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American Rare Earths Limited (ARR)

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Metallurgy is the Key to Rare Earths

Recommendation: Spec Buy

Our View

End users seeking security of supply of rare earths - Given China's history of using trade as a weapon, several countries are now seeking supply chain security in several critical and strategic minerals, including rare earths, for which China controls global trade. This monopoly provides threats to both military and domestic supplies, exacerbated given current geopolitical tensions.

Threats recognised by the US Government - The US has recently enacted bi-partisan legislation looking to promote domestic upstream and downstream production of rare earths, with this including the provision of US$800 million for R and D. Downstream includes separated products, for which China currently produces close to 90% of global supply – the only non-Chinese producer of separated rare earths is Lynas Corporation's (ASX: LYC, "Lynas") Malaysian facility. Lynas has recently contracted with the US Department of Defense ("DoD") to develop both heavy and light rare earth separation facilities in the US.

Growing market for rare earths - The need to secure and develop security of supply is also underpinned by the forecast increase in demand, largely due to the adoption of green technologies, including electric vehicles ("EV") and wind turbines. These are major users of rare earths, particularly neodymium and praseodymium ("NdPr") which are key elements in the magnets used in these applications. Forecast growth for NdPr is up to 7% CAGR over the next decade.

US rare earths opportunity recognised by ARR - This presents an ideal opportunity for companies to move into the rare earth space in the US, both in mining/processing and in taking part in R & D in processing technologies. American Rare Earths Limited (ASX: ARR, "ARR" or "the Company") has recognised this, setting up operations in the US. This has included the acquisition of the La Paz (Arizona) and Laramie (Wyoming) rare earths projects, with a third project in Nevada (and close to Mountain Pass) under review.

Metallurgy the key at La Paz – Drilling is due to commence shortly at the La Paz Rare Earth and Scandium Project ("La Paz"), a large, shallow (thus far drilled to a depth of only 31 m), albeit low grade deposit, open at depth and along strike. In addition to looking to enlarge the deposit, a key facet will be to collect samples for metallurgy, including concentration and extraction, with the Company forming key partnerships to undertake this. Metallurgy is the key to unlocking value, and that optimising work that was completed in 2011 could result in a flowsheet that would produce a clean high-grade/high recovery concentrate that may, with the other factors mentioned above, overcome the low grade. Mineralisation is mineralogically relatively simple and importantly has no radioactive elements that add significant costs to other rare earth projects.

Broken Hill interests - ARR continues to hold interests near Broken Hill in NSW, Australia, including a 2% Net Smelter Return ("NSR") royalty over Cobalt Blue Holdings' (ASX: COB, "Cobalt Blue") Broken Hill Cobalt Project ("BHCP"). The holdings are considered prospective for precious, base and industrial minerals, with the Company considering options about how to generate value.

Liquid assets – With A$5.0 million in the bank as of January 19, and shareholdings with a value of ~A$2.13 million, ARR is cashed up to support ongoing work programmes.

Experienced board and management – Personnel have extensive experience in the junior resources sector, as well as having significant holdings in the Company, thus aligning their interests with other shareholders.

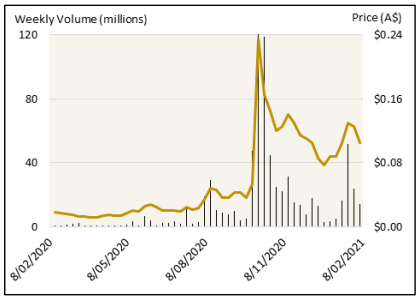
US domiciled operations team – With the exception of the Managing Director, company employees are US domiciled, who have experience in the jurisdiction and the deposits – this situation also cuts down on duplication and hence costs.

Ongoing news flow – ARR has active ongoing work programmes, including the La Paz drilling and metallurgical work, with results to flow into a planned Scoping Study.

Summary (AUD)

Structure and Cash	
Market capitalisation (undiluted)	**$33.2m**
Share price (February 10, 2021)	**$0.10**
52 week low	$0.011
52 week high	$0.235
Cash (19/1/21)	$5.00m
Cash on in-money option conversion	$0.13m
Ordinary shares (undiluted)	331.6m
Unlisted options	18.83m
In-money options	5.50m
Diluted for in-money options	335.3m
Fully diluted	348.7m
Other Financial Assets	
COB Shares (February 10, 2021)	$A2.13m
COB Promissory note (face value)	A$3.00m
COB NSR (TC risked valuation)	A$3.00m

Share price graph (AUD)



Directors & Management

Mr Creagh O'Connor	Non-Executive Chairman
Mr Geoffrey Hill	Non-Executive Director/Deputy Chairman
Mr Keith Middleton	Managing Director
Mr Dennis Geldard	Non-Executive Director

Top Shareholders

Hill Family Group	16.40%
IPS Nominees	2.12%
Middleton Nominees	2.11%
Top 20	38.80%
Directors	27.46%

Background & Strategy

Background

American Rare Earths (previously Broken Hill Prospecting) is focussing on strategic metals exploration and development, particularly rare earths and scandium in the USA (Figure 1).

The Company's key properties, and those on which activities are concentrated, include (and which are detailed later in this report):

- The **La Paz Rare Earths and Scandium Project** located in Western Arizona, which has an Indicated and Inferred Mineral Resource Estimate of 128.2 Mt @ 0.037% total rare earth elements ("TREE")[1]; and,
- The **Laramie Rare Earths Project** located in **Central Wyoming**, which is an early-stage exploration project in the process of being acquired from Zenith Metals Limited (ASX: ZNC, "Zenith").

Also, as announced in the December 2020 Quarterly Report, ARR has identified another project in Nevada, 30 km from Mountain Pass, the only operating rare earths mine in the US. The area, covering 626 hectares, is on Bureau of Land Management ("BLM") land, and samples have been collected for assaying and petrographic analysis in preparation for staking and claim filing.

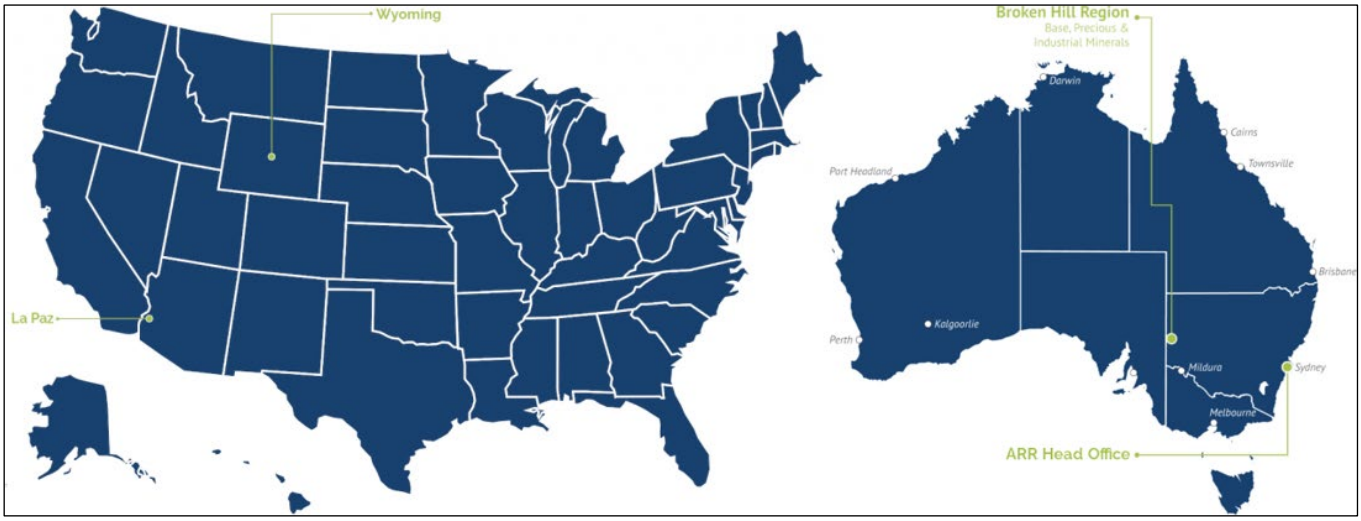
Another plank in ARR's US rare earth strategy is research and development into innovations in the processing side. As such, the Company has partnered with the Lawrence Livermore National Laboratory ("LLNL") and Pennsylvania State University ("Penn State"), collaborating on research on rare earth extraction using samples from both La Paz and Laramie. This has resulted in a proof-of-concept demonstration using biosorption technology, with work ongoing. The Company has also interest from other groups in testing innovative extraction technologies, including Lixivia, with their SELEX™ process.

As part of the above, the Company is looking for up to US$1.4 million in research funding from the US Department of Energy ("DoE").

This is in addition to, and separate from, the beneficiation metallurgical programme planned for La Paz, with the Company engaging Wood plc ("Wood") to manage this work, with the test work to be undertaken by the Saskatchewan Research Council ("SRC"), who undertook the original beneficiation work on La Paz.

The Company has set up a US based management and operations team, with the only Australian domiciled employee being the Managing Director.

Figure 1: Project locations (Source American Rare Earths)



American Rare Earths holds significant tenements in and near Broken Hill NSW in what is a world class mineral province (Figure 1) These contain the Main Line, Broken Hill North-West and Triple Chance base and precious metals projects. ARR is currently reviewing its strategy for these project area tenements. However, given their proximity to the world class Broken Hill mineralisation, the Company is confident of being able to identify a commercial pathway and realise the full value of the holdings.

