EL27416 & EL27420

2nd ANNUAL REPORT for WATERLOO

FOR THE YEAR ENDED 12 May 2012

Group Report Number: GR216/11

Commodity: Nickel, Copper & Platinum Group Elements

Compiled by: Maryanne Muir

Title Holders: Proto Resources & Investments Ltd (Operator)

Map Sheet:

- 1:250,000 Waterloo SE 52-03
- 1:100,000 Newry 4765 31/1
- 1:100,000 Kildurk 4865 31/2
- 1:100,000 Waterloo 4764 31/4

Datum: GDA94, Zone 52

Compilation Date: 7 July 2012
Contact Details: Chief Operations Officer: Ashley Hood

ProtoResources & Investments Ltd

Office: Suite 1906, Level 19, 109 Pitt St, Sydney NSW 2000

Postal: PO Box R1870, Royal Exchange, Sydney NSW 1225

Telephone: (02) 9225 4000

Email: ashley.hood@protoresources.com.au
Copyright Statement

ProtoResources & Investments Ltd

EL27416 & EL27420 Annual Report for Wave Hill for the Year Ending 12 May 2012

© 2012, ProtoResources & Investments

ALL RIGHTS RESERVED. This Report contains material protected under Copyright Laws and Treaties. Any unauthorized reprint or use of this material is prohibited.

ProtoResources & Investments Ltd authorises the Minister to publish information, copy and distribute data after the five year closed file period.
Abstract

The Waterloo Project is located approximately 400km SW of Katherine in the Northern Territory. The region is dominated by the Cambrian-age Antrim Plateau Volcanics which are part of the Kalkarindji Flood Basalt Province. The Kalkarindji Volcanic Group is considered to be analogous to the Nadezhdinsky series (Norilsk basalts) which host the world’s largest Ni-Cu-PGE deposits at Norilsk in Russia.

Exploration activities conducted by Proto Resources & Investments Ltd (Proto) and their JV partners are based on the possibility of the Antrim Plateau Volcanics (as part of the Kalkarindji Volcanic Group) hosting economic “Norilsk-style” Ni-Cu-PGE mineralisation.

Work during the reporting period has included:
- Commencement of the Research projects headed by Dr Mike Widdowson of the Open University (UK) and Dr David Murphy of the Queensland University of Technology (QUT) including field visits, stratigraphic traverses and review of previous BMR drilling in the region.
- Preparation, planning and execution of the semi regional Gravity survey

Work for the upcoming year (2012-2013) should include the following:
- Continuation of Research programmes using the expertise of M Widdowson (Open University UK) and PHD student as well as a Masters and Honours student from QUT (Dr David Murphy) to cover the Antrim Plateau Volcanics in the region.
- Potential EM surveys and Drilling Programmes for any targets identified through the Research Project and the Gravity Survey.
TABLE OF CONTENTS

1. INTRODUCTION ........................................................................................................... 1
2. PROPERTY DESCRIPTION AND TENURE .................................................................. 1
3. ACCESSIBILITY AND INFRASTRUCTURE ................................................................. 2
4. GEOLOGICAL SETTING .............................................................................................. 4
5. PREVIOUS EXPLORATION .......................................................................................... 7
6. EXPLORATION COMPLETED DURING THE REPORTING PERIOD 13TH MAY 2011 TO 12TH MAY 2012. .............................................................................................................. 9
   6.1 Open University (UK) / QUT Collaboration ......................................................... ..... 9
   6.2 Gravity Survey ....................................................................................................... 13
7. CONCLUSIONS AND RECOMMENDATIONS .................................................................. 16
8. REFERENCES ............................................................................................................. 17

APPENDICES

Appendix 1 – Geophysics – Gravity Data.............................................................................. 18
Appendix 2 – NT Research Secondment Progress................................................................... 19
Appendix 3 – Stratigraphic Sections and sample waypoints.................................................. 30
Appendix 4 – Reanalysis of BMR Holes .............................................................................. 31

LIST OF TABLES

TABLE 1: TENEMENT DETAILS ........................................................................................... 1
TABLE 2: REVIEW OF EXPLORATION IN THE WATERLOO REGION ............................................ 7
TABLE 3: ROCKCHIP SIGNIFICANT RESULTS ......................................................................... 8

FIGURES

FIGURE 1: LOCATION OF EL27416 & 27420 ON LOCAL TOPOGRAPHY ........................................ 3
FIGURE 2: REGIONAL SURFACE GEOLOGY FROM NT 1:250, 000 MAPPING ................................ 5
FIGURE 3: WATERLOO 1:250,000 GEOLOGY MAP REFERENCE .............................................. 6
FIGURE 4: STRATIGRAPHIC TRAVERSES FOR THE WATERLOO AREA. UNIT A-D ARE DISTINCTIVE CORRELATABLE PAHOEHOE INFLATION UNITS FROM NORTH WATERLOO. .............................................. 11
FIGURE 5: LOCATION OF GRAVITY STATIONS FOR THE WATERLOO PROJECT ..................... 14
FIGURE 6: PRELIMINARY GRAVITY SURVEY RESULTS FOR THE WATERLOO PROJECT ........ 15

Note: All maps are in datum GDA94 (Zone 52)
1. INTRODUCTION

The Waterloo Project is located approximately 350km southwest of Katherine in the Northern Territory and 75km southeast of Kununurra and to the east of Lake Agryle in Western Australia. The region is dominated by the Cambrian-age Antrim Plateau Volcanics which are part of the Kalkarindji Flood Basalt Province. The Kalkarindji Volcanic Group is considered to be analogous to the Nadezhdinsky series (Nor’ilsk basalts) which host the world’s largest Ni-Cu-PGE deposits at Nor’ilsk in Russia.

