



**Cameco Australia Pty Ltd**

**MAJARI PROJECT**

**EL 3346**

**Relinquishment Report 2004**

**CONFIDENTIAL**

**Date: November 2004**

**Report No.: MJ04-04**

**Period: 6 September 2000 to 5 September 2004**

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## SUMMARY

This report describes exploration work undertaken on the relinquished portion of the Majari Project between 6 September 2000 and 5 September 2004. The tenement is situated approximately 330 km to the east of Darwin, and is wholly within the Arnhem Land Aboriginal Reserve.

The tenement was granted to Afmeco Mining and Exploration Pty Ltd on 6 September 2000 for a period of six years. AFMEX was in joint venture with SAE Australia Pty Ltd and Cameco Australia Pty Ltd. Cameco became sole owner and manager of the tenement in 2002.

This report details work performed by Cameco Australia and Afmex on EL 3346, during the period 6 September 2000 to 5 September 2004. The relinquished portion of the tenement is overlain by recent Cainozoic sands and Cretaceous sediments that obscure the Palaeoproterozoic sediments of the Kombolgie Subgroup and basement rocks. One area in the north-west of the tenement has outcropping Nimbawah basement rocks. The exploration work conducted consists of airborne geophysical surveys with very limited geological sampling due to lack of outcropping rocks.

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## **INTRODUCTION**

Exploration Licence 3346 was explored in joint venture by Afmeco Mining and Exploration Pty Ltd, SAE Australia Pty Ltd and UAL Pty Ltd. In 2002, Cameco Australia Pty Ltd entered into the joint venture and has now attained ownership of the licence.

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

The project is underlain by interpreted Nimbuwah granitoid basement rocks, which are not considered favourable to host unconformity uranium mineralisation. The Kombolgie Subgroup sandstone outcrops extensively throughout the southern portion of the tenement. Several large structures are present in the region. Uranium occurrences have been identified to the west of the project area, an indication of a favourable mineralising and alteration event.

The exploration activities on the relinquished portion of EL 3346 included airborne radiometric and magnetic geophysical survey, an airborne TEMPEST electromagnetic geophysical survey, and limited outcrop sampling.

### **Location and Access**

Exploration Licence 3346 is located in western Arnhem Land. The tenement is centred approximately 340km east of Darwin and 35km southwest of Maningrida.

Road access is via the Oenpelli – Maningrida road that traverses the tenement. Several subsidiary tracks branch off the main road, servicing outstations in the region. Much of the tenement is flat lying and can most likely be accessed by four-wheel drive vehicle. The principal access to most of the tenement is by helicopter.

### **Location Map**

#### **Tenure**

On 5 September 2004 the subject licence reached the end of its fourth year of tenure. The licence, which is on Aboriginal freehold land in northwestern Arnhem Land, was granted to Afmeco Mining and Exploration Pty Ltd (Afmex) on 6 September 2000 for a period of six years. Afmex were in joint venture with SAE Australia Pty Ltd and UAL Pty Ltd. Cameco, through acquisition of UAL assets became involved with the project in 2001. After the withdrawal of Afmex from Arnhem Land in late 2002, Cameco became sole owner and manager of the tenement.

The relinquishment of the area covering the north-eastern portion of the licence, effective from 5 September 2004, consists of 94 blocks for an area of 315.7 square kilometres.

#### **Physiography**

Much of the topography in the relinquished portion of the tenement is relatively flat lying and covered by savannah woodland and dissected by small creeks and floodplains. To the west and south of the area the topography is sandstone covered and marks the northern and eastern limits of the Arnhem Land plateau country in the region.

The principal drainage in the area is the north flowing Liverpool River, located to south and east of the area. Several minor creeks traverse EL 3346.

