

ANNUAL REPORT
For the period 12th April 2007 to 12th April 2008
EL-25406 “Fog Bay”

to

NORTHERN TERRITORY GOVERNMENT
Department of Primary Industry, Fisheries and **Mines**

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Hapsburg
Exploration Pty Ltd

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NT EL-25406 “Fog Bay” Airborne Geophysical Report
(M.Varkey 03/08)

APPENDIX 2
UTS Geophysics Logistic Report

Summary

EL-25406 “Fog Bay” covers an area of 77 sq. km and has little outcrop apart from a ridge of Proterozoic Depot Creek Sandstone that strikes north-south through the tenement with a maximum height of 50m above the surrounding plains. ELA-26439 “Fog Bay East” is an easterly 23 km extension to EL-25406.

The tenement extends to the south as the Finnis River and Delissaville-Wagait-Larramia Aboriginal Reserve boundary.

The area occupies part of the Litchfield Region at the western end of the Pine Creek Orogen. Drilling shows the geology to be structurally complex with isoclinal folding and metamorphic grade extending to amphibolite facies.

The older higher-grade metamorphics, now known as Fog Bay Metamorphics, contain a calc-silicate and graphitic sequence towards its base termed the Sweet’s Member. This is considered a stratigraphic correlative of the Cahill Formation in the Alligator Uranium Field in the far east of the Pine Creek Orogen, and is the main target of present exploration. Amphibolite layers in the metamorphics lie above the calc-silicates and are magnetic markers.

The Depot Creek Sandstone of the Tolmer Group lies above the 1800 Ma unconformity and correlates with the Kombolgie Sandstone of the Katherine River Group.

A previous regional airborne magnetic-radiometric survey was flown along north-south lines generally parallel to regional stratigraphy. The contract for a new survey was awarded to UTS and this was completed in late December 2007. Flight lines were oriented east-west and flown at a height of 50m. Contouring of original data highlights 3 magnetic anomalies A, B and C.

Anomalies A and B are directly on or underneath the Depot Creek Sandstone unconformity in Palaeoproterozoic metamorphics. Anomaly A is spatially related to a N-S and NW-SE fault intersection. Anomaly C is a linear feature several kilometres long and passes out of the tenement to the south. It is located on a major postulated fault with outcropping quartz breccia.

A ground magnetic and radiometric survey of anomalies is recommended. Fence drilling and collection of fresh bedrock samples for magnetic susceptibility measurements is also recommended. This will aid geophysical modelling and an estimate of depth of anomalies.

1. INTRODUCTION

EL-25406 “Fog Bay” was granted on 12 April 2007 for 6 years. It consists of 25 blocks with an area of 77 sq. km. Annual rent is \$275; minimum expenditure in Year 1 is \$90,000.

ELA-26420 “Fog Bay East” is currently under application and comprises 7 blocks with area 22.5 sq. km. Annual expenditure on granting is \$60,000. This area became available in August 2007 and extends the EL to some of the western area drilled by the Idemitsu-Urangesellschaft JV in 1982.

The area of interest is 60 km southwest of Darwin and is bounded by Dundee Beach and Fog Bay to the west, the Darwin-Dundee Beach road to the north and the Finnis River to the south. EL-25406 contains 2 Mining Leases (MLN 1982, MLN 1983), which are excluded from the EL (**Figure 1-1, Figure 1-2**).

The Delissaville-Wagait-Larrakia Aboriginal Land Trust boundary follows the Finnis River and adjoins the EL to the south.

2. LOCATION, ACCESS and LOGISTICS

Dundee Beach Lodge and settlement is in the northwest corner of EL-25406 and is 150 km from Darwin by road (**Figure 2-1**). Access is by sealed road to Noonamah, then by largely unsealed road around the margins of Litchfield National Park to Dundee Beach. The road journey takes around 3 hours. Dundee Beach is a growing settlement and much sub-division has taken place. Power was extended to the community in 2006, and house prices and rentals are expensive.

Fuel, provisions and accommodation (units, caravan park) are available at Dundee Lodge.

The Finnis River Pastoral Lease covers the tenement. Contact was made with the manager and Hapsburg's 2007 exploration programme outlined.

Access into the area is difficult with few tracks. The area is low lying and swampy during the Wet Season (**Figure 2-2**).