[1] Throughout this note "REE" refers to the rare earth elements, with "REO" referring to the oxides. The prefix "H" refers to heavy elements or oxides, "L" to the light rare earths and "T" to the total assemblage.

The Company also retains rights to an NSR royalty of 2% on all cobalt production from the BHCP which was sold to Cobalt Blue by ARR, which was then Broken Hill Prospecting Limited (ASX: BPL). Consideration for the sale, and our valuation of the NSR is detailed later.

Given the focus on the US, the Broken Hill tenements will not be discussed further.

Why the US?

The focus on the US is a considered and strategic one by ARR, given current and forecast developments in the rare earth and other critical minerals markets. With most current rare earth (as well as other strategic/critical materials) production controlled by China, other countries, including the US and Australia are now looking to build certainty and diversity into supply chains. This includes promoting domestic production where possible, particularly for the valuable NdPr REEs, which are widely used in permanent magnets, as used in EVs and wind turbines. Rare earth metals are also crucial for defence applications.

Control of the rare earth's market, both for concentrates and finished goods, gives China a potent political and strategic weapon, which in the writer's view China will not hesitate to further use in the future with increasing geopolitical tensions. A recent example was the 2010 restriction of supplies of finished products to Japan following a diplomatic stoush relating to the South China Sea, which resulted in a steep spike in prices. Restrictions on supplies globally continued until 2015, at which time the WTO made an adverse ruling against the restrictions.

Also, it has been recently reported that China is now looking again to restrict production and exports of finished products, citing reasons such as cracking down on illegal mining and closing environmentally unfriendly operations.

However, are these reasons just excuses for flexing market control muscles? On the other hand, the opposite can occur, with the ability to free up domestic mine production, and thus force down prices of imported concentrates resulting in distress to non-Chinese miners. Uncertainty in pricing also makes it harder to get financing for what can be high capex operations.

This situation will be exacerbated should global demand for NdPr oxides increase to between 60,000 and 70,000 tpa as forecast by some, up 60 to 80% from the 2019 demand of ~38,000 t. The only non-Chinese producer of separated rare earths is Lynas, which in 2019 produced 19,737 t of TREO, including 5,898 t of NdPr, which equates to ~12% of TREO and 16% of NdPr global supply. Total 2019 supply of separated products was estimated at 170,000 t.

In late September 2020 President Trump signed an Executive Order declaring a national emergency in the mining industry (specifically mentioning rare earths and scandium), and the wish to have more control over the supply chain and generate domestic production. This is supported by both major parties in the US with two pieces of supporting legislation before the law makers, namely the "Onshore Rare Earths Act" and Reclaiming American Rare Earths Act" The push also allows for US$800 million in R and D funding. ***Therefore, the US provides an obvious jurisdiction to set up strategic/critical mineral operations (both upstream and downstream)***.

The re-joining of the Paris Accord by the Biden administration should also drive US domestic growth in the take up of "green" technologies, key users of the targeted metals.

Another feature of the overall push for self-sufficiency is to provide funding for Phase 1 of the establishment of a HREE separation facility in the US. Lynas was awarded such a contract by the US Department of Defense ("DoD"), as announced to the market on April 22, 2020. The contract was signed in July, with the scope of work to include a market and strategy study, followed by detailed planning and design work.

This was followed up in January 2021 with the announcement that Lynas had signed a further contract with the DoD to build a LREE separation plant, most likely to be situated in Texas. The DoD is expected to provide funding of up to US$30 million, with Lynas expected to contribute a similar amount.

This will be expected to produce 5,000 tpa of LREE, including ~1,250 tpa of NdPr. Should the HREE plant contract as signed earlier proceed past Phase 1, it is likely both the HREE and LREE separation plants will be in the same facility.

Works will be undertaken by Lynas and their strategic US partner Blue Line.

It should be noted that until the 1990s, the US was a major producer of rare earths globally, largely by virtue of the Mountain Pass Mine in California that first opened in 1952. However, the mine was defunct by 2002, in part strangled by strict environmental regulations. China then stepped into the gap and provided a ready supply. Molycorp was formed in 2005 to restart Mountain Pass, and things looked good when rare earths prices spiked in 2010 following China restricting supply to Japan.

Molycorp then went on an acquisition spree, which included assets in China. However, the early 2010s saw fortunes fall (ending in bankruptcy in 2014), which also saw the best assets (including processing plants) being transferred to the Chinese-linked Neo Materials. Mountain Pass was purchased out of bankruptcy in 2017 (by a group that included Chinese interests), with operations recommencing in 2018 – 2019 production as published by the USGS was 28,000 t of REO concentrate, all of which was exported to China for processing.

Structure and Funding

ARR currently has 331.6 million fully paid ordinary shares and 18.83 million unlisted options on issue. The options have exercise prices ranging between A$0.02 and A$0.15, with 5.5 million being in the money. Expiry dates range from 10/1/2023 to 11/12/2023.

The largest shareholder is the Hill Family Group with 16.40%. This is an entity related to the Deputy Chairman, Mr Geoffrey Hill, who has direct and indirect interests in 78.52 million shares, or 23.68% of the Company. Directors currently hold 27.46%, with, as of June 30, 2020 there being 1,219 shareholders.

Over the last year the Company has raised A$4.205 million in three raisings – these include:

- March quarter 2020 – A$1.310 million through a 52.6% subscribed 1 for 1 rights issue, issuing 87.3 million shares at A$0.015/share – this included a 1 for 8 loyalty share to be issued to subscribers still holding the shares 12 months after issue,
- June quarter 2020 – A$0.495 million through the placement of 31.1 million shares at A$0.015/share – this includes a 1 for 8 loyalty share to be issued to subscribers still holding the shares on February 24, 2021; and,
- December quarter 2020 – A$2.4 million through the placement of 26.6 million shares at A$0.09/share, which included a 1 for 2, three-year A$0.15 option.

Also, American Rare Earths has received A$6 million in cash, shares and financial instruments through the sale of the final 30% of the Broken Hill Cobalt Project to Cobalt Blue. Consideration included the following:

- A$500,000 cash,
- 9,000,000 COB fully paid ordinary shares at a deemed issue price of $0.15 per share,
- A$1,000,000 three-year Convertible Note (CN), with interest of 6% per annum payable annually in arrears. BPL is able to convert the CN to COB fully paid ordinary shares at maturity or on 18 January 2021 or on 17 January 2022. The CN is convertible with a $0.20 conversion price. The issuer of the note can redeem the CN early,
- A$3,000,000 five-year Promissory Note (PN), interest free for years 1, 2 and 3 and interest of 6% per annum payable in arrears. The PN is secured over the title to the tenements; and,
- A 2% NSR royalty over any future production from the BHCP, as well as base (Cu, Pb, Zn) and precious (Au, Ag) metals on the tenements.

The Company has subsequently:

- Sold 8 million COB shares realising A$2.469 million,
- Converted the note into 5 million COB shares (and received A$60,328 in interest), with the Company now holding 6,000,448 COB shares.

As of January 19, 2021, the Company had A$5 million in cash and no debt. Conversion of all options would yield a further A$2.13 million, although these are relatively long dated, with the exercise dates of these options being after January 10, 2023. The 13.33 million A$0.15 options issued with the November 2020 raise are out of the money.

BHCP Royalty Valuation

We have undertaken an DCF valuation on the NSR royalty, using inputs as presented in Cobalt Blue's BHCP update, released to the market on July 16, 2020. Cobalt Blue is currently undertaking a Definitive Feasibility Study on the BHCP, which includes the current construction of a pilot metallurgical plant.

We get an indicative valuation of the NSR at ~A$20 million. Our view is that, given the stage of the BHCP, this should be risked at 15%, giving a risked value of A$3 million, with this to increase on successful advancement of the BHCP. A rule of thumb is that projects that are fully permitted and financed (i.e. are shovel ready) have a market value at around 40% of NPV, so given the earlier stage and other factors, a 15% multiplier is reasonable. This is also similar to the ratio between the NPV as published in the update and the current EV of Cobalt Blue.

La Paz Rare Earths and Scandium Project - Arizona, United States

Location and Tenure

La Paz, which is located some 150 km as the crow flies (and ~200 km by road) WNW of Phoenix, comprises one Arizona State Exploration Permit (640 acres/259 ha) and 218 unpatented lode claims (4,504 acres/1823 ha), for a total area of 2,082 hectares (Figure 2). The Project is readily accessible by tar roads and then ranch tracks, and has a high-pressure natural gas line and a high voltage power line within 11 km.

