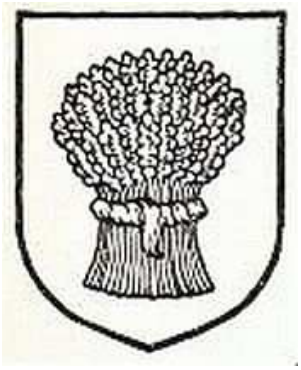
Tuesday, April 13, 2021



HALLGARTEN & COMPANY

Sector Review

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Rare Earths – Ion-adsorption Clays

Novel Mineralogy Moving Mainstream

	Strategy	Exchange	Ticker	Market Cap (mns)
Biolantanidos (Hochschild)	**Long**	**LSE**	HOC.L	£1,052.0
Ionic Rare Earths	**Long**	**ASX**	IXR.ax	$175.60
Serra Verde	**n/a**		Unlisted	-
Reenova Inv. Holdings	**Neutral**	**SGX**	5EC	-

Ion-adsorption Clays

Novel Mineralogy Moving Mainstream

- + There are less than a handful of ion-adsorption clay deposits being developed outside China
- + Ionic Rare Earths is the only listed entity exclusively devoted to this mineralisation, though the obscure Singapore-listed Reenova may also be a challenger
- + Ion-adsorption clay deposits have been seen as the "Holy Grail" of Rare Earth projects due to their lower weighting in the throw-away REEs (Lanthanum & Cerium) and the reduced presence of the deleterious radioactive elements, Uranium & Thorium
- + Rare Earth prices have firmed dramatically over the last twelve months
- + The low level of radioactive contaminants in most IAC deposits is a major plus
- + The Chinese dependency upon imported HREEs from problematic locations such as Burma makes securing large sources of these lanthanides a strong temptation to secure offtakes or buy these assets outright
- ✘ China still has the whiphand in REE-pricing and can sink prices, suddenly, at will
- ✘ There is only one direct exposure in public markets, one indirect exposure and other assets are not listed
- ✘ The environment for funding REE projects has been tough (though now improving) so capex to the low side (something we doubt for Serra Verde) is a virtue

Rare Earths Begin to Buzz

The renewed interest in Rare Earth by politicians and investors coincides with the on-going slide in China's own internal production (not that they are trumpeting the fact). This changes the dynamic from the one which has reigned for the last eight years, where China definitively had the whip-hand. With Chinese supplies (particularly of Heavy Rare Earths) under a cloud and the West having added no capacity in recent years, the scenario is potentially one of shortages and rationing, particularly with regard to those REEs most used in EVs, wind turbines, defence and 5G.

From over 300 claimants to be potential Rare Earth producers in 2011, at the end of the last Rare Earths boom, the number of developers shrunk to less than twenty survivors. The evolving situation has drawn all sorts of players out of the woodwork (or the bunkers where they have been hiding) creating a blizzard of news and misinformation. The number of REE wannabes has seen some augmentation in recent times, but nothing like the surge of 2010.

The eternal dilemma is that most REE mineralisations are overweight in Lanthanum, Cerium and the Light Rare Earths with only ion-adsorption clays and Xenotime countering this preponderance. Of all the

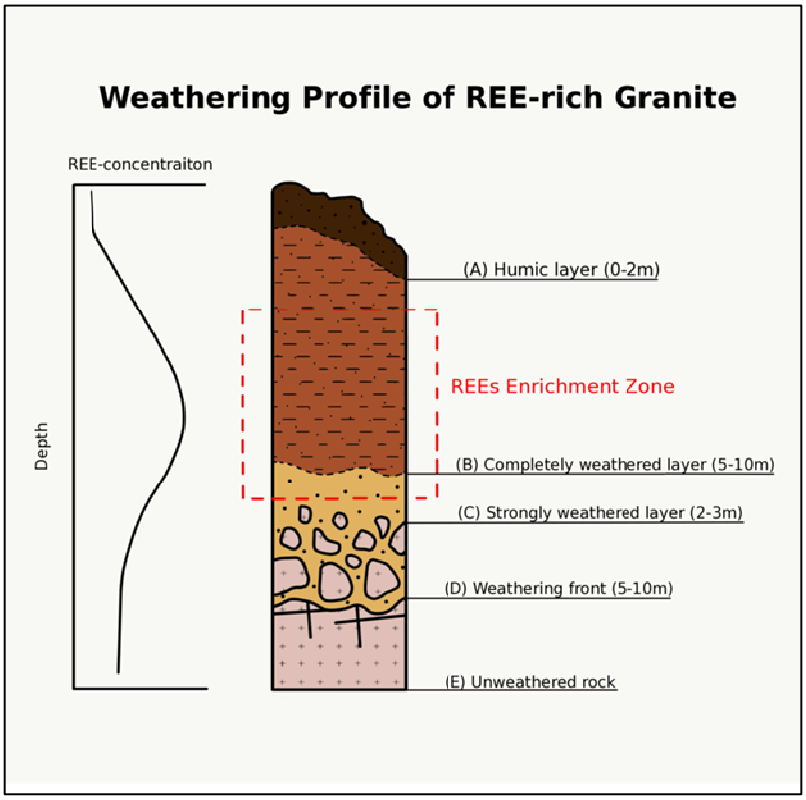
listed explorers back in the first REE boom, there was only one targeting ion-adsorption clays (Tantalus A.G.) and now there is still only one listed champion exclusively devoted to this type of deposit (Ionic Rare Earths) and one indirect play in the form of Hochschild, the owner of Biolantanidos.

Therefore the number of plays with ion-adsorption clays can be counted on less than the fingers on one hand so, in this review, we shall look at the claimants to having viable IAC deposits, the dynamics of the mineralogy and its attractions.

Ion-Adsorption Clays – Rare Indeed

To put this type of Rare Earth mineralisation into a context that is familiar to the more generalist mining investor, the ion-adsorption clay deposits are essentially lateritic, i.e. weathered by climatic conditions. They were formed by chemical weathering decomposition and dissolution of granite and granite porphyry (containing a relatively high abundance of REEs) and subsequent adsorption and enrichment on clay minerals during the migration and penetration process of Rare Earth mineral solutions. The minerals are therefore also called weathering crust elution-deposited Rare Earths.

This process of the enrichment by natural forces produces deposits preponderant in some of the most desirable Rare Earths. It is for this reason that we have described these clays in the past as the "Holy Grail" of the Rare Earths space.



The ion-adsorption clays are a process-enabling geology. They are massive chromatographic formations. If and when they lie below rocks that contain Rare Earth minerals that are then dissolved in the "pure" rainwater and then "separated" by passage through the clays where the most soluble go on through the fastest and the least soluble stay behind they become Heavy Rare Earth laden, relatively Thorium-free, ion-adsorption clays.

