

Orocobre Limited - Positive Results from PFS for Boric Acid Plant

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Brisbane, Australia (ABN Newswire) - [Orocobre Ltd.](#) (ASX:ORE) (TSE:ORL) is pleased to announce the results of a Pre-Feasibility Study ("PFS") on the development of a 25,000 tpa boric acid plant at Olacapato in NW Argentina ("Olacapato Project").

Positive Results from Pre-Feasibility Study for 25,000 tpa Boric Acid Plant at Olacapato

Key Findings:

Production Rate	25,000 tpa Boric Acid
Capital Cost	US\$ 18.2 million plus \$2.6m in working capital and commissioning costs.
Payback	4.9 years
Cash Operating Cost at 25,000tpa	484 US\$/ton
After Tax NPV (10%)	\$18.1 million
After Tax IRR%	24%
Modelled Project Life	20 years
Measured and Indicated Resources	1.02 Million tonnes B2O3

The Project has strong fundamentals with a healthy after tax internal rate of return of 24% based on modeled project life of 20 years underpinned by a resource base of 1.02 million tonnes B2O3.

The engineering design and cost estimates for the preliminary Feasibility Study was undertaken by Borax Argentina staff and consultants in conjunction with CP/QP Consulting Processing Engineer, Peter Ehren. The resource estimate and geological aspects were undertaken by CP/QP Consulting Geologist, Murray Brooker.

Richard Seville Managing Director and Chief Executive Officer of Orocobre Ltd. said:

"We are very pleased to announce the positive results of our PFS." Mr. Seville said. "The project has a modest capital requirement and an attractive IRR and we will advance the project now to the Definitive Feasibility Study stage and permitting. Although not material in itself, this project is part of a range of initiatives and projects in each of the product streams which are rejuvenating Borax Argentina and will establish it as a major and profitable regional player."

Introduction

Borax Argentina SA, including the Porvenir ulexite mine and land at Olacapato 40kms south of the mine, was acquired by Orocobre from Rio Tinto Minerals in August 2012. Borax Argentina has been in operation for over 50 years and operates open pit mines in Tincalayu, Sijes and Porvenir. There are concentration plants in Tincalayu, Sijes and Porvenir (not currently used) and refinery facilities in Campo Quijano. Additionally, the large deposit at Diablillos is essentially undeveloped, although some ulexite is mined for processing into boric acid.

There are presently three product streams. Firstly, the mineral tincal is mined and concentrated at the Tincalayu mine and then carted approximately 350kms to produce the range of Borax chemicals at Campo Quijano. Secondly, ulexite is mined (mainly at Porvenir) and transported to Campo Quijano to produce Boric Acid. The third product stream, hydroboracite and colemanite are mined at Sijes and concentrated to produce mineral concentrates for direct sale.

Currently at Porvenir, ore is selectively mined at 21% B₂O₃ and then transported to drying areas where it is spread in windrows, to a height of approximately 20 cm. The windrows are turned regularly by hand rakes over a 3 week period to increase drying by the sun and wind and to remove sand and clay from the ulexite, resulting in a feed grade of 26% B₂O₃. Following drying, the material is loaded into trucks and transported to the company's current operating Boric Acid plant in Campo Quijano, 300kms to the south-east. This boric acid plant has a capacity of 9,000tpa and was designed to process a high grade ore feed.

A pre-feasibility study ("PFS") has been completed to investigate the construction of a new boric acid plant in Olacapato, only 40 km south of the Porvenir mining operations, to produce up to 25,000 tpa of boric acid (Figure 1). The design concept behind this plant is to process lower grade run-of mine ore produced by more mechanised and lower unit cost methods. The plant is being designed for a feed grade of approximately 18% B₂O₃. This allows an economic cut-off grade of 9%. The results of the PFS are presented herein.

Location and Properties

Porvenir and Olacapato are located at the north end and south end respectively of the Cauchari salar (Figure 1). The project is in the Puna geographical region, at an altitude of ~3900 m above sea level, 160 km west-northwest of San Salvador de Jujuy, and 225 km west of Salta.