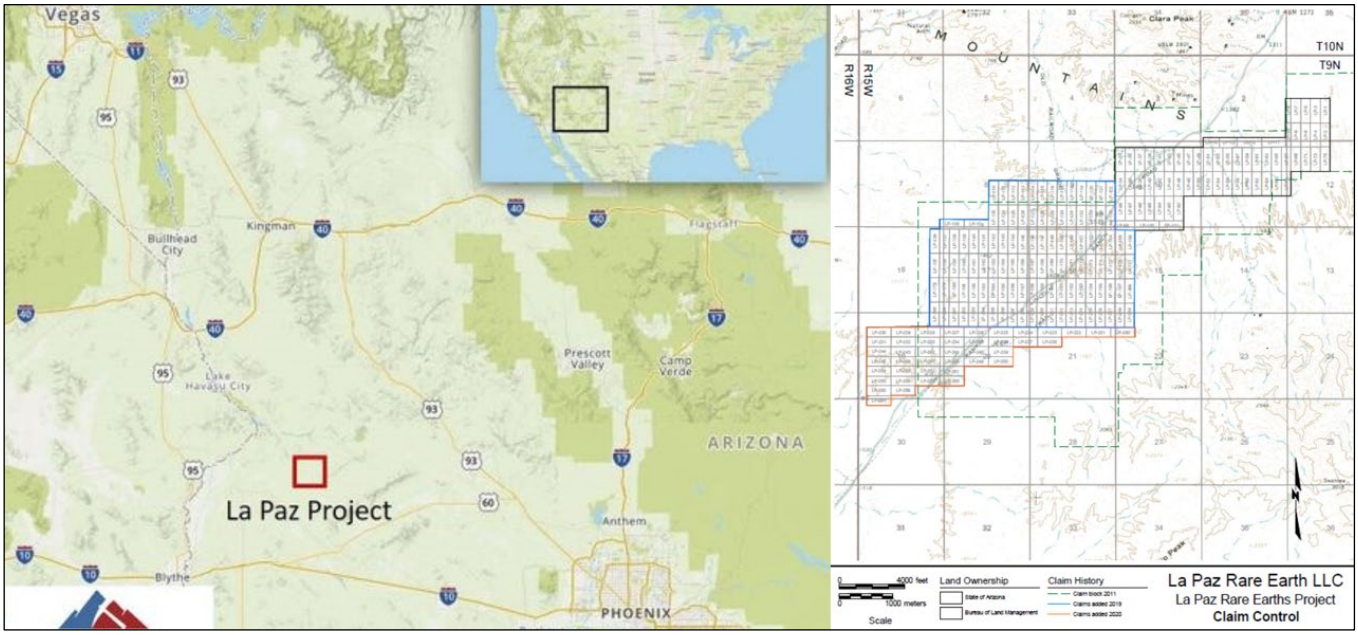
The claims have been staked by the Company, with the lode claims (each of 1,500' x 600' and staked over Bureau of Land Management "BLM" controlled land) remain valid in perpetuity as long as annual claim maintenance fees of US$165/claim are paid by the due date in September each year. The State Exploration Licence is valid for a period of up to five years, with rents payable of US$2/acre in year one, none in year two, and US$1/acre in years three through five. There is also an expenditure commitment of US$10/acre in years one and two, and $20/acre in years three to five. If no work is undertaken an equivalent amount needs to be paid to the Arizona State Land Department.

Geology and Mineralisation

The Project covers elements of the Basin and Range Province, which covers a significant part of the western USA. The province has undergone major extensional tectonics since the mid-Tertiary (and continuing to the current day), with some believing extension in the order of 100%, and being related to the commencement of oblique movement along the western edge of the North American Plate, marked partially by the San Andreas Fault.

The tectonics have resulted in the development of the characteristic "basin and range" topography, marked by horsts (up-faulted blocks) and grabens (down-faulted blocks). Other features are large scale detachment faults, flat-lying to listric faults that have accommodated the movement, and caused rotation of structural blocks, including those of syntectonic units, largely sediments. Also, the period immediately prior to extension was marked by widespread volcanic activity throughout the Western USA.

Figure 2: La Paz Project location and claims (Source American Rare Earths)



Lithologically, the pre-Tertiary basement is comprised largely of Proterozoic to Mesozoic sediments, intrusives, volcanics and metamorphics, including uplifted metamorphic core complexes, including the Harcovar Camplex as present in the Project area, which has been metamorphosed to amphibolite facies and mylonitised along detachment faults.

The geology within the current Resource area is shown in Figure 3 (map) and Figure 4 (lithological section) – the Resource area as shown in Figure 3 is towards the NE end of the overall claim area as shown in Figure 6.

The Project geology comprises two main structural blocks separated by the sub-horizontal Buckskin-Rawhide detachment fault – the blocks are termed the Upper Plate and Lower Plate (Figures 3 and 4).

The Lower Plate, which hosts the majority of REE (including scandium) mineralisation, is comprised largely of quartz-feldspar gneiss (and possibly an intrusive unit), with the Upper Plate being composed of tilted red-bed sediments and mafic flows – there is also a component of deformed Palaeozoic to Mesozoic units in the Upper Plate (Figure 4). Areas of the property are masked by younger gravels and alluvium.

Figure 3: La Paz Project geology, drilling and resource outline (Source: American Rare Earths)

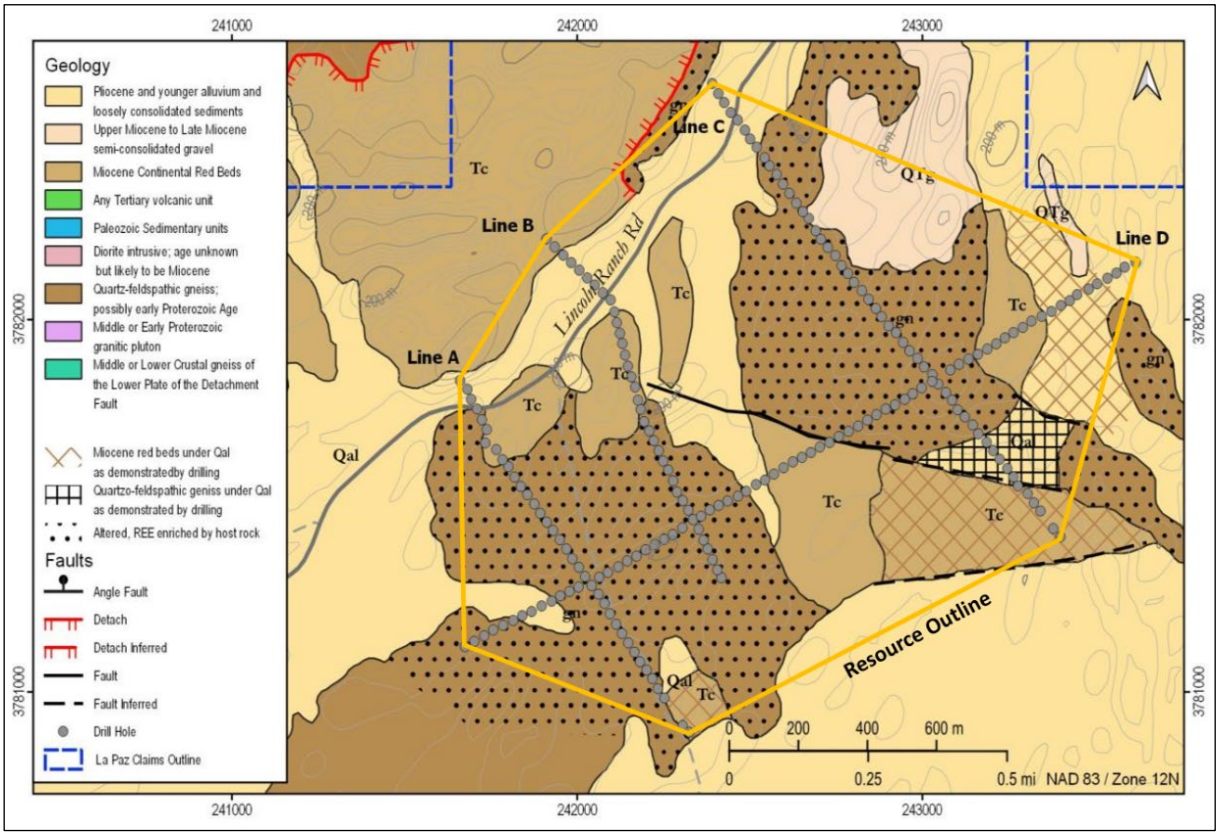
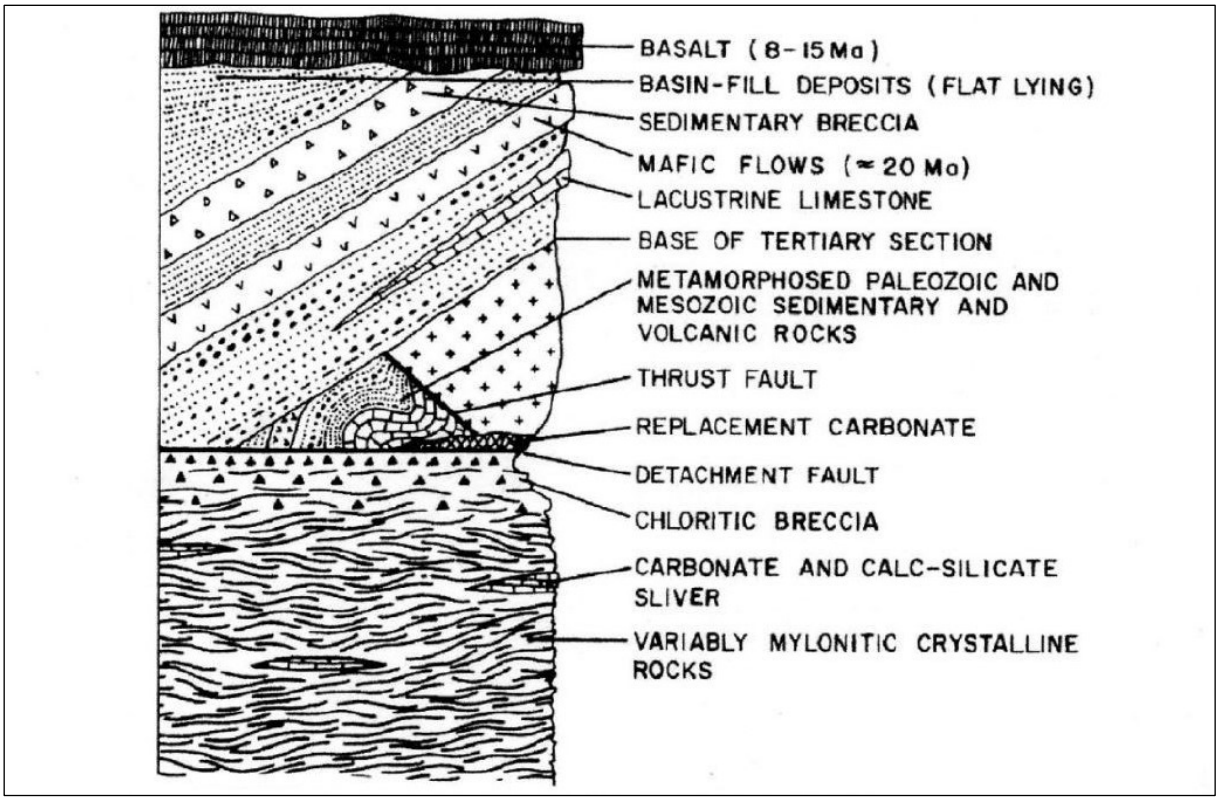


