BARKLY PROJECT

NORTHERN TERRITORY

TENEMENTS EL27197, EL27198, EL27199, EL27200

COMBINED THIRD ANNUAL AND FINAL REPORT

FOR THE PERIOD 17 SEPTEMBER 2009 TO 02 NOVEMBER 2012

GROUP REPORTING NO. 135/09

Submitted by: Vale Exploration Pty Ltd
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Date: 23 November 2012

Distribution: NT Department of Resources – Geological Survey
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<thead>
<tr>
<th><strong>Title Holder</strong></th>
<th>Vale Australia EA Pty Ltd</th>
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</thead>
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<tr>
<td><strong>Operator</strong></td>
<td>Vale Exploration Pty Ltd</td>
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<tr>
<td><strong>Titles</strong></td>
<td>Exploration Licences 27197, 27198, 27199, 27200</td>
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<td><strong>Project Name</strong></td>
<td>Barkly</td>
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<td><strong>Report Title</strong></td>
<td>Combined Third Annual and Final Report for period 17 September 2009 to 2 November 2012, Barkly Project ELs 27197, 27198, 27199, 27200</td>
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<td><strong>Group Reporting No.</strong></td>
<td>GR 135/09</td>
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<td><strong>Corporate Author</strong></td>
<td>Vale Exploration Pty Ltd</td>
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<tr>
<td><strong>Commodity</strong></td>
<td>Phosphate</td>
</tr>
<tr>
<td><strong>Date of Report</strong></td>
<td>23 November 2012</td>
</tr>
<tr>
<td><strong>250 000 K map sheet</strong></td>
<td>Tennant Creek and Alroy</td>
</tr>
<tr>
<td><strong>100 000 K map sheet</strong></td>
<td>Balmore, Barkly, Dalmore, Favenc, Frewena, Playford</td>
</tr>
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<td><strong>Contact details</strong></td>
<td>Vale Exploration Pty Ltd</td>
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<td><a href="mailto:lynne.odonnell@valeaustralia.com.au">lynne.odonnell@valeaustralia.com.au</a></td>
</tr>
</tbody>
</table>
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Executive Summary

This is the combined third annual and final report for ELs 27197, 27198, 27199, 27200, Barkly Project for the period 17 September 2009 to 31 October 2012. Year 2 50% relinquishments were lodged for all four tenements in 2011. The Barkly Project, located approximately 66km east of Tennant Creek, is a sub-project of Vale’s Georgina Phosphate Exploration Project and covers Cambrian rocks of the Georgina Basin. The rocks of the Georgina Basin range in age from Late Proterozoic to Early Palaeozoic. Outcrop within Barkly is limited with much of the basement geology concealed beneath Tertiary and Quaternary sediments. Drilling was completed on ELs 27198 and 27199 in 2011 and on ELs 27197 and 27200 in 2010. Surface sampling and mapping was completed in 2010. Phosphate exploration work on Barkly in 2012 consisted of focused drill targeting, 46.3km of line clearing, reconnaissance reverse circulation drilling, an environmental audit report and drill site and track rehabilitation of all disturbed sites. A Geophysical Basin Modelling Study done in 2011 was used in conjunction with 2011 drill results to gain a better understanding of the Georgina Basin and assist with phosphate drill targeting. In 2012, 21 RC drill holes were completed on EL27198, targeting phosphate highs from 2011, totalling 1544 m and gathering 769 2m composite with QA/QC samples. 2012 drilling outlined a 1% P₂O₅ body approximately 6 km by 9 km with high grade 9% of approximately 1 km by 6 km. The size of the resource was adequate however resource grade was much lower than a required average of 17% P₂O₅. For that reason the decision was made to surrender the Barkly project tenements.
1 Introduction

1.1 Location and Access

The Barkly Project is located approximately 66 km east of Tennant Creek (Figure 1; Barkly Tenement Location Plan) and is comprised of four contiguous tenements on the Tennant Creek (SE53-14) and Alroy (SE53-15) 1:250,000 and the Dalmore (6058), Barkly (5859), Dalmore (6058), Favenc (5958), Frewena (5959) and Playford (6059) 1:100,000 map sheets. The project straddles parts of Tennant Creek (PPL1142), Dalmore Downs (PPL988, NT Por 773) and Alroy Downs (PPL985, NT Por 651) cattle stations.

The Barkly Roadhouse is located near the eastern margin of the project area and was used as a field base during reclamation only. The nearest homestead, Dalmore Downs, is approximately 8km east of the project area.

Access to the Barkly Project is 23 km north of Tennant Creek thence 134 km eastwards from Three Ways Roadhouse along the Barkly Highway. The sealed Barkly Highway transects the two easternmost tenements (EL27197 and EL27200). Vehicular access throughout the western tenements is hampered by sandy, low scrub terrain and a paucity of tracks. A 62km track was pushed into EL27198 in 2011 to gain access for drilling. That track was left open at the end of 2011 and reused for this exploration period as a field camp was set up for a base of operation.

1.2 Tenement Details

The Barkly Project consists of four contiguous tenements held by Vale Australia EA Pty Ltd and operated by Vale Exploration Pty under Authorization 0554-01. There are two exclusion zones within the project.

