

Biden, the Chinese raw material hunt and the 'massive' monazite results of Appia Rare Earths & Uranium

While the Biden Administration fixates on solving the port problem in the United States, China continues to dominate the Western world's supplies of, when it comes to the bigger picture, critical metals and materials. Literally, at the same time the US government is trying to focus on the issues right in front of it that may disrupt Christmas (*heaven forbid*), Chinese companies continue to seek out and lock up more of the raw materials that will drive the future. In just the last few days, Zijin Mining Group Co., Ltd. launched a C\$960 million takeover bid for Canadian domiciled Neo Lithium Corp. (TSXV: NLC | OTCQX: NTTHF), while Contemporary Amperex Technology Co. Limited (CATL), the world's largest battery supplier and ironically already part owner of Neo Lithium, signed a battery supply deal with U.S. commercial EV maker, Electric Last Mile Solutions Inc. (NASDAQ: ELMS). Three weeks ago CATL made a C\$377 million takeover bid for Canada's Millennial Lithium Corp. (TSXV: ML). Zijin is no stranger to taking out Canadian mining companies having previously acquired Nevsun Resources (C\$1.86 billion), Guyana Goldfields (C\$323 million), and Continental Gold (C\$1.4 billion), and those were just some of its Canadian targets.

From an investor's perspective, I guess this takeover activity can be viewed as a good thing given that these Chinese entities are paying full value for their acquisitions. So you get your liquidity event and hopefully have made money to go off and find the next possible target. But it is disappointing to see the West talk the talk about our greener future but not walk the walk as our leaders appear to be completely oblivious

as to how we'll get there if we let China control all the raw materials. I will save that rant for another day. In the meantime let's have a look at a company that could tick the boxes for a potential acquisition by the Chinese.

Of late it seems the flavour of the day is lithium but that isn't the only critical material out there. The Chinese have long since cornered the market for rare earths but if no one is willing to stop them, or even slow them down, then why wouldn't they continue to acquire everything the world will let them. One Canadian junior mining company that could fit the bill is Appia Rare Earths & Uranium Corp. (CSE: API | OTCQB: APAAF), or perhaps you know it by its former name Appia Energy Corp. but that was so yesterday (today is literally the first day trading under its new name). Appia is a Canadian publicly-listed company in the uranium and rare earth element sectors and is currently in its largest exploration and diamond drilling program in the Company's history, focusing on delineating high grade critical rare earth elements, gallium, and uranium on its 100% owned Alces Lake property, as well as exploring for high-grade uranium, in the prolific Athabasca Basin, on its Loranger, North Wollaston, and Eastside properties. Appia has found some of the highest grade samples of neodymium rich monazite on its properties in Saskatchewan.

The Alces Lake discovery of an accessible extensive hard rock deposit of monazite is very important to the world's demand for magnet rare earths. This is because Appia's monazite is neodymium rich, which is the most desirable for the production of rare earth permanent magnets. Not only is it rich in neodymium (Nd) and praseodymium (Pr), but also contains 1% of xenotime, the best heavy rare earth bearing hard rock mineral. The good news is that yesterday the Company announced it has discovered new and previously unknown occurrences of massive and semi-massive monazite in the Wilson North area of Alces Lake. A total of 27 drill holes (2,460 m) have been completed at the Wilson-Richard-Charles-Bell zones (WRCB), with at least

27 holes (2,360 m) remaining. In total the Company has completed 61 drill holes (4,575 m) including drilling at Biotite Lake (13 holes – 685 m), Danny (7 holes – 430 m) and Sweet Chili Heat (14 holes – 995 m) with monazite occurrences identified in each area. One drill continues to test the continuity and depth extent of the WRCB zones, while the other moves across the property, exploring new drill targets, named Diablo and Oldman River.