### **Tenement Geology**

Based on the most recent NTGS mapping (Milingimbi 1:250000 geological series), the oldest rocks within the area comprise the basement Paleoproterozoic Nimbuwah Complex. Sandstones of the Kombolgie Subgroup sediments overlie these basement rocks. Cambrian Buckingham Bay sandstone crops out as scattered remnants to the north and east of the tenement, which is largely covered by Quaternary sands and black soil floodplains.

The Nimbuwah Complex consists of gneiss, migmatite and various granitic intrusives. The most recent age determinations place the Nimbuwah within 1870-1850 Ma. The 'complex' has an I-type granite origin and is considered to be, in part, intrusive into Paleoproterozoic metasediments, in this case the Myra Falls Metamorphics. (Carson et al., 1999). Within EL 3346, visible Nimbuwah is restricted to a series of scattered outcrops in the northwest corner of the tenement.

The basement Nimbuwah Complex rocks are overlain by the Kombolgie Subgroup, which comprise the lower subgroup of the early Proterozoic Katherine River Group, the oldest rocks of the McArthur Basin. The Kombolgie Subgroup comprises an alternating sequence of quartz arenite sandstones and basaltic flow volcanics. The Mamadawerre Sandstone is the basal unit of the Kombolgie Subgroup, which is disconformably overlain by the Nungbalgarri Volcanic Member, a regionally distributed basaltic flow volcanic. Gumarrirbang Sandstone overlies the volcanic member. The age of the Mamadawerre has been constrained between 1822 and 1720 Ma and is probably closer to 1800 Ma (Sweet and others 1999). Mamadawerre Sandstone outcrops to the south-west and disappears under sand and ferricrete cover to the east. The ferricrete may be interpreted as being the residual debris from the now eroded Nungbalgarri Volcanic Member. Dissected sandstone plateaux and rugged hills of the Gumarrirbang Sandstone outcrop to the south of the area.

The basal unit of the Cambrian Wessel Group, the Buckingham Bay Sandstone, occurs as scattered outcrops in the eastern portion of the area. These Cambrian sediments, which comprise the oldest rocks of the Arafura Basin, obscure any northern and eastern extensions of the Paleoproterozoic basement and sandstone.

Oenpelli dolerite is interpreted to intrude basement Nimbuwah Complex rocks and the Kombolgie Subgroup and has been observed at one location to the south of the area, within a northwest trending lineament intruding the Gumarrirbang Sandstone. The dolerite is exposed as small boulders and rounded outcrop in the bottom of the linear feature.

A variety of quaternary surficial materials cover much of the region, obscuring the basement rocks and Kombolgie Subgroup sediments.

## **Geology Map**

### **Regional Structure and Geological History**

The early Proterozoic rocks of the region have been affected by the Top End orogeny (1880 to 1780 Ma), which includes the initial Nimbuwah Event or Barramundi Orogeny

at about 1870 Ma. This event produced a prograde metamorphic effect with associated tight folding and faulting. The various 'domains' exhibit a variability of deformation and metamorphic grade, with the western and eastern margins of the Pine Creek Inlier (Litchfield Province and Nimbuwah domain respectively) exhibiting the most pronounced effects.

Major regional faults, which affect the early Proterozoic, have northwest (Bulman), north-northwest (Aurari) and northerly (Anuru, Goomadeer) strikes. Another significant set trends to the east and includes both the Ranger and Beatrice faults. The Bulman Fault Zone is the principal regional feature and is considered to represent a long-lived, deep crustal structure, which has exerted a large lateral component in rocks of the Pine Creek Inlier.

A more intense concentration of structures traverse the mid Proterozoic and younger rocks and include northwest, east, northeast and north trends. Both faulting and jointing, with displacements ranging from a few metres up to 100 metres, locally heavily dissect the Kombolgie.

Deposition of the Mamadawerre Sandstone took place in an environment of extension and local basin formation with probable fault-controlled sedimentation. Rapid thickening and thinning of the sequence imply this.

