



**Cameco Australia Pty Ltd**

**EL 9452**

**MANYALLULUK PROJECT**

**NORTHERN TERRITORY**

**ANNUAL REPORT**

**CONFIDENTIAL**

**Date: May 2008**

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**Authors: Gavin Otto, Senior Project Geologist  
Geoff Beckitt, Senior Geophysicist**

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

## SUMMARY

This report describes exploration work undertaken on the Manyalluluk Project during the fourth year of tenure from 4<sup>th</sup> May 2007 to 3<sup>rd</sup> May 2008. The tenement was granted on 4<sup>th</sup> of May 2004 for an initial period of six years. Cameco Australia has applied for a partial relinquishment. Cameco wishes to relinquish 125 blocks and portions of blocks for an area of 396.8 km<sup>2</sup> to be made effective on the anniversary date of May 3<sup>rd</sup> 2008, and retain the remaining 284 blocks for an area of 939.2 km<sup>2</sup>.

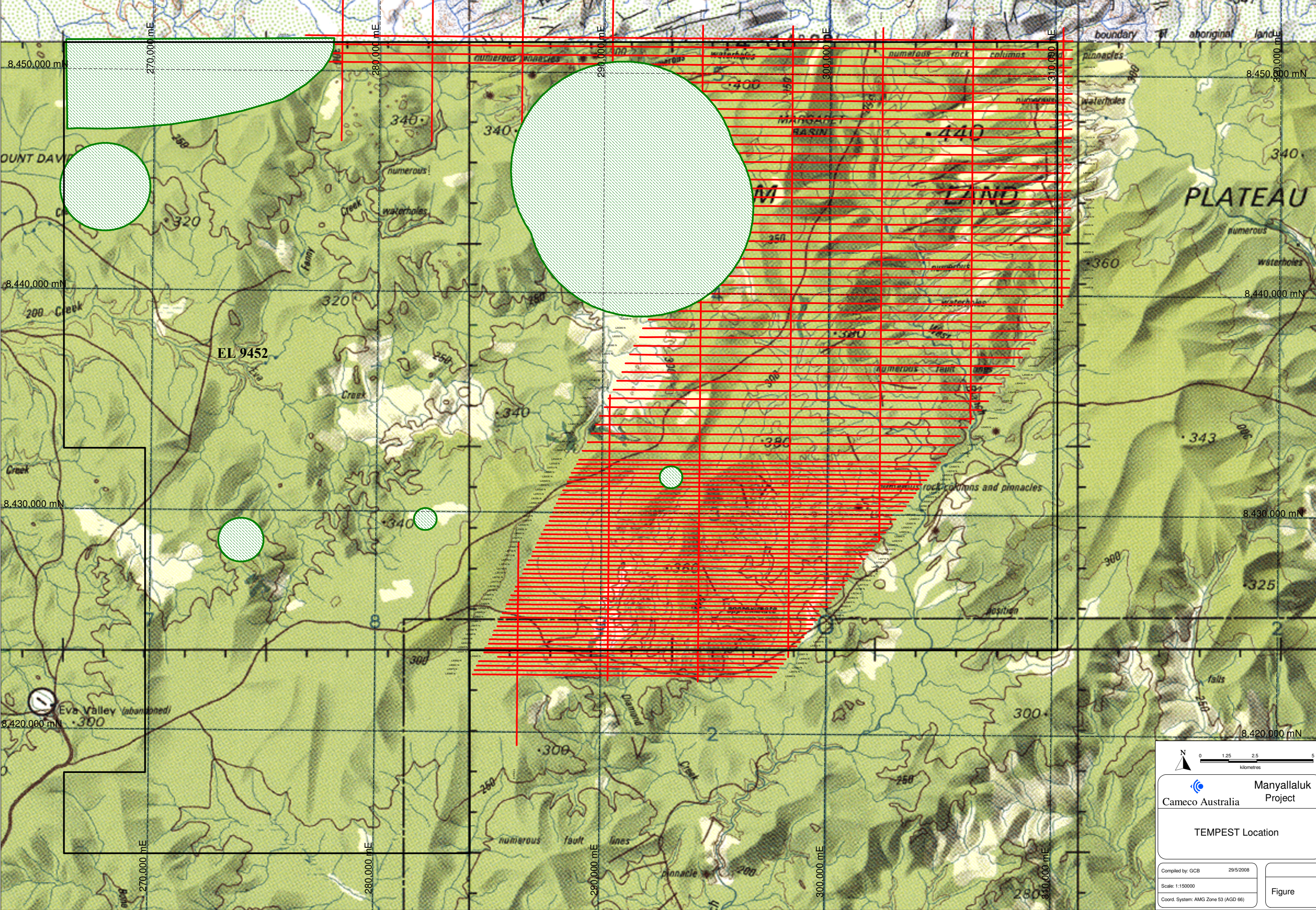
There was no on-ground exploration activity conducted during the last field season. Exploration consisted of a TEMPEST airborne electromagnetic survey over the eastern portion of the Manyalluluk Project and covering the mapped Mamadawerre Sandstone. A total of 1763 line-kms was flown at a flying height of 120 m in a west-east direction with lines 400 m apart in the north and 200 m apart in the south.


