

## **RareX (REE AU, \$0.044. Market cap A\$26.5m)**

### **A staged development at Cummins Range aimed at delivering attractive returns from a very large REO/phosphate orebody**

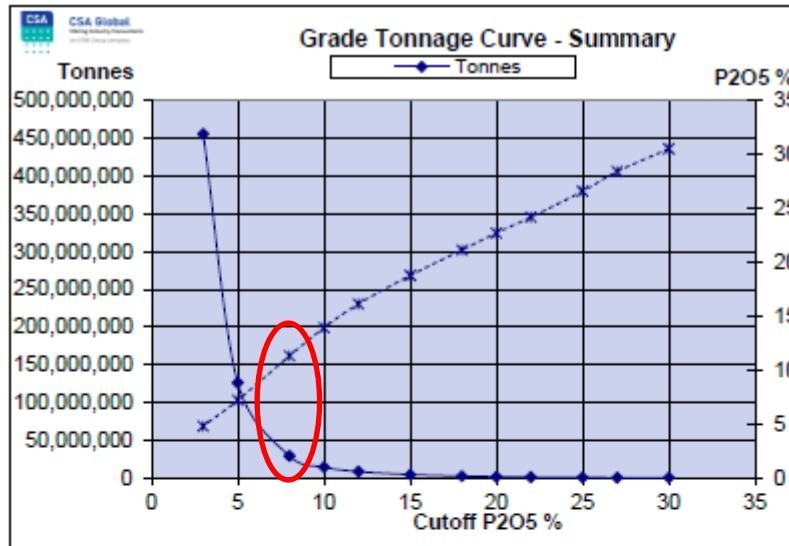
*Investment view: Rare earths and phos-rock explorer REE has been somewhat of a moving feast over recent years and the market has become confused. The company has now refocused on what looks to be a low capital intensity project with the early production of phosphate rock potentially with highly attractive returns. Project economics should be further enhanced as a pathway to commercialising the rare earths component held within the very large Cummins Range carbonatite-hosted orebody. An updated scoping study due out mid-year should allow us to provide some valuation estimates for the project. With a market cap of around A\$30m, REE is the least expensive of its peer group. The current share price malaise presents an excellent entry point for investors, in our view.*

- Carbonatites are one of the most prospective rock types on Earth with almost 10% of occurrences hosting an active or former mine. The principal commodities mined from carbonatites include phosphate, niobium, fluorite, rare earth elements (REOs), vermiculite, iron, and zircon.
- REE has recently published resources for its 100%-owned carbonatite-hosted Cummins Range (CR) project which has emerged as a very large, low grade rare earth and phosphate resource. The headline resource is now over 500mt at 0.32% total rare earth oxides (TREO) and 4.6% phosphate (P<sub>2</sub>O<sub>5</sub>), and now is Australia's largest undeveloped rare earth deposit.
- REE's management has been restructured with the appointment of engineer James Durrant as CEO. He has been tasked with the completion of an updated scoping study, aimed initially at the phosphate resource then advancing to a flow sheet which can deliver the valuable rare earths (especially Nd/Pr). REE has also recruited to the board a marketing specialist, Danny Goeman (ex RIO, FMG, Danakali) to assist with marketing aspects of the project.
- In this note we will discuss what the forthcoming scoping study - due mid 2023 - might look like. In our view it will be a long way from the scoping study presented in early 2023, and will focus on a project capable of being funded by a small/mid-cap company, which can initially stand alone with phosphate products within perhaps 2 years and an NdPr-rich REO co-product within perhaps 4 years.
- In this note we present a 'what if' analysis which could deliver say 20% P<sub>2</sub>O<sub>5</sub> direct shipping ore to the Northern Australian agricultural industry and which might also be suited to seaborne export to neighbouring nations. Phase 2 could see mine cashflows of ca. A\$200m emerge from mine and plant costing perhaps \$200-300m solely from phos-rock. Rare earths could then deliver significant additional revenue as soon as a pathway to market is developed. We like the idea of early cashflows from a low capex project, which allows boot-strapping of higher capex phos-rock then TREO/phos-rock/phosphoric acid production further down the track.
- We should remember that none of Australia's rare earth projects have been overnight successes. We look to the example of Hastings Technology Metals' Yangibana project, now moving toward construction. Yangibana's maiden resource was announced in August 2014 and the project's first scoping study was delivered in November 2015, some 7.5 years ago.
- REE recently raised \$4m in new capital to allow completion of the revised scoping study and to commence the drill-out of high grade phosphate zones at Cummins Range in coming months.

