BRUNCHILLY PROJECT

NORTHERN TERRITORY

TENEMENTS EL27191, EL27192, EL27547, EL27612, EL27613 AND EL27614

COMBINED THIRD ANNUAL AND FINAL REPORT

FOR THE PERIOD 26 OCTOBER 2009 TO 02 NOVEMBER 2012

GROUP REPORTING NO. 134/09

Submitted by: Vale Exploration Pty Ltd
Level 11, 100 Creek Street
Brisbane Qld 4000

Compiled by: Miguel Ricardo, Exploration Geologist

Date: 23 November 2012

Distribution: NT Department of Resources – Geological Survey
Vale Library
<table>
<thead>
<tr>
<th>Title Holder</th>
<th>Vale Australia EA Pty Ltd</th>
</tr>
</thead>
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<tr>
<td>Operator</td>
<td>Vale Exploration Pty Ltd</td>
</tr>
<tr>
<td>Titles</td>
<td>Exploration Licences 27191, 27192, 27547, 27612, 27613, 27614</td>
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<td>Project Name</td>
<td>Brunchilly</td>
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<td>Report Title</td>
<td>Combined Third Annual and Final Report for the period 26 October 2009 to 2 November 2012, Brunchilly Project, ELs 27191, 27192, 27547, 27612, 27613, 27614</td>
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<tr>
<td>Personal Author</td>
<td>Ricardo, Miguel</td>
</tr>
<tr>
<td>Corporate Author</td>
<td>Vale Exploration Pty Ltd</td>
</tr>
<tr>
<td>Commodity</td>
<td>Phosphate</td>
</tr>
<tr>
<td>Date of Report</td>
<td>24 November 2012</td>
</tr>
<tr>
<td>250 000 K map sheet</td>
<td>Helen Springs, Tennant Creek</td>
</tr>
<tr>
<td>100 000 K map sheet</td>
<td>Barkly, Brunchilly, Flynn, Munkaderry</td>
</tr>
<tr>
<td>Contact details</td>
<td>Vale Exploration Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>GPO Box 731, Brisbane Q 4001</td>
</tr>
<tr>
<td>Fax</td>
<td>07 3136 0510</td>
</tr>
<tr>
<td>Phone</td>
<td>07 3136 0957</td>
</tr>
<tr>
<td>Email for further technical details</td>
<td><a href="mailto:miguel.ricardo@valeaustralia.com.au">miguel.ricardo@valeaustralia.com.au</a></td>
</tr>
<tr>
<td>Email for expenditure</td>
<td><a href="mailto:lynne.odonnell@valeaustralia.com.au">lynne.odonnell@valeaustralia.com.au</a></td>
</tr>
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- Vale, October 2012

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- Vale, October 2012
Executive Summary

This is the combined third annual and final report for Brunchilly Project ELs 27191, 27192, 27547, 27612, 27613, 27614 for the period 26 October 2009 to 31 October 2012. Year 2 50% relinquishments were lodged for ELs 27547, 27613 and 27614 in 2012. Exemptions from Year 2 50% reductions were approved for ELs 27191 and 27192 in 2011, and for EL 27612 in 2012. The Brunchilly Project, located approximately 90 km northeast of Tennant Creek, is a sub-project of Vale’s Georgina Phosphate Exploration Project and covers a sequence of Cambrian sedimentary rocks of the Georgina Basin. The sedimentary rocks of the Georgina Basin range in age from Late Proterozoic to Early Palaeozoic. Outcrop is limited with basement concealed beneath Tertiary sediments. Drilling was completed on ELs 27191, 27192, 27547, 27613 and 27614 in 2011 and on ELs 27191 and 27192 in 2010. Surface sampling and mapping was completed in 2010 on ELs 27191, 27192 and 27547. Phosphate exploration work on Brunchilly in 2012 consisted of focused drill targeting, 48.4 km 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 NTGS mapping to gain a better understanding of the Georgina Basin and assist with phosphate drill targeting. In 2012 nine (9) RC drill holes were completed on ELs 27547 and 27614, targeting basement highs and NTGS gum ridge formation rocks, totalling 645m gathering 323 2m composite with QA/QC samples. One significant section > 1% P₂O₅ was returned from this year’s exploration. No significant phosphate ore zones have been defined in the Brunchilly tenements. For that reason the decision was made to surrender the Brunchilly project tenements.
1 Introduction

1.1 Location and Access

The Brunchilly Project is located approximately 90 km north east of Tennant Creek at the nearest point and 235km north east of Tennant Creek at the north easternmost corner (Figure 1). The Brunchilly Project consists of contiguous tenements located on the Helen Springs (SE53-10) and Tennant Creek (SE53-14) 1:250,000 and the Barkly (5859), Brunchilly (5760), Flynn (5759) and Munkaderry (5860) 1:100,000 map sheets. The project area also straddles parts of Banka Banka (PPL938, NT Por 1311), Brunchilly (PPL, NT Por 283), Phillip Creek (NT Por 408) and Rockhampton Downs (NT Por 1484) stations. All are operating cattle stations.

