Annual and Final Report
EL 27365

Covering the period from 12/01/2010 to 23/10/2015

COMMODITIES: Base Metals, Gold and Uranium

250K Map Sheet Pine Creek SD5208
100K Map Sheet Pine Creek 5270

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SUMMARY

Exploration Licences (EL) 27365 is located about 180 km SE of Darwin and 30-40 km east of Pine Creek. It is part of amalgamated annual reporting group GR204-11. The project has been explored for uranium, gold and base metals mineralisation.

The project area is located within central part of the pine Creek Orogen which is a folded sequence of Palaeoproterozoic pelitic and psammitic sediments, with interlayered cherty tuff units. These rocks have been intruded by the late-orogenic Palaeoproterozoic granites, causing wide spread contact/thermal aureole which contains most of the gold and other mineralisation in the Orogen. Geology of the project area is dominated by the Palaeoproterozoic rocks of the Namoona Group, Mt Partridge Group and the members of the Cullen Batholith. Main lithologies are tightly folded dolomites, sandstones, ferruginous shales and quartz-andalusite schists which have intruded by the Allamber Springs and Minglo Granites. This geological sequence has potential for uranium, base metals and uranium mineralisation.

During the tenement life, exploration activities included an airborne radiometric and magnetic survey flown over the entire tenement area, geological mapping, ground-truthing, gravity survey, soil and rock chip sampling and data interpretation.

A technical review of geological, geochemical and geophysical data indicates that project area has potential for base metals, gold and uranium mineralisation. However Element 92 has not been able to identify solid drilling target within the licence therefore decided to relinquish the tenement. Moreover the tenement was initially pegged for uranium potential and uranium exploration is not currently a priority for Element 92. Therefore this report recapitulate exploration work undertaken on EL27365 by Element 92 for the all tenement life.
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1. INTRODUCTION
Exploration Licences (EL) 27365 is located about 30-40 km east of Pine Creek and is part of amalgamated annual reporting group GR204-11. It is explored for uranium, gold and base metals mineralisation. Element 92 has decided to surrender the tenement in October 2015 therefore this report recapitulate exploration undertaken by E92 during the licence life; from the 12/01/2010 to the 23/10/2015.

2. LOCATION AND ACCESS
The licence is located about 180 km SE of Darwin and about 30-40 km east of Pine Creek (Figure 1). It can be accessed via the Frances Creek Road, turning north off the Kakadu Highway approximately 3km east of Pine Creek. Tenement can also be reached via Kakadu Highway — A track coming off from the Kakadu Highway about 27 km from Pine Creek and leads towards NE and passes though the tenement. Access within the tenement is via station tracks.

3. TENEMENTS DETAILS
EL 27365 was applied for on 27 May 2009 and was granted on 12 January 2010 to Element 92 Pty Ltd, which is a wholly owned subsidiary of Thundelarra Exploration Ltd. The tenement was granted for a period of 6 years and will expire on 11 January 2016. Now, it has only 3 blocks and covers about 10.05 Km². Element 92 has decided to surrender the tenement on the 23rd of October 2015, before its expiry date. Underlying cadastre is covered by three pastoral leases and those are PPL 1134 held by Mary River Wildlife Ranch Pty Ltd, PPL 1111 held by Ban Ban Springs Station Pty Ltd and PL 815 held by Adicrest Pty Ltd.
Figure 1: EL27365 location
4. GEOLOGICAL SETTING

The project area is located within central part of the pine Creek Orogen which is a folded sequence of Palaeoproterozoic pelitic and psammitic sediments, with interlayered cherty tuff units (Needham and Stuart-Smith (1984) and Needham et al. (1988). These rocks have been intruded by the late-orogenic Palaeoproterozoic granites, causing wide spread contact/thermal aureole which contains most of the gold and other mineralisation in the Orogen (Bajwah, 1994). Some uranium mineralisation is also confined to contact areoles. Less deformed Mesoproterozoic sedimentary and volcanic sequences unconformably overlie the Palaeoproterozoic rocks and is overlain by Cambrian-Ordovician lavas, sediments and Cretaceous strata. Cainozoic sediments, laterite and recent alluvium may obscure parts of the Orogen lithologies.