Source

With assays pending for all 61 holes drilled to date in the 2021 program, it's certainly exciting times for Appia. The Wilson North 21-WRC-015 drill hole showed monazite mineralization over 8.85 m from 15.74 m – 24.59 m. As noted above, three other locations also saw monazite occurrences. If the grades in this season's drill holes match the world class grades previously announced things could get very interesting very quickly. The Company is well funded to complete this season's drilling with plans to prepare an NI 43-101 report

following the conclusion of the current exploration program later this year. With 107.6 million shares outstanding, the current market cap for Appia stands at roughly \$82 million. That's chump change given what some of these Chinese companies are throwing around for quality assets.

Keep in mind that for the last few years China has been buying monazite concentrates, thrown off as residues from heavy mineral sands' mining, from all over the world including, until recently, from the USA! China bought 30,000 tonnes last year from Rio Tinto in Southern Africa; and up to another 20,000 tons from Indonesia, Brazil. It is logical to assume that China would have a great interest in a higher grade neodymium rich monazite deposit than Lynas' Mt Weld especially since the Appia material has 1 percent xenotime, which is a higher grade of heavy rare earth rich, xenotime, than Lynas' deposits at Mt Weld.

Appia may be on the cusp of an exciting future.

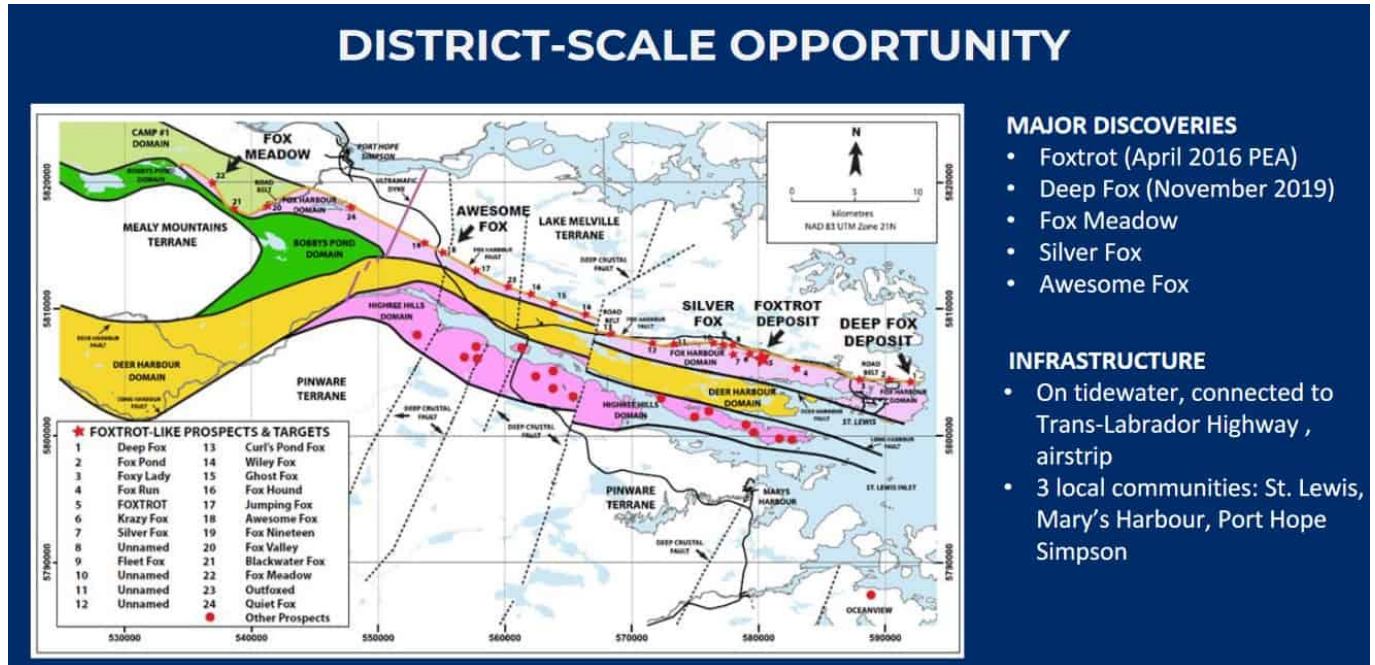
Rare Earths developer Search Minerals charging towards a 2022 PEA

