

# **MINERAL PROSPECTIVITY REPORT**

**Merlin Coal Pty Ltd**

**Purni Coal Project**

**Prospectivity for other minerals**

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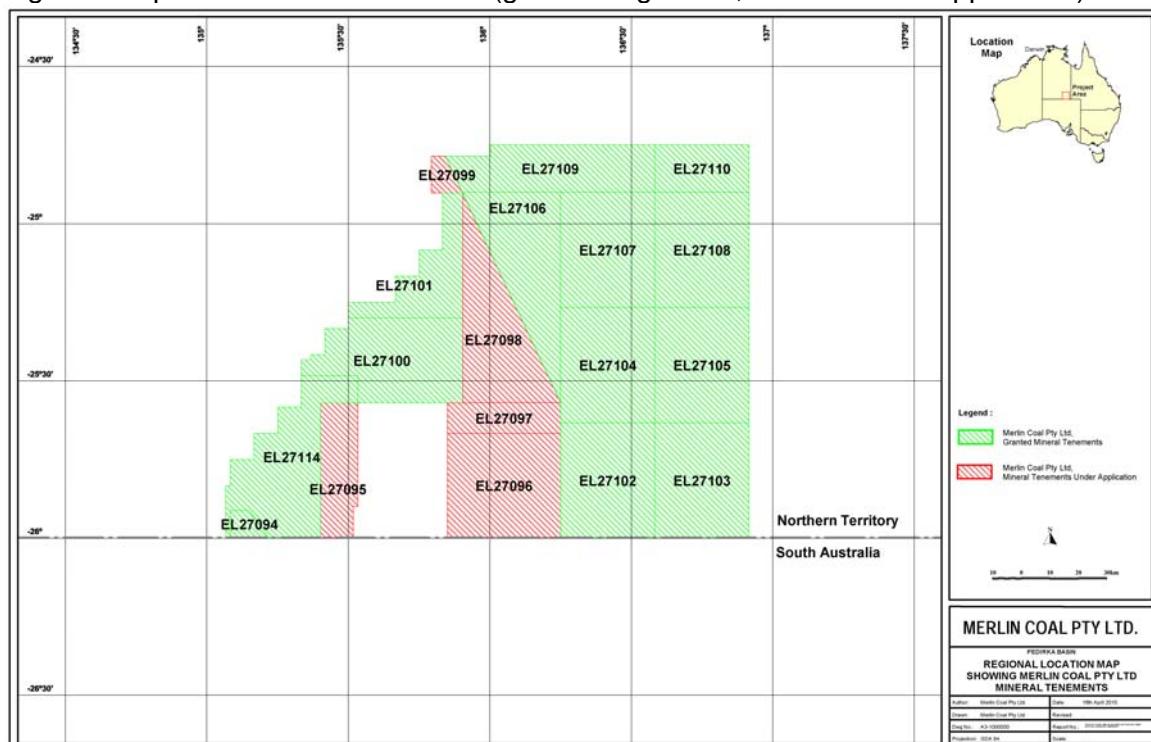
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## Introduction

The area covered by the thirteen mineral Exploration Licences in the Pedirka Basin (see Figure 1) is virtually unexplored for minerals. The group of tenements are referred to as the Purni Coal Project (PCP) and cover part of the Simpson Desert. Time constraints restrict this paper to a brief overview of the potential for mineralisation and the general exploration methods which could be employed.

The almost complete lack of exploration on the ground reduces the chance of easily finding exploration targets through research but conversely means that there is little evidence to exclude mineralisation in the area.

Figure 1 Exploration Licence location (green are granted, red are under application)



## Previous Exploration

A number of historical (dead) tenements exist in the area covered by the Exploration Licences these are shown in Figure 2.

Previous exploration targets have included opal, coal, diamonds, and uranium. Little, if any, sampling or field work was reported to have been carried out in the exploration tenements. Most of the earlier exploration efforts in the project area were confined to (often expensive) office based research and studies.

Copies of most of the available exploration reports for old tenements in the area have been ordered from the NT DoR. Most have now arrived and are filed. The bulk of the reports have only been briefly reviewed due to time constraints.

