Cameco Australia
EXPLORATION

Mount Howship

Northern Territory

Annual Technical Review

CONFIDENTIAL

EL9637

Date:	June 2013
Period:	15 May 2012 to 14 May 2013
Report No.:	MH12-03
Target commodity:	Uranium
Authors:	Ekaterina Savinova, Geologist Ben Wyke, Project Geologist Tim Dunlevie, CAD Specialist
Contact Details:	PO Box 748 Osborne Park BC, WA 6916 Ph. 08 9318 6600
Email for further technical details: **Email for expenditure:**	ekaterina_savinova@cameco.com ratih_sagung @cameco.com
Datum/Zone:	GDA94 (Zone 53)
Map Sheets:	1: 250, 000: Alligator River (SD-5301) 1:100, 000: Howship (SD-5572)
Tenement manager:	Austwide

Drafting:	Tim Dunlevie
Copies:	Cameco Australia Pty. Ltd. (1) Department of Mines and Energy (1) Heavy Metal Resources Pty Ltd (1)

Verified By:	Approved By:
Jason Bishop Principal Geologist, Exploration	**Damien Ewington** Regional Manager

SUMMARY

The Mount Howship project comprises one exploration licence (EL 9637), located in western Arnhem Land, approximately 250 km east of Darwin. The exploration licence was granted to Heavy Metal Resources Pty Ltd (Heavy Metal Resources) on 15 May 2009 for an initial period of six years. Cameco Australia Pty. Ltd. (Cameco) has formed a joint venture with Heavy Metal Resources and is the manager of the project. The total area covered by the licence is 66.51 km^2.

The focus of Cameco's exploration strategy in Arnhem Land is the discovery of unconformity-related uranium deposits. The archetype unconformity-style uranium deposits are found in the Athabasca Basin in northern Saskatchewan, Canada. The prospective nature of the Alligator Rivers region is demonstrated by the presence of nearby deposits at Ranger, Jabiluka, Koongarra, and the now depleted Nabarlek Mine. These major deposits appear to have a common position relative to the base of the Kombolgie Subgroup i.e. the Paleoproterozoic unconformity, or to its erosional margin, and serve here as exploration models. The Mount Howship tenement is considered to be prospective for uranium mineralisation because of the presence of an unconformity between metasedimentary packages of Cahill Formation and the overlying Kombolgie Subgroup, as well as additional structural complexity.

Two drillholes were completed in 2012, MHDD0001 and MHDD0002. MHDD0001 intersected 97.0 m of Mamadawerre Formation sandstone, followed by alternating intervals of intense silica-flooded breccia and Cahill Formation pelitic schist accompanied by intense hematite alteration to the final depth of 254.2 m. MHDD0002, drilled ~3.75 km to the southwest of MHDD0001, intersected 213.4 m of Mamadawerre Sandstone, followed by Cahill Formation pelitic schist down to 257.7 m. There is no significant structural disruption or hematite alteration in MHDD0002. Radioactivity is background in both drillholes.

The total reportable expenditure for 2012 is $685,786 (AUD) for EL 9637, which is significantly in excess of the covenant of $26,500.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

The Mount Howship project comprises one exploration licence (EL 9637), located in western Arnhem Land in the Northern Territory, Australia.

The 2012 exploration activities consisted of helicopter-supported diamond drilling. Two drillholes, MHDD0001 and MHDD0002, were completed. Contractors used during the operating period to complete the exploration activities include:

- Winmax Drilling Pty. Ltd., East Victoria Park, WA
- Jayrow Helicopters Pty. Ltd., Darwin, NT

Tenement History

The exploration licence was granted to Heavy Metal Resources on 15 May 2009 for an initial period of six years. Cameco formed a joint venture with Heavy Metal Resources. Cameco is the operator of the project. The total area covered by the licence is 66.51 km^2 (22-sub-blocks). There was no previous exploration on the project until 2009 when Cameco commenced as operator on the project.

In 2009, an airborne hyperspectral survey was completed by HyVista Corporation and a magnetic-radiometric survey was flown over the project area by UTS Geophysics. An airborne TEMPEST survey was completed in 2010 by FUGRO Airborne Surveys.

During the 2010 field season, ground mapping and sampling was completed following up the results of the geophysics surveys. Additional mapping and sampling occurred during the 2011 program.

Location and Access

The Mount Howship project lies approximately 260 km east of Darwin, 240 km northeast of Katherine, and 40 km east-northeast of Jabiru (Figure 1).

