



**Cameco Australia Pty Ltd**

**EL25002**

**ROBBIE'S WEST PROJECT**

**NORTHERN TERRITORY**

**ANNUAL REPORT**

**CONFIDENTIAL**

**Date:** September 2010

**Period:** 2 September 2009 to 1 September 2010

**Report No.:** RW10-02

**Target commodity:** Uranium

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**Datum/Zone:** GDA94 (Zone 53)

**Map Sheets:** 1: 250,000: Alligator River (SD-5301)  
1:100,000: Howship (SD-5572) &  
1:100,000 Oenpelli (SD-5573)

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**Copies:** Cameco Australia Pty Ltd (1)  
DRDPIFR - Minerals and Energy (1)  
Northern Land Council (1)

## SUMMARY

Robbie's West project comprises Exploration License 25002 (EL25002) which covers 10.83 km<sup>2</sup> (portions of 4 blocks) and was granted to Cameco Australia Pty Ltd (Cameco) on 2<sup>nd</sup> September 2008.

Robbie's West prospect was defined by historical exploration with rock chip sampling that returned 0.12 % U<sub>3</sub>O<sub>8</sub> plus 872 ppb Au from a north-south trending quartz breccia and 61 ppm U<sub>3</sub>O<sub>8</sub> plus 11 ppb Au, 681 ppm Li, and 251 ppm Ni from a weathered amphibolite immediately below the unconformity. Several other samples are anomalous in Zn (9280 ppm) and W (196 ppm). Sandstone immediately above the unconformity also reported weakly anomalous Ag (0.65 ppm) and As (10.5ppm).

Limited exploration consisting of a helicopter reconnaissance flight over the project was conducted during the reporting period. No ground-based exploration has been completed.

Cameco is in the process of divesting EL25002 to a new operator, with completion of the sale anticipated to be concluded by year end.

Work proposed for the third year of tenure will involve ground investigations, reconnaissance, sampling and mapping over the licence.

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## INTRODUCTION

EL25002 is a uranium exploration project in Arnhem Land, Northern Territory, operated by Cameco Australia Pty Ltd (Cameco).

EL25002 is located on Arnhem Land Aboriginal Reserve and the exploration program was carried out under the terms of consent documentation agreed with the Northern Land Council (NLC) pursuant to the Aboriginal Land Rights Act (1976). Exploration work clearance was given by the NLC on behalf of the Traditional Owners following the Exploration Work Program and Liaison Committee Meetings held on 2<sup>nd</sup> June 2010 at Oenpelli.

### Location and Access

EL 25002 is located in western Arnhem Land approximately 250 km east of Darwin and approximately 50 km northeast of Jabiru in the Northern Territory, Australia.

Figure 1: Location Map for Robbie's West EL 25002

Access is by road via the Arnhem Highway to Jabiru and then via Cahill's Crossing and unsealed roads to the Myra Base Camp located on Tin Camp Creek. Vehicle access into the northeastern part of EL 25002 is possible via drill access tracks constructed by Cameco on adjoining tenements in 2008; however these tracks were rehabilitated at the end of the 2008 and are considered closed. The remainder of the tenement is only accessible by helicopter and then by foot.

### Tenure

EL25002 was granted to Cameco Australia Pty Ltd on 2<sup>nd</sup> September 2008 for an initial period of six years. The license covers portions of 4 blocks for an area of 10.83 km<sup>2</sup>.

EL25002 was covered by historical EL2505 which was granted to Queensland Mines Pty Ltd (QML), on 12<sup>th</sup> September 1995. Exploration was conducted by QML and farm-in partner Afmeco Mining and Exploration Pty Ltd (AFMEX) until QML divested its interest in February 1998. The tenement was then acquired by Cameco (49%), SAE (24.5%), AFMEX (24.5%) and West Arnhem Land Corporation Pty Ltd (2%) and was explored in joint venture with AFMEX as the operator. EL2505 formed part of the Tin Camp Creek project which included a six other licenses covering the Myra Inlier. In 2000, EL2505 was reduced down to the four blocks now covered by EL25002, and was allowed to expire in September 2005.

EL25002 covers the same area as historical EL2505 which expired in September 2005. The area of application covered areas that were sensitive or have cultural and/or social significance to the Traditional Owners, 'Non-Consent', which are excluded from the exploration licence.

The proposed exploration work for 2010 was presented to the Traditional Owners and Northern Lands Council (NLC) at the Work Program Meeting held on 2<sup>nd</sup> June 2010 at Oenpelli. Clearance to conduct the program was given by the NLC on behalf of the Traditional Owners.