Figure 4: La Paz lithology (Source: American Rare Earths)



Mineralisation, which comprises veinlets and disseminations of the epidote group mineral allanite ($(Ce,Ca,Y,La)_2(Al,Fe^{+3})_3(SiO4)_3(OH)$) is found in both the Upper and Lower Plates, with the Lower Plate having a slightly higher average grade. Within the Lower Plate, the intensity of mineralisation may reflect the REE abundance of the precurser lithologies, however with this possibly upgraded through fluid flow controlled by the detachment fault and associated structures. Brecciation along the fault provides an ideal mineralising fluid pathway.

The source and paragenesis of the La Paz mineralisation is yet to be fully understood, however. One key factor though is that the mineralisation contains negligible radioactive elements, including uranium and thorium. Globally these elements are commonly associated with rare earths mineralisation, and cause challenges in permitting and waste disposal and increase costs.

Historic and Current Exploration Activities

Mineralisation at La Paz was originally identified in 2010 by the Uranium King, which was then acquired by the ASX-listed American Australian Mining ("AAM"), with a number of work programmes completed between 2010 and 2012. No work was undertaken from 2012 (when the claims were relinquished) until 2019, when the area was picked up by ARR.

Work over the Project by both parties has included:

- Surface geochemical sampling and geological mapping by both,
- Rock chip traverse sampling by ARR,
- Drilling by AAM, including 195 percussion holes for 5,731 m and four diamond core holes for 718 m – drill holes were generally to a depth of 31 m (100'),
- Preliminary metallurgical test work by AAM and ongoing work by ARR; and,
- A Mineral Resource Estimation, originally to the NI43-101 standard by AAM, and subsequently updated by ARR to be JORC 2012 compliant.

Some of these activities are discussed further below.

Mineral Resource Estimate

As mentioned above, the initial MRE (on a REE basis) was prepared by AAM, and restated by ARR – there was no change in the Resources, which are presented in Table 1 below. The Resource area is shown in Figure 3 and drill line sections in Figure 5. Table 2 presents the individual REE and REO concentrations from the drill hole data.

The Resource was based on the drilling, with continuity supported by the results of surface sampling within the Resource area (Figure 6).

Table 1: La Paz JORC 2012 Compliant Mineral Resource Estimate (Source: American Rare Earths)

La Paz JORC 2012 Mineral Resource Estimate				
Zone	Tonnes (millions)	Grade above cut-off (ppm)	Grade above cut-off (%)	Pounds REE (millions)
Upper Plate Indicated	0.4	337.7	0.034	0.3
Lower Plate Indicated	15.8	373.4	0.037	11.8
Total Indicated	16.2	373.4	0.037	12.1
	Tonnes (millions)	Grade above cut-off (ppm)	Grade above cut-off (%)	Pounds REE (millions)
Upper Plate Inferred	7.2	369.8	0.037	5.4
Lower Plate Inferred	104.8	371.6	0.037	77.9
Total Inferred	112	371.5	0.037	83.3
	Tonnes (millions)	Grade above cut-off (ppm)	Grade above cut-off (%)	Pounds REE (millions)
Upper Plate Total	7.6	368.1	0.037	5.7
Lower Plate Total	120.6	371.8	0.037	89.7
Total Resources	128.2	371.7	0.037	95.4

Table 2: La Paz REE and REO average drill hole sample concentrations (Source: American Rare Earths, Taylor Collison analysis)

La Paz REE and REO concentrations													
	Total REE		Upper Plate		Lower Plate			Total REO		Upper Plate		Lower Plate	
REE	REE ppm	%	REE ppm	%	REE ppm	%	Conv	REO ppm	%	REO ppm	%	REO ppm	%
La	56.6	16.88%	41.3	17.99%	59	16.68%	1.173	66.39	16.57%	48.44	17.69%	69.21	16.38%
Ce	120.4	35.90%	84.1	36.63%	126.8	35.84%	1.171	140.99	35.20%	98.48	35.96%	148.48	35.14%
Pr	14	4.17%	9.6	4.18%	14.8	4.18%	1.17	16.38	4.09%	11.23	4.10%	17.32	4.10%
Nd	54.4	16.22%	35.8	15.59%	57.7	16.31%	1.166	63.43	15.83%	41.74	15.24%	67.28	15.92%
Sm	10.4	3.10%	6.7	2.92%	11	3.11%	1.16	12.06	3.01%	7.77	2.84%	12.76	3.02%
Eu	2.6	0.78%	1.8	0.78%	2.7	0.76%	1.158	3.01	0.75%	2.08	0.76%	3.13	0.74%
Gd	9.1	2.71%	5.7	2.48%	9.7	2.74%	1.153	10.49	2.62%	6.57	2.40%	11.18	2.65%
Tb	1.3	0.39%	0.8	0.35%	1.4	0.40%	1.151	1.50	0.37%	0.92	0.34%	1.61	0.38%
Dy	7	2.09%	4.5	1.96%	7.5	2.12%	1.148	8.04	2.01%	5.17	1.89%	8.61	2.04%
Ho	1.4	0.42%	0.9	0.39%	1.5	0.42%	1.146	1.60	0.40%	1.03	0.38%	1.72	0.41%
Er	3.8	1.13%	2.5	1.09%	4	1.13%	1.143	4.34	1.08%	2.86	1.04%	4.57	1.08%
Tm	0.5	0.15%	0.4	0.17%	0.5	0.14%	1.142	0.57	0.14%	0.46	0.17%	0.57	0.14%
Yb	3	0.89%	2.2	0.96%	3.2	0.90%	1.139	3.42	0.85%	2.51	0.92%	3.64	0.86%
Lu	0.4	0.12%	0.3	0.13%	0.5	0.14%	1.137	0.45	0.11%	0.34	0.12%	0.57	0.13%
Y	36.1	10.76%	24.1	10.50%	38.2	10.80%	1.269	45.81	11.44%	30.58	11.17%	48.48	11.47%
Sc	14.4	4.29%	8.9	3.88%	15.3	4.32%	1.5338	22.09	5.51%	13.65	4.98%	23.47	5.55%
Total	**335.4**	**100%**	**229.6**	**100%**	**353.8**	**100%**	**1.194**	**400.58**	**100%**	**273.84**	**100%**	**422.59**	**100%**

We note the following regarding the Resource:

- The published MRE is presented in terms of REE – we have, in Table 2, converted the drill hole data to provide an idea of what the Resource grade in REO may be, as is commonly presented – this analysis indicates that the conversion factor for the overall grade from REE to REO is around 1.19, which would provide an overall Resource grade in the order of 444 ppm TREO – note that the data is from drill hole samples, and not the Resource, although we have assumed identical rare earth assemblages.
- We note the low grade, however one of the reasons behind the upcoming drilling is to test for the presence of higher grade mineralisation below the current resource; also, recent rock chip sampling (discussed below) has resulted in differentiating grades in different rock metamorphic rock types, which may result in the ability to domain the Resource.

Metallurgy

Our view is (which is also that of the Company), given the low-grade Resource, metallurgy will be a critical element in determining the economic and technical viability of La Paz. Metallurgical studies are a key part of ARR's activities going forward, with primarily the concentration test work with Wood/SRC being critical.

There is also the association with the LLNL and Penn State looking at extraction and separation metallurgy.

AAM undertook preliminary metallurgical studies from 17 samples collected from a percussion hole drilled specifically for the purpose – this twinned a previously drilled hole so that grades could be reasonably assumed. Samples were sent to the SRC, with whom the Company is currently working.

