



Cameco Australia Pty Ltd

ARNHEM LAND WEST JV

**EXPLORATION LICENCE EL5890
KING RIVER PROJECT
NORTHERN TERRITORY**

ANNUAL REPORT 2000 FIELD SEASON

CONFIDENTIAL

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SUMMARY

This report describes exploration work undertaken within Exploration Licence 5890 (EL5890) during the fifth year of tenure ending 12 May 2001. The licence area is located in north western Arnhem Land and was granted in May 1996.

The exploration program was managed by Cameco Australia Pty Ltd on behalf of the Yok Joint Venture partners, Cameco Australia Pty Ltd, PNC Exploration (Australia) Pty Ltd and the Yok Aboriginal Corporation.

The primary exploration target is unconformity related uranium deposits similar to the nearby Ranger, Jabiluka and Koongarra deposits and the now depleted Nabarlek mine.

The current years exploration program consisted of a DIGHEM survey (heli-borne EM) covering the Myra Falls Metamorphics stratigraphy. Interpretation of the data is expected to clarify the geological framework of the tenement, leading to more accurate selection of ground for further exploration.

De Beers Australia Exploration Limited (formerly Stockdale Prospecting Limited) gave notice to the Joint Venture of their withdrawal from diamond exploration on the tenement following the discouraging results of their 1999 field program.

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1. INTRODUCTION

This report describes program activities carried out during the 2000 field season on behalf of the Yok Joint Venture, a joint venture between Cameco Australia Pty Ltd (Cameco), PNC Exploration (Australia) Pty Ltd (PNC) and the Yok Aboriginal Corporation. EL5890 forms part of the King River Project which is included within the Cameco / PNC joint venture agreement termed the 'Arnhem Land West Joint Venture' (AWJV). Exploration on this licence is presently being conducted simultaneously with that on the adjoining King River tenements, EL734 and EL5891. Since the Exploration Licences are located on Aboriginal Land the exploration program was carried out under the terms of consent documentation agreed with the Northern Land Council pursuant to the Aboriginal Land Rights (Northern Territory) Act and dated 1 March 1996.

Clearance for the work program was given by the Northern Land Council following the Liaison Committee Meeting held on 1 June at Gunbalanya (Oenpelli).

A DIGHEM survey was undertaken by Fugro Airborne Surveys Corporation. The survey commenced on 20 August and was completed on 27 August. The survey area included part of the adjoining EL734.

1.1. Location and Access

The tenement is located in western Arnhem Land immediately north-east of the Aboriginal settlement of Gunbalanya and is wholly within Aboriginal Land. The Ranger uranium mine is situated approximately 100km to the south-west and the rehabilitated Nabarlek site is within tenements which adjoin the southern boundary of the King River the project area. Access from Darwin is via the Arnhem Highway to Jabiru then north to Gunbalanya. The main Gurig National Park / Wark road traverses the licence area and provides access to various parts of the tenement..

[Location Plan](#)

Vehicular access is variable dependent upon topography. In general, most of the country is flat lying and can be traversed relatively easily by four wheel drive vehicle.

1.2. Tenure

EL5890 was granted on 13 May 1996 for an initial period of six years. On granting, the total area under licence was 1188 square kilometres of which 890 square kilometres remained into the fifth year. A total of 160.3 square kilometers were designated restricted zones following site surveys undertaken by the Northern Land Council.

Under the Mining Act a reduction in area is required on each anniversary commencing 13th May 1998 unless a waiver is obtained from the Department of Mines and Energy. A waiver for 2000 / 2001 (Year 5) was granted by the NTDME in respect of EL5890 where an insufficient number of blocks was relinquished to meet the statutory requirement.

1.3. Physiography

The far north western corner of the tenement consists of dissected sandstone plateau of the Wellington Range. The remainder is comprised dominantly of gently undulating sandy plains, generally underlain by a ferruginous duricrust. In places, erosion of this duricrust has led to the development of 'breakaways' along the erosional boundary. Thin remnants of lateritised Cretaceous sediments form scattered localised tablelands and small mesas throughout the tenement. The main drainage systems are Cooper and Birraduk Creeks draining westwards and the north east flowing tributaries of the King River.

