp radiometric peak intersected in 1990 in hole TOL-P-97. The hole was collared in a creek because of access difficulties. It intersected various strongly graphitic sandstones, chlorite schist (green Fe-rich chlorite) and sandstone, and minor sericite schist.

A minor radiometric anomaly was intersected at 57.5m associated with graphite in a chloritic sandstone; this was not of any economic significance.

4.3.9 Drill Cross Section 8850N (Plate 9)

This cross section was drilled to test a strong mise à la masse anomaly. Hole TOL-P-83, drilled vertically in 1990, was thought may have missed the main conductor so it was decided to drill an angle hole.

+ TOL-P-115
Co-ordinates  8850N  9985E
Azimuth  045° magnetic
Declination -60°
Depth  84m
Radioactivity Nil

The hole intersected very hematitic chlorite and graphite schists beneath the unconformity with the Depot Creek Sandstone of the Tolmer Group, which adequately explains the presence of the mise à la masse anomaly. No variation in the background radioactivity and hence no uranium mineralisation was noted in the hole.
4.3.10 Drill Cross Section 7950N (Plate 10)

+ TOL-P-116
Co-ordinates 7950N 9925E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity:
At 20.3m Peak 1: maximum 450cps
At 25.5m Peak 2: maximum 200cps
At 54.8m Peak 3: maximum 160cps
Cumulative >100cps = 3m

The hole intersected a number of strongly graphitic zones, abundant chlorite and sericite schist and minor greisen/pegmatite veins. The mineralisation occurs in sericite/chlorite schists rather than graphite schists as one would expect. The radiometric anomaly like elsewhere at the ECCLES II Prospect is low grade but relatively thick.

+ TOL-P-117
Co-ordinates 7950N 9950E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

Significant intersections of chlorite and graphite schist were made, intruded by one pegmatite/greisen dyke. However, no radioactive anomalies were recorded above an increase in the background. The depth of weathering was generally to 30m, but in specific rock units such as the graphite schist, extended so the bottom of the hole, i.e. 42m below the surface. Hematite was the main iron oxide noted.
Co-ordinates 7950N 9975E
Azimuth 047° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

The hole intersected thick sequences of graphite and chlorite schist but like in TOL-P-117 there was no variation in the radioactivity above the background.

Conclusion
There was a distinct decline in the intensity of pegmatite/greisen intrusions in this section as compared to the others further south. The mineralisation intersected in hole TOL-P-116 although not economic was of interest as it shows that mineralisation occurs at various stratigraphic levels and makes and breaks along the strike although none of the intersections are of economic significance.

4.3.11 Drill Cross Section 8050N (Plate 11)

This cross section was drilled to test the VLF conductor which passes through the ECCLES II prospect.

Co-ordinates 8050N 9975E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

This hole is the most westerly drilled on section 8050N. It intersected abundant hematitic chlorite schist which from other holes is interpreted as having originally been a graphite/chlorite schist. No radioactive anomalism was recorded. The graphite unit is the cause of the VLF conductor traced from the ECCLES II prospect.
+ TOL-P-120

Co-ordinates 8050N 10000E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

This hole intersected thick units of chlorite schist and also of a quart muscovite greisen/pegmatite. The quartz muscovite greisen/pegmatite intrusions here were both numerous and thick, this is in contrast to that intersected on the 7950N section to the south. This indicates just how irregular these intrusions are. The weathering was again very deep (30m vertically). No anomalous radioactivity was recorded.

4.3.12 Drill Cross section 8200N (Plate 12)

It was planned to drill two holes on this cross section to cover the VLF-defined conductor along strike from the ECCLES II prospect. The access road was too steep for the rig and water truck to negotiate and so the hole at 8200N 10050E was cancelled.

+ TOL-P-121

Co-ordinates 8200N 10025E
Azimuth 045° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

The hole intersected predominately a hematitic medium to coarse-grained poorly sorted sandstone, however, chlorite schists interbeds are common.

These schists were totally oxidised (hematised) to the bottom of the hole. No significant radiometric anomalism was noted in the hole although there is some lithologic differentiation possible from the radiometry. The chlorite schists are slightly more radioactive than
the chloritic sandstones and there is a higher radioactive background near the surface. This may be due to the increased hematitic content.

