



# Investor Presentation

Advancing the Makuutu Rare Earths Project

20 July 2020

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This presentation should be considered in its entirety. If you do not understand the material contained in this presentation, you should consult your professional advisors. The sole purpose of this presentation is to provide shareholders with an update on current activities of the Company and the current state of exploration at the Makuutu Rare Earths Project in the Uganda.

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## Competent Person Statements

Information in this report that relates to previously reported Exploration Targets and Exploration Results has been cross-referenced in this report to the date that it was originally reported to ASX. Ionic Rare Earths Limited confirms that it is not aware of any new information or data that materially affects information included in the relevant market announcements.

The information in this report that relates to Mineral Resources for the Makuutu Rare Earths deposit was first released to the ASX on 23 June 2020 and is available to view on [www.asx.com.au](http://www.asx.com.au). Ionic Rare Earths Limited confirms that it is not aware of any new information or data that materially affects information included in the relevant market announcement, and that all material assumptions and technical parameters underpinning the estimates in the announcement continue to apply and have not materially changed.

# A Major, Low-Cost Rare Earths Development Opportunity

## IXR acquiring up to 60% of the Makuutu Rare Earths Project

- Makuutu is a strategically / geopolitically significant Rare Earth Elements (“REE”) project located in Uganda
- Project at advanced exploration and development study stage
- Confirmed ionic clay rare earth mineralisation, akin to Chinese ionic clay projects, and clay-hosted deposits are currently the lowest-cost sources of critical and heavy rare earths in the world
- Updated Mineral Resource Estimate underpins massive potential with more drilling to come in the next 6 months
- Near-surface, high-grade exploration results indicate low-cost mining pathway
- IXR now at 31% ownership
- Scoping Study / Preliminary Economic Assessment has commenced and expected to be completed in late 2020

## Project area well supported with excellent infrastructure

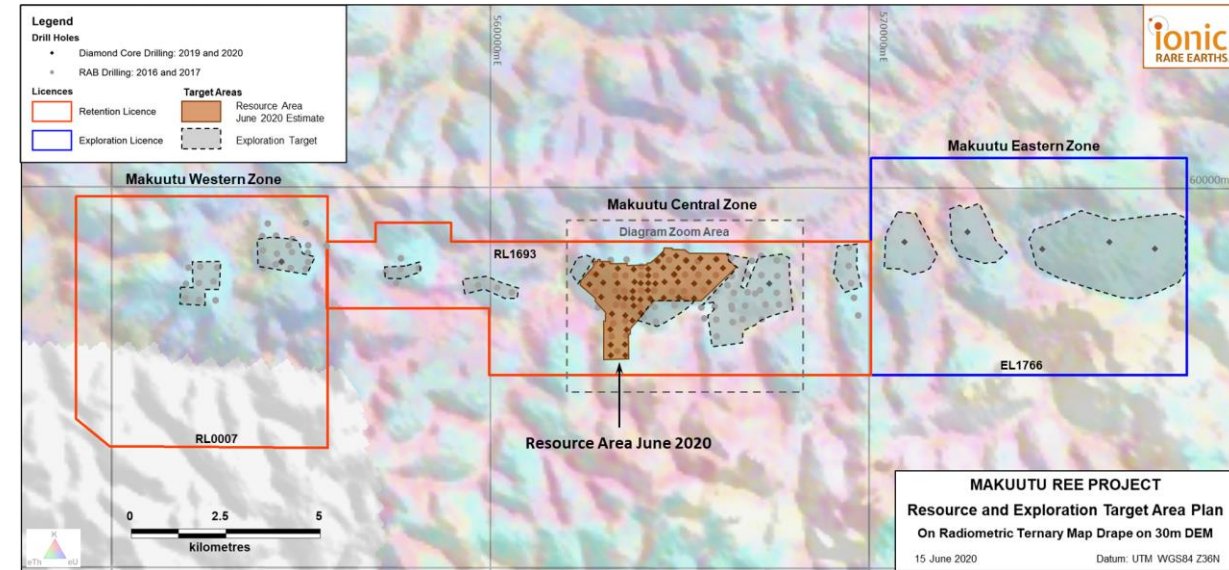
- Easy highway and road access to site, nearby power infrastructure with readily available hydropower, rail, cell phone communications and water availability



Makuutu Rare Earths Project Location

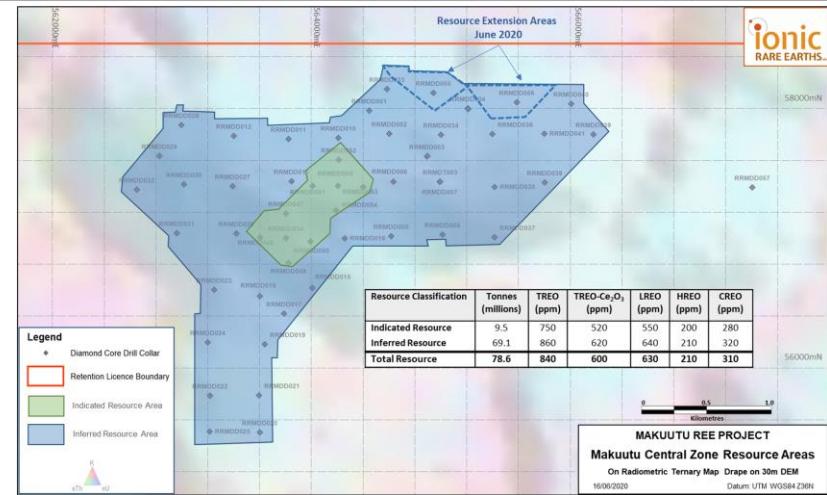
# Updated Mineral Resource Estimate

- 903m of drilling in 2019 and 2020 defining MRE
- Makuutu Mineral Resource Estimate<sup>1</sup> reported above a 300 ppm TREO less Ce<sub>2</sub>O<sub>3</sub> marginal cut-off grade
- MRE only contains Clay domain
- Potential for significant resource extension with additional drilling given tested less than 20% of Exploration Target area
- 26 km of mineralisation corridor to explore (upside!)
- 2020 drilling program resumed mid July, with 3,700m remaining to be drilled



Category	Estimation Domain	Tonnes (Mt)	TREO (ppm)	TREO no Ce <sub>2</sub> O <sub>3</sub> (ppm)
Indicated Resource	Clay	9.5	750	520
Inferred Resource	Clay	69.1	860	620
<b>Total Resource</b>	<b>Clay</b>	<b>78.6</b>	<b>840</b>	<b>610</b>

\* Rounding has been applied to 0.1Mt and 10ppm which may influence grade average calculations.



<sup>1</sup> ASX announcement 23<sup>rd</sup> June 2020.



# Ionic Rare Earths Limited Corporate Snapshot

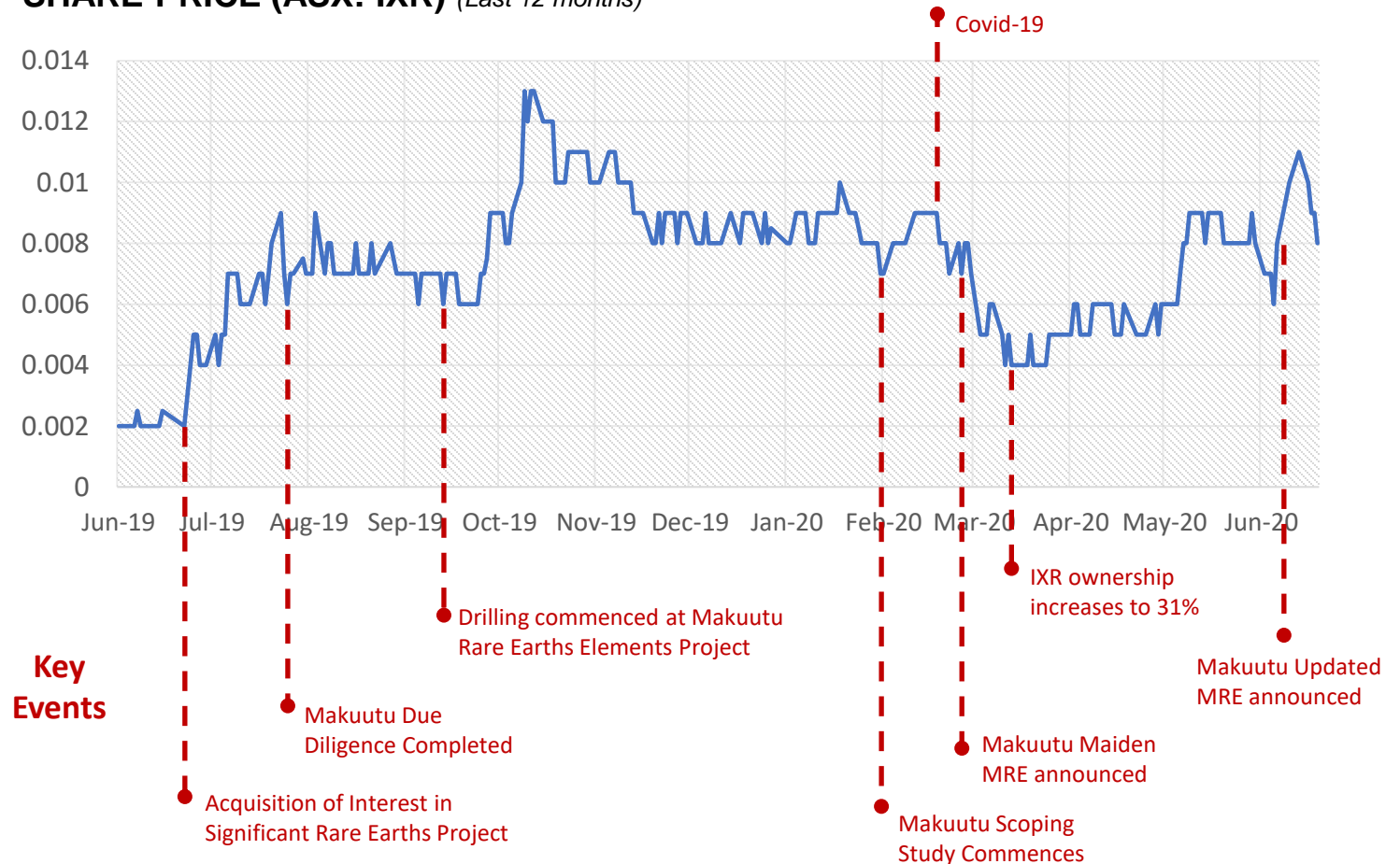
## CAPITAL STRUCTURE (As At 17/07/2020)

