SUMMARY

Goomadir River is a uranium exploration project area in northwest Arnhem Land, which is managed and operated by Cameco Australia Pty Ltd (Cameco). The exploration activities carried out in the 2005-2006 reporting period were designed to provide a framework for future exploration. Due to granting of the tenement mid-year, Cameco were unable to arrange a work program meeting until late in the dry season and were thus unable to carry out any groundwork on the tenement during this reporting period. Cameco were, however, able to carry out a tenement-wide airborne radiometric-magnetic survey at 200 m line spacing (Table 1). Numerous radiometric anomalies have been identified and will be ground checked in the following field season.

Eligible expenditure on the Project for the reporting period was $42 302.

Table 1  Exploration summary for 2005-2006 for EL23035

Work proposed for the second year of tenure includes:
- Generate new project-scale geology map with accurate representation of the main structures.
- Integrated analysis of airborne radiometrics, magnetics and geology to determine additional anomalies to follow up.
- Fly airborne HYMAP hyperspectral survey.
- Investigate and sample outcrops to ascertain stratigraphic and metallogenic information using a helicopter.

The estimated expenditure for this program is $60 000.
TABLE OF CONTENTS

SUMMARY ...............................................................................................................................i
INTRODUCTION ...................................................................................................................1
  Location and Access ........................................................................................................1
  Tenure ...............................................................................................................................2
GEOLOGICAL SETTING .....................................................................................................2
  Local Geology of Goomadir River ..................................................................................6
PREVIOUS EXPLORATION ..................................................................................................8
EXPLORATION TARGET .....................................................................................................8
EXPLORATION METHODOLOGY FOR 2005-2006 ............................................................9
EXPLORATION RESULTS AND INTERPRETATION IN 2005-2006 ....................................9
  Expenditure for 2005-2006 .........................................................................................10
CONCLUSIONS ..................................................................................................................11
RECOMMENDATIONS .......................................................................................................11
WORK PROGRAM FOR 2006-2007 (2nd YEAR) ..............................................................11
BIBLIOGRAPHY ................................................................................................................11

FIGURES

Figure 1  Location map for EL 23035 .......................................................................................1
Figure 2  Topographic map for EL23035 showing main features and No go zones .................2
Figure 3  Regional Geology of the Alligator Rivers Region ................................................3
Figure 4  Geology of EL23035 modified from 250k NTGS mapping ....................................7
Figure 5  Airborne Magnetics – Reduction To Pole with First Vertical Derivative .................10
Figure 6  Airborne Radiometrics – Total Count (TC) ..........................................................10
Figure 7  Airborne Radiometrics – RGB=U,Th,K ...............................................................10
Figure 8  Airborne Radiometrics – U²/Th ..........................................................................10
Figure 9  Airborne DTM – height with NW Sun Angle – faults and dykes overlay .............10

TABLES

Table 1  Exploration summary for 2005-2006 for EL23035 ..................................................i
Table 2  Stratigraphy of EL23035 ......................................................................................6
Table 3  Summary of Eligible Expenditure for the 2005-2006 Reporting Period ..................10

APPENDICES

Appendix 1  Airborne Geophysics Logistics Report for EL23035 by UTS ......................9
INTRODUCTION

Goomadir River is a uranium exploration project covering exploration licence EL23035. The project is managed and operated by Cameco Australia Pty Ltd (Cameco). This report details exploration work completed by Cameco during the 2005-2006 licence year, the first year of tenure.

The prime objective is to discover economic ‘unconformity style’ uranium mineralisation within a geological environment similar to the known deposits of the Alligator Rivers Region, Northern Territory, and the concealed high-grade deposits of the Athabasca Region, Saskatchewan, Canada.

The Kombolgie Subgroup sandstone and volcanic units outcrop extensively and basement is concealed throughout the area. The project lands appear to be underlain by mainly Nimbuwah Complex granites that host known, but thus far minor uranium mineralisation in the Arnhem Land region. Favourable structures and hydrothermal alteration occur in the region.

The objectives of the work completed by Cameco during the 1st year of the Exploration Licence were to:

- Analyse government mapping and remote sensing data sets and develop a GIS environment for the integrated analysis of these data sets and those data sets collected in the future. The aim is to delineate surface features, structure, lithology, radioactivity and alteration for the purpose of target generation;
- Collect airborne magnetic and radiometric data over the tenement to identify potential radioactive leakage into the Kombolgie sandstones and basalts from the basement.