3. CLIMATE, TOPOGRAPHY and VEGETATION

Climate is tropical with a well-defined Wet Season from November to April, and Dry Season from May to October. Temperatures average 30⁰C in the Wet Season with daily rainfall and high humidity. The area is prone to cyclones, and Cyclone Helen passed over the area in late December 2007

Topography is subdued (**Figure 3-1**). The highest point is around 50m on the ridge of north-south trending Depot Creek Sandstone (Mesoproterozoic). The digital terrain model (DTM) for the Fog Bay Region highlights the ridge of Depot Creel Sandstone and shows strongly folded Palaeoproterozoic rocks separated by featureless flat area. A linear fault trace is also discernable corresponding to the faults associated with magnetic anomaly C (see section 8-1).

Paludal and estuarine black soil plains occur in the central and southern parts of the tenement. Dunes and swales extend inland for several kilometres from the coast. Tidal mudflats and mangroves fringe the coastline and Finnis River.

Vegetation is mainly tangled scrub and ferns with patches of rainforest along beach fringe. Patches of paperbark cover slightly elevated areas of Cainozoic sediment.

4. STRUCTURAL SETTING

EL-25406 “Fog Bay” is structurally located on the North Australian Craton. This Precambrian basement block is made up of several orogenic domains of which the Pine Creek Orogen is but one - the others being Arnhem, Tennant and Murphy Inliers, Arunta and Tanami Regions. These domains underwent regional metamorphism during the Barramundi Orogeny (1880-1850 Ma), followed by intermittent igneous activity to 1800 Ma. EL-25406 lies within the northern Litchfield Region of the Pine Creek Orogen.

Late Archaean (>2500 Ma) granite and gneiss outcrop as inliers at nearby Rum Jungle. Other inliers are at Waterhouse and Jabiru. These rocks form the basement to surrounding Palaeoproterozoic sequences.

Palaeoproterozoic strata were deposited in basins formed by rifting of the Archaean basement. Clastic sediments predominate with occasional intercalations of volcanics. The thickness of sedimentation in the Litchfield Region is unknown.

All sequences were tightly folded, schistose and metamorphosed to greenschist facies and locally to amphibolite and granulite facies during the Barramundi Orogeny.

This was followed, and in places overlapped, by felsic volcanism, granitic intrusion and volcanoclastic sedimentation. In the Pine Creek Orogen, felsic rocks are K rich and predominantly I-type, but S-type in the Litchfield Region. Ages range from 1860-1840 Ma. This intrusive event and accompanying thermal gradients are important in mobilising magmatic fluids with mineral deposition in Palaeoproterozoic sediments at, or near, the Archaean unconformity.

Six syn-and post-orogenic intrusions are present in the Litchfield Region. The granitic bodies are light grey, fine to medium grained and equigranular. They characteristically contain greisens and pegmatites, which can be Sn-Ta mineralised.

Palaeoproterozoic to Mesoproterozoic platform sequences were then deposited unconformably on the preceding domains. The platform sequences are un-metamorphosed and gently folded quartz arenites, carbonates and volcanics and are not considered prospective for mineralisation.

Stratigraphic correlation across the Pine Creek Orogen is shown in **Figure 4-1**.

5. LOCAL GEOLOGY

Oldest units are the Fog Bay Metamorphics and Hermit Creek Metamorphics consisting of metamorphosed basic igneous rocks, psammite and pelitic gneiss with granoblastic texture. Cordierite, garnet and graphite are present as accessories, and facies grade is amphibolite to granulite.

The lower part of the sequence is characterised by the calc-silicate Sweets Member. The mineral assemblage (tremolite-quartz-garnet) indicates middle amphibolite facies. The Sweets Member was first identified in the Litchfield Block following stratigraphic and exploration drilling by Idemitsu in the Bynoe Harbour area to the northeast, where vein-type pitchblende is hosted in graphitic microgneiss units.

The Welltree Metamorphics consist of quartzo-feldspathic schists and gneisses and are the metamorphosed equivalent of the Burrell Creek Formation and Koolpin Formation in the Rum Jungle and Central Regions.

Tom Turner's Fault crosses the area. West of the fault, Mesoproterozoic Depot Creek Sandstone unconformably overlies the Welltree Metamorphics.

Litchfield Region S-type granitoids intrude the metamorphics towards the end of the Palaeoproterozoic and are of similar age to the Cullen Batholith intrusions to the east. Locally, the Wagait Granite has been intersected in drilling by Idemitsu.

The ridge of metamorphosed ferruginous and pebbly sandstone is assigned to the Mesoproterozoic Depot Creek Sandstone (Tolmer Group), which correlates with the Kombolgie Sandstone (Katherine River Group) in the South Alligator and Alligator Rivers Region.

6. TARGET MODEL

6.1 Uranium : Unconformity, vein type – Cahill Formation analogue

Target is vein pitchblende mineralisation within graphitic microgneiss units of the Fog Bay Metamorphics, showing Mg metasomatism and chlorite alteration and related to intrusives.