Exploration activities conducted by Proto Resources & Investments Ltd (Proto) and their JV partners are based on the possibility of the Antrim Plateau Volcanics hosting economic “Nor’ilsk-style” Ni-Cu-PGE mineralisation. Jones (2010)

2. PROPERTY DESCRIPTION AND TENURE

The Waterloo Project comprises two granted exploration licences (ELs 27416 & 27420) which cover a combined area of 2,369 square kilometres. The licences are held 100% by Proto Resources & Investments Ltd. See Table below for further details on grant dates. Jones (2010)

Table 1: Tenement Details

<table>
<thead>
<tr>
<th>Title</th>
<th>Status</th>
<th>Grant Date</th>
<th>Expiry</th>
<th>Area (Sq Km)</th>
<th>Area (Blocks)</th>
<th>Current Rent</th>
<th>Covenant ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EL27416</td>
<td>GRANTED</td>
<td>13/05/2010</td>
<td>12/05/2016</td>
<td>1,235</td>
<td>375</td>
<td>7,755</td>
<td>44,500</td>
</tr>
<tr>
<td>EL27420</td>
<td>GRANTED</td>
<td>15/04/2010</td>
<td>14/04/2016</td>
<td>1,134</td>
<td>344</td>
<td>7,135</td>
<td>44,500</td>
</tr>
</tbody>
</table>

During the first quarter of 2011 Group Reporting was requested and granted by the Department of Resources – Minerals and Energy with the new Report dates as follows 13th May to 12th May the following year. The Group Reporting Number is GR216/11.
3. ACCESSIBILITY AND INFRASTRUCTURE

The Waterloo Project tenements are located approximately 350km southwest of Katherine in the Northern Territory and 75km southeast of Kununurra and directly to the east of Lake Agryle in Western Australia. The tenements are accessed from Kununurra via the Victoria Highway and then the Duncan Highway (Figure 1). The licence lies within the Rosewood Station Perpetual Pastoral Lease and Newry Station Perpetual Pastoral Lease.
Figure 1: Location of EL27416 & 27420 on local topography with inset showing location relative to Katherine. Plans in GDA94.
4. GEOLOGICAL SETTING

Jones (2010) states a large portion of the Waterloo Project area is covered by basalts of the Cambrian-aged Antrim Plateau Volcanics. In addition to the basalts, an area at the northern end of EL 27420 is covered by sedimentary units of the Proterozoic Duerdin Group and the Cambrian Kinevans Sandstone with other areas of younger laterite, sand dune cover and black soil plain.

The area is covered by the WATERLOO 1:250,000 map sheet and explanatory notes. Also the 1:100,000 mapsheets are as follows,

- EL27420 4765 NEWRY 1:100,000 31/1
- EL27420 4865 KILDURK 1:100,000 31/2
- EL27416 4765 NEWRY 1:100,000 31/1
- EL27416 4764 WATERLOO 1:100,000 31/4

The project area is transected by the northeast trending Blackfellow Creek Fault. The Blackfellow Creek Fault is a major structure that is believed to have been active for a long period of time. The fault is an important part of Proto Resources Exploration strategy to locate a Norilsk Style Deposit. The Antrim Plateau Volcanics make up part of the Kalkarindji Volcanic Group Continental Flood Basalt Province. This province is considered analogous to continental flood basalts in other parts of the world, most importantly the Nadezhdinsky series (Norilsk basalts) which host the world’s largest Ni-Cu-PGE deposits at Norilsk in Russia. The PGE, Ni and Cu depletion from the Nadezhdinsky series has been attributed to assimilation of continental crust, which stimulated sulphide segregation, thus sequestering the chalcophile elements from the basaltic magma. The correspondingly low PGE and Ni values for the Kalkarindji basalts may indicate a similar process took place (Glass, 2002).

The only recorded mineral occurrences within the Waterloo Project area are copper occurrences either within the Antrim Plateau Basalts or within the overlying Headley’s Limestone. These occurrences include Matilda, Byrnes Hill and a cluster of three unnamed copper occurrences approximately 12km southeast of Rosewood Station Homestead. All known copper occurrences are within EL27416 Waterloo West.

A single barite vein occurrence within the Antrim Plateau Basalts occurs near Newry Station Homestead on EL 27420 Waterloo East.
Figure 2: Regional surface geology from NT 1:250, 000 mapping. Plan in GDA 94
Figure 3: Waterloo 1:250,000 Geology Map Reference
5. PREVIOUS EXPLORATION

Jones (2010) has completed a comprehensive study of the previous exploration completed in the region and is as follows. The Waterloo Project area has been the subject of various exploration programs since the 1960’s through to the present day. The majority of this exploration has been for diamonds due to the areas close proximity to the Argyle Diamond Mine (located 75 km west of the project area in Western Australia) and the Bow River diamond mining area (located 40 km west of the project area also in Western Australia). The table below shows which companies have explored the Waterloo area for which commodity targets.

Upon review of the historic exploration data the work completed by Metals Exploration NL & Freeport Australia Inc between 1968 and 1970 should assist with Proto’s exploration activities as stream sediment samples were taken across the western part of the Waterloo project area identifying several areas of anomalous copper. In addition, work completed by Australian Kimberley Diamonds in 1997 identified a circular feature in Blackfellow Creek along an eastern extension of the Blackfellow Creek Fault which sampling indicated was unlikely to be a kimberlite but did contain large amounts of magnetite unlike the Antrim Basalt flows. Australian Kimberley Diamonds hypothesized that this circular feature may represent a volcanic vent or the location of an intrusion at depth.