Location and Access

EL23035 is located in western Arnhem Land, Northern Territory on the Millingimbi (SD-5302) 1:250 000 scale topographic map sheet and the Liverpool (5672) and Goomadeer (5673) 1:100 000 scale topographic map sheets. 1:50 000 scale topographic coverage is also available (Dalabon and Goomadeer River).

The Goomadir River tenement is centred approximately 85 km east of Jabiru (Figure 1). The rugged nature of the sandstone, which overlies most of the licence, means that access is only possible by helicopter and then by foot. Vehicle access into the southern part of the tenement was at one stage possible via exploration tracks on the adjacent EL23462, but these have fallen into disrepair. Helicopter access will be based from Jabiru or from Cameco’s semi-permanent field camp located 40 km northwest on Tin Camp Creek, named ‘Myra Camp’ (Figure 1). Road access to Myra Camp is via the Arnhem Highway to Jabiru and bitumen road to Cahill’s Crossing, then by dirt road via Oenpelli and Nabarlek.

Figure 1 Location map for EL 23035
Tenure

The Goomadir River project Exploration Licence (EL23035) is located in western Arnhem Land and covers an area of 355.3 km$^2$, comprising 106 blocks. The exploration licence was granted by the Division of Mines and Energy (DME) in the Department of Business Industry and Resource Development (DRIRD) on 15th June 2005. Grant of title is for a period of six years; extensions to the period and re-issue of the exploration licence are permitted under the Mining Act.

The EL23035 licence contains several areas that are sensitive or have cultural and/or social significance to the Traditional Owners, ‘No go zones’ or ‘Non-consent areas’. These areas, shown on Figure 2, are excluded from exploration access.

Figure 2  Topographic map for EL23035 showing main features and No go zones

GEOLOGICAL SETTING

The Goomadir River project area lies on the eastern margin of the Pine Creek Inlier (PCI), roughly on the boundary of the so-called East Alligator and Nimbuwah structural domains (Figure 3) (Needham, 1988; Needham and Stuart-Smith, 1980). The following section relates largely to this region. Reconnaissance mapping of the PCI has been carried out by the Bureau of Mineral Resources (BMR) personnel since 1946, with more detailed work in the 1950’s and 60’s following the discovery of uranium at Rum Jungle. The Alligator Rivers region was systematically mapped by the BMR during the period 1972 to 1983, resulting principally in the publication of two 1:250 000 scale geological and metallogenic maps (Needham, 1990; Needham et al., 1983) and a detailed report (Needham, 1988). Cobourg Peninsula was also mapped at this time (Hughes, 1973). Relevant 1:100 000 scale compilation maps were published in colour and/or black & white format. Related publications are numerous (Hughes, 1978; Needham et al., 1980; Needham and Stuart-Smith, 1985; Stuart-Smith and Ferguson, 1978; Stuart-Smith and Needham, 1982; Stuart-Smith and Needham, 1984; Warren and Kamprad, 1990). In more recent years, the Northern Territory Geological Survey (NTGS) has remapped the central parts of the PCI and the Milingimbi sheet (Ahmad, 1998; Carson et al., 1999; Ferenczi and Sweet, 2004). It has also begun focussed geochronological studies aimed at developing a better stratigraphic framework, in collaboration with Geoscience Australia (GA) (Worden et al., 2004).

