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<tr>
<td>Author(s)</td>
<td>Jim McKinnon-Matthews BSc (Hons) - Geology</td>
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<td>Coolabah Group</td>
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<td>Contact Details</td>
<td>Coolabah Group Pty Ltd - Author Phone: 0415087434</td>
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<td>Email</td>
<td><a href="mailto:jimmckm@gmail.com">jimmckm@gmail.com</a></td>
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1 SUMMARY

This is the first and final Annual Technical Report for EL30863 and covers work carried out during the twelve months between 10/2/2016 and 9/2/2017. EL30863 formed part of the Coolabah Groups Broughton Project which is targeting base metal deposits.

Exploration activities during the period have involved:

- Collecting, collating, extensive digitising and compiling of all previous historic data of all available open file reports and data.
- Historical data review.
- Conceptual model and targeting.
- No field work was completed.
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2 INTRODUCTION
This report outlines the work conducted within EL30863 for the first and final year of tenure. The tenement covered the western portion of the Palaeo-Mesoproterozoic McArthur Basin in the Northern Territory near the southern margin of Arnhem Land approximately 150km east-northeast of Katherine as the crow flies, Figure 1. Coolabah are exploring this region for large scale sedimentary-hosted base metal deposits.

The main attractions of the project area are:

- Situated in the Carpentaria Zinc Belt, a world class province with giant Cu, Zn, Pb deposits (Isa, HYC, Century)
- Roper Basin currently overlooked for this type of mineral system, although some significant conventional exploration during 1980-1995
- Significant interest in unconventional petroleum in this area now, and was once a conventional oil and gas “hotspot”
- Petroleum exploration hole Broughton #1 contains evidence of disseminated sulphides in stratigraphy regionally viewed as “barren”
- Review of historic exploration identifies numerous low-grade base metal prospects and broad anomalies, dominantly Zn-Pb
- We speculate that these are “smoke” of a base metal mineral system
- The Broughton #1 target is at shallow depth of <100 m
- Numerous other “lookalike” structures in the Arnhem region
3 TENEMENT

The tenement EL30863 covered 73 km² of pastoral land and was held by Boab Resources Pty Ltd, a 100% subsidiary of Coolabah Group.

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Table 1: Tenement Schedule

4 LOCATION AND ACCESS

The project is semi-remote, lying near the southern boundary of Arnhem Land, Northern Territory. The large service centre of Katherine lies 200 km to the west by road and Darwin is 500 km to the northwest by road. The project lies within pastoral properties and is subject to Native Title legislation. Access is via the all-weather gravel Central Arnhem Road that is used for cattle transport, and then well-maintained station tracks. Access otherwise within the tenement is via cross-country 4WD vehicle. The area is seasonally inaccessible due to rain and wet ground, with work possible between April and November in most years.
Much of the project area is flat to moderately hilly, and vegetated by open woodland and grasses, figure 2. The pastoral properties are well-maintained with good infrastructure, enabling relatively simple exploration operations. Geological exposures are moderate owing to the presence of broad Blacksoil plains associated with the Flying Fox/Maiwok Creek drainage that drains into the Roper Valley to the south.

5 GEOLOGICAL SETTING

The tenement EL30863 comprised the northwestern wedge of the exposed Roper Superbasin (Wilton package; NTGS) on the Arnhem Shelf - this is the uppermost stratigraphic component of the McArthur Basin (Figure 3). The Roper Group comprises interlayered sandstone, siltstone and TOC-rich shale deposited in a large epeiric seaway associated with a foreland basin connected to the south with an unknown orogen. It is underlain to the northwest by the dolostone-rich Mount Rig/Nathan Group (Favenc package), which is also expected to be the case under EL30863 based on seismic and petroleum well data. The Nathan Group may in turn be underlain by thin remnants of the older McArthur Group (Glyde package), but this is largely conjectural, as there is little outcrop or drilling to support this notion. Seismic and well data also predict the Katherine River Group (Redbank package) to be widespread under the Roper
cover on the Arnhem Shelf. The Roper Group is overlain by patchy remnants of the Neoproterozoic to Cambrian Georgina Basin and in turn by poorly-constrained patches of Permian-Jurassic and Cretaceous sediments of the Dunmarra Basin, and finally by Tertiary to recent alluvial sediments and soils. Blacksoil in particular is thickly developed over large areas of the Arnhem Shelf, including EL30863. In terms of igneous activity, the Roper Group is intruded by regional sills of the Derim Derim Dolerite, emplaced at the latter stages of Roper Group deposition.

Figure 3 Regional geology map of the McArthur Basin showing the location of EL30863. Base metal prospects are red dots. Fold closures in Roper Group on Arnhem Shelf outlined in blue.