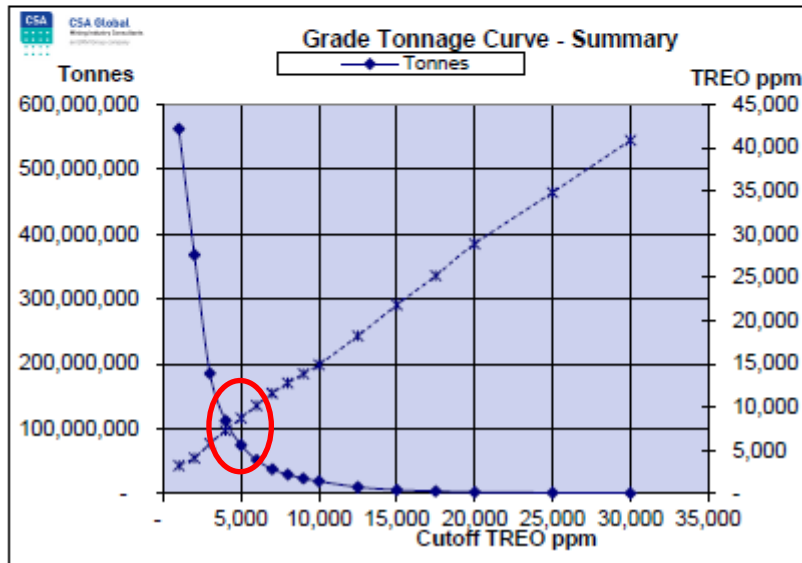
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**The Cummins Range resource**

Completion of assaying from the 2022 drill programme has allowed REE to report a global resource for the Cummins Range rare earth/phosphate deposit. The headline resource (519mt at 0.32% TREO and 4.6% P2O5 at a 2.5% P2O5 cut-off grade) is further illustrated as two grade tonnage curves for both P2O5 and rare earths, as follows:



**Figure 3. Resource Grade Tonnage Curve for Phosphate**



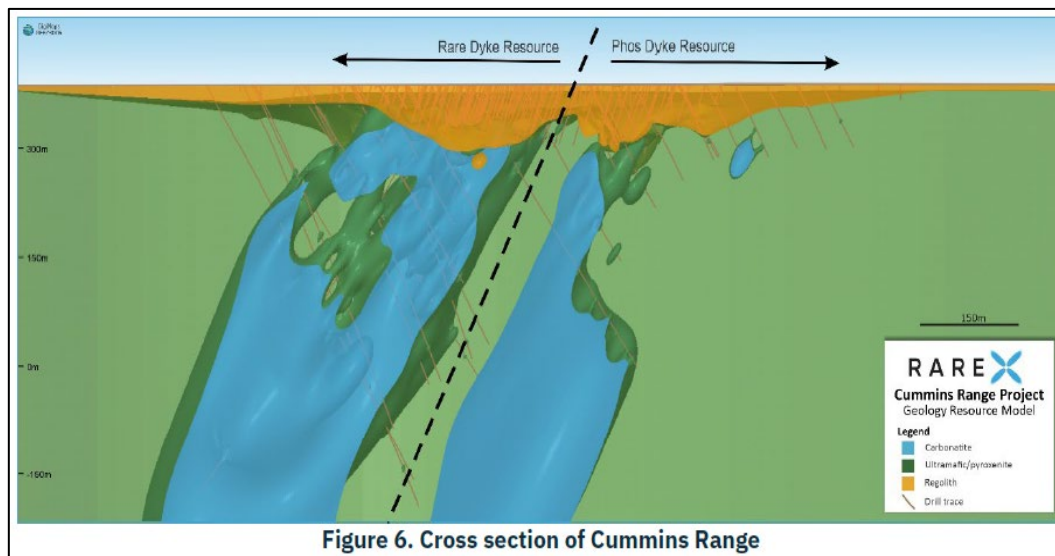
**Figure 4. Resource Grade Tonnage Curve for TREO**

