SUMMARY

The Goomadir River Project is located in Western Arnhem Land, approximately 250 km east of Darwin and consists of Exploration Licence (EL) 23035. The EL has an area of 355 km\(^2\) and was granted to Cameco Australia Pty Ltd on June 14 2005 for six years.

The 2nd year exploration program included helicopter supported outcrop sampling, geological reconnaissance and a tenement-wide hyperspectral survey. A total of 29 HyMap image strips covering approximately 1,150km\(^2\) were acquired at a spatial resolution of 5 m.

A total of 35 rock chip samples were collected in the western portion of the tenement to test point source anomalies identified from the previous year’s radiometric survey.

The outcrop assay results were disappointing, with all elevated Uranium (46.9 ppm U best result from sample GR060025) associated with the Nungbalgarri Volcanics or the Gilruth Volcanic Member.

The hyperspectral survey identified several illite and tourmaline alteration anomalies in the bottom arm of the tenement in association with a fairly strong northeast-trending fault zone. The anomalies will be field checked and sampled in the 2007-2008 field season.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Details</th>
<th>Location</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcrop Sampling</td>
<td>• 35 samples for geochemical analysis</td>
<td>Heli-supported sampling over western portion of tenement</td>
<td>Sample GR060025 – U: 46.9 ppm in Basalt Sample GR060015 – U: 29.5 ppm in weathered mafic volcanic rocks</td>
</tr>
<tr>
<td></td>
<td>• 3 petrography samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 35 samples for PIMA analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperspectral survey</td>
<td>• Hyperspectral survey</td>
<td>Entire tenement</td>
<td>illite and tourmaline alteration corridors associated with fault zone</td>
</tr>
</tbody>
</table>

The eligible expenditure for the 2\(^{nd}\) year of tenure was $75,756.21.

As required by the Mining Act, 50% of the tenement will be relinquished in 2007.

The program for the 3\(^{rd}\) year of tenure will include field checking and sampling the hyperspectral anomalies in the southern arm of the tenement. The estimated expenditure for this program is $30,000.
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INTRODUCTION

Goomadir River is a uranium exploration project covering exploration licence EL23035. The project is managed and operated by Cameco Australia Pty Ltd. This report details exploration work completed by Cameco during the 2006-2007 licence year, the second year of tenure.

The 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 2nd year of the Exploration Licence were to:

- Sample anomalies identified by the radiometric survey;
- Collect airborne hyperspectral data over the tenement to identify alteration haloes in the Kombolgie sandstones and other outcropping lithology

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 EL23025
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.

As required by the Mining Act, 50% of the tenement will be relinquished in 2007. The areas relinquished are predominantly covered by Cretaceous/Quaternary deposits (Figure 1).

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 and Stuart-Smith 1980; Needham 1988). 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, Smart et al. 1983; Needham 1990) 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; Stuart-Smith and Ferguson 1978; Needham, Crick et al. 1980; Stuart-Smith and Needham 1982; Stuart-Smith and Needham 1984; Needham and Stuart-Smith 1985; 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, Brakel 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, Claoué-Long 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 (Crick, Muir et al. 1980; Ferguson, Ewers et al. 1980; Ferguson and Goleby 1980; Fraser 1980; Needham and Roarty 1980; Needham and Stuart-Smith 1980; Rossiter and Ferguson 1980; Stuart-Smith, Wills et al. 1980; Tucker, Stuart et al. 1980; Crick 1981; Johnston 1984; Ewers, Needham et al. 1985; Needham 1985; Maas and McCulloch 1988; Wilde, Mernagh et al. 1989; Browne 1990; Carville, Leckie et al. 1990; Dunn, Battey et al. 1990; Hancock, Maas et al. 1990; Needham and De Ross 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 Kudjumardji Quartzite (both Kakadu Group). These are laterally equivalent to the Mount Basedow Gneiss and Munmarlary Quartzite respectively (Ferenczi, Sweet 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, Sweet 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, Sweet 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, Sweet 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, Smart 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, Smart 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, Claoué-Long 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, Brakel et al. 1999; Sweet, Brakel et al. 1999) (Figure 3). This subgroup consists of a series of sandstone formations (Mamadawerre, Gumarrirribang and Marlgow 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, Brakel et al. 1999).