EL27199: Excludes NT Por 1416; small parcel of private land far NE corner
EL27200: Excludes NT Por 5738; Barkly Homestead Roadhouse

Table 1: Barkly Project Tenement Details

<table>
<thead>
<tr>
<th>Tenement Number</th>
<th>Holder</th>
<th>Area (Blocks)</th>
<th>Date of Grant</th>
<th>Surrendered</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL27197</td>
<td>Vale Australia EA Pty Ltd</td>
<td>181</td>
<td>26/10/2009</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27198</td>
<td>Vale Australia EA Pty Ltd</td>
<td>234</td>
<td>17/09/2009</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27199</td>
<td>Vale Australia EA Pty Ltd</td>
<td>192</td>
<td>17/09/2009</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27200</td>
<td>Vale Australia EA Pty Ltd</td>
<td>99</td>
<td>26/10/2009</td>
<td>31/10/2012</td>
</tr>
</tbody>
</table>
Figure 1: Barkly Tenement Location Plan
1.3 Native Title

For Land Council jurisdiction, the Barkly tenements can be classified as follows:
- Barkly East (EL27197, EL27200) in NLC jurisdiction with a Native Title claim.
- Barkly West (EL27198, EL27199) in CLC jurisdiction with no Native Title claims.

The three Native Title claims over the Eastern Barkly Project are:
- Dalmore Downs DC01/30 is registered (overlaps southern portion of EL27197 and western portion of EL27200);
- Dalmore Downs South DC02/2 is registered (overlaps eastern half of EL27200);
- Rockhampton Brunette Downs DC03/1 is not registered (overlaps northern portion of EL27197).

1.4 Historical, Aboriginal and Heritage Sites

An inspection of the Aboriginal Areas Protection Authority (AAPA) Register was conducted for Barkly Project tenements on 9 September 2009. No sites of historical significance are listed on the Australian Heritage database.

An information meeting for Traditional Owners of EL 27197 and EL 27200 was organized by the Northern Land Council (NLC) and held in Tennant Creek on 1 December 2009. Prior to the 2012 exploration season correspondence between Vale and the NLC was conducted in order to clear the work that was planned and to solidify our relationship with NLC representatives.

Aboriginal Areas Protection Authority (AAPA) Certificate C2010/0143 for EL27198 and EL27199 and AAPA Certificate C2010/0144 for EL27197 and EL27200 issued 17 June 2010 and 22 June 2010 respectively.

<table>
<thead>
<tr>
<th>Licence</th>
<th>Exclusions from Grant</th>
<th>Land Council</th>
<th>AAPA Register Inspection</th>
<th>AAPA Authority Certificate</th>
<th>Meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL27197</td>
<td></td>
<td>NLC</td>
<td>9-Sep-09</td>
<td>C2010/144</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22-Jun-10</td>
<td></td>
</tr>
<tr>
<td>EL27198</td>
<td>excl. NT Por 1416; small parcel of private land far NE corner</td>
<td>CLC</td>
<td>9-Sep-09</td>
<td>C2010/143</td>
<td>25 June 2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17-Jun-10</td>
<td></td>
</tr>
<tr>
<td>EL27199</td>
<td>excl. NT Por 5738; Barkly Homestead Roadhouse</td>
<td>CLC</td>
<td>9-Sep-09</td>
<td>C2010/143</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17-Jun-10</td>
<td></td>
</tr>
<tr>
<td>EL27200</td>
<td></td>
<td>NLC</td>
<td>9-Sep-09</td>
<td>C2010/144</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22-Jun-10</td>
<td></td>
</tr>
</tbody>
</table>
1.5 Climate and Hydrology

The Barkly region is semi-arid with annual rainfall of 453 mm. The climate is characterized by distinct wet and dry seasons (Table 3: Climate Statistics – Tennant Creek Airport (BOM 2009)) with the majority of rain falling between November and March. The predominant wind direction is from the east.

Table 3: Climate Statistics – Tennant Creek Airport1 (BOM 2009)

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Maximum Temperature ⁰C</td>
<td>36.7</td>
<td>35.7</td>
<td>34.4</td>
<td>31.7</td>
<td>27.6</td>
<td>24.5</td>
<td>24.6</td>
<td>27.4</td>
<td>31.5</td>
<td>34.8</td>
<td>36.5</td>
</tr>
<tr>
<td>Highest Temperature ⁰C</td>
<td>44.0</td>
<td>44.5</td>
<td>40.7</td>
<td>38.4</td>
<td>36.4</td>
<td>33.6</td>
<td>34.7</td>
<td>35.5</td>
<td>38.9</td>
<td>41.6</td>
<td>43.4</td>
</tr>
<tr>
<td>Mean days ≥ 40 ⁰C</td>
<td>5.9</td>
<td>2.7</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.9</td>
<td>3.5</td>
</tr>
<tr>
<td>Mean Minimum Temperature ⁰C</td>
<td>25.0</td>
<td>24.5</td>
<td>23.3</td>
<td>20.4</td>
<td>16.4</td>
<td>12.9</td>
<td>12.2</td>
<td>14.4</td>
<td>18.4</td>
<td>21.8</td>
<td>23.8</td>
</tr>
<tr>
<td>Lowest Temperature ⁰C</td>
<td>17.2</td>
<td>17.2</td>
<td>14.6</td>
<td>11.6</td>
<td>6.7</td>
<td>5.3</td>
<td>4.5</td>
<td>6.0</td>
<td>7.4</td>
<td>11.6</td>
<td>10.7</td>
</tr>
<tr>
<td>Mean Rainfall (mm)</td>
<td>113.5</td>
<td>118.6</td>
<td>54.3</td>
<td>15.4</td>
<td>7.4</td>
<td>5.4</td>
<td>4.3</td>
<td>1.7</td>
<td>8.1</td>
<td>20.2</td>
<td>38.0</td>
</tr>
<tr>
<td>Mean number of days of rain</td>
<td>9.8</td>
<td>9.2</td>
<td>5.9</td>
<td>1.9</td>
<td>1.4</td>
<td>0.9</td>
<td>0.6</td>
<td>0.7</td>
<td>1.8</td>
<td>3.9</td>
<td>5.8</td>
</tr>
</tbody>
</table>