These are important plots demonstrating that within the low grade carbonatite there exists potentially substantial tonnages of higher grade material. For example, in the upper chart we can see the potential for a higher grade phosphate resource of perhaps 40Mt and 12% P2O5, and in the lower perhaps 80Mt at around 1% (or 10,000ppm) TREO. We look forward to more detail emerging from the resource model.

The CR orebodies are complex, with 2 styles of mineralisation, the apatite/phosphate rich zone (the Phos Dyke) and the monazite/bastnasite/TREO rich zone (the Rare Dyke). Note that the resources presented above are composites of both.

Superimposed on the primary orebody are eons of weathering, which has resulted in the higher grade, but

smaller tonnage regolith mineralisation, overlying the Rare Dyke. This has previously been reported as 18.8mt at 1.15% TREO. This has been a focal point for previous studies.



Source: REE announcement, May 2023

### Cummins Range in a global context

On the following page we list a number of rare earth and phosphate-bearing deposits as a comparison against REE's CR project, together with the project owners and their market caps. We make the following observations:

- As described by REE, CR is indeed the largest accumulation of unmined rare earths in Australia, at 1.65Mt of TREO, a larger than ARU's Nolans Bore, but at a significantly lower grades.
- The lower grade CR regolith deposit is comparable in contained TREOs to Hasting's Yangibana project. Note that REE has not yet been able to generate what would be considered as a commercial concentrate at acceptable metallurgical recoveries. Met. test work is on-going.
- Even at the 2.5% P<sub>2</sub>O<sub>5</sub> COG, CR's grade of the higher value REOs, Nd+Pr, is comparable to the grades offered by NTU's isolated Browns Range project.
- We've included for comparison quoted resources for two so-called ionic clay deposits. These are very low grade REO accumulations which are targetted for leach extraction of the contained rare earths. However, from what we can understand, very few of the Australian "ionic clay" deposits are likely to be economic (and are not ionic clays at all). Grades and leach characteristics to our eye do not offer attractive economics. As well, the Koppamurra deposit is really quite modest in size (around 80kt of contained REOs), is quite thin, and represents a very challenging mining task. IXR's Makuutu is showing more promise, but is a long way from production.
- CR's contained phosphate is substantial at around 24Mt, larger than all others in the table, other than the huge carbonatite at Phalaborwa in South Africa. Grades are comparable with Phalaborwa (5.9% in the Phos Dyke against Phalaborwa at 6.5% at the chosen COGs). Phalaborwa is owned by South African company Foskor, a major phos-rock and phosphoric acid supplier.
- We've included LKAB's resource for a large iron ore/phosphate/REO project, Per Geijer, which attracted the media's attention in recent months as the largest REO deposit in Europe.
- Finally, we think the CR phosphate project is worth comparing with CXM's Ardmore sedimentary phosphate project in Queensland, which has recently moved into production. At Ardmore, the high grade phos-rock (>25%) is crushed, screened and trucked/railed to port for sale to the agricultural industry. This demonstrates that a 25- 35% P<sub>2</sub>O<sub>5</sub> product can find ready markets in Asia and Australia.