The tenement is located on map sheets:

1:250,000 – Alligator River (SD-5301)
1:100,000 – Howship (SD-5572)
1:50,000 – Mount Howship (5572-4)

There are no access tracks to the area, and it is only accessible by helicopter.

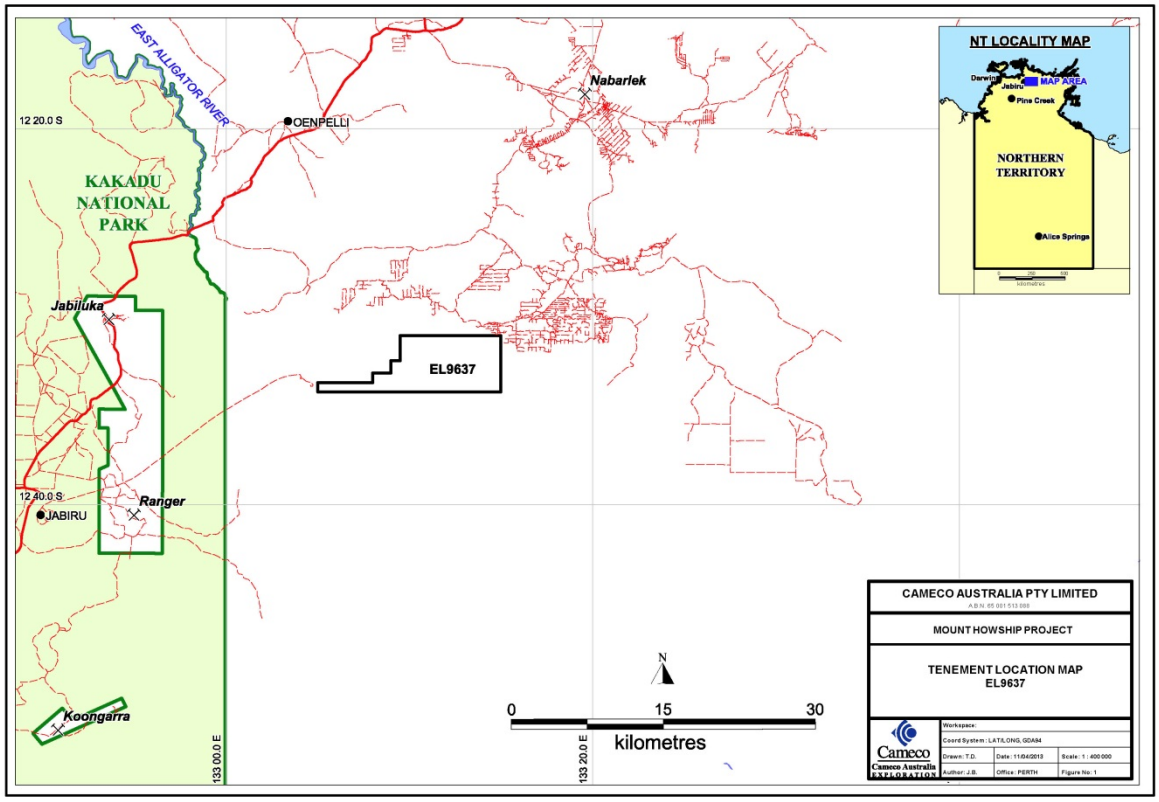

Figure 1: Tenement location map

Physiography

The topography is rugged and dissected sandstone escarpments and gorges of the Arnhem Land plateau. Open woodland and scrub sporadically cover the sandstone country. Gorges contain thick scrub or remnants of monsoonal-type forest.

Soils in the region consist of thin sandy types and some black loams covering (in part) the plateau country. Gorges and valleys within the plateau typically contain alluvium with some soil development and denser vegetation.

There are no major watercourses on the project area. Small creeks and drainages are likely to exist within the heavily dissected sandstone plateau country. Many of these have pools until late in the dry season.

Regional Geology

The regional geology of Arnhem Land has been systematically and intensely studied and described in detail since 1946, comprising work from the Bureau of Mineral Resources (BMR) (1972 – 1988), the Northern Territory Geological Survey (late 1990's to 2008), Geoscience Australia (2004) and many previous reports for Cameco Exploration Licences in the western Arnhem Land area. Studies included geological mapping and reconnaissance, as well as regional-scale and deposit-scale metallogenic research. Only a brief summary and

overview of the geology is provided in this report. The regional geology section is largely based on the work by Needham (1998 and 1990), and Needham and Stuart-Smith (1980). Information that is not based on these references is indicated below.