1.6 Land Area Type

The majority of the project is within the Davenport Murchison Ranges (DMR) bioregion, however the northern boundaries of the easternmost tenement extend into the Mitchell Grass Downs (MGD) bioregion. Both of these bioregions are further described below.

MGD: Lies over the Georgina and Dunmurra basins containing sedimentary rocks of Cretaceous, Tertiary and Cambrian ages and soils are predominantly cracking clays. The vegetation is predominantly Eucalyptus microtheca low open-woodland with Bluebush (Chenopodium auricomum) sparse-shrubland understory and Mitchell Grass (Astrebla) grassland on the Barkly Tableland.

DMR: Comprises low but rugged rocky hills formed from folded volcanics, sandstone, siltstone and conglomerates. Soils are generally shallow lithosols, but fine grained alluvial soils occur in the valleys and surrounding plains. Vegetation includes hummock grasslands and low open woodlands dominated by eucalypt and Acacia species. (Baker et al., 2005).

On the eastern side of the project (within EL27197) lies Prentice Lake, a small ephemeral wetland.

The entire Alroy sheet area occurs within the Barkly Basin. The Barkly Basin is not a single entity but consists of a number of bluebush swamps or lakes which are internal drainage conduits. The major lakes lie to the north. To the south, the Frew River flows into local internal drainage claypans.

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1 All rainfall and temperature measurements from 1969 - 2009 (i.e. 40 years data)
Physiographic features are delineated by the divisions of landforms into grass-covered downs and timbered areas.

A prominent timberline separates the mainly carbonate rocks of the downs country to the north from the timbered and scrubby exposures of shale, siltstone and chert of the Wonarah Beds and from areas of Cainozoic travertine, red sandy soil and sand dunes (Randal, 1966).

South of the Barkly Highway and north-west of Frewena, the country consists of gently undulating terrain and vegetation consists mainly of snappy gum, with some Acacia spp and mallee scrub, particularly in the south. The scrublands south of the Barkly Highway form part of a large semi-desert which extends north westwards from near Georgina Downs in the Sandover River Sheet area (Nichols, 1966) to the Brunchilly area. (After Nichols, 1966 as cited in Randal, 1966).

1.6.1 Flora

The dominant vegetation community within the project area is Corymbia low open woodland. Small areas of Acacia tall open shrubland, Astrebla low tussock grassland and Triodia low open hummock grassland also occur within the project (Figure 2: Barkly Project – Vegetation Plan).2

Introduced flora (weed) species that may occur in the Barkly region, possibly within the Barkly project area include:

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Generic Name</th>
<th>Where</th>
<th>Type of Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia nilotica</td>
<td>Prickly acacia</td>
<td>Barkly Highway</td>
<td>Occurrences</td>
</tr>
<tr>
<td>Parkinsonia aculeata</td>
<td>Parkinsonia</td>
<td>Lake Sylvester (further north)</td>
<td>Infestation</td>
</tr>
<tr>
<td>Prosopis sp</td>
<td>Mesquite</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Figure 3 Produced with Digital Vegetation Mapping data purchased from NRETAS October 2009.
Figure 2: Barkly Project – Vegetation Plan
1.6.2 Fauna

A search of NRETAS\(^3\) data found that two fauna species covered by the *EPBC Act 1999* have been recorded in surveys completed within the Barkly Project. These are the Greater Bilby (*Macrotis lagotis*) and the Hooded Robin (*Melanodryas cucullata*) (Table 5: Vulnerable Fauna Species Recorded within the Project Area).

The Australia Bustard (*Ardeotis Australis*) has been recorded within the Barkly Project tenement EL27197 (Table 5: Vulnerable Fauna Species Recorded within the Project Area and Table 6: Threatened Species (Protected Matters Search tool, 2009)). This species is not considered to be vulnerable, endangered or critically endangered under the *EPBC Act*, however it is considered vulnerable by the NT Government and is protected by the *Territory Parks and Wildlife Conservation Act 2009*.

The following vulnerable species have been recorded within the project area (see Figure 3: Barkly Project – Fauna Plan).