Table 2: Review of Exploration in the Waterloo Region

<table>
<thead>
<tr>
<th>Date</th>
<th>Company</th>
<th>Target</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 - 2005</td>
<td>Gravity Diamonds Ltd/ Rio Tinto Exploration Pty Ltd</td>
<td>Diamonds</td>
<td>Data review and surface sampling.</td>
</tr>
<tr>
<td>1997 - 1999</td>
<td>Stockdale Prospecting</td>
<td>Diamonds</td>
<td>Stream sediment sampling</td>
</tr>
<tr>
<td>1997</td>
<td>Australian Kimberley Diamonds</td>
<td>Diamonds</td>
<td>Air photo interpretation, field visits, sampling. Circular feature on Blackfellow Creek identified which had high magnetite content in loam samples. Possible intrusion.</td>
</tr>
<tr>
<td>1989 - 1990</td>
<td>Kakadu Resources Ltd</td>
<td>Silica, Au</td>
<td>Bulk sampling for silica. BLEG for Au.</td>
</tr>
<tr>
<td>1988</td>
<td>Murchison Mining Corporation NL</td>
<td>Au, Base metals</td>
<td>Stream sediment sampling.</td>
</tr>
<tr>
<td>1980 - 1982</td>
<td>Aberfoyle Exploration Pty Ltd</td>
<td>Diamonds</td>
<td>Gravel sampling.</td>
</tr>
<tr>
<td>1979 - 1982</td>
<td>Ashton Mining Ltd</td>
<td>Diamonds</td>
<td>Gravel sampling.</td>
</tr>
<tr>
<td>1968 - 1970</td>
<td>Metals Exploration NL/Freeport Australia Inc</td>
<td>Copper</td>
<td>Stream sediment sampling, geological mapping, IP &amp; EM. Several areas with copper anomalism including Byrnes Hill defined.</td>
</tr>
</tbody>
</table>
For the first reporting period between 13-05-2010 to 12-05-2011, Waterloo work included:

- Regional re-imaging of available data – an image Atlas was produced of the data available from the NTGS and reprocessed by Southern Geoscience Consultants.
- QUT / Open University Collaboration reviewed the region and included field visit and rockchipping. Seventeen rockchips were taken overall.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Northing</th>
<th>Easting</th>
<th>Cu_%</th>
<th>Ag_ppm</th>
<th>Co_ppm</th>
<th>Ni_ppm</th>
<th>Au_ppm</th>
<th>Pt_ppm</th>
<th>Pd_ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR010</td>
<td>8168512</td>
<td>506403</td>
<td>1.02</td>
<td>&lt;1</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>0.001</td>
<td>&lt;0.005</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WR012</td>
<td>8168524</td>
<td>506416</td>
<td>1</td>
<td>&lt;1</td>
<td>10</td>
<td>&lt;10</td>
<td>0.001</td>
<td>&lt;0.005</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WR013</td>
<td>8168529</td>
<td>506407</td>
<td>8.83</td>
<td>13</td>
<td>10</td>
<td>&lt;10</td>
<td>0.006</td>
<td>&lt;0.005</td>
<td>0.001</td>
</tr>
</tbody>
</table>

- Gravity Survey planning.

Work during the reporting period has included:

- Open University (UK) /QUT collaboration confirmed and field visits completed.
- Completion of gravity survey.

6.1 Open University (UK) / QUT Collaboration

Dr Mike Widdowson will head a programme jointly funded with the Open University (UK), using a PhD student who will implement a programme of sophisticated geochemical analysis including sulphur isotope analysis (Leeds University) ICP_MS and Ar/Ar dating (Open University). XRF analysis will be completed by QUT. The research project will be titled “Architecture, chemostratigraphy and economic prospectivity of the Central Kalkarindji Flood basalt Province, Australia.” The programme will be funded from the 1 October 2011 to 30 September 2014 and will include two field visits to the area, use of thin section and electron microprobing.

The rationale behind the project in the Waterloo area is that the area contains substantial outcrop of Antrim Plateau Volcanics that represents a Mid-Cambrian Large Igneous Province (“LIP”) consisting of a thick pile of tholeiitic lava flows and interbedded sedimentary material. This “LIP” is believed to be prospective for Noril'sk-style Ni-Cu-PGE mineralisations. Understanding the volcanic stratigraphy and facies of the lava flows is key to understanding the relationship between faulting in the area and the role of faults in providing a centre of extrusion for volcanic feeder vents with the focus of the project being around the Blackfellow Creek Fault. This is integral to identifying the locations of potential shallow intrusions that could be situated beneath feeder vents and would be the potential location for Ni-Cu-PGE mineralisation (Mortimer 2012).

The aim of the project is to combine volcanological data and geochemical data which will aid in constraining the geological setting and evolution of the Antrim Plateau Volcanics and also will determine the geochemical characteristics and dimensions of recognisable stratigraphical units and eruptive packages at a variety of scales over the APV. The project will also establish the eruptive units that make up the volcanic hierarchy and their relationship to the broader regional geological setting. This detailed analyses will aid in determining the economic potential of the flood basalt succession, the likelihood of crustal
sill complexes and the potential for mineralisation within the surrounding country rocks and basement (Mortimer 2012).

Initial Results for the field work completed September 2010-August 2011. Analytical results (XRF&ICP-MS) of sampled eruptive units at Waterloo reveal them to be predominantly “low Ti-Tholeiitic basaltic andesites and basaltic trachy-andesites, with relatively high K, Na and Si and low Ca and Ti”. The eruptive units of the waterloo area can be subdivided into two groups based on TiO2 content, one with TiO2>1.35% and one with TiO2<1.22%. These groups can be separated using the trace elements Y, Zr, and La. This distinctive element enriched geochemical signature is rare amongst large igneous province tholeiitic basalts and may be a function of crustal contamination – thus the Waterloo region and the Kalkarindji province may represent an analogue to the Noril’sk-Yalnakh Ni Cu deposit (See Appendix 2 & 4 for more detailed description and diagrams).

A database of structural geology, geochemistry and already identified geophysical anomalies is being compiled and will be expanded on to help site upcoming drilling. The database has been expanded on with data from a team lead by Dr David Murphy from the Queensland University of Technology (QUT) (Mortimer 2012).