Project	Ownership	Market cap (A\$)	Resource (Mt)	Rare earths TREO grade (%)	Total contained TREO (Mt)	NdPR grade (%)	By-product Phosphorous (%)	Total contained phosphate (Mt)	P2O5 con. grade (%)	Iron ore grade (%)	Niobium (%)	
<b>Carbonatite hosted</b>												
Cummins Range regolith - high grade	REE		6.5	1.98%	0.13	0.38%	11.7%	0.76	n/a	None	0.21%	
Cummins Range regolith - low grade	REE		18.8	1.15%	0.22	0.23%	9.9%	1.86	n/a	None	0.14%	
Cummins Range - Phosphate + TREO, Rare Dyke	REE		414.8	0.32%	1.33	0.07%	4.2%	17.42	35-40%	None	n/a	
Cummins Range - Phosphate + TREO, Phos Dyke	REE		104.6	0.26%	0.27	0.07%	5.9%	6.17	35-40%	None	n/a	
Cummins Range - Phosphate + TREO, Global	REE	35	519.3	0.32%	1.65	0.07%	4.6%	23.89	35-40%	None	n/a	
Phalaborwa (South Africa) - Phosphate	Foskor	n/a	6174.4	Trace	-	-	6.5%	401.91	37%	n/a	n/a	
Yangibana	HAS	253	21.67	1.17%	0.25	0.39%	n/s	-	n/s	n/s	n/s	
Yin - Mangaroon - high grade	DRE		4.59	2.16%	0.10	0.67%	n/s	-	n/s	n/s	n/s	
Yin - Mangaroon - low grade	DRE	199	14.4	1.13%	0.16	0.34%	n/s	-	n/s	n/s	n/s	
Mt Weld, rare earth deposit	LYC		53.7	5.30%	2.85	1.95%	n/s	-	n/s	n/s	n/s	
Mt Weld, niobium-rich rare metals deposit	LYC	6140	37.7	1.16%	0.44	n/a	8.0%	3.01	n/s	n/s	1.07%	
Mountain Pass rare earth project (California)	MP NYSE	5397	9.1	5.10%	0.46	0.84%	n/a	-	n/a	n/a	n/a	
Ngualla rare earth project (Tanzania)	PEK	103	214.4	2.15%	4.61	0.45%	n/a	-	n/a	n/a	n/a	
<b>Magnetite hosted</b>												
LKAB, Per Geijer (Sweden)	LKAB	n/a	585	0.18%	1.05	n/a	2.4%	14.10	34%	50.5%	n/a	
<b>"Ionic" rare earth deposits</b>												
Koppamurra	AR3	43	101	0.082%	0.08	0.018%	None	-	None	None	None	
Makutu (Uganda)	IXR	105	532	0.064%	0.34	0.014%	None	-	None	None	None	
<b>Other styles of REO mineralisation</b>												
Nolans Bore	ARU	835	56	2.60%	1.46	0.69%	11.2%	6.27	?	None	None	
Browns Range	NTU	201	10.8	0.76%	0.08	0.09%	None	-	None	None	None	
<b>Sedimentary phosphate</b>												
Ardmore	CXM	107	16.2	-	-	-	27.80%	4.50	34.5%	None	None	

Share prices as at 8 May 2023

### What could we expect from the next scoping study.

Early in the history of REE at Cummins range, we imagined a modest scale open cut mining proposition within the higher-grade regolith deposit, providing a REO concentrate for sales to third parties. Separating the REO-bearing minerals (monazite and bastnasite in particular) has thus far proved challenging, but met work is ongoing.

In 2021, REE decided to push ahead with exploration at CR, with the expectation of finding significant tonnages of medium to high grade REO's, effectively extensions of the zones identified in the regolith. This was successful, but it became clear that the deposit would likely bulk out into a large, low grade REO+phosphate deposit. Test work subsequently demonstrated that the P2O5-bearing mineral was easily separated from its host using froth flotation, which also concentrated the rare earths.