4.3.13 Drill Cross section 8300N (Plate 13)

This cross section was drilled to investigate a strong VLF anomaly below the Depot Creek sandstone unit of the Tolmer Group.

+ TOL-P-122
  Co-ordinates 8300N 10050E
  Azimuth 045° magnetic
  Declination -60°
  Depth 84m
  Radioactivity Nil

The unconformable contact between Burrell Creek Formation and Tolmer Group - Depot Creek Sandstone was at 3m. The underlying chlorite/sericite schist unit was strongly hematised. There was no radiometric anomaly with the radiometric signature showing no variation above background from the various lithologies.

+ TOL-P-123
  Co-ordinates 8300N 10075E
  Azimuth 043° magnetic
  Declination -60°
  Depth 84m
  Radioactivity Nil

The unconformable contact between the hematised Tolmer Group - Depot Creek Sandstone and the underlying hematite/chloritic schist and sandstone of the Lower Proterozoic was intersected at 10m. This contact is clearly undulating, varying from 0m in hole TOL-P-124 to 10m in TOL-P-123, a distance of only 25m.
There is a minor increase in the radiometric response directly below the unconformity which may relate to a higher content of hematite.

+ TOL-P-124

Co-ordinates 8300N 10100E
Azimuth 043° magnetic
Declination -60°
Depth 84m
Radioactivity Nil

This hole intersected predominantly a sericitic sandstone to 60m then a chlorite schist to the bottom of the hole.

Specular hematite was noted within the sandstone of the Lower Proterozoic between 20 and 30m.

Conclusion
The strong broad VLF conductor can be explained by the abundant hematized chlorite schist and sandstone sequence beneath the Depot Creek Sandstone.
5. CONCLUSION AND RECOMMENDATIONS

No economic uranium accumulation was discovered at the ECCLES II prospect in 1991. A mineralised phenomenon was discovered centered on hole TOL-P-96 which appears to be stratiform and intimately associated with an interbedded sequence of chlorite and graphite-rich schist and intruded pegmatite/greisen veins.

It was found that the EM-37 Input method identified conductive zones beneath the Tolmer Group sandstones, however many were found to be from within the sandstone itself. The sandstone is quite heterogeneous both laterally and vertically which causes problems of interpretation for all the geophysical methods.

The VLF-Wadi survey using both the North West Cape (NWC) and the Japanese (NDT) stations was both fast and effective. This method when well controlled by geological mapping proved a satisfactory method in tracing relatively conductive horizons along strike beneath rubble and thin sandstone cover. This was shown by the 1991 drilling programme which traced VLF conductors from the ECCLES II prospect both north and south. Unfortunately uranium mineralisation did not always accompany these conductive lithologies. Without the aid of the geophysics, it is not possible to determine the structure and lithology beneath the unconformity.

The alphacard and scintillometry over both the Tolmer Group and the Burrell Creek were of limited use. The alphacard anomalies were hard to interpret and often related to radioactive spring water within the sandstone. The SPF-2 survey of the Tolmer Group, its unconformity with the Lower Proterozoic and the Lower Proterozoic itself, although finding the ECCLES II prospect, was generally difficult if not impossible to interpret. At ECCLES II, for instance, the significant mineralisation noted in hole TOL-P-96 near the surface was not identified by scintillometer survey until the bulldozer cut was made. It was however picked up as a lower order anomaly by the alphacard survey.
It is thought that a combination of careful geological mapping and VLF with alphacard surveying over the Lower Proterozoic was an effective and efficient method of exploring in this environment. On the Middle Proterozoic sandstone cover the exploration is more difficult. It is thought the most effective and efficient exploration is to carry out airborne Input EM over the entire area and carefully investigate on the ground any anomalies located. Ground exploration should include detailed and careful geological mapping of the sandstone, to identify any post-sandstone faulting particularly with associated alteration effects. Selected anomalies should then be ground checked by EM37 and close spaced VLF surveying.

A detailed, relatively close-spaced drilling programme cannot be avoided, however once an intersection has been made of a suitable lithology, down hole SIROTEN or mise à la masse can be used to trace that unit away from this intersection.