Porvenir lies approximately 20 km south of the paved highway (Figure 2) that passes through the international border with Chile, approximately 80 kilometres by road to the west (Jama Pass). That road continues on to the major mining centre of Calama and the port of Mejillones in northern Chile, a major port for the export of mineral commodities and import of mining equipment. Olacapato with a population of 186 (INDEC, 2001) is 40 km south of the Porvenir leases and is on the unsealed road from San Antonio de Los Cobres to Chile via the Sico Pass. The railway line from Salta to Antofagasta (currently not used) passes through Olacapato as does a gas pipeline.

[Orocobre](#), through its 100% owned subsidiary Borax Argentina, owns thirty nine mining properties in the Cauchari salar which contain a significant resource of ulexite (Figure 2). Borax Argentina holds the rights to mine the borate mineralisation and has granted Lithium Americas Ltd, through its Argentine subsidiary Exar SA, a right to extract brine from these properties until 18 May 2041 for which it receives a royalty payment.

At Olacapato, the company holds properties and easements acquired in the past for the purpose of building mineral processing facilities. The PFS considers mining of ulexite at Porvenir and cartage of the ore to Olacapato for production of boric acid.

Geology, Exploration Data and Interpretation

Borates are the group of minerals which consist of boron bonded with oxygen and cations such as Ca, Mg and Na. Economic borate mineralisation largely consists of minerals such as ulexite (NaCaB₅O₆(OH)₆₋₅(H₂O)) and borax which were deposited in salar (salt lake)/playa-lake environments. Significant borate deposits are located in Turkey, the USA and Argentina. These are regarded as industrial minerals and have a wide range of uses. These include uses as fluxes in a wide variety of industrial applications, as frits for the glass industry and in industrial products such as fibre glass and flame retardants. Boric acid is used in a wide variety of applications including glass, ceramics, fertilisers and wood preservatives. The market has a growth profile above world GDP growth. Boric acid is 56.3% B₂O₃.

The ulexite at Porvenir most frequently occurs within sandy and clayey units as potato-sized clots which are referred to as papas (Figure 3). Sandy units are developed on the margins of the alluvial fans surrounding the Cauchari salar. Where boron-bearing groundwater is transported towards the salar, papas of ulexite grow/precipitate in these sandy units. Clayey units are developed outside the sandy channels and these host deposits of finer grained ulexite referred to as barras. Ulexite mineralisation is hosted in up to four different horizons, although 62% of test pits encountered a single ulexite horizon.

Porvenir Mineral Resource

The total area covered by the Porvenir properties is 40.03 km² with the resource covering 17.5 km² within

these properties and the area exploited by mining to date covering 1.34 km². As the Porvenir deposit is currently being mined, areas of historical mining have been surveyed and removed from the resource calculated from the pit sampling. The resource estimate at Porvenir is compliant with the JORC 2012 code and is entirely based on pit sampling.

Mineralisation occurs in flat lying interlayered sand and clay units, with variations between the papa and barra styles of mineralisation within mineralised units generally corresponding to change in host lithology. As mineralised units cross host lithologies there has been no differentiation of areas/domaining of the resource based on lithology, as the resource is planned to be exploited in non-selective operation.

The Mineral Resource at Porvenir has been reported at two cut-off grades (refer announcement of 2nd April 2014, "Porvenir Historical Estimate Upgraded to JORC Compliant Resource"). The first estimate is based on the current mining cut-off of 16% B₂O₃ which is appropriate to the current mining and processing operation describe above. The second estimate is based on an economic cut-off grade of 9% B₂O₃ which takes into account the anticipated total operational costs of the Porvenir mine, the contemplated Olacapato processing plant and a price of US\$775/t boric acid (FOB). These estimates are set out in Table 1:

Table 1: The Porvenir Measured and Indicated Resource at 9% B₂O₃ cut-off

Classification	Cut-off grade	Tonnes	Grade% B ₂ O ₃	Tonnes B ₂ O ₃
Measured	9%	4,907,877	14.5	710,672
Indicated	9%	1,942,433	16.0	310,517
Measured & Indicated	9%	6,850,000	14.9	1,020,000

Mining

In order to produce better capital efficiency and produce 25,000 tonnes per annum through the processing plant discussed later, the mining cut-off has been raised to 14% B₂O₃. This allows mineable production of approximately 3.3 million tonnes at 18.7% B₂O₃ pre-dilution as detailed in Table 2.