The widespread Oenpelli Dolerite intrusive event took place at about 1715 Ma. Localised effects in the sandstone include silicification, the introduction of magnesium rich to intermediate chlorite and the formation of muscovite-illite. A characteristic mineral assemblage of prehnite-pumpellyite-epidote has formed in the quartzofeldspathic basement rocks adjacent to the intrusions.

### **Exploration Target**

The focus of the exploration strategy is the discovery of unconformity-related uranium deposits. The nearby deposits at Ranger, Jabiluka and Koongarra and the now depleted Nabarlek Mine serve as models for this strategy. The presence of gold, palladium and platinum in these deposits plus the economic gold-platinum resource at Coronation Hill in the South Alligator Valley, indicates an additional potential for this deposit style.

### **Previous Exploration**

McIntyre Mines (Australia) in joint venture with Canadian Superior Oil (Australia) and Ocean Resources conducted exploration on Exploration License 144 from 1971 to 1973. An airborne radiometric survey over the western portion of EL 3346, and the eastern portion of Cameco operated EL 5892 located two significant U anomalies associated with the Nungbalgarri Volcanic Member to the northwest of Gudjekbinj outstation. Drilling was recommended for the prospect, but was not conducted before the EL was relinquished in 1973. The prospect lies outside of EL 3346 and EL 5892.

## **EXPLORATION PROGRAM**

Afmex gained exploration access to EL 3346 in September 2000. Afmex carried out limited exploration prior to Cameco involvement, and was restricted to geophysical remote sensing surveys. A detailed (100m line spacing) airborne radiometric and magnetic survey was conducted over the entire tenement during September 2001. Results from the radiometric

survey identified 7 low order anomalies for follow up ground investigation, within the relinquished portion of the tenement. An airborne electromagnetic survey (TEMPEST) was flown in August 2002 over a small area in the central portion of the original tenement, with a portion lying inside the relinquished area. The survey area was selected based on an interpreted shallow depth to basement rocks and a suggestion from magnetics that several large structures are present in an area of relatively sparse rock outcrop. During early September 2002, Cameco personnel conducted ground investigations of radiometric anomalies and performed broad regional outcrop sampling over sandstone outcropping areas.

One outcrop sample of Nimbuwah Complex basement rocks, collected as part of the radiometric follow-up sampling, lies within the relinquished portion of the project. The remainder of the airborne radiometric anomalies were associated with black soils and floodplains. Geochemical results from the sampling did not highlight any areas requiring further follow-up work.

Work during 2003 and 2004 concentrated on areas of Kombolgie Subgroup sandstone cover and did not cover the relinquished portion of the tenement.

All digital data, which has been acquired by Cameco has been submitted on CD with this report. In some cases data over culturally sensitive “nogo” zones has been excised from figures and data in accordance with requests by Traditional Owners.

### **Outcrop Sampling**

One outcrop sample was collected as part of the radiometric anomaly follow-up program conducted in September 2002. The radiometric anomaly was due to outcropping Nimbuwah Complex very coarse-grained porphyroblastic granodiorite, of higher radiometric response than the surrounding Cainozoic sands. No further work was recommended for the area.

All samples were sent to NTEL in Darwin and Pine Creek, Northern Territory, for multi-element analysis. In total, four separate methods were used to analyse up to 65 elements and four isotopes. The geochemical methods used are detailed in the following tables. All data pertaining to the samples within the relinquished area is listed in the following tables, and included within the data directory on CD.

## **Location of Outcrop Sampling and Work Completed**

### **Station Locations**

### **Sample Physical Properties**

### **Sample Alteration and Structural Measurements**

### **Sample PIMA – TSA Clays**

### **Sample Chemistry – NTEL Laboratory**

## **NTEL Chemical Analysis and Methods**

### **Competency, Grain Size, Friability and Munsell Colour Codes**

## Geophysics

### Airborne Magnetism and Radiometrics

In 2001 Universal Tracking Systems Pty Ltd (UTS) conducted a single airborne magnetic, radiometric and DTM survey over the whole tenement totalling 7931 line km. Survey specifications employed for this survey were 60m flight height, 100m lines flown in a west east direction. The primary aims of the survey were to locate any surface uranium enrichment and to acquire data useful for future geological mapping.