The airborne electromagnetic TEMPEST survey has provided some insights into the subsurface stratigraphy due to increased conductivity of the volcanic members (particularly the Nungbalgarri) but also the Mamadawerre Sandstone / Basement unconformity and Hindrance Creek Sandstone. However, the survey has failed to identify any specific targets such as inferred basement graphite and has not responded to the alteration at the MLR015 uranium occurrence. Further interpretative work is required of the TEMPEST data in conjunction with the geology to help in the understanding of the geologically complex area in the Diamond Creek region.

Work planned and proposed for exploration on EL9452 during 2008 may consist of, helicopter-supported outcrop sampling and reconnaissance, and ten RC drill holes. There will be a requirement for track construction to access the work areas, and for the establishment of a base camp near the work area.


Figure 1: Conducted Work on next page







01.252.5kilometres

Manyallaluk Project

TEMPEST Location

Compiled by: GCB29/5/2008

Scale: 1:150000

Coord. System: AMG Zone 53 (AGD 66)

Figure



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## **INTRODUCTION**

This report describes exploration activities carried out from 4<sup>th</sup> of May 2007 to the 3<sup>rd</sup> of May 2008 for EL 9452. The Exploration Licence is located on Aboriginal Land and the exploration program was carried out under the terms of consent documentation agreed with the NLC pursuant to the Aboriginal Land Rights (Northern Territory) Act 1976. Exploration work clearance was given by the NLC on behalf of the Traditional Owners following the Exploration and Liaison Committee Meeting held on 27 April 2006 at Katherine.

### **Location and Access**

Exploration Licence 9452 is located in south western Arnhem Land. The project area is centred about 90 km north east of Katherine and 25 km north east of the aboriginal community of Manyalluluk.

The tenement is traversed in the central area by the access track to the Mann River Camp, established by Cameco Australia in 1998. Various other unmaintained tracks traverse the western portion of the tenement to Mary River Station and other areas and in the eastern portion to Mountain Valley and other outstations beyond the tenement.

### **Figure 2: Project Location Map**

### **Tenure**

EL 9452 was granted on the 4<sup>th</sup> of May 2004 for an initial period of six years. On granting, the total area covered by the licence was 1336 km<sup>2</sup>. Approximately 153.5 km<sup>2</sup> of EL 9452 is designated as 'no-go' and is excluded from exploration. No reduction of tenement holding has been made to date.

### **Physiography**

The tenement consists of tablelands developed on Cretaceous sedimentary rocks in the south western area, merging into undulating plains and small bouldery hills developed on the Grace Creek Granite covering the central to north western area of the tenement. The central to eastern portion of the tenement is dominated by Kombolgie Subgroup sediments exposed as deeply dissected sandstone, which form local escarpments up to 80m high, and rubbly sandstone hills with deep narrow valleys merging into rubbly clay plains and rubbly ridges, formed on volcanic rocks, to the eastern margin of the tenement.

Vegetation varies with geology and topography but generally consists of eucalyptus woodland and scrubland with remnants of monsoonal forest confined to deep gorges, and grassland dominating the western areas.