The Mount Howship project area is located at the northeast margin of the Neoarchean and Paleoproterozoic Pine Creek Orogen, which has been subdivided into the Nimbuwah Domain of the Alligator Rivers region.

The Bureau of Mineral Resources (now Geoscience Australia) completed 1:250,000 geological maps of the Pine Creek Orogen between the 1940s and 1960s, following the discovery of uranium at Rum Jungle, near Batchelor. The Alligator Rivers region was systematically mapped by the BMR and the Northern Territory Geological Survey between 1972 and 1983. This later work produced 1:100,000 geological maps and reports for the region from Darwin to Katherine to the Alligator Rivers region (Refer to Figure 2).

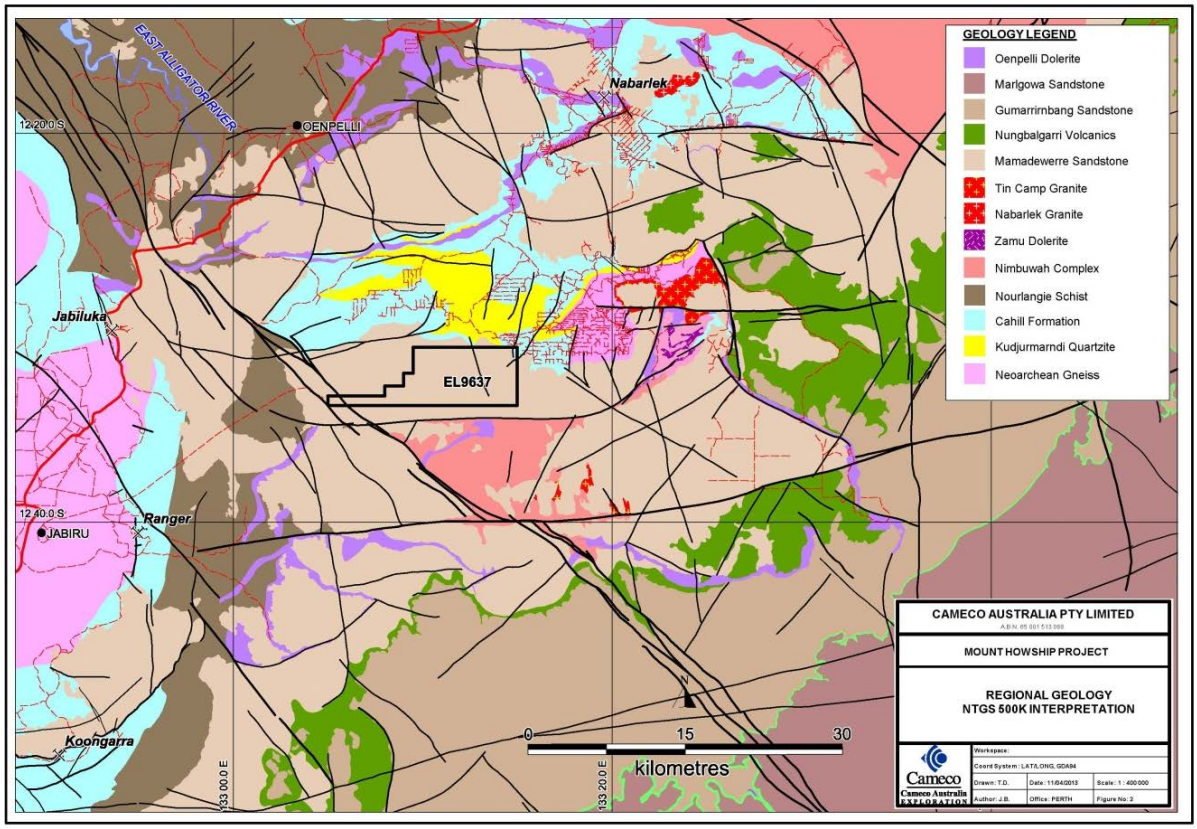

Figure 2: Regional geology of the Mount Howship area

The oldest exposed rocks in the Alligator Rivers region are part of the Neoarchean (ca. 2,500 Ma) Nanambu Complex. The complex consists of paragneiss, orthogneiss, migmatite, and schist forming dome-like structures that are unconformably overlain by Paleoproterozoic metasedimentary and metavolcanic rocks, which were originally included in the Pine Creek Geosyncline. Recent collaborative research work by the NTGS and Geoscience Australia indicates that SHRIMP U-Pb age dating of an area of previously mapped as Myra Falls Metamorphics outcropping within the Myra Inlier is Neoarchean in age (Hollis et al., 2009a). Age dating of quartzofeldspathic gneiss samples has yielded two age groups 2.67 – 2.64 Ga