Field Work Carried out by the QUT during June/July 2011, involved a series of stratigraphic traverses in the area of Riedel Shears to the east and west of the major structural feature, the Blackfellow Creek Fault. (See Figure 4 and Appendix 3 for traverse locations). This trip follows the earlier one in November 2010, when the northern most basaltic outcrops in the vicinity of the Blackfellow Creek Fault were extensively mapped through a series of stratigraphic traverses. In that area the basalts were found to be almost perfectly flat lying and have relatively low degrees of alteration. In addition, most of the area mapped to the west of the Blackfellow Creek Fault demonstrated a coherent stratigraphic package of lavas that could be correlated over ~10km. However, a small number of traverses that where done further to the south but still to the west of the fault and traverses to the east of the fault all had very different stratigraphies that could not be correlated. Upon investigation of aerial photographs and regional magnetic data it became clear that the Blackfellow Creek Fault had a number of fault splays that appeared to be Riedel shears that correlated with the stratigraphic breaks (Mortimer 2012).
Figure 4: Stratigraphic Traverses for the Waterloo Area. Unit A-D are distinctive correlatable pahoehoe inflation units from North Waterloo. Locations of traverses are given in Figure 1 and Table 1.
The traverses are in the vicinity of the two regional stratigraphic drill holes, Waterloo 1 and 2, that were drilled by the BMR in 1969.

This allowed for the stratigraphic sequences encountered to be extended vertically.

All stratigraphic traverses were extensively sampled for petrological and geochemical investigation. The geochemical data obtained will examine features of the lava to make inferences about the lava formation. This will include petrological and barometry calculations (i.e., low pressure and melting experiments). This work is now underway and will provide invaluable information on the location of potential vents across a larger area of Proto’s tenements (Mortimer 2012). See Appendix 3 for traverse location and data. No sample data was available in a complete format or was still under analysis.

The field trip also investigated the nature of malachite mineralisation around the Limestone Hill locality. Several days were spent collecting samples and mapping zones of mineralisation at the Antrim Plateau Volcanics/Headleys Limestone contact.

Resampling of two stratigraphic drillholes in the Waterloo Area, completed in 1969 by the Bureau of Mineral Resources (BMR) was undertaken by QUT at Geoscience Australia in Canberra. The Stratigraphic drillholes: Waterloo 1 and Waterloo 2 (Bultitude 1972) were Reverse Circulation (RC) drilling with minor Diamond drilling. Both holes were interpreted to have thick lava flows (from 3.5m to 30m+). These two holes were resampled in May 2011 to verify Bultitudes (1972) stratigraphy and to sample the drillholes for petrography and geochemistry (See Appendix 4). Some 145 samples were taken at 1.5m intervals and shipped to the UK for analyses by XRF for major and trace element geochemistry and a sub set selected for isotopic (Sr and Nd) analysis. Unfortunately, due to the generally small size of the RC drill chips detailed vulcanological information was very difficult to ascertain. Nevertheless, it was evident that the original logging of Bultitude was excellent given the nature of the RC drill chips. In an effort to gleam more information from the stratigraphic holes each 5 foot drilling interval was sampled. A subset of this sampling is being analysed for petrography, major and trace element analysis. This will potentially provide evidence for additional lava units within some of the more disrupted intervals and also provide valuable information on the eruptive evolution of the volcanic sequence in the Waterloo area that can be matched to and augment the field evidence that was collected in July 2011. (Mortimer 2012).

To add to this work a Masters level project is under negotiation to investigate ‘and document the magnetostratigraphy of the APV succession. Results will aid in establishing
a detailed chronology of magnetic fluctuations during the eruption of the APV, this will aid in: (1) improving the tectonic interpretation of the northern Australian continental area and (2) develop a stratigraphic correlation tool which can then be extended throughout the Kalkarindji CFBP (Swensson 2012).

### 6.2 Gravity Survey

The rationale behind the Gravity survey in this region was to accurately survey the Blackfella Creek Fault which is thought to have acted as conduit for the Antrim Plateau Volcanics. The survey will define discrete targets identified during mapping in 2010. A semi regional gravity programme was completed at the Waterloo Project by Altas Geophysics Pty Ltd. The survey consisted of approximately 900 gravity stations surveyed at 500-100m spacing. The region was divided into a North and South Block. The North Block covered 400 line km at 500m spacing (some 192 sq km) and the South Block covered 1400 line km at 500m spacing (~686 sq km). The preliminary gravity results highlighted the Blackfella Creek Fault (oriented in a NE-SW direction) and several discrete gravity anomalies were identified. The results for this survey are found in Appendix 1 – Gravity Geophysics.

See Figures 3 & 4 for station locations and preliminary view of the data.
Figure 3: Location of Gravity Stations for the Waterloo Project.
Figure 4: Preliminary Gravity Survey Results for the Waterloo Project.
7. CONCLUSIONS AND RECOMMENDATIONS

2011-2012 provided Proto Resources & Investments the opportunity to commence work on a semi regional gravity survey over the region and to follow this up with the Research collaboration with Open University (UK) and the Queensland University of Technology (QUT).

During October research sponsorship was finalised confirming that leading volcanologist Dr Mike Widdowson of the Open University (UK) was seconded to an exploration collaboration centred on ProtoResources & Investments Ltd Waterloo Project. The collaboration will involve a PhD student and will involve support for a database, a “virtual spatial framework” of structural geology, geochemistry and already identified geophysical anomalies used to site future exploration in the Northern Territory.

Field work has commenced in the region with extensive stratigraphic work and sampling being undertaken. XRF and ICP-MS analytical results of the sampled eruptive units show them to be low Ti-tholeitic basaltic andesites and basaltic trachy-andesites with relatively high K, Na and Si and low Ca and Ti. The lavas also exhibit “extreme” crustal signatures with Th/Nb>1, enrichment in Pb and depletion in Sr. These geochemical signatures imply that there was significant crustal involvement during the genesis of the APV in this area. The High Si content and low Ca and Ti content is seen to be indicative of a high volatile content during crystallisation. This geochemistry could have been derived from a metasomatised mantle source or be due to ‘assimilation of significant quantities of hydrous crustal material during the passage through the continental crust – if the latter then the geochemistry of the Kalkarindji Basalts mimics that of the mineral rich Siberian example. (Swensson 2012).