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

The geological history and regional structure is based on the Explanatory Notes, Katherine SD 5309 1:250000 Geological Map Series (Kruse and others 1994). EL 9452 lies close to the southern margin of the Pine Creek Geosyncline to the

west and the western portion of the McArthur Basin, of which the Kombolgie Basin is part, in the east of the tenement.

### Figure 3: Regional Geology Map

The Finnis River Group rocks form the basement rocks in the area and were deformed and metamorphosed by the Top End Orogeny (1880 to 1780 Ma), which includes the initial Nimbuwah Event or Barramundi Orogeny at about 1870 Ma. This produced prograde regional metamorphism of the sedimentary rocks with associated tight folding and faulting demonstrated within the Tollis Formation.

Intracratonic basin development from extensional block faulting prompted deposition of the Edith River Group with basal clastic sediments overlain by subaerial volcanoclastics of the Plum Tree Volcanics coeval with the intrusion of the Grace Creek Granite at the base of the ignimbrite sheet. The Grace Creek Granite was likely emplaced central to the intersection of major faulting.

The Katherine River Group deposition was initiated on broad epicontinental platforms, with early sedimentation controlled by basins initially developed along marginal faults. The Kombolgie Group depicts a history of mature, fluvial and shallow marine, stable platform sedimentation, dominated by quartz arenites, punctuated by episodes of instability with associated flood basalt extrusions and renewed sedimentation on intraformational erosional surfaces. Extended basin development is demonstrated within the McKay and Cottee Formations with deposition of marine sediments and evaporitic sequences. Later instability led to the deposition of thin less mature lithic and feldspathic sandstone units and later basic and acid volcanism associated with the West Branch Volcanics.

Platform instability in the form of tilting, open folding and erosion took place prior to deposition of the Mount Rigg Group. East of the tectonic high developed on the Grace Creek Granite, the Katherine River Group is warped in a broad 35km wide northeast trending syncline, the Waterhouse Syncline. Bedding dips recorded along the flanks of the syncline are gentle between 5 and 30° with steeper bedding associated with faulting. The synclinal axis is dominantly north east, with a gentle north east plunge in the south, becoming subhorizontal in the north before dying out. The Waterhouse Syncline is not consistent in style or trend to the broad folding of Edith Falls Syncline and Seventeen Mile Anticline to the west of the Grace Creek Granite, and may represent different tectonic phases.

A period of platform stability persisted through deposition of the initial basal fluvial sediments and later marine sediments of the Mount Rigg Group. Further deformation and faulting took place prior to the deposition of the Roper Group. To the east of the Grace Creek Granite, a zone of east to north east trending faults, with a conjugate system of faults, extends across the Kombolgie Group. The Diamond Creek Fault immediately to the south of EL 9452 is a major fault trending to south east which juxtaposes the Kombolgie Subgroup with Upper

Katherine River Group rocks, with a secondary fault to the north which juxtaposes Edith River Group with Upper Katherine River Group rocks.

Sedimentation within the local area ceased until the early Cretaceous with deposition of shallow marine and continental sands and silts capping and obscuring the pre-existing exposed geology during periods of elevated sea levels.

### **Tenement Geology**

Based on the NTGS mapping of the Katherine 1:250000 geological series (Kruse and others 1994), outcropping rocks within the tenement consists of a compressed stratigraphic sequence of Palaeoproterozoic Kombolgie Subgroup sedimentary and volcanic rocks, Kombolgie Group sediments and volcanics unconformably overlying Edith River Group sediments and volcanoclastics which has been intruded by the Grace Creek Granite. Metamorphosed sediments of the Finniss Group, while not exposed on the tenement, may underlie Cretaceous sediments in the south western portion of the tenement. The Maud Dolerite, prior to the emplacement of the Grace Creek Granite, intrudes the Edith River Group. All of the above rocks are overlain in part by Cretaceous marine sediments.

### **Figure 4: Tenement Geology Map**

The Edith River Group is comprised of the Hindrance Creek Sandstone and the conformably overlying Plum Tree Creek Volcanics. The Hindrance Creek Sandstone is characterised by a coarse cobble conglomerate, at the base grading to massive to thickly bedded lithic to feldspathic quartz sandstone and arkose. The basal conglomerate is comprised of rounded quartz pebbles, and subangular clasts of volcanics and chert. The formation is interpreted to represent alluvial fan deposits flanking active marginal fault scarps to the north (Kruse and others, 1994). The Plum Tree Creek Volcanics consists of dominantly subaerial rhyodacitic ignimbrite conformably overlying the Hindrance Creek Sandstone. The ignimbrite commonly contains feldspar and quartz phenocrysts, with rare hornblende in a finely crystalline groundmass.