1.4. Tenement Geology

Paleoproterozoic rocks, which are present in the project area, have been named the Myra Falls Metamorphics (MFM). These are considered to be higher metamorphic grade equivalents of the Cahill Formation (the host rocks to the Alligator Rivers uranium deposits) and consist broadly of quartzo-feldspathic±garnet gneiss, quartz-mica-amphibole-garnet schist and amphibolite. No carbonates have as yet been identified on the tenements but probable calc-silicate lithotypes are present as amphibole-rich schists and ?para-amphibolite. Structurally the MFM form a broad synclinal structure (the 'Oenpelli Syncline'), which is confined to the western half of the tenement. The structure contains a well defined and easily traceable sequence of 'lower' and 'upper' units. A thin but fairly persistent quartzitic unit, formerly considered to be Kudjumarndi Quartzite by the BMR (AGSO), forms a stratigraphic marker in the upper MFM and accurately outlines the fold structure. Outcrop is extremely sparse, being confined mostly to drainage channels. Ferricrete and Quaternary sands cover much of the area. Mapping of the stratigraphy has been made possible by a combination of air photo studies, geophysical interpretation and regional RAB drilling traverses.

The Myra Falls Metamorphics abut the granulite facies Nimbuwah Complex, which consist of gneiss and 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 the paleoproterozoic metasediments (Carson and others 1999). The inferred contact with the MFM is marked by an anomalously magnetic unit. It is a finely banded, fine grained quartz feldspar rock containing magnetite and almandine garnet and may be a transitional (contact) phase between the MFM and the Nimbuwah Complex. There appears to be a rapid regional progression of metamorphic grade increasing from west to east.

Outcrop tends to be slightly more extensive in comparison to the MFM. Good exposures of both gneissic rocks and the intrusive granitic variants occur throughout.

The basement rocks are overlain by the Kombolgie Subgroup (formerly Kombolgie Formation) which forms the base of the early Proterozoic Katherine River Group. The Mamadawerre Sandstone, the fluvial basal unit of the Kombolgie, outcrops as the characteristic escarpment country of the Arnhem Land plateau. It outcrops in the north western corner of the tenement forming rugged cliffs and dissected plateau as part of the southern extensions of the Wellington Range. The age of the Mamadawerre has been constrained between 1822 and 1720 Ma and is probably closer to 1800 Ma (Sweet and others 1999).

Remnants of the Cretaceous outcrop in various parts of the tenement usually along the erosional fringes of lateritised tablelands. They overlie both the MFM and Nimbuwah Complex rocks.

Intrusive rocks other than the Nimbuwah granites include extensive sills and lopoliths of Oenpelli dolerite and several generations of younger cross-cutting dolerite. Circular features, as defined by airborne magnetics, are considered to be pipe-like mafic bodies, which have been identified elsewhere in the Alligator Rivers region (Andrew Brown, pers. comm.). These features were the focus of diamond exploration by De Beers on the tenement.

[Regional Geology and Major Structures Plan](#)

1.5. 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 produced a prograde metamorphic effect with associated tight folding and faulting. The various 'domains' exhibited 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 north-west (Bulman), north-north-west (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 principle 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 north-west, east, north-east and north trends. The Kombolgie is heavily dissected by both faulting and jointing with displacements ranging from a few metres up to 100 metres locally.

The King River region occupies the north-western extension of the Arnhem Shelf in the northern McArthur Basin. Deposition of the Mamadawerre Sandstone took place in an environment of extension and local basin formation with probable fault-controlled sedimentation. This is implied by rapid thickening and thinning of the sequence.

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.

1.6. Exploration Target

The focus of the exploration strategy is the discovery of unconformity-related uranium deposits. The nearby economic deposits at 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.

1.7. Previous Exploration

1.7.1 Union Carbide Exploration Corporation

During the period 1970-1972 Union Carbide Exploration Corporation undertook substantial exploration, principally for uranium. This work comprised airborne magnetics and radiometrics, regional geochemical surveys and geological mapping. Numerous radiometric anomalies were investigated including the more important Tadpole group of prospects and Dreadnought Creek. Results were discouraging.

Union Carbide's exploration work was curtailed in early 1973 by a federal Government imposed moratorium on exploration pending a resolution on the issue of Aboriginal land rights.

1.8. Previous Joint Venture Exploration

1.8.1. 1996 Field Season

Grant of title was given in May 1996. Initial reconnaissance work included regional outcrop mapping, orientation soil geochemistry and regional drainage BLEG in conjunction with diamond indicator sampling (Mackie, 1997). A regional fixed wing airborne survey at 200 metre line spacing was conducted and included magnetics, spectrometrics and VLF. This was carried out by Geoterrex Pty Ltd (now Fugro Airborne Systems Corp). A consultant was utilised to conduct the regional stream sampling program.

1.8.2. 1997 Field Season

The 1997 program consisted of airborne anomaly follow up, further geochemistry (soil, rock, stream and BLEG), geological mapping and RAB drilling. Two shallow Diamond holes were drilled into the lower MFM to gain data on host rock lithology and alteration. (Melville and others 1998).