Shares Outstanding	2,473,828,050
Total Options Outstanding	472,000,000 <small>(exercisable at 0.75 to 1.8 cents)</small>
Share Price	A\$0.008
Market Capitalisation	A\$19.8 million
52 week share price range	A\$0.002 – A\$0.015

## IXR MAJOR SHAREHOLDERS

Major shareholders	17%
Executives, Directors & Key Advisors	17%

## SHARE PRICE (ASX: IXR) (Last 12 months)



# An Advanced Stage Project Opportunity

**IXR earning into Rwenzori Rare Metals Ltd. (RRM, Ugandan), which holds 100% of the Makuutu Rare Earths Project:**

- Ionic Rare Earths – 31% currently (earning up to 60%)
- Rare Earth Elements Africa (REEA) (currently 59% and reducing)
- Ugandan Partners (currently 10% and reducing)

## **Ionic clay-type geology:**

- Similar to major rare earths projects in Southern China which are responsible for majority of global supply of low-cost rare earths, specifically the high value Heavy Rare Earths (>95% originating from ionic clays)

## **Work already completed at Makuutu by Ionic Rare Earths:**

- ✓ Large Exploration Target, supported by drilling demonstrating near-surface, thick intercepts of REE-bearing clay mineralisation
- ✓ Metallurgical testing confirms high recoveries of the ionic-clay hosted REEs using simple, traditional and low-cost techniques
- ✓ Updated Mineral Resource Estimate from preliminary drilling to date

## **Easy access to local infrastructure and workforce**

**Project development to proceed with a targeted staged approach in the next 12 months**

**Scoping Study underway, expected to be completed in Q4 2020**

# A Clear Focus on Efficient, Timely and Successful Development

*“Through the technical expertise of the executive and in-country team, Ionic Rare Earths aims to systematically de-risk, develop and advance the Makuutu Rare Earths Project up the value curve”*

**For Success, attractive metrics for a successful Rare Earth Project are:**

- ✓ High grade and high-value heavy rare earths (HREEs) to yield high value-per-tonne mineralisation; a hallmark of a cost-competitive project
- ✓ Favourable metallurgical characteristics with sufficient REE recovery and simplicity that provide multiple avenues for a low-OPEX process route
- ✓ Technical expertise to efficiently and effectively add project value and move up the value curve
  - ✓ **The Makuutu Rare Earths Project team tick all the boxes**

**Makuutu Project – Building a World-Class Rare Earths Operation by:**

- ✓ Defining a strategic and geopolitical alternative REE resource outside of China
- ✓ Converting the large Exploration Target to JORC Mineral Resources and Ore Reserves
- ✓ Building a simple, low-cost mining and processing operation
- ✓ Producing a favourable, high grade (+90% REO) concentrate and selling to external refinery – avoiding a high CAPEX downstream processing plant

# Ionic Clay REE vs. Hard Rock REE Projects

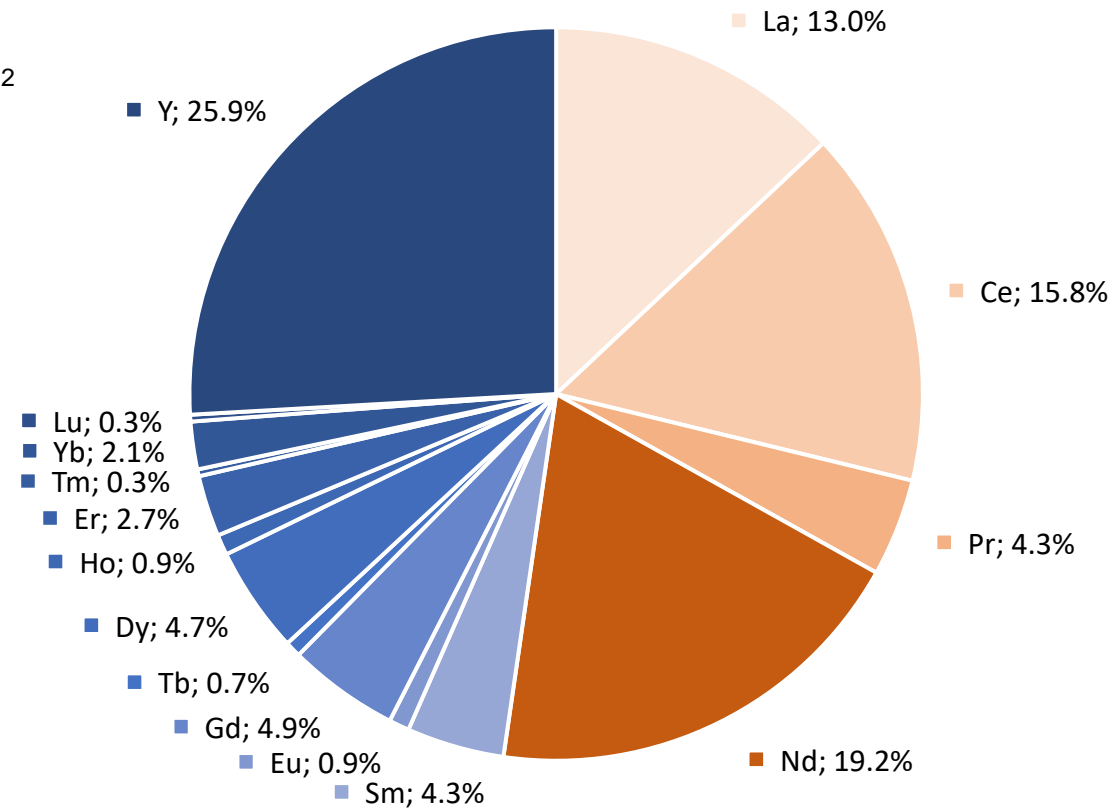
Significant project and cost advantages associated with ionic clay projects like Makuutu

MINING/PROCESSING STAGES	IONIC ADSORPTION CLAY-HOSTED REE	HARD ROCK-HOSTED REE
<b>MINERALISATION</b>	Soft material, negligible (if any) blasting Elevated HREO/CREO product content	Hard rock; Bastnaesite and Monazite (LREO dominant); Xenotime (HREO dominant)
<b>MINING</b>	Low relative operating costs: Surface mining (0-20 m) Minimal stripping of waste material Progressive rehabilitation of mined areas	High relative operating costs: Blasting required Could have high strip ratios
<b>PROCESSING – MINING SITE</b>	No crushing or milling Simple process plant Potential for static or in-situ leaching with low reagent consumption at ambient temperature	Comminution, followed by beneficiation that often requires expensive (flotation) reagents to produce mineral concentrate
<b>MINE PRODUCT</b>	Mixed high-grade rare earth precipitate, either oxide or carbonate (+90% TREO grade) for feedstock directly into rare earth separation plant, low LaCe content	Mixed REE mineral concentrate (typically 20 – 40% TREO grade), high LaCe content, requires substantial processing before suitable for feed to rare earth separation plant
<b>PRODUCT PAYABILITY</b>	70-80% payability as a mixed Rare Earth oxide/carbonate/chloride	35-40% payability as a mineral concentrate
<b>PROCESSING - ENVIRONMENTAL</b>	Non-radioactive tailings Solution treatment and reagent recovery requirements (somewhat off-set by advantageous supporting infrastructure)	Tailings often radioactive (complex and costly disposal) Legacy tailing management
<b>PROCESSING – REFINERY (TYPICALLY NOT ON MINING SITE)</b>	Simple acid solubilisation followed by conventional REE separation Complex recycling of reagents and water	High temperature mineral “cracking” using strong reagents to solubilise the refractory REE minerals Complex capital-intensive plant required Radionuclide issues follow REE mineral concentrates