Both the Gravity Survey and the Research Projects will effect planning for the 2012-2013 field season. Identified targets could be sited for more detailed Ground EM surveys and drilling.
8. REFERENCES


Appendix 1 – Geophysics – Gravity Data

Data
Folder: GR216-11_2012_A_02_APPENDIX_1_Gravity geophysics
Files: P2011016_Waterloo_GravityData.dat
P2011016_Waterloo_GravityData.ddf
P2011016_Waterloo_GravityData.des
P2011016_Waterloo_GravityData.dfn
PRW_WLOO_EL27420gravitystns0512.PNG
PRW_WLOO_GRAV2010_LOCPLAN-0512.PNG

Folder: P2011016_final
Files: P2011016_PROTO_Waterloo_Gravity.xls
P2011016_PROTO_Waterloo_Gravity_production_report.doc

Folder: GRIDS
Files: P2011016_PROTO_Waterloo_Gravity_GRS80HTM
P2011016_PROTO_Waterloo_Gravity_GRS80HTM.ers
P2011016_PROTO_Waterloo_Gravity_SCBA267MGAL
P2011016_PROTO_Waterloo_Gravity_SCBA267MGAL.ers
P2011016_PROTO_Waterloo_Gravity_SCBA267MGALVD
P2011016_PROTO_Waterloo_Gravity_SCBA267MGALVD.ers
Appendix 2 – NT Research Secondment Progress

Data – See following file.
STOCK EXCHANGE ANNOUNCEMENT

July 11, 2012
NT Research Secondment Progress

ASX Release Stock Code: PRW

Proto Resources & Investments Ltd (“Proto”, “the Company”) is pleased to update on geological research in the Northern Territory. The sponsorship commenced six months ago, and has provided strong inputs into Proto’s exploration across the Northern Territory, which now extends into northern Western Australia. Geochemical work is underway to better understand development of the basalts, but results so far have already encouraged Proto to focus on the areas that are most geologically prospective under Proto’s exploration models.

Executive Summary

Dr Mike Widdowson has completed the first six months of geological research into Vulconology of the Antrim Plateau Volcanics. Dr Widdowson together with a PhD student jointly funded with The Open University, UK has commenced a program of work that will culminate in sophisticated geochemical analysis including sulphur isotope analysis and Ar/Ar dating. The secondment will support the integrated database of structural geology, geochemistry and already identified geophysical anomalies that is being used to site upcoming drilling in the NT.

Key Findings were: The lava morphologies observed in the Waterloo region of the Kalkarindji LIP are similar to those observed in other Continental Flood Basalt Provinces. The Kalkarindji lava units in the Waterloo area (Blackfellow Creek examples) are predominantly basaltic trachy-andesites, rather than basalts typical of CFBP elsewhere. This enrichment in Si (and K, Na) may be a function of significant crustal contamination.

Progress of the Exploration Collaboration

Proto Resources & Investments Ltd (“Proto”, “the Company”) is pleased to announce progress under the research sponsorship (including linked professional secondment of leading volcanologist Dr Mike Widdowson) that is investigating Proto’s Northern Territory tenements. Dr Widdowson has been seconded to Proto as part of an exploration collaboration that included the funding of a dedicated PhD project focused on the Waterloo project area. Waterloo is being explored under Proto’s joint venture with Peak Mining and Exploration Limited (“Peak”) and is situated approximately 80km southeast of Kununurra in the Kimberley region of the Northern Territory. Waterloo sits within the extensive Antrim Plateau Volcanics. Waterloo comprises two granted exploration licenses (EL27416 and EL27420) and two applications (EL28504 and EL28505) that sit near the major structural feature, the Blackfellow Creek Fault. This work builds on the geochemical database, that has already been the subject of work by a team from the Queensland University of Technology (“QUT”) led by Dr David Murphy.

The reconnaissance and analytical work conducted at QUT and the Open University is to be presented at two major geoscience venues: The annual American Geophysical Union (AGU)
Fall Meeting in San Francisco, USA (December 2011), and at the Volcano and Magmatics Studies Group (VMSG) Annual Meeting at Durham University, UK (January 2012).

The current exploration and research project is an industry-academia partnership between Proto Resources, The Open University, UK, and QUT, Brisbane. The aims are to explore a large tract of the volcanic terrain lying some 1000 - 1500 km south of Darwin in the Northern Territories (NT) of Australia. Here occur remnants of lava sheets from a once extensive volcanic province, now known collectively as the ‘Kalkarindji’ continental flood basalt province (CFBP). This is the world’s most ancient CFBP for which significant thicknesses of the lava succession still remain preserved (Figure 1): many of the thickest, most complete and extensive successions are located in the Waterloo and Limbunya areas (Figure 2) which are currently under investigation by Proto Resources.

Due to their remoteness of the remnants relatively little is known, or has been published, about these volcanics and, because of erosion, the remnants now consist of scattered basaltic suites occurring across northern and central Australia: Together these suggest a minimum eruptive volume of c. 1.5 x105 km3, though an original total volume may have significantly exceeded 5 x 105 km3. Those extensive remnants currently of interest to Proto Resources are commonly collectively termed the ‘Antrim Plateau Volcanics’ (APV), and form a substantial sub-region of the wider Kalkarindji province (Figure 1).
Proto Resources interest in the Kalkarindji CFBP succession stems from its potential for hosting significant mineralization. Flood basalts are derived from the partial melting of Earth’s mantle. Once generated, the melt migrates towards the surface as a magma, or else become stored in chambers within the crust (>1 - 10 km depth); these chambers are then tapped by shallow conduits (dykes), and the magma is erupted at the surface as lavas. Importantly, this ‘plumbing system’ allows the hot magma to interact with the continental crust, and scavenge elements from it. Those lavas which contain significant amounts of scavenged contaminants are termed ‘contaminated lavas’. However, highly contaminated lavas are a rarity in most CFBP successions; but the Siberian Traps (Russia), and the Kalkarindji are notable exceptions to this rule. Importantly, the Siberian Traps host the Noril’sk-type deposits which are among the world’s most commercially significant mineral reserves. The challenge in Australia is to determine whether the Kalkarindji flood basalt province hosts similar mineral wealth to that of the Siberian example.