The chemically and petrologically similar Grace Creek Granite intrudes the Plum Tree Creek Volcanics. The Grace Creek Granite is interpreted as the intrusive magma chamber from which the subaerial ignimbrite sheet of the Plum Tree Creek Volcanics was derived, and is located at the intersection of major faults. The granite is broadly zoned with equigranular grey granite in the central zone grading into more phenocrystic and xenolithic finer grained reddish granite.

The Katherine River Group overlies the Edith River Group. The age of the Katherine River Group is constrained by the Plum Tree Creek Volcanics below 1857 – 1822 Ma and the West Branch Volcanics above 1712 – 1705 Ma (Kruse and others, 1994) and the Oenpelli Dolerite above 1720 Ma and is probably closer to 1800 Ma (Sweet et al., 1999). The Kombolgie Subgroup is comprised of mature quartz arenites punctuated by basaltic, extrusive, volcanic units.



Extrusive volcanic rocks of the Nungbalgarri Volcanics and the Gilruth Volcanic Member are present. The former conformably separates the Mamadawerre (basal member of the Kombolgie Subgroup) from the Gumarrirnbang while the Gilruth outcrops as a thin lateritised or saprolitic surface separating the latter from the overlying Marlgowa Sandstone and conformable McKay Sandstone.

Overlying the Kombolgie Subgroup, six formations in ascending order, Cottee Formation, Shadforth Sandstone, McCaw Formation, Diamond Creek Volcanics, Gundi Sandstone and West Branch Volcanics comprising the Upper Katherine River Group are exposed within the south eastern portion tenement. The formations grade from shallow marine sandstones, polymictic conglomerate lenses and mudstones of the Cottee Formation, Shadforth Sandstone and McCaw Formation, to basaltic lava flows, fluvial volcaniclastic sandstones and pebbly lithic sandstones of the Diamond Creek Volcanics and Gundi Sandstone to fluvial to shallow marine conglomerate, lithic sandstones and extrusive mafic lavas of the West Branch Volcanics.

Undifferentiated Cretaceous sandstone and claystones cap and obscure the older rocks throughout the tenement. Recent cover comprising sands and clay, gravel and cemented ferruginous deposits infill most valleys and also obscure any outcrop.

### **Exploration Target**

The focus of the exploration strategy is the discovery of unconformity-related uranium deposits. The nearby economic deposits at Coronation Hill, Ranger, Jabiluka, 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**

Historically, the area has little to no known historical uranium exploration. Other exploration activities have been small-scale prospecting/mining for tin, tungsten and copper, which included some associated uranium, from the late 1970's until 1990's. Some copper with minor associated uranium, and tungsten mineralisation is indicated from historical records, however, these anomalies have not been ground verified.

A summary of exploration is discussed below and tabulated in Table 1.

#### **Table 1: Previous Exploration at Manyallaluk**

##### **Cameco Exploration 2004-2005**

The 2004 exploration program consisted of an airborne hyperspectral survey, and outcrop sampling of areas of airborne radiometric anomalies identified from the airborne radiometric surveys conducted by UTS in 2000 and 2003. In total, 86 samples were collected from 91 stations; 42 airborne radiometric (ARAD) anomalies were ground investigated.

The ARAD anomaly investigation identified seven areas of interest identified by their ARAD anomaly numbers; MLR005, MLR006, MLR014 within the Diamond Creek area and MLR001, MLR015, MLR039 within the Grace Creek Granite.

#### Cameco Exploration 2005-2006

The 2005 exploration program consisted solely of outcrop sampling. In total 250 stations were visited, and 225 samples taken; the outstanding stations being mapping locations. The aims of the 2005 program were to continue ground investigation of the ARAD anomalies identified from the radiometric surveys flown in 2000 and 2003; ground investigate and validate interpreted clay anomalies derived from the hyperspectral survey flown in 2004; and to continue with the collection of regional baseline samples.