Table 2: The Porvenir Measured and Indicated Resource with 14% B₂O₃ Cut-Off

Classification	Cut-off grade	Tonnes	Grade% B ₂ O ₃	Tonnes B ₂ O ₃
Measured	14%	2,173,234	18.4	398,932
Indicated	14%	1,113,957	19.3	214,776
Measured & Indicated	14%	3,287,191	18.7	613,708

Mining is planned to occur using simple strip mining techniques to a maximum depth of approximately 3m using excavators, loaders and trucks. If required, the ulexite bed will be cleaned of overlying waste before mining the ulexite. Based on experience from the existing operation, dilution has been estimated at 15%. The ore will then be carted to a drying pad where it will be dried for 10 to 20 days to reduce moisture content and allow dry screening to remove sand gangue. Following screening, the ulexite ore will be transported to Olacapato at approximately 19% B₂O₃. Mining, drying, screening and cartage costs are based on quotations from experienced local contractors based on Porvenir being a "stand alone" operation not integrated with the company's other mining operations at Sijes and Tincalayu.

Processing

Borax Argentina has been producing boric acid at Campo Quijano since 2003 in a 9,000 tpa plant designed for a ulexite with 26% B₂O₃ feed grade with ore sourced principally from Porvenir, a distance of 300 kms. Therefore, the company has significant operating experience.

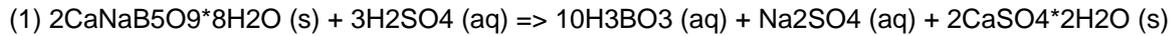
The proposed new plant is based on processing lower grade ore of approximately 16-20% B₂O₃ and the plant has been designed accordingly (Figure 4) based on operating experience and test work (Figure 5) to investigate leach kinetics, acid consumption and solid-liquid separation.

The production process of boric acid from ulexite is relatively simple and consists of the following process

steps:

- Milling. The mined ulexite is fed to the plant and milled in order to improve leaching of the borate.

- Leaching. The ulexite is leached with recycled acidified mother liquor, which is unsaturated in boric acid. The sulfuric acid transforms the borate in boric acid and precipitates the calcium as gypsum according to the following reaction.



The reaction is elaborated at 80°C in order to improve reaction kinetics and to take advantage of higher boric acid solubility at this temperature. The resulting pH of the reaction is about 3 in order to assure all the borates are leached and present as boric acid.

- Solid-liquid separation. The insoluble solids (sand and clay from ulexite minerals together with the precipitated gypsum) are separated by filtering. The cake is washed in order to reduce boron losses. The solids are disposed in a tailings pile.

- Crystallization. The pregnant mother liquor is cooled in a crystallizer in order to precipitate boric acid. The solubility of boric acid decreases strongly with temperature and therefore boric acid crystallizes by cooling.

- Solid-liquid separation & washing. The boric acid is thickened and filtered in a belt filter in order to separate the solids from the mother liquor. The product is washed with treated water in order to remove the impregnated mother liquor. The mother liquor is recycled to the leaching step. A fraction of the mother liquor is also purged in order to remove the impurities.

- Drying & Packing. Finally the boric acid is dried and packed as final product.

A recovery of 80% has been simulated based on current plant performance and planned modifications.

Boric Acid Markets

Of the approximately 1.6 million tonnes/year of B₂O₃ equivalent consumed worldwide it is estimated that more than 80% is used as refined borates - 48% as refined sodium borates (borax) and 34% as refined non-sodium borates such as boric acid. The balance (18%) is used directly in the form of a boron mineral concentrate.

In glass manufacturing, for example, the precise form of the boric oxide depends on the type of glass being manufactured. For the most part, this is usually as refined hydrated or anhydrous borate, as boric acid, or as natural minerals such as borax or colemanite. The form used largely depends on the type of glass produced. - In heat resistant glasses, boric acid, anhydrous borax, borax pentahydrate and borax decahydrate may be used while in insulation grade fibreglass borax pentahydrate is preferred. In textile grade fibreglass non-sodium forms such as boric acid is used.

