EL27978 UNDIPPA PROJECT

FINAL REPORT

For the period 1/11/2010 to 13/01/2014

CENTRAL AUSTRALIAN RARE EARTHS PTY LTD

March 2014
Compiled by T. Coppin

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Executive Summary

EL27978 is located near Alice Springs within the Aileron and the adjacent Irindina Provinces of the Arunta Region. The Nolans, Holsteins, Mount Mary, Blue’s Folly and Mount Finnis rare earth element (REE) prospects are located in this part of the Northern Territory and potential exists to locate similar, new prospects within CARE’s exploration licences.

During the first year of tenure work consisted of a reconnaissance field trip to the tenement and a comprehensive review of all previous exploration and technical data.

In the second year of tenure Core Geophysics was contracted to undertake the following work:
- A review of competitor REE activity and projects
- Assess the project for its Rare Earth potential using Open File geophysical data
- Define a number of possible target zones for further follow up

No further work was carried out in the third year of tenure. The potential of the tenement was downgraded and it was surrendered at the end of the third year.
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Figure 2: Simplified Geology of the Undippa Project Area
1.0 Introduction

EL27978, known as the Undippa Project, was granted on 1 November 2010, for a period of six years, over an area of 65 sub blocks (204 km²). It lies within the Arunta Region, northeast of Alice Springs.

1.1 Location and Access

The licence area straddles the main road to the Harts Range and can be accessed by driving north from Alice Springs on the Stuart Highway for approximately 75 km and then northeast on the Plenty River Highway to just past Mud Tank, then to Alcoota and the Engenela Community to the north. From there access is via station tracks.

The main road marks the geological divide with the Harts Range to the south and Alcoota is located in the centre of the northern part of the licence.

The Ongewa Creek flows through the centre of the licence area.

Figure 1. EL27978 location map
1.2 Tenure

EL27978 was granted to Strategic Resource Management Pty Ltd on 1 November 2010, for a term of six years. It was subsequently transferred to Central Australian Rare Earths Pty Ltd, a wholly owned subsidiary of Rarus Limited. Rarus is an unlisted public company focused on exploration for rare earth mineralisation.

A mandatory 50% area reduction was made from 65 to 33 sub-blocks at the time of the second anniversary (Figure 2).

![Figure 2. EL27978 new area - 2012](image)

2.0 Geology

2.1 Regional Geology

The Arunta Region covers about 200,000 km² in central Australia and has undergone a prolonged and complex geological history with several major periods of geological activity concentrated in the Palaeo-Mesoproterozoic and Palaeozoic from near 1900Ma. It comprises variably deformed, greenschist to granulite facies, metamorphosed sedimentary and igneous rocks. Several high grade metamorphic events coupled with mountain building orogenies have almost completely altered the rocks. The project lies within the Aileron Province of the Arunta Region.

Within the Undippa Project area granitoid gneiss is less dominant than in CARE’s EL27927 area and the dominantly sedimentary rocks within EL27978 have been metamorphosed to higher grade amphibolite and granulite facies.
2.2 Local Geology

To the north of the main east-west Plenty River Highway there is poor outcrop with recent alluvial cover or Tertiary aged Waite Formation cover consisting of chalcedonic limestone, sandstone, mudstone and minor sandy conglomerate. To the south, Quaternary aged alluvium, including in Ongewa Creek which dominates the southern half of the licence, overlie Early Proterozoic Irindina Gneiss of the Harts Range Group comprised of mainly garnet-quartz-plagioclase gneiss; quartzofeldspathic gneiss; amphibolite; gneiss; marble, rare biotite gneiss; sillimanite gneiss and pegmatite. (Migmatite, mafic granulite and garnetiferous mafic granulite).

The Mordor Igneous Complex is located to the south of EL27978 and is a highly potassic alkaline suite considered highly prospective for REE mineralisation. Alkali feldspar syenite–quartz alkali feldspar syenite-shonkinite rocks and surrounding country rocks appear to be the most prospective for REE.

At Blueys Folly, located approximately 45km to the southeast, allanite occurs as a primary igneous mineral in a pegmatite swarm, which has plug-like to lenticular subvertical bodies and sheet-like apophyses that intrude the surrounding amphibolite facies metamorphic rocks which can also contain allanite. Other allanite-bearing pegmatites are common in the region and provide an exploration target.