1.8.3. 1998 Field Season

The 1998 program consisted of ongoing regional work including geological mapping and interpretation, stream sediment sampling concentrating on the Nimbuwah Complex and RAB drilling. A further two diamond holes were drilled into the lower MFM to gain additional data on the sequence. Prospect scale activities on several airborne radiometric anomalies included auger soil sampling, ground magnetics and some systematic RAB drilling (BIR 1 anomaly only). A DIGHEM test survey was flown across a section of the Myra Falls Metamorphics to gain data on the response of the various lithotypes. (Williams and others 1999).

1.8.4. 1999 Field Season

Some regional RAB traversing was continued across the Myra Falls Metamorphics and one diamond drill hole was collared on radiometric anomaly BIR 1. Stream sediment and auger soil sampling was conducted across 'Ralph's Fault' where a low order gold anomaly was previously outlined. Ground magnetic surveys were conducted across the latter as well as at anomaly BIR 4. UTS Pty Ltd conducted a heli-borne EM-Magnetic survey over the southward extensions of the Aurari Fault zone.

1.8.5. De Beers Farm-in

Stockdale Prospecting Ltd (now De Beers Exploration Australia) undertook detailed airborne magnetic surveys, field inspection and check sampling of selected magnetic anomalies.

A progress report was submitted to the Joint Venture detailing the updated results of the 1999 program and the expenditure incurred (Vercoe, 2000). In summary, the report stated that the negative results of the loam sampling coupled with poor MMI geochemical signatures appeared to rule out the presence of kimberlitic intrusions on the leases. Formal notification of De Beers's withdrawal from the King River program was contained in the report.

2. PROGRAM ACTIVITIES

The only field activity for the 2000 season was flying heliborne frequency domain electromagnetics (DIGHEM) over the Myra Falls Metamorphics.

[Work Summary 2000](#)

[Map of 2000 Geophysics](#)

A total of 1778 linekm of DIGHEM was flown over the western part of EL 5890 at 200 m line spacing and 30 m sensor height. The survey was flown with the DIGHEM all coplanar system recording four frequencies: 75 kHz, 15 kHz, 3 kHz and 600 Hz. All frequencies were converted to apparent resistivity and all line data was converted to apparent conductivity depth information to allow generation of depth slices and facilitate three-dimensional analysis. The main aim of the survey was to identify basement lineaments, discriminate different lithologies beneath the Quaternary cover and provide targets for drilling in 2001.

[Logistics Report by Fugro Airborne Surveys](#)

[Map of DIGHEM Conductivity - 75 kHz](#)

[Map of DIGHEM Conductivity - 15 kHz](#)

[Map of DIGHEM Conductivity - 3 kHz](#)

[Map of DIGHEM Conductivity - 600 Hz](#)

[Map of DIGHEM Conductivity - RGB=600,3k,15 kHz](#)

The DIGHEM survey has been particularly effective at mapping quartzite and has also partially discriminated the quartzo-feldspathic rich gneiss from those, which gneisses that are less rich. Unfortunately further subdivision of the Myra Falls Metamorphic equivalents has not been possible. This is not surprising since some of the divisions (i.e. garnetiferous) are mineralogical with no equivalent physical property change. Many lineaments have been observed and some offsets have

been postulated, which should be further investigated. No anomalism was observed, which could be related to known prospects or radiometric anomalies.

3. REFERENCES

Carson, L.J., Haines, P.W., Brakel, A., Pietsch, B.A., and Ferenczi, P.A. 1999. Milingimbi, Northern Territory. 1:25000 Geological Map Series. Northern Territory Geological Survey and Australian Geological Survey Organisation, Explanatory Notes SD 53-2.

Mackie, A.M. January 1997, Annual Report - Arnhem Land West Joint Venture: 1996 Field Season - Exploration Licences 3597, 4015, 734, 5890 & 5891. PNC Exploration (Australia) Pty Ltd.

Melville, P.M., Sawyer, L.M., Follington, D., 1998. Arnhem Land West Joint Venture: 1997 Field Season - Exploration Licences 734, 5890 & 5891. PNC Exploration (Australia) Pty Ltd.

Needham, R.S. 1988, Geology of the Alligator Rivers Uranium Field. Bureau of Mineral Resources Bulletin 224.

Sweet, I.P., Brakel, A.T., Carson, L., 1999, The Kombolgie Subgroup- a new look at an old 'formation'. AGSO Research Newsletter, 30; pages 26-28.

Vercoe S, 2000 Progress Report for PNC Exploration EL 734 & EL 5890, 2000 Progress Report. Stockdale Prospecting Limited.

Williams, S.V. 1999, Arnhem Land West Joint Venture: Annual Report Program Activities 1998 Field Season Exploration Licences 734, 5890 and 5891. PNC Exploration (Australia) Pty Ltd.