and 2.53 – 2.51 Ga (Hollis et al., 2009b). Gneiss with ages dated at 2.53 – 2.51 Ga is informally named as 'Kukalak Gneiss' and gneiss with age dated at 2.67 – 2.64 Ga is informally named as 'Arrarra Gneiss' (Hollis et al., 2009a).

Paleoproterozoic lithologies in the Alligator Rivers region are amphibolite facies psammites assigned to the Mount Howship Gneiss and the Kudjurmarndi 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 on-lap Neoarchean basement highs, with gneissic variants thought to pass transitionally into paragneiss of the Nanambu Complex.

The Cahill Formation of the Namoona Group conformably overlies the Kudjurmarndi 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 lower calcareous marble and calc-silicate gneiss, overlain by pyrite-garnet-bearing carbonaceous schist, quartz-feldspar-mica gneiss, and minor amphibolite.

The informally named Upper Cahill Formation is overall psammitic and consists of feldspar-quartz schist, quartzite, minor mica-feldspar-quartz-magnetite schist, metaconglomerate, and amphibolite. The Upper Cahill Formation contains a magnetic horizon that is significant at the base of the psammitic unit in what is informally known as 'hangingwall sequence'. The magnetic characteristics of this unit are due to the presence of mafic sills or magnetite and it is used for distinguishing the Cahill Formation from occasionally ambiguous surrounding less magnetic lithologies (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 with local garnet and staurolite porphyroblasts.

The supracrustal rocks of the region are structurally complex after having been affected by several deformation events before deposition of the late Paleo- to Mesoproterozoic Kombolgie Subgroup. The lithologies have also been locally migmatized during the ca. 1,847 ± 30 Ma Nimbuwah Event. In addition, there is a broad trend of increasing metamorphic grade from southwest to northeast in the Nimbuwah Domain. This gradient is thought to reflect the synchronous emplacement of ca. 1,865 Ma granites in the Nimbuwah Complex.

The Kombolgie Subgroup is the basal unit of the late Paleo- to Mesoproterozoic Katherine River Group of the McArthur Basin (Sweet et al., 1999). The subgroup consists of sandstone units known as the Mamadawerre Sandstone, Gumarrirnbang Sandstone, and Marlgowa Sandstone, which are divided by thin basaltic units, the Nungbalgarri Volcanics, and Gilruth Volcanics. The Mamadawerre Sandstone has a minimum age of ca. 1,700 Ma, which coincides with 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. 1,810 Ma.

The Oenpelli Dolerite is the most pervasive mafic intrusive suite to affect the Alligator Rivers region and is the youngest exposed Proterozoic unit. It intrudes various Neoarchean,

Paleoproterozoic, and the Kombolgie Subgroup units, forming sills, dykes, lopoliths, and laccoliths, all with magnetic signature. The Oenpelli Dolerite has a SHRIMP U-Pb baddeleyite date of 1,723 ± 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. Localized effects in the sandstone include silicification, desilicification, chloritisation, sericitisation, and pyrophyllite alteration. Locally, 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 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 Mount Howship 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 fault-like structures, including those with a marked geomorphic expression, show no displacement, and are best described as joints or lineaments.

Erosional remnants of flat-lying Paleozoic Arafura Basin and Cretaceous Carpentaria Basin are present as a veneer throughout the coastal zone. Various regolith components are ubiquitous as cover throughout much of the Arnhem Land region.

Local and Project Geology

The Mount Howship tenement lies to the south of the Myra Falls Inlier, and to the north of the Beatrice Inlier. Refer to Figure 3 for the local geology of the tenement area.

The tenement area is almost entirely covered by the Mamadawerre Sandstone, with variable thickness of 0 m in the northeast to an estimated maximum depth of 350 m in the southwest. Outcropping Cahill Formation is present in the northeast corner of the tenement. Overall, basement units throughout the tenement are interpreted to be the various lithologies that are part of the Cahill Formation documented above.