Access to the tenements is via the Stuart Highway and 72 km north from Tennant Creek, thence easterly of Attack Creek for 26 km on the Brunchilly Station access road. Internal access is good via a network of station tracks which range from excellent to fair.

1.2 Tenement Details

The Brunchilly Project is comprised of six contiguous tenements held by Vale Australia EA Pty Ltd and operated by Vale Exploration Pty Ltd under Authorisation 0553-03.

Year 2 50% relinquishments were lodged for ELs 27547, 27613 and 27614 in 2012. Exemptions from Year 2 50% reduction were approved for ELs 27191 and 27192 in 2011, and for EL 27612 in 2012.

<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>EL27191</td>
<td>Vale Australia EA Pty Ltd</td>
<td>339</td>
<td>26/10/2009</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27192</td>
<td>Vale Australia EA Pty Ltd</td>
<td>349</td>
<td>26/10/2009</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27547</td>
<td>Vale Australia EA Pty Ltd</td>
<td>54</td>
<td>04/03/2010</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27612</td>
<td>Vale Australia EA Pty Ltd</td>
<td>36</td>
<td>08/07/2010</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27613</td>
<td>Vale Australia EA Pty Ltd</td>
<td>56</td>
<td>13/05/2010</td>
<td>31/10/2012</td>
</tr>
<tr>
<td>EL27614</td>
<td>Vale Australia EA Pty Ltd</td>
<td>44</td>
<td>08/04/2010</td>
<td>31/10/2012</td>
</tr>
</tbody>
</table>

1.3 Native Title

There are two Native Title claims over the Brunchilly Project:

- Banka Banka DC01/5 is registered and overlaps the western portion of EL27192 and EL27547;
- Brunchilly DC01/31 is registered (entirely covers EL27191and EL27546 and overlaps eastern portions of EL27192 and EL27547).
Figure 1: Brunchilly Tenement Location Plan
(see Figures 2-4 for areas relinquished from ELs 27547, 27613, 27614)
Figure 2: EL27547 – Area Relinquished/Retained 3.3.12
Figure 3: EL27613 – Area Relinquished/Retained 12.5.12
Figure 4: EL27614 – Area Relinquished/Retained 7.4.12
1.4 Historical, Aboriginal and Heritage Sites

The Attack Creek Historical Reserve (NT Portion 624) is located on the eastern side of the Stuart Highway, approximately 72km north of Tennant Creek on the south side of Attack Creek (Table 2). This site is not prescribed\(^1\) and occurs outside the project area but is close to an access route.

At the site is the ‘Stuart Memorial’, a memorial to explorer John McDouall Stuart, who was the first non-Aboriginal person to enter the area and along with his two companions, was forced to abandon his expedition and turn back from a place he called Attack Creek after a confrontation with Warumungu people.

Tarrabool Lake (located 30km NE of the Brunchilly Project) is listed on the Register of the National Estate as a place of natural significance (Place ID: 103047), and is a ‘Site of Conservation Significance’ in the N.T. It is frequented by large numbers of birds, including migratory species, is an important breeding site for waterbirds and supports the largest known colony in the NT of Australian Pelicans (*Pelecanus conspicillatus*) and the largest known colony in the NT of Straw Necked Ibis (*Threskiornis spinicollis*). Tarrabool Lake is the only known breeding locality in the NT for Painted Snipe (*Rostratula benghalensis*).

**Table 2: Heritage Sites**

<table>
<thead>
<tr>
<th>Name</th>
<th>Register</th>
<th>Class</th>
<th>Location &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attack Creek Historical Reserve</td>
<td>Not Registered (NT Portion 624)</td>
<td>Historic</td>
<td>Marked by Stuart Memorial. Outside of the tenement area, however access passes close to it.</td>
</tr>
<tr>
<td>Tarrabool Lake</td>
<td>Register of the National Estate - Place ID: 103047</td>
<td>Natural</td>
<td>In wet years the perimeter extends into the Northern portion of EL 27191 (Brunchilly)</td>
</tr>
</tbody>
</table>

An inspection of the Aboriginal Areas Protection Authority (AAPA) Register was conducted for EL27191 and EL27192 on 9 September 2009 and for EL27546, EL27547, EL27612, EL27613 and EL27614 on 6 October 2010.