Over the millennia, prodigious flushing of the mineralisation by water flows carries the Rare Earths through the clay. As a

result the Light Rare Earths, Thorium, and Uranium have now mostly passed through these clays, but the higher atomic numbered Rare Earths, the "heavier ones," have been slower to follow, so we have now "deposits" trending sharply towards the Heavy Rare Earths in concentrations of 50-500 ppm in southern China and in other places along the rainforest arc of the southeast Asia – Indonesian Archipelago area.

REE Clays & China

Ion-adsorption deposits were first discovered in Ganzhou, China, in 1970. Initially, it was not considered as a mineral phase because it did not behave like any of the known phases of Rare Earth minerals. These particular types of deposits are sparsely distributed throughout seven adjacent provinces of southern China (Jiangxi, Guangdong, Fujian, Zhejiang, Hunan, Guangxi and Yunnan).

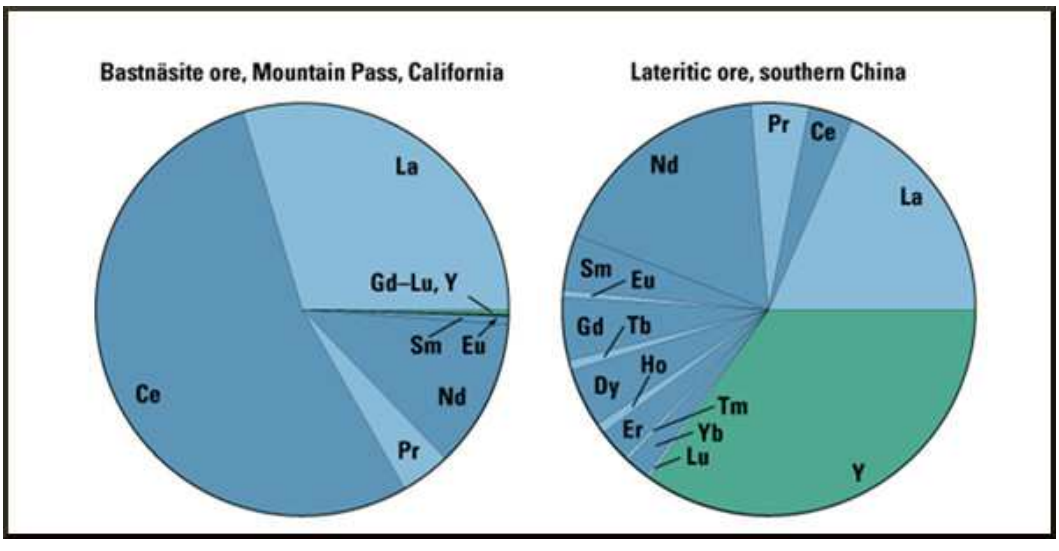
In China these deposits are generally found in small mountains (as pictured below) with a humus topsoil layer of 0.3–1 m, a full- regolith layer of 5–30m (the main ore body, containing 0.03–0.15% REE in general), a semi-regolith layer of 2–3m and a bedrock layer.

As ion-adsorption Rare Earth minerals occur at a simple trivalent cationic state, which is simply adsorbed onto clays, they can be readily extracted by a simple leaching technique with an aqueous electrolyte solution (sodium chloride or ammonium sulfate) via an ion-exchange process.

Therefore, the extraction of ion-adsorption Rare Earths is carried out by open-cut mining followed by tank or heap leaching with sodium chloride or ammonium sulphate solution. Using traditional surface/ mountain top mining and heap-leaching techniques it is estimated that for the production of one tonne of Rare Earth oxide from ion-adsorption Rare Earth ores, 300m2 of vegetation and topsoil are removed, 2000 tonnes of tailings are disposed into adjacent valleys and streams, and 1000 tonnes of waste water, containing high concentrations of ammonium sulphate and heavy metals, is produced.

In spite of an extremely low ratio of ion-adsorption Rare Earth reserves (only 2.9% of China's total REE reserves), this mineralisation accounted for 26% of China's total REE production between 1988 and 2007 and reached 35% after 2009, before declining due to tightened environmental laws and over-exploitation.

So why should ion-adsorption clays be a “Holy Grail” of Rare Earths? The main reason is that the dynamic forces of the leaching and enrichment have ridded the average IAC deposit from much or its Cerium, a significant portion of Lanthanum and usually, much or all of the Thorium or Uranium (see below for a comparison between Mountain Pass and a southern Chinese IAC deposit). In the place of the unwanted Light Rare Earths there is exceptional concentration on the Mid- & Heavy Rare Earths. Over and beyond this the fact that a miner is dealing with clays rather than hard rock reduces the grinding component in process flowcharts involving clay deposits.



The pie charts above are poignantly illustrative as they show the proportions of individual Rare Earths in two representative ores, bastnäsite (dominated by La, Ce and Nd, with Eu through Lu, & Y making up

only a feeble 0.4%). When looking at the Chinese lateritic ion-adsorption ores, one notes that they are dominated by Yttrium, with a dramatic reduction in the throwaway Cerium. Dark blue and light blue segments represent Lanthanides of even or odd atomic numbers with Yttrium indicated in green.

Comps

The universe of ion-adsorption clay deposits has always been small. The subset accessible to investors in Western capital markets is even smaller. Even at the peak of the Rare Earth boom of 2009-12 there was only one asset that we knew of, amongst the 100s of wannabes on offer. That was Tantalus A.G. with a deposit in Madagascar and a listing on the Frankfurt Stock Exchange. There was nothing on offer amongst the heaving mass of arm-wavers on the TSX-v and the ASX.

The Ion-adsorption Clay Universe

		Tonnage (mns)	REO grade (ppm)	Cut-off (ppm)	Contained REO (tonnes)
Biolantanidos (Hochschild)	Chile	22.2	600	100	13,300
Ionic Rare Earths	Uganda	315.0	650	200	204,750
Serra Verde	Brazil	458.0	980		
Tantalus	Madagascar	197.7	897		177,383

Alas for Tantalus though it came to grief in the long period of quiescence after 2012 and disappeared off the radar. It is not clear if it has resurfaced on the Singapore Stock Exchange.

Until the appearance on the scene of Ionic Rare Earths, the only parties were two private entities, Serra Verde in Brazil and Biolantanidos (now part of Hochschild). These were, interestingly, both in Latin America, a zone which the first REE Boom passed by.

The table on the following page shows the differences, in mineralogy, grade, structure, mining method and processing chemistry between the different major known IAC deposits:

Projects	Makuutu	Serra Verde/Pela	Tantalus	Southern China
Form of occurrence	Sedimentary Basin ~ 100km2	Granites/Batholith >100km2	Syenites & Granites/Stocks	Granites/Stocks <100km2
Mineralised Bodies	Discontinuous due to watercourse	Continuous	Discontinuous	Discontinuous
Sediment (bedrock) –	0.03 – 0.05%	0.12-0.16%	0.08%	0.025-0.04%
Saprolite – TREO	0.01 – 1.4 %	0.1-1.0%	0.08%	0.03-0.3%
Saprolite –	10% – 70%	25-60%	19%	25-50%
Mining Method	Strip mining - no blasting	Strip mining - no blasting	Strip mining - no blasting	Strip mining - no blasting - in situ
TREO - Extraction	Ammonium Sulphate	Sodium Chloride	Sodium Chloride & Ammonium	Ammonium Sulphate

Ionic Rare Earths

(ASX: IXR)

Strategy: Long

Background

IonicRE is the only pure-play listed exposure to ion-adsorption clay deposits. The background to its move into Rare Earths is that the company has been listed on the ASX for some time (and was previously called Oro Verde).