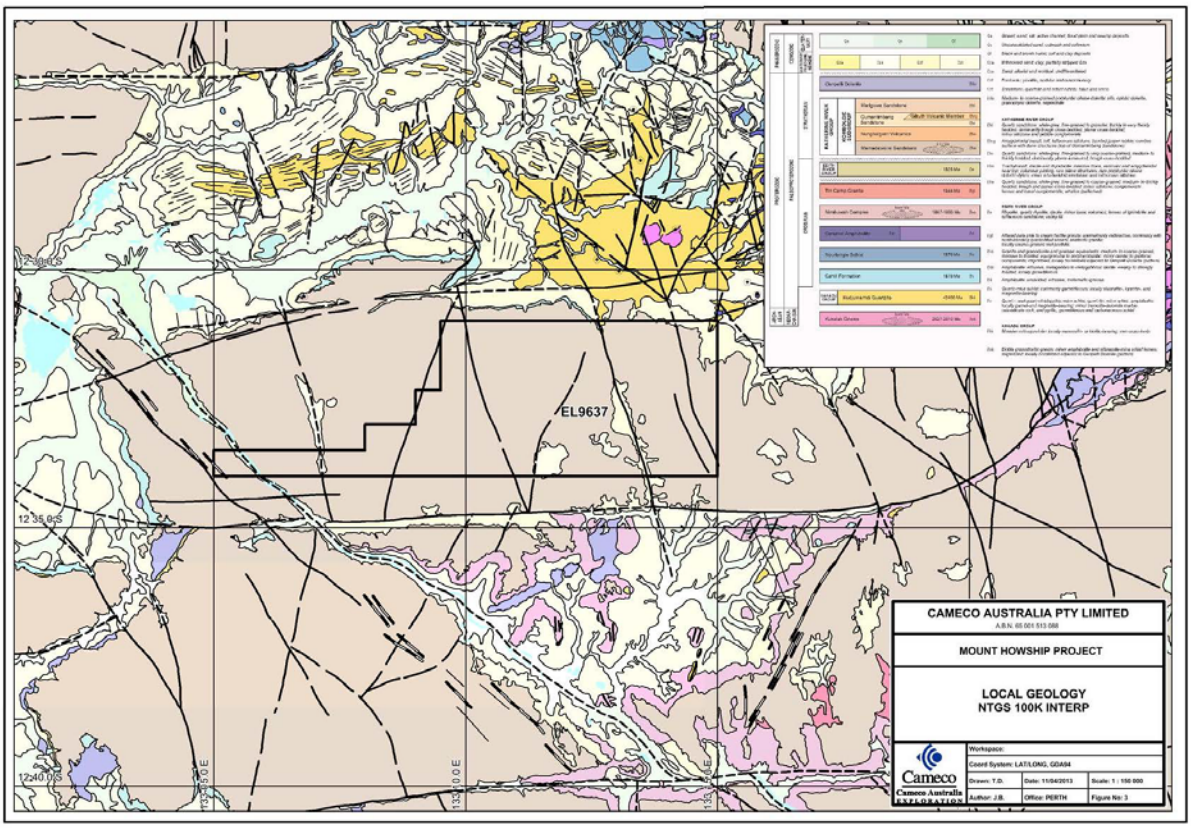

Figure 3: Local geology map

PREVIOUS EXPLORATION

Air photography was completed over the Mount Howship project area prior to the licence grant (with permission) in June 2008. The produced image was geometrically corrected to create an ortho-photograph with a resolution of 90 cm per pixel. Two airborne surveys, magnetic - radiometric and hyperspectral, were flown over the Mount Howship project area in 2008 – 2009.

The airborne radiometric and magnetic survey was completed by UTS Geophysics using a 100 m line spacing and 1,000 m tie lines. Interpretation of the survey data identified two northwest trending structures cutting across the sandstone and underlying basement, with likely dolerite emplacement at intersections of cross-cutting structures. Interpretation of the regional magnetic trend over the project area suggests that the sandstone is thickening to the west. This thickening could be caused by either a sharp paleo-topographical change or by three major vertical offsets controlled in part by the interpreted northwest trending structures. The magnetic high present in the northeast of the project area is believed to be lithologies of the Cahill Formation, while the largest magnetic feature of the survey, in the southeast of the tenement, is attributed to a dolerite intrusion.