Known mineral deposits of the Northern Territory are shown in Figure 3. Exploration licences granted in the surrounding area are shown in Figure 4.

Several oil and gas and CBM holes have been drilled in the area but no analysis was carried out for any other potential mineralisation. Seismic data is also available for parts of the area.

Records for tens to hundreds of water bores are available. Some consist of only basic location data; however others have geological logs of varying quality and will be a good source of information for stratigraphy and geology of the area. Compilation of these will provide valuable geological and stratigraphic information for the project area. This information should be put into a database which can be used as additional stratigraphic data points for interpretation of seismic and to help verify existing interpretations.

### Figure 2: Historical tenements

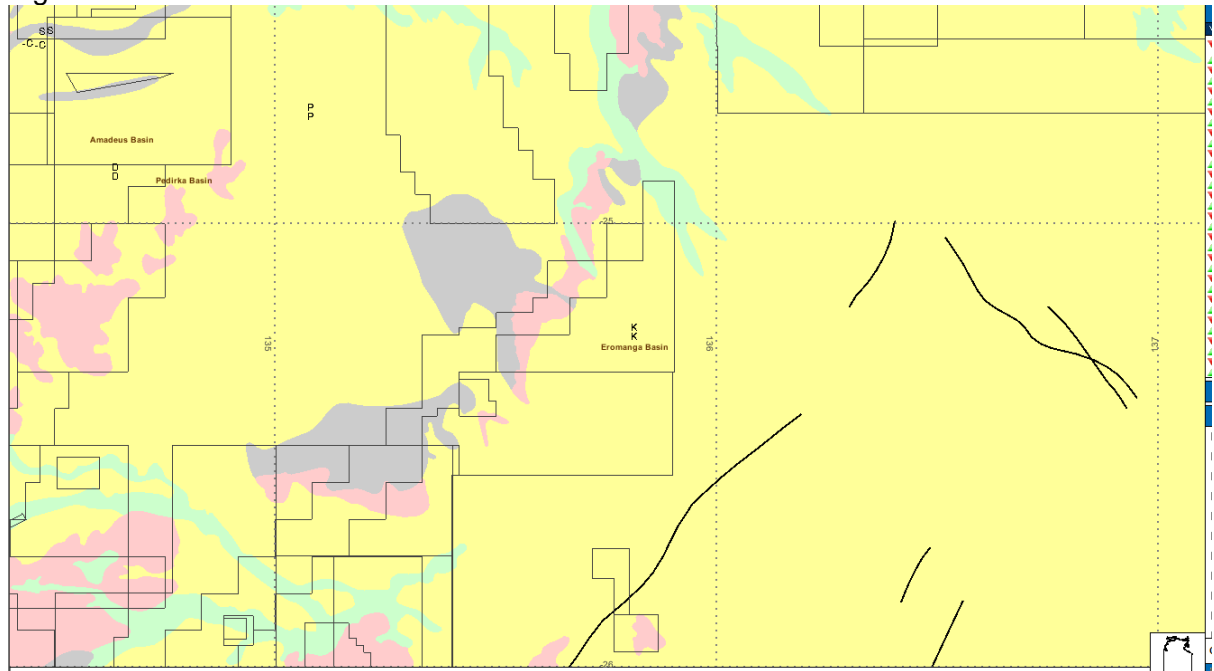


Figure 3: Mineral Deposits of the Northern Territory (Modified from NT GS report).  
Merlin Coal area of interest is in south eastern corner of NT.