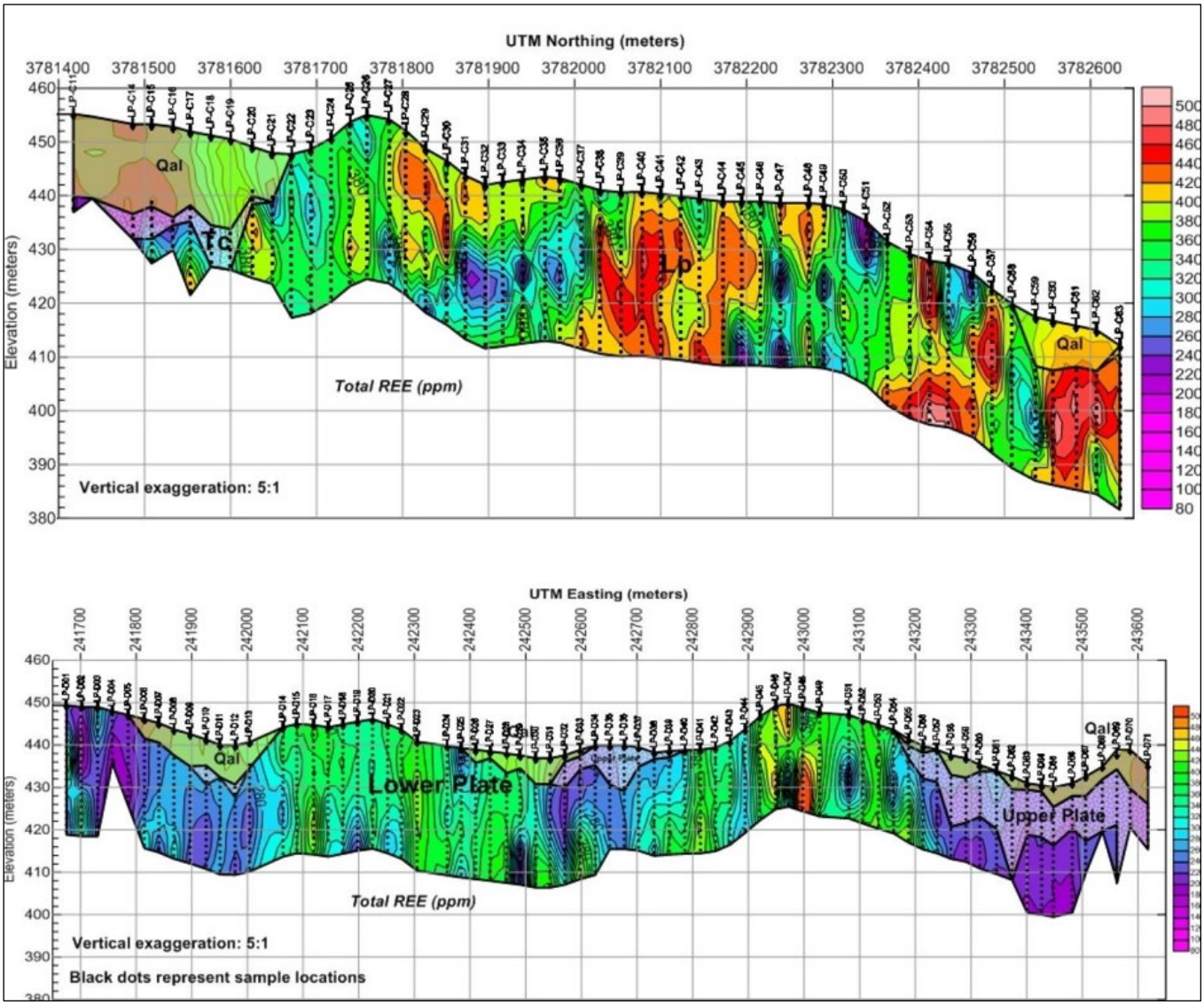
The work included preliminary concentration and leaching test work and indicated an average concentration recovery of 68.1% to an average grade of 1,248 ppm REE, with a mass pull of 26.90%. Concentration stages included gravity separation and six stages of flotation. This work however reached a peak concentrate grade of over 2,000 ppm REE.

The high mass pull to the concentrate was a result of less-than-optimal liberation of the allanite in the concentration stage – a significant factor in this was the difference between the grind size (150 µm) and the allanite grainsize (generally less than 25 µm) in the concentrates.

Best extraction results were achieved by roasting and sulphuric acid leaching, with this from a relatively low-grade concentrate.

We note that this work did not consider scandium, which the Company is now considering as a product of La Paz, and which could add significant value.

Figure 5: La Paz drill section C (top, looking west) and D (bottom, looking north) showing total REE grades – refer to Figure 3 for location of drill lines (Source: American Rare Earths)



Subsequent work has included a recently completed review, by Wood, of the original test work, with this commenting on the previous work and putting forward suggestions. This has pointed out the challenges in producing a concentrate of sufficient grade for economic downstream processing, for which, as mentioned earlier, Wood/SRC have now been engaged to explore with the current and upcoming metallurgical test work. Currently, work is being undertaken on rock chip samples (from the sampling discussed below), with core from upcoming drilling then to be used.

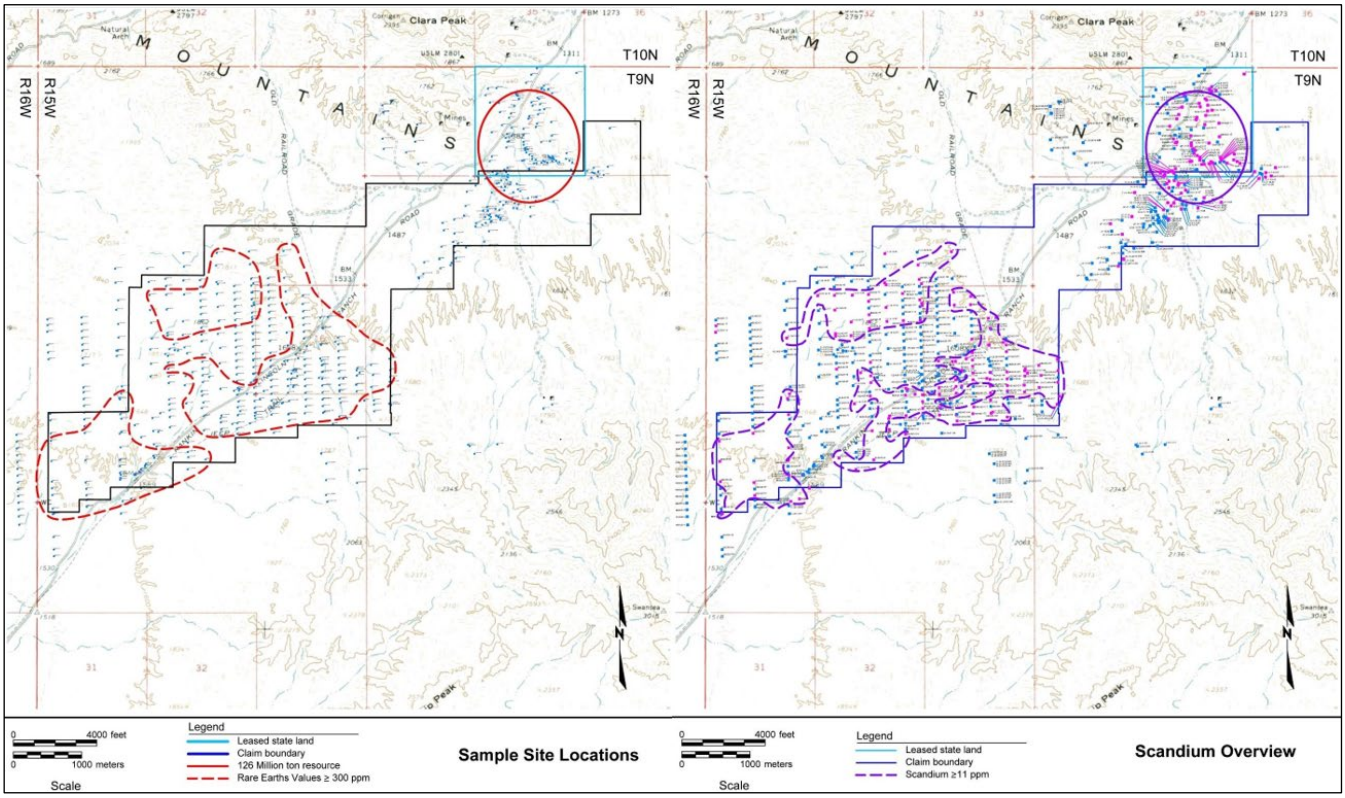
Extraction and separation research is being undertaken on alternative treatment methods, firstly in conjunction with the LLNL and Penn State. As mentioned earlier this thus far has resulted in a proof-of-concept demonstration using a biosorption technology using a plant protein called LanModulin and is targeted at extracting scandium as well as the lanthanides. Scandium is not extracted in traditional rare earth processing. This has shown recovery rates of 99% of REEs from pregnant leachate solutions. Ongoing work will also look at improving the liberation of allanite to a concentrate.

A second technique being explored is the use of SELEX ™, developed by Lixivia, which, by carefully controlling conditions, is able to refine a broad range of mineral assemblages, including REEs.

Geochemistry

The Company has undertaken extensive rock chip and rock chip traverse sampling, with results of the rock chip sampling shown in Figure 6, with REE (>300 ppm) on the left and scandium (>11 ppm) on the right - the area that has not been sampled is covered by recent alluvium. As mentioned above bulk rock chip samples are being used in metallurgical test work.