Local Geology

Geology of project area (EL 25868 and EL 27365) is dominated by the folded rocks of Namoona Group and Mount Partridge Group and intruded by the Allamber Springs Granite towards south and the Minglo Granite towards east (Figure 2). The Allamber Springs Granite was emplaced during 1820 – 1850 Ma. The members of the Cullen Batholith/Cullen Supersite are predominantly I-type (Chappell and White, 1974), but some may also have S-type characters. The oldest formation exposed in the project area is the Masson Formation (Namoona Group) shown in Figure 2. It conformably underlies the Mundogie Sandstone (Mount Partridge Group). It predominantly contains greywacke, carbonaceous shale, sandstone and beds of dolomite with minor quartzite, massive ironstone and rare tremolite marble. They are commonly exposed as ferruginous rubble on low rises, in creek beds (Stuart-Smith et al. 1987). It is intruded by several sills of Zamu Dolerite and is extensively hornfelsed by the intrusion of the Allamber Springs Granite towards the south of the project area (Figure 2). Due to contact metamorphism, beds have been metamorphosed to carbonaceous chiastolite hornfels, spotted grey cordierite-andalusite-muscovite hornfels and biotite-muscovite-quartz hornfels. Contact relation relationship between the Masson Formation and intruding Allamber Springs Granite is mainly discordant (Stuart-Smith et al. 1987).
Towards east, the Masson Formation is host to a number of uranium deposits (e.g. Cleo, Dams, Twins) as shown in Figure 2, where mineralisation is present in contact metamorphosed rocks such as graphitic schist, Zamu Dolerite and tongues of the Allamber Springs Granite (Figure 2). Here, mineralisation is confined to fault structure/shear zone within a north northwest-trending embayment at the margin of the Allamber Springs Granite.
The Mundogie Sandstone is another rock type exposed in the project area. The formation overlies the Mason Formation and structurally appears conformable with the Masson Formation. The contact between the two rock units is obscured by scree or alluvium or may have been displaced by the emplacement of the Zamu Dolerite. In the project area, the unit is truncated by the emplacement of the Allamber Springs Granite and is responsible for contact metamorphism, hornfelsing the sediments extensively. The contact is mostly discordant and very irregular with the Allamber Springs Granite.

It is mainly composed of coarse pebbly sandstone with lenses of conglomerate and shale. Beds are generally about 1 – 5 meters thick and are massive with laminated tops in places. Sedimentary structures present include graded bedding, lenticular cross-bedding and load-cast (Stuart-Smith et al. 1987). In the contact zone with the Allamber Springs Granites, beds are generally tourmalinised and silicified and contact metamorphosed to micaceous hornfels, Cordierite-mica hornfels and black carbonaceous hornfels.

In the project area, the Palaeoproterozoic meta-sedimentary sequence is intruded by quartz dolerite sills of the Zamu dolerite. Due to poor exposure, contact effects are not well known. Dolerite is poorly exposed in valleys as rounded rubbles and pebbles.

Towards south project area is intruded by the Palaeoproterozoic Allamber Springs Granite (Figure 2) which is one of the significant plutonic bodies, genetically related to gold, uranium and base metals mineralisation in the adjacent contact zone. It is mainly massive and largely homogenous and even-grained, although porphyritic marginal variants occur in several restricted localities. Mafic inclusions in low abundances occur particularly towards the margin of the pluton. It crops out as expanses of bare rock, boulders and tors separated by alluvial flats. The marginal fine-grained porphyritic variety is light grey and characterised by the presence of quartz and/or K-feldspar phenocrysts. It is mainly composed of quartz (25-35%), K-feldspar (30-35%), plagioclase (20-25%), biotite (5-8%) and accessories such as magnetite, allanite and sphene. Hornblende (>10%) is generally confined to medium to coarse-grained varieties which form greater part of the pluton and shows a progressive increase in grain size from the marginal to the core of the granite body. In coarse-grained variety K-feldspar could be up to 50%. The Allamber Springs show weak pervasive hydrothermal alteration (sericitisation, chloritisation) throughout but towards griesenisation of the granitic rock may occurs towards the margins.

The Allamber Springs is characterised by a variable SiO₂ range (66.10-78.10 wt%), K₂O contents range from 4.20-7.0 wt% and are predominant over Na₂O. In terms of trace elements, the granite body has high concentrations of Th (2-90), U (3-30) and Rb (141-336). Rb increases when plotted against SiO₂ and indicate crystal fractionation as supported by RRE contents of the pluton (Bajwah, 1994).