REE then pushed ahead with the first iteration of a Scoping Study (released in September 2022) which comprised a mine and flotation beneficiation facility at site producing a rare earth mineral concentrate and a phosphate mineral concentrate which was to be trucked around 500km to the port of Wyndham. At Wyndham it was envisaged that a rare earth refinery facility would produce a mixed rare earth carbonate (MREC) product for export with a by-product of merchant grade phosphoric acid.

This was an ambitious proposal, with indicative capital costs of around A\$430m, but with an IRR of 29% and a pre-tax NPV<sub>8</sub> of A\$633m. While on paper potentially a viable project, it would have been a challenging project for REE to fund.

Roll on to May 2023 and we see the publication of a resource for CR, described above. Based on this resource, REE has announced that on the basis of this resource upgrade it will look to refresh the Scoping Study. This study is due to be completed by mid-year. It is envisioned it will be made up of the following stages:

**Stage 1 - DSO phos-rock:** Fast tracked production of medium grade direct shipping phosphate ore to the agricultural industry in the Ord River Valley in the Kimberley and potentially to export markets. Key features of this stage might be:

- Low capital requirement and in our view fundable by REE.
- Potential to mine very high grade zones within the Phos Dyke, where drill intercepts of 26 to 106m at 18-19% P2O5 have been intercepted in drillholes.
- Recent test work has shown high levels of bio-availability (ie the proportion of P2O5 which is soluble and available as a fertiliser for plants). Numbers as high as 40-50% have been reported.
- However, the size of the Kimberley Ord River/Carlton Plain market is quite small, perhaps 15,000t per year.
- Factoring down from current P2O5 pricing (around US\$340/t for Moroccan phos-rock, fob basis) it's possible that DSO could be mined/screened/trucked to the Ord for a cost of perhaps A\$100/t and sold for perhaps A\$300/t, delivering local cashflows of perhaps a few million dollars per year. Modest, but handy cashflow to establish other markets and to begin the funding of Stage 2.
- The balance of production would seek markets in nearby offshore locations and if a few hundred thousand tonnes per year can be mined and sold out of Wyndham, there could be a few hundred million dollars of free cashflow to unlock. Quite attractive for this start up stage.
- Critical to this stage is (1) establishing the size of the market (local first, but offshore as well) and (2) the acceptability of the product by Ord Valley farmers and off-takers more broadly.
- The next step is to drill out the high grade phos-rock and establish a high grade resource. This is likely to happen in 3Q23.

**Stage 2 – Upgrading the phos-rock:** Production of high grade (+35% P<sub>2</sub>O<sub>5</sub>) phosphate rock by screening/flotation of medium to high grade zones within the Phos Dyke at CR will next be evaluated. Phosphate rock could be sold to agricultural users in Asia and Australia for direct application to soils (assuming good bioavailability) and to producers of phosphoric acid.

- Modest capital requirement. Capital costs here could be as high as A\$200-300m (depending on whether infrastructure can be outsourced) for a crushing/screening/grinding/flotation plant of around 3Mtpa (producing say 1mtpa product) and infrastructure at site and at the port. Again, this could be funded by REE, possibly with an off-take partner.
- Even excluding the value of the rare earths, this material could be quite valuable, and sell for over US\$300/t (and possibly over \$350/t at current spot prices factoring a 10% higher grade than Moroccan benchmark). This, we think, could be a highly desirable product with high P<sub>2</sub>O<sub>5</sub> grades and low contaminants.
- Operating costs could be the \$100/t described for DSO above, plus perhaps \$40/t for flotation, dewatering and materials handling, so let's say \$150/t including \$10/t G&A.
- Assuming an FOB sales price of say A\$400/t the margin could be as high as A\$250/t.
- It is therefore not hard to imagine site cashflows of over A\$200m for a 1mt product per year operation over what could easily be a +15 year mine life.

It must be stressed that these estimates are very much an 'educated thumb suck' but in our view well within the bounds of possibility.