Figure 6: Rock chip geochemical results (Source: American Rare Earths)



As part of this work, careful note was made of the rock type in the sampling, to consider the potential to differentiate (and hence domain) grades based on lithology. Overall, REE values ranged from 25 ppm to 714 ppm, with averages dependent upon rock type and alteration. The highest values came from augen gneiss, with a range of 82 ppm to 714 ppm, and an average of 395 ppm.

The results highlight the potential to significantly extend the Resource to the southwest, with Figure 6 highlighting three main anomalies in this area. With regards to scale, each grid square is one statute mile, or 260 ha in area.

Laramie Rare Earths Project – Wyoming, USA

Location and Tenure

Laramie is in southeast Wyoming, approximately 130 km by road from the Capital Cheyenne, which has a population of around 60,000. Laramie has ready access to the state and national road networks and is within 35 km of rail (Figure 7).

Laramie, which is being acquired from Zenith Minerals Limited (ASX: ZNC, "Zenith") comprises a single Wyoming State Mineral Lease application and five BLM lode claims, the latter which have been granted. Final settlement was to be December 31, 2020, however due to delays in processing the lease application this has now been extended to June 30, 2021. Half of the consideration of A$50,000 and 2.5 million ordinary ARR shares (at a deemed price of A$0.02/share) has been paid, and the BLM claims transferred.

Geology and Mineralisation

REE mineralisation, which is largely contained in allanite, is hosted within a syenite unit, part of a large scale anorthosite intrusive complex. The allanite occurs as disseminated, discrete grains within the syenite, with early-stage petrology indicating a grain size of generally between 0.1 mm to 0.5 mm, with grains also up to 2.5 mm. Two areas, three kilometres apart, have been identified as hosting mineralisation.

Historic and Current Exploration Activities

Work over Laramie has been relatively limited and has included rock chip traverse surface sampling and preliminary metallurgical test work.

The sampling has provided very encouraging results, including:

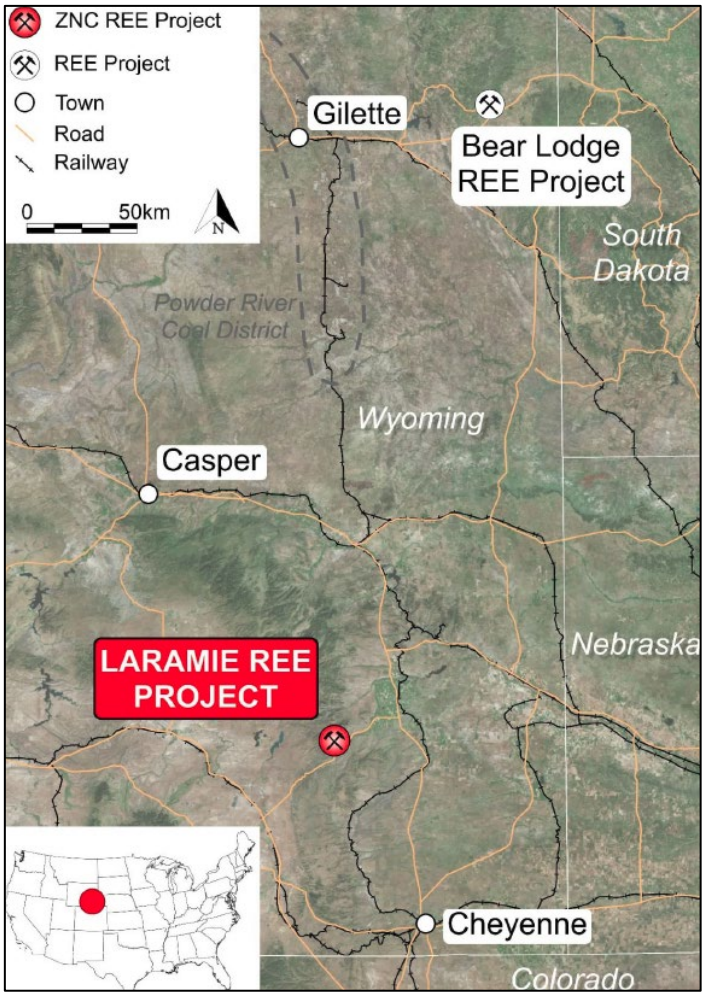
- 80 m @ 0.40% TREO,
- 137 m @ 0.37% TREO; and,
- 72 m @ 0.33% TREO, amongst others.

The mineralogical and metallurgical test work has likewise been positive, highlighting the presence of allanite as relatively large, discrete grains. Preliminary concentration test work was completed on a 100 kg bulk sample generated from the rock chip traverses.

Magnetic separation, using samples crushed to -0.5 mm, recovered 87% of REE minerals at a mass pull of 22%; gravity separation using samples crushed to -2 mm recovered 76% of the REE minerals at a 22.2% mass pull. Analysis of individual grains from the concentrates indicated that the mineralisation is homogenous within the allanite, with a TREO content of 26%, and with a ND_2O_3+Pr_2O_3 absolute content of 6%, or ~23% of the TREO assemblage.

Our view is that these results are very encouraging, and that additional test work should improve on this. As for La Paz, samples for Laramie are being used in the ongoing LLNL/Penn State metallurgical research.

Figure 7: Laramie project location (Source: American Rare Earths)



Current and Upcoming Activities

ARR has an active work programme going forward, largely concentrated at La Paz.

Major work will include a nine-hole diamond core drilling programme, with planned hole depths of 61 m, double that of the historic drilling to test for deeper mineralisation. Drilling will include six core holes twinning previous percussion holes, and three holes within the newly identified mineralisation in the SW of the tenement package, with the core also to be used for metallurgical test work.

Timing of the commencement will depend upon permitting, but it is expected within Q1, 2021.

Metallurgical test work, in addition to future work on the drill samples includes work being undertaken on surface samples collected from within the current Resource area, as well as samples collected to the SW of the Resource – this work includes comminution/concentration work at the SRC, and extraction work as discussed previously. Metallurgical results from surface samples are expected to be received in March, with that for the core dependent on timing of the drilling, but potentially around mid-year.

Activities at the other rare earth properties will include early stage ground work – The State Lease approval is still awaited for Laramie, with this expected to be granted by mid-year. The company is still awaiting results from the Nevada sampling, with claims to be staked and lodged over selected areas should results warrant.

Peers

Table 3 presents a list of rare earth focused companies, listed both in the US and Australia. This includes the two major non-Chinese producers, Mountain Pass and Lynas, with only Lynas producing separated products. For the operating companies Reserves have been quoted, and for those that are pre-operation Resources have been quoted unless otherwise noted. Where a company is quoted on a foreign exchange, prices have been converted to AUD using current exchange rates.

Table 3: Rare earth focused companies (Source: IRESS, company releases, Taylor Collison analysis)

Rare earth focused companies										
Company	Project	Style	Market Cap AUD	Tonnage	TREO %	Contained REO (Mt)	MC/Tonne Contained REO Company Equity Share	Pr/Nd % of Total	HREE % of Total	Status
Mp Materials Corp.	Mountain Pass, California - Reserve	Carbonatite complex - mineralisation largely associated with Bastnaesite	$6,832 m	13.6 mt	8.24%	1.12	$6,102	15.50%	0.10%	Operating
Lynas Rare Earths Limited	Mt Weld, Western Australia - Reserve	Laterites developed above a Proterozoic carbonatite complex	$4,695 m	19.2 mt	8.50%	1.63	$2,877	23.30%	1.96%	Operating
Australian Strategic Materials (Holdings) Ltd	DZP, NSW	Jurassic intrusive related mineralisation. Also contains significant zircon	$627.4 m	35.7 mt	0.92%	0.33	$1,910	18.10%	4.63%	Evaluation
Texas Mineral Resources Corp.	Round Top, Texas	Carbonatite complex - mineralisation largely associated with Bastnaesite	$325 m	821.7 mt	0.05%	0.43	$754	7.40%	30.04%	Development studies
Arafura Resources Limited	Nolans, Northern Territory	Alkalic intrusive complex association	$292 m	56.0 mt	2.60%	1.46	$201	26.50%	1.78%	Looking at Pilot Plant
Greenland Minerals Limited	Kvanefjeld, Greenland	Rhyolite Dome	$275 m	1010.0 mt	1.21%	12.22	$22	17.10%	3.90%	Permitting negotiations
Hastings Technology Metals Ltd	Yangibana, WA	Syn-intrusive vein deposit, possibly derived from nearby alkalic/carbonatite intrusive complexes	$253 m	21.7 mt	1.14%	0.25	$1,021	35.87%	3.32%	BFS Complete
Northern Minerals Limited	Browns Range, WA	Veins associated with Gifford Creek Ferrocarbonatite system main mineral is monazite	$248 m	9.3 mt	0.67%	0.06	$4,387	4.04%	28.56%	To develop a pilot plant
Pensana Metals Ltd	Longongo, Angola; Saltend, UK	Predominantly vein-hosted xenotime/florencite mineralisation.	$201 m	313.0 mt	1.43%	4.48	$45	22.37%	NR	Development studies
Pensana Metals Ltd	Longongo, Angola; Saltend, UK, weathered zone	Carbonatite, DFS concentrating on weathered zone	$201 m	65.9 mt	2.07%	1.36	$148	22.37%	NR	Development studies
Peak Resources Limited	Ngualla, Tanzania	Carbonatite, DFS concentrating on weathered zone	$182 m	214.4 mt	2.15%	4.61	$39	20.97%	1.44%	BFS Complete
Peak Resources Limited	Ngualla weathered zone - Reserve	Carbonatite complex - mineralisation largely associated with Bastnaesite	$182 m	18.5 mt	4.80%	0.89	$205	21.27%	1.07%	BFS Complete
Ionic Rare Earths Limited	Makuutu, Uganda	Ionic clays	$141 m	78.6 mt	0.08%	0.07	$4,144	23.64%	8.98%	Evaluation
Rarex Limited	Cummins Range, WA	Weathered carbonatite	$51 m	13.0 mt	1.13%	0.15	$348	20.10%	NR	Evaluation
American Rare Earths Limited	La Paz, Arizona	Syn-deformation structurally controlled allanite in various units, with mineralisation possibly controlled by Basin and Range detachment structures	$33 m	128.2 mt	0.04%	0.06	$589	21.09%	8.83%	Evaluation

Note: "NR" = not reported

One factor that stands out is that the two current listed non-Chinese producers, Lynas and MP Materials, have high grade Reserves, both being above 8% TREO. At least for Lynas, this may in part reflect higher costs relating to the thorium content of the mineralisation, one of the reasons that Lynas is now constructing a cracking and extraction plant in Australia.