Radiometric data suggests a substantial area of EL3346 is sandstone and low activity Cainozoic cover. No radiometric response within the survey boundary is considered to be particularly anomalous. Most responses are of low tenor and appear spatially related to dykes, volcanics or Cainozoic cover. Seven radiometric anomalies were identified within the relinquished portion of EL 3346. These anomalies were investigated in September 2002, with one sample taken at anomaly MJR23. Six of the anomalies were identified as black soil and floodplains, with only the one anomaly MJR23 having outcropping rocks. The Nimbuwah Complex granodiorite rocks are responsible for the anomaly having a higher background U signal compared to the surrounding ferricrete littered sand cover.

Interpretation of magnetic data suggests most of the tenement has a substantial thickness of sandstone, increasing towards the northeast. Major structures have been identified in the magnetic data. Movement along these structures is difficult to interpret given the poor magnetic contrast prevalent in much of the stratigraphy.

### UTS Logistics Report

### Location of ARAD Anomalies

### Airborne Radiometric Anomalies Followed Up

### Airborne Electromagnetic TEMPEST

In 2002, Fugro Airborne Surveys Pty Ltd (Fugro) undertook a TEMPEST airborne electromagnetic survey over a portion of the Majari project. TEMPEST is a high-powered time-domain system with a broad bandwidth, which enables good resolution of variations in resistivity and penetration through relatively thick sandstone. The airborne platform allows electromagnetic data to be acquired over areas where ground geophysics is impractical due to rugged topography. The survey was flown with the aim of providing 3-D electromagnetic data over a broad area to identify structure/alteration and in particular, infer the depth to the unconformity below sandstone. Geology within the survey area is interpreted to have a high proportion of Mamadawerre sandstone, which is stratigraphically below the Nungbalgarri Volcanics. A total of 575 line kms were flown with a survey line spacing of 200 m and flying height of 120 m.

### TEMPEST Logistics Report by Fugro

### Location of Surrendered TEMPEST Survey



In the south of the survey area, the CDIs (Conductivity Depth Images) indicate a weak to moderately conductive feature at shallow depth within a resistive host. This conductive feature is attributed to the Nungbalgarri Volcanic Member, which is consistent with the interpretation from airborne magnetics. In the north of the survey area the NTGS has mapped surface Gumarrirbang Sandstone and Cretaceous sediments. CDIs covering the Gumarrirbang Sandstone show a weakly conductive feature at depths ranging up to approximately 400 m. This is thought to represent the conductive unconformity contact between sandstone and basement rocks rather than the Nungbalgarri Volcanic Member, which is generally more conductive over a broader zone (especially in areas affected by Oenpelli Dolerite). Several structures are indicated by sudden changes in the conductive unconformity elevation, with many being confirmed by magnetics. Alternatively, basement paleotopographic highs are also indicated and could provide additional conceptual targets.

There are no discrete basement conductors indicated by the TEMPEST. Instead the main conductive features appear to be related to the Oenpelli Dolerite and the Nungbalgarri Volcanic Member. There are no conductive features associated with the magnetic bull's eye identified by A. Bisset (2002).

## **CONCLUSIONS**

The relinquished portion of EL 3346 is covered by recent sands, alluvium, and Cretaceous sediments, mostly obscuring the underlying rocks and geology. To further explore the area would involve regional RAB drilling or the like to determine the basement rocks and prospectivity. The airborne TEMPEST electromagnetic survey did not identify any targets within the relinquished area that would warrant follow-up by drilling. The low prospectivity of the Nimbuwah granitoids, the lack of targets generated the Tempest survey and the lack of surficial targets would suggest that further work on the area is not warranted.

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