AAPA certificate for EL27191 and EL27192 (C2010/135) issued 9.6.10. Nineteen (19) Restricted Work Areas (RWAs) were identified.

AAPA Certificate for EL27547, EL27612, EL27613 and EL27614 issued 27.1.11 (C2011/017) recording six (6) RWAs.

An information meeting was organized by the Northern Land Council (NLC) and held in Tennant Creek on 1 December 2009.

Prior to any ground disturbance activities taking place (site preparation, sump excavation, hole pegging), a Vale representative accompanied a NLC representative and one or more Traditional Owners on a field visit to check all proposed drill sites. The NLC representative and Traditional Owners were satisfied with the entire proposed ground disturbances and a good relationship with the NLC and Traditional Owners has been established.

\(^1\) If a park is prescribed it is an offence to possess, consume, transport or sell alcohol in the park
1.5 Climate and Hydrology

The Brunchilly region is semi-arid with annual rainfall of 414.2mm. The climate is characterized by distinct wet and dry seasons with the majority of rain falling between November and March. The predominant wind direction is from the east (Table 3).

<table>
<thead>
<tr>
<th>Table 3: Climate Statistics – Brunette Downs (BOM 2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>Mean Maximum Temperature ºC²</td>
</tr>
<tr>
<td>Highest Temperature ºC</td>
</tr>
<tr>
<td>Mean days ≥ 40 ºC</td>
</tr>
<tr>
<td>Mean Minimum Temperature ºC</td>
</tr>
<tr>
<td>Lowest Temperature ºC</td>
</tr>
<tr>
<td>Mean Rainfall (mm)³</td>
</tr>
<tr>
<td>Mean number of days of rain</td>
</tr>
</tbody>
</table>

1.6 Land Area Type

The project straddles both Davenport Murchison Ranges (DMR) and Mitchell Grass Downs (MGD) bioregions, which 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).

Drainage within the tenements is dominated by ephemeral creeks - Attack Creek, Brunchilly Creek, Bullcamp creek, Chow-Chowra Creek, Lirri-Lirri Creek, and Tooliganbilly Creek that drain into Tarrabool Lake to the north east or Lake Sylvester and Copella Lake to the east. The inner basin of Tarrabool Lake occurs outside the Project area (approximately 20km north east of the north easternmost corner of tenement EL27192), however in exceptionally wet years the Tarrabool Lake floods and the extent of the flooded area (the outer basin) extends into the Brunchilly project area. During exceptionally wet years Lake Tarrabool joins with Eva Downs Swamp to the North (outside the tenement area) and together they cover an area of over 2750km².

² Temperature measurements from 1957 - 2009
³ Rainfall measurements from 1949 - 2009
The outer basin of Tarrabool Lake (plus a 2km buffer) is an NT Government ‘Site of Conservation Significance’ and the largest basin-form freshwater wetland and largest wooded swamp in Tropical Australia. NRETAS ranks its significance rating as ‘International Significance’.

Unlike the other Barkly lakes, Tarrabool Lake is dominated by woodland of coolabah (Eucalyptus coolabah) and has a wooded area of at least 1200km², making it one of Australia’s largest wooded swamps. The lake also supports large areas of grassland and open lignum (Muehlenbeckia florulenta) and bluebush shrubland. A significant infestation of Parkinsonia aculeata occurs in the NE of the main lake (NRETAS, 2009). As such, there is potential for this weed to occur within the Brunchilly project area.

**Physiography**

The Brunchilly Project consists of two physiographic divisions, differentiated on the basis of their topography and superficial deposits

- **‘Sand plains’** with a superficial cover of red sand, supporting spinifex and low trees and shrubs occur in the westernmost third of the Brunchilly Project. These sand plains occur (within the Brunchilly project) to the east of the Ashburton and Whittington Ranges and the grassy downs to the east, on a surface sloping gently away from the ranges.
- **‘Downs country, with swamps and lakes’** occurs on the easternmost two thirds of the Brunchilly Project. The downs country is lower than nearby areas of sand plain and the ranges. It is largely covered by black soils supporting Mitchell and flinders grass.

**1.6.1 Flora**

The Flora data was documented in 2010 and is included here for reference purposes.