Waterloo Field reconnaissance

Field reconnaissance and follow-up laboratory research (September 2010 - August 2011) in the north-western part of the Waterloo region (Figure 2) of NT has delivered several important findings.

Extensive, flat lying lava flows are present as low mesas rising c. 160 m from the basement topography; the flanks of these allow access to a detailed volcanostratigraphy. The lava flows are predominantly simple sheet flows of up to 60 m thick of mostly aphanitic massive basalt with vesicular or brecciated/rubbly flow tops and, less commonly, plagioclase-phyric porphyritic lavas. Subordinate compound-type flows also occur. In detail, the flow types observed are subdivided into 4 groups; 1) sheet flows (50 - 60 m thick) with brecciated flow tops (Figure 3), poorly formed hackly columnar jointing and melt segregations; 2) pahoehoe sheet flows (30 - 40 m thick) with vesicular flow tops; 3) a plagioclase phryic sheet flow (15 m thick) with horizontal platy jointing and elongate vesicles, and; 4) laterally discontinuous flow lobes (5 - 25 m thick) with hackly (‘turtle shell’) jointing. A thin sandstone layer observed
beneath this lava flow succession contains ‘pepperite’ textures indicative of explosive interaction between lava and soft sediment.

Figure 3 – Brecciated flow top preserved in a c. 60 m thick eruptive unit in the Blackfellow Creek area of the Waterloo area.

In most areas APV basalts overlie eroded Precambrian rocks, but in some areas on massive Neoproterozoic to Early Cambrian quartz sandstones and, in some instances erupted before the sandstone was fully lithified. Interbedded with this volcanic succession are clean, arenitic sandstones (up to 10 m thick). Some of these sandstones may be of aeolian origin, but others are carbonate-rich, and are more typical of near-shore marine or fluvial environments. Early mid-Cambrian shallow-water sediments overlie the APV, and form thick successions passing from limestones, to organic-rich mudstones, and then marine/fluvial sandstones. In the Waterloo area, the APV are overlain by the Headleys Limestone (and the equivalent Montejinni Limestone to the south-east, Wave Hill area). Together, these sediments indicate that during, and immediately after eruption, this part of the basalt province remained topographically low and an active depocentre. Importantly, the encapsulating sedimentary succession (pre- and post-APV) contain potential sources of, and host sites for, mineralization.

Analytical results (XRF and ICP-MS) of the sampled eruptive units reveal them to be predominantly evolved low Ti-tholeiitic basaltic andesites and basaltic trachy-andesites, with relatively high K, Na and Si and low Ca and Ti (Figure 4). The eruptive units of the Waterloo area can be subdivided into two groups based on TiO2 content, one with TiO2 > 1.35% and one with TiO2 < 1.22% (Fig. 5b). These groups can also be distinguished using the trace elements Y, Zr and La.

The lavas also demonstrate extreme crustal signatures with Th/Nb >1, enrichment in Pb and depletion in Sr (Figure 5). Importantly, this distinctive Low-Ti character, and incompatible element enriched geochemical signature are far removed from typical LIP tholeiitic basalts found elsewhere in the world, and implies significant crustal involvement during the genesis of the Waterloo, APV and the wider Kalkarindji, basalt stratigraphy. Further, the high Si content and low Ca and Ti content is considered indicative of a high volatile content during crystallization. The atypical geochemistry of the Kalkarindji basalts is likely due to either
derivation from a hydrous metasomatised mantle source, or due to the assimilation of significant quantities of hydrous crustal material during passage through the continental crust. If the latter, then the chemistry of the Kalkarindji effectively mimics that of the mineral-rich Siberian example.

Figure 4 – Total alkali-silica diagram used to classify igneous rock types. Analysed Waterloo (Blackfellow Creek) samples are shown as green diamonds.

Figure 5 – Trace element and Rare Earth Element (REE) compositions of analysed Waterloo samples.

Paton Basin Field and ‘Argyle Corridor’ Reconnaissance

A field trip (20th September – 3rd October, 2011) reconnaissance was conducted by Dr Mike Widdowson (The Open University, Milton Keynes, UK) and Dr David Murphy (QUT,
Brisbane, Australia). This was to investigate key basaltic successions and geophysical anomalies identified within, and around the eastern side of the Ord Basin area (and Panton sub-basin, in particular) where the APV outcrop occurs. The team also visited the NTGS core archive.

The Ord Basin is a 40,000 sq km intracratonic basin of Phanerozoic age (dominantly Cambrian age sedimentary and APV infill), that lies to the east of the Halls Creek Fault zone (Limbunya area; Figures 2 and 6). It contains three, gently folded, asymmetrical synclines (preserving Cambrian basinal successions) which are (from N – S): the Argyle (smallest), Rosewood, and Hardman (largest), synclines. All are bounded on their northerly limbs by normal faults which are sub-parallel to the synclinal axis. A major NW – SE trending fault (Negri Fault) transects the Hardman syncline forming the Panton sub-basin. The core of the Hardman Syncline contains a thick succession of Devonian age conglomerates and alluvial sandstones that lie with marked unconformity upon the Cambrian succession. The eroded remnants of these conglomerates and sandstones now form the internationally important geomorphology of the Bungle-Bungles in the Purnululu National Park.