# Makuutu Basket – Strategic Alternative for CREO/HREO

- Product generated from metallurgical optimisation testwork<sup>1</sup> infers basket price of approx. US\$34.40/kg REO using June 2020 spot pricing<sup>2</sup>
- Ionic Adsorption Clay (IAC) products achieve payability of 70-80%, so revenue circa US\$24 to US\$27.50/kg REO
- Product contains > 51% Critical REO, > 47% Heavy REO
- Strategically important supply alternative for CREO/HREO
- Basket quality generated from IACs is superior to bastnaesite / monazite mineral concentrate products, circa US\$10 to US\$18 / kg REO (using June 2020 spot pricing<sup>2</sup>), with only 35-40% payability, i.e. US\$3.50-US\$7.20/kg REO revenue



Makuutu Preliminary Product Basket<sup>3</sup>

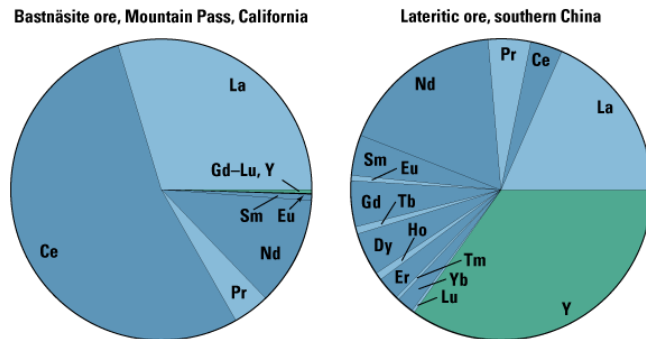


Figure 6. Proportions of individual REE in two representative ores: bastnaesite, dominated by La, Ce, and Nd, with Eu through Lu plus Y totaling only 0.4%; and lateritic ion-adsorption ore, Y-dominated. Dark blue and light blue sectors represent lanthanides of even and odd atomic number, respectively (see figs. 2, 3). Yttrium is indicated by green.

Comparison on the left of two baskets<sup>4</sup>, on left Bastnaesite at Mountain Pass (USA) with nearly 80% made up of low value LaCe product, and only 35/40% payable without significant capital expenditure to process, compared to the more valuable basket on the right which is a south Chinese Ionic Adsorption clay where LaCe only makes up approx. 23%, and payability exceeds 70%.

<sup>1</sup> ASX announcement 26<sup>th</sup> May 2020; <sup>2</sup> REO Pricing Spot June 2020 - <https://institut-seltene-erden.de/unser-service-2/metall-preise/seltene-erden-preise/>;

<sup>3</sup> Rounding has been applied; <sup>4</sup> Rare Earth Elements—Critical Resources for High Technology \_ USGS Fact Sheet 087-02\_files;

# Tier-One Infrastructure already there!

## Logistics

- ✓ Approximately 10 km from Highway 109, connecting Makuutu to both capital city Kampala and Port of Mombasa, Kenya
- ✓ Approximately 20 km from rail line connecting to Port of Mombasa

## Power

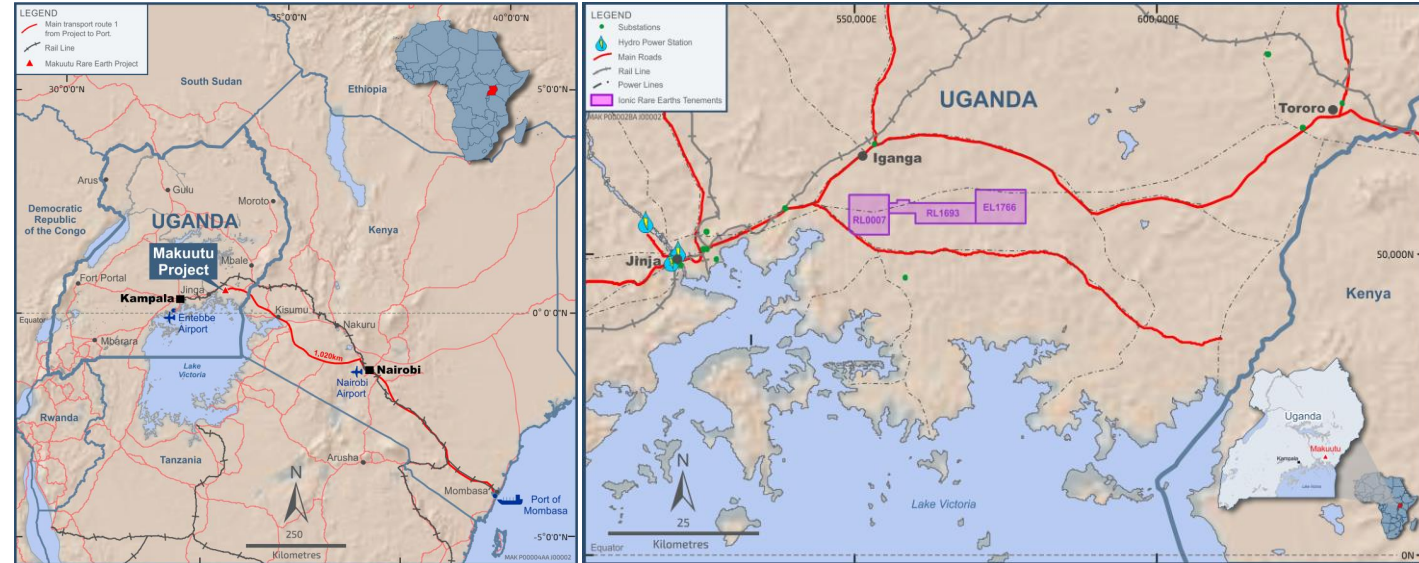
- ✓ Large hydroelectric generation capacity within 80 km of Makuutu project area will deliver very low-cost power
- ✓ Existing electrical grid infrastructure near to site

## Water

- ✓ Plentiful fresh water within and near project area

## Workforce

- ✓ Low-cost professional local workforce



**Makuutu Rare Earths Project site and existing Infrastructure Access**



Images; From left, Isimba hydroelectric dam with 183 MW installed capacity at Jinja, rail line connect to Kampala and Port of Mombasa, all weather access roads connecting site to highway, sealed highway running directly adjacent site, and 132 kV power lines running through site.

# Development highlights since Acquisition

- Announcing an updated Mineral Resource of **76.8 Mt @ 840 ppm Total Rare Earths Oxide (TREO)**<sup>1</sup>, at a cut-off grade of 300 ppm TREO-Ce<sub>2</sub>O<sub>3</sub>; while maintaining its Exploration Target at:

**270 - 530 million tonnes grading 0.04 – 0.1% (400 – 1,000 ppm) TREO**<sup>2</sup>

*This Exploration Target is conceptual in nature but is based on reasonable grounds and assumptions. There has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource.*

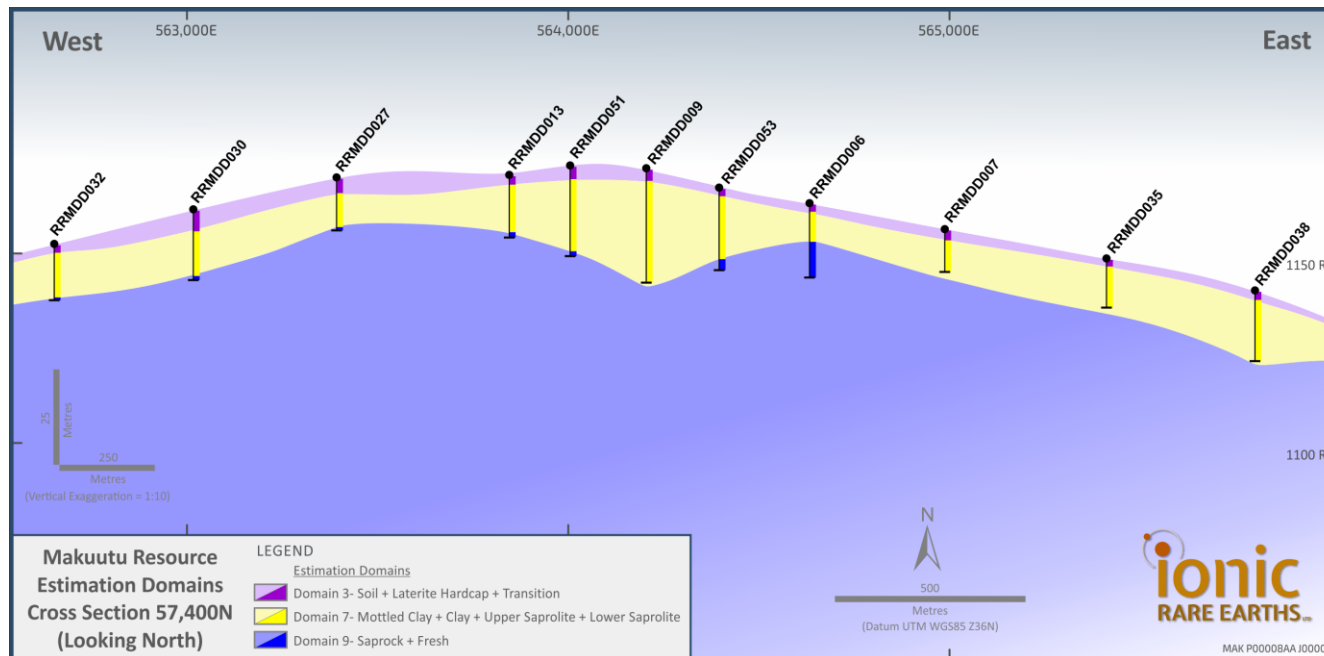
- Shallow, near surface orebody, with clay layer averaging 11.9m thick under cover approximately 3m deep;
- Achieving encouraging **metallurgical recoveries of up to 75% TREE-Ce**<sup>3</sup> (Total Rare Earth minus Cerium) using simple extraction techniques – desorption/leaching and precipitation;
- Heavy rare earth elements (HREE<sup>4</sup>) generally achieve higher recovery compared to the Light rare earth elements (LREE<sup>5</sup>), with average HREE recovery typically being double the average LREE recovery;
- Exploring analogous low CAPEX, low OPEX modular processing options enabling short construction lead time and ramp up to commercial production, and scalable modules to increase production capacity very quickly;
- Rare Earth product is dominant in critical rare earth elements (CREE<sup>6</sup>), with Nd + Eu + Tb + Dy + Y > 50% of product mass, or > 55% when including Pr, leading to high basket price product
- Strong project support within Uganda from community and government to develop the Makuutu Rare Earths Project.