Vegetation communities within the project area are Astrebla low tussock grassland, with smaller pockets of Chenopodium open Chenopod shrubland and Eucalyptus low open woodland. The southern third of EL27191 is dominated by Corymbia Low open woodland (Figure 5, Table 4).

*Parkinsonia aculeata*, an introduced weed, is known to occur within the north east portion of Lake Tarrabool and may also occur within the Brunchilly project area.

<table>
<thead>
<tr>
<th><strong>Table 4: Introduced Flora (Weeds)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Species Name</strong></td>
</tr>
<tr>
<td><em>Parkinsonia aculeata</em></td>
</tr>
</tbody>
</table>

*Figure 2 Produced with Digital Vegetation Mapping data purchased from NRETAS October 2009.*
1.6.2 Fauna

The Fauna data was documented in 2010 and is included here for reference purposes.

No fauna species covered by the *EPBC Act 1999* have been recorded in surveys completed within the Brunchilly Project.

In 1993, an exceptionally wet year when Lake Tarrabool was flooded, a single Yellow Chat (*Epthianura crocea*) was recorded outside to the east of tenement EL27191 (at Lat: -18.59855, Long: 134.84121).

The Australia Bustard (*Ardeotis Australis*) has been recorded within the Brunchilly Project tenement EL27192. 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*.

Tarabool Lake, which in exceptionally wet years overlaps the tenement area, is recognized as a Site of Conservation Significance by the NT Government as it supports internationally significant numbers of two significant waterbird species (the Australian pelican and the straw-necked ibis) and one shorebird, the black-winged stilt (Jaensch and Bellchambers 1997 as cited by NRETAS, 2009).

Major Waterbird breeding events typically occur after flooding, then receding waters provide habitat for migratory shorebirds.

A search of NRETAS\(^5\) data found that the following vulnerable species have been recorded within the project area (Figure 6, Table 5).

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

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Generic Name</th>
<th>EPBC(^6) Status</th>
<th>TPWC(^7) Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ardeotis australis</em></td>
<td>Australia Bustard</td>
<td>No status</td>
<td>Vulnerable</td>
</tr>
<tr>
<td></td>
<td>(Bush Turkey)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A search of the Australian Government Department of the environment, water, heritage and the areas website, ‘protected Matters Search tool’ identified 3 threatened species and 8 migratory bird species within a rectangular search area encompassing the tenements. 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 Tarrabool or within Lake Sylvester and Corella Lake further east.

The search tool indicates that it is likely that the Mulgara will occur within the tenement area, however it has not been recorded on the tenements to date.

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\(^5\) NRETAS - NT Department of Natural Resources, Environment, the Arts and Sport  
\(^6\) Environmental Protection and Biodiversity Conservation Act 1999  
\(^7\) Territory Parks and Wildlife Conservation Act 2009
Figure 6: Brunchilly Project – Fauna Plan

Legend

Threatened Fauna
- Australian Bustard
- Australian Painted Snipe
- Bily
- Black-footed Rock-wallaby
- Barrooing Bettong
- Carpentarian Antechinus
- Common Brushtail Possum
- Crescent Nailtail Wallaby
- Dusky Hopping-mouse
- Mulgara

- Emu
- Floodplain Monitor
- Golden Banded Monitor
- Golden-banded Tree-rat
- Hooded Robin
- Lesser Stick-neck Rat
- Long-tailed Hopping-mouse
- Mala
- Marten's Water Monitor
- Yellow Chat

- Night Parrot
- Northern Quoll
- Northern Shrike-hit
- Partridge Pigeon
- Princess Parrot
- Red-tailed Phascogale
- SDCS
- Western Quoll
- Vale Tenement

Brunchilly Project Fauna Map

Distances

Coordinates System: GDA04
Projection Model: Zone 53
2 Regional Geology

The Brunchilly Project covers a sequence of Cambrian sedimentary rocks of the Georgina Basin (Figure 7 & Figure 8, Table 6). The sedimentary 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, to the east they unconformably overlie mid–Proterozoic rocks of the Cloncurry-Mt Isa Block. On the southern margin of the basin, Georgina Basin rocks overlie strata of the Arunta block, whilst to the west (and in the Brunchilly area) they unconformably overlie basement composed of rocks of the Early Proterozoic Hatches Creek and Warramunga Groups and their equivalents (Cook, P, 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 7 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).