In May 2009, an airborne hyperspectral survey was completed over the Mt Howship project by HyVista Corporation. The survey was flown with a pixel size of 4.7 m, a flight path width of 61 pixels and a height of 2,000 m. The objective of the survey was to identify anomalous hydrothermal clay alteration in the sandstone cover and abrupt changes in clays that could

possibly indicate structural offsets. Several areas with anomalous signatures have been identified.

During the 2010 field season, a ground mapping and outcrop sampling program was completed. A total of 59 mapping stations were recorded; with 43 being rockchip sample locations and 16 structural mapping points. There were no anomalous uranium results returned from the rock-chip samples.

In April 2010, 363 line kilometers of airborne electromagnetic (EM) survey using the TEMPEST system was flown over the Mount Howship project by FUGRO Airborne Surveys. The survey was completed to attempt to map possible conductive zones that could be related to hydrothermal alteration in the sandstone and underlying basement. Interpretation of the TEMPEST data was also used to create a model of the depth to the unconformity. Specific areas of interest were where the sandstone basement unconformity is interpreted to be vertically offset.

In 2011, exploration activities consisted of outcrop sampling and reconnaissance mapping to follow up previously identified radiometric and structural anomalies. A total of 84 mapping stations were recorded, consisting of 46 rockchip sample locations and 113 structural mapping points. In total, 46 samples were submitted for geochemical analysis. Several weak uranium anomalies were identified that warrant follow-up.

2012 EXPLORATION PROGRAM ACTIVITIES

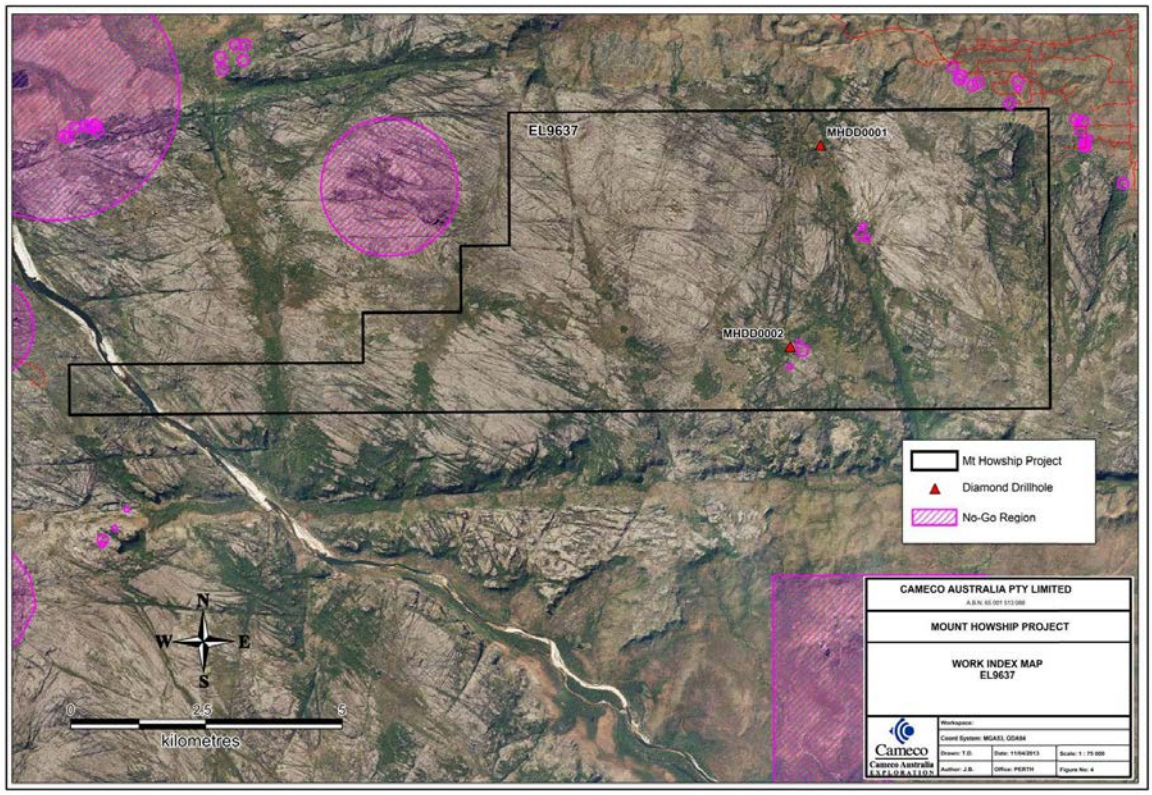

Figure 4. Work Index Map with location of 2012 exploration program activities.