<sup>1</sup> ASX announcement 23<sup>rd</sup> June 2020; <sup>2</sup> ASX announcement 4 September 2019; <sup>3</sup> ASX announcement 18 February 2020; <sup>4</sup> HREE = Sm + Eu + Gd + Tb + Dy + Ho + Er + Tm + Yb + Lu + Y; <sup>5</sup> LREE = La + Ce + Pr + Nd;

<sup>6</sup> CREE = Nd + Eu + Tb + Dy + Y;

# Near Surface Mineralisation

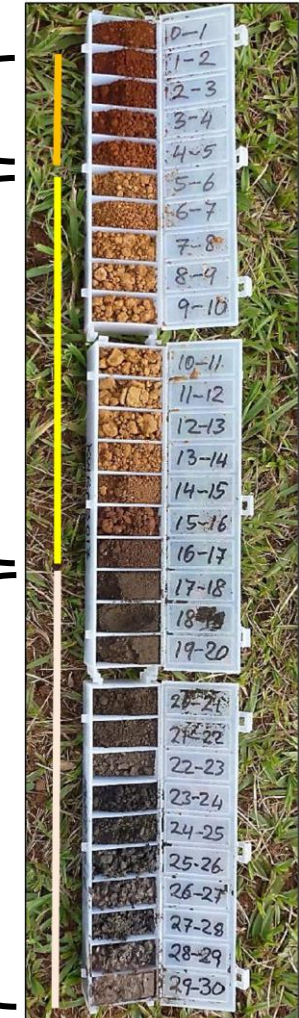
- Geological characteristics confirm ionic clay-type mineralisation similar to Southern China deposits: Currently the cheapest and most readily accessible Critical and Heavy REO source
- Thick intersections of mineralisation averaging 11.9m near-surface under cover averaging 3m deep, with Rare Earths contained within complete mineralisation profile
- Continuous mineralisation, low strip ratio, low cost bulk mining potential



**Hardcap Domain**  
0 to 2-5m

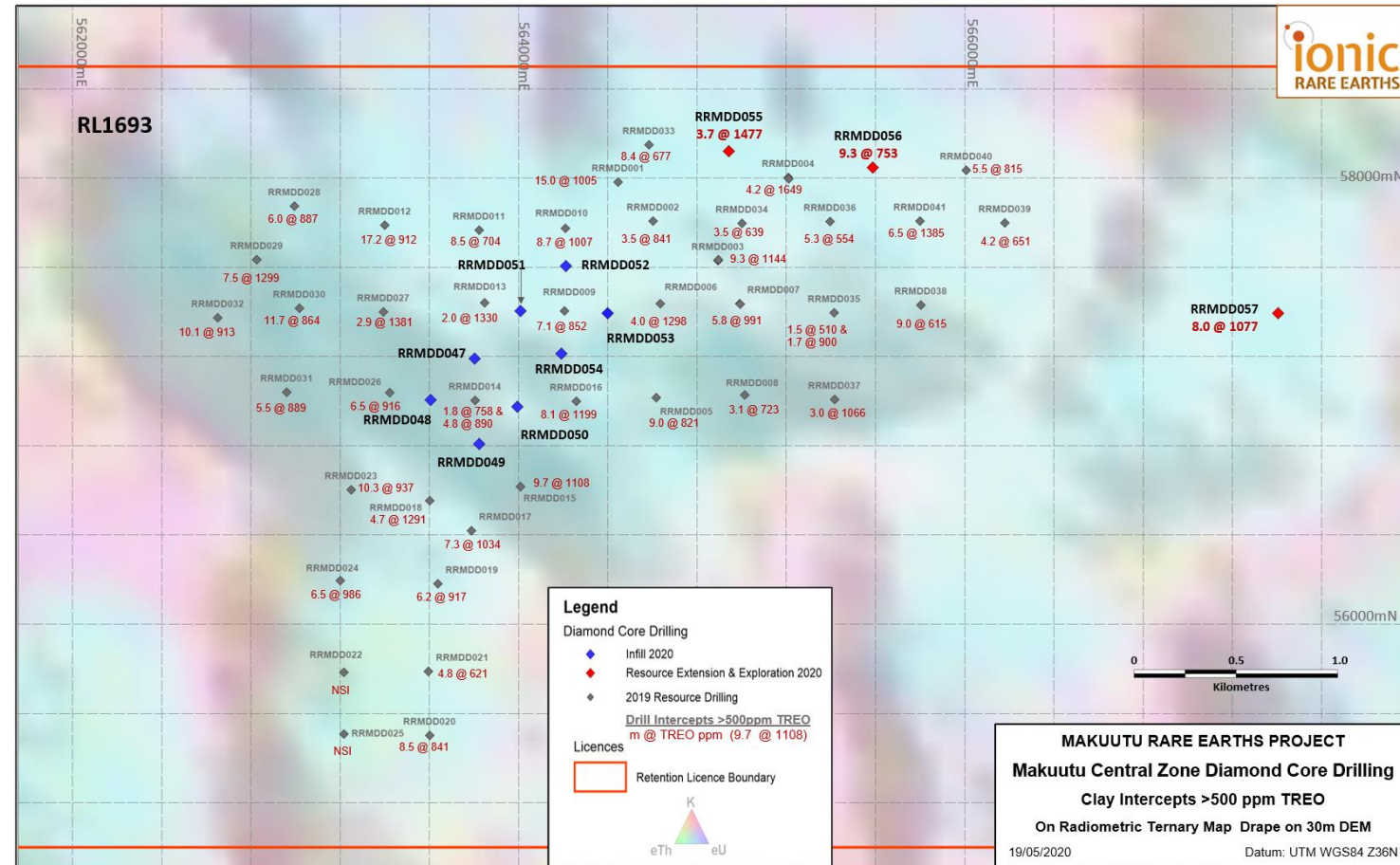
**Clay Domain**  
~5 to 18m

**Saprock / Fresh Domain**  
~18m onward



# 2020 Drilling Program

- Program suspended on 25<sup>th</sup> March 2020 due to COVID-19
- 4,000 m planned program suspended after only 240m of drilling completed
- Successful resource extension drilling ◆ with high grade intersections near surface and over significant widths, including<sup>1</sup>:
  - RRMDD055: 3.7 metres @ 1,477 ppm TREO from 6.8 metres
  - RRMDD057: 8.0 metres @ 1,077 ppm TREO from 4.5 metres
- High-grade infill ◆ intersections over significant widths including<sup>1</sup>:
  - RRMDD047: 7.4 metres @ 886 ppm TREO from 6.3 metres
  - RRMDD048: 6.8 metres @ 1,081 ppm TREO from 9.7 metres
  - RRMDD049: 8.5 metres @ 909 ppm TREO from 6.9 metres
  - RRMDD052: 10.8 metres @ 1,533 ppm TREO from 3.6 metres
  - RRMDD054: 4.9 metres @ 1,226 ppm TREO from 9.1 metres
- Commenced staged resumption of site activities in Uganda during June now that restrictions are lifted<sup>2</sup>
- Recommencement of drilling in July<sup>3</sup> to expand resource across 26 km mineralisation corridor, with 2<sup>nd</sup> rig from late July



<sup>1</sup> ASX announcement 28<sup>th</sup> May 2020; <sup>2</sup> ASX announcement 11<sup>th</sup> June 2020; <sup>3</sup> ASX announcement 15<sup>th</sup> July 2020;