2.3 Rare Earth Mineralisation

EL27978 is located in the Arunta region, where numerous REE deposits and mineralised areas are known, with few prospects having been fully evaluated. Most prospects occur within the Irindina Province and adjacent areas in the south-eastern part of the Arunta Region. These REE prospects appear to be related to REE-enriched pegmatite or granite emplacement, with an associated hydrothermal REE-rich fluid-related event resulting in replacement or vein systems.
The timing of these REE deposits appears to be broadly associated with the Palaeozoic Alice Springs Orogeny. A regional REE fluid-flushing event appears to have occurred in the Arunta during the Alice Springs Orogeny while the source of the REE may be related to regional-scale mantle metasomatism. Carboniferous aged carbonatites and/or kimberlites might be present in the surrounding regions.

The Nolans REE prospect is currently the largest known REE deposit in the Arunta Region with an estimated resource of about 30Mt@2.8wt% rare earth oxides. Nolans is a geologically unique deposit, which has world-class characteristics in size and grade of REE, phosphate, U and Th. Apatite-hosted REE-P-U-(Th-F) mineralisation at Nolans is distributed over an area of approximately 150 hectares within a kilometre radius of the bore. Primary mineralisation occurs predominantly in a series of sub-parallel tabular zones of massive fluorapatite (Ca₅(PO₄)₃(F,OH)) or as a stock-work of fluorapatite ± allanite ± carbonate veins and associated calc-silicate alteration. The massive zones dip steeply (65°-90°) to the NNW, are up to about 75m thick, and extend laterally and at depth over tens to several hundreds of metres (Hussey, 2003). They are hosted primarily within gneissic granite assigned to the Mount Boothby Orthogneiss (MBO), and also by the Lander Rock Beds (LRB) and pegmatites.

Other REE occurrences in the Arunta region include Blue’s Folly, Mount Finniss, Holsteins and Mount Mary, Quartz Hill and the Entia pegmatite group.

The potential for significant replacement or pegmatite-hosted REE deposits is high in the Arunta Region where abundant REE-rich pegmatite swarms occur. There is also some potential for REE
mineralisation associated with currently unrecognised carbonatites and alkaline igneous complexes and for supergene or lateritic enrichment deposits.

REE can also be found in alteration halos, faults and vein systems associated with the emplacement of carbonatites and alkaline rock types as well as other extrusive alkaline volcanic rocks and as supergene enrichment/lateritic deposits developed on carbonatites and or alkaline igneous rocks. The Mud Tank Carbonatite Complex and the Mordor Igneous Complex are occur in the Arunta Region as well as alkaline pegmatites and associated granitic rocks. The Mud Tank Carbonatite Complex is near 10km to the west of the Undippa licence while a possible carbonatite dyke has been recognised near Mount Bleechmore approximately 20km to the northwest. Little is known about this deeply weathered rock. The presence of an individual carbonatite complex in the Arunta Region would favour the existence of additional complexes emplaced at that time on similar structures as carbonatite complexes tend to cluster in both space and time along suitable structures. Apart from being buried beneath transported or residual cover, it may simply be a problem of recognising them amongst the complexly deformed and metamorphosed rocks of the Arunta Region. The MTCC is deformed and has been stretched into an elongate shape with weakly to strongly developed foliation/layering.

3.0 Previous Rare Earth Exploration

Most exploration within the Undippa Project area was for gold, base metals, diamonds, gemstones, uranium and industrial garnet. A few open file reports mention testing for carbonatite including work by Kewanee Australia in the early 1970s and by CRAE in JV with Hillrise Properties in the late 1970s. The Clarence River Finance Group in the early 1990s considered rare earths while pegmatites were considered for various styles of mineralisation including W by Kewanee Australia in the early 1970s.

Although the Northern Territory geochemical and drilling database may not be complete due to various reporting inconsistencies, only a few rock chips, stream samples and no soil samples are reported for the Undippa area. The stream samples were not assayed for REE or associated elements and no anomalies for those elements are therefore apparent. Rock chips collected by PNC (Australia) in the early 1990s, as part of a uranium search, were assayed for a suite of elements. The sampling returned anomalous values for Ce, La, Ba and Th in a sample (5308480) located in the eastern part of the licence area and slightly elevated Ba, Ce and Th in an iron rich sample (5302784) on the eastern edge of the central part of the licence.

Uranium exploration involved field inspections of many radiometric anomalies. REE deposits would be expected to form weak to moderate radiometric anomalies that may have been dismissed at an early stage in a uranium focused program.

4.0 REE Potential

The Undippa Project area is within a region known to contain REE enriched rocks and there is potential to locate more sources in the area with high enough grade and size to form economic concentrations. Datasets appear to provide some evidence for the prospectivity of the Undippa Project area.