The Ord Basin is the result of extensional tectonics, and provided accommodation space for the accumulation and preservation of voluminous mafic lava infill and later sedimentary successions during the ensuing marine incursion. At the base of the preserved Cambrian stratigraphy is the continental tholeiitic basaltic succession of Mid-Cambrian age (i.e. Antrim Plateau Volcanics), which form a substantial part of the 700,000 sq km Kalkarindji flood basalt province of Northern Australia (Figure 1). The basalts are thickest in the Ord Basin (c. 1100 m) suggesting that this region was close to the eruptive centre. Post-volcanic marine incursion in the late Cambrian developed the Negri Subgroup consisting of the Headleys (elsewhere, Montejinni) Limestone, Nelson Shale (a sulphide-bearing black shale succession), Linnekar Limestone and Panton Formation. Intertidal and fluvial sands of the overlying Elder Sub-group terminate this Cambrian succession. In the late Devonian vertical movement along the Osmond Fault initiated an alluvial fan, and associated braided stream-aolian siliclastic depositional system (Mahony Group). The Mahony Group is restricted to the Hardman Syncline where its eroded remnants form the Bungle-Bungles.
A major lineament feature, termed the ‘Argyle Corridor’, is apparent as a structural complex consisting of a series of en-echelon NW – SE trending faults. These extend c. 100km from the western end of the Rosewood syncline, passing east of the Hardman syncline core, and then form the SW boundary of the Panton sub-basin (Negri Fault), before extending into the Limbunya area as the Nutwood Fault (Figures 2 and 6). The existence of the Argyle diamondiferous pipe (Argyle Diamond mine) is postulated to be the result of emplacement along a zone of structural weakness created by the intersection of the Argyle Corridor and the recognised SW-NE trending Halls Creek Fault zone. It is argued that where the Argyle Corridor is elsewhere intersected by other major SW – NE faults (e.g., West Baines Fault, Osmond Fault and Red Rock Fault), these zones of weakness likewise could have been exploited by magmatism (Antrim volcanic intrusions), emplacement of sister diamondiferous intrusions, or else provided the loci for movement of hydrothermally-driven mineralising fluids.
The field team were unable to investigate the section in the Purnululu National Park due to access restrictions. By contrast, extensive reconnaissance was achieved along the Duncan Highway which passes for c. 300 km along the eastern side of the Ord Basin, and eventually connects with the Victoria Highway SE of Kununurra. Along this traverse the southernmost exposures of basalt were characterised by large, breccia-topped flow units which lie unconformably upon Precambrian basement. The uppermost is capped by the widespread Headley’s limestone. Further northward along highway, an increasingly higher topography provides sections through thicker successions of the basalt stratigraphy, though regional dip remains low so that considerable distances are travelled along the same flow before rises or falls in elevation allow observation of flow units above and below. Crossing the West Baines and Blackfellow Creek Faults provides opportunity to examine different parts of the basalt succession. At the northern end of the Duncan Highway, the succession has already been investigated and mapped by QUT students (see above).

Literature review reveals that two deep boreholes, Waterloo #1 and #2 were sunk by BMR (now Geoscience Australia) in the early 1970s. These penetrated the basalt succession for c. 200 – 300 m on the southern side of the NE – SW trending Blackfellow Creek Fault, a third, Limbunya #1, was sunk, c. 150 km to the south, in the Limbunya area. Material from these bores is preserved at the core repository in Canberra, and sub-samples are currently being geochemically analysed by QUT and the Open University.

This background work has identified several exploration targets that will be further explored in the area:

Magmatic – Nor’ilsk-type Ni, Cu, and PGE in association with APV: The northern part of the Panton basin is likely to contain the thickest preserved sections of the APV succession (c. 1000 m of extrusive volcanics). Work conducted by QUT and the Open University in the Waterloo area to the north, demonstrate at least 400 m of succession in the region currently under investigation (i.e., Newry and Rosewood Stations). Further, data from archive BMR boreholes in the Waterloo area (Waterloo #1 and #2; Figure 7) demonstrate a substantial subsurface basalt succession. Given these thicknesses, the Panton Basin and adjacent Waterloo regions are more likely to contain the original focus of extrusive volcanism. Importantly, establishing the occurrence of Nor’ilsk-type mineralization requires the identification of either, intrusive magmatic bodies, feeder dykes, or vent systems. These are more likely to occur nearer the original focus of magmatic activity.

It is important to note that key sites described in the reports occur at the intersections of the Argyle Corridor lineament and the West Baines, Osmond, and Red Rock faults. If further reconnaissance work along the Negri Fault and within the Panton Basin were to prove promising, then these should be considered as a priority for future attention and detailed exploration.

Stratigraphically-related/stratiform Cu/Ag and Zn/Pb mineralization: This may occur in association with the Nelson Shale succession, and within the vesiculated/rubbly tops of the APV lava units, and Headley’s Limestone succession. The Nelson Shale is documented as containing sulphide minerals. Growth of such minerals occurs during early diagenesis of organic-rich sediments, and is known to effectively scavenge and concentrate key elements (e.g. Cu) from ground waters. Subsequent decomposition of pyrite and chalcopyrite, and release/remobilisation of the constituent elements, may be responsible for the observed
secondary mineralization stratiform hosts such as the Headleys Limestone, and vesiculated/rubbly tops of the APV.

Structurally-related mineralization along the NW-SE Negri (and Limbunya) fault system: It is likely that these deep-seated features cut through both the exposed Cambrian volcano-sedimentary units, and penetrate into the sub-cropping Proterozoic successions. Such structures provide effective conduits for hydrothermally-driven mineralising fluids. The Caves prospect lies in the Cambrian succession adjacent to the Negri Fault.