![Figure 7: Schematic West to east stratigraphic transect across Wiso and Georgina Basins](image)

Major phosphate deposition occurred in the Middle Cambrian (Templetonian), a period which corresponds to a significant rise in sea level corresponding to 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).
Figure 8: Brunchilly Project – Regional Geology Plan Scale
Table 6: Stratigraphy of the Helen Springs 1:250,000 Sheet (NTGS)

<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
<th>Stratigraphic Unit</th>
<th>Distribution</th>
<th>Lithology</th>
<th>Approximate Thickness (Feet)</th>
<th>Topography</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cainozoic</td>
<td></td>
<td>Cza</td>
<td>Valleys and flood-outs; swamps and distributaries</td>
<td>Sands and gravels, sandy and silty alluvium, clayey swamp sediments</td>
<td>?</td>
<td>Flat valley floors, plains with distributary channels, closed depressions of downs country swamps</td>
<td>May include some residual soils</td>
</tr>
<tr>
<td>Cainozoic</td>
<td></td>
<td>Czb</td>
<td>Northeast</td>
<td>Black and dark grey clayey soils; variable content of sand and pebbles</td>
<td>?</td>
<td>Flat grassy plains with low rises. Some gilgai microtopography</td>
<td>Support Mitchell and flinders grasses</td>
</tr>
<tr>
<td>Cainozoic</td>
<td></td>
<td>Czs</td>
<td>Ashburton and Whittington Renages, and smaller areas farther east</td>
<td>Sand and sandy soils; usually red; some leached and lateritic soils and old lake deposits</td>
<td>?</td>
<td>Gently sloping plains. Some fixed longitudinal dunes in southwest</td>
<td></td>
</tr>
<tr>
<td>Cainozoic</td>
<td>Tertiary</td>
<td>Brunette Limestone (Tb)</td>
<td>Mainly on downs country. Small areas in ranges</td>
<td>White limestone, mainly calcilutite, with some massive chalcedony; sandstone</td>
<td>15</td>
<td>Low rises in downs country; in valley floors of ranges</td>
<td>Thickness from bore data. Greater thickness known on Brunette Downs Sheet area to east</td>
</tr>
<tr>
<td>Cainozoic</td>
<td>Tertiary</td>
<td>(T1)</td>
<td>Small areas in ranges and downs country</td>
<td>Laterite, massive or pisolithic ironstone and ferruginous rubble, some sand and soil cover</td>
<td>20</td>
<td>Low rises in downs country. In ranges usually residual mesas in major valleys</td>
<td>Best developed on basic igneous rocks and argillaceous sedimentary rocks</td>
</tr>
<tr>
<td>Mesozoic</td>
<td></td>
<td>(M)</td>
<td>Ashburton and Whittington Ranges</td>
<td>Quartz sandstone, pebbly sandstone, micaceous sandstone; micaceous siltstone; some cobble and boulder conglomerate</td>
<td>80</td>
<td>Dissected plains and residual mesas in major valleys in ranges. Resistant beds form terraces on hillsides</td>
<td>Leaf impression from Whittington Range indicates Jurassic or Lower Cretaceous age</td>
</tr>
<tr>
<td>Mesozoic</td>
<td>Lower Cretaceous</td>
<td>Mullaman Beds (Klm)</td>
<td>Northern part, east of Ashburton Range</td>
<td>Quartz sandstone, pebbly and cobbly sandstone; overlain by siltstone and claystone. Many outcrops silicified.</td>
<td>140+</td>
<td>Low rubbly rises</td>
<td>?Neocomian-Aptian to Alban. Plants in sandstone, radiolarian in siltstone</td>
</tr>
</tbody>
</table>
Palaeozoic | Middle Cambrian | Anthony Lagoon Beds (Cmy) | Northeast | Fine sandstone; dolomitic siltstone; dolomite and dolomitic limestone with chert nodules | 285+? | Low rubbly rises | Outcrops mainly chert and sandstone scree with some blocks of carbonate rocks |
--- | --- | --- | --- | --- | --- | --- | --- |
Palaeozoic | Middle Cambrian | Gum Ridge Formation (Cmg) | Ashburton and Whittington Ranges and margins | Siliceous siltstone, chert; silicified limestone; sandstone and leached calcareous sandstone | 170+ | Low Rises | Early Middle Cambrian trilobites. Outcrops brecciated and re-silicified |
Palaeozoic | Lower Cambrian | Helen Springs Volcanics (Clh) | Valleys in ranges: some outcrops on west side of Ashburton Range | Basalt, coarse doleritic, aphanitic and vesicular at base’ basal sandstone with large crossed, sandy breccia, minor siltstone and chert | 120+ | Grassy downs country with some gilgai patterns, and mesas with cappings of laterite or Mesozoic rocks. | Cavities and fractures are often lined with quartz crystals |
Precambrian | Lower Proterozoic | Tomkinson Creek Beds (Plt) | Ashburton and Whittington Ranges | Qtz sandstone with much clasts, pebbly sandstone, glauconitic sandstone, siltstone, calcareous siltstone, siliceous siltstone, dolomite, limestone, chert, minor conglomerate and dolomite breccia. Cross-bedding, oscillation ripple marks, mudcracks, halite casts, stromatolites, Dolerite sill. | 50,000 | Sandstones form strike ridges and plateaux. Siltstone, carbonate rocks, and dolerite eroded into valleys, locally protected by siliceous or ferruginous cappings. | Medium cross-bedded quartz sandstone dominant. Beds were formerly termed ‘Ashburton Sandstone’ |