Search Minerals Inc. (TSXV: SMY | OTCQB: SHCMF) ("Search") is an emerging rare earths developer with three properties in Labrador, Canada. The three are:

1. The Port Hope Simpson (PHS) property (flagship) – Includes Foxtrot, Deep Fox, Silver Fox, Awesome Fox, and Fox Meadow deposits.
2. .The Henley Harbour Area in Southern Labrador, and

3. The Red Wine Complex located in Central Labrador, plus some newer acquisitions.

Search Minerals has a rare earths district scale opportunity in Labrador, Canada



Source: June 2021 corporate presentation

At the Port Hope Simpson (PHS) property, Search is currently working on advancing its Direct Extraction Process test work, a resource upgrade, a Preliminary Economic Assessment ("PEA") completed in Q1 2022 (fully funded), and a demonstration plant (subject to funding) to be operational in 2022. Search targets being ready to build its full-scale rare earths processing plant by the end of 2023 (subject to funding) and once complete to become a North American rare earths producer by about 2025 or shortly thereafter.

The Direct Extraction Process test work – Bulk sample magnetic separation testing

Current work at the flagship PHS Project consists of taking an ~80 tonnes bulk sample from the Deep Fox and the Foxtrot resources for the testing of the Magnetic Pilot Plant. Search states: "The bulk sample will be used to scale up our

successful bench scale results using Low Intensity Magnetic Separation (“LIMS”) along with Wet High Intensity Magnetic Separation process (“WHIMS”) to produce a Rare Earth Element concentrate for further testing of the Direct Extraction Process. The use of magnetic separation for rare earth ore processing is uniquely suited to our deposits in SE Labrador. The 80 tonnes bulk sample is expected to demonstrate that a continuous process involving crushing, grinding, and magnetic separation (LIMS and WHIMS) can treat large samples of mineralization from Foxtrot and Deep Fox and achieve the potential recoveries and quality of concentrates suggested by the small scale testing.”

PHS Project – Foxtrot/Deep Fox Resource PEA 2022 commencing and for completion in Q1 2022.

Search recently announced the commissioning of a Preliminary Economic Assessment (“PEA”), for the combined Foxtrot/Deep Fox Resource, due for completion in Q1 2022, and called “PEA 2022”. Search is already fully funded to achieve PEA 2022.

This PEA is an expansion of the 2016 PEA which included only the Foxtrot Resource and was based on a 1,000 tons per day processing rate. The post-tax NPV8% was C\$48 million with an IRR of 16.7%, an initial CapEx of C\$152 million, and a mine life of 14 years (8 years open pit, 6 years underground).

Search states that there are multiple improvements in the upcoming 2022 PEA including:

- PEA 2022 will incorporate the results of the 7000 m drilling program completed at Deep Fox in 2021.
- The combination of the Deep Fox and Foxtrot resources will potentially allow for an increase in production rate to 2,000 tons per day compared to the 2016 PEA (1,000 tons/day).
- Assays from Deep Fox have shown higher grades of the key rare earth elements used in the permanent magnet market

(neodymium, praseodymium, dysprosium and terbium) than those in Foxtrot.

- The optimization of the Direct Extraction Process in two pilot plant programs has resulted in increased recoveries of key elements (Nd, Pr, Dy, Tb).
- Magnetic separation in the mineral processing flowsheet results in multiple improvements such as production of an iron ore concentrate by-product and concentration of the rare earths to 15-27% of the ore mass resulting in a smaller extraction plant, and it opens the possibility of making a zirconium/hafnium by-product.
- The company will produce a mixed rare earth carbonate to supply the separation facility.
- New grinding and magnetic beneficiation added to the flowsheet to optimize capital and operating costs.
- Rare earth prices have increased significantly over the past year.