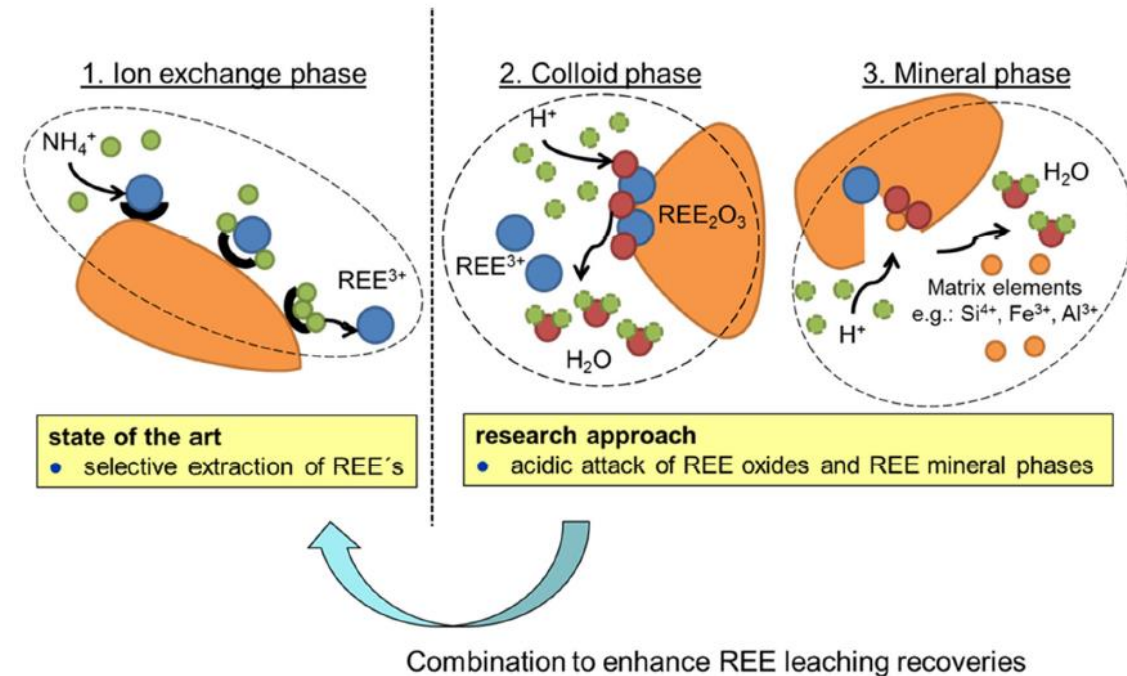
# Excellent Metallurgy Characteristics & Results

- Metallurgical recoveries of up to 75% TREE-Ce (Total Rare Earth Elements minus Cerium) were achieved using simple extraction techniques (salt desorption at pH 4)<sup>1</sup>
- Recoveries compare favourably to other known ionic clay hosted rare earth projects
- Optimisation testwork<sup>2</sup> on lower recovery samples demonstrated dramatic improvement (+700%) with addition of acid to lower pH (pH 1) and extended duration to solubilise 'colloidal REE'<sup>3</sup>
- Ionic Clays produce a high-grade product (+90% REO) as a mixed Rare Earth Carbonate product achieving high payability (70-80%)
- REE basket compares favourably with peer ionic adsorption clay projects in China
- Positive initial metallurgical results and characteristics indicate a simple reduced capital intensity development scenario

Phase 1 met testwork demonstrated the initial basis with a simple salt desorption to exchange three  $\text{NH}_4^+$  cations for one  $\text{REE}^{3+}$  cation



Optimisation met testwork enhanced the results by utilising acid addition ( $\text{H}^+$ ) to solubilise REE colloidal component in the ore, releasing  $\text{REE}^{3+}$  cation for extraction.

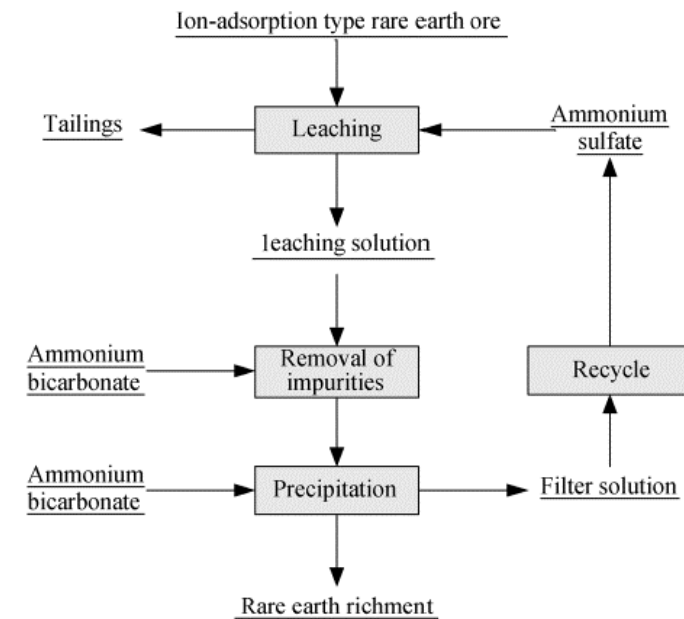


Salt Desorption / Leaching mechanism for Ionic Adsorption Clays  
Stoltz, 2017, "Geometallurgical Investigation of Ion Adsorption Clays")

<sup>1</sup> ASX announcement 18 February 2020; <sup>2</sup> ASX announcement 26 May 2020; <sup>3</sup> Colloidal REE is weathered REE in an oxide / hydroxy-oxide form readily soluble in the present of acid;

# Simple Metallurgy and Processing

- Chinese development of Ionic Adsorption Clay has been refined to optimise reagents, and refine methods producing the lowest cost base of REO production;
  - Static leach options been employed for decades in China as low cost scalable approach
- No leaching of Th or U so no radionuclide issues to manage
- No need to “crack” refractory REE minerals, therefore no need for very large CAPEX and lead time to production
- IXR to integrate membrane technology into the flowsheet to optimise reagent recovery and ensure the highest water management standards can be employed
- Enables scalable and modular production approach – Hub & Spoke Model – to permit low cost development strategy and rapid ramp up of REO production
  - Option to build a low-cost Demonstration plant
    - Validation of process parameters, metallurgical performance and OPEX
    - Data used to define scale up
  - Initial targeting of areas with most favourable metallurgy
  - Ramp up REO production through replication of low CAPEX leach modules



**BioLantanidos Demonstration Plant in Bio , Chile**

# Scoping Study Status

- Drilling program resumed mid July 2020, 2<sup>nd</sup> rig arriving on site late July
  - 3,700m of additional drilling to potentially grow resource
  - Drill program represents approx. 4 fold increase on drilled metres to date by IXR
- Expenditure on Scoping Study will result in IXR's project ownership increasing to 51%
- Scope of works include:
  - In-fill drilling to upgrade resource classification and provide sample for advanced metallurgical testing;
  - Exploration drilling in new areas;
  - Metallurgical process development test work to support preliminary engineering;
  - Resource development and mining studies;
  - Preliminary Environmental and Social Impact Assessments (ESIA);
  - Preliminary mining, tailings and infrastructure assessments; and
  - Product marketing and engagement with potential off-take partners.
- Scoping Study to be completed during the Q4 2020



Drilling near-surface, high-grade REE at Makuutu



# Target Pathway to Development

	COMPLETED	COMPLETE BY
Re-assay of selected historical samples confirms presence of Rare Earths	✓	
First-pass metallurgy confirms presence of ionic-clay hosted REEs	✓	
Initial Core Drilling Program	✓	
Phase 1 Metallurgical Testing recovers up to 75% TREE-Ce	✓	
JORC-compliant Mineral Resource Estimate (updated)	✓	
Phase 2 Core Drilling Program		Q4, 2020
Environmental Baseline Monitoring		Q4, 2020
Environmental and Social Impact Assessment (ESIA) – Stage 1		Q4, 2020
Phase 2 Metallurgy and Process Engineering		Q4, 2020
Mining, Tailings and Infrastructure Assessments and Studies		Q3, 2020
Scoping Study / expenditure to earn 51% Project Interest		Q4, 2020
Bankable Feasibility Study	Commence Q4, 2020	

## Objective: Makuutu to Supply Low-Cost, High-Value Critical and Heavy Rare Earths

- ✓ Strategically and geopolitically significant Critical / Heavy Rare Earths supply in stable jurisdiction
- ✓ Strong interest for Makuutu as an ionic clay hosted REE deposits given their demonstrated simple low-cost nature
- ✓ Impressive exploration results from drill program
- ✓ Large Mineral Resource Estimate defined with scope for substantial growth with further drilling
- ✓ Metallurgical results indicate simple low-CAPEX and low-OPEX mining and processing operation potential
- ✓ Experienced and proven team in place to advance Makuutu through development to operations stage
- ✓ Active development pathway leading to regular newsflow throughout 2020
- ✓ Third party strategic interest in Makuutu



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# Additional Slides

# Experienced and Proven Team

## Mr. Tony Rovira – Chairman

- Geologist, company executive and Board Director with over 30 years' technical, executive and company management experience in the mining industry.
- Experience in large and small companies including BHP, Barrack Mines, Pegasus Gold and Jubilee Mines, and currently Managing Director of Azure Minerals.
- Exploration team leader with Jubilee Mines responsible for the discovery and development of the world class Cosmos and Cosmos Deeps nickel sulphide deposits in Western Australia.

## Dr. Marc Steffens – Executive Technical Director

- Minerals engineer with a PhD in Metallurgy from the WA School of Mines, Member of the AusIMM.
- 15 years' experience including areas of project management and process development covering a broad range of mineral commodities.
- Rare Earth Elements (REE) experience covers project evaluation, process development and study management.

## Mr. Brett Dickson – Executive Finance Director

- Over 30 years' financial, executive and company management experience, including more than 20 years as a Company Director.
- Experienced in start-up, management, growth and financing of publicly listed exploration & mining companies.
- Has been a Director and in executive management of publicly-listed resource companies operating in Australia, Nicaragua, Chile, Mexico, Finland, Ukraine, Laos, Papua New Guinea & Africa.