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, Sweet 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, silstone 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>Gumarrinbang 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>Mamadawere 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, Brakel et al. 1999), 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 unconformably 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 Marlgow 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, Brakel 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’ (Rippert 1992; Taylor 1999; Thomas 2002; Otto, O’Connor et al. 2003). 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

In 1969-1971 Geopeko and a joint venture lead by Electrolytic Zinc Company of Australia/Asia conducted a rapid photo-interpretation followed by an airborne radiometric and magnetic survey over the then named AP 2364 tenement, now the western section of the current EL23035 tenement (Figure 5). The purpose was to locate Westmoreland-type uranium deposits. The radiometric survey failed to locate significant radiometric anomalies other than a 700 cp U high associated with a muddy radon spring approximately 34km west of EL23035. The radiometric highs that fall over the current tenement are listed in Table 3.

With the discovery of the unconformity-style uranium deposits of Narbalek and Ranger 1, the joint venture downgraded the potential of the area to host Westmoreland deposits and re-directed their efforts to search for large-scale uranium deposits in basement. When a review of aerial photographs failed to locate outcropping basement through “Windows” (Maynard 1971) in the Kombolgie Subgroup the area was relinquished in 1971.

Figure 5 Historical exploration over EL23035
Table 3 Radiometric highs recorded in 1971 over AP2364

<table>
<thead>
<tr>
<th>U High No.</th>
<th>Flight lines</th>
<th>Counts (cps)</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>AY</td>
<td>300-450</td>
<td>Cretaceous (Mullama Beds (Klm))</td>
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<td>AY</td>
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<td>28</td>
<td>AX</td>
<td>320</td>
<td>Unassigned</td>
</tr>
<tr>
<td>29</td>
<td>AX</td>
<td>270-420</td>
<td>Volcanics</td>
</tr>
<tr>
<td>30</td>
<td>AX</td>
<td>420</td>
<td>Cretaceous (Mullama Beds (Klm))</td>
</tr>
</tbody>
</table>

Kombolgie Sandstone background 200 cps

Uranerz Australia, Afneco Mining and Exploration (AFMEX) and Cameco Australia have been exploring for uranium periodically on adjacent tenements (now EL23462 and ELA24992) since about 1986. 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, Brakel 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 ground-based 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 2006-2007

Exploration on EL23035 during the current reporting period consisted of a tenement-wide airborne hyperspectral survey, field reconnaissance mapping and outcrop sampling of radiometric highs identified from the previous year’s radiometric and magnetic survey.

Rock chip sampling

At each rock chip sample location, photographs, radiometric readings from a scintillometer and geologic observations are taken as relevant to the site. A 1-2 kg rock chip sample is taken, which is then halved using a core saw in camp. One half is submitted for geochemical analysis, whilst SWIR spectra and magnetic susceptibility measurements are taken from the other half, before being sent to Darwin for archiving.

Appendix A Cameco Logging codes

HYMAP Hyperspectral survey

In August 2006 HyVista Corporation was contracted by Cameco Australia Pty Ltd. to acquire hyperspectral data over EL23035. A total of 29 HyMap image strips covering approximately 1,150km² were acquired at a spatial resolution of 5 m (Appendix B). The object of the airborne survey was to identify clay alteration anomalies in the sandstone cover.

The HyMap is an airborne hyperspectral scanner delivering 126 bands (approx 18 nm width) of imagery over the 450 nm to 2500 nm spectral interval. Hyperspectral remote sensing is a mineral mapping technology based on spectroscopic principles. Thus, an understanding of the spectral signatures of surface materials is required for its application. In essence, each pixel of a hyperspectral image contains a spectrum, which forms the basis for determining the materials present in a scene. Surface mineralogy and other components are mapped using algorithms which either de-convolve a scene into component end-member signatures (unsupervised un-mixing) or by specifically targeting spectral signatures of known materials (supervised match filtering). A combination of these approaches is usually applied to produce the final classified mineral end-member images.

All digital data that have been acquired by Cameco have been submitted on CD and DVD with this report.

Appendix B Airborne Geophysics Logistics Report for EL23035 by HyVista
Geochemical Analysis

Cameco uses NTEL (Northern Territory Analytical Laboratories) exclusively for geochemical analysis. A suite of analytical methods, known internally as the Cameco standard suite, is conducted on all Cameco samples. The standard suite consists of the following analyses: the G400 multi-element suite, the G950 partial leach suite, the G140 B analysis, LOI and fire assay. Sample preparation at NTEL involves initial drying at 110°C. The entire sample is crushed to a nominal 2 mm in a Boyd Crusher, then divided using a Rotary Sample Divider (RSD) to give a 300-400 g split. The split is milled in a Whisper ring mill to a nominal 75 μm. The material used on the crushing surfaces was selected to be free of contaminant trace metals (the major contaminant is iron) and this was confirmed in tests conducted by Cameco prior to submitting field samples. The Boyd Crusher is flushed with barren blue metal and the ring mills are flushed with garnet sand before and after each sample. The RSD is vacuum cleaned.