In July of 2019 the company announced that it had bought into the Makuutu project in Uganda. The project had hitherto been owned 100% by Ugandan-registered Rwenzori Rare Metals (RRM), which in turn was owned 85% by South African-registered Rare Earth Elements Africa (REEA). Rwenzori had been founded in 2012. Oro Verde entered into a binding earn-in agreement to acquire up to a 60% direct interest in RRM, and thus up to a 60% indirect interest in the project.

For a more extensive coverage of IonicRE we would refer investors to our Initiation of Coverage which went out in late March 2021.

Makuutu

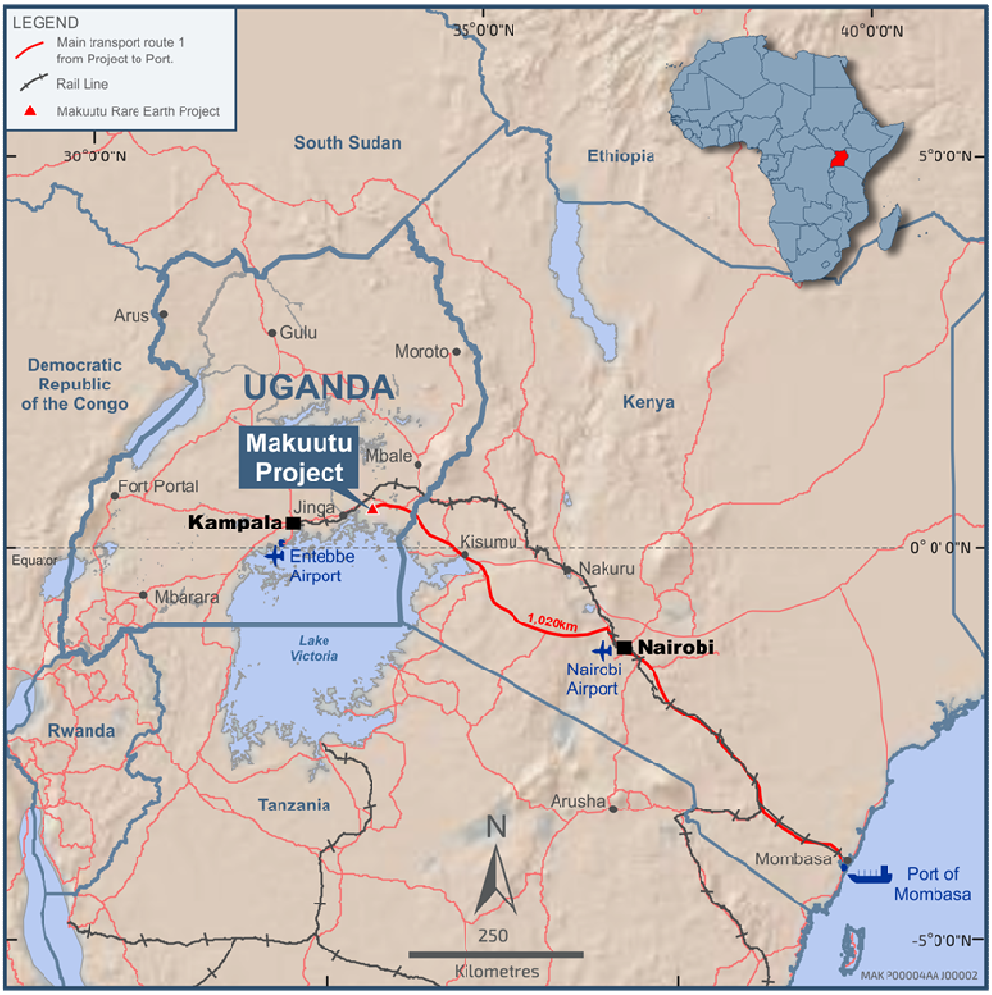
IonicRE's target is the Makuutu project, which is comprised of five licences covering approximately 242 km2. It is located ~40km east of the regional centre of Jinja and 120km east of the capital city of Kampala in eastern Uganda. Makuutu is gifted with excellent infrastructure with tarred roads, nearby rail, power and water, cell-phone coverage, as well as being readily accessible throughout the year irrespective of weather conditions.

Geology

The Makuutu Project is located in the Paleoproterozoic (1600 – 2500 Ma) Lake Victoria Terrane with the Kayango granite and the Iganga Suite granites interpreted as basement rocks and potentially the primary source of the REE.

Overlying the basement granites in the project area is a basin filled with sediments including

diamictite/glacial tills, mudstones, siltstones and shales. The upper units of these sediments are potentially derived from degradation of the surrounding granites and represent the protolith for the mineralisation at Makuutu.



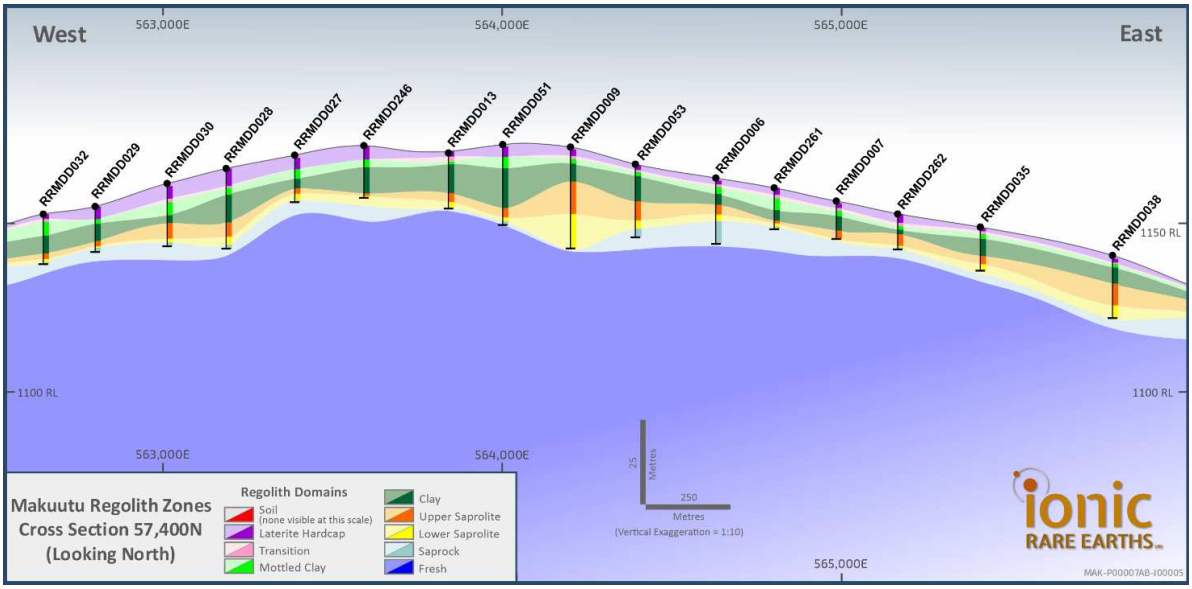
The REE mineralisation at Makuutu is considered to be ion-adsorption clay style similar to the type of deposits found in China, Myanmar, Madagascar and Brazil, with the mineralisation hosted in the near surface tropical lateritic weathered sediments. The weathered profile is typically comprised of a surface hard-cap, followed by mottled clays grading to saprock and fresh sediments at the base. The hard-cap is variably overlain by recent alluvial soils, up to 1m thick. The average thickness of the mineralised zones >300ppm TREO between the zones ranges from 8m to 20m.