Catalysts

Assay results from the recent 7,000 m drilling program completed at Deep Fox will be reported very soon once all the results have been received and interpreted. Following this investors can expect an updated resource estimation by October 31, 2021 and the 2022 PEA in Q1, 2022

There will also be news regarding early stage exploration at the company's Red Wine Complex located in Central Labrador and of other possible district exploration in the following months.

Greg Andrews, President/CEO stated recently: "Our immediate goal is to advance our Critical Rare Earth Element District to production. This will require (a) advancing our **DEEP FOX** project to a measured and indicated resource, (b) providing engineering and economic studies such as Preliminary Economic Assessments and Feasibility Studies and (c) developing and submitting an Environmental Assessment report

to initiate the environmental and permitting process for **DEEP FOX**. Our goal is to have the updated Preliminary Economic Assessment report by January 2022. Also, we will continue our exploration work in the District to advance some of our other prospects to be drill ready for 2022.”

Search Minerals’ strategic plan and potential catalysts (PEA is now expected in Q1 2022)



Source: June 2021 corporate presentation

Closing remarks

Search is making steady progress on their milestones towards production, as they charge towards PEA results in the New Year. Investors can also look forward to assay results, a resource upgrade, direct extraction process test work results, and the 2022 PEA. The 2022 Foxtrot/Deep Fox PEA has potential to improve significantly on the 2016 Foxtrot PEA.

Search Minerals trades on a market cap of C\$52 million.

Lynas Rare Earths, making record profits and growing to meet the EV demand

While the lithium-ion battery boom for EVs is getting most of the headlines, investors should not forget about the rare earths. The most valuable rare earths, neodymium (Nd), praseodymium (Pr), and dysprosium (Dy) are those used in the permanent magnets used in electric motors, key components in electric vehicles, EVs.

As shown on the graph below, China neodymium (Nd) prices are up 73% the past year as demand for the rare earth permanent magnet material continues to grow. Praseodymium (Pr) prices and dysprosium (Dy) prices are also on the rise.

Neodymium 5 year price chart



Source: Trading Economics

Lynas Rare Earths Limited (ASX: LYC) (“Lynas”) is the second largest NdPr [The trade term for the neodymium-praseodymium blend, which is the standard item of trade in the rare earth magnet raw material production industry], producer in the world. Lynas owns the Mt Weld rare earth mine, which is one of the world’s highest grade rare earths mines, and it operates there also the Mt Weld Ore Concentration Plant, both located in Western Australia.

Lynas has recently drilled up to 1 kilometer deep at Mt Weld discovering additional carbonatite below the current rare earth open pit mine. Lynas stated: “The current exploration drillhole has ended in visible coarse grained REE mineralisation. First pass geochemical assay results, microscopic petrology, and mineralogical study reports are expected by November 2021 and the drilling report is expected to be completed in December 2021.”

Lynas also owns the Lynas Advanced Materials Plant (LAMP), which is an integrated manufacturing facility, preparing and

separating the mixed rare earths from Mt. Weld into individual rare earth materials, located in Malaysia. In recent legal news, Lynas announced that: "...on 28 July 2021 the High Court of Malaysia at Kuala Lumpur dismissed the judicial review proceedings commenced by the anti-Lynas activists seeking review of the processes followed by the Government of Malaysia in reaching the August 2019 decision to renew Lynas Malaysia's fourth operating licence. Lynas has received a notice of appeal by the anti-Lynas activists. Lynas intends to defend the appeal."

In company news, Lynas recently announced a record net profit after tax of A\$157 million for the 2021 financial year (July 1, 2020 to June 30, 2021). The profit was partly as a result of higher rare earths production, but mostly due to stronger rare earths pricing. Lynas stated: "Despite the global shortage of semi-conductors which affects all industries and in particular, the automotive industry, the NdFeB market is experiencing very strong growth, supporting the demand for NdPr and the Heavy Rare Earths' blend produced by Lynas"

Lynas' rare earth products (notably NdPr) are seeing strong demand and rising prices