**Geochemical and Analytical Research**

Following advertisement and recruitment of the Proto Resources/Open University jointly-funded PhD research project, Peter Marshall, a post-graduate from Leeds University was selected. Peter started his employment at the Open University in September, and undertook a month-long visit to QUT during November 2011. During this visit, Peter worked closely with co-supervisor, Dr David Murphy (QUT) and the two Masters students, Nathaniel Clark and Benjamin Gray, who are currently engaged in Proto Resources funded research projects on the APV.

Peter spent time collating and updating the existing APV sample database (collected in the Waterloo field area by Drs. Murphy and Widdowson, and the Masters students during the 2011 – 2011 period). In addition, the Waterloo (i.e. ‘Blackfellow creek’) sample set was placed into a new geospatial database (incorporating Google Earth information), which now contains all known exploration within the Kalkarindji province. The eventual aim is to give a graphical view of how each sample set relates to one another in a geographical as well as stratigraphical sense. This database will be fundamental to understanding the volcanic architecture across Kalkarindji CFBP province.

Using volcanological techniques developed during fieldwork by the QUT team, sampling of the BMR ‘Waterloo’ cores (Waterloo #1 and #2) was conducted at GeoScience Australia in Canberra: a total of 145 samples were taken (at 1.5 m intervals throughout the borehole depth of c. 300 m). The aim of this sampling was to compare the vertical stratigraphy of the core material with that derived from field data. A further sub-set of 12 samples were then selected from throughout the whole core length. These 12 were selected on their suitability for thin-sectioning and geochemical analysis, which included assessing samples for levels of alteration.

A similar exercise was performed on the Limbunya #1 core material (sunk during the same program as the Waterloo boreholes in 1971; Figures 8 and 9). The ‘BMR Limbunya #1’ hole is located c. 150 km south of both Waterloo holes (Figure 6). These samples have been shipped to the UK, and will be analysed during the coming months by XRF for major and trace element geochemistry, and a sub-set selected for isotopic (Sr and Nd) analysis.
Figure 8 – A selection of the samples from Limbunya #1 core. Each sample contains 1.5 m of core, sampled as aggregated chips. Each box contains c. 25 m of core.

Figure 9 – Vesiculated flow top at a depth of 71.3 – 71.6 m in Limbunya #1 core. The white marks are calcite amygdales which have in-filled the gas vesicles which formed within the flow top.

In addition an additional targeted Masters-level project is under negotiation for September 2012 – June 2013, which will aim to investigate and document the magnetostratigraphy of the APV succession. Results will aid in establishing a detailed chronology of magnetic fluctuations during the eruption of the APV. This will aid in: (1) improving the tectonic interpretation of the widely northern Australian continental area and, (2) developing a stratigraphic correlation tool which can then be extended throughout the Kalkarindji CFBP.

Enquiries:

Mr Andrew Mortimer
Managing Director
Proto Resources & Investments Ltd
Office: +61 (2) 9225 4000
Mobile: +61 (0)433 894 923
Appendix 3 – Stratigraphic Sections and sample waypoints

Data

Folder: GR216-11_2012_A_03_APPENDIX_3_Stratsections

Files: stratsections and sample waypoints minus workings 2.xls
Appendix 4 – Reanalysis of BMR Holes

Data –
Folder: GR216-11_2012_A_04_APPENDIX_4_Reanalysis of BMR Holes

Files:
Waterloo 2 - Geochem.xls
Waterloo 1 - Geochem.xls
Probation Report.pdf
P Marshall_IGC_Abstract.doc
Limbunya 1 – Geochem.xls
Kalkarindji.KMZ
Appendix 1.pdf
Appendix 2.pdf
Borehole Volcanostratigraphy of the Central Kalkarindji CFBP, Australia

Peter MARSHALL\textsuperscript{1}, Mike WIDDOWSON\textsuperscript{1}, David MURPHY\textsuperscript{2}, Benjamin GRAY\textsuperscript{2}, Nathaniel CLARK\textsuperscript{2,3}

\textsuperscript{1}Dept. Environment, Earth & Ecosystems, The Open University, Walton Hall, Milton Keynes, UK. MK7 6AA; Email peter.marshall@open.ac.uk
\textsuperscript{2}Biogeosciences, Queensland University of Technology, Brisbane, QLD 4000, Australia.
\textsuperscript{3}Newcrest Mining Limited, 400 George Street, Brisbane, QLD 4000, Australia.

The Kalkarindji flood basalts are remnants of the world’s most ancient CFBP, for which significant thicknesses of the lava succession still remain preserved. This 505-510 Ma LIP now consists of scattered basaltic suites across northern and central Australia, which together indicate a minimum eruptive volume of $1.5 \times 10^{15}$ km$^3$, though this may have been at least 5 times this size prior to erosion.

The western Waterloo region contains some of the best preserved and most extensive lava flows. Within this region, an area SE of Lake Argyle (c. 600 km$^2$), contains three boreholes sunk to depths of 200 - 300 m. Field reconnaissance reveals flow units to be thick (40 - 60 m) sheet-like aphanitic basalt with vesiculated or rubbly flow-tops. Each flow package is chemically distinct allowing for direct comparison between borehole stratigraphy and surface exposures, and the interpretation of palaeo-flow patterns across large distances. The general geochemical characteristics of the units indicate predominantly evolved, low Ti-tholeiitic basaltic andesites and basaltic trachy-andesites exhibiting extreme crustal contamination signatures. Therefore, composition of the Kalkarindji eruption is distinct from other, more typical, tholeiitic CFBP successions elsewhere.

We present new stratigraphical data of archive material from boreholes BMR Limbunya 1, BMR Waterloo 1, & BMR Waterloo 2, (drilled in 1971). Detailed inspection of core-chip material combined with detailed geochemistry provides a method for flow-unit identification and thus the basis for correlating over distances of c. 100 km. Comparisons between these logs reveal insights to both correlative stratigraphy and larger-scale eruption mechanics within this central region.