The mineralisation is contained within the tropical lateritic weathering profile of a basin filled with sedimentary rocks including shales, mudstones and sandstones potentially derived from the surrounding granitic rocks. These granitic rocks are considered the original source of the REE which were then

accumulated in the sediments of the basin as the granites have degraded. These sediments then form the protolith that was subjected to prolonged tropical weathering.

The weathering developed a lateritic regolith with a surface indurated hardcap, followed downward by clay rich zones that grade down through saprolite and saprock to unweathered sediments. The thickness of the regolith is between 10 and 20 metres from surface.

The REE mineralisation is concentrated in the weathered profile where it has dissolved from its primary mineral form, such as monazite and xenotime, then adsorbed on to fine particles of aluminosilicate clays (e.g. kaolinite, illite, smectite). This adsorbed REE is the target for extraction and production of REO. A typical cross-section through the project area is shown below.



The clay band (illustrated in green) demonstrates the generally consistent nature of the profile over the section distance of 2.4 km. The REE mineralisation is dominantly hosted in the clay and laterite, although some rare earths are contained in the shales, albeit at lower concentrations than in the overlying clays.

Drilling at the project shows a clear vertical zonation of REE through the weathered profile, which is typical of a laterite style of mineralisation. The zonation is notable as the Light Rare Earths (LREE), particularly Cerium, are concentrated in upper portions of the profile, especially the hard-cap.

The transitional and the mottled clays beneath the hard cap are more Cerium-rich relative to the rest of the mineralisation. The higher value rare earths such as Neodymium, Praseodymium, Dysprosium and Terbium are generally concentrated toward the mid to lower levels of the weathered sequence, within the clay and upper saprolite regolith.

Resource

In early March 2021, an updated resource was announced, showing a significant 210% increase in the Mineral Resource (at a cut-off grade of 200 parts per million Total Rare Earth Oxide minus CeO_2) to 315mn tonnes grading at 650 parts per million Total Rare Earth Oxide.

Makuutu Resource

@ 200 ppm cut-off

Category	Tonnes (Mt)	TREO (ppm)	TREO w/o Ce_2O_3 (ppm)	LREO (ppm)	HREO (ppm)	CREO (ppm)	Sc2O3 (ppm)
Indicated	66	820	570	590	230	300	30
Inferred	248	610	410	450	160	210	30
Total Resource	**314**	**650**	**440**	**480**	**170**	**230**	**30**

In this latest resource estimate, the Heavy Rare Earth Oxides (26%) and Critical Rare Earth Oxides (35%) account for a substantial component of the Resource mineralisation.

Work is now advancing towards publication of a PEA, which is expected to be released to the ASX in April 2021. IonicRE has already publicly advised that the intention is then to move directly to a BFS to support a Mining Licence application by the end of October 2022.

Latest News

Since we published our Initiation a few weeks back the company has signed a non-binding Memorandum of Understanding Chinalco's subsidiary, China Rare Metals and Rare Earth (Jiangsu) Co., Ltd in relation to the development of the Makuutu project.

IonicRE and Chinalco have agreed to use their reasonable endeavours to strategically cooperate to accelerate Makuutu mine development and production for mutual benefit. Additionally the Chinese company will explore the potential for future investment in IonicRE, and/or the Makuutu project directly, and/or off-take agreements.

Conclusion

IonicRE has less Lanthanum, less Cerium and less radioactive elements. That must put the company in a stronger position than those trying to compete with the burden of these deleterious elements. The challenge now for the company is to use this advantage (and its good infrastructure) to present a Feasibility Study with attractive economics which puts it in the Final Five of companies that will make it to production in the current cycle.

Thus we have given IXR a LONG rating with a 12-month target price of 15 cts.

Hochschild

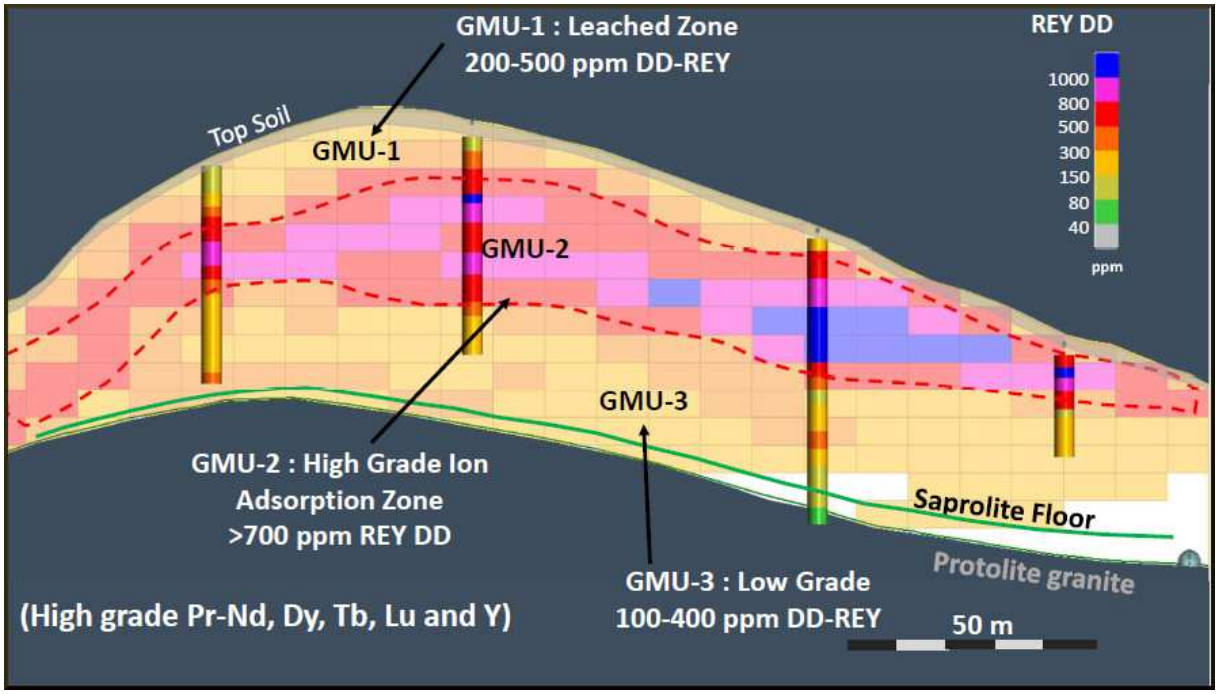
(LSE: HOC)

Strategy: Long

We were seemingly one of the few impressed by the earthshaking announcement of Hochschild acquiring the part of Biolantanidos in October of 2019. The target being an advanced development stage ion-adsorption clay project in Chile.