Favourable market dynamics

- Global vehicle sales forecast to grow between 8 and 10% in 2021 (S&P Global Ratings)
- Demand for electric vehicles has accelerated - global electric car sales rose by around 140% in Q1 2021 (IEA)
- NdPr demand growing with forecast global demand for NdFeB alloys and powders increasing at a CAGR of 9.7% from 2020 to 2030 (Adamas Intelligence)
- NdPr China domestic price (ex-VAT) grew to US\$64.7/kg in June 2021 from US\$36.0/kg June 2020; future price trends are dependent on end product demand

Lynas
Rare Earths



Growing demand for our products

- High growth NdFeB market contributing to demand for our NdPr product family and mixed Heavy Rare Earths
- Lynas is the leading supplier of NdPr products to the Japanese market
- Demand for catalyst from the automotive and Fluid Catalytic Cracking (FCC) sectors back to pre-COVID levels
- Continued focus on strategic customer relationships

9

Source: Lynas Rare Earths FY 21 results presentation

Latest progress at Lynas as part of their 2025 growth strategy

- **Kalgoorlie Rare Earths Processing Facility (Australia)** – Lynas is currently progressing their new Kalgoorlie Rare Earths Processing Facility, where site works have commenced and orders have been placed for all long lead time items. Fabrication of the five kiln shell sections is now complete. The final Environmental Review Document (ERD) has been submitted to the Australian EPA for the Kalgoorlie Project.
- **LRE/HRE separation & specialty materials facility (USA)** – Lynas has completed the Phase 1 detailed engineering and design work for a Heavy Rare Earths (HRE) separation facility in the USA, and it has been submitted to the US Government. The U.S, DoD is now conducting a merit evaluation of the submission. Lynas is progressing with site studies and planning for the American integrated Rare Earths Separation Facility.

Lynas current facilities and 2025 growth strategy

Lynas 2025 growth plan to meet accelerating market demand



Source: Lynas Rare Earths FY 21 results presentation

Closing remarks

Lynas Rare Earths is performing very well, buoyed by strong rare earth prices. Most analysts are forecasting a strong decade ahead for rare earths based on growing demand for the powerful rare earth permanent magnets used in electric motors in the automotive, aerospace, and appliance industries.

Lynas is steadily working towards achieving its 2025 growth strategy of developing new facilities to enlarge its capacities for rare earths processing and separation in Australia and the USA.

Investor interest in Lynas remains strong, because it is the largest non-Chinese based rare earth permanent magnet raw materials' producer. Lynas trades on a market cap of A\$6.4 billion. It is certainly one to follow as it makes steady progress towards achieving its 2025 growth target.

Canada's entry point to a domestic North American rare earths products production center

Why is Appia Energy Corp.'s (CSE: API | OTCQB: APAAF) Alces Lake discovery of an accessible extensive hard rock deposit of the rare earth bearing mineral, monazite, so very important to the non-Chinese world's demand for magnet rare earths? It is because Appia's monazite is, in fact, the neodymium rich variant, which is the most desirable for the production of rare earth permanent magnets. It is not only rich in neodymium (Nd) and praseodymium (Pr), but also contains 1% of xenotime, the best heavy rare earth bearing hard rock mineral.

Monazites are typically up to 50% higher in contained Nd and Pr than bastnaesite, the ore mined at Mountain Pass by MP Materials Corp. (NYSE: MP) and the residual mineral from China's Baotou region iron mining, which up until recently was the world's most-produced source mineral for light rare earths. Lynas Rare Earths Limited (ASX: LYC) is currently the world's largest producer of rare earths derived from monazite deposits at Mt. Weld in a remote area of northern Australia.

Monazites are produced today as a byproduct of the processing of heavy mineral sands to recover zircon and ilmenite, respectively the ores of zirconium and titanium. Until recently processing monazite for rare earths was inhibited by the fact that monazites always contain radioactive thorium and sometimes uranium. The monazites were thus returned to the tailings from these operations and in the USA the

environmental regulations required that they be returned to the worked-out deposits and distributed so that the residual background radiation was equal to or less than it was before the deposit was worked.