## REGIONAL GEOLOGY

The Robbie's West project area is located within the eastern margin of the Pine Creek Orogen (PCO) and lies on the eastern boundary of the Nimbuwah structural domain (Needham, 1988; Needham and Stuart-Smith, 1980). Figure 2 shows the regional geological setting of the PCO with the project location in the north-eastern corner.

Figure 2: Simplified geology of the Pine Creek Orogen showing the location of selected mineral deposits (after Pirajno and Bagas, 2008).

This section is largely based on the work by Needham (1988), and Needham and Stuart-Smith (1980). Information that is not based on these references is indicated below.

The Bureau of Mineral Resources (now Geoscience Australia) completed 1:250 000-scale geological maps of the Pine Creek Orogen between the 1940s and 1960s following the discovery of uranium at Rum Jungle. The Alligator Rivers region was systematically mapped by the Bureau of Mineral Resources and the Northern Territory Geological Survey between 1972 and 1983. This later work produced 1:100 000-scale geological maps and reports for the region from Darwin to Katherine and the Alligator Rivers region.

Figure 3: NTGS (1:500,000 scale) Regional Geology Map

The oldest exposed rocks in the Alligator Rivers region are within the Neo-Archaean (ca. 2500 Ma) Nanambu Complex. The complex consists of paragneiss, orthogneiss, migmatite, and schist forming domical structures that are unconformably overlain by Palaeoproterozoic metasedimentary and metavolcanic rocks, which were formerly included in the Pine Creek Geosyncline. Recent collaborative research work by the Northern Territory Geological Survey (NTGS) and Geoscience Australia (GA) indicates that SHRIMP U-Pb age dating of an area of previously mapped Myra Falls Metamorphics outcropping within the Myra Inlier is Neo-Archaean in age (Hollis et al., 2009a). This quartzofeldspathic gneiss is now referred to as the 'Kukalak Gneiss' (Hollis et al., 2009b).

Palaeoproterozoic rocks in the Alligator Rivers region are amphibolite facies psammites assigned in the Mount Howship Gneiss and the Kudjumarndi Quartzite. These formations are included in the Kakadu Group and are probably correlatives of the Mount Basedow Gneiss and Munmarlary Quartzite, respectively (Ferenczi et al., 2005). The group appears to onlap Neoproterozoic basement highs, with gneissic variants thought to pass transitionally into paragneiss of the Nanambu Complex.

The Cahill Formation of the Namoon Group conformably overlies the Kudjumarndi Quartzite. The lower part of the Cahill Formation (informally referred to as the Lower Cahill Formation) hosts the Nabarlek, Ranger and Jabiluka uranium deposits. The Lower Cahill Formation consists of a structurally lower calcareous marble and calc-silicate gneiss, which is overlain by pyritic, garnetiferous and carbonaceous schist, quartz-feldspar-mica gneiss, and minor proportions of amphibolite.

The informally named Upper Cahill Formation is psammitic and consists of feldspar-quartz schist, quartzite, lesser proportions of mica-feldspar-quartz-magnetite schist, and minor proportions of metaconglomerate and amphibolite. The Upper Cahill Formation is magnetic

and significantly so at the base of psammitic unit in what is informally known as 'hanging wall sequence'. The magnetic characteristic of this unit is due to the presence of mafic sills or magnetite and it is a useful characteristic used to distinguishing the Cahill Formation from surrounding less magnetic rocks (Kendall, 1990). Mafic sills and dykes assigned to the Goodparla and Zamu Dolerites intruded the Cahill Formation prior to metamorphism.

The Nourlangie Schist overlies the Cahill Formation and consists of argillaceous to quartzose phyllite and quartz-mica schist that locally contain garnet and staurolite.

The supercrustal rocks of the region are structurally complex, having been affected by at least three deformation event before deposition of the late Palaeo- to Mesoproterozoic Kombolgie Subgroup (Thomas, 2002). The rocks have also been locally migmatized during the ca. 1847-30 Ma Nimbuwah Event. In addition, there is a broad trend of increasing grade from southwest to northeast in the Nimbuwah Domain. This gradient is thought to reflect the synchronous emplacement of ca. 1865 Ma granites in the Nimbuwah Complex.

The Kombolgie Subgroup is the basal unit of the late Palaeo- to Mesoproterozoic Katherine River Group of the McArthur Basin (Sweet et al., 1999a; Sweet et al., 1999b). The subgroup consists of sandstone units called the Mamadawerre Sandstone, Gumarrirngang Sandstone, and Marlgowa Sandstone, which are divided by thin basaltic units called the Nungbalgarri Volcanics, and Gilruth Volcanics. The Mamadawerre Sandstone has a minimum age of ca. 1700 Ma, which is the minimum age of the intrusive Oenpelli Dolerite. Detrital zircon SHRIMP data from the GA OZCRON database constrain the maximum age of the sandstone at ca. 1810 Ma.