The G400 analysis involves an 8-hour, four-acid (HF, hydrochloric, nitric and perchloric) near-total digest of pulped material, followed by double dehydration before the liquor is read on an ICP-OES (major elements) or ICP-MS (minor and trace elements). The G950 analysis involves the leaching of a large weight of pulped sample in high purity nitric acid on a mixing table for a limited period of time. After settling, the liquor is then decanted and presented to an ICP-MS for analysis of U and Pb-isotopes. For boron analysis (G140B), the pulped sample is fused with sodium peroxide, iron is precipitated and the resulting solution is read by ICP-OES. Fire assay for Au, Pt and Pd involves an appropriate charge of up to 50g, depending on mineralogy and sample size being fused in a lead collection assay. The resulting prill is dissolved and presented to either an ICP-MS or AAS.

Appendix C presents the G400 and G950 analytical suites, as well as detailing analysis methods, detection limits and analytical precision for each individual element.

Appendix C INTEL multi-element suites, detection limits and analytical precision

Short wave infrared reflectance spectroscopy

Reflectance spectra were collected from a dry, cut surface of each rock chip or drill core sample using a TerraSpec mineral spectrometer produced by Analytical Spectral Devices, Inc. Spectra cover the interval between 350 nm (visible light) and 2500 nm (short wave infrared region) at a resolution between 6 and 7 nm, and an acquisition time of 10 seconds. Features of reflectance spectra in the SWIR region typically relate to H₂O, OH, CO₃ and metal-OH (Al-OH, Fe-OH and Mg-OH) vibrations, overtones and combination modes. Many minerals possess diagnostic spectra with several features relating to vibrational modes of elements of its crystal structure located at specific wavelengths/wavenumbers. The intensity of certain features in the spectra also provides an indication as to the level of crystallinity of the mineral (e.g. kaolinite).
Following acquisition, the spectral analysis software TSG (The Spectral Geologist, produced by AusSpec International Pty Ltd) is used to resolve spectra into mineral components using an extensive library of mineral spectra. The one or two most likely matches are then added to the database as TSG mineral species associated with that particular sample.

EXPLORATION RESULTS AND INTERPRETATION IN 2006-2007

In 2006, Cameco flew a 1,150km$^2$ hyperspectral survey at 5 m resolution over the entire tenement. An external consultant using Athabasca Basin clay alteration models was engaged to interpret the raw data. The clay alteration models focus on the identification of clay assemblage haloes that have known association with Athabasca Basin uniformity–type uranium deposits. According to (Thomas) there are two types of ore-related alteration halos in Athabasca Basin unconformity-type uranium deposits, which are being used as the exploration models in this area of Australia. One type of alteration is comprised of illite, chlorite, and hematite, the other is comprised of illite, dravite, chlorite, and kaolinite.

The interpretation generated several alteration anomalies. However, most of the favourable alteration minerals such as illite, chlorite and kaolinite occur as earlier original clay matrix material prior to being diagenetically altered to dickite (Zamudio 2007). When favourable alteration minerals do occur, they don’t occur together at the surface. For example, illite, chlorite and tourmaline are present as alteration corridors, but only illite and tourmaline occur at the surface together. Despite this, tourmaline (dravite) is considered to have the highest priority, as that apparently does not occur as a product of earlier diagenetic alteration (Zamudio 2007).

The most prospective area from a structural and alteration perspective is an area in the southern arm of the tenement denoted by the largest red circle in Figure 6. This area has a co-occurrence of illite and tourmaline as is bisected by a NE trending fault.

A total of 35 outcrop samples were collected over the tenement (Figure 7) to test point source anomalies identified in the previous year’s radiometric survey. The results were disappointing with all elevated U and Th (Table 6) associated with either the Nungbalgarri Volcanics or Gilruth Member.

Three outcrop samples underwent thin section analysis.