In the last five years as Chinese bastnaesite deposit grades have declined and mining created pollution has become a big problem in China the Chinese rare earth industry has begun to import very large quantities of monazites from the USA, Madagascar, South Africa, Brazil, and Australia. All of this material was produced as a byproduct of heavy mineral sands processing for zircon and ilmenite.

In order to solve the thorium/uranium problem, China requires that all imports of monazite go first to China Nuclear Corporation, which removes the thorium and uranium, and then ships a clean mixed rare earth carbonate to the Chinese refiner that ordered the material. China nuclear is licensed to process up to 50,000 tons of monazite containing up to 30,000 tons of total rare earths a year.

In the USA the only licensed uranium mill, Energy Fuels Inc.'s (NYSE American: UUUU | TSX: EFR) White Mesa Utah facility, has replaced China as the destination for monazite produced from its heavy mineral sands operations in Georgia by US Chemical Group, Chemours. Energy Fuels removes the uranium, which is a payable for Energy Fuels, and is storing, legally, the thorium, which has been committed to a medical radioisotope group. The first clean mixed rare earth carbonate produced by Energy Fuels from the Chemours' monazite has already been sold to and shipped to Neo Performance Materials Inc.'s (TSX: NEO) European solvent extraction rare earth separation facility.

Appia is working with Canada's and the world's most attractive (Report's the Fraser Institute) mining investment jurisdiction, the Province of Saskatchewan. The Province's Saskatchewan (Mining and Refining) Research Center, the SRC, has agreed to develop a hydrometallurgy for Appia's monazite

and the SRC has already designed and begun the construction of a 3000 ton per annum rare earth solvent extraction separation facility, where the separation and purification of Appia's monazite will be proven and piloted in what will be Canada's anchor for a total rare earth permanent magnet supply chain. Saskatchewan is the home of Canada's uranium mining industry and so the sale of any recovered uranium and the storage (or use) of any recovered thorium is not a problem.

North America is well on its way to becoming a world center of monazite processing, and Appia is Canada's entry point to a domestic North American rare earth products production center.