## Mr. Tim Harrison – Chief Executive Officer

- 20 years' experience in the mining industry covering technical and project development roles, Fellow of the AusIMM.
- Experienced in both mineral processing and hydrometallurgy project development, studies, engineering, construction, commissioning, operations, project management and owners' team roles.
- Multi commodity experience – Rare Earth Elements, alumina, coal, cobalt, copper, gold, magnetite, molybdenum, nickel, rhenium, scandium, silver and uranium.

## Mr. Geoff Chapman – Consulting Geologist

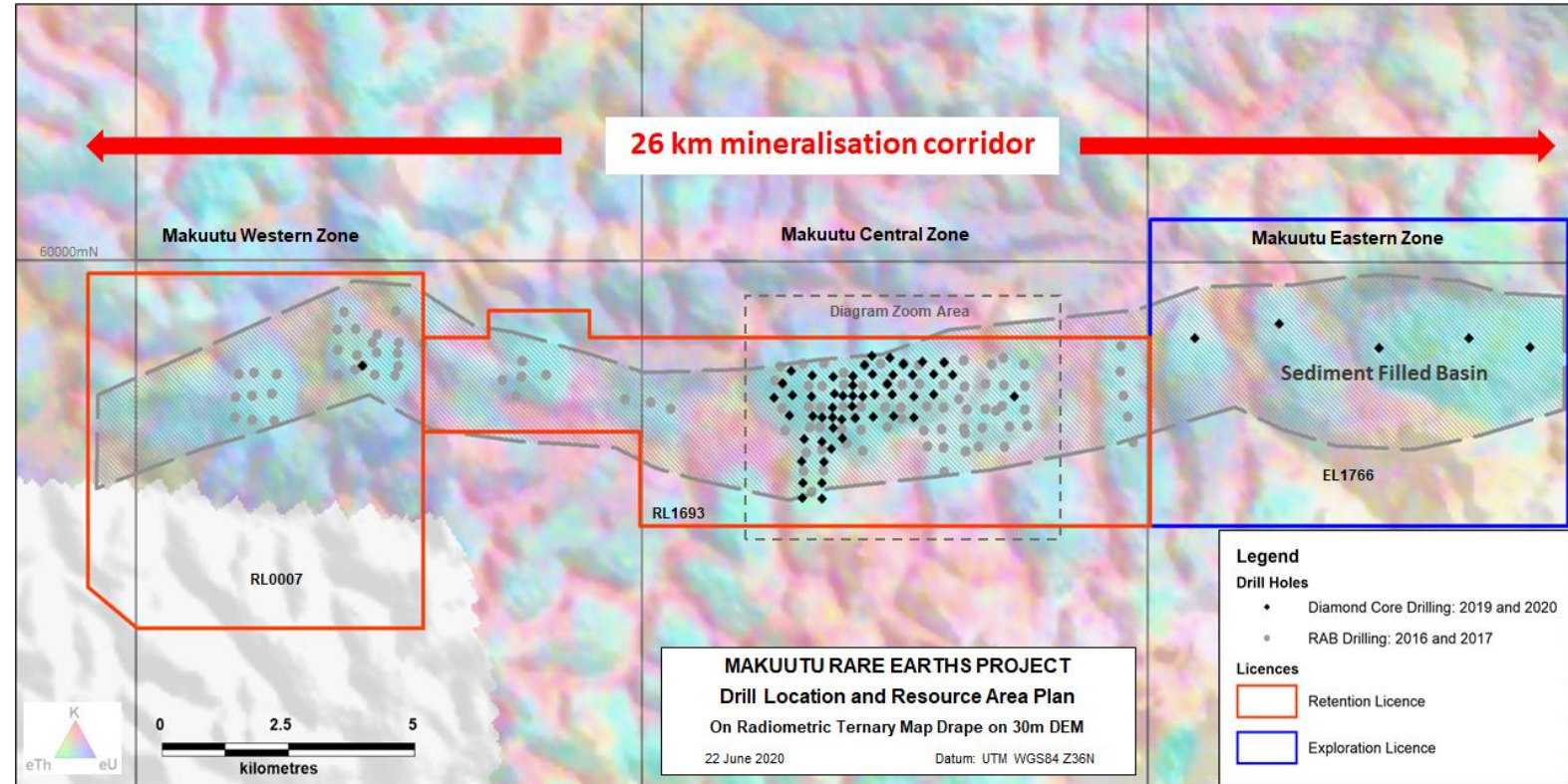
- 30 years' experience in the mining industry covering technical and senior management roles, Fellow of the AusIMM.
- Experienced in exploration, feasibility studies and mining operations in Africa, Australasia, Europe and the Americas.
- Commodity experience with rare earths, gold, nickel, uranium and manganese.

# Exploration Upside

- 26 km long mineralisation corridor identified by historic RAB drilling and radiometrics
- Mineralisation begins at surface to depths of 15-20m: simple shallow mining methods will be applicable
- Exploration target of 270 - 530 million tonnes grading 0.04 – 0.1% (400 – 1,000 ppm) Total Rare Earth Oxide (TREO)<sup>1</sup>

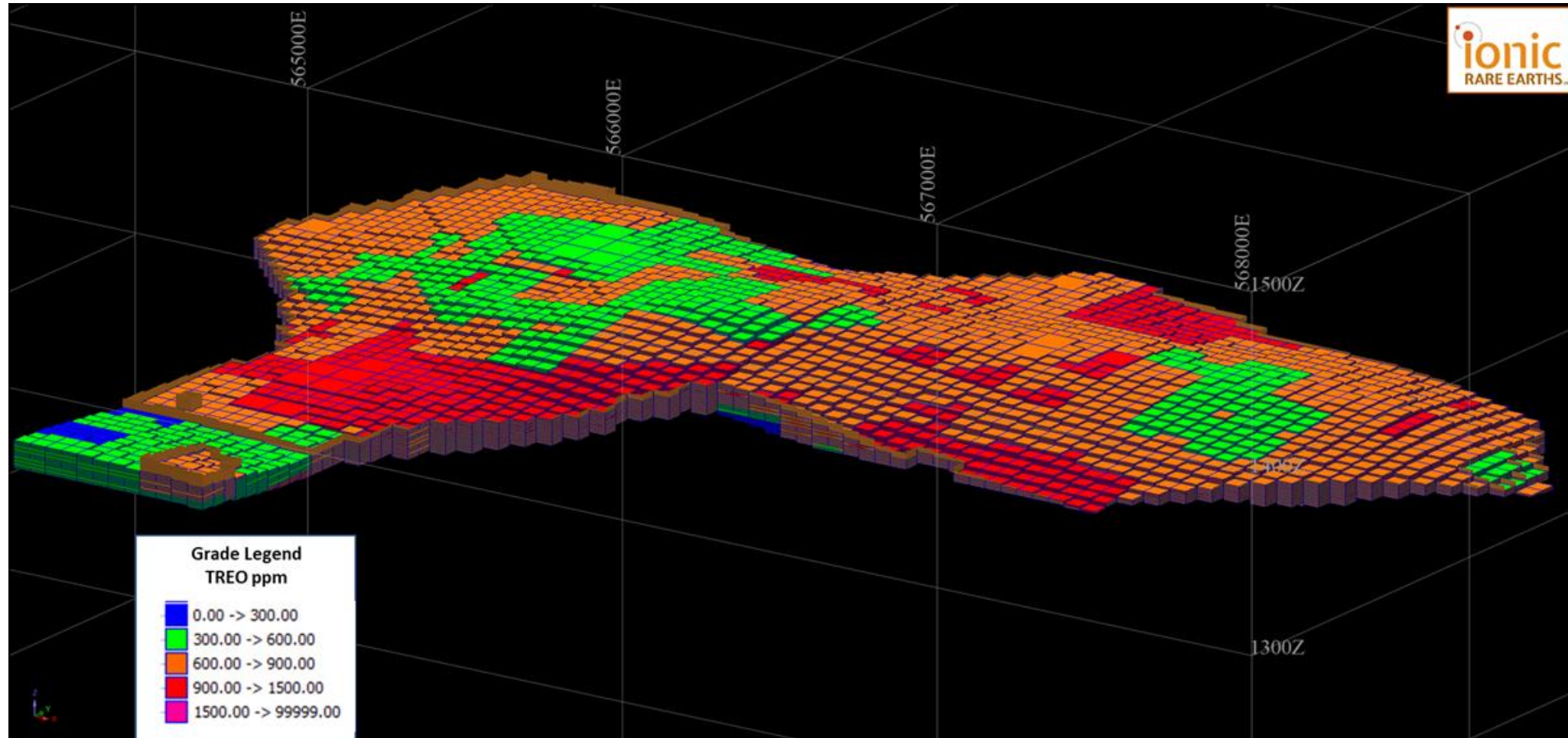
\* This Exploration Target is conceptual in nature but is based on reasonable grounds and assumptions. There has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource.

- Plan to fully define Makuutu Central plus Makuutu Eastern Zone (Buwunga) and Makuutu Western Zone (Buwaya)



<sup>1</sup> ASX announcement 4<sup>th</sup> September 2019.