Over the past ten years or more there has been a trend towards the production and use of refined borates, largely driven by the increased demand for refined product in the vitreous sector which accounts for 60% of B₂O₃B₂O₃ demand worldwide. Of these, the fastest growth in demand over recent years has been in boric acid.

The estimate of global demand for borates was 2 million tonnes of B₂O₃ in 2012 with demand projected to reach 2.23 million tonnes of B₂O₃ between 2014-16. A major driver of any growth in borate sales is demand for insulation grade fibre glass (IGFG), which is intimately linked with construction activity and energy prices. Similarly, the growth of technical grade fibre glass (TGFG) has been driven by the increased production of products based on fibreglass-reinforced composites which are replacing wood, metal, ceramics and other traditional materials. In particular, there has been considerable growth in the use of continuous reinforced thermoplastics in aerospace and automotive areas plus new applications in the furniture, fastener, medical and marine markets for example. Demand for frits and glaze in ceramics is growing and the main production area has shifted from southern Europe and the United States to Asia.

There is no direct substitute for borates as a micronutrient in agriculture and this is a growing segment for borate demand as farming becomes more intense and sophisticated and biofuels become more popular.

Clearly the supply - demand balance is the key determinant of future prices. In many sectors when prices rise it attracts would-be producers or the expansion of existing suppliers, but the limited opportunities for new production or even expansions in borates limits the potential for new supply (supply is relatively inelastic due

to the significant entry barriers and lead time in bringing capacity expansions on stream).

The boric acid price adopted for the PFS is US\$775/t based on the average 2013 import pricing in Brazil on an FOB port of dispatch basis.

Production Rate and Project Life

The processing plant has been designed to produce 25,000 tpa boric acid at 80% recovery from a 16%-20% B₂O₃ feed grade. To produce this approximately 95,000 tonnes (dry) at 18.7% B₂O₃ are planned to be mined each year to produce 25,000 tpa of boric acid to total 1.9 million tonnes over 20 years. Based on these requirements, there are sufficient resources to support a 20 year project life at a 14% B₂O₃ mining cut-off with substantial resources remaining at the end of the period, both above the 14% B₂O₃ mining cut-off and between the 9% economic cut-off and the 14% B₂O₃ mining cut-off grade.

Capital Cost

Development of the process engineering flow sheet and mass balance has been undertaken by Consulting Processing Engineer, Peter Ehren. Capital cost estimates were undertaken by the Borax Argentina professional staff and reviewed by Peter Ehren. The PFS capital cost estimate (Table 3) is based on a conventional EPCM implementation methodology and is estimated to an accuracy of +/-15% and includes a 20% contingency.

Table 3: CAPEX Summary Table

Construction Capital	US\$ (,000's)
Boric Acid	\$9,509
Tailings Pond	\$396
Utilities	\$807
Buildings	\$1,760
Operational Infrastructure	\$1,566
Freight	\$686
EPCM	\$281
Contingencies	\$3,001
Sub-Total	\$18,006
Other Capital	
Pre-construction studies	\$200
Working Capital during commissioning	\$596
Working Capital during operating	\$2,019
Sub-Total	\$2,815
Total	\$20,821

The capital cost estimate allows for detailed engineering design, EPCM and owner's costs (working capital) through the development period and through to positive operating cash flow. Expenditure is based on initial construction of 15,000tpa production capacity (US\$15.8 million) with expansion to 25,000tpa capacity in the following year (US\$2.2 million) for a total of US\$18 million in construction capital. Working capital has been allowed for both phases. The timing of capital expenditure is set out in Table 4 below.

Table 4: Capital Expenditure Timing

Description	(U\$S)		
	Year 1	Year 2	Year 3
Pre construction capital	-200,000		
Commissioning		-596,257	
Construction Capital	-15,821,948	-2,184,687	
Sustaining Capital			
Working Capital		-1,345,688	-672,907
Total	-16,021,948	-4,126,633	-672,907

Borax Argentina staff have considerable experience in local supply, having built the current Boric Acid plant in 2002 and also through managing the current Borax plant relocation.