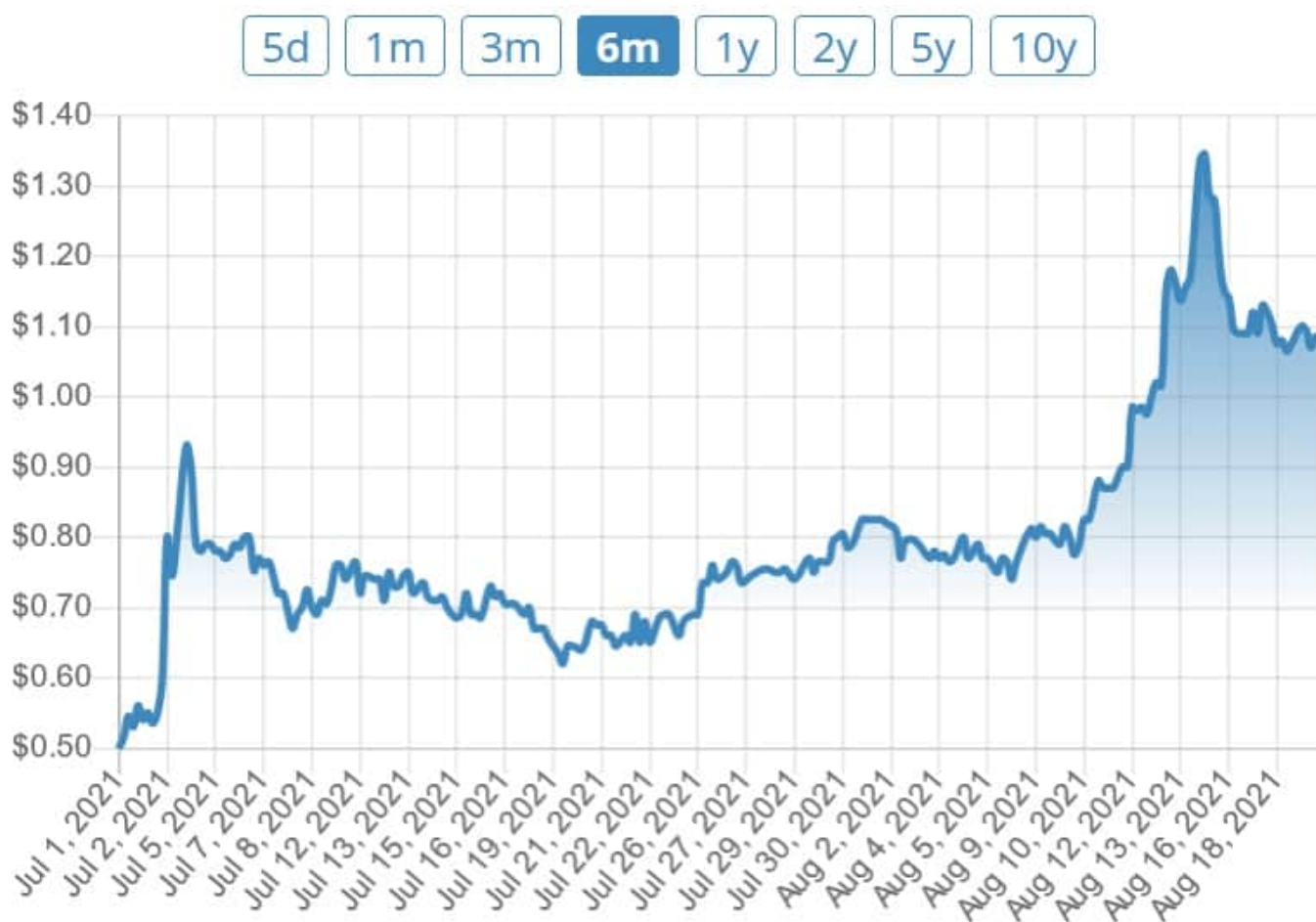
Newly listed Australian Rare Earths Limited is off to a flying start

Rare earth permanent magnets are so powerful they are the heart of modern 'efficient' motors that drive many electric vehicles, wind turbines and electrical appliances. Their advantage is that they achieve stronger output and therefore reduce power consumption and boost efficiency compared to other electric motors with no rare earth permanent magnets. These magnets contribute 30% of the market by volume and >90% by value.

Key magnet rare earth material prices such as Neodymium (Nd), Praseodymium (Pr) and Dysprosium (Dy) have been rising the past 2 years, partly due to the surge in electric vehicle (EV) sales and also due to supply concerns out of China.

Australian Rare Earths Limited (ASX: AR3) (“AREL”) is a newly listed Australian company focused on the valuable magnet rare earths at their Koppamurra Project in Australia. The Company listed at A\$0.30 on July 1, 2021 raising A\$12 million. The stock tripled in the first five days after listing reaching A\$0.90, and is currently trading at A\$1.08.

Australian Rare Earths Limited stock price chart (IPO at A\$0.30 on July 1, 2021)



Source: Australian Rare Earths Limited

The Koppamurra Project







AREL is progressing the exploration of a significant deposit of valuable ‘clay-hosted’ rare earth elements, located at their Koppamurra Project spread over tenements in South Australia and Victoria. Past exploration of the Koppamurra region has shown it contains mineralization containing the

rare earth elements neodymium, praseodymium, dysprosium and terbium as revealed from reviewing historic drilling data and samples available from State core repositories. The rare earths were found to accumulate in the shallow clay layer deposited onto a limestone base (Gambier Limestone).

The Koppamurra Project is a frontier ‘ionic clay’ rare earth opportunity in South Australia and Victoria, Australia, spread over a massive ~4,000km². Clay hosted rare earth mining is shallow-excavation mining involving progressive rehabilitation and is much lower impact than many other forms of mining. The deposits of interest are non-radioactive, which is a significant advantage over other mineral sand and hard rock rare earth element deposits.

