Alcoa of Australia Limited

EL3350 - Howard Island, Arnhem Land
Annual report for the period ending 19/10/2015

Target Commodity: Bauxite

Maps

1:100 000	Topographic Series	
	Howard	5973
1:250 000	Geological Series	
	Arnhem Bay-Gove	SD/53-3-4

Prepared by Alex Hatch February 2016

TABLE OF CONTENTS

1 ABSTRACT

EL3350 on Howard Island, East Arnhem Land was initially granted in October 2014 after traditional owners provided consent for bauxite exploration following a period of punctuated consultation dating back to 1981. Exploration programs aim to test whether bauxite occurrences on the eastern side of Elcho Island, reported by Plumb (1965), have analogies on Howard Island and whether the occurrences are indications of a significant deposit of marketable bauxite. Preliminary geological reconnaissance included the collection and analysis of 5 samples of float, the best of which returned assays of 11.7% available alumina and 16.9% reactive silica. Pervasive cover limits exposure of the underlying laterite and a program of vacuum drilling is planned to better test the laterite thickness and alumina grade across the license.

2 COPYRIGHT

3 LOCATION, TITLE HISTORY, PHYSIOGRAPHY AND ACCESS

The subject of this report, EL3350, covers an area of 71.72km^2 on Howard Island and was initially granted on October 20th 2014 for a period of 6 years.

Howard Island is Aboriginal Freehold Land and is located about 550km east of Darwin just off the East Arnhem Land coast. Access is only possible by light aircraft or boat but there are no scheduled services of either to the island. A gravel airstrip adjacent to the settlement of Langarra on the north coast Howard Island is suitable for single engine aircraft. Shallow draft barges are able to access the beach adjacent to Langarra during high tide. The Marthakal Homeland Resource Centre barge operated by the Marthakal Rangers was used during this program to transport four-wheel drive vehicles and personnel from Elcho Island to Howard Island.

Two four-wheel drive vehicles used to complete the program were hired from Marthakal Yolngu Airlines at Galiwin'ku Airport.

EL3350 occupies the interior of the western two thirds of Howard Island. It represents the larger of two areas, for which consent was received, from an exploration license application that covered the whole of Howard Island. The license area, initially applied for in 1981, was the subject of a number of periods of consultation and moratorium before consent areas were agreed following consultation meetings held in 2012. These were passed by the full council of the Northern Land Council (NLC) in May 2014 prior to the approval of the Federal Minister of Indigenous Affairs and the subsequent grant of exploration licenses. A work program was proposed to traditional owners at a meeting facilitated by the NLC in June 2014 and subsequently this program of preliminary exploration was planned to coincide with an archaeological survey commissioned by the NLC. The coincidental running of the archaeological survey and the geological reconnaissance meant that the cost of logistics, in particular the barging, could be shared between the two programs.

EL3350 forms part of Alcoa's Arnhem Land project consisting of five semi-contiguous applications, being Elcho Island, Howard Island and three mainland applications immediately to their south (see Figure 1). Authorisation 0865-01 and the associated Mine Management Plan is current for exploration activities on EL22821, EL3350 and EL29848 on Elcho and Howard Islands.

The title area is relatively flat and generally overlain by a residual sandy to silty soil cover. Surface water appears limited to two small swamps in the south and drainage lines are poorly defined and intermittent, apparently flowing only briefly after heavy rain.

Access to the title area once on the island is by four-wheel drive vehicle. An access track that links Langarra and Nikawu at the eastern end of Howard Island was not well defined, overgrown and cut in several places by fallen trees. Despite this, it was possible to traverse this track by four wheel drive vehicle from Langarra to within about 1 km of the eastern edge of the title area. All other traverses were on foot.