At the ECCLES II prospect, although no economic accumulation of uranium mineralisation was intersected, the mineralised phenomenon discovered is indicative, along with the mineralisation known as the March Fly prospects on EL 4857 and the strongly radioactive springs at Surprise Creek, Mistake Creek on EL 4856 and at Hayward Creek on EL 4857, of further uranium mineralisation, perhaps some of an economic scale, existing in the region. It is still thought that the western margin of the Pine Creek geosyncline is highly prospective for economic uranium mineralisation.

All the parameters thought necessary for the formation of an economic ore deposit occur at the Tolmer prospect. These are as follows:

- Suitable prospective lithofacies such as Mg-chlorite schist, graphite schist, and pegmatite intrusives.
- Proximity of a low-angle unconformity.
- Proximity of a major structural feature with a low-angle thrust subsequent component.
- Intensity of pegmatite/greisen intrusives
- Regional greenschist metamorphism caused by tectonic effects.

This increases to lower amphibolite facies metamorphism at the contact of intrusives such as the Carpentarian granites and their
derivatives the pegmatite/greisen units. Andalusite developed within the pelitic units due to dynamic metamorphism as well as contact metamorphism.

Source rock thought to be the remobilised Archaean block - the Litchfield block.

No further work is recommended by the Joint Venture at this stage on EL 4856 and EL 4857 because of the Federal Government's policy on uranium in Australia. It is thought that there are enough encouraging features existing on the western margin of the Pine Creek geosyncline to recommence exploration should the political and economic climate for uranium in Australia and the world improve.

It is recommended that EL 4856 and EL 4857 be relinquished and that the Joint Venture's obligations to restore and rehabilitate the ground are met. These include the following:

1. The removal of all grid pegs.
2. The revegetation of drill sites and access.

The latter has occurred naturally. It is proposed to visit the sites with officers of the Conservation Commission after the 1991-1992 wet season to determine what, if anything, is required to effect this revegetation.

A final synthesis report for both EL 4856 and EL 4857 must be produced and submitted to the Department of Mines and Energy once the tenements have been relinquished.
6. EXPENDITURE STATEMENTS

6.1 Expenditure Statement for EL 4856

FOR THE PERIOD 1ST MARCH 1991 TO 29TH FEBRUARY 1992

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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<td>CONTRACT SERVICES</td>
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TOTAL: $100,544
6.2 Expenditure Statement for EL 4857

FOR THE PERIOD 1ST MARCH 1991 TO 29TH FEBRUARY 1992

<table>
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<th>Item</th>
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<td>CONTRACT SERVICES</td>
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TOTAL $12,899
APPENDIX 1.

GEOCHEMICAL ANALYSES

TOLMER DRILLING
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<th>Sample No.</th>
<th>Location</th>
<th>Description</th>
<th>U</th>
<th>Th</th>
<th>Mobile U</th>
<th>SPP-2 cps</th>
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<tbody>
<tr>
<td>73901</td>
<td>TOL-P-104 40-41m</td>
<td>Graphite rich sandstone</td>
<td>250</td>
<td>32</td>
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<td>73902</td>
<td>TOL-P-104 41-42m</td>
<td>Black graphite rich sandstone</td>
<td>470</td>
<td>26</td>
<td>390</td>
<td>1000</td>
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<td>73903</td>
<td>TOL-P-104 42-43m</td>
<td>Black graphite rich sandstone</td>
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<td>73904</td>
<td>TOL-P-104 47-48m</td>
<td>Graphite chlorite sandstone</td>
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<td>500</td>
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<td>73905</td>
<td>TOL-P-104 48-49m</td>
<td>Chlorite graphite rich fine grained sandstone</td>
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<td>28</td>
<td>500</td>
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<td>73906</td>
<td>TOL-P-116 21-22m</td>
<td>Hematitic fine grained sandstone</td>
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<td>170</td>
<td>600</td>
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<td>18</td>
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Sample type: Drill cuttings

Method of analysis: U and Th by XRF
Mobile U by ICP
APPENDIX 2.