North-eastern part of EL 25868 is covered by the Minglo Granite (Figure 2) which is also member of the Cullen Batholith. Much of the granite body is covered by residual sandy soil and Quaternary alluvial deposits of the Mary River. The pluton forms semi-continuous outcrops of rugged hills along the eastern side of the Minglo Creek, elsewhere outcrop is restricted to low boulder hills and isolated tors and pavements. It intrudes the Palaeoproterozoic metasediments, causing contact metamorphism which contains several Sn and Sn-sulfide prospects/deposits towards north.
The Minglo Granite is generally medium- to coarse-grained, equigranular to porphyritic. Quartz is the most abundant mineral (up to 35%) whereas K-feldspar and plagioclase are other felsic minerals. Biotite and hornblende (rare) are mafic minerals which are randomly distributed within the granite pluton. Accessory minerals are sphene, and magnetite along with rare minerals such as allanite, apatite and zircon. Felsic nature of the granite is shown by SiO$_2$ content which ranges from 72.12 – 75.38 wt%. FeO$_{(t)}$ and MgO are in restricted range and are low in concentrations. Na$_2$O is consistently higher whereas K$_2$O is moderately high but in narrow range (Bajwah, 1994). Trace elements such as Rb and Ba are in moderate range, varying from 167 – 310 ppm and 177 – 691 ppm. Sr is low and decreases in response to SiO$_2$ rise, whereas Rb increases when plotted against Sr, which is indicative of feldspar fractionation.

**5. PREVIOUS EXPLORATION ACTIVITY**

EL 27365 has been explored since 1960’s when first edition of the Pine Creek (1:250 00) map was prepared by BMR (now Geoscience Australia). Second Edition Pine Creek map was published by NT Geological Survey in 1993 (Ahmad et al, 1993) which incorporated metallogenic data and provided a framework for exploration. A regional geophysical cover (WGC, 1999) which includes the project area is available from Northern Territory Geological Survey. Following these programs on ground exploration activities commences for the discovery of uranium, gold and base metals mineralisation. These exploration programs were mainly conducted by Australia Geophysical Survey Pty Ltd, CRA Exploration Pty Ltd, CSR Limited, Dominion Gold Operation Pty Limited, Aztec Mining Company, Corporate Development Pty Ltd and Total Mining. Details of these programs are given in Bajwah and De Kever (2011b).

Since the grant of these tenements to Element 92 Pty Ltd, project area has been explored aggressively for gold, uranium and base metals mineralisation. It includes geological mapping, soil/rock chip geochemical survey, geophysical survey, drilling and data interpretation. Details of these programs are given in Mees (2008), Vieru (2009), Bajwah and De Kever (2011a), Bajwah and De Kever (2011b), Bajwah and Vieru (2012) and Mill and Mees (2013).
6. EXPLORATION DONE BY ELEMENT 92 ON EL27365

Exploration during year ending in 2011

During the 2011 field season, exploration activities mainly included a radiometric/magnetic airborne survey, ground-truthing and selected geological mapping.

Airborne Radiometric/Magnetic Survey

A radiometric/magnetic airborne survey was completed in August 2010 over some of the most prospective areas of the Allamber and Mary River Projects. The survey was designed to improve the company’s understanding of the geology; including structures controlling uranium mineralisation and to identify new uranium radiometric targets. An image of the project area is shown in Figure 3 with radiometric anomalous areas.

The survey was completed by Thomson Aviation Pty Ltd using an Air Tractor fixed wing aircraft. East-west lines were spaced 70m apart, with 445 line-kms flown over EL27365. Survey specifications are attached in Appendix 3 and GDF formatted data are given in Appendix 3.

Modelling of the raw data was completed by Southern Geoscience Consultants in Perth and identified 2 uranium radiometric anomalous areas for follow up work/reconnaissance.

Figure 3: Airborne radiometric image showing uranium anomalies.
The geological setting of the project area was noted to be similar to that of Cleo group of uranium deposits located further east, where Allamber Springs Granite appears to have played a role for providing hydrothermal fluids responsible for mineralisation. Interpretation of radiometric images of the area showed a number of anomalous areas.

**Exploration during year ending in 2012**
Gravity survey overlapping small portion in the North-East part of the tenement Figure 4 and Figure 5 and APPENDIX 1.
The area was covered with stations at 100x100m, it was undertaken by Haines Surveys and the data processing done by David McInnes. This survey hasn’t highlighted any zone of interest or target in the tenement under review.

**Exploration during year ending in 2013**
Work completed within this title in this period included geological reconnaissance, rock chip and soil sampling.

**Geological Reconnaissance**
Several visits were made to this title in an attempt to identify similar outcrops of the vuggy, ferruginous quartz that typifies the Tarpon Lode to the south. There is good potential for skarn-type mineralisation if carbonate lithologies can be identified in this title.