We have included two listings for Pensana and Peak – both companies have development studies concentrating on the enriched mineralisation that is found in the weathered zones of their respective carbonatites, and as such we have included data for both weathered and overall Resources.

Although on the face of it the grade of Ionic Rare Earth's Makuutu deposit is low, it needs to be noted that mineralisation is hosted as ionic clays (as for a significant amount of Chinese production) and could lend itself to low cost ionic exchange extraction.

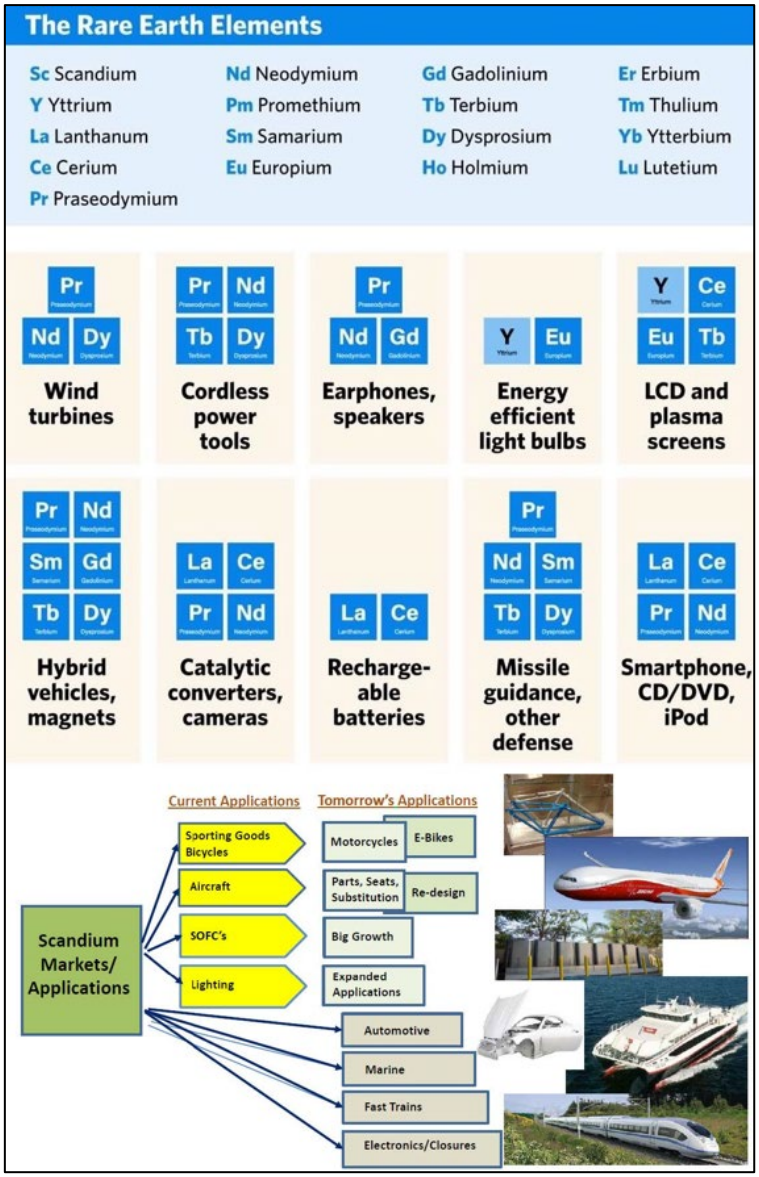
Although it has a larger Resource, the closest comparable to ARR may be Texas Mineral Resources Corp ("TMRC"), the holder of the Round Top Mountain deposit in Texas. A Preliminary Economic Assessment ("PEA") was completed for Round Top in 2014 and updated in 2019. This however included non-REE commodities including beryllium and uranium. We do note the significant disparity in market capitalisation between TMRC and ARR.

Background – Rare Earths and Markets

Rare Earths and Uses

Rare earths are a group of elements, including lanthanides that have atomic numbers ranging from 57 to 71, but also including the non-lanthanides yttrium and scandium as shown in Table 2 and Figure 9. Despite their name they are not particularly rare, and are found in several minerals, however it is rare to find them in accumulations that are economically viable to exploit.

Figure 9: REE and scandium uses



Traditionally they have been classified into two groups – the LREEs and HREEs – in the past it has been a rule of thumb that the HREE's are more valuable than the LREEs, largely due to supply factors.

They are also referred to as light rare earth oxides ("LREO") and heavy rare earth oxides ("HREO"), with the conversion factor from elements to oxides ranging from 1.137 to 1.173 for the lanthanides, 1.269 for yttrium and 1.534 for scandium (Table 2). The distinction between REEs and REOs is important when considering data – most data, including grades and tonnages is presented in the terms of oxides, although some is reported in the terms of the element, as is the case with ARR's MRE.

The economically largest and fastest growing market is for magnets, used both in power generation and electric motors, which mainly use neodymium and praseodymium, along with dysprosium. The addition of rare earths to permanent magnets makes the magnets extremely strong and allows them to operate at higher temperatures – the advent of new technology is driving the demand for such magnets, including those used in wind turbines and electric vehicles. It is estimated that each EV uses 2 kg to 2.5 kg of rare earths, including in the main motors, as well as in magnets/motors associated with ancillary equipment.

The market for scandium is very small, estimated at between 10 and 20 t per annum, with the metal being produced as a by-product. Some analysts believe that the limited market is due to supply factors, and thus, if supply increased, so would the market.

Scandium's main use is as an addition to aluminium to make strong, light weight alloys with a number of current and potential uses - the addition of a minor amount of scandium greatly increases the strength of aluminium, which can lead to significant weight savings in weight-critical applications.

Rare Earth Geology

Two of the commonest rare earth bearing minerals are monazite (a phosphate, $((Ce,La,Nd,Th)PO_4)$ and bastnasite (a flouro-carbonate, with a generalised formula of $(Ce,La,Y)CO_3F$). However as mentioned above another mineral is allanite $((Ce,Ca,Y,La)_2(Al,Fe^{+3})_3(SiO4)_3(OH))$, which is the REE mineral at La Paz and Laramie.

Monazite and bastnasite are commonly found in carbonatites and hydrothermal systems associated with carbonatite intrusive complexes – examples include Bayan Obo (China), Yangibana (WA), Mountain Pass (Ca), Mt Weld (WA) and Ngualla (Tanzania). These deposit styles are largely a source of LREE, and residual supergene enrichment is a common feature.

An issue with the carbonatite sourced mineralisation is the presence of radioactive elements including thorium and uranium, which need to be separated and then disposed of, adding costs and permitting requirements to operations. Lynas has had challenges at its Malaysian treatment plant, and as such is building a new cracking and leaching plant at Kalgoorlie, so as product shipped to Malaysia will be free from the radioactive elements.

Another Chinese rare earth source are laterites which are enriched in HREE, with the elements loosely bound to clay minerals – these deposits have been variously described as "ionic clays", "elution deposited" and "ion-adsorbed", and form the dominant source of global HREE production. ASX listed Ionic Rare Earths' ("ASX: IXR, "Ionic") Makuutu Project in Uganda is of this style.

Rare Earth Supply

Rare earth supply comprises two main streams – the upstream mining and production of concentrates, and the downstream processing and separation into the various individual oxides or other compounds. In both cases China is the dominant producer, particularly with regards to HREEs.

Total mine production in 2019 was estimated at 210,000 t (USGS, 2020), with 132,000t (63%) of this from China, however with China effectively supplying close to 90% of separated oxides and products. – as mentioned earlier the only non-Chinese producer of separated products is Lynas, which produced 19,737 t of the total estimated global finished product output of ~170,000 t TREO equivalent.

Non-Chinese mine production in 2019 included the US (Mountain Pass, 26,000 t), Australia (Mt Weld, 21,000 t) and Myanmar (22,000 t).

Until the late 1940's the main supply was from monazite bearing placer sands in Brazil and India, with rare earths being a by-product of mineral sands mining. This was followed by South Africa taking the mantle until around 1965, with production from vein-style monazite mineralisation – however global demand was low, with generally <10,000 tpa of global production in this period. The mid-1960's to mid-1980's saw Mountain Pass become the major global producer, with demand rising from ~10,000 tpa to 40,000 tpa in this period. The mid-1980's saw the commencement of significant Chinese production, with this continuing to the current day.