Regional and deposit scale metallogenic research, including uranium, has also been carried out in the PCI by a number of organisations, including the BMR (and subsequently AGSO and GA), Queens University, Johns Hopkins University, Bas-Becking Laboratory, Australian National University, CSIRO, USGS and NTGS (Ahmad, 1998; Browne, 1990; Carville et al., 1990; Crick, 1981; Crick et al., 1980; Dunn et al., 1990; Ewers et al., 1985; Ferguson et al., 1980; Ferguson and Goleby, 1980; Fraser, 1980; Garven and Raffensperger, 1996; Hancock et al., 1990; Holk et al., 2003; Johnston, 1984; Maas and McCulloch, 1988; Mernagh, 1992; Needham, 1985; Needham and De Ross, 1990; Needham and Roarty, 1980; Needham and Stuart-Smith, 1980; Raffensperger and Garven, 1995a; Raffensperger and Garven, 1995b; Rossiter and Ferguson, 1980; Snelling, 1990; Solomon and Groves, 1994; Stuart-Smith et al., 1993; Stuart-Smith et al., 1980; Sweet, 2001; Tucker et al., 1980; Wilde et al., 1989; Wilde and Noakes, 1990).
The oldest rocks exposed in the Alligator Rivers region, belonging to the 2500 Ma (late Archaean) Nanambu Complex, crop out sparsely in Kakadu National Park and include paragneiss, orthogneiss, migmatite, granite and schist (Needham, 1988) (Figure 3). The Archaean complexes form structural domes that are unconformably overlain by metasediments and minor metavolcanics of the Palaeoproterozoic Pine Creek Succession or Supergroup (PCS), which constitutes the Pine Creek Orogen tectonic unit (formerly the Pine Creek Geosyncline). In the Alligator Rivers region, the PCS initiates with meta-psammitic and quartzose rocks of the Mount Howship Gneiss and Kudjumarndi Quartzite (both Kakadu Group). These are laterally equivalent to the Mount Basedow Gneiss and Munmarlary Quartzite respectively (Ferenczi et al., 2005). This Group appears to onlap the Archaean basement highs, but gneissic variants are also reported to be transitional into paragneiss of the Nanambu Complex (Needham, 1988).

Figure 3 Regional Geology of the Alligator Rivers Region

The Cahill Formation and Masson Formation of the Namoona Group (Ferenczi et al., 2005) conformably overlie the Munmarlary Quartzite, the Cahill Formation being informally mapped as two subunits or members (Needham, 1988). The Lower Cahill Formation hosts the main uranium ore bodies in the region (e.g. Nabarlek, Ranger and Jabiluka; Figure 3) and consists of a basal calcareous marble and calc-silicate gneiss unit that is overlain by pyritic, garnetiferous and carbonaceous schist (meta-pelite), quartz-feldspar-mica gneiss (meta-arkose) and minor amphibolite. The Upper Cahill Formation is more psammitic, comprising feldspar-quartz schist (meta-arkose) and quartzite, lesser mica-feldspar-quartz-magnetite schist (meta-pelite), and minor conglomerate and amphibolite. It also contains the mafic to intermediate Stag Creek Volcanics, which have a SHRIMP U-Pb age of 2048±13 (Ferenczi et al., 2005). The Cahill Formation is notably magnetic, in particular the base of upper psammitic unit (also known as ‘hangingwall sequence’), due the presence of mafic sills and/or magnetite, providing a means of spatially distinguishing it from underlying and overlying less magnetic formations (Kendall, 1990). The Masson Formation is generally considered to be the lower grade metamorphic equivalent of the Cahill Formation.

The unconformably overlying Nourlangie Schist is a monotonous succession of argillaceous to quartzose phyllite and quartz-mica schist that locally contains garnet and staurolite. Nourlangie Schist is interpreted to be the eastern temporal correlative of the combined interval – Mundogie Sandstone and Wildman Siltstone (Mount Partridge Group), and Koolpin Formation, Gerowie Tuff and Mount Bonnie Formation (all South Alligator Group) (Needham, 1988). Some authors argue that temporal equivalents of the Mundogie Sandstone are absent east of the South Alligator River (Ferenczi et al., 2005), but it may not be possible to distinguish facies variants at the Cahill Formation-Nourlangie Schist level. Wildman Siltstone is characteristically composed of silty carbonaceous phyllite, sandy ferruginous siltstone and shale, consistent with a Nourlangie Schist ‘protolith’.

Early stratigraphic columns also included the Kapalga Formation as a lateral equivalent of the Nourlangie Schist (Needham et al., 1983), however, outcrops formerly mapped as this unit in the Mount Evelyn sheet are now re-assigned to South Alligator Group (Ferenczi and Sweet, 2004). As a result, the name Kapalga Formation will probably be abandoned and various outcrops throughout the eastern PCI re-assigned to other units. Lithological descriptions of the Kapalga Formation (Needham et al., 1983) – ferruginous, pyritic and carbonaceous chert-banded metasiltstone (slate/phyllite) or biotite schist, garnetiferous schist and quartzite – are
consistent with the lower metamorphic grade Koolpin Formation, which hosts a number of
gold prospects and deposits in the central PCI (Ahmad, 1998). However, calcareous and
dolomitic lithologies (including stromatolites) and banded iron formation that are also
common in the Koolpin Formation are not documented in the Kapalga Formation. The
overlying Gerowie Tuff and Mount Bonnie Formation in the central PCI comprise variously
interbedded massive silicic-potassic tuffaceous chert, carbonaceous clayey siltstone, coarse
‘greywacke’ and lithic sandstone. Metamorphosed equivalents of these lithologies have not
yet been recognised in the Nourlangie Schist, suggesting either facies variation,
onlap/pinchout, erosional removal or a lack of definitive exposure in the east.