# MRE – Resource Limiting Optimisation Shell



Oblique View Looking North West of Makuutu Resource Model Coloured by TREO ppm with Limiting Shell (Brown). The reported Mineral Resources have been assessed against a resource limiting optimisation shell using appropriate marginal cost, metallurgical recovery, and price assumptions. The shell is contiguous across most of the modelled resource and limited primarily by the extent of the model.

# Excellent Metallurgy & Processing Fundamentals

## → Low Cost Base OPEX

Parameter	Result	Significance
<b>Desorption Salts (Leaching)</b>	Demonstrated desorption of rare earths using ammonium sulfate (a common fertiliser) and sodium chloride (table salt).	<b>Reduces OPEX</b> Cheap reagents. Low-cost salt sources located nearby may be suitable.
<b>Salt Requirement</b>	Demonstrated that low salt concentrations (~13-70 g/L ammonium sulfate) are effective in desorbing rare earths.	<b>Reduces OPEX</b> Recycling of salt solution expected to be a part of the process.
<b>Desorption pH</b>	Demonstrated desorption of ionic clay rare earths can occur at pH between 3.0 – 5.0. Potential to increase desorption extent by reducing pH further (pH 1 to 2) on specific ore types.	<b>Reduced OPEX</b> Natural pH of solutions is ~pH 5, thus anticipated acid requirement is low. Target pH specific heaps if required. Further optimisation to be explored.
<b>Desorption Kinetics</b>	Desorption kinetics are rapid, with agitation assisted desorption complete within 15 minutes. Extended duration for static options	<b>Reduced CAPEX and OPEX</b> Suggests smaller process equipment required (low residence times). Extended duration for static leach will result in lower capex options and reduced maintenance costs
<b>Beneficiation</b>	Potential to beneficiate mineralisation by screening.	<b>Reduced OPEX</b>
<b>Viability of Static Leach</b>	Demonstrated desorption of rare earths without any agitation applied (static leach).	<b>Reduced CAPEX and OPEX</b> Indicates that static leach options may be viable and should be examined further in larger scale testwork.
<b>Reagent Recycle</b>	Preliminary analysis of solution chemistries indicates that reagent can be recycled using membrane systems.	<b>Reduced OPEX</b> Availability of low-cost power at project site to allow effective washing and recycling of salt reagent.



# Exploration and Mining in Uganda

- The mining industry in Uganda and was at peak levels in the 1960's when the sector accounted for up to 30% of Uganda's export earnings
- Instability experienced in the 1970's led to drastic decline in the sector. The decline was not a result of resource depletion.
- Since 2000, exploration and mining activity has been growing. In terms of licenses issued;
  - In 1999 there were 66 licenses issued in the exploration and mining license categories combined;
  - By the beginning of 2010 there was a total of 517 licenses issued.
- Current ASX exploration companies engaged in Uganda;
  - Jervois Mining Limited (ASX: JRV)
  - Sipa Resources Limited (ASX: SRI)
- Base metals, precious metals and industrial minerals the main focus
- Nearby mining with private Namekara Mining Company mining vermiculite
- Ugandan government supportive of re-establishing the mining industry
  - Mining Tax Rate = 30%
- Significant petroleum investment by global majors Total and China National Offshore Oil Corporation (CNOOC) – Lake Albert Oil Project



**Kilembe Copper Mines, mined copper near Kasese in the Rwenzori Mountains in western Uganda from the 1950's to 1982**



# Development Options

## Build low-cost Demonstration Plant

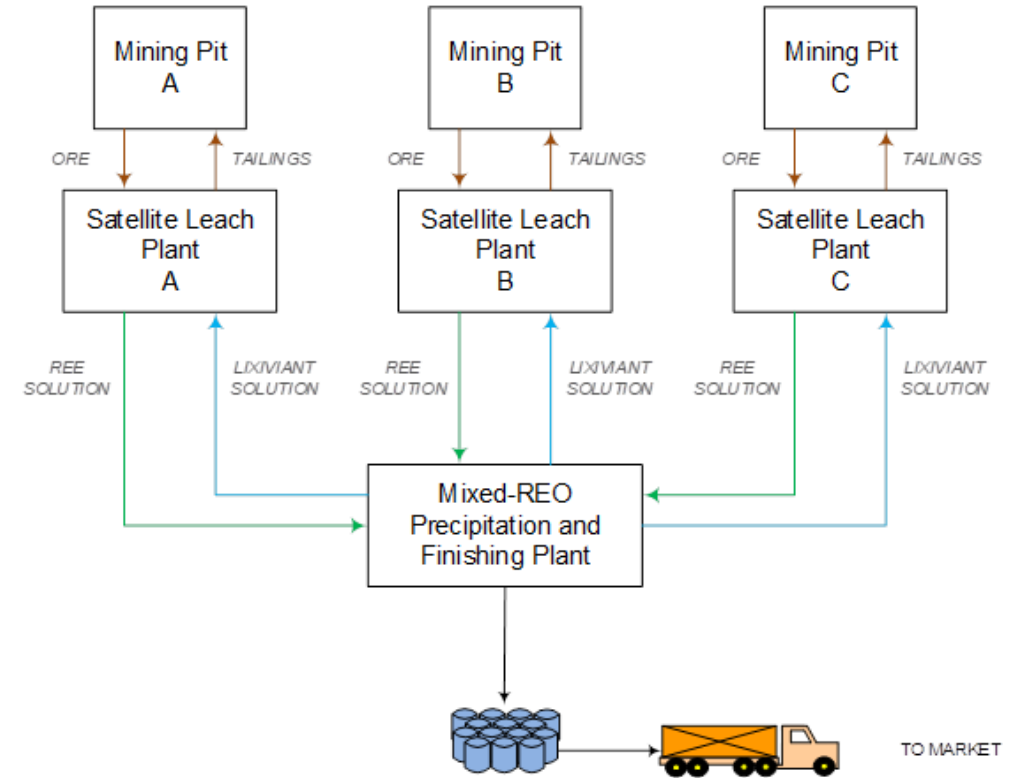
- ✓ Validation of process parameters, metallurgical performance and OPEX
- ✓ Demonstration plant data used to define scale up
- ✓ REO/REC product to cover operating costs
- ✓ De-risk project

## Scalable and Modular Expansion

- ✓ Demonstration plant transition to Commercial Operations
- ✓ Replication of desorption/leach pads to provide REO production increase
- ✓ Initial targeting of areas with most favourable metallurgy
- ✓ Minimise ore transport distances
- ✓ Ramp up REO production through low CAPEX modules
- ✓ Faster payback on subsequent modules funded by revenue

## Hub & Spoke Model

- ✓ Centralised mixed Rare Earth Oxide / Rare Earth Carbonate product precipitation circuit



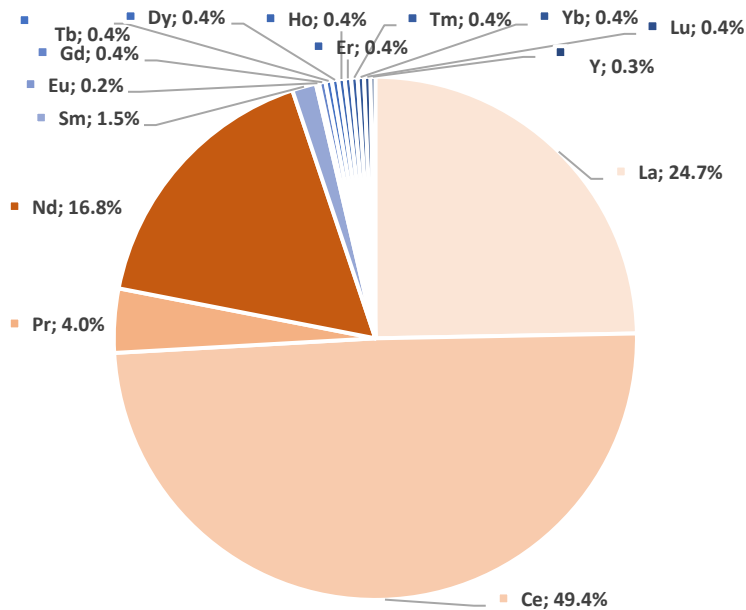
Conceptual Arrangement of the Envisaged Makuutu Rare Earth Project

# Why are Ionic Adsorption Clays so heavily desired?

Ionic clay product contains more CREO/HREO content compared to a REE mineral concentrate

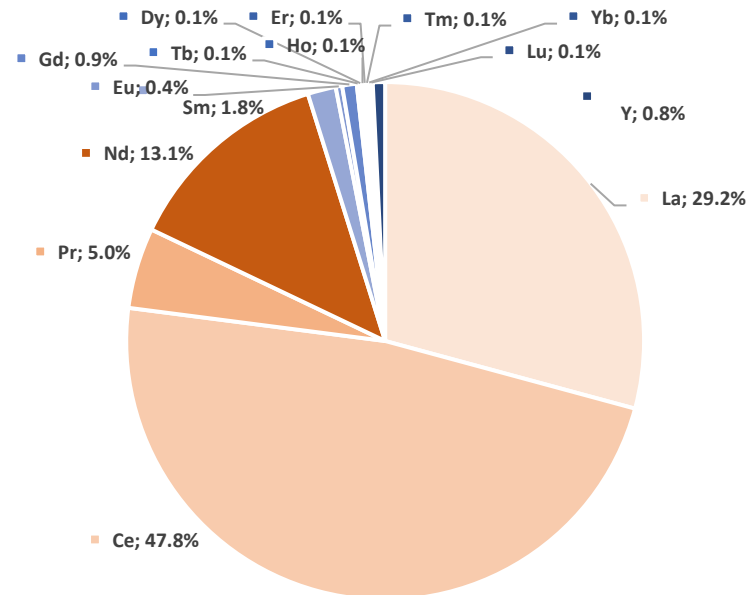
**Bayan Obo REE Mineral concentrate<sup>1,4</sup>**  
Inner Mongolia  
Bastnaesite/ Monazite concentrate