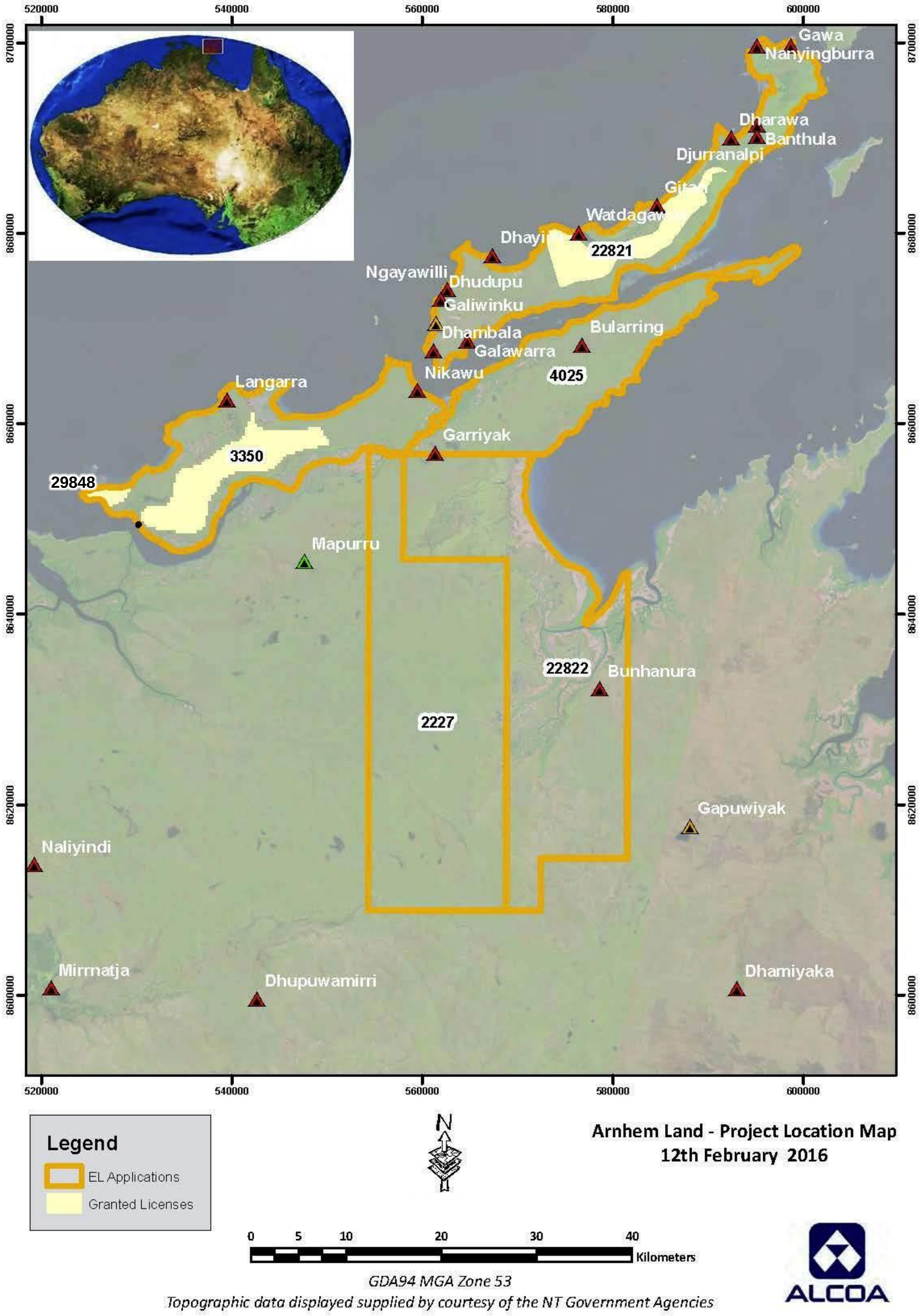

Figure 1. Location map showing license boundaries relative to Exploration License Applications