**Table 5: Vulnerable Fauna Species Recorded within the Project Area**

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Generic Name</th>
<th>EPBC(^4) Status</th>
<th>TPWC(^5) Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Macrotis lagotis</em></td>
<td>Greater Bilby</td>
<td>Vulnerable</td>
<td>Vulnerable</td>
</tr>
<tr>
<td><em>Ardeotis australis</em></td>
<td>Australia Bustard</td>
<td>No Status</td>
<td>Vulnerable</td>
</tr>
<tr>
<td><em>Melanodryas cucullata</em></td>
<td>Hooded Robin</td>
<td>Ssp melvillensis</td>
<td>Ssp melvillensis Hooded robin (Tiwi Islands) is Endangered</td>
</tr>
</tbody>
</table>

A search of the Australian Government Department of the Environment, Water, Heritage and the Arts website, ‘Protected Matters Search tool’ identified one threatened species and seven migratory bird species (one of which is threatened) within a rectangular search area encompassing the tenements (Table 7: Marine and Migratory Bird Species (Protected Matters Search tool, 2009)). These species may also occur within the tenements, however birds listed as migratory or marine are most likely to be located in the vicinity of Lake Prentice.

**Table 6: Threatened Species (Protected Matters Search tool, 2009)**

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Generic Name</th>
<th>Status</th>
<th>Type of Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td><em>Rostratula australis, Rostratula benghalensis s. lat</em></td>
<td>Australian Painted Snipe</td>
<td>Species or species habitat may occur within the area</td>
</tr>
</tbody>
</table>

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\(^3\) NRETAS - NT Department of Natural Resources, Environment, the Arts and Sport

\(^4\) Environmental Protection and Biodiversity Conservation Act 1999

\(^5\) Territory Parks and Wildlife Conservation Act
Figure 3: Barkly Project – Fauna Plan
### Table 7: Marine and Migratory Bird Species (Protected Matters Search tool, 2009)

<table>
<thead>
<tr>
<th>Terrestrial/Marine/Wetland</th>
<th>Species Name</th>
<th>Generic Name</th>
<th>Status</th>
<th>Type of Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory Terrestrial Species</td>
<td>Merops ornatus</td>
<td>Rainbow bee-eater</td>
<td>Listed overfly Marine area; Migratory: JAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
<tr>
<td>Migratory Wetland &amp; Marine Species</td>
<td>Ardea alba (CAMBA &amp; JAMBA as Egretta alba)</td>
<td>Great Egret, White Egret</td>
<td>Listed overfly Marine area; Migratory: CAMBA, JAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
<tr>
<td>Migratory Wetland &amp; Marine Species</td>
<td>Ardea ibis (CAMBA as Ardeola ibis, JAMBA as Bubulcus ibis)</td>
<td>Cattle Egret</td>
<td>Listed overfly Marine area, Migratory: CAMBA, JAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
<tr>
<td>Migratory Wetland Species</td>
<td>Charadrius veredus</td>
<td>Oriental Plover, Oriental Dotterel</td>
<td>Listed overfly Marine area, Migratory: Bonn A2H6, JAMBA, ROKAMBA.8</td>
<td>Foraging, feeding or related behaviour may occur within the area</td>
</tr>
<tr>
<td>Migratory Wetland Species</td>
<td>Glareola Maldivarum</td>
<td>Oriental Platincole</td>
<td>Listed overfly Marine area, Migratory: CAMBA, JAMBA, ROKAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
<tr>
<td>Migratory Wetland Species</td>
<td>Rostratula australis / Rostratula benghalensis s. lat.</td>
<td>Painted Snipe</td>
<td>Listed overfly Marine area, Migratory: CAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
<tr>
<td>Migratory Marine Birds</td>
<td>Apus pacificus</td>
<td>Fork-tailed Swift</td>
<td>Listed overfly Marine area, Migratory: CAMBA, JAMBA, ROKAMBA.</td>
<td>Species or species habitat may occur within the area</td>
</tr>
</tbody>
</table>

Feral animals that may occur within the project area include:
- Cat (*Felis catus*)
- Donkey (*Equus asinus*)
- Fox (*Vulpes vulpes*)
- Horse (*Equus caballus*)
- Pigs (*Sus scrofa*) – near permanent water sources.

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6 BONN - Bonn Convention
7 ROKAMBA - Republic of Korea – Australia Migratory Bird Agreement
2 Regional Geology

The Barkly Project covers Cambrian rocks of the Georgina Basin (Figure 4: Schematic west to east stratigraphic transect & Figure 5: Barkly Project – Regional Geology Plan). The rocks of the Georgina Basin range in age from Late Proterozoic to Early Palaeozoic. To the north, they overlie Mid Proterozoic rocks of the South Nicholson and McArthur Basins and to the east they unconformably overlie Mid Proterozoic rocks of the Cloncurry-Mt Isa Block. Georgina Basin rocks overly Arunta Block rocks on the southern margin of the Georgina Basin and to the west, Georgina Basin rocks unconformably overly basement composed of rocks of the ‘Early Proterozoic Hatches Creek and Warramunga Groups and their equivalents (Cook, 1986).

The Georgina Basin rocks show complex facies relationships and no single stratigraphic column can be provided for the Georgina Basin (Smith, 1972; Cook 1986). Figure 4: Schematic west to east stratigraphic transect shows the schematic stratigraphic relationship of formations across the Wiso Basin and Georgina Basin. Stratigraphic locations of phosphate occurrences are also identified (Khan et al., 2007). The Undilla Sub-Basin sequence has been sourced from Kruse and Radke (2008) and the southern Georgina Basin after Dunster et al (2007). Regional NTGS outcrop geology is shown in Figure 5: Barkly Project – Regional Geology Plan.