The project consists of approximately 72,000 hectares of concessions and an initial modular project developed in the Penco area in an area of 300 hectares, approximately 15km from Concepción in Chile.

Hochschild had previously invested US$2.5mn in the project during 2018 and early 2019 in exchange for a 6.2% equity stake with an option to increase ownership. It was this option that was exercised in the last quarter of 2019, finally acquiring the remaining 93.8% stake for $56.3m.



The fascinating thing is that we have a mid-sized cash-flowing miner as an interloper entering a sub-space (then) widely regarded as blighted and snapping up one of the few assets capable of being added to the thin ranks of HREE producers.

Biolantanidos had prepared a feasibility study (positing 1,700 tpa of mixed REO concentrate) before its takeover but Hochschild signaled its intention to revise the study over the following 18 months, as well as appointing a dedicated management team to oversee development of the project.

NI 43-101 Resource Estimation (Penco)[1]

Cutoff (ppm REO)	Tonnes (Mt)	Average grade (ppm REO)	REO in-situ (ton)
150	20,9	629	13,150
120	21,4	618	13,210
100	22,2	600	13,300
0	23,0	580	13,360

[1] NI 43-101 Resource Estimation update as of September 2016

Oh, and look, a real life pilot plant that isn't just a chemistry set in the CEO's kitchen!

Conclusion

The combination of our bullish perspective for the silver price and somewhat of a gold rush (excuse the mixed metaphor) in the Rare Earth space implies to us that Hochschild is exceedingly undervalued at the current levels. While so-called pundits muse upon which no-hoper in the United States might be the

next to produce a tea-cup worth of Rare Earths, the prospect is definitely better that Biolantanidos (either within Hochschild or spun-out) will be producing Heavy Rare earths within the next three years than most of the other current non-producers.

With a sound jurisdiction and well-padded owners, the project does not have to scrabble around in the dirt for drachma like so many others. With its substantial pilot plant it is also the most advanced of all the IAC claimants.

We established a LONG rating on Hochschild in December of 2020 and have a twelve-month target price of £3.40.

Serra Verde

(unlisted)

Strategy: N/A

Serra Verde was founded in 2008 and is primarily funded by Denham Capital, a U.S.-based investment fund. The project is located in Minaçu County, Goiás State, Brazil, targets the production of a Rare Earths concentrate.

It is envisaged that Serra Verde will enter into production in mid-2022 and is currently submitting reports to the government. Tailings dam issues have become a hot topic in Brazil and thus this must be addressed before moving forward.

Geology

Geology

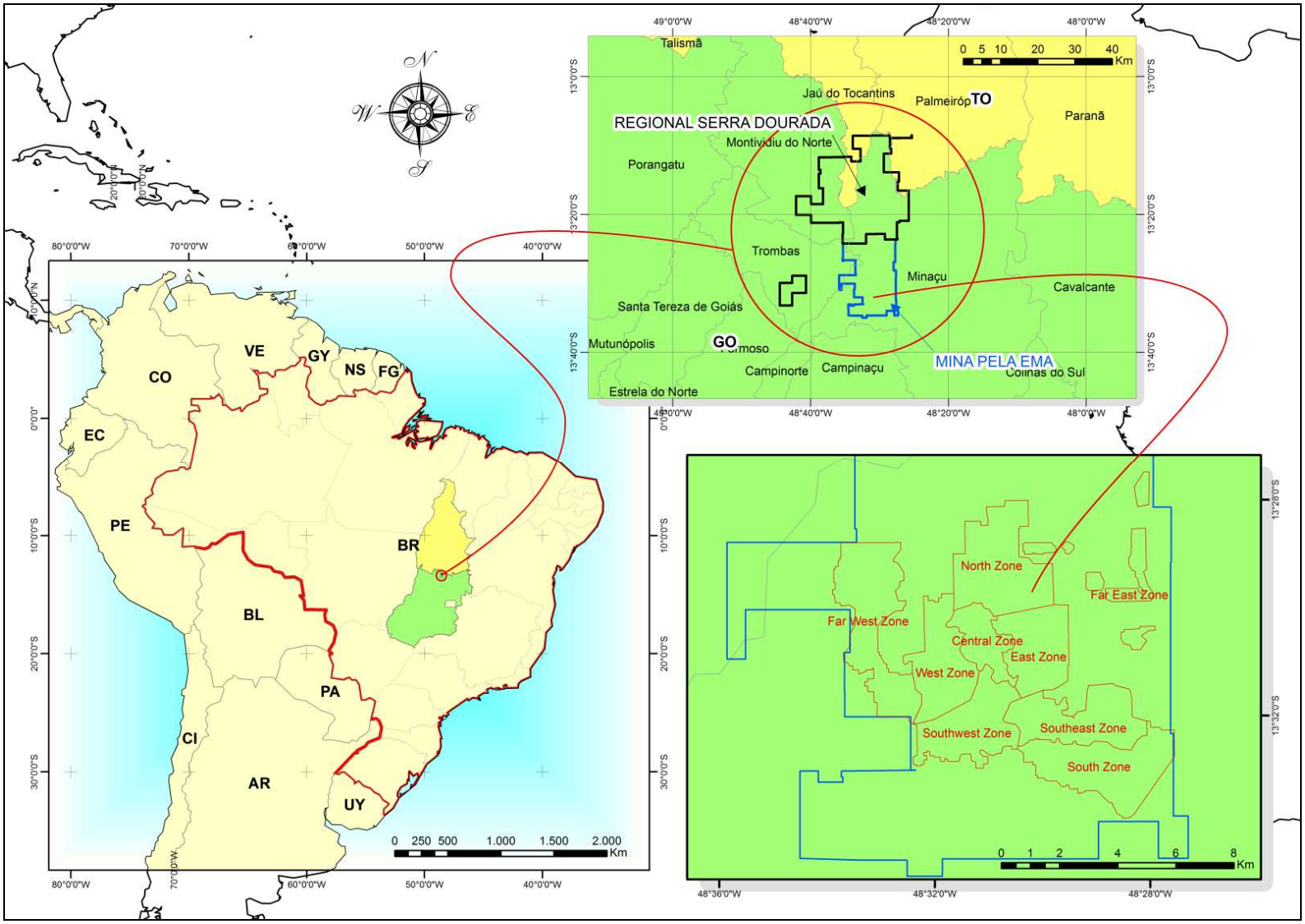
The REE typically occur in a six metre-deep layer of clay-bearing saprolite produced by the deep weathering of granite. Initial testing suggests that more than 50% of the REE bulk is sorbed on clay and can be recovered by a simple elution process.