Drilling Campaign

Diamond drilling was the main exploration activity completed within EL9637 during the 2012-2013 reporting period. Two drillholes (MHDD0001 and MHDD0002) were completed for a total of 511.6 m. Drillhole locations are shown on the Work Index map in Figure 4.

All drillholes were geologically logged using Cameco's internal logging codes, listed in Appendix 1. Full geological logs and drillhole location information are included in digital format in Appendix 2.

Drillhole #	Dip (°)	Azimuth (°)	Total Depth (m)	Start Date	Finish Date
MHDD0001	-60	045	254.2	27/06/2012	10/07/2012
MHDD0002	-60	020	257.7	16/07/2012	07/08/2012

Table 1. Summary of 2012 drilling activities on Mount Howship Project.

MHDD0001 intersected 97.0 m of Mamadawerre Formation sandstone, followed by alternating intervals of intense silica-flooded brecciation and Cahill Formation pelitic schist accompanied by intense hematite alteration to the final depth of 254.2 m.

MHDD0002, which was drilled approximately 3.75 km to the southwest of MHDD0001, intersected 213.4 m of Mamadawerre Sandstone, followed by Cahill Formation pelitic schist

down to 257.7 m. No significant structural disruption or hematite alteration was intersected in MHDD0002.

Downhole Gamma Probing

Downhole gamma logging was completed within the drill rods for both drill holes. This data is provided in digital format in Appendix 2. No anomalous radioactivity was noted in either of the drillholes.

Downhole Geochemistry

A total of 122 samples from drillcore (66 samples from MHDD0001 and 56 samples from MHDD0002) were collected for geochemical analysis in 2012. All samples collected for geochemistry were submitted to Northern Territory Environmental Laboratories (NTEL) for analysis. All samples were prepared by crushing and milling and analysed using ICP. All analytical geochemistry results for the 2012 field season are provided in digital format in Appendix 2. Methodology is described in detail in Appendix 3.

All geochemical data received from the Mount Howship samples passed the following Cameco quality control procedures:

1. Rigorous checking of the laboratory's accuracy and precision in the analysis of U, Al_2O_3, As, Ba, Be, CaO, Ce, Co, Cr, Cu, Dy, Fe_2O_3, Hf, K_2O, La, MgO, Mn, Mo, Nb, Nd, Ni, P_2O_5, Pb, Rb, S, Sr, Ta, Th, TiO_2, U, V, W, Y, Zn, and Zr via the use of three matrix matched certified geochemical standards (at the insertion rate 5% or approximately 1 in 20 samples) of differing U content (with average U concentrations of 4.76 ppm, 42.18 ppm, and 111.10 ppm);
2. Monitoring the laboratory's ability to repeat results on analyses of sub-sets of the powdered sample via monitoring of the laboratory's analytical duplicates (duplicate insertion rate is 10% or approximately 1 in 10 samples) for the entire standard Cameco analytical element suite as given in Appendix 2, and including loss on ignition (LOI).

In 2012 no blanks were used to test for cross-contamination during the laboratory sample preparation process due to unavailability of a blank with uranium concentrations low enough so that such a test could be adequately accomplished.

All data was analysed in detail as part of desktop studies in the office upon completion of the field season. As a result, several observations about the distribution and concentration of elements were made through various geo-statistical calculations and charts. No highly anomalous results in geochemical data were noted, but select weakly elevated values are encouraging for the possible presence of uranium mineralisation in the area and warrant further follow up. In particular, locally elevated U/Th ratios are indicative of relative U enrichment and possible Th depletion in the area, suggesting the passage of mineralizing fluids moving through the structural zones interacting with wall rocks. In addition, analysis

of lead isotope data from the Mount Howship samples also generated results suggestive of, at the very least, the migration of fertile fluids.

Downhole Reflectance Spectroscopy

A total of 93 drillcore samples were analyzed for hydrothermal alteration clay minerals using reflectance spectrometry. Alteration minerals containing hydroxyl, carbonate, and several sulphate complexes exhibit diagnostic absorption features in the shortwave infrared portion of the electromagnetic spectrum (wavelengths of 1300 to 2500 nm). These features are often associated with hydrothermal alteration minerals and therefore, this technique may be useful for identifying these minerals, and also diagenetic clay phases that could be related to unconformity-type uranium deposits and their host rocks. All collected samples were analyzed by Cameco personnel while working in the field on the Arnhem Land projects during the 2012 season using a Terraspec3® Spectrophotometer manufactured by Analytical Spectral Devices Inc. (ASD). The interpreted spectral reflectance results are provided in digital format in Appendix 2. Appendix 3 includes a detailed description of the analytical procedure for reflectance spectrometry.