The idealised model is shown in **Figure 6-1**.

Drilling and stratigraphic interpretation in the Litchfield Block to the northeast of EL-25406 confirm the presence of a Palaeoproterozoic calc-silicate sequence in the lower Fog Bay Metamorphics analogous to calc-silicate gneisses and schists of the Lower Cahill Formation in the Alligator Rivers Region. Major U_3O_8 and Au mineralisation is hosted in the Lower Cahill Formation.

7. PREVIOUS EXPLORATION

Several companies have investigated the area surrounding EL-25406 since 1970. Their activity is detailed in the report by J.McGregor-Dawson and salient points are repeated here.

7.1 BHP (EL-71, 1972-76)

BHP explored an area of 350 sq km just to the southeast of Hapsburg's boundary. Target was Daly River type base-metal mineralisation, and Cainozoic uranium mineralisation. Methodology used was ground magnetics, IP/resistivity, rock and soil sampling, auger drilling and 8 cored holes. *Similarities were made with the geology Alligator Rivers Uranium Province.*

Aeromagnetics and radiometrics were flown over the Finniss River swamp, together with ground traverses and auger drilling. This was in an attempt to locate 2 BMR airborne radiometric anomalies. No anomalous U_3O_8 was intersected, but P_2O_5 to 2.5% was located in basal Cambrian sediments.

7.2 Esso Australia (EL-877, 1973)

Esso's tenement covered an area of 250 sq.km to the east of Hapsburg's current EL. Exploration was mainly auger drilling beneath Cainozoic cover to determine bedrock stratigraphy and geochemistry. Lithologies are mainly quartz-mica-schist and minor shale, mudstone and amphibolite. No mineralisation was located.

7.3 AOG & Union Oil (5 EL's, 1978-80)

Auger drilling located weak base metal and uranium mineralisation (to 70ppm) in gneissic granite near the contact with metasediments over an area of 2500m by 200m. Elevated values were interpreted to be due to secondary enrichment at the watertable.

Other exploration centred on evaluation of the Finniss River Plains radiometric anomaly and drilling intersected marble and granulite. Weakly anomalous U_3O_8 assays ranged from 10-70ppm, with radiometric counts to 210 cps.

AOG recommended further work on the Finniss Plains U anomaly, but in any event the area was relinquished.

7.4 Idemitsu & Urangesellschaft (10EL's, 1978-86)

This JV's tenements were located to the east and north of present EL-25406. Focus of activity was the "Lookin Project" which is approximately 15 km distant from the present eastern boundary.

7.4.1 Lookin Project

Exploration premise was that greenschist to amphibolite rank gneisses in the Lookin area are similar in chemistry and geological setting to the Lower Cahill Formation of the East Alligator River Uranium Field.

The area under consideration lies to the east of Tom Turner's Fault, which separates Port Patterson gneisses to the west from the Lookin gneisses.

Muddy sand and silts with basal intercalated calcareous and carbonaceous sediments were deposited in a shallow marine intertidal environment. Syngenetic U was concentrated in black shales. The sediments have been metamorphosed to medium

and high-grade amphibolites and granulites. Folding is NW-trending isoclinal with steep westerly pitch.

The Dumbell Prospect covers part of the Tom Turners Fault System (an extension of the Hall's Creek Mobile Zone Fault System). Lithologies are meta-carbonates, amphibolites, microgneiss, biotite-sillimanite-quartz-feldspar gneiss and intrusive granitoids. A schematic cross-section is shown in **Figure 7-1**.

By comparison, the Port Patterson gneisses to the west of Tom Turner Fault (and on Hapsburg EL-25406) are described as coarse grained, lower to upper amphibolite facies gneiss and amphibolite. The sequence, from bottom up, is :

- coarse grained feldspathic gneiss;
- a slightly magnetic (after pyrrhotite) amphibolite unit with thin carbonate bands;
- graphite-pyrite –biotite-pelitic gneiss grading to :
- coarse feldspathic biotite gneiss.

The pyrrhotite rich units show up well as curvilinear belts on magnetic maps. A circular airborne magnetic anomaly on the Port Patterson tenement was drilled and found to be an ultramafic pipe composed of peridotite, pyroxenite and norite.

After 4 years exploration the final analysis of the area is that it is underlain by a Palaeoproterozoic metasedimentary sequence of quartz-feldspar-biotite gneiss and amphibolites correlated to the upper Cahill Formation of the East Alligator River Province. No significant areas of chloritisation and uranium mineralisation were encountered. Prospective target horizons were not outlined and if present, would be at too great a depth to warrant further exploration.