DRILL LOGS
WEST PINE CREEK JOINT VENTURE
TOLMER PROJECT
EL 4856 AND EL 4857
ANNUAL REPORT
TO THE DEPARTMENT OF MINES AND ENERGY
1991
VOLUME 2 - PLATES 1 - 14
21st February 1992

BY COURIER

The Director of Mines & Energy
Titles Registration Branch
Department of Mines & Energy
Centrepoint Towers Building
DARWIN NT 0800

Dear Sir,

ELs 4856 and 4857

Please find enclosed two copies of the following report:

"West Pine Creek Joint Venture - Tolmer Project EL 4856 and EL 4857
Annual Report to the Department of Mines & Energy 1991 Volumes 1 and 2" by D.W. Harrop.

As in the past, the two ELs have been worked together as parts of the Tolmer project. As in 1991 only some rehabilitation was carried out in EL 4857 there was little scope in writing a separate report for this tenement. Instead, one report was written covering the work in both ELs and two copies are provided for your files. Sepia copies of the plans will be sent under separate cover. We hope that this arrangement is satisfactory.

Also attached are the expenditure statements for 1991 and the drilling sample record forms for holes TOL-P-103 to TOL-P-124 inclusive.

The 1991 drilling campaign did not lead to the discovery of an economic accumulation of uranium. The report recommendation is that no further work be carried out and that EL 4856 and EL 4857 be relinquished at the end of the permit year.

Cont/....
The recommendation was accepted by the Joint Venture partners at the last Management Committee Meeting. We understand that there is no requirement for a formal surrender of the licences as the six year term will expire at the next anniversary date. Could you please advise whether this is correct or whether you require a surrender letter executed under Company Seal by the Joint Venture parties.

The Joint Venture's obligations for restoration and rehabilitation of the exploration areas will be met in 1992 after consultation with your Department and the Conservation Commission.

Yours faithfully,

D. Cocquio
Technical Services Manager

cc: PNC Exploration (Australia) Pty Ltd

Enc.
EXPENDITURE STATEMENT FOR EL 4857

FOR THE PERIOD 1ST MARCH 1991 TO 29TH FEBRUARY 1992

<table>
<thead>
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<th>Expenses</th>
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<td>Purchases</td>
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<td>Transport and Accommodation</td>
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<td>Administrative Expenses</td>
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<td><strong>Total</strong></td>
<td><strong>$12,899</strong></td>
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</table>
EXPENDITURE STATEMENT FOR EL 4856

FOR THE PERIOD 1ST MARCH 1991 TO 29TH FEBRUARY 1992

$  

PURCHASES  76
PERSONNEL  4,084
SUPPLIES AND SERVICES  95
TRANSPORT AND ACCOMMODATION  8,492
ADMINISTRATIVE EXPENSES  1,148
DEPRECIATION  -
GENERAL ADMINISTRATION  -
CONTRACT SERVICES  86,649

TOTAL  $100,544

---------
LEGEND

TOLMER GROUP

DEPOT CREEK SANDSTONE (251): Pebby quartz arenite and conglomerate. Light colored in dark brown and very ferruginous. Cross bedding and slump.

REEF LIMESTONE (253): Fine grained chalky to gray, finely bedded quartz arenite. Rare shale and rare, breccia at unconformity. Sharp folded in places.

INTRUSIVES

Quartz vein
Gneiss/Pyroxene vein

Unconformity

DURBELL CREEK FORMATION (252): Fine to coarse grained sandstone, quartz-rich, sericitic argillaceous rocks. Minor conglomerate. Green sericitic and dark grey-green chloritic alteration where indicated.

Schist: Fine to medium grained, variable composition: quartz-kaolinite, sericitic, andalusite and graphite. Alteration as for above.

ALTERATION PHENOMENA

bas Basaltic staining or hematization
li Limonite staining
ch Chloritization
seq Sericite green sericitization
grf Graphite

SOURCES

Anticline
Syncline

Fault showing movement where applicable
strike and dip of S/N

TOL-P-116 Drift hole

TOTAL Mining Australia Pty Limited
TOLMER PROJECT - N.T.
ECLES II PROSPECT
Geological Cross Section
7950N

1:500

SHEET 6\0\547-290