4 GEOLOGICAL SETTING, EXPLORATION HISTORY AND EXPLORATION RATIONALE

Geologically, Elcho Island and Howard Island sit in the onshore portion of the Arafura Basin. A detailed description of the geology of the Arafura Basin can be found in Rawlings (1997). Beneath cover, the geology of Howard Island is dominated by the Elcho Island Formation with limited exposure of the younger Jigaimara Formation on the north coast of the island. The surface geology of EL3350 is dominated by alluvium and residual soil that ranges from sand to silty sand. This cover masks an underlying laterite which is exposed only on coastal cliffs and sits unconformably on the sandstones and siltstones of the Elcho Island Formation. Sub-cropping siltstones and sandstones in some locations suggest that the laterite is absent in these areas.

No record of previous mineral exploration within EL3350 has been found, although the presence of laterite is noted on the drill logs of water bore drilling carried out in the 1980s. Two bauxite occurrences on the eastern side of Elcho Island, recorded by Plumb (1965), provided the impetus for exploration of Elcho and Howard Islands. The occurrences are essentially untested and Ferenczi (2001) suggested that the area “may host bauxite deposits comparable to those on Marchinbar Island”.

The target of the current exploration is lateritic bauxite of marketable grade that could be added to the sea-borne market, most of which is bound for China. In this setting, the target bauxite would lie immediately below cover within the laterite profile and if present, could be up to several metres thick. The aim of the reconnaissance described is to sample outcropping laterite to allow refinement of a follow-up program of drilling. The drilling program aims to test the thickness and grade of the bauxite without missing individual targets of approximately five million tonnes.

5 EXPLORATION INDEX MAP

The exploration index map has been plotted at 1:100,000 and is included as an attachment with the filename EL3350_2015_A_02_IndexMap.pdf.

6 SURFACE GEOCHEMISTRY

The aim, during reconnaissance, was to sample available laterite exposure within the license area. These samples were expected to provide an indication of alumina content in the laterite that would allow refinement of the drilling program to follow. The opportunity was taken at the same time to conduct an archaeology survey and assess conditions along access-ways and drill pads planned on 1km centres.

Vehicle access within the license area was limited to the main access track, so the traverses walked seeking exposure all originated on this track and roughly followed likely rig access. Grab samples of float were collected on the traverses, but no outcropping laterite was encountered. It turned out that low coastal cliffs along the north coast and seen from the ocean during the barge ride from Elcho Island, were the limit of laterite exposure observed on Howard Island. The cover was pervasive throughout the area traversed, although sub-cropping siltstone encountered occasionally, suggested a discontinuous laterite cap.

Five samples were collected and transported to Alcoa’s Mining Laboratory at their Kwinana Refinery. Once there, the samples were dried, crushed, split to around 375g and re-packaged. The samples were then pulverized at Bella’s on-site contract facility in preparation for analysis by Alcoa’s Mining Laboratory. All samples were analysed in duplicate for a standard suite of analytes using the respective reference methods. One blank and one standard sample was analysed with each batch of samples. Since analysis, pulverized material from all samples has been stored at the mining laboratory.

Table 1 contains a summary of analyses and the respective analysis methods. More detailed descriptions of the sample preparation and analysis methods are provided in Appendix 1.

Table 2 shows the results of the main analytes of interest. Sample H002 with Av. Al_2O_3 of 11.7% and Re.SiO2 of 16.9% was the best sample from a bauxite perspective suggesting limited potential. Also of interest is sample H001, a piece of iron rich sandstone, which returned a value of 94.1% Fe_2O_3.