**Table 4 Summary descriptions of outcrop samples (Purvis 2006) from thin section analysis**

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Description</th>
<th>U ppm</th>
<th>Th ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR060019</td>
<td>Coarse to very coarse-grained sandstone with interstitial chalcedony and vein-like arrays rich in fine-grained hematite.</td>
<td>1.38</td>
<td>2.03</td>
</tr>
<tr>
<td>GR060025</td>
<td>Extremely altered possible basalt with sparse feldspar phenocrysts and amygdales as well as microlites and areas of perlitic cracking: sericite/illite-limonite/hematite-leucoxene alteration is intense with rare prehnite and quartz-</td>
<td>46.9</td>
<td>12.2</td>
</tr>
</tbody>
</table>
clay veins.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Lithology</th>
<th>U (ppm)</th>
<th>Th (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR060025</td>
<td>Basalt; leached</td>
<td>46.9</td>
<td>12.2</td>
</tr>
<tr>
<td>GR060015</td>
<td>Mafic volcanic rock; weathered</td>
<td>29.5</td>
<td>18.8</td>
</tr>
<tr>
<td>GR064001</td>
<td>Laterite gravel</td>
<td>28.6</td>
<td>11.2</td>
</tr>
<tr>
<td>GR060009</td>
<td>Ferricrete; pisolitic</td>
<td>28.3</td>
<td>4.05</td>
</tr>
<tr>
<td>GR060014</td>
<td>Mafic volcanic rock; weathered</td>
<td>27.1</td>
<td>18.7</td>
</tr>
<tr>
<td>GR060010</td>
<td>Ferricrete; pisolitic</td>
<td>25.9</td>
<td>4.4</td>
</tr>
<tr>
<td>GR060017</td>
<td>Lateritised mafic volcanic rock</td>
<td>18.7</td>
<td>7.87</td>
</tr>
<tr>
<td>GR060011</td>
<td>Lateritised mafic volcanic rock</td>
<td>16.1</td>
<td>16.8</td>
</tr>
</tbody>
</table>

See Appendix D for full mineralogical report

Sample GR060025, a suspected basalt, recorded the highest U and Th with 46.9ppm and 12.2ppm respectively. The two sandstone samples, GR060019 and GR064008, recorded very weak U and Th. Hydrothermal alteration may be associated with interstitial quartz in GR064008.

All outcrop samples underwent PIMA analysis. The raw and interpreted data are included as digital files with this report. Table 5 has a summary of the interpreted PIMA data.

Appendix D Mineralogical Report No.8923

Figure 6 Hyperspectral prospect map

Figure 7 Sample location map

Table 5 PIMA interpreted data

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Lithology</th>
<th>U (ppm)</th>
<th>Th (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR060025</td>
<td>Basalt; leached</td>
<td>46.9</td>
<td>12.2</td>
</tr>
<tr>
<td>GR060019</td>
<td>Mafic volcanic rock; weathered</td>
<td>29.5</td>
<td>18.8</td>
</tr>
<tr>
<td>GR064008</td>
<td>Medium to very coarse-grained sandstone with a lens of fine to medium-grained sandstone, probable optically continuous overgrowths commonly cut by sericite or illite with limonite and sparse anatase. Some interstitial quartz may be hydrothermal.</td>
<td>0.46</td>
<td>1.72</td>
</tr>
</tbody>
</table>

Table 6 Outcrop samples with the highest U and TH

Table 7 Full listing of samples for U and Th

**Expenditure for 2006-2007**

Expenditure on EL23035 during the 2nd year of licence totalled $75,756.21 (Table 8). 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 8 Summary of Eligible Expenditure for the 2006-2007 Reporting Period

CONCLUSIONS

In 2006, Cameco flew a 1,150km$^2$ hyperspectral survey at 5 m resolution over the entire tenement. Interpretation of the hyperspectral 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 the hyperspectral anomalies 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.

WORK PROGRAM FOR 2007-2008 (3rd YEAR)

Work planned for the next reporting period will involve helicopter follow-up investigations and sampling of the hyperspectral anomalies identified in last year’s hyperspectral survey.

Proposed Exploration Method

Exploration in 2007 will consist of further helicopter-supported reconnaissance and outcrop sampling in an attempt to define possible drill targets.

Helicopter-supported reconnaissance of target areas throughout the project will involve mapping, photography, and the use of handheld spectrometers/scintillometers to delineate areas of elevated radiometric activity. Up to 30-60 brick-sized rock samples (1-2 kg) will be collected for geochemical and petrographical analyses.
REFERENCES