No new areas were discovered in 2005. Sampling density was increased in the already identified areas of MLR015 (northern granite anomaly) and MLR014 (Diamond Creek area). Sampling at MLR015 obtained a maximum value of 650 ppm U from clay-altered granite. At MLR014, basal conglomerate interpreted as Gumarrirnbang Sandstone unconformably overlies outcrop of Hindrance Creek Sandstone. No additional sampling was conducted at MLR005, although the area is ranked as a high priority drill target. Drilling of targets MLR005 and MLR014 in the Diamond Creek area was proposed for 2006.

#### Cameco Exploration 2006-2007

The exploration program for 2006 consisted of helicopter-supported drilling of two diamond-core holes (MLD001 and MLD002) in the Diamond Creek area in the southern portion of EL9452. In total, 815.7 m of core was drilled in two holes. No significant mineralisation was intersected in the drilling.

Drill hole MLD001 intersected sandstones and minor volcanics of the Kombolgie Subgroup in faulted contact with the Hindrance Creek Sandstone. Drill hole MLD002 was collared and terminated in interpreted Hindrance Creek Sandstone.

Drilling and mapping in the Diamond Creek area has indicated there are complex stratigraphic and structural relationships between the Kombolgie Subgroup and underlying Hindrance Creek Sandstone, and that much of the NTGS mapping in this area requires re-interpretation.



## EXPLORATION PROGRAM

The only exploration work carried out during the reporting period is an airborne electromagnetic survey. No on-ground work has been completed. 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.

### Geophysics – TEMPEST

During June/July 2007, Fugro Airborne Surveys Pty Ltd (Fugro) undertook a TEMPEST airborne electromagnetic survey over the eastern portion of the Manyalluluk Project and covering the mapped Mamadawerre Sandstone. A total of 1763 line-kms was flown at a flying height of 120 m in a west-east direction with lines 400 m apart in the north and 200 m apart in the south.

#### Figure 5: TEMPEST Location Map

TEMPEST is a high-powered airborne time-domain system with a broad bandwidth, which enables good resolution of variations in resistivity whilst maintaining reasonable ground penetration. In addition, the airborne platform allows electromagnetic data to be acquired over broad areas where ground geophysics is impractical due to rugged topography. The survey was flown with the aim of providing 3-D electromagnetic data to assist with the identification of basement graphite, structural offsets, alteration, and to infer the depth to the unconformity below sandstone. Also, it was hoped that the expected response from the Nungbalgarri Volcanic Member would assist with interpreting sub-surface geology particularly in vicinity of the 2006 drilling.

#### [Appendix 1: Fugro TEMPEST Logistics Report](#)

#### [Figure 6: TEMPEST X Time Constant \(Tau\) Map](#)

#### [Figure 7: TEMPEST Z Time Constant \(Tau\) Map](#)

#### [Figure 8: TEMPEST X RGB = Ch 8,4,1](#)

#### [Figure 9: TEMPEST Z RGB = Ch 8,4,1](#)

### Background

Conductivity Depth Images (CDIs) are an important inversion product calculated by Fugro using EMFlow software (Encom Pty Ltd) and used to compare the TEMPEST with geology. Cameco has also utilised Profile Analyst software (Encom Pty Ltd) to calculate a 3D voxel, which can be used to investigate 3D features. This allows the depth to the first conductive layer to be extracted, referred to as the “conductive unconformity”. The 3D voxel has also been filtered to highlight maximum conductivities greater than 50 m below the surface (likely to relate to cover and weathering rather than features within the basement). A number of these 3D aspects have also been reprojected to plan view to facilitate comparison with ancillary datasets including geology. The z-component data has been used extensively since it

is less prone to noise and couples best with sub-horizontal features such as the conductive unconformity.

The “conductive unconformity” is a term adopted to describe the first sub-horizontal conductive layer, commonly depicted in TEMPEST CDIs. In areas of Mamadawerre Sandstone this layer generally relates to the sandstone-basement unconformity contact (+/- ~ 20 m) but it may also relate to shallow cover or volcanic units. Abrupt changes in the elevation of the TEMPEST conductive unconformity can sometimes be utilised to infer faulting and structure.