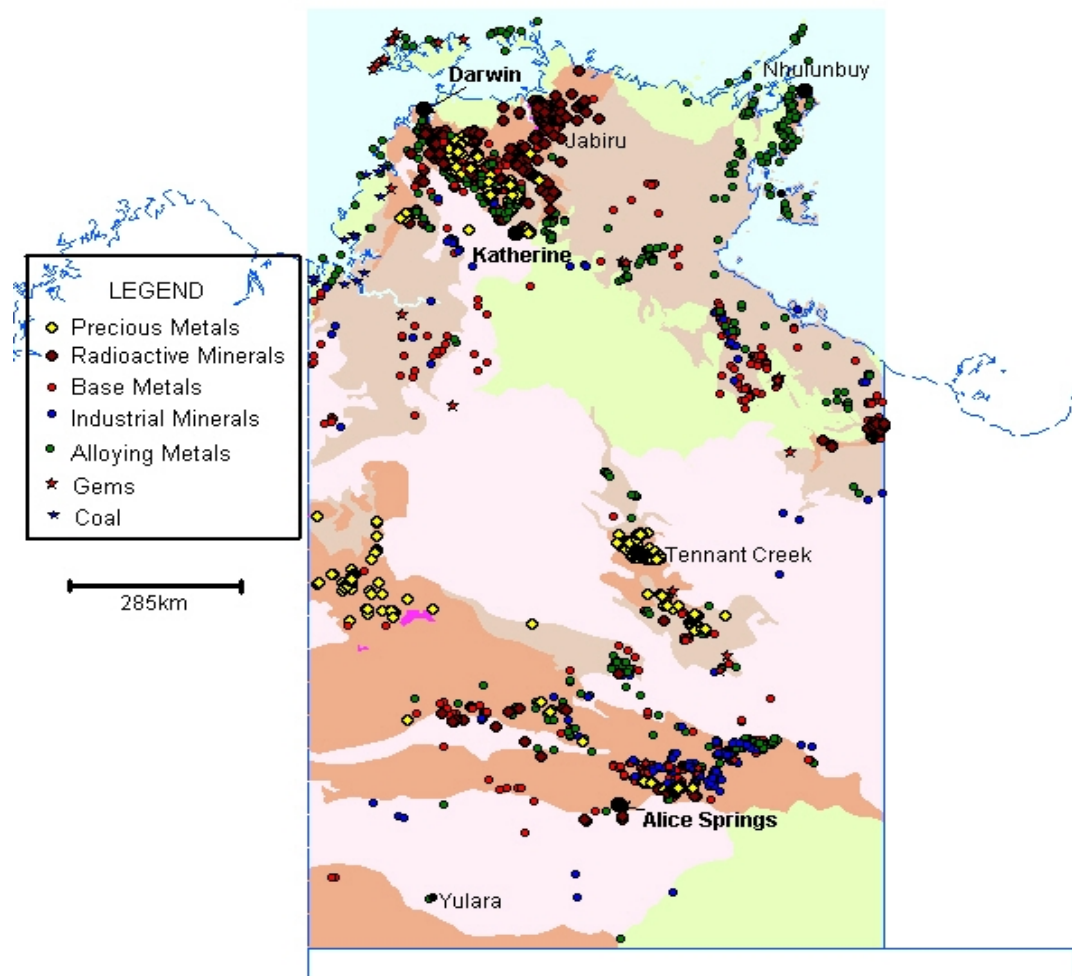
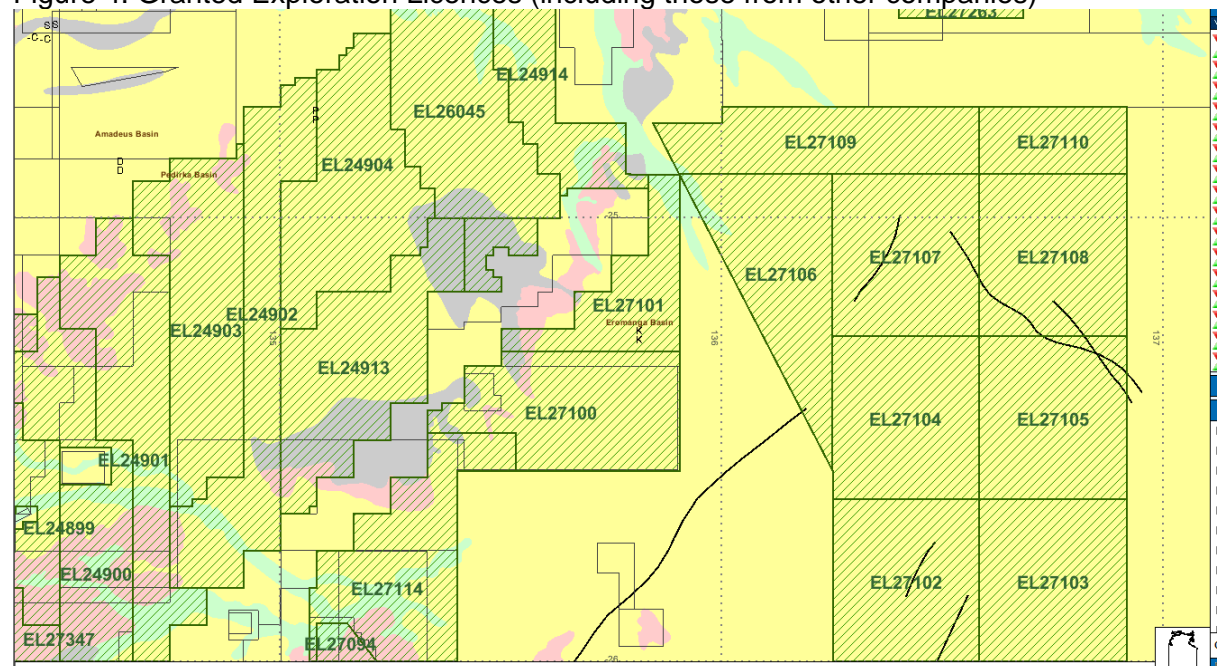