The age of the Nourlangie Schist is only constrained by its inferred correlatives. The
Wildman Siltstone is about 2025 Ma and the Gerowie Tuff is 1863±2 Ma, based on SHRIMP
U-Pb zircon dating (Worden et al., 2004). Large time breaks are obviously present in the
succession.

Mafic sills and dykes including the Goodparla and Zamu Dolerites intrude the PCS, with the
former common in the upper Cahill Formation and the latter prolific in the South Alligator
Group (Warren and Kamprad, 1990). Lower metamorphic grade rocks have typical dolerite
textures, but in the Alligator Rivers region, they are generally amphibolite sensu stricto.
Regardless, these dykes impart a magnetic signature to their respective hosts where they
contain residual magnetic phases.

The sedimentary and igneous rocks of the PCS are structurally complex, having undergone at
least three recognisable phases of deformation (Thomas, 2002) related to Top End Orogeny
(1880 to 1780 Ma). They have also undergone high-temperature low-pressure prograde
metamorphism, including local migmatisation and remobilisation, during the ~1850-1860 Ma
Nimbuwah Event of the Barramundi Orogeny (Page and Williams, 1988). The intensity of
metamorphism and deformation varies across the region, with the western and eastern
margins of the Pine Creek Inlier (Litchfield Province and Nimbuwah Domain respectively)
showing the most pronounced effects. In the Nimbuwah Domain or Alligator Rivers region,
there is a broad trend of increasing grade from southwest to northeast. This gradient clearly
reflects synchronous emplacement of the 1865 Ma Nimbuwah Complex granitoids in that
area. Distinctions based on metamorphic grade and protolith type have been made on
regional maps (Needham, 1988) and are summarised below.

Greenschist to amphibolite facies metasedimentary rocks in the southwest can generally be
distinguished stratigraphically and are assigned to specific formations and groups.

1. Amphibolite to granulite facies metasedimentary rocks that lie between the Nimbuwah
Complex in the northeast and the areas of better-defined stratigraphy in the southwest
are mapped as Myra Falls Metamorphics. They incorporate outcrop that cannot be
distinguished from the Zamu Dolerite and Kakadu, Mount Partridge, Namoona or
South Alligator Groups, but where a sedimentary precursor can be demonstrated
(Needham, 1988). Rocks with a likely felsic igneous protolith are assigned to the
Nimbuwah Complex (see below).

2. Magmatic rocks (mostly I type granodiorite) and felsic to intermediate migmatite and
granulite in the northeast are distinguished as the Nimbuwah Complex. These rocks
have a relatively simple isotopic character (Page and Williams, 1988) that suggests an
entirely igneous protolith. However, there is some doubt about this distinction, as
much of the mapped Nimbuwah Complex around King River appears to have a sedimentary protolith (e.g. lit par lit zones).

Metamorphic, igneous and sedimentary rocks of the PCS have been intruded by later Palaeoproterozoic ‘post-orogenic’ granites of the Cullen Batholith, including the Jim Jim and Mount Bundey Granites (Jagodzinski and Wyborn, 1997) (Figure 3).

The PCS and Cullen Batholith are locally overlain by felsic volcanic rocks belonging to the Edith River and El Sherana Groups, which are comagmatic with the Cullen Batholith (Jagodzinski, 1992). These units are thickest in the south in the South Alligator Fault Zone and are generally absent in the Alligator River region due to Palaeoproterozoic erosion.