Ionic clay projects have significant advantages over mineral sand and hard rock rare earth projects

KOPPAMURRA: AUSTRALIA'S ONLY PROSPECTIVE IONIC CLAY REE DEPOSIT

	Ionic Clays	Hard Rock
 Location	<ul style="list-style-type: none"> Currently mined <u>in China and Myanmar</u>, but resources are depleting 	<ul style="list-style-type: none"> China still dominates but mines in production and under development in USA, Australia etc
 REE Assemblage	<ul style="list-style-type: none"> Supply virtually <u>all heavy REEs (>80%)</u> and a significant portion of light (La-Eu) REE globally 	<ul style="list-style-type: none"> Monazite or Bastnaesite ores which are typically higher in light REE assemblage
 Scale	<ul style="list-style-type: none"> Scalable development – lower initial capex requirements 	<ul style="list-style-type: none"> Typically require significant scale for economic viability given higher capex requirements
 Exploration	<ul style="list-style-type: none"> <u>Quick and inexpensive to define</u> resources given shallow drilling using aircore, auger, push-tube core 	<ul style="list-style-type: none"> Similar to other hard rock base metals requiring substantial drilling, geochemistry, geophysics etc
 Mining	<ul style="list-style-type: none"> Shallow free digging material with low strip ratio Progressive rehabilitation 	<ul style="list-style-type: none"> Drill and blast with large mining fleet Deep open pits or underground mining
 Processing	<ul style="list-style-type: none"> Simple metallurgy; screen then heap or tank leach No toxic chemicals <u>nor radioactive waste streams</u> 	<ul style="list-style-type: none"> High temperature +/- pressure leaching Radioactive tailings
 Risk / Economics	<div style="border: 1px dashed black; padding: 5px; text-align: center;"> Fast to drill and develop, low capex and high value product </div>	<div style="border: 1px dashed black; padding: 5px; text-align: center;"> Significant time and cost to develop, complex processing, radioactivity issues, lower product value </div>

Source: Company presentation

Current news and next steps

Prior to AREL listing on the ASX, 470 aircore, auger and push tube drill holes were completed in January 2021 and a JORC 2021 **Inferred Mineral Resource of 39.9Mt @ 725ppm TREO** was

announced. A feature of the Koppamurra Mineral Resource is low radioactivity. Preliminary testwork at ANSTO has demonstrated that recovery improves at lower pH levels and this will be investigated further to improve optimization of metallurgical recoveries, currently around 50% to 70%.

More recently a further 79 hole drill campaign was completed with assay results pending and expected by mid to late August. Further field exploration will begin in October.

In July AREL announced that they had acquired new tenements and expanded the Koppamurra project by greater than 40%.

Board and management are highly regarded

The AREL board consists of renowned metallurgist Dudley Kingsnorth. He is an internationally recognized expert in the rare earths industry, providing advice to producers, end-users and government entities. He has over 50 years of experience in operations, project development and marketing.

Australian Rare Earths Limited reasons to invest summary

INVESTMENT HIGHLIGHTS

-  Australia's only prospective **ionic clay hosted REE deposit** and one of two listed opportunities globally
-  **Maiden resource identified** with ability to **rapidly expand** through low cost drilling
-  **Favourably located** in Australia with access to a skilled workforce and good infrastructure
-  **High value REE assemblage** with **low radioactivity**
-  Globally, Ionic clay hosted REE deposits represent simple, **low cost mining and processing**
-  Potential to be a **strategic, independent and sustainable source** of **HREEs** essential for future economies
-  Strong pipeline of **upcoming news flow**

Source: Company presentation

Closing remarks

It is still very early days for Australian Rare Earths Limited and their ionic clay rare earths Koppamurra Project in Australia, already with an Inferred Mineral Resource of 39.9Mt @ 725ppm TREO. The IPO raised A\$12 million which will largely be used for exploring their tenements with drill assays due out shortly in August, to be followed by a further exploration program starting in October. Ionic clay projects have several advantages including lower CapEx, faster and easier development