The Serra Verde REE deposit is associated with a Proterozoic alkali granite within the Goiás province of Brazil. The REE introduction and enrichment may be related to three main stages of geological evolution:

- Emplacement of the Pela Ema Tin granites (~1.8 Ga). This resulted in the formation of typical tin-bearing greisen veins hosting monazite and xenotime.

- Intrusion of an evolved alkaline (possibly carbonatite) complex at depth (~540 Ma).This caused potassium metasomatism (K-feldspar-biotite) with additional introduction or recrystallisation of monazite, xenotime and magnetite.

- Lateritisation, possibly during the Miocene.


REGIONAL SERRA DOURADA
MINA PELA EMA
Talismã
Jaú do Tocantins
Palmeirópolis
TO
Paranã
Montividiu do Norte
Porangatu
Trombas
Minaçu
Cavalcante
Santa Tereza de Goiás
Mutunópolis
GO
Campinorte
Campinaçu
Colinas do Sul
Estrela do Norte
0 5 10 20 30 40 Km
CO
VE
GY
NS
FG
EC
PE
BR
BL
PA
CI
AR
UY
0 250 500 1.000 1.500 2.000 Km
North Zone
Far East Zone
Far West Zone
Central Zone
East Zone
West Zone
Southwest Zone
Southeast Zone
South Zone
0 1 2 4 6 8 Km

A 30-35 metre thick lateritic weathering profile developed, resulting in the breakdown of feldspars to clay and the dissolution of REE-bearing minerals with reprecipitation in the saprolite ore zone. Colluvial accumulations of REE are also present.

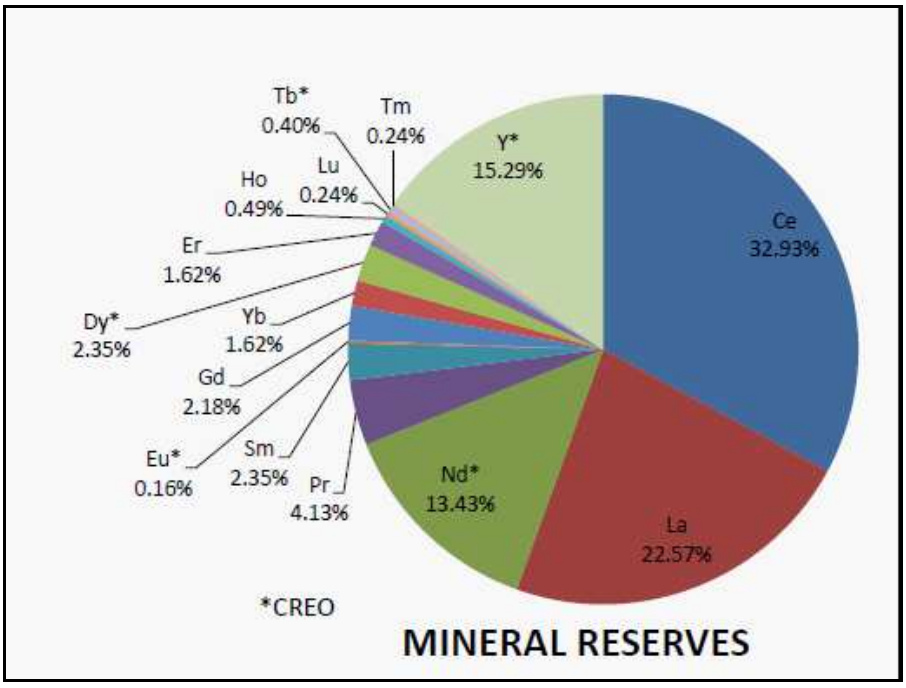
The Resource

The most recent resource we can find for Serra Verde is that dating from February of 2015 that was prepared by Roscoe Postle & Associates. The results of which are shown below:

Serra Verde Saprolite Resource

Category	Tonnes mns	LREO %	HREO %	TREO %	ZrO2 ppm	ThO2 ppm	U3O8 ppm
Measured	22	0.15	0.06	0.21	844	93	14
Indicated	368	0.11	0.04	0.15	711	106	14
M&I	390	0.07	0.02	0.1	564	78	11
Inferred	521	0.07	0.02	0.1	564	78	11

One of the challenges for Serra Verde is that, despite being an ion-adsorption clay deposit, its REE mix/distribution (shown in pie chart below) looks only slighter better than a conventional Rare Earth mineralisation, with a preponderance of Cerium and Lanthanum coming in at around 55%.



Mining

The mine plan prepared by RPA back in 2015 envisaged:

- A 22-year LOM
- A mining rate of 6 mn tpa for Years 1-4 and then 20mn tpa for years 5-22
- TREO production of 5,000 tpa TREO in Years 1-4 and then 10,000 tpa in Years 5-22 for a total of 189,000 tonnes of TREO

This plan is now somewhat dated so we suspect it will see revision again to reflect changed realities and economics. To achieve the types of volumes being talked about we suspect the capex is going to be quite eye-watering.

Denham Capital

Denham Capital is a global private equity firm focused on energy and resources. Since its founding in 2004, Denham Capital has raised eleven institutional funds totaling almost $9bn in committed capital. The firm is headquartered in Houston, with offices in Boston, London and Perth.

We have come across the fund various times in the past. Most recently it has been mentioned by us in the context of its controlling position (58%) in our favoured Tin major, Alphamin Resources (TSX-v:AFM) that operates in the DRC. It is no surprise that such a group should get behind Serra Verde.

As a PE group there is always one eye focused on the eventual exit strategy from any situation.

Conclusion

We are intrigued as to where this project is ultimately heading. If Denham are determined to seize the day they might use the SPAC boom (if this isn't exhausted already) to give this asset a listing on the NY markets. There is also the potential of a trade sale to the Chinese. However Brazil is not exactly a China-friendly location. Bringing in Chinese *Gastarbeiter* is not on. However the preponderance of HREE would definitely be a draw for the Chinese.

A combination with MP Materials is a tempting thought, but only time will tell.