Regional prospectivity can be summarised as follows:
- Zinc-lead-silver-copper hosted by carbonates of the Nathan/Mt Rigg/Vizard Groups around Bulman (Pb, Zn), Mt Warrington (Pb, Ag), Walmudga (Cu, Pb, Zn), Mt Birch (15m at 0.18% Cu), and Mountain Ck (15m at 0.4% Zn). These are largely thought to be MVT-style deposits.
- Zinc-lead-silver-molybdenum hosted by sandstones/siltstones of the Roper Group in structural juxtapositions (eg Wongalara, Galena Cliffs, The Swamp) and anticlinal traps (Broughton 1). These have been likened to the Laisvall sandstone lead-zinc deposit, Sweden.
- Minor prospects in underlying Katherine River Group, inc Conways (Zn-Pb), McKay Hills.
- Unconventional shale oil/gas hosted in the Velkerri Formation, the current focus of petroleum exploration by Santos in the area.

6 PREVIOUS EXPLORATION

The following is a summary of the historic exploration in the vicinity of EL30863:

- Mostly diamond exploration during 1970s to 2000 (Stockdale, CRAE/Rio, Ashton).
- Uranium exploration in 1970s to early 1980s.
- Brief period of base metals exploration in early 1980s (AAO, WMC) and early 1990s (BHP, Stockdale, Normandy/Poseidon).

Regional stream sediment and soil sampling during this period shows a generic anomalous trend of Pb, Zn and lesser Cu, particularly in lower part of Roper Group – Limmen Sst, Mainoru Fmn, Crawford Sst. Numerous Pb-Zn-(Mo-Ag) prospects were discovered in the lower Roper Group, including Wongalara, Galena Cliffs and The Swamp. A number of prospects were also discovered in the immediately underlying Nathan/Mt Rigg/Vizard Grps, including Bulman (Zn, Pb – this was really discovered in the early 1900s), Mt Warrington (Pb, Ag), Walmudga (Cu, Pb, Zn), Mt Birch (15m at 0.18% Cu) and Mountain Ck (15m at 0.4% Zn). Minor prospects were identified in underlying Kath River Group, including Conways (Zn-Pb) in the McKay Hills.

The Regional stream sediment surveys carried out historically could be described as extensive but not much is in digital form. The NTGS STRIKE data is shown in blue in figure 4. There is substantially more data than this map depicts.
**Normandy-Poseidon sediment hosted exploration**

- Extensive regional stream sediment and soil sampling, followed by prospect scale rock chips and -80# soils. >2000 samples
- Element suite: Cu, Pb, Zn, Ag, +/- Ba, Bi, Fe, Mn, Cr, Sb, Mo
- None of the data is in NTGS STRIKE database
- Excellent quality work that led to the discovery of Galena Cliffs and The Swamp
- They utilised a sandstone-hosted Pb-Zn model derived from Laisvall, Sweden.
- Three year effort is the only significant piece of base metal exploration undertaken in the Broughton area
- Cu is locally 20 times background, but not of the same order of dynamic range as Pb and Zn. Common association with dolerite bedrock. Typically anomalous in Pb-Zn samples, but again an order of magnitude lower.
- Soil sample maxima:
  - Pb 3610 ppm
  - Zn 1.07% (partly surface enrichment)
- Cu 340 ppm
- Rockchip maxima
  - Pb 0.5% (galena dissem)
  - Zn 0.2%
  - Cu 310 ppm
  - Mo 900 ppm

**Wongalara Pb-Zn Prospect (1982)**

- Stream seds and soils identify a 2.5 km long Pb-Zn anomaly in mapped Crawford Fmn (Roper Grp; Figure 5). No Cu anomaly. Up to 2500 ppm Pb and 1800 ppm Zn.
- Rockchips 2.2% Pb and 2.3% Zn associated with Mn.
- Core drilling (WD1,2 and 3) results
  - 1.5m at 1.3% Pb, 1% Zn from 1.6m and
  - 2m at 0.6% Pb and 0.5% Zn from 15.6m.
- Host is light grey and brown fine grained micaceous sandstone with minor siltstone laminae.
- Ave 2-5% "feathery" Fe/Mn oxide after sulphides. Pyrite identified in petrology. No Ag in assays. Broad 22m zone >0.5% Pb+Zn.
- Flat lying mineralisation approx 10-20 m thick and strike 1.5 to 2.5 km NE-SW.
- Ground EM survey suggests two zones; one fault controlled (South) and the other shallow-dipping (or flat lying) stratiform style (North). Not notably conductive.
- IP survey shows weak chargeability anomaly (Figure ).
- Rock samples Pb isotope results by CSIRO suggest North prospect is similar to HYC and Broken Hill.
- Recommended AEM survey to explore further afield for better grades (massive sulphides).
- Coincides with NE-trending magnetic linear in Govt dataset (Figure ) – dyke related?
Figure 5  Geological map and TMI image showing the setting of Wongalara
The Swamp Pb-Zn Prospect (1993)