3 Local Geology

The Brunchilly project is located on the Helen Springs (SE53-10) and Tennant Creek (SE53-14) 1:250,000 and the Barkly (5859), Brunchilly (5760), Flynn (5759) and Munkaderry (5860) 1:100,000 map sheets.

Outcrop is limited with basement concealed beneath Tertiary sediments.

The 1:250,000 Helen Springs map sheet indicates that Anthony Lagoon Beds outcrop in the NW corner of the Brunchilly Project as well as along a small section of Brunchilly Creek and in the northern and southern portions of EL27191 and EL27192.

Gum Ridge Formation has also been mapped, to the east of Brunchilly Homestead.

A small amount of Pts (Possible Tomkinson Creek Beds – Hayward Creek Formation) has been mapped to the west of Gum Ridge Formation approximately 6km to the north west of Brunchilly Homestead.

Diamond Drill hole BN04DD01, a 521.3m diamond hole drilled approximately 1km to the NE of EL27191 intersected Anthony Lagoon Formation (Figure 9), underlain by Gum Ridge Formation and Helen Springs volcanics. A stratigraphic section of this hole has been included for reference (Kruse et al., 2010).

Figure 9: Brunchilly Drill Hole BN04DD01
4 Previous Exploration

An open file literature review of EL 27191 and EL 27192 was completed during the previous reporting period and is included in this report for reference only.

Four previous explorers were recorded as having held exploration tenements overlying or partially overlapping EL 27191 and EL 27192. The majority of work was for diamonds with minor base metal and copper-gold exploration. A literature review of the remaining licences is pending.

No historic company phosphate exploration is recorded on EL 27191 or EL 27192.

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

AP 2757
CR 1971-0028
Peel, Smith, Hines and Mawson
Drillingham Mining Company of Australia
November 1970 - 18 July 1971

Work involved reconnaissance targeting base metals and involved:

- Airborne magnetics and radiometrics scintillometry – 1800 line kms,
- 46 Rock Chip Samples [Cu, Pb, Zn, Ni, Co, Ag],
- 56 Stream Sed Samples [Cu, Pb, Zn, Ni, Co, Ag],
- Geology Map 1:100,000
- Geochemical Map 1:100,000
- Scintillometry Overlay Map, 1:100,000
- Geochemical Analysis Results

Geology is restricted largely to a northwest trending Proterozoic block. Strata include Middle Cambrian Gum Ridge Formation and Lower Cambrian Helen Springs Formation basalt which unconformably overlie Proterozoic Tomkinson Creek Beds. The Tomkinson Creek Beds were noted to contain some manganese shaley members near the headwaters of Bootu Creek. No magnetic anomalies were identified. The best radiometric response was obtained in the Northwest corner of the tenement near Tomkinson Creek – located over siltstone and sandstone members of the Tomkinson Creek Beds. This feature was not followed up on the ground as it was believed to be due to glauconitically enriched siltstones. Highest Cu, Pb and Co values were associated with the Bootu Creek manganese beds, where it was believed the high metal content was a reflection of the scavenging ability of manganese oxides.

EL 4253
CR 1986-0071, CR 1985-0013
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.

52 samples were taken from trap sites in streams. At each site approximately 30 to 35kg of minus 4mm material was collected. Samples were processed at Ashton’s Perth laboratory where they were concentrated by Wilfley table and heavy liquid separation. The heavy liquid used was tetrabromomethane 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. No evidence of kimberlites was found.
EL 4314  
CR 1986-0077, CR 1985-0041  
AOG Minerals Limited, Ashton Mining Limited, Aberfoyle Exploration Pty Limited, Australian Diamond Exploration N.L.  
December 1983 to November 1985  
The target was kimberlite pipes.  
24 gravel and 27 loam samples were collected and processed as per EL4253. Loam samples were collected as surface scrapes of 15 to 20kg of material. Processing of samples was as per the samples from EL4253. No evidence of kimberlites was found.