The various basement units are unconformably overlain by the Kombolgie Subgroup, the basal unit of the late Palaeoproterozoic Katherine River Group, McArthur Basin (Sweet et al., 1999a; Sweet et al., 1999b) (Figure 3). This subgroup consists of a series of sandstone formations (Mamadawerre, Gumarrirmbang and Marlgota Sandstones), which are divided by thin basaltic units (Nungbalgarri and Gilruth Volcanics). The minimum age of the Mamadawerre Sandstone is 1725 Ma based on geochronology of the Oenpelli Dolerite (see below). Detrital zircon SHRIMP data from the GA OZCRON database constrain the maximum age as ~1810 Ma. The true age is probably close to 1800 Ma (Rawlings, 2002). The sandstones form a flat-lying or shallow southeast-dipping strongly-jointed platform, called the Arnhem Land Plateau. The eroded edge of the Mamadawerre Sandstone forms the characteristic Arnhem Land escarpment and the isolated sandstone mesas and ranges on the coastal plain. The middle to upper part of the Katherine River Group is exposed ~50 km further to the southeast near Mount Marumba (Sweet et al., 1999b).

The Oenpelli Dolerite is the most pervasive mafic intrusive suite to affect the Alligator Rivers region and is the youngest Precambrian rock unit exposed. It intrudes various levels of the stratigraphy, including the PCS and Kombolgie Subgroup (Figure 3), forming highly magnetic sills, dykes, lopoliths and laccoliths. Intrusions can be either concordant or discordant with Palaeoproterozoic stratigraphy. This unit is currently constrained by a SHRIMP baddeleyite date of 1723±6 Ma (Ferenczi et al., 2005), however, geochemical and geophysical data suggest several phases of intrusion throughout the region. At least one phase correlates with emplacement of the Nungbalgarri Volcanics at about 1780 Ma (Rawlings, 2002). These intrusive events had a pronounced thermal effect within the Kombolgie Subgroup, with the promotion of fluid flow and aquifer/aquitard modification. Localised effects in the sandstone include silicification, desilicification and introduction of chlorite, muscovite and pyrophyllite in active aquifer systems. A characteristic mineral assemblage of prehnite-pumpellyite-epidote has formed in the quartzofeldspathic basement rocks adjacent to the intrusions.

Field evidence for the age of the Nabarlek and Tin Camp Creek Granites is inconclusive, with both pre- and post-sandstone interpretations being valid. The Tin Camp Granite has been traditionally interpreted as unconformably overlain by Mamadawerre Sandstone along Tin Camp Creek, however, pervasive silicification and up-doming of the cover sequence above this granite is also consistent with emplacement as a sill at the basement-sandstone unconformity and subsequent thermal metamorphism of the sandstone. The pre-sandstone explanation of these observations involves long-lasting radiogenic-driven fluid flow and silicification above the granites and structural displacement of the granite (i.e solid state diapirism).
Deformation since deposition of the Katherine River Group includes transpressional movement along steep regional-scale strike-slip faults and possibly some shallow thrusting. These regional faults follow a pattern of predominantly north, northwest, north-northwest and northeast strikes, giving rise to the characteristic linearly dissected landform pattern of the Kombolgie plateau (Figure 3). Another significant set trends east-west and includes both the Ranger and Beatrice Faults. The Bulman Fault Zone is a principal regional feature and is considered to represent a long-lived deep crustal structure, with a large lateral component in rocks of the PCS. However, it is clear that post-Kombolgie displacements along this and other faults have not been great, because the Arnhem Land Plateau is essentially coherent and offsets along lineaments are generally minor. Field investigations of many interpreted ‘faults’, including those with a marked geomorphic expression, show no displacement, and are best described as joints or lineaments (Thomas, 2002).

Erosional remnants of flat-lying Palaeozoic Arafura Basin and Cretaceous Carpentaria Basin are present as a veneer throughout the coastal zone of the Top End. Various regolith components are also recognised in the region.

**Local Geology of Goomadir River**

EL23035 encompasses the western margin of the Kombolgie Plateau and comprises Palaeoproterozoic sedimentary and volcanic rocks of the Kombolgie Subgroup of the McArthur Basin and minor Oenpelli Dolerite (Table 2). Basement is not exposed.