One of the primary objectives for the TEMPEST survey is to identify conductors associated with structure, since these could relate to clays, porosity or graphite; indicative of alteration and/or fluid-rock interaction with potential to precipitate uranium. Unfortunately, conductors can be difficult to reliably identify with 1D inversions due to artefacts and tails related to edge effects. Also, the conductive unconformity response or cover (+/- dolerite) may mask the response from underlying basement. Geometry, line-to-line consistency and x/z characteristics help to increase confidence that conductors are real, especially in the context of known geology.

## Results

The TEMPEST survey has failed to identify any discrete conductors that can be identified with a signature thought to be due to basement graphite or alteration. Rather, the volcanic members dominate the response including the Nungbalgarri, Gilruth and Diamond Creek; observed in many CDI images to be shallowly dipping. There are some subtle conductors revealed in the CDIs below Mamadawerre Sandstone conductive unconformity and proximal to the mapped Plum Tree Creek Volcanics, however, the volcanics is the most likely source since the features lack linearity expected of graphitic basement. There is a broad and weak response in the CDIs that appears to be associated with the Hindrance Creek Sandstone. This seems plausible since it is far more lithic than the Mamadawerre Sandstone and therefore likely to be slightly more conductive.

Abrupt changes in the elevation of the conductive unconformity can indicate fault offsets and structural disruption. Significant faulting of the Mamadawerre Sandstone is mapped by the government in the northern portion of the project east of the Grace Creek Granite. These structural disruptions are also clearly reflected as variations in the elevation of the conductive unconformity.

Attached figures show the TEMPEST CDIs, geology and drilling; in plan view and sections for the Diamond Creek area. As discussed in the June 2007 annual report, the geology proximal to holes MLD001 and MLD002 is complex and Cameco has modified the stratigraphy from that mapped by the government. The TEMPEST weak conductive response for MLD001 and MLD002 is consistent with the Hindrance Creek Sandstone that has been identified by drilling and Nungbalgarri Volcanics is clearly observed as a



shallowly easterly dipping conductor. However, there does not appear to be a good contrast in conductivity between the Mamadawerre Sandstone and Hindrance Creek Sandstone. Furthermore there is no conductive unconformity response that may indicate the depth of Hindrance Creek Sandstone and inference of faults is not readily apparent. Further mapping and synthesis of the geology proximal to the 2006 drill holes should also utilise the new TEMPEST data, which does provide insights into the subsurface geology.

[Figure 10: Geology with TEMPEST ZCDIs and Drilling Compilation](#)  
[Figure 11: Geology with TEMPEST ZCDIs and Drilling Sections](#)

Both north-south and west-east TEMPEST flight lines were flown within 500 m of the MLR015 granite uranium showing. The CDIs do not show any variations in conductivity that might be related to alteration.

## CONCLUSIONS AND RECOMMENDATIONS

The airborne electromagnetic TEMPEST survey has provided some insights into the subsurface stratigraphy due to increased conductivity of the volcanic members (particularly the Nungbalgarri) but also the Mamadawerre Sandstone / Basement unconformity and Hindrance Creek Sandstone. However, the survey has failed to identify any specific targets such as inferred basement graphite and has not responded to the alteration at the MLR015 uranium occurrence. Further interpretative work is required of the TEMPEST data in conjunction with the geology to help in the understanding of the geologically complex area in the Diamond Creek region.

## EXPENDITURE

A summary of the expenditure for the reporting period is given in [Table 2](#). The total reportable expenditure for EL 9452 up until the anniversary date is \$322,230.

[Table 2: Summary of Expenditure EL 9452](#)

## WORK PROGRAM

Work planned and proposed for exploration on EL9452 during 2008 may consist of, helicopter-supported outcrop sampling and reconnaissance, and ten RC drill holes. There will be a requirement for track construction to access the work areas, and for the establishment of a base camp near the work area.

Interpretation of the airborne electromagnetic geophysical survey (TEMPEST) is planned for 2008. The TEMPEST survey interpretation will be used to help with stratigraphic correlation in the Diamond Creek area, where complexities in the geology has made identification of the geological rock units difficult. It is anticipated that the TEMPEST survey will also identify targets for possible drilling in 2009.

An estimate of the expenditure to complete the program as planned is expected to be in excess of \$40,000.

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