EL 4316  
CR 1986-0081, CR 1985-0014  
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.  
71 gravel and 20 loam samples were collected. Gravel and loam samples were collected and processed as per EL4314. Samples were only observed for diamonds. No evidence of kimberlites was found.

EL 8559  
CR 1994-0806  
Stockdale Prospecting Limited  
October 1993 to July 1994  
The licence was acquired to explore for diamondiferous diatremes.  
Work consisted of an aeromagnetic and radiometric survey which identified 7 discrete anomalies, one of which was considered worthy of follow-up. A detailed helicopter-borne magnetic survey downgraded the anomaly. No drilling or sampling was completed.

EL 8562  
CR 1994-0804  
Stockdale Prospecting Limited  
October 1993 to July 1994  
The licence was acquired to explore for diamondiferous diatremes.  
Work consisted of an aeromagnetic and radiometric survey which identified 8 discrete anomalies, two of which were considered worthy of follow-up. A detailed helicopter-borne magnetic survey over one anomaly and a ground magnetometer survey over the other downgraded the anomalies. No drilling or sampling was completed.

EL 9412  
CR 1997-0500  
Normandy Gold Pty Ltd  
10/5/96 to 8/5/97  
The licence was applied for to explore for magnetic ironstone related Tennant Creek style Au/Cu/Bi mineralisation with the target being a coincident gravity and magnetic anomaly beneath Cambrian cover.  
A regional geological and geophysics study concluded that basement was likely to be Hatches Creek Group rather than the more prospective Warramunga Group. Estimated thickness of Cambrian in the tenement was estimated to be at least 80m. No drilling or sampling was completed.
5  **Exploration completed in previous reporting periods**

Vale's previous exploration activity on the Brunchilly tenements is summarized below. Refer Figure 10 for location of 2010 and 2011 sampling and drilling locations.

**2010 Exploration Season:**

- AAPA Register inspections; AAPA Certificate for ELs 27191 and 27192; meeting with NLC and Traditional Owners.
- Open file literature review; acquisition and reprocessing of geophysical data; and acquisition of NRETAS environmental data.
- Vale commissioned CSIRO to undertake XRF analysis of 373 water bore chip samples from 13 historic water bore holes within Brunchilly.
- Review of regional water bore analyses to assist in phosphate horizon targeting.
- Geological outcrop mapping.
- Rock chip sampling (158 samples on ELs 27191, 27192 and 27547); assays reported.
- In-house depth to basement geophysical modelling to assist first pass drill targeting.
- 14 Reverse Circulation (RC) drill holes (VGRC001-014 for 1878 m and 694 composite drill samples – 1 hole for 96 m on EL27191; and 13 holes for 1782 m on EL27192; assays reported.
- 1.3 line km of access track; 14 drill pads and 14 sumps – total disturbance 1.51 ha with rehabilitation pending next reporting period.

**2011 Exploration Season:**

- AAPA Certificate for ELs 27546, 27547, 27612, 27613, 27614.
- Field reconnaissance.
- Flora and Fauna Desktop Study.
- Geophysical Basin Modelling completed by MIRA Geoscience to assist with phosphate targeting by generating detailed images of depthbasement, gravity and magnetics.
- Line and pad clearing – 8.0 line km access tracks (2.4 ha), 16 pads and 16 sumps (1.28 ha).
- 16 RC drill holes (VGRC032-042 and 046-050) for 2038 m and 1075 composite samples.
- Rehabilitation of access tracks, drill pads, sumps and drill collars completed – total area disturbed 3.68 ha.
Figure 10: Brunchilly 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 (refer Figure 11 and Appendix 1)
- MIRA Geoscience basement model (Appendix 2)
- 2010/11 significant assays (Appendix 3)
- Shelf morphology
- Ore body geometries present in 2012 (Appendix 3)

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. 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 Brunchilly, the only area explored in 2012 where previous drilling had been completed, required a drill spacing between 3-10 km (refer to Appendix 3 for simple morphologies).
Figure 11: Vale Georgina 100km Railway Buffer
7 Exploration Current Reporting Period

Exploration in the current reporting period consisted of:

- Drill targeting based on previous Vale exploration in Georgina, geophysical basement modelling, 100km railway corridor and ore body geometries.
- Line and pad clearing – 48.4 line km access tracks (14.52 ha), 19 pads and 19 sumps (1.6 ha).
- RC Drilling – 9 of the 19 holes cleared were drilled totalling 645 m, 323 2m RC composite samples (drill samples minus QA/QC controls).