The licence is adjoined on its eastern side by fossicking reserves for garnet and mica. Pegmatite, possibly REE enriched, could be a source of these minerals in the Undippa Project area. The combined radiometrics and magnetic image shown suggests that a major near east-west trend that passes through the Mud Tank Carbonatite Complex continues through EL27978, where it kinks to a more southeast strike. As structure is known to be important in the emplacement of the types of rocks that will host REE enrichment, it is encouraging that structural trends through known enriched rocks continue into the Undippa Project.
5.0 Competitor activity

The major REE resource in the region is at Nolans Bore (Arafura Resources Ltd). Arafura report the mineralisation as outcropping, but in general it is largely covered by thin alluvial sand and gravel.

The report for CARE by Core Geophysics suggests that the following aspects of Nolans Bore are potentially relevant for Rarus’ exploration programme (but in no particular order):

- The deposit outcrops, but is largely covered. This has implications when trying to ascertain a characteristic radiometric signature for the deposit, if one exists.
- Mineralisation is noted to occur in a series of NE trending veins which may be an indication of a larger scale structural fabric. Radiometric data support the interpretation of a larger NNE structure through the deposit.
- High grade REO zones do not necessarily have elevated gamma ray emissions from increased concentrations of potassium, thorium or uranium. However it is possible for strong host rock alteration to have anomalously high radiogenic particle concentrations.
- Massive fluorapatite veins may exhibit increased thorium concentrations
- The airborne radiometric signature over Nolans is probably related to the outcropping gneissic granite host, although it displays a dominant thorium response.

Other competitor activity in the region includes:

Kidman Resources
Hale River Project, which lists REO in 1-3 metre thick carbonate veins. The carbonate veins are unlikely to be characterised by any significant radiometric emissions, or magnetic signatures

Crossland Uranium Mines
- Discovered REE anomalies at their Charley Creek Project
- Unusual setting that targets heavy minerals in alluvial deposits
- Reportedly discovered through stream sediment sampling, auger + aircore drilling and bulk sampling
- Should be considered a risky exploration model for REE

Northern Minerals - Projects are not within the region of interest but the geology of their REE mineralisation is interesting and worth noting
- Browns Range – WA Hydrothermal xenotime mineralisation identified by PNC whilst exploring for uranium
- Good source of heavy REE
- Possible radiometric signature
- John Galt Project - WA - Xenotime mineralisation discovered through follow up of airborne gamma ray survey anomalies
- Similar mineralisation to the company’s Brown Range Project

Nupower Resources - Close proximity to Mud Tank
- Hold the Strangways Rare Earth Project which reportedly contains REE mineralisation associated with carbonatites and pegmatites
- Company identifies major structures as possible influences on mineralisation
- Pegmatite dykes within the companies tenements appear have an elevated radiometric response, although this has not been verified

Newera Resources - White Lady Project north east of Alice Springs is listed for having REE potential within large scale pegmatite dykes
6.0 Work during the period 1/11/2010 and 13/01/2014

During the first year of tenure work consisted of a reconnaissance field trip to the tenement and a comprehensive review of all previous exploration and technical data.

In the second year, open file magnetic and radiometric data were interpreted for major structures and possible radiogenic anomalies. With a majority of this tenement under alluvial cover, target selection that relies primarily on radiometrics will have limited effectiveness.

The following observations were made:
- The area is structurally very complex with the faults/shears interpreted representing only a fraction of the true complexity
- A small gravity low may represent some covered intrusive
- A single uranium anomaly is noted for its relative tenor and isolation.

In year three no exploration was undertaken.

7.0 Conclusions and recommendations

Due to a fall in the global commodity price of REEs, the company downgraded the potential of the tenement and it was surrendered on 13 January 2014.
APPENDIX

Memorandum - Lander Yard Range and Harts Range Project Review
Andrew Bisset – Core Geophysics
MEMORANDUM

To : Rarus Limited
From : Andrew Bisset
Subject: Lander Yard Range and Harts Range Project Review
CC : 
Date : 30th May 2012

Summary

- A review of the Lander Yard Range and Harts Range Projects was undertaken for Rarus Limited
- Competitor REE activity and projects are summarised
- Open file geophysical data was sourced and used to assess the projects for their Rare Earth potential
- A number of possible target zones are presented for further follow up

Background

Rarus Limited requested a review of the Rare Earth potential within tenements of their Lander Yard Range and Harts Range Projects in the Northern Territory (Figure 1). The tenements are considered prospective for rare earth mineralisation, with a major resource located nearby at Nolans Bore.

Review of competitor activity was also undertaken with a view to detailing styles of mineralisation and geological settings for REE.