The Oenpelli Dolerite is the most pervasive mafic intrusive suite to affect the Alligator Rivers region and is the youngest Proterozoic rock unit exposed. It intrudes various Neo-Archaean, Palaeoproterozoic, and the Kombolgie Subgroup units, forming magnetic sills, dykes, lopoliths, and laccoliths. The Oenpelli Dolerite has a SHRIMP U-Pb baddeleyite date of  $1723 \pm 6$  Ma (Ferenczi et al., 2005). Geochemical and geophysical data suggests several phases of intrusion throughout the region. These intrusive events had a pronounced thermal effect within the Kombolgie Subgroup, with the promotion of fluid flow and aquifer or aquitard modification. Localised effects in the sandstone include silicification, desilicification, chloritisation, sericitisation, and pyrophyllite alteration. A characteristic mineral assemblage of prehnite-pumpellyite-epidote has formed in the quartzofeldspathic basement rocks adjacent to the intrusions.

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, and northeast strikes, giving rise to the characteristic linearly dissected landform pattern of the Kombolgie Plateau. Another significant structural trend strikes east – west which 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. However, it appears 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 ubiquitous as cover throughout much of the region.

### **Project Geology**

The tenement is located on the southern margin of the Myra Inlier and comprises escarpments of Kombolgie Sandstone, Early Proterozoic quartz-mica schists of the Cahill Formation (in the valleys) and ridges of Kudjumarndi Quartzite in the northern part of the licence area.

Figure 4: Tenement Geology Map for EL25002

The Kudjumarndi Quartzite forms an expansive, moderately south-dipping dip slope throughout much of the northern part of the tenement. In the southeastern corner of the project area there is an irregular north-trending chlorite-haematite breccia zone in the basement immediately below the unconformity. Basement quartz-mica schists in this area have common micro folding (S2) and crenulation developed in the S0/S1 fabric. The elevation of the unconformity is locally variable along the escarpment.

The basal Mamadawerre Sandstone dips gently south from the escarpment edge. The basal conglomerate of the sandstone in this area is dominantly a boulder conglomerate up to 5 m thick, and typically recessive above the unconformity. The unconformable contact between basement and overlying sandstone is well-exposed through most of the area.

Structures of interest in the project area include a major north-northwest – south-southeast trending fault and an interpreted intersecting east-west trending fault. The latter is present within the northeastern corner of the tenement and is thought to be an extension of the Caramal Fault which transects the Caramal uranium deposit approximately 17 km to the east.

Sets of north-south trending quartz-breccia zones are observed in the basement rocks. These breccias vary between 2 to 10 m in width and consist of massive quartz matrix with host rock (quartzite) fragments. In places, the matrix is highly ferruginous and less commonly has a gossanous box-work appearance. It is interpreted that these quartz-breccias predate the Kombolgie Sandstone based on fieldwork observations that recorded large boulders of breccia within the basal conglomerate of the Mamadawerre Sandstone (Parks et. al., 2004).

## **PREVIOUS WORK**

### **Exploration Pre – 1996**

Queensland Mines Ltd and Uranerz Australia Pty Ltd conducted exploration covering a large portion of Arnhem Land in the 1970s and late 1980's, however the exploration is poorly documented and it is unclear if any work was conducted in the area of EL25002.

## **EL2505 - Exploration 1996 to 2002**

AFMEX in joint venture with Cameco and SAE conducted a number of airborne geophysical surveys over the Tin Camp Creek project, including EL2505. The surveys included Dighem (DIGital Helicopter ElectroMagnetics), radiometrics and magnetics. A number of radiometric anomalies were followed up by various sampling programs in 1997 and 1998, from which the best assays returned were up to 129.7 ppm U<sub>3</sub>O<sub>8</sub> and 240 ppm Cu in samples of hematitic quartzite. These samples were taken from near the eastern edge of EL25002, however the sample locations were not documented (Parks and Beckitt, 2003).