Table 1. Summary of the standard suite and their respective reference methods

Code	Description	Formula	Unit	Method
CO	Carbonate	$NaCO_3$	kg/t	BD/NDIR
EO	Organic Carbon	EOC	kg/t	BD/NDIR
OX	Oxalate	NaC_2O_4	kg/t	BD/GC
MS	Magnetic Susceptibility		CGS	
AL	Available alumina	Av. Al_2O_3	%W/W	MD/ICP-MS
SI	Reactive Silica	Re. SiO_2	%W/W	MD/ICP-MS
AT	Total Alumina	Al_2O_3	%W/W	XRF
FE	Iron	Fe_2O_3	%W/W	XRF
NA	Sodium	Na_2O	%W/W	XRF
ST	Silica	SiO_2	%W/W	XRF
TI	Titanium	TiO_2	%W/W	XRF
GA	Gallium	Ga_2O_3	%W/W	XRF
KP	Potassium	K_2O	%W/W	XRF
PT	Phosphate	P_2O_5	%W/W	XRF
SU	Sulphate	Na_2SO_4	kg/t	
SU_READING	Sulphur	SO_3	%W/W	XRF
BO	Boehmite	y-AlO(OH)	%W/W	XRD

Table 2. Summary of surface sampling analysis results

Date	Zone	MGA East	MGA North	Sample ID	Description	AL	SI	AT	FE	ST	TI
						Av. Al2O3	Re. SiO2	Al2O3	Fe2O3	SiO2	TiO2
		m	m			%W/W	%W/W	%W/W	%W/W	%W/W	%W/W
10/08/2014	53	544896	8658637	H001	Fe stained sandstone	0.00	1.59	2.44	94.11	3.82	0.10
10/08/2014	53	549026	8658722	H002	Fe rich pisolitic cemented float	11.70	16.87	38.50	14.79	25.63	1.80
11/08/2014	53	547994	8658490	H003	Laterite nodules picked clean from silty overburden	0.53	16.18	28.16	25.30	31.55	0.76
13/08/2014	53	542722	8658716	H004	Clay cemented Fe rich nodular float	0.00	12.82	23.26	38.30	25.71	0.77
12/08/2014	53	544122	8658051	H005	Fe rich nodular cemented float	1.85	11.92	21.81	42.97	20.65	0.73

7 CONCLUSION AND RECOMMENDATIONS

The lack of suitable access meant that reconnaissance was restricted to the northern half of EL3350. The archaeological survey undertaken on that part of the title will allow complete coverage of drilling at 1km centres, and given the low prospectivity indicated in work to date, it was not thought necessary to clear access to allow investigation of the southern portion unless an indication of bauxite is found in sub-surface samples.

The presence of pervasive cover and the need to better inform a decision on how to proceed in the southern half of the license, suggests that a drilling program is prudent. As a result, the recommended next step is a program of vacuum drilling to cover the area surveyed. This will allow the collection of sub-surface samples through the laterite profile and provide a more conclusive indication of the bauxite prospectivity of the northern part of the license. It should also be possible to infer, from the results of that program, the potential for a bauxite discovery in the southern part of the license area and by doing so assess the need to establish access.

8 REFERENCES

Ferenczi P, 2001. Iron ore, manganese and bauxite deposits of the Northern Territory.
Northern Territory Geological Survey, Report 13.

Plumb KA, 1965. *Wessel Islands-Truant Island, NorthernTerritory. 1:250 000 geological map series and explanatory notes, SC 53-15, 16*.
Bureau of Mineral Resources, Geology and Geophysics, Australia, Canberra.

Rawlings DJ, 1997. *Arnhem Bay-Gove, SD 53-3, 4*. *1:250 000 geological map series explanatory notes.*
Northern Territory Geological Survey, Australia.

9 APPENDIX 1: ANALYSIS METHODS

9.1 Sample Preparation – milling

The samples are processed by an automated robotic system whereby they are milled to 85 % passing 180 micron in a bank of ring mills. The milled samples are then split and the retained portions deposited into plastic sample containers. These containers are 80mm in diameter and 20mm high, and hold approximately 80g to 100g. A matching bar-coded lid is printed and automatically placed on the container after scanning confirms that there is sufficient sample in the container. If there is insufficient sample, the system halts until the issue can be diagnosed and rectified by a laboratory operator. The discarded portions of the post milling splits are discarded to waste.