<table>
<thead>
<tr>
<th>ROCK UNIT</th>
<th>THICKNESS</th>
<th>GEOLOGICAL AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual sand cover and laterite on tableland, silt and alluvium in valleys</td>
<td>Up to several metres</td>
<td>Quaternary-Tertiary</td>
</tr>
<tr>
<td>Undifferentiated Cretaceous-sandstone, siltstone and pebble conglomerate</td>
<td>Remnant outliers 10-50 m</td>
<td>Cretaceous</td>
</tr>
<tr>
<td>Oenpelli Dolerite – intrusive dolerite sills and dykes</td>
<td>Up to 250 m</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Marlgowa Sandstone – quartz arenite</td>
<td>Up to 300 m</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Gilruth Volcanic Member – altered basalt and siltstone</td>
<td>Up to 30 m</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Gumarrirbang Sandstone – quartz arenite with minor pebble conglomerate</td>
<td>Up to 250 m</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Nungbalgarri Volcanics – vesicular and amygdaloidal basalt</td>
<td>Up to 150 m</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Mamadawerre Sandstone – quartz arenite, quartzite and conglomerate</td>
<td>Greater than 150 m and possibly as much as 400 m.</td>
<td>Palaeoproterozoic</td>
</tr>
<tr>
<td>Nimbuwah Complex? – foliated granite and granodiorite</td>
<td>Interpreted only</td>
<td>Palaeoproterozoic</td>
</tr>
</tbody>
</table>

Table 2  Stratigraphy of EL23035
The Mamadawerre Sandstone, the oldest formation of the Kombolgie Subgroup (Sweet et al., 1999a), occupies only a small fault-bounded inlier in the northern part of the tenement, called the Tibet-Nepal horst (Figure 4). It is composed of generally fine-to-medium-grained quartzose sandstone, with a basal 20-30 m of pebbly sandstone facies. Planar bedding, ripples and trough cross-beds dominate, but there are local planar cross-beds. The disconformably overlying Nungbalgarri Volcanics are exposed in the western part of the tenement. The basal contact is expressed locally as 100-500 m diameter subcircular depressions (‘dome and basins’), with the upper sandstone surface interpreted to represent the palaeotopographic surface of giant lunate current ripples or aeolian sand dunes with the volcanics draped over the top (Nott and Ryan, 1996). It may also represent large dewatering structures formed as a result of hot volcanic rocks draped over water-saturated sediments, which were deposited in estuarine conditions (Needham, 1978). The Nungbalgarri Volcanics consist of multiple vesicular and amygdaloidal basaltic flows. Regionally, the stratigraphic thickness of the volcanic unit is quite variable between 50 m and 200 m.

Figure 4 Geology of EL23035 modified from 250k NTGS mapping

The overlying Gumarrirnbang Sandstone occupies most of the eastern portion of the tenement, where it forms the deeply dissected plateau surface (Figure 4). This area is composed largely of bare rock with sparse areas of shallow sandy soil supporting Spinifex and scrub. The Gumarrirnbang Sandstone comprises fine to coarse-grained quartz arenite with scattered pebbly units. Sedimentary structures include planar and trough cross-stratification, ripples and horizontal planar stratification, suggesting a proximal to distal fluvial braided stream and estuarine depositional environment.

The Gilruth Volcanic Member is a thin marker unit that has a distinctive aerial photographic pattern of parallel rills preserved at its lower contact (relict dunes?) and dark ferruginous deposits. The actual unit is very poorly exposed, but in drill core to the southwest, it is made up of basalt and siltstone. It is overlain conformably by Marlgowa Sandstone, which exhibits similar fine-grained quartzose sandstone facies to the underlying Gumarrirnbang Sandstone. Sandstone above and below the volcanic marker is notably highly silicified.

Oenpelli Dolerite intrudes the Kombolgie Subgroup as sills and dykes, mainly along the curvilinear Kukalak Valley, which impinges on the southern part of the tenement (Figure 4). This discordant part of the Oenpelli Dolerite may be partly fault controlled, and this valley is currently interpreted to mark the eastern-most extent of Oenpelli Dolerite in central Arnhem Land. This theory has not been validated by drilling or geophysics. Dolerite is coarse, fresh and locally porphyritic near the intrusive margins.

Undifferentiated Cretaceous rocks have been mapped on the edges of the tenement (Carson et al., 1999). The rocks are exposed as weathered outcrops of lateritised sandstone and siltstone forming resistant mesa-like ridges. Thick sand cover is present through the middle of the tenement (Figure 4).