Figure 4: Schematic west to east stratigraphic transect is a useful guide but it should be noted that Rio Tinto geologists who worked at Wonarah considered the Wonarah Deposit occurred within the Gum Ridge Formation (Lilley, 2002). However, the Wonarah is identified here as occurring in the Wonarah Formation, as others consider that the phosphorite interval on the Alexandria-Wonarah basement high is more likely to be the basal Wonarah Formation (Kruse et al., 2010)

![Figure 4: Schematic west to east stratigraphic transect across Wiso and Georgina Basins (Khan et al., 2007)](image-url)
Figure 5: Barkly Project – Regional Geology Plan
Major phosphate deposition occurred in the Middle Cambrian (Templetonian), a period which corresponds to a major rise in sea level. It was the time of maximum phosphate deposition with up to 100m of siltstones, fine-grained sandstones, cherts and phosphorites being deposited around the eastern margins of the basin and adjacent to the Alexandria-Wonarah High (Cook, 1986).

Drill hole data indicates a consistent thickness of 141-151m for the Gum Ridge Formation across the Barkly Sub-basin, thinning to approximately 51m near the Wonarah basement high (Kruse et al. 2010). The formation consists of two successive marine limestone units, each underlain by a thin (8-10m) peritidal siliciclastic unit. Basal rocks consist of brecciated, brown-red dolomitic siliciclastic siltstone.

3 Local Geology

Outcrop within the Barkly Project is limited with much of the basement geology concealed beneath Tertiary and Quaternary sediments. The area is covered by extensive superficial deposits with loose blocks of carbonate rocks and pebbles of chert and pisolithic ironstone gravel.

Although no Proterozoic rocks outcrop in the area, by extrapolation, it is thought that the Cambrian succession may be underlain by the Warramunga Group (Noakes & Traves, 1954; Ivanac, 1954) in the west and by the Hatches Creek Group in the south and south-west (Smith, Stewart, & Smith, 1961). The depth to magnetic basement is approximately 800 feet (240m) near the Wonarah Telegraph Station (Jewell, 1960). Magnetic basement estimates in the western part of the project area is between 650-3700 feet (200 – 1100m) below surface.

The 2010 edition of the 1:250,000 Alroy map (Sheet SE53-15) shows a small amount of Gum Ridge Formation outcrops near the northern boundary of EL27198 (Figure 5: Barkly Project – Regional Geology Plan). The NTGS have collected a fossil sample NTGS46768 (fossil sample reference) from this outcrop and Vale collected samples from this outcrop in 2010.

Anthony Lagoon Beds outcrop near the North West corner of EL27199 and straddle the boundary with EL27198 (Figure 5: Barkly Project – Regional Geology Plan). Small outcrops have also been mapped near the eastern margin of EL27199 and within the western portion of EL27197.

A number of small outcrops of Cainozoic ferricrete, calcrete, and alluvium have been mapped within EL27199.

EL27197 and EL27200 are both dominated by Cainozoic calcrete and unconsolidated colluvial and Aeolian sand and red earths.

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8 Details of NTGS4676 have not been obtained at present.
4 Previous Exploration

A review of open-file historic exploration reports (Source: NTDoR) was completed in the previous report period and is included here for reference. The historic report compilation revealed the Barkly Project tenements have been unexplored for phosphate.

Approximately six previous explorers have held exploration tenements overlying or partially overlapping the Barkly Project. Much of the area has never been held under granted tenement. The majority of exploration within the Barkly project area has been for diamonds (Ashton) with some copper-gold (CRA, Giants Reef, Kratos, Asian Minerals).

Continental Oil Company of Australia Ltd held title over parts of the Barkly Project for phosphate. Some drilling was completed but this work was not within the area now under Vale tenure.

Exploration activity on each of the historic tenements is summarised below:

**AP2081**
Continental Oil Company of Australia Ltd
1968
The tenement was taken out to test for western extensions of known phosphatic units at Alroy.
Four holes totalling 458ft were drilled and none were collared within Vale’s tenements.

**AP2588**
Kratos Uranium N.L.
1970 to 1971
Kratos Uranium conducted a ‘campaign of aeromagnetic prospecting’ to locate Tennant Creek style mineralisation. Follow-up ground magnetic surveys downgraded targets.

**EL1184**
CRA Exploration Pty Limited, Australian Ore and Minerals Ltd
1978 to 1980
CRA explored for Tennant Creek style copper-gold mineralisation. An airborne magnetometer and spectrometer survey was flown. No significant radiometric anomalies were detected. Only one magnetic feature was identified but was not considered worthwhile drill testing.