Operating Costs

Operating cost estimates (Table 5) were undertaken by the Borax Argentina professional staff and reviewed by Peter Ehren and are estimated to an accuracy of +/-15%. Borax Argentina staff are very familiar with local operating costs as the company is an operating business including the operation of a boric acid plant. Mining costs are based on contractor quotation including drying, screening and transport.

Table 5: Cash Operating Costs

	US\$t	
	Yr 2	Yr 3 to 20
Mining	115	115
Reagents	122	122
Personnel	61	37
Utilities	65	65
Maintenance	27	16
Packing	16	16
Internal Freight	41	41
Camp	31	18
Other	26	25
Overhead	14	9
Sales costs	33	20
	551	484

At the forecast 25,000 tonnes per annum production rate, the cash operating cost is estimated at US\$484 per tonne of industrial grade boric acid. Improvements to costs are possible through:

- Production of sulphuric acid at Olacapato
- Optimisation of mining through integration with the company's other mining operations at Sijes and

Tincalayu

- Optimisation of the mining schedule

These aspects will be considered in future investigations.

Economic Analysis

An economic analysis has been undertaken using a model developed by the Borax Argentina professional staff. The model has been reviewed by Processing Engineering Consultant Peter Ehren. The analysis has been undertaken in constant US\$ based on Argentine cost inflation equalling Argentine currency devaluation.

Analysis of after tax NPV at different discount rates:

Table 7: NPV analysis

Discount Rate	NPV in US\$ million
0.0%	\$69.7
7.5%	\$25.8
10%	\$19.3
12.5%	\$12.6

The 0% NPV is equivalent to the cumulative after tax cash flow over the modelled 20 years.

The economic analysis includes the various investment provisions as allowed for under the Argentina Mining Code, including accelerated depreciation and includes the following royalties and applicable taxes.

- Corporate Tax - 35%
- Royalties - 3% mine mouth value
- Export Duties - 5% (Argentina law rebates: General 2.5%; Puna Rebate - 2.5%.)

Project Development

The Company is encouraged by the results from the PFS and will be advancing the project to the next phase. This will focus on Feasibility Study level mining engineering studies to develop an overall life of mine schedule and an Ore Reserve statement. As the plant capital estimate and operating costs estimates are both to +/-15% accuracy, this area will move directly to the detailed engineering stage. The option of production of high purity boric acid will also be considered as part of the final project scope. EIS's are currently in preparation for submission to the government authorities.

The next stage in the project development should take approximately 6 months.

To view the complete release including Forward Looking Statements, Technical Information, Competent Persons' and Qualified Persons Statements with diagrams and charts, please visit:
<http://media.abnnewswire.net/media/en/docs/ASX-ORE-792396.pdf>

About Orocobre Limited:

[Orocobre Ltd.](#) is listed on the Australian Securities Exchange and Toronto Stock Exchange (ASX:ORE, TSX:ORL), and is building a substantial Argentinian-based industrial minerals company through the construction and operation of its portfolio of lithium, potash and boron projects and facilities in the Puna region of northern Argentina. The Company is building in partnership with Toyota Tsusho Corporation the first large-scale, "greenfield" brine based lithium project in 20 years at its flagship Salar de Olaroz resource, with projected production of 17,500 tonnes per annum of low-cost battery grade lithium carbonate scheduled

to commence at the end of Q2, 2014. The Company also wholly-owns Borax Argentina, an important regional borate producer. Orocobre is included in the S&P/ASX 300 Index and was named 2012 Mining Company of the Year by Argentine mining magazine Panorama Minero and the Fundacion para el Desarrollo de la Mineria Argentina ("Fundamin" or Foundation for Development of Argentina Mining).

Contact:

Australia and Asia
David Hall, Business Development Manager
[Orocobre Ltd.](#)
T: +61 7 3871 3985
M: +61 407 845 052
E: dhall@orocobre.com

North America
James Calaway, Chairman
[Orocobre Ltd.](#)
M: +1 (713) 818 1457
E: jcalaway@orocobre.com

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