The nature of basement in EL23035 is not known because it is not exposed and there is no existing drilling on this tenement. Based on extrapolation from the adjacent
tenements, EL23462 and ELA24992, basement is interpreted to be Nimbuwah Complex granite. However, there is also the possibility of other basement units, such as stratigraphic equivalents of Archaean Nanambu Complex and Palaeoproterozoic Myra Falls Metamorphics, Edith River Group, Cullen granite suite and Tin Camp Granite. Depth to basement, based on the surface geology, is likely to be in the range 300-800 m.

The most visibly obvious structures in the tenement are the ENE-trending Ranger Fault and N-trending Tibet Fault (new informal name used herein; Figure 4). There are numerous other linear structures with variable lateral extent that cross-cut the plateau country as incised valleys and creeks. Most appear to have little or no displacement and probably represent joints or dykes, but some appear to have minor lateral displacement, such as the Manggabor Fault (new informal name used herein). Also present in EL23035 is the southern termination of a deeply incised curvilinear feature, informally termed the Kukalak Valley, which extends from the adjacent EL23462 (Figure 4). This feature has previously been inferred to be a shallow southwest-dipping reverse fault, the ‘Goomadeer Thrust’ (Otto et al., 2003; Rippert, 1992; Taylor, 1999; Thomas, 2002). It is overall northwest to southeast oriented, and in part traces the Goomadeer River. It is now thought to represent the margin of an uplifted block of sandstone above a dolerite sill or laccolith.

PREVIOUS EXPLORATION

There has been no previous exploration within EL23035. Uranerz Australia, Afmeco Mining and Exploration (AFMEX) and Cameco Australia have been exploring for uranium periodically on adjacent tenements (now EL23462 and ELA24992) since about 1987. The Northern Territory Geological Survey undertook geological mapping in the area as part of regional program to map the Milingimbi 1:250 000 sheet (Carson et al., 1999). No prospects are known within the tenement.

EXPLORATION TARGET

The focus of the Cameco exploration strategy is the discovery of unconformity style uranium deposits. The nearby economic deposits at Ranger, Jabiluka, Koongarra and Nabarlek serve as exploration models. The gold, palladium and platinum rich Coronation Hill style deposits of the South Alligator Valley are also a valid exploration target.

Given that there are local variations in geological setting (structure, host rock, element association), the deposits appear to have a common position relative to the base of the Kombolgie Subgroup i.e. the Palaeoproterozoic unconformity, or to its erosional margin. In several examples, down-faulted blocks of Kombolgie Sandstone (reverse faulting) are juxtaposed adjacent to the mineralisation, as at Ranger No. 3 orebody and the Hades Flat Prospect between Ranger and Jabiluka. These and other recognised features are considered to be indicative of a favourable setting for the concentration of mineralising fluids within a structurally disrupted unconformity setting.

The deposits of the South Alligator Valley (SAV) and the Rum Jungle-Waterhouse region also exhibit a spatial relationship to Palaeoproterozoic unconformities. The SAV deposits are ‘capped’ by the Kombolgie Subgroup sandstone and have an igneous affiliation (sub-volcanic intrusive). They tend to be more gold enriched and are characterised by the presence of
palladium and platinum selenides. The Sargeants and Kylie styles of mineralisation, located south of Rum Jungle on the fringe of the Archaean Waterhouse Complex, have some similarities to the SAV with Au-PGE enrichments in association with uranium. The Depot Creek Sandstone, the basal unit of the Tolmer Group, unconformably overlies these deposits, which are hosted in a carbonate-carbonaceous schist sequence.

Whilst there has been no exploration in the Goomadir River tenement to date, the area is considered prospective for unconformity related uranium-gold-PGE mineralisation based upon the following:

- proximity to the unconformity between metasedimentary packages and overlying Kombolgie Sandstone (300-800 m)
- favourable reported lithologies and uranium prospects in adjacent tenements
- regional structures that have established mineralisation along them to the west (e.g. Ranger Fault)

**EXPLORATION METHODOLOGY FOR 2005-2006**

Exploration on EL23035 during the current reporting period consisted of: a review of historic data; flying of a tenement-wide airborne magnetics-radiometrics survey – summarised in Table 1. All digital data that have been acquired by Cameco have been submitted on CD and DVD with this report.

The data review involved analysis of government 250k mapping and existing remote sensing data sets and development of a GIS environment for the integrated analysis of these data sets and those data sets collected in the future. The aim is to delineate surface features, structure, lithology, radioactivity and alteration for the purpose of target generation.