**Stage 3 – adding the REOs:** The final stage introduces the REOs into the value chain. In this case, the mine may pivot to the higher TREO grade Rare Dyke and look to produce a P<sub>2</sub>O<sub>5</sub> concentrate with significant TREO credits. It will then need to find end-users (likely phosphoric acid producers) which are able deal with the rare earths and produce a mixed rare earth concentrate (MREC) for sale to the numerous refineries under construction. And it will need to negotiate reasonable payabilities for the MREC.

It is too early to speculate as to the nature of the process flowsheet and potential net-back to REE from the REOs. But future benefits can only improve what might already be an attractive project based on phosphate alone. We are attracted to the work being done by AIM-listed Rainbow Rare Earths, which looks like it may have cracked the metallurgy of REO-bearing tails from old Phalaborwa residues from the production of phosphoric acid. Good science has delivered good results for Rainbow. The same might prove the case for REE.

It is still early days for the CR project, but at last we can see a possible way forward, and one which will allow the company to fund the early stages of the project itself. REE state that it expects to release a feasibility study for Stage 1 by the end of 2023 (following a scoping study mid-year).

### Commodity comment

The Russia/Ukraine conflict saw disruption to supply from Russian phosphate producer, Phosagro. Phosagro supplied ca. 6Mt of P<sub>2</sub>O<sub>5</sub> (on a DAP equivalent basis) to a 75Mtpa market. This was hugely disruptive, and the strong price response is seen in the chart below. After several months at around US\$320/t the price has continued to move up.

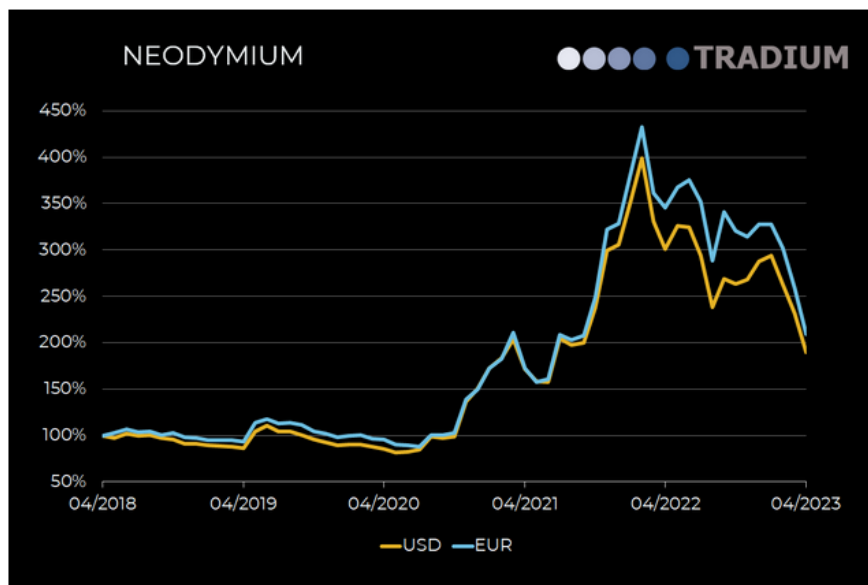




Moroccan phosphate rock prices, 70% BPL, fas basis. Source: IndexMundi.com.

Given recent price performance, rare earths might not be the place to be at the moment. Prices have fallen strongly over the past 12 months. The REO market is dominated by China, where there is poor transparency around pricing. Higher prices have undoubtedly encouraged new supply. Here we see significant by-product volumes of REO-bearing mineral monazite emerging (from the mineral sands producers), and modest additional volumes coming from the carbonatites of North Vietnam. Lynas has just announced that it had been provided a six-month reprieve regarding the ban on importation of REO concentrates into Malaysia.

As shown in the following example the price of high value neodymium, an essential ingredient in high intensity magnets, has more than halved in the last 18 months. We have no visibility regarding the rare earths cost curve, so have no idea where these prices eventually settle. Some observers correlate REO pricing with Chinese EV sales (which have been soft). Looks like an inventory unwind to us. Time will tell.



Source: Tradium

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