**Rock Chip Sampling**
A total of 3 rock chip samples were collected within EL27365 as part of the wider sampling programme (Figure 4 and Figure 5). Samples were assayed at NAL in Pine Creek for the suite of elements shown in Table 1. Selected assay results are shown in Table 2 and APPENDIX 2.
The results show clear anomalism in As, Au (ppb), Cu and Bi across samples TK555665 and TK555666. These rock chips were collected on a ridge of ironstone breccia and will be followed up in the 2013 field season.

**Table 1: Summary of analytical parameters for rock chips collected within EL27365 in 2012 field season.**

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Laboratory Preparation Technique</th>
<th>Assay Technique/s</th>
<th>Analytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock</td>
<td>Ultra Trace</td>
<td>PR044 ICPMS ICPOES</td>
<td>Ag, As, Pb, Bi, Mo, Th, U</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Au, Co, Cu, Fe, Zn, Pd, Pt</td>
</tr>
</tbody>
</table>
Table 2: Details of rock chips collected within EL27365 during the 2012 field season.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Easting MGA94 Zone 52</th>
<th>Northing MGA94 Zone 52</th>
<th>As ppm</th>
<th>Au ppb</th>
<th>Au ppm</th>
<th>Cu ppm</th>
<th>Pb ppm</th>
<th>Zn ppm</th>
<th>Bi ppm</th>
<th>Mo ppm</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK55566 2</td>
<td>820971</td>
<td>8498203</td>
<td>40</td>
<td>-1</td>
<td>0</td>
<td>-50</td>
<td>30</td>
<td>-50</td>
<td>1</td>
<td>5</td>
<td>Conglomerate. Large haematite clasts up to 10cm + laterite + angular VQ clasts. Haematite /goethite matrix.</td>
</tr>
<tr>
<td>TK55566 5</td>
<td>820042</td>
<td>8497978</td>
<td>61</td>
<td>68</td>
<td>0</td>
<td>150</td>
<td>20</td>
<td>10</td>
<td>8</td>
<td>15</td>
<td>Ironstone breccia ridge. Angular VQ clasts, Haematite /goethite matrix. 10m wide.</td>
</tr>
<tr>
<td>TK55566 6</td>
<td>819933</td>
<td>8497928</td>
<td>12</td>
<td>25</td>
<td>0</td>
<td>750</td>
<td>70</td>
<td>10</td>
<td>0</td>
<td>1730</td>
<td>Haematitic sandstone + ex-sulphides + trace malachite &amp; azurite</td>
</tr>
</tbody>
</table>

**Soil Sampling**

A total of 71 soil samples, screened to +2mm, were collected within Lead Prospect in EL27365 (Figure 4 and Figure 5) to investigate anomalous lead values in rock chip samples associated with a quartz breccia unit where a raft of metasediments lenses outcrop into granite. Minor cerrusite was observed in hand specimen.

The samples were analysed at NAL in Pine Creek, Northern Territory, for a suite of elements shown in Table 3 and APPENDIX 2.

The results indicated a significant lead anomaly in soils surrounding the quartz breccia unit (“Sardine Anomaly”), consistent with the discovery of cerrusite in these areas.

Table 3: Summary of analytical parameters for soil samples collected within EL27365 in 2012 field season.

<table>
<thead>
<tr>
<th>Sample Type</th>
<th>Laboratory</th>
<th>Preparation Technique</th>
<th>Assay Technique/s</th>
<th>Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>NAL</td>
<td>Drying, pulverising</td>
<td>FA050 G300I</td>
<td>Au, Ag, As, Cu, Pb, Zn, Bi, and Mo</td>
</tr>
</tbody>
</table>
Figure 4: Tenement map illustrating gravity survey location as well as rock chips and soil samples collected in 2013
Figure 5: Zoom on gravity survey location as well as rock chips and soil samples collected in 2013.
Exploration during year ending in 2014

During the year ending in 2014, exploration activities included geological mapping, ground-truthing, and data interpretation. The Palaeoproterozoic rocks of the Masson Formation and Mundogie Sandstone underlies the tenement. Towards south, these rocks have been intruded by the Allamber Springs (Figure 2). During the reporting period, exploration activities included, ground-truthing, selected geological mapping and technical review of available exploration data in order to understand mineral potential of the project area. Appraisal of the regional geochemistry data revealed a zone of strong Pb-Zn (“Sardine Anomaly”) in stream sediment in streams draining Masson Formation sediments 4.5 km SW of Ox-Herring, in close proximity to the Allamber Granite contact. Limited soil sampling follow-up (3 traverses at 250m spacing) by Aztec/Dominion obtained peak Zn and Pb in soils results of 1430 ppm Pb and 1290 ppm Zn.