The clay minerals in both MHDD0001 and MHDD0002 are of relatively similar and consistent composition and overall display similar spectral signatures. The sandstone column in both drillholes is dominated by a kaolinite + illite mixture, and kaolinite is present sporadically in the muscovite schist below the unconformity, but rarely in brecciated intervals.

Basement lithologies in both drillholes are dominated by illite. In MHDD0002 the lower boundary of the hematite/red paleoweathering zone is coincident with an increase in chlorite minerals. However, this chlorite is likely part of the paleoweathering profile or of metamorphic origin and, at the moment, is not considered to be of interest to warrant any further follow-up.

Downhole Petrology

A petrography study was conducted by Pontifex & Associates Pty. Ltd. on six samples from MHDD0001. Refer to Appendix 4 for the details of the report. Samples for the study were selected from various depths and are considered representative of quartz-flooded breccia, muscovite schist and amphibolite. All samples have a strong hematite overprint that often masks the rock type and overprints other alteration features. The origin of the hematite is ambiguous and is interpreted as low temperature hydrothermal or deep supergene. Further work is required to determine the hematite's origin and its significance.

CONCLUSIONS AND RECOMMENDATIONS

Airborne geophysical surveys from previous years provide a number of prospective radiometric, magnetic and structural targets. Assay results from the 2011 surface sampling program and interpretation of the 2010 mapping work indicated several prospective areas for drill test follow-up. Results of the 2012 drilling campaign confirmed the presence of the Cahill Formation underneath the Mamadawerre Sandstone and intersected a zone of strong hematite alteration.

Future exploration on the tenement may consist of testing several geophysical anomalies at the intersection of the Paleoproterozoic unconformity and northwest-trending structures (similar to the setting of MHDD0001), as well as investigation into the nature of regional northeast trending structures. In addition, several ground visits for mapping, geological reconnaissance, outcrop sampling, and a brief ground radiometric survey to the areas along these structures should also be planned.

A tenement wide airborne gravity survey (Heli-Falcon) may add valuable information to the existing geophysical dataset and may potentially map out in greater detail several structural trends that are not yet fully understood.

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. *Northern Territory Geological Survey*, *Explanatory Notes*.

Granholm X., Dunlevie T. and Christie N., 2012. *EL9637, Cameco Australia Pty. Ltd. Annual Report – Mt Howship Project*. June 2012.

Hollis J.A., Carson C.J. and Glass L.M., 2009a. SHRIMP U-Pb Zircon Geochronological Evidence for Neoarchean Basement in Western Arnhem Land, Northern Australia. *Precambrian Research* 174, p. 364 – 380.

—, 2009b. Extensive exposed Neoarchean crust in Arnhem Land, Pine Creek Orogen: U-Pb zircon SHRIMP geochronology. *Annual Geoscience Exploration Seminar (AGES) 2009. Record of Abstracts.* Northern Territory Geological Survey. 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, Vol. 1. *The Australasian Institute of Mining & Metallurgy, Monograph Series*, 14, 799 – 805.

Needham R.S., 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. *International Atomic Energy Agency*; p. 233 – 257.

Needham R.S., 1988. Geology of the Alligator Rivers Uranium Field, Northern Territory. *Bureau of Mineral Resources, Geology and Geophysics, Bulletin, 224.*

Needham R.S., 1990. Geological and mineralisation map of the Alligator Rivers uranium field, Northern Territory. 1:250,000 scale Map. *Bureau of Mineral Resources, Geology and Geophysics*.

Sweet I.P., Brakel A.T. and Carson L., 1999. The Kombolgie Subgroup — a new look at an old 'formation'. *AGSO Research Newsletter,* 30, p. 26 – 28.

Sweet I.P., Brakel A.T., Rawlings D.J., Haines P.W., Plumb K.A. and Wygralak A.S., 1999. Mount Marumba, Northern Territory (2nd edition). 1:250,000 Geological Map Series explanatory notes, SD53-06. *Northern Territory Geological Survey*, Darwin.