9.2 EOC, CO & OX Reference Analyses

For the reference determinations of Extractable Organic Carbon (EOC), carbonate (CO) and oxalate (OX), samples are digested in a bomb oven at 145^{0}C in a 10ml pressure vessel bomb using 52% carbonate free caustic. The final liquor is centrifuged and diluted ready for TIC, TOC & GC analysis.

Sample determinations of TIC (carbonate) and TOC (EOC) are performed by wet oxidation. TIC is determined by measuring CO_2 released when a sample is acidified with Phosphoric acid. The CO_2 is purged from the solution and detected by a NDIR detector that has been calibrated to directly display the mass of CO_2 detected. After the sample is acidified and purged of TIC, sodium persulphate is added. The oxidant quickly reacts with organic carbon in the sample at 100^{0}C to form CO_2. The carbon dioxide is purged from the solution and also detected by the NDIR. The resulting mass of carbon dioxide is proportional to the mass of the TOC in the sample.

Gas Chromatography (GC) is used in the measurement of sodium oxalate (Ox) in process liquor samples, which involves a sample being vapourised and injected onto the head of the chromatographic column. The sample is transported through the column by the flow of an inert, gaseous mobile phase. The column itself contains a liquid stationary phase which is adsorbed onto the surface of an inert solid.

9.3 Al & SI Reference Analyses

Available alumina and reactive silica reference determinations are conducted using ICP analysis. The samples are digested in a microwave oven using a 13% caustic solution. Internal Standard and 13% Sulfuric acid is later added to the digested solution and diluted in preparation for ICP analysis.

The ICP is used to analyse for Al and SI simultaneously using pre-prepared Av.Alumina and Reactive Silica standards. The ICP instrument works by pumping the sample from an auto sampler rack through a capillary tube into a nebuliser unit where the liquid sample is converted into a fine aerosol mist which is carried into the spray chamber. A small portion of the mist is carried into the plasma which looks visually like a flame. The sample is introduced as a mist into the plasma which excites each element to emit light at defined wavelengths. The intensity of the light emitted from each element is then compared with calibration standards to determine the concentration.

9.4 MS Analyses

The sample is placed inside a magnetic coil and the frequency through the sample is measured. The difference between this and the frequency with no sample in the coil is used to calculate the magnetic susceptibility (MS).

9.5 BO Reference Analyses

For the analysis of Boehmite (BO), reference samples are micronized to a fine size suitable for XRD analysis, pressed and presented to an XRD instrument.

XRD has the potential to qualitatively and semi-quantitatively estimate the main mineralogical components within a bauxite sample.

9.6 FE, ST, PT, SU & AT Reference Analyses

For the reference determinations of total iron (FE), total silica (ST), total phosphorous (PT), sulphur (SU_READING) and total alumina (AT), the sample (a mixture of flux and the unknown sample) is weighed accurately, fused in a platinum crucible and cast into a platinum mould to produce a glass disc. This disc is presented to the XRF instrument for analysis of the routine elements present. The accuracy of the XRF analysis is increased by using the fusion technique of sample preparation, in which particle size and mineralogical effects are eliminated.

10 APPENDIX 2: GLOSSARY OF ABBREVIATIONS AND TERMS

Abbreviation	Description	Used as
AHD	Australian Height Datum	Geodetic datum for altitude measurement in Australia
EL	Exploration Licence	Mineral title for non-extractive exploration
GDA94	Geocentric Datum of Australia 94	projected coordinate system for Australia
GPS	Global Positioning System	Allows reliable location information
ICP-MS	Inductively Coupled Plasma Mass Spectrometry	Analysis method
MGA	Map Grid of Australia	Coordinate system based on the UTM projection and GDA94
NDIR	Non-Dispersive Infra-Red	Analysis method for gases (CO_2)
PDF	Portable Document Format	File type
XRD	X-Ray Diffraction	Semi-quantitative analysis method
XRF	X-Ray Florescence	Analysis method for major oxides