In 2005, UTS Geophysics Pty Ltd of Perth conducted a joint magnetic, radiometric and DTM survey over EL23035, totalling 2068 line km. The survey was oriented east-west with a line spacing of 200 m and a terrain clearance of 40 m (Appendix 1). The object of the airborne survey was to identify new uranium anomalies and allow improvements to the geological map and knowledge base in the area.

**Appendix 1 Airborne Geophysics Logistics Report for EL23035 by UTS**

**EXPLORATION RESULTS AND INTERPRETATION IN 2005-2006**

Various datasets emanating from the geophysical survey are presented below. Interpretation of the survey data has made a number of immediate improvements to the geology map, a process that will continue incrementally into the future with ground checking. The aeromagnetic image (Figure 5) shows a number of features, including the distribution of Nungbalgarri Volcanics (high frequency domains), Oenpelli Dolerite (high amplitude edge affect), and a regional NE-trending dyke set of unknown age (extensive high amplitude linear features). The Ranger and Tibet Faults are evident as weak discontinuous linear alignments of negatively magnetised zones, suggesting preferential emplacement of dolerite or small offsets across the faults. The total count radiometric image (Figure 6) shows the distribution of Nungbalgarri Volcanics quite accurately. Importantly, however, there are several small
anomalies along the Ranger Fault that may be of interest. There is also offset evident along the Tibet Fault. The RGB image (Figure 7) shows that there is variety in the response of the Nungbalgarri and Gilruth Volcanics. Some outcrop areas are dominated by the potassium channel response, while others are dominated by uranium and/or thorium. The U²/Th image best illustrates the areas that are enriched in uranium relative to the other two channels (Figure 8). Based on this image and integration of other data sets, Cameco have generated numerous anomalies for follow up in future years. The two most notable anomalies are in the northern part of the tenement, one associated with the Ranger Fault and the other a large area enclosed within Nungbalgarri Volcanics that has an otherwise potassium response. The Gilruth Volcanic Member appears to have a ubiquitous uranium signature in the south and may be excluded from exploration pending initial follow up. The digital terrain model is shown in Figure 9 and mimics many of the regional structures.

Figure 5  Airborne Magnetics – Reduction To Pole with First Vertical Derivative

Figure 6  Airborne Radiometrics – Total Count (TC)

Figure 7  Airborne Radiometrics – RGB=U,Th,K

Figure 8  Airborne Radiometrics – U²/Th

Figure 9  Airborne DTM – height with NW Sun Angle – faults and dykes overlay

**Expenditure for 2005-2006**

Expenditure on EL23035 during the 1st year of licence totalled $42 302 (Table 3). For a typical work program, the main expenditure items are: payroll costs including geologists, consultants and field assistants; drilling costs; airborne geophysical survey contractor costs; fuel and air charters; camp costs; NLC administration costs; analytical expenses; equipment; travel; communications. Associated overheads such as office costs are allowable, but have not been included here. Compensation payments made to the NLC and tenement rental paid to DBIRD do not constitute reportable exploration costs.

Table 3  Summary of Eligible Expenditure for the 2005-2006 Reporting Period
CONCLUSIONS

No field-based work was completed by Cameco during the first year of exploration due to the late grant of title. Cameco were able to fly an airborne magnetic-radiometric-digital terrain survey over the entire tenement at 200 m line spacing. Interpretation of the survey data has generated numerous anomalies for follow up. The geology map has been improved by integration of the survey data with existing 250k government mapping, a process that will continue incrementally into the future with ground checking.

RECOMMENDATIONS

Future work on EL23035 will mainly involve follow up of anomalies that have been identified in the geophysical data acquired during the current reporting period. The geology map needs to be improved in terms of accuracy and content based on integration of various datasets and via ground inspections and mapping. Kinematics and possible leakage along the main structures needs to be investigated. Hyperspectral data would be useful in delineating zones of alteration in the sandstone.

WORK PROGRAM FOR 2006-2007 (2nd YEAR)

Work planned for the next reporting period will involve helicopter-borne follow-up investigations and sampling in a variety of locations throughout EL23035, mainly areas identified as anomalous in the radiometric survey. A HYMAP Hyperspectral survey is planned for entire tenement. It is anticipated that expenditure on EL 23035 for the next reporting period will be $60 000 to complete the proposed exploration work.

BIBLIOGRAPHY