Open file government and company geophysical data was sourced from the NTGS including:

<table>
<thead>
<tr>
<th>AREA</th>
<th>SURVEY</th>
<th>LINE SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lander Yard Range</td>
<td>Napperby – Hermannsberg</td>
<td>200m, 350m and 400m</td>
</tr>
<tr>
<td></td>
<td>Mt Peak</td>
<td>500m</td>
</tr>
<tr>
<td>Harts Range</td>
<td>Alcoota – Alice Springs</td>
<td>400m</td>
</tr>
</tbody>
</table>

No detailed company survey data was found over the respective tenements.
Figure 1: Location of Rarus projects Lander Yard Range (EL27927) and Harts Range (EL27978)
**Competitor Activity**

The major REE resource in the region is at Nolans Bore (Arafura Resources Ltd). Arafura report the mineralisation as outcropping, but in general is largely covered by thin alluvial sand and gravel.

Magnetic and radiometric data covering the region around Nolans Bore is presented in Figure 2

The following aspects of Nolans Bore are potentially relevant for Rarus’ exploration programme (but in no particular order);

1. The deposit outcrops, but is largely covered. This has implications when trying to ascertain a characteristic radiometric signature for the deposit, if one exists.
2. Mineralisation is noted to occur in a series of NE trending veins which may be an indication of a larger scale structural fabric. Radiometric data support the interpretation of a larger NNE structure through the deposit.
3. High grade REO zones do not necessarily have elevated gamma ray emissions from increased concentrations of potassium, thorium or uranium. However it is possible for strong host rock alteration to have anomalously high radiogenic particle concentrations.
4. Massive fluorapatite veins may exhibit increased thorium concentrations
5. The airborne radiometric signature over Nolans is probably related to the outcropping gneissic granite host, although it displays a dominant thorium response.

Other competitor activity in the region includes;

- **Kidman Resources**
  - Hale River Project which lists REO in 1-3 metre thick carbonate veins.
  - The carbonate veins are unlikely to be characterised by any significant radiometric emissions, or magnetic signatures
- **Crossland Uranium Mines**
  - Discovered REE anomalies at their Charley Creek Project
  - Unusual setting that targets heavy minerals in alluvial deposits
  - Reportedly discovered through stream sediment sampling, auger + aircore drilling and bulk sampling
  - Should be considered a risky exploration model for REE
- **Northern Minerals**
  - Projects are not within the region of interest but the geology of their REE mineralisation is interesting and worth noting
  - Browns Range – WA
    - Hydrothermal xenotime mineralisation identified by PNC whilst exploring for uranium
    - Good source of heavy REE
    - Possible radiometric signature
  - John Galt Project - WA
    - Xenotime mineralisation discovered through follow up of airborne gamma ray survey anomalies
    - Similar mineralisation to the companies Brown Range Project
- **Nupower Resources**
  - Close proximity to Mud Tank
  - Hold the Strangways Rare Earth Project which reportedly contains REE mineralisation associated with carbonatites and pegmatites
  - Company identifies major structures as possible influences on mineralisation
Pegmatite dykes within the companies tenements appear to have an elevated radiometric response, although this has not been verified.

**Newera Resources**
- White Lady Project north east of Alice Springs is listed for having REE potential within large scale pegmatite dykes.

Figure 2: Magnetic (top) and radiometric (bottom) data over the Nolans Bore Project. A larger scale NNE structure is interpreted to cross the deposit (arrows) however this is not so apparent in the magnetic data. Nolans Bore is characterised by a strong, thorium dominated response.
**Interpretation**

It is felt the primary geophysical aid for REE exploration is going to be radiometrics. There is a repeating mineralisation style occurring within pegmatites however these features are not likely to have a distinctive airborne radiometric response. It is also felt that strictly targeting pegmatite mineralisation will only ever yield a low opportunity result (small scale, low tonnage).

Xenotime mineralisation potentially has the largest value in terms of market impact (high heavy REE concentrations) but little is known of the expected geophysical response of such (if any). It is probable the mineralisation will bear a strong uranium/thorium association which may be detectable from the air or ground.

Structural complexity, chemical contrasts and chemical interaction almost certainly plays an important role, however unravelling these concepts is beyond the scope of this document.

To assist the interpretation of radiometric data, several ratios have been calculated using the standard three channel information of airborne data. Ratios are used to highlight a bias in one element over another and can serve to indicate a change in geological composition which may not otherwise be detectable.

For instance, typical uranium exploration practice is to normalise the square of uranium by thorium, thereby reducing the amplitude of anomalies that have high thorium content, whilst increasing (relatively) the amplitude of uranium anomalies with low thorium content. This is achieved through simple data manipulation as follows;

\[
\frac{U^2}{Th}
\]

Likewise, other ratios are calculated with the intention of highlighting variations in selected elements. The exact nature and interpretation of the ratios is always open to interpretation; however it serves to show enrichment or depletion in elements that would otherwise not be seen.