**EL1951**
CRA Exploration Pty Limited, Australian Ore and Minerals Ltd
1979 to 1980
EL 1951 lay between Vale’s EL27197 and EL27200, but it did cover the gravity high and CRA targeted concealed Tennant Creek Style Copper-gold mineralisation. An airborne magnetometer and spectrometer survey was flown. No significant radiometric anomalies were detected. Two magnetic features were identified from the survey. One of the anomalies was followed-up with ground magnetics and subsequently drill tested (79ALD1 and 79ALD2). A 50m spaced gravity survey was also completed. Drilling intersected approximately 158m of calcareous sediments before intersecting basalt. The top of the basalt showed palaeo-weathering with moderate haematisation. No assay results were presented in reports.
EL2043
CR1980-0157, CR 1981-0125
CRA Exploration Pty Limited
1980 to 1981
The target was Tennant Creek style copper-gold mineralisation. The EL was design to cover the eastern extensions of a magnetic anomaly on EL 1951.
An airborne magnetometer and spectrometer survey was flown. Ground magnetics and drilling were undertaken on the anomaly that was originally defined in EL 1951. Source of the anomaly was magnetite bearing metasediments.
The single drill hole which is collared outside Vale tenure recorded:
0 to 6m Aeolian sand
6 to 24m Clayey Siltstone
24 to 54m Calcilutite
54 to 116.5m No sample return (end of RC precollar)
116.5 to 149.9m Cambrian limestone with minor sandy bands (start of coring)
149.9 to 180.3m Antrim Plateau basalt
180.3 to 346.2m Proterozoic sediments and metamorphics
Diamond core was assayed for Pb, Zn, Cu, Mn, Ag, Au and Co.

EL4251
CR 1985-0038, CR 1986-0068
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
December 1983 to 1986
The target was kimberlite pipes.
9 gravel and 50 loam samples were collected and processed at Ashtons Perth Laboratory. Gravel samples were taken from trap sites in streams, where approximately 30 to 35kg of minus 4mm material was collected. Samples were processed at Ashtons Perth laboratory where they were concentrated by Wilfley table and heavy liquid separation. The heavy liquid used was tetrabromoethane which has an SG of 2.96.
Any apatite (SG 3.19) in the sample should at this stage go to the concentrate. Sizing and magnetic and electrostatic separation of the concentrates followed, which probably excluded any apatite. Concentrates were only observed for diamonds

EL4254
CR 1985-0039, CR 1986-0039
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
December 1983 to December 1985
The target was kimberlite pipes.
Loam samples (>12 samples) were collected and processed in the manner of other loams collected by Ashton within the Georgina Basin. No evidence of kimberlites was found.

EL4332
CR 1986-0084
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
February 1985 to November 1985
The target was kimberlite pipes.
65 loam samples were collected and processed as per other Ashton samples collected in the Georgina Basin. No evidence of kimberlites was found.
EL4333
CR 1986-0086
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
February 1985 to November 1985
The target was kimberlite pipes.
19 gravel and 35 loam samples were collected and processed as per other Ashton samples collected in the Georgina Basin.
No evidence of kimberlites was found.

EL4340
CR 1985-0021, CR 1986-0090
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
December 1983 to December 1985
The target was kimberlite pipes.
5 gravel and 47 loam samples were collected and processed as per other Ashton samples collected in the Georgina Basin.
No evidence of kimberlites was found.

EL4341
CR 1985-0022, CR 1986-0091
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.
December 1983 to December 1985
The target was kimberlite pipes.
Initial 11 gravel and 35 loam samples plus a follow up 52 samples were collected and processed as per other Ashton samples collected in the Georgina Basin.
No evidence of kimberlites was found.

EL22231
CR 2002-0336
Giants Reef
Giants Reef explored for Tennant Creek style ironstone-related gold-copper deposits. Work included a literature search, geological assessment and geophysical assessment. No physical work was conducted on the tenement.

EL23776, EL23779
CR 2005-0170
Asian Minerals Pty Ltd
December 2003 to November 2004
The target was Tennant Creek style copper-gold mineralisation beneath shallow cover. Targeting was based on recently released NTGS geophysics. Asian Minerals were unable to attract a joint venture partner and the tenements were relinquished.
5 \textbf{Exploration completed in previous reporting periods}

Vale’s previous exploration activity on the Barkly tenements is summarized below. Refer Figure 7 for location of 2010 and 2011 sampling and drilling locations.

\textbf{2010 Exploration Season}

- AAPA Register search and AAPA Certificates; meeting with NLC and Traditional Owners in Tennant Creek.
- Open file literature review; acquisition and reprocessing of geophysical data; and acquisition of NRETAS environmental data.
- CSIRO commissioned to undertake XRF analysis of 75 water bore chip samples from 4 historic water bore holes within Barkly.
- Review of regional water bore analyses to assist in phosphate horizon targeting.
- Helicopter-supported field mapping.
- Rock chip sampling – 165 samples on ELs 27197, 27198, 27199 and 27200.
- In-house depth to basement gravity modelling to assist first pass drill targeting.
- 22.5 line km of access track; 7 drill pads and 7 sumps – total ground disturbance 7.31 ha and rehabilitation pending next reporting period.
- 7 Reverse Circulation (RC) drill holes (VGRC015-021) for 1080 m and 399 composite drill samples – 6 holes for 930 m on EL27197; and 1 hole for 150 m on EL27200.
- Analysis of samples – 434 3m RC composites and 175 rock chip samples (including QA/QC inserts) were assayed by SGS.