<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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</thead>
<tbody>
<tr>
<td>EL27547</td>
<td>RC</td>
<td>VGRC103-108</td>
<td>6</td>
<td>411</td>
<td>206</td>
<td>187</td>
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<tr>
<td>EL27614</td>
<td>RC</td>
<td>VGRC109-111</td>
<td>3</td>
<td>234</td>
<td>117</td>
<td>93</td>
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</tbody>
</table>

- Refer Figure 12 for 2012 drill hole location plan.
- Refer Appendix 4 for 2012 drill hole data.
- Environmental audit.
- Rehabilitation of drill pads, sumps, drill collars and tracks completed (16.12 ha).
- Analysis of samples – a selection of 280 of the 323 2m RC composites and QA/QC samples were assayed by ALS.
- Refer to Appendix 5 for 2012 drill assay data.

7.1 RC Drilling

Reverse Circulation (RC) exploration drilling (VGRC103-111, 9 holes, 645 m and 323 samples were 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 hole depths.

The Brunchilly station track was used to access all drill holes and the exploration camp. Above station tracks, 48.4 km of line clearing was required to access the 19 drill holes originally planned.

Brunchilly 2012 drilling was designed to find drill targets in previously explored and unexplored Brunchilly tenements that were within 100km from the Adelaide-Darwin railway. In unexplored tenements geophysical basement depth modelling was used primarily to target phosphate by placing drill holes close to basement highs. On explored tenements basement depth modelling was used in conjunction with previous assays to select drill targets.
All holes were drilled vertical with a planned depth range of 60-80 m, depth determined to be sufficient to drill through desired mineralization. Of the nine holes drilled the shallowest was drilled to 62 m and the deepest to 80 m.

Follow-up drilling on EL27614 targeted assays that returned high P₂O₅ in 2011 and geophysical basin depth targets. The drilling “spider-web” set up around previous high assays encountered a similar sequence of dominant carbonate-rich (mainly dolomite-lesser limestone) rocks with minor chert and siltstone/sandstone units. The program was not able to be completed due to budgetary constraints yet returned high values in the drill hole closest to last year’s high P₂O₅ return. Depth to fresh rock varied from 24 - ~50 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 Brunchilly 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 (72 m) than the 2011 RC drilling (128 m). Apart from one hole completed in siltstone all the Brunchilly 2012 holes were stopped in a carbonate (dolomitic) lithology.

2012 drilling results are discussed in Appendix 3 and significant drill sections summarised below.

Table 8: 2012 Significant Drill Intersections

<table>
<thead>
<tr>
<th>Hole No</th>
<th>Sample</th>
<th>Location</th>
<th>Drilling Sample Statistics (True Thickness)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hole No</td>
<td>Hole Dip</td>
<td>Hole Azimuth</td>
</tr>
<tr>
<td>VGRC103</td>
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</tr>
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<tr>
<td>VGRC111</td>
<td>-90</td>
<td>0</td>
<td>53</td>
</tr>
</tbody>
</table>
7.2 New Disturbances

Vale cleared 48.4 line km of access track approximately 3 m wide (14.52 ha) and cleared 19 drill pads on which 19 sumps were excavated (total pad area 1.6 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 Brunchilly Project for the 2012 field season was approximately 16.12 ha. Rehabilitation of drill pads, sumps and drill collars was completed in the reporting period.

7.3 Rehabilitation Completed

Rehabilitation of 2012 drill pads, sumps, collars and tracks was completed during the reporting period.

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 323 2m composite samples were gathered from 9 RC drill holes (339 including QA/QC inserts) for a total of 645 m drill metres. These samples were riffle split immediately at the rig. Each 1m 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 2m of drill chips, unless the hole ended on an odd number or if void spaces were encountered (voids were encountered on a few holes in Brunchilly; VGRC108 and 110). 280 of the 323 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 6 for QA/QC report).
8 Conclusion

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 19 optimally spaced and targeted drill sites for 2012.

Only 9 of the 19 planned RC drill holes were completed for a total 645 m.

The drilling was cut short due to budgetary constraints. Assays from the holes drilled returned one section in VGRC111 >1% P₂O₅ and thicker than 10 m.

This value, when modelled together with other high values from the Brunchilly project area from previous years of drilling, lead to the conclusion that further drill holes on the Brunchilly project would not result in the discovery of a high phosphate zone that could be developed into a resource.

For that reason, Vale decided no further exploration was warranted and the decision was made to surrender all Brunchilly project tenements.
9 References


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


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