Figure 4: Granted Exploration Licences (including those from other companies)



## Geology

The geology of the area is described in numerous papers by Greg Ambrose and others so no detailed description will be given here.

The sand dunes cover approximately 70% of the surface of the project area. Beneath and between the dunes sand cover extends to tens of metres below surface (10-35m Wopfner and Twidale 1967) to unconformably overlie Cretaceous shales and siltstones.

Two features of specific interest to exploration are two sets of palaeochannels in the area. East-west oriented Jurassic age channels are visible on magnetic maps, and a more recent series oriented north-west to south-east (Craddock et al). The Jurassic channels are at an unknown depth but this is being worked on by Roger Clifton of the NT DoR. The recent channels are immediately below the sand dunes. The channels may be prospective for placer deposits (HM, gold, and uranium) or for sandstone hosted uranium mineralisation.

## Gold

No auriferous structures or rocks are known from the project area however the project area is poorly explored for its mineral potential. The nearest known gold deposits are on the south-eastern margin of the Arunta Region, some 200km north west of the project area. The Pedirka basin is ranked as poorly prospective for gold by the NT Geological Survey with the nearest known gold deposits several hundred kilometres north-west of the Project area.

Palaeochannels within the project area are a target for placer deposits. Potential placer deposits have no obvious auriferous source rocks nearby, however analysis of both the Mesozoic and recent palaeochannels may show a connection from the auriferous Arunta region to the project area.

Greg Ambrose mentioned that granite was intersected at depth in one water bore (and possibly others) and depending on depth to basement; there could be targets in basement contacts where they are still shallow enough to have some prospect of being mineable. Major fault zones and intersections of major fault zones are another target for early gravity and magnetic analysis.

Proposed action to start gold exploration is to sample the composites (if they exist) from the coal drill holes for the top 100m (10m composites) and planned water bores. These could be sent for multi-element geochemical testing for the standard range of valuable minerals and tracer elements. If samples are to be sent it is important to establish whether the samplers handled the samples and if were wearing jewellery when taking the samples as this could have contaminated the samples.

“In the NT gold is usually found within metamorphosed Precambrian rocks or related alluvial sediments and regolith, often near granite intrusions.”

Almost all known gold deposits of the Northern Territory are located within metamorphosed Precambrian rocks or related alluvial sediments or regolith. This effectively reduces the search to the Pine Creek Orogen, Tennant Region, Murphy Inlier, Arnhem Province, Tanami Region, Arunta Region and Musgrave Province. Even in these areas, gold deposits are limited to particular rock types and suitable structures. In most cases, they are located in the vicinity of granitic intrusions. The Arnhem Inlier may also be considered prospective for gold, but

has attracted insignificant exploration.” (Gold Deposits of the Northern Territory p9).