\textbf{2011 Exploration Season}

- Flora and Fauna Desktop Study.
- Geophysical Basin Modelling completed by MIRA Geoscience to assist with phosphate targeting by generating detailed images of depth basement, gravity and magnetics.
- Line and pad clearing – 62 line km access tracks (18.6 ha), 9 pads and 9 sumps (0.72 ha).
- RC Drilling – 9 holes (073-081), 993 m, 525 2m RC composite samples.

\begin{table}[h]
\begin{tabular}{|c|c|c|c|}
\hline
EL27198 & 7 holes & 731 m & 387 drill samples \\
\hline
EL27199 & 2 holes & 262 m & 138 drill samples \\
\hline
\end{tabular}
\end{table}

- Rehabilitation of drill pads, sumps and drill collars completed; access tracks pending next reporting period.
- Analysis of samples – 434 3m RC composites and QA/QC samples were assayed by SGS.
- Analytical results were not available in the last reporting period and are provided here at Appendix 1.
Figure 6: Barkly Project - 2010 and 2011 Sampling and Drilling Locations
6 Drill Targeting 2012

There were five main aspects that determined targeting for the 2012 exploration season.

- 100km distance from Adelaide-Darwin railway (report available in Appendix 2)
- MIRA Geoscience basement model (report available in Appendix 3)
- 2010/11 significant assays (assays available in Appendix 4)
- Shelf morphology
- Ore body geometries present in 2012 (table available in Appendix 4)

It was determined prior to the 2012 exploration season that any phosphate resource would need to be within 100 km of the main Northern Territory railway in order for a target size resource (100 million tons @ 17% P₂O₅) to be economic.

This was based on a figure of approximately $2.5 million/km of railway built from the existing railway to a discovered ore body. For that reason the 100 km corridor was used as an overriding factor when selecting tenements for exploration drilling (refer Figure 7: Vale Georgina 100km Railway Buffer). Using the 100 km envelope as an overlay it was quick to ascertain which tenements were desirable and which were not.

Of the remaining tenements two different approaches were used, one for areas that had been explored and another for areas that had not.

For areas that had been explored prior to 2012, targets were selected primarily on previous rock chip and drill assays that contained P₂O₅ highs while using the MIRA basement model as a guide to determine depth to basement in the vicinity of those highs.

For areas that had not been explored by Vale, the MIRA model was used primarily with particular focus on basement highs and apparent embayments that could potentially trap phosphate during the sea level rise of the middle Cambrian.

For both methods stratigraphy and NTGS mapping concentrated on areas where desirable rock formations and phosphate-high depths within that formation would be encountered. From 2010/11 drilling, basement was encountered at depths different from the MIRA model. For that reason, 2012 drill targeting using the MIRA basement model was used as a rough guide and not as true depths.

Drill spacing was chosen on the basis of finding a “Vale” sized deposit. This was specified as a 100 million ton 17% average grade P₂O₅ reserve. The minimum area for a deposit this size to fit in would be a 5 km x 1 km rectangular shape, but more likely to be a 6 km x 2 km elliptical shape. Using that morphology the drilling in Barkly, the only area explored in 2012 where previous drilling had been completed, required a drill spacing between 2-4 km (refer Appendix 4 for simple morphologies).
Figure 7: Vale Georgina 100km Railway Buffer
7 Exploration Current Reporting Period

- Drill targeting based on Vale’s previous exploration in Georgina, geophysical basement modelling, 100km railway corridor and ore body geometries.
- Line and pad clearing – 46.3 line km access tracks (13.89 ha), 21 pads and 21 sumps (1.68 ha).
- RC Drilling on EL27198 – 21 holes, 1544 m, 769 2m RC composite samples (drill samples minus QA/QC controls). Refer Figure 9 for 2012 drill hole location plan.

<table>
<thead>
<tr>
<th>Tenement ID</th>
<th>Hole Type</th>
<th>Hole Number Range</th>
<th>No. of Holes</th>
<th>Total Metres</th>
<th>No. of Samples</th>
<th>No. of samples assayed</th>
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<td>RC</td>
<td>VGRC082-102</td>
<td>21</td>
<td>1544</td>
<td>769</td>
<td>564</td>
</tr>
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</table>

- Refer Appendix 5 for 2012 drill hole data.
- Environmental audit.
- Rehabilitation of drill pads, sumps, drill collars and access tracks completed (15.57 ha).
- 2011 access track rehabilitated (18.6 ha).
- Analysis of samples – a selection of 564 of 769 of the 2m RC composites and QA/QC samples were assayed by ALS.
- Refer to Appendix 6 for 2012 drill assay data.

7.1 RC Drilling

Reverse Circulation (RC) exploration drilling (VGRC082-102, 21 holes, 1544 m, 769 samples was completed by Kennedy Drilling (Kalgoorlie, WA). The drill rig used was a KD180 with 900cfm @ 350 psi onboard air coupled to a Sullair auxiliary (1150 cfm @ 350 psi) and Hurricane booster (700 psi).

The program was completed in a safe and timely manner and hole depths varied based on target horizons. Drilling conditions, sample recovery and quality and drilling rate of penetration (ROP) were of a satisfactory standard although drilling activities were very slow due to frequent breakdowns even with the use of the smaller, more mobile drilling rig, less support vehicles and shallow holes.

Due to the remote nature of the terrain and lack of any existing tracks, the 62 km east-west access track cleared in 2011 was left open at the end of 2011 and all 21 holes were accessed off this track by way of 46.3 km of north-south grid-style access tracks.