Reenova Investment

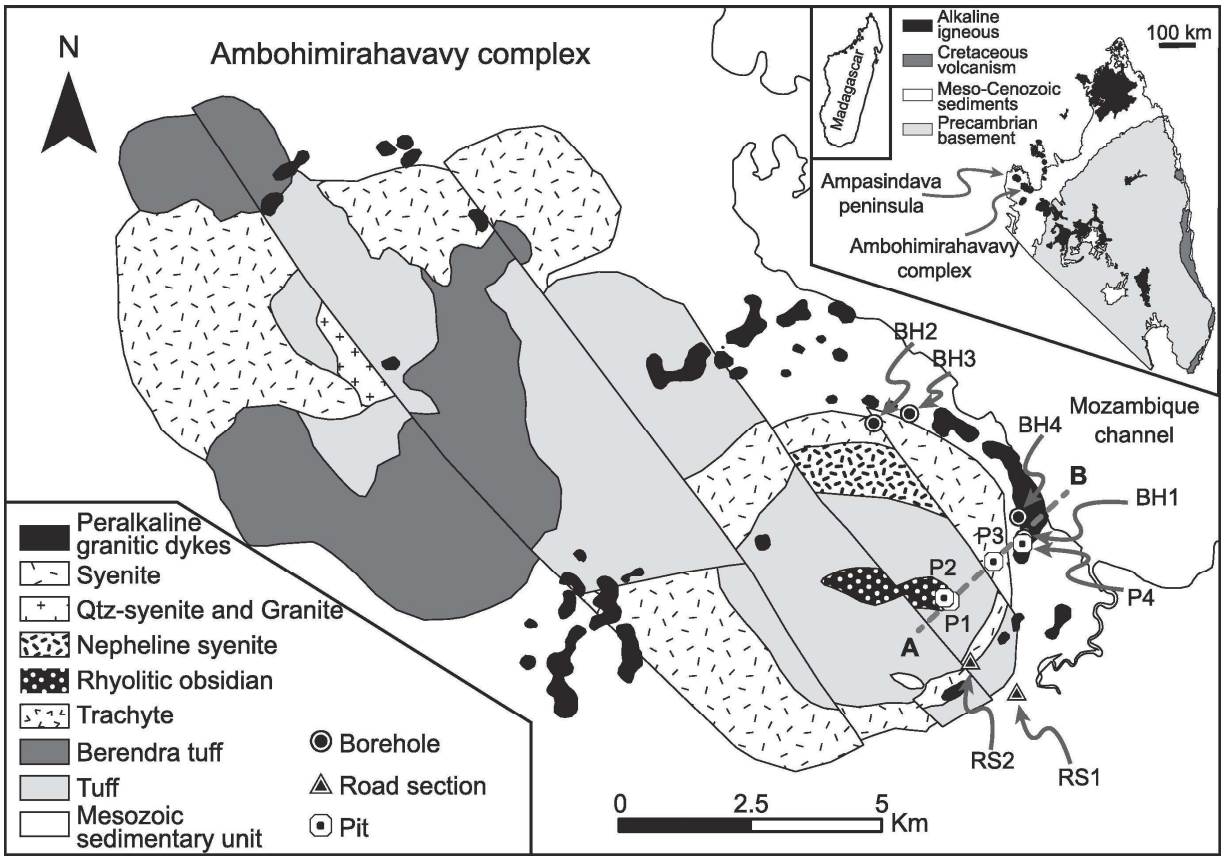
(SGX: EC5)

Strategy: Neutral

The Asset

Its Tantalus asset is an exploration project in Madagascar which comprises rare earth-tantalum-niobium-zirconium-hafnium enriched dykes and sills and rare earth element bearing Lateritic Clays.

The 92-square mile (238-square kilometer) concession is located on the Ampasindava peninsula in northwest Madagascar, just across the water from Nosy Be, the country's main tourist destination.



SRK (UK) Ltd completed the analysis of the pitting and drilling results available as at mid-November 2011

and estimated an Inferred Mineral Resource of 130 million tonnes of rare earth oxide (REO) bearing Lateritic Clays with an average grade of 0.08% REO. This is very much on the low side.

Since 2012, the company has completed 4412 pits (up to 10m deep) and 359 boreholes (up to 130m deep) providing a set of geological and geochemical data extending across the entire complex. These data points were used to build a 3D geological model and calculate a (M&I) mineral resource of 197 mn tonnes at 897 ppm total Rare Earth oxide.

Travails

Tantalum Rare Earth Malagasy (TREM), a company owned by firms in Germany and Singapore, held the rights to the project after Tantalus went bankrupt in 2015. The ownership of Tantalum Rare Earth Malagasy (TREM) was in a state of flux from late 2015. ISR Capital, a Singapore-listed company, was in the process of taking a majority stake in TREM. In 2016, just before the announcement of its TREM acquisition, ISR's stock price began a dramatic rise that lasted several months. When it later crashed, the Singapore Stock Exchange suspended trading of ISR stock.

In late 2017 it was reported that the project, previously valued at over $1 billion, was reappraised at just $48mn.

Current Fate

In June of 2019 it was announced that a unit of China Nonferrous Metal Mining Group (CNMC) had signed a non-binding memorandum with ISR Capital that could see the Chinese firm work as a contractor on a rare earths project in Madagascar with rights to purchase products.

China Nonferrous Metal Industry's Foreign Engineering and Construction Co Ltd said in a filing to the Shenzhen stock exchange it had priority rights to be the engineering, procurement and construction (EPC) contractor for the Tantalus project.

The company changed its name to Reenova Investment Holdings in late 2020 but has not traded since last November.