7.5 Eupene Exploration Enterprises (1985-94)

This outfit held several EL's in the Fog Bay, Port Patterson, Bynoe Harbour areas for base and precious metal exploration and shell grit. Exploration limited to sampling pisolitic gravels for base metals and shallow auger drilling.

7.6 Australian Coal and Gold Holdings (1981-89)

Several tenements were held in the Dundee Downs area 15 km north-northeast of Hapsburg's area. Target minerals were gold, base metals and uranium. Exploration consisted of ground magnetics and radiometrics, auger, RAB and diamond drilling and gamma logging. Anomalous base metal assays interpreted to relate to faults and intrusives.

8. FIELD INVESTIGATIONS and RESULTS - 2007

No detailed fieldwork was undertaken in 2007 due to the flat terrain, black soil cover, heavy vegetation and lack of access. An orientation visit was made to Finnis River Station to introduce the company and prepare for the aerial survey.

8.1 Aeromagnetic Survey

A regional geophysical survey had previously been flown in a north-south direction generally parallel to stratigraphy (**Figure 8-1**). This limits the full magnetic response so it was decided to re-fly the area with east-west flight lines. Universal Tracking Systems (UTS) of Perth were awarded the contract, which was planned for September. Technical and mechanical problems delayed the survey until late December 2007. Climatic conditions at that time were monsoonal with electrical storms and daily rainfall. Two days were lost and standby rates charged.

Parameters of the survey were :

Traverse Spacing	:	100m
Traverse Direction	:	090-270
Tie Line Spacing	:	1,000m
Tie Line Direction	:	000-180m
Sensor Height	:	50m
Total Line Kilometres:		2,210 km

A verification montage map was provided containing total magnetic intensity (TMI) and derivative-enhanced TMI. This data was contoured, and first derivative TMI contours overlain on geology (**Figure 8-2**). Three anomalies - A, B and C - are evident. A preliminary geophysical interpretation is given in **Appendix 1**. The UTS Logistics Report is attached as **Appendix 2** and all data is included on DVD.

Anomaly A is the northernmost anomaly and is located at the base of the Depot Creek Sandstone approximately 4 km southeast from Dundee Beach settlement. Anomaly B is 3 km due south of Anomaly A and is also at, or near the base of the Depot Creek Sandstone. Anomaly C is the southernmost anomaly and approximates part of a postulated north-south trending fault. It passes out of the Hapsburg tenement to the south and onto the Aboriginal Land Trust. A blow of quartz breccia outcrops at its northern extremity.

9. CONCLUSIONS and RECOMMENDATIONS

EL-25406 is located close to major population centres. Geologically, it covers northern extremity of the Litchfield Region in the structural entity known as the Pine Creek Orogen. World-class U₃O₈ deposits are located in the East Alligator River Region on the eastern side of the Orogen. They are hosted in calc-silicate rocks of Lower Cahill Formation of Palaeoproterozoic age, near the Archaean unconformity.

Prior drilling in the Bynoe Harbour region several kilometres to the east and northeast of the Fog Bay tenement intersected calc-silicate rocks with graphitic horizons. These units are now assigned to the Sweets Member of the Fog Bay Metamorphics and are considered stratigraphically equivalent to the Lower Cahill Formation. These rocks were deformed and metamorphosed to a moderate to high grade during the 1850-1800 Ma Barramundi Orogeny. However, the Litchfield Region differs from the East Alligator Region in that metamorphic grade is higher (amphibolite versus greenschist) and different granite protolith (S-type versus I-type).

Several granite bodies intrude the Litchfield Region post-Barramundi Orogeny and are postulated to have established thermal cells enabling magmatic fluids to leach country rock and deposit mineralisation under favourable physical-chemical conditions.

The only intrusive-related mineralisation known to date from the Litchfield Region is Sn and Ta derived from pegmatites and greisens.

Preliminary interpretation of aeromagnetic data from a survey flown in December 2007 highlights 3 anomalies. Two anomalies are near the Mesoproterozoic unconformity at the base of the Depot Creek Sandstone, with the northern anomaly localised at a fault intersection. A third anomaly to the south is located on a strong regional fault, which has a quartz breccia body along its length.

A more detailed interpretation of the anomalies is recommended. This will involve a study of the relevant flight lines and 3D modelling to determine approximate depths to the anomalies. A ground magnetic survey is planned to aid definition of drill targets. Cored drilling is also recommended to obtain fresh samples for analysis and magnetic susceptibility measurements.

10. REFERENCES

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