All holes were drilled vertical with a planned depth range of 60-80 m, depth determined to be sufficient to drill through desired mineralization. In some holes depth varied from this target (47 m shallowest to 116 m deepest) when the rig geo interpreted the change to Lower Cambrian (or older) underlying formations which were considered to be no longer phosphate prospective.
Drilling targeted assays that returned high P₂O₅ in 2011 and geophysical basin depth targets. The drilling grid encountered a similar sequence of dominant carbonate-rich (mainly dolomite-lesser limestone) rocks with minor chert and siltstone/sandstone units. It also defined the extent and grade of mineralization highs returned in 2011. Depth to fresh rock varied from 27 to ~70 m. The dolomite logged consisted of a mainly cream coloured uniform textured, massive fine-grained rock.

The most important units that relate to potential phosphate mineralisation are interpreted to be the siltstones fine-grained sandstones (now quartzites) and, most importantly, the cherts which rest conformably on the massive quartzite sandstone Meso Proterozoic basement rocks. The Barkly RC drilling recorded minor siltstone/sandstone near the top of the hole usually grading into cherts before hitting the thick, non-prospective carbonate sequences.

The 2012 drill campaign included RC holes with a much shallower average depth (74 m) than the 2011 RC drilling (114 m). Apart from two holes completed in basalt, one in sandstone and one in saprolite, all the Barkly 2012 holes were stopped in a carbonate (dolomitic) lithology.

2012 drilling results are discussed in Appendix 4 and significant drill sections summarised below.

### Table 10: 2012 Significant Drill Intersections

<table>
<thead>
<tr>
<th>Sample No</th>
<th>Hole No</th>
<th>Hole Dip</th>
<th>Hole Azimuth</th>
<th>Zone</th>
<th>MGA East (m)</th>
<th>MGA North (m)</th>
<th>Sample Interval (m)</th>
<th>From (m)</th>
<th>Cut-offs: &lt;1 % P₂O₅</th>
<th>Total depth (m)</th>
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<td>2</td>
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<td>-</td>
<td>68</td>
</tr>
</tbody>
</table>
7.2 New Disturbances

Vale cleared 46.3 line km of access track approximately 3 m wide (13.89 ha) and cleared 21 drill pads on which 21 sumps were excavated (total pad area 1.68 ha; individual pad size approximately 20 m x 40 m). The requested 50 m x 25 m area as described in the MMP was to cover any potential circumstances where a larger pad may be required for safety or any unforeseen reasons. None arose during the 2012 drilling campaign so all pads cleared were of the smaller size.

The total ground disturbance for the Barkly Project for the 2012 field season was approximately 15.57 ha and rehabilitation of this 2012 disturbance, as well as the 62 km access track left open from 2011 (18.6 ha) was undertaken shortly after the drilling was completed in the reporting period.

7.3 Rehabilitation Completed

Rehabilitation of 2012 drill pads, sumps, collar and access tracks was completed during the reporting period. The 62 km access track cleared in 2011 that the NT DoR granted permission to keep open was rehabilitated along with 2012 disturbances.

Drill holes were plugged after each hole was drilled and sumps filled. Access tracks were ripped and topsoil respread at the end of exploration activities.

Revegetation involved scarifying compacted surfaces, and respreading topsoil (and its contained seedbank) over disturbed surfaces. Any vegetation stockpiled during clearing processes was spread/placed on top of the topsoil to allow the seedbank to germinate naturally.

7.4 Sample preparation and analysis

A total of 769 2m composite samples were gathered from 21 RC drill holes (816 including QA/QC inserts) for a total of 1544 m drill metres. These samples were riffle split immediately at the rig. Each 1 m sample was passed through the riffle splitter as soon as it came from the sample return and the sample bags were tied and gathered once they contained 2 m of drill chips, unless the hole ended on an odd number or if void space was encountered (voids were encountered on a few holes in Barkly). 564 of the 769 samples were sent to ALS Chemex for analysis. Four batches were sent to ALS with the largest being approximately 500 samples. Preparation of the samples included:

- WEI-21 – weigh and dry
- CRU-21 – crush
- SPL-21 – split
- PUL-24 – pulverize entire sample to nominal 85% passing 75 microns

Analysis performed on each sample was ME-XRF24 which tested for the following analytes: Al₂O₃, CaO, Fe₂O₃, K₂O, MgO, MnO₂, Na₂O, P₂O₅, SiO₂, TiO₂ and LOI at 1000°C reporting all values in percent with a 0.01% detection limit (refer to Appendix 7 for QA/QC report).
8 Conclusions

Modelling and interpretation from the geophysical study commissioned over Vale’s Georgina Phosphate Exploration Project, previous drill hole data, distance from the Adelaide-Darwin railway, shelf morphology and “Vale size” phosphate ore body geometries were all used to identify 21 optimally spaced and targeted drill sites for 2012.

As a result, Vale completed all of the 21 target holes for a total of 1544 m.

Assays from the holes drilled returned five sections >1% P₂O₅ and thicker than 10 m; the highest being from VGRC094 with a thickness of 22 m and 4.53% P₂O₅ starting at 26 m depth.

The highs from 2012, when modelled together with other high values from the Barkly project area from previous years of drilling, form an ore body of desirable tonnage with grade that is far below the desired 17% P₂O₅ average.

Although phosphate is present in this zone, its low grade does not constitute a prospect suitable for infill drilling. As a result Vale decided no further exploration was warranted on Barkly and the decision was made to surrender all Barkly project tenements.
9 References


Northern Territory Bioregions Assessment of key Biodiversity Values and Threats.  Department of Natural Resources, Environment and the Arts.