Basket Price ~ US\$18.23 / kg REO<sup>5</sup>



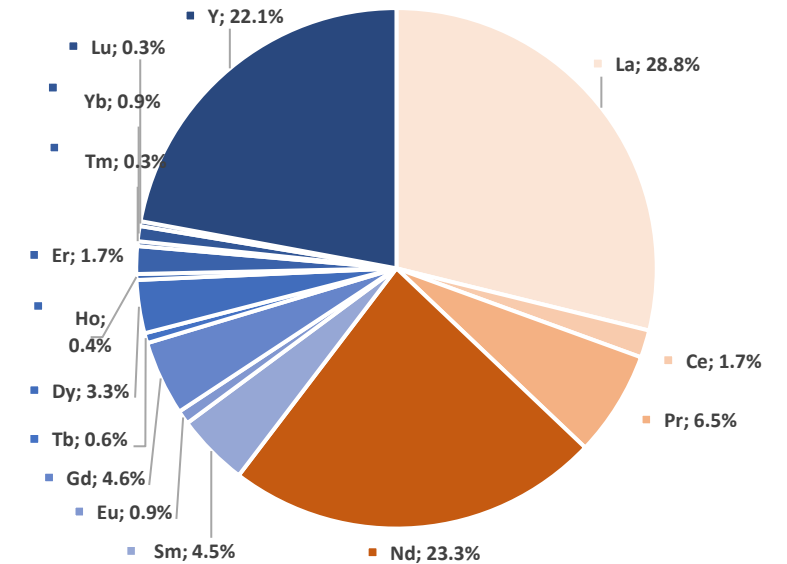
**Maoniuping REE Mineral concentrate<sup>1,4</sup>**  
Sichuan  
Monazite concentrate

Basket Price ~ US\$12.04 / kg REO<sup>5</sup>



**Ionic Clay<sup>2,3,4</sup> Product**  
Southern China

Basket Price ~ US\$31.94 / kg REO<sup>5</sup>



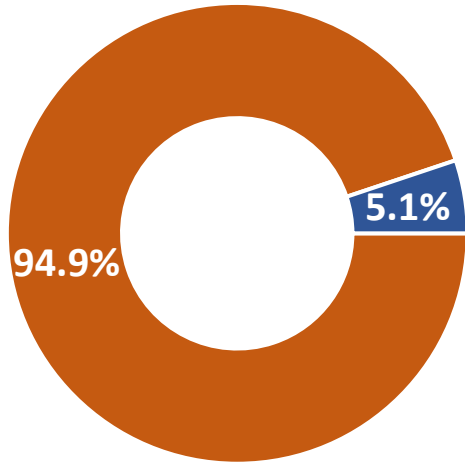
<sup>1</sup> Ling ZHI LI, Xiaosheng YANG, China's rare earth deposits and beneficiation techniques, 2014; <sup>2</sup> Ionic clay represented by average from Ningde, Wingpu, Jianning and Qingliu mines; <sup>3</sup> Chi R, Zhou Z, Xu Z, Hu Y, Zhu G, Solution-chemistry analysis of ammonium bicarbonate consumption in REE precipitation, 2003; <sup>4</sup> Rounding has been applied; <sup>5</sup> REO Pricing Spot June 2020 - <https://institut-seltene-erden.de/unser-service-2/metallpreise/seltene-erden-preise/>;

# High Margins make Ionic Adsorption Clays desirable

Ionic clay product is a more valuable product, with > 35% HREO plus higher payability

## Bayan Obo<sup>1</sup> Product Basket

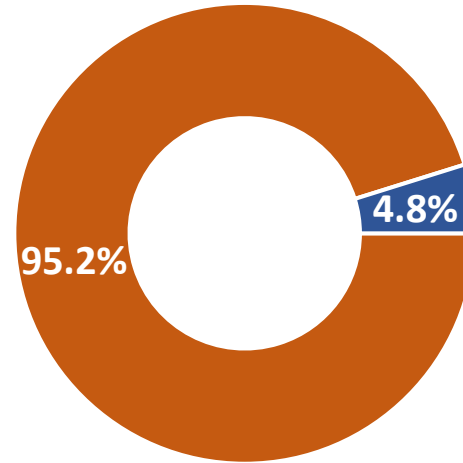
Hardrock REE Mineral Concentrate  
35-40% payable



■ LREO ■ HREO

## Maoniuping<sup>1</sup> Product Basket

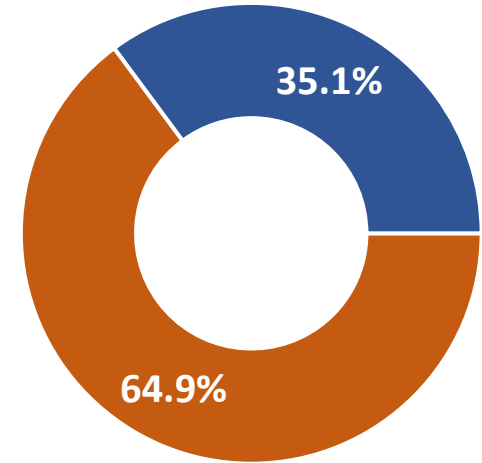
Hardrock REE Mineral Concentrate  
35-40% payable



■ LREO ■ HREO

## Ionic Clay<sup>2,3</sup> Product Basket

Chemical Precipitate  
70-80% payable



■ LREO ■ HREO

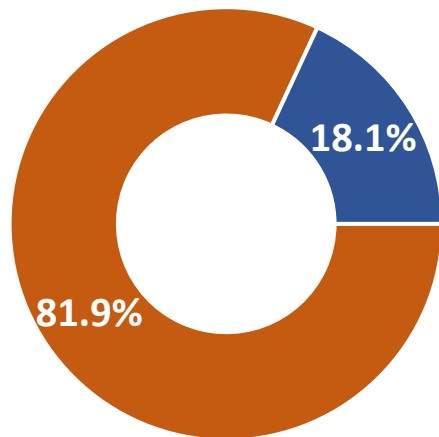
<sup>1</sup> Ling ZHI LI, Xiaosheng YANG, China's rare earth deposits and beneficiation techniques, 2014; <sup>2</sup> Ionic clay represented by average from Ningde, Wingpu, Jianning and Qingliu mines; <sup>3</sup> Chi R, Zhou Z, Xu Z, Hu Y, Zhu G, Solution-chemistry analysis of ammonium bicarbonate consumption in REE precipitation, 2003.

# High Margins make Ionic Adsorption Clays desirable

Ionic clay > 50% CREO translates to higher basket price plus higher payability

## Bayan Obo<sup>1</sup> Product Basket

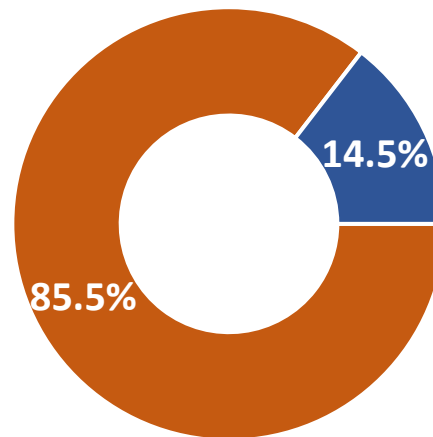
Hardrock REE Mineral Concentrate  
35-40% payable



■ Non CREO ■ CREO

## Maoniuping<sup>1</sup> Product Basket

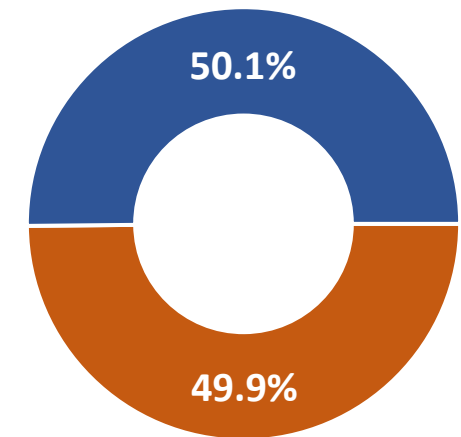
Hardrock REE Mineral Concentrate  
35-40% payable



■ Non CREO ■ CREO

## Ionic Clay<sup>2,3</sup> Product Basket

Chemical Precipitate  
70-80% payable



■ Non CREO ■ CREO

<sup>1</sup> Ling ZHI LI, Xiaosheng YANG, China's rare earth deposits and beneficiation techniques, 2014; <sup>2</sup> Ionic clay represented by average from Ningde, Wingpu, Jianning and Qingliu mines; <sup>3</sup> Chi R, Zhou Z, Xu Z, Hu Y, Zhu G, Solution-chemistry analysis of ammonium bicarbonate consumption in REE precipitation, 2003.