In previous reporting period, Element 92 undertook Soil sampling program from Sardine anomaly. Samples retrieved were assayed by in-house portable Delta XRF analyser (Mill, P., and Mees, H, 2013). A total of 42 soil samples were assayed for P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Zr, Mo, Cd, Sn, Sb, W, Hg, Pb, Bi, Th and U. An examination of assay data show that it is characterised by elevated levels of Co, Ni and Cu. Cobalt varies from 1 to 21 ppm with an average of 9 ppm. Ni is present in some samples up to 31 ppm. Cu and Zn are also high and are present up to 47 ppm and 1433 ppm. Th also shows elevated levels ranging from 3 to 27 ppm with an average of 15 ppm. Rock chip sampling undertaken during 2012-13 reporting period, returned some enhanced level of Au, Cu and Bi. These samples came from ironstone-breccia which should be further followed up. Soil sampling conducted during the same period, also retuned anomalous lead values which shows the prospectivity of EL 27365.

Geological setting of the project area is similar to that of Cleo group of uranium deposits located further east, where Allamber Granites appears to have played a role for providing hydrothermal fluids responsible for mineralisation. Bajwah (1994) suggested that fractionated members of the Cullen Batholith have genetic link with gold, uranium and base metal mineralisation present in the adjacent metasediments. A number of studies carried out, so far, indicate that elevated levels of gold, uranium and base metals within a number of plutons indicated that granites were fertile rocks, which generated hydrothermal systems that led to releasing of metal-rich fluids and were responsible for gold, uranium and base metals mineralisation in the structurally prepared sites mainly in contact aureoles.

The Mason Formation in the project area has similar characters and requires a thorough assessment. Radiometric image of the project area shows a number of anomalous areas. Towards south-east of EL 27365, the Allamber Springs shows anomalous area but towards south-west, contact zone between Masson Formation and Allamber Springs appears to be anomalous for uranium mineralisation.

Mineralogical and geochemical characters of Allamber Springs Granite show that it is an I-type, fractionated and high heat producing granite. In the final stages of magma emplacement, hydrothermal fluids were released and a variety of mineralisation such as gold, uranium and base metals was deposits in structurally prepared sites in the contact aureoles (Bajwah, 1994). Important
examples for gold are Pine Creek goldfield, Union Reefs gold mines and Spring Hills whereas for uranium Cleo group of deposits are noteworthy. Some additional mineral occurrences are also located in the NW of EL mainly hosted by the Masson Formation. The prospectivity of the Masson Formation has been demonstrated by the presence of uranium, base metals and gold mineralisation in the Allamber project area. It appears to be an important host for mineralisation in the Pine Creek Orogen, particularly where it is intruded by the Allamber Springs Granite. Greisenised part of the Allamber Springs Granite is indicative of generation of hydrothermal system responsible for mineralisation in the adjacent sediments.

**Exploration during year ending in 2015**
During the year ending in 2015, exploration activities mainly focused on geological mapping, ground-truthing, and data interpretation including review of soil sampling results collected by Element 92 in 2012-2013 reporting period.

**Exploration during year ending in 2016**
No field exploration work undertaken during the current reporting period and therefore Element 92 decided to voluntary relinquish the license before its expiry date.
7. CONCLUSIONS

Geological information reveals that project area contains important rock units such as the Masson Formation, which has been intruded by the Allamber Springs Granite and Minglo Granite. Both granite bodies are fractionated and has the ability to generate a hydrothermal system that can produce significant gold, base metals and uranium deposits, as noted in other parts of the Pine Creek Orogen. Geochemical sampling and geophysical survey programs have provided encouraging results for the prospectivity of the project area. However Element 92 has not been able to identify solid drilling targets within the licence therefore decided to relinquish the tenement. Moreover the tenement was initially pegged for uranium potential and uranium exploration is not currently a priority for Element 92.
8. REFERENCES


Chappell, B.W., and White, A.J.R.W., 1974, Two contrasting granite types, Pacific Geology, 8, 173-174

Corporate Development Pty Ltd, 1998, Exploration License 9369, Frances Creek East, Annual Report to Dept of Primary Industry, Fisheries and Mines, CR98-0539