Conclusion

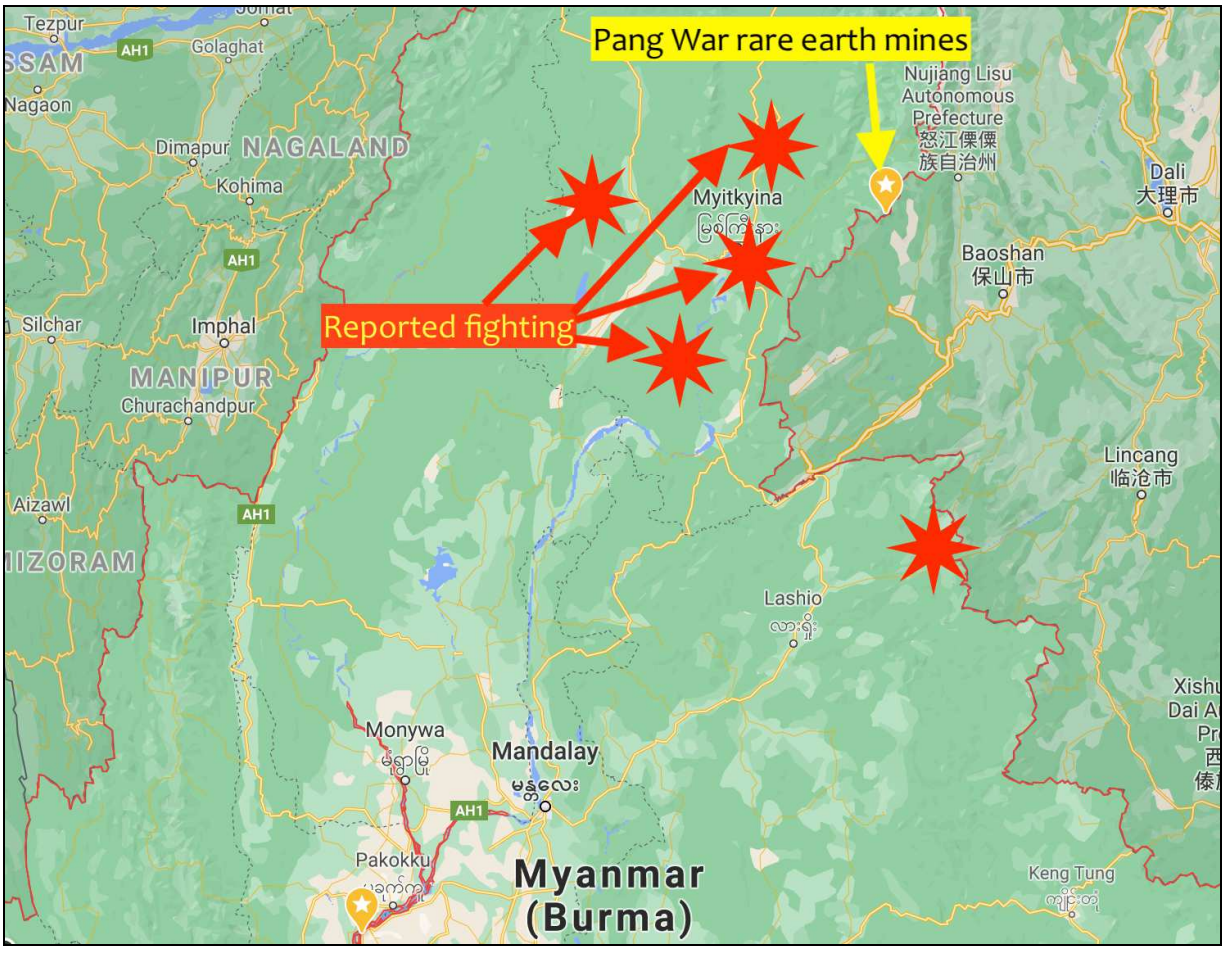
To say the current status of this asset and its ownership is obscure is an understatement. The Tantalus asset is interesting and tantalising. Whether it would obtain mining approval remains a mystery. The Chinese seems to have the jump on it though.

Something to watch…

Burma on the Mind

It has been mused upon by observers that China may have kicked themselves an own goal in backing/sponsoring/condoning the move of the Burmese military against the civilian government there. The resulting disruption to the supply of Rare Earth ores, concentrates and semi-processed products between Myanmar and China has the potential to create significant supply chain issues for processors in southern China.

Roskill reported in late March that all IAC mining operations, including those who had operated throughout in 2020, asked to be suspended in late February, and there are no signs of any re-start yet. They noted that the proposed introduction of ammonia-free *in-situ* leaching technology at various IAC projects in China has not materialised despite continued concerns regarding pollutants, recovery rate and social impacts.



Source: Rare Earth Observer

This means that there are very few operational alternatives to Myanmar-derived production of HREEs such as Dysprosium and Terbium, with viable sources either only in pilot-scale production, or producing mixed HREE products as a by-product of Nd-Pr. Roskill estimates that, in 2020, Myanmar accounted for 39% of global HREE mine production, with China itself the only other major producer of HREE mined products at 48% of global supply. In comparison, the next largest producer of HREE mined products was Lynas at roughly 5.5% global supply. The consultants reported that there are stockpiles of refined HREEs, including Dysprosium and Terbium compounds, held by both private and public inventories, which could be drawn down in China, though without primary production these inventories would soon become depleted.

Risks

The whole Rare Earth industry finds itself in a different world with some constants from the previous "boom", but also quite a few things have changed. However it is worth enumerating some of the risks that may be faced:

- A return to weak Rare Earth prices
- The REE market is still controlled largely by China
- Financing difficulties for mine build
- Failure of demand to match rising production (i.e. build it and no-one comes)
- Excessive number of competing projects could crowd the scene and investors' attention in the event that REE prices turn up

Rare Earth prices are not likely to go lower than the levels they have been at in recent years, even the Chinese are not running a charity any more. Prices have been ebullient for the last three months but there is no rationale for them to even vaguely test the highs of 2011-12. The Chinese have learnt their lesson from last boom and that lesson is that the best way to maintain control and discipline market players is by aggressive predatory pricing. Even now there is talk swirling of the Chinese pondering ramping down (!) LREE prices.

Despite the hullabaloo, there is not a lot of money for major REE capex pipedreams out there. The MP SPAC came with $500mn embedded, which got the company off to the races. UUUU are running on the smell of an oil rag. Many of the fakers and wannabes are promoting the hell out of the concept but not actually spending anything.

With the EV "revolution" finally gaining traction outside of China the potential for greater demand for REE magnets from the automotive sector is enhanced. We see no reason for REE demand to slacken and indeed there is the potential for it to finally start to meet some of the bullish projections of 10 years ago.

Finally, there is the issue of competing projects. The Canadian projects have a few contenders to be real, but most of the promoters there remind us of Mark Twain's definition of miners, except they don't even have a hole to stand at the top of. Projects farther away (and we don't mean Greenland or Angola) stand some prospect (particularly if located on the territory of US allies, i.e. Australia) of being seen as being "as good as onshore".

Conclusion

In the first Rare Earth boom there was a certain "couldn't care less" attitude towards mineralisations and other finer details of the art of developing a Rare Earth mining and processing operation. This time around the focus is on processability (and the cost thereof). Thus the key consideration now is if the host mineral for the REEs is economically mineable and then can be subjected to a processing regime that is not too expensive in terms of opex or capex. A key difference this time is that the first boom saw indiscriminately high prices for ALL Rare Earth Oxides. This time the prices of Lanthanum and Cerium are so low they can be scraped off the floor. The implication of this is that the economics of also-ran deposits with high Le-Ce preponderance are shot to pieces in the market place.

Back in 2009-11, the ion-adsorption clays were regarded as the Holy Grail of REE deposits but they were also regarded as very rare unicorns, in which only the Chinese (supposedly) had cornered the market. In a marketplace rife with speculation and ignorance this was one of a plethora of lies doing the rounds. In fact, while not common, these clays do exist around the world in laterite form where natural weathering has leached out many of the "undesirable" elements, whether it be radioactive elements or the "throwaway" REEs like Cerium and Lanthanum.

"Less is more" might be the mantra of this go-around in Rare Earths. Ion-adsorption clay deposits have less Lanthanum, less Cerium and, usually, less radioactive elements. That must put those companies with this mineralisation in a stronger position than those trying to compete with the burden of these deleterious elements. The challenge now for the challengers is to use this advantage to present to the market projects with attractive economics. This could put an IAC project in the Final Five of companies that will make it to production in the current cycle.

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