- Soils up to 1.07% Zn! Also anomalous Pb, Mo, Ag and Cu.
- Basal Mainoru, Limmen and upper Mt Rigg Grp.
- RC drilling (14 holes) results
- Minor galena, sphalerite and pyrite
- Assays were all <0.6% for Pb and Zn, but over >20m width.
  - Cu max 340 ppm.
  - Zn may be partly surficial enrichment.
  - Bitumen vughs.
  - Minor dolerite encountered.
- In nearby stratigraphic DDH hole, Mt Rigg Grp contained narrow interval of disseminated sphal, gal, cpy and py. Max 2% Pb, 1% Zn, 7 ppm Ag, 130 ppm Cu.
- Ground IP showed low chargeability and high resistivity, which can be taken as background.
- NNE trending fault that has been intruded by dolerite may have acted as reductant.
Figure 7 Geological map and TMI image showing the setting of The Swamp

**Galena Cliffs Pb-Zn-Mo Prospect (1993)**

- Stream seds and soils identify a 6x1 km Pb-Zn-Mo anomaly in Limmen Sst (Roper Grp).
  - Up to 3610 ppm Pb, 1210 ppm Zn, 0.4 ppm Ag and 14 ppm Mo.
  - Zn may be scavenging in swampy clays.
- Rockchips: 0.5% Pb, 26 ppm Sb and 900 ppm Mo; visible galena in clean white sst.
- No coherent geochem or geophysical anomaly could be defined.
- Ground IP showed no elevated chargeability or conductivity.
• Coincides with edge of NW-trending fault– dyke related?

Figure 8 Geological map and TMI image showing the setting of Galena Cliffs
**Normandy-Poseidon sediment hosted exploration - Petrological snapshot**

In all of these samples, galena is the dominant sulphide phase. It may be accompanied by lesser sphalerite, and trace amounts of chalcopyrite and pyrite. In places, galena and sphalerite are intimately intergrown, a feature that confirms their contemporaneous deposition. Chalcopyrite may occur as angular grains within these intergrowths, indicating that it also was deposited at this time.

The sulphides occur in interparticle pore spaces in the sandstone in close association with quartz of different types. This close physical association points to a close genetic association between the quartz and the sulphides.

Chalcopyrite occurs as very small disseminated ragged grains, and also as larger anhedral grains within coarser-grained dolomite. Most grains have suffered partial or complete replacement by very fine-grained covellite and associated goethite.

The host rock is a well-sorted, compositionally mature quartzose sandstone. Rounded quartz particles were abundant, with lesser feldspar and tourmaline, a detrital assemblage that infers a felsic crystalline source terrain. There is no evidence that the primary interparticle pores were filled by any matrix materials at the time of deposition. It may be inferred, therefore, that the primary sandstone was highly porous.

The most likely origin for the mineralisation is that it was introduced from an external source by hydrothermal fluids. Dominance of Pb over Fe and Cu suggests that the fluids were of relatively low temperature, an inference that is supported by the presence of fine-grained chalcedonic silica in some interstitial pores. It is possible that the hydrothermal fluids were related to a low-grade regional metamorphic event (as distinct from a localised igneous-related hydrothermal event), but there is no direct evidence for this in the mineralised rocks.
Figure 9 Normandy prospect-scale rockchip example - Cu

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Figure 10 Normandy soil assay example
Figure 11 Normandy soil assay example - Zn

Figure 12 Normandy soil assay example – Cu
Conways Zn-Pb Prospect (1994, 2012) – Located within EL30863

- Normandy held this area and drilled two DDHs to test soil anomalies, intersecting weak disseminated sphalerite and galena mineralisation in the McCaw Formation (max 430 ppm Zn).
- In 2012, Merlin Diamonds identify further anomalous base metal anomaly from historic and new stream sediment/rockchip data but did not follow up.
- Area of 1x1.5 km anomalous geochemistry (Figure ).
- Rockchips: 0.2% Zn, 500 ppm Pb; visible galena and pyrite in dolomitic siltstone of McCaw Formation (Katherine River Group; Figure ).
- Bitumen and live oil in calcite-lined vughs over 5 km strike (Figure ).

![Figure 13 Merlin stream sediment geochem results](image_url)
Figure 14 Geological map and TMI image showing the setting of Conways
7 EXPLORATION CARRIED OUT

Work completed by Coolabah was restricted to compilation and analysis of the historic data, as outlined above. No field visits were undertaken to the area.

8 CONCLUSIONS AND RECOMMENDATIONS

There is significant base metal “smoke” in the region in the form of several base metal prospects (Galena Cliffs, Bulman, etc) and widespread base metal anomalism in stream sediments and soils and regionally, there is sporadic evidence of sulphides in the Corcoran, Limmen, Crawford and Velkerri Fmns.

However the review of the previous work suggests that the area Coolabah wishes to focus is further to the south where potential trap sites for mineralisation are interpreted to be more prevalent. As a result of this the tenement was relinquished.

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