## **EL2505 - Exploration 2003 to 2005**

AFMEX and SAE withdrew from the joint venture on 1<sup>st</sup> March 2003 and Cameco subsequently acquired their interests in the project. Work on EL2505 comprised mainly helicopter-supported sampling with 47 rock chip samples of which the highest uranium value of 0.12 % U<sub>3</sub>O<sub>8</sub> plus 872 ppb Au from a north-south trending quartz breccia and 61 ppm U<sub>3</sub>O<sub>8</sub> plus 11 ppb Au, 681 ppm Li, and 251 ppm Ni from a weathered amphibolite immediately below the unconformity. Several other samples were anomalous with Zn (9280 ppm) and W (196 ppm). Sandstone immediately above the unconformity also reported weakly anomalous Ag (0.65 ppm) and As (10.5ppm). (Parks et al., 2006). Subsequent follow-up of the anomalous quartz breccia sample indicated that the structure was pre-Kombolgie in age.

EL2505 expired in 2005 and Cameco submitted an application for exploration over the area in October 2005.

Figure 5: Exploration Conducted by Cameco between 1995 and 2005

## **EL25002 - Exploration 2008 to 2009**

EL25002 was granted 2<sup>nd</sup> September 2008. Data compilation and review showed that further work was required to the west of the areas historically sampled. Reconnaissance and mapping was also deemed necessary along interpreted structural features. No on-ground exploration was completed during the first year of tenure.

## **EXPLORATION PROGRAM 2009 – 2010**

No ground-based exploration has been conducted over EL25002 during the reporting period. Limited exploration on the project consisted of a helicopter reconnaissance survey with visual observation and determination of the spatial aspects of the north-south trending breccias and the interpreted Caramal fault trend.

Cameco is in the process of divesting EL25002 to a new operator, with completion of the sale anticipated to be concluded by year end.

## **2010 WORK PROGRAM**

Work proposed for the third year of tenure will involve ground investigations, scintillometer surveying, geological reconnaissance and mapping across the licence to better determine the



structural relationships and mineralising potential of the quartz hematite breccias and other cross structures.

## REFERENCES

- Ferenczi, P.A., Sweet, I.P., and authors, c., 2005, Mount Evelyn, Northern Territory (Second Edition); 1:250 000 Geological Map Series, sheet SD53-5; Explanatory notes, Northern Territory Geological Survey.
- Hollis, J.A., Carson, C.J., and Glass, L.M., 2009a, SHRIMP U-Pb Zircon Geochronological Evidence for Neoproterozoic Basement in Western Arnhem Land, Northern Australia.
- , 2009b, Extensive exposed Neoproterozoic crust in Arnhem Land, Pine Creek Orogen: U-Pb zircon SHRIMP geochronology.: Annual Geoscience Exploration Seminar (AGES). Record of Abstracts. Northern Territory Geological Survey., v. Record 2009-002.
- Kendall, C.J., 1990, Ranger uranium deposits, *in* Hughes, F.E., ed., *Geology of the mineral deposits of Australia and Papua New Guinea*, Volume 1: Monograph Series: Melbourne, Australasian Institute of Mining and Metallurgy, p. 799-805.
- Needham, R.S., 1988, *Geology of the Alligator Rivers uranium field*, Northern Territory, Bureau of Mineral Resources, Geology and Geophysics.
- Needham, R.S., and Stuart-Smith, P.G., 1980, *Geology of the Alligator Rivers uranium field*, *in* Ferguson, J., and Goleby, A.B., eds., *Uranium in the Pine Creek Geosyncline; proceedings of the International uranium symposium on the Pine Creek Geosyncline*: Vienna, International Atomic Energy Agency, p. 233-257.
- Parks, J., and Beckitt, G., 2003, Exploration Licences 2505, 2506, 2507, 2516, 2517, 7029, 9354. Tin Camp Creek - Northern Territory Annual Report, Cameco Australia Pty Ltd, p. 26.
- Parks, J., Beckitt, G., Potter, K., and Zaluski, G., 2006, Exploration Licences ELs 2505, 2506, 2516, 2517, 7029, 9354 Tin Camp Creek - Northern Territory Final and Annual Report for the period September 12 2004 to September 11 2005, Cameco Australia Pty Ltd, p. 60.
- Sweet, I.P., Brakel, A.T., and Carson, L., 1999a, The Kombolgie Subgroup - a new look at an old 'formation': AGSO Research Newsletter, v. 30, p. 26-28.
- Sweet, I.P., Brakel, A.T., Rawlings, D.J., Haines, P.W., Plumb, K.A., and Wygralak, A.S., 1999b, Mount Marumba, Northern Territory (Second Edition); 1:250 000 Geological Map Series, sheet SD53-6, Australian Geological Survey Organisation-Northern Territory Geological Survey (NGMA).
- Thomas, D., 2002, Reconnaissance structural observations: Myra-Kukulak Project, Arnhem Land, Northern Territory, Cameco Australia.