As discussed earlier China has, and will continue in the future, to use its stranglehold on supply as an economic and strategic weapon and to influence the market. This highlights the need for robust diversification of supply, both upstream and downstream.

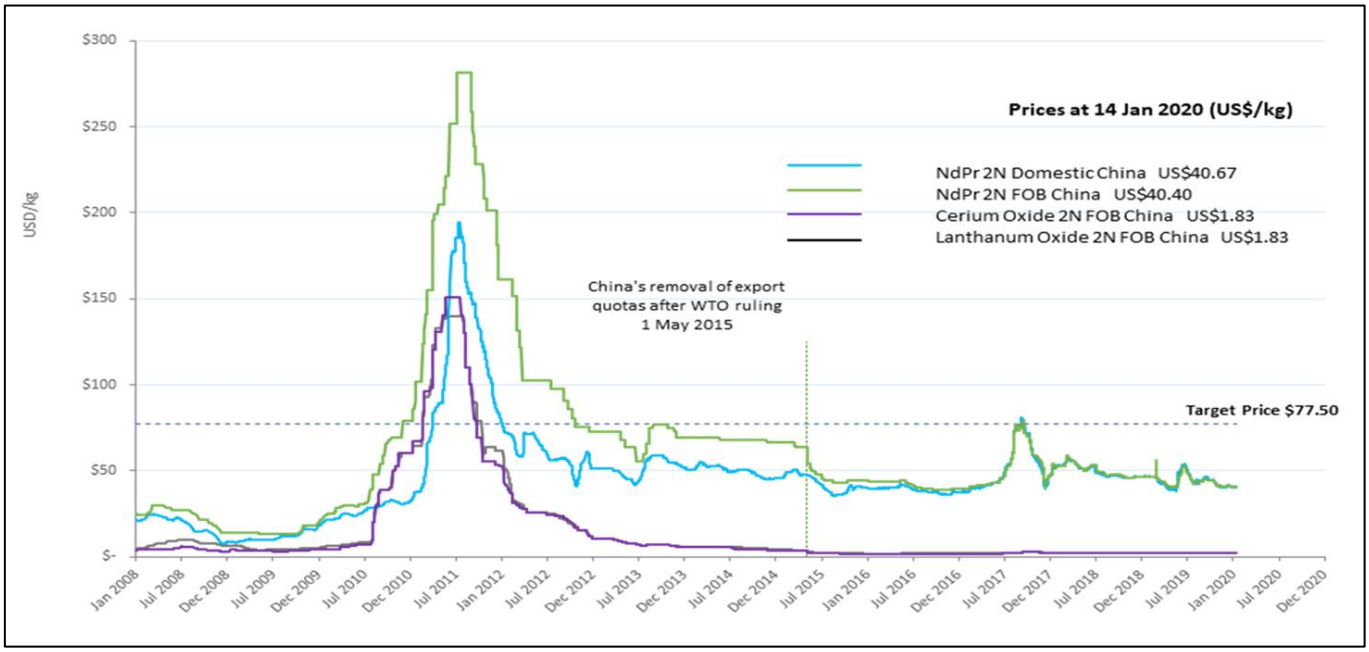
Rare Earth Demand

This will concentrate largely on the NdPr market, given this is are the largest sector by value (70% to 80% of the total rare earths market), although the lower value La and Ce dominate the market by volume with 60%, as compared to the ~25% in NdPr. Given

their abundance, Ce and La are now largely produced as a by-product in operations concentrating on higher value elements, particularly NdPr, with substantial amounts of Ce/La not being separated.

Prices for various rare earths over the 12-year period to January 2020, which covers the 2011 spike, are shown in Figure 11.

Figure 11:MdPr prices (Source Peak Resources January 2020 presentation)



China consumes some 65% of rare earths produced, and thus is a net exporter, although this situation is now changing. Other significant consumers include Japan, the US and the EU, all of whom are 100% importers of separated materials.

Given the different applications, market metrics for different REE's vary.

The strongest demand growth over coming years is expected to be for magnet applications, and as such is forecast to drive the demand for NdPr more than for the other rare earths. Magnet applications include those for motors in electric vehicles and for wind generators.

As we mentioned earlier, some see the demand for NdPr oxide growing to up to 70,000 t by 2020, a 7% CAGR growth. As such an additional five Lynas Mount Weld operations would need to progressively come online by that time to meet demand. We would expect this to put upward pressure on prices.

Pricing scandium, given the nature of the market is difficult. Prices in early 2017 were reportedly US$1,500/kg or US$1.5 million/tonne for oxide, however prices of between US$4,000/kg and US$20,000/kg have been reported for pure scandium; at the height of the rare earths price spike in 2010 scandium oxide was selling for ~US$7,000/kg.

However, should appreciable increases in supply be realised would we see a concurrent reduction in the scandium price?

Board and Management

Creagh O'Connor AM, FAIM, FAICD – Chairman

Creagh has approximately 40 years' experience as a chief executive and board member for a number of public and private companies. During this time he has been involved in managing a number of Australian and international oil, gas and mineral projects.

Creagh is an experienced board member and his most public role was with Cricket Australia as Director for 11 years including as Chairman from 2005 to 2008.

In addition, he was Director of South Australian Cricket Association (SACA), Director of the International Cricket Council, Director of the Kerry Packer Cricket Foundation, Director of Rundle Capital Ltd, Governor of the Bradman Memorial Fund, Chairman of the Lords Taverners (SA), Trustee of the Les Favell Foundation and Chairman of ACHA Health Ltd. He was also a past director of A G O'Connor Pty Ltd and chairman of the Maurice de Rohan International Scholarship Fund..

Geoffrey Hill BEc, FCPA, ASIA, FAICD – Non-Executive Director and Deputy Chairman

Geoff was a director of ARR from 1989 to June 2014 and re-joined the board on 27 August 2015. He has extensive experience in the identification and implementation of mergers and takeovers and has acted for a wide range of corporate clients in Australia and overseas. Mr Hill also has extensive experience in giving corporate advice to mining companies.

He is a director of unlisted companies including International Pacific Capital Limited, So Co Ltd, Coromandel Gold Limited and Texas and Oklahoma Coal Company Limited. Listed company directorships include Metals Finance Corporation Limited (MFC) and Mount Gibson Iron Limited (MGX). He is a former director of Heritage Gold NZ Limited (now New Talisman Gold Mines Limited) (1999-2012).

Keith Middleton – Managing Director

Keith is an experienced corporate advisor and director of ASX listed companies specializing in the Australian and International resources sector.

He has direct experience in advising and raising equity for companies in the form of direct investment, company loans and initial public offerings. Keith has extensive experience in financial analysis, risk management, major capital works expenditure, corporate governance and WHS regulations. He is accountable for the day-to-day operational problem solving and decision making, with responsibilities also including strategy formulation, project evaluation and investor presentations. Previous experience includes working for over 20 years in senior executive positions in major corporations.

Keith is currently a director of ASX-listed Redbank Copper Limited (RCP).

Denis Geldard AWASM, MAusIMM – Non-Executive Director

Denis has over 40 years technical and operational experience in mineral exploration and project development in Australia and internationally. He has over 20 years' experience in the Heavy Mineral Sands Industry with companies such as Western Titanium Ltd, Associated Minerals Consolidated and Iluka Resources.

Denis is a Mining Engineering graduate from the Kalgoorlie School of Mines in Western Australia. He has managed and run several junior and mid-tier mining and exploration companies and mining operations over the past 40 years including directorships of a number of Australian listed mining and exploration companies.

Threats/Risks

- **Exploration/Resource risk –**This is a key risk for any junior resource stock. This includes the discovery of new deposits, as well as delineating potentially economically and technically viable Resources following an initial discovery.
- **Metallurgical risk –** This applies largely to La Paz, given that viable project economics will depend largely on metallurgy. As mentioned previously the Company is cognisant of this and as such is focussing efforts on metallurgy, both concentration and extraction. Initial work at Laramie indicates better beneficiation characteristics from higher grade mineralisation.
- **Markets –** The markets and appetite for risk are currently at high levels, however can turn on a dime due to any number of factors, including geopolitical and economic amongst others.
- **REE prices and currency rates –** Negative movements will adversely affect the viability of any future operation, access to capital and the sentiment of investors. The converse will also apply, with positive movements in prices and exchange rates. Several factors can affect prices, including changes in demand and supply amongst others. Changes in demand are expected to largely flow on from the take up of EVs and wind turbines.
- **Permitting and approvals** – This is a key risk for all potential developers, both for ongoing exploration activities, and for approvals for any future operation. In the case of La Paz and Laramie, this may be somewhat mitigated by the history of mining in the relevant states, and their rankings (at 9 and 26 respectively) in the 2019 Fraser Institute Mining Industry Survey. In our view the main issue here is that time frames may be longer than targeted, with COVID-19 also being a factor in this.

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Analyst Interests: The Analyst holds no ARR shares or options.

At the time of writing of this report, Taylor Collison, Principals and Staff held 4.1 million ordinary shares and 5 million unlisted A$0.02 options in American Rare Earths, with an expiry date of November 22, 2023.

Analyst Certification: The Analyst certifies that the views expressed in this document accurately reflect their personal, professional opinion about the financial product(s) to which this document refers.

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