“Most Northern Territory gold deposits are located in the vicinity of major structural breaks. Anticlinal axes and iron-rich rocks are other suitable targets. Many of these features can be identified with the use of airborne geophysics.” (Gold Deposits of the Northern Territory p10)

Exploration techniques include;

- Analysis of existing gravity, and magnetic survey data,
- Geochemical sampling – stream bed, lag sampling, and biotic sampling (CRCLEME project). One thing to evaluate in any grab sampling programme is whether the surface sediments will be of use. In the Tanami region, aeolian sands over a degraded lateritic profile in turn overlying weathered bedrock made surface soil samples of little use and exploration relied heavily on drilling the weathered bedrock (presumably RAB). (from Gold Deposits of the Northern Territory p10)
- Analysis of any available drill samples from petroleum holes.
- Drilling of identified targets.

Targets

- Jurassic channels
- Recent channels
- Major fault zones

## Uranium

“NT has most of Australia’s high-grade unconformity related deposits. Sandstone-hosted and palaeochannel uranium potential is high.” (Ore Struck pamphlet, NT DoR, May 2009)

The project area has the potential to host sandstone style uranium deposits.

The Angela deposit in the Amadeus Basin is a sandstone hosted deposit in a similar setting to the project area. One significant difference is the proximity of the granitic units (uranium source) within the Arunta Complex to the Angela deposit.

Previous uranium exploration has been around the western and northern margins of the project area. Exploration activities in South Australia and Queensland have not been researched.

Afmeco, Uranium Equities, and Pancontinental Resources (with Central Rare Earths Corporation) - reports received but not yet properly reviewed. Significant data sets appear to have been submitted with some of the reports and these can be obtained from the NT DoR.

“It is a significant observation that all known uranium deposits exhibit clear spatial relationships with uranium-enriched bedrocks. This observation holds true at regional to local scales.” Lambert et al, Ausgeo News, issue 80 2005  
Geoscience Australia

The source of the uranium is usually bedrock and can be transported by fluids. So one challenge would be to find if there are spatial relationships with uranium enriched

bedrocks this could be at depth or via palaeochannels. If a uranium source exists, palaeochannels can also host uranium enriched calcretes.

The most cost effective exploration method is likely to be analyse existing radiometric, magnetic, and gravity data to generate targets for new geophysical data acquisition. To justify the cost of flying new surveys, specific target areas would need to be identified.

## **Coal**

Sub-bituminous Coal is present in the mineral tenements at depths ranging from 240m to greater than 1000m. Seams up to 30m thick have been recorded in the recent holes drilled as part of the coal bed methane project.

Typically coal seams more than 30cm are considered mineable if other economic factors are met. Some of the coal seams in the tenements are 30m thick which increases their economic potential significantly. Obviously coal quality and composition affect the viability of any potential operation.

Some observations on the economic potential for coal are;

### **Open cut**

Significant thicknesses of sub-bituminous coal exist but may be too deep for open cut mining. The deepest open cut mines are mining at 350m to 700m but most are less than 100m deep. Stripping ratios range from 1:1 to 15:1 and depend greatly on the value per ton of the coal and the cost of stripping the overburden (hardness and composition of the overburden).

Open cut coal mines are typically shallower than 100m but some such as the Mount Owen Coal Mine in Hunter Valley, NSW are >250m deep and the Korkinsk Coal Mine in Russia is 700m deep.

Stripping ratios vary from 1:1 to 15:1 (15.1:1 in US Green River Mine) per tonne of coal recovered. The more valuable per tonne the coal the higher stripping ratio it will support.

The Mount Owen Coal Mine in the Hunter Valley, NSW is ~250m deep (possibly going to 350m, 22 mineable seams, totalling 55m total thickness) and produces semi soft coking coal.

### **Underground**

Underground mining of coal is typically economic at depth less than 300m and with a 0.5m minimum seam thickness.

“Current general mining practices include coal seams that are contained in beds thicker than 27 inches and at depths less than 1,000 feet.”

(From

<http://www.cartage.org.lb/en/themes/sciences/earthscience/geology/coal/AboutCoal/coalgeology/coalgeology.htm>)

The economics of underground mining may also be unfavourable due to the remote location, lack of infrastructure, and depth of coal. Coal has been mined below 1000m by shaft mining methods.

## **Diamonds**

CRA have explored in some of the area and dropped tenements within 4 months citing South Australian anomalies not diamondiferous. No work was carried out on the tenements in the NT.

No evidence of pipes seen in literature review. Alluvial diamonds would require a source upstream. Nearest recorded diamond find is on the south edge of the Georgina Basin. Both the recent and Jurassic palaeochannels are a logical place to sample for indicator minerals. The recent channels could be sampled from surface and the Jurassic from drill core.

As far as can be ascertained from the exploration reports and available literature there has been no significant diamond exploration effort in the project area. Therefore the project is untested for diamond potential and should be considered a green field exploration area.

## **Heavy Minerals**

The heavy mineral (HM) potential of the area is unknown. Heavy minerals include garnet, ilmenite, rutile, leucoxene, and zircon. Potential targets could be aeolian concentrations in the Simpson Desert dunes and near surface HM accumulations in drainage channels.

To test for this, samples could be sent for analysis from upper sections of the petroleum drill holes (if they are available). Additional samples can be obtained by grab sampling in stream beds or hand auger drilling in dunes.

Pancontinental identified some anomalous results at the South end of Hale River where it debouches into the dunes of the Simpson Desert. Most of this area now falls under Aboriginal freehold land. The bed of the Finke River in EL27114 would also be an early target for HM exploration.

## **Phosphate**

Exploration for phosphates should focus on sedimentary units which can be identified to be anomalous levels of phosphate. The most prospective sedimentary units for phosphate are Lower Palaeozoic (Cambrian). Information can be from the company drill holes and also from the water bores. The Georgina Basin is a major target for phosphate exploration.

“Middle Cambrian rocks of central and northern Australia host several major phosphate deposits, including Duchess-Phosphate Hill, Lady Annie and D Tree in Queensland, and Wonarah, Alexandria, Alroy and Highland Plains in the Northern Territory.” (pp 1 NTGSRec2007-003)

“The favourable phosphate stratigraphy is identified as the Cambrian Todd River Dolomite which has been recorded to contain significant phosphatic occurrences, including historical drilling with a reported intersection of 6m @ 22.8%  $P_2O_5$ .” (From <http://northernuranium.com.au/?id=253>)

## **Gypsum**

Gypsum may be present in salt lakes/playa in the area. Whether there is sufficient quantities for commercial exploitation would require exploration of existing lakes and search for palaeo lakes.



## **Potash**

Further work required.

Marine facies required – Pedirka Lacustrine

Greg Ambrose said there was no drill hole evidence from the holes drilled so far?

## **Base metals Pb/Zn**

Further work required.

There is a lead zinc metal deposit along the southern margin of the Georgina Basin.

## Recommendations

As the area is unexplored for minerals, exploration should start with the basics,

- Comprehensive review of earlier exploration for the project and surrounding areas,
- Compile and put into digital form, the logs from the existing water bores – a lot of geological background and stratigraphic knowledge to be gained,
- Analysis of existing gravity, magnetic and radiometric survey data,
- Review of exploration targets in similar sedimentary basins
- Geochemical testing on petroleum drill hole samples – top 100m – 10m composites may be available,
- Review down-hole geophysical logs for anomalous intervals,
- Review Aeromag for evidence of salt diapirs,
- Geochemical testing on petroleum drill hole samples – top 100m – 10m composites may be available,
- Conduct stream sampling, where possible, such as the south west corner and north eastern edge). This should include full geochemical testing and search for diamond indicator minerals,
- Field mapping of any exposures such as stream/river beds especially in the south western part of the tenements,
- In the longer term flying a radiometric survey may be worthwhile for uranium exploration. Some radiometrics exist already and may need to be obtained from the NT DoR and compiled. CRA (EL3461) and Afmeco flew radiometrics