Ratios that are of potential importance are;

\[
\frac{K^2}{Th} : \text{Highlighting potassic enrichment relative to thorium}
\]

\[
\frac{K^2}{U} : \text{Highlighting potassic enrichment relative to uranium}
\]

and \[
\frac{Th^2}{K} : \text{Highlighting thorium enrichment relative potassium, or potassic depletion.}
\]

Given the high noise levels in the uranium channel, most ratios involving uranium tend to be noisy.

Any unusual or enigmatic ratio signatures should be field checked to determine their geological significance, especially those that seem to change along strike of any single lithology.

Ratios have been calculated on line data for both areas with the more detailed data over EL27927 being used in preference to the wider spaced regional data.

Plots of ratios are included in separate A0 scale images.
Lander Yard Range (EL27927)

Open file magnetic and radiometric data was interpreted for major structures and possible radiogenic anomalies. With a majority of this tenement under alluvial cover, target selection primarily relying on radiometrics will have limited effectiveness.

Figure 3 shows geophysical data over the tenement and surrounding areas.

The following observations are made;
- The area is structurally very complex with the faults/shears interpreted representing only a fraction of the true complexity
- A small gravity low may represent some covered intrusive
- A single uranium anomaly is noted for its relative tenor and isolation.
- Most of the selected radiometric anomalies are only going to be weakly discernible on the ground, and field follow up should be supplemented with rock chip/auger sampling.

Figure 4 shows the interpretation of radiometric and magnetic features that are considered to have some REE mineralisation potential.

Harts Range (EL27978)

Open file magnetic and radiometric data was interpreted for major structures and possible radiogenic anomalies. As with Lander Yard Range, much of the ground is under cover limiting the effectiveness of radiometrics.

Figure 5 shows geophysical data over the tenement and surrounding areas.

The following observations are made;
- Gravity data shows a distinct intrusive feature to the east of the tenement. Targeting structures associated with this intrusive may be more favourable for REE mineralisation.
- A possible concealed dyke is interpreted in the north west of the tenement; however the wide line spacing of available data has made this interpretation a little subjective. There may be substantial cover over this feature.
- NE-SW trending structures in the south east are viewed as favourable for possibly intersecting the region around the intrusive and re-mobilising fluids to cross-cutting structures.
- Most of the selected radiometric anomalies are only going to be weakly discernible on the ground, and field follow up should be supplemented with rock chip/auger sampling.

Figure 6 shows the interpretation of radiometric and magnetic features that are considered to have some REE mineralisation potential.
Figure 3: Geophysical data over Lander Yard Range (EL 27927) clockwise from top left – TMI RTP, Bouguer gravity anomaly, digital terrain model, ternary radiometrics image of K, Th, U as red, green, blue.
Figure 4: Lander Range Yard geology and interpretation

Uranium anomaly – no outcrop
Figure 5: Geophysical data over Harts Range (EL 27978) clockwise from top left – TMI RTP, Bouguer gravity anomaly, digital terrain model, ternary radiometrics image of K, Th, U as red, green, blue. The effect of the intrusive is clearly visible in the gravity image.
Figure 6: Harts Range geology and interpretation
Conclusions and Recommendations

Target selection has been largely based on radiometric responses using the assumption that anomalous REE occurrences tend to display some form of enigmatic gamma radiation signature.

It is not expected that an outcropping pegmatitic dyke would necessarily have a discernible radiometric response. It is expected that xenotime related mineralisation would have some form of elevated radiogenic signature, but exactly what that is cannot be stated.

Interpretation of the various radiometric ratios has highlighted certain parts of outcropping lithologies that are of potential interest. The classification is qualitative in nature and serves to identify parts of outcrop that for one reason or another, display an unusual character.

Ground checking of all anomalies with a portable differential spectrometer is recommended. In cases where no discernible response is observed, consideration should be given to a grid based ground radiometric survey (limited area) with possible auger drilling to follow up any confirmed targets. In situations where extensive alteration of host rocks has occurred, it is reasonable not to expect any remaining resistive outcrop but there may be residual radiogenic particles in the weathered profile.

Some of the U²⁺/Th anomalies on EL27927 are considered particularly interesting because there is no associated outcrop. They may be very weak on the ground and difficult to follow up. If ground checking reveals minor calcrete in creek banks around the uranium anomalism then it is highly likely that is the source of the anomaly.

In all cases, rock chip sampling within the targeted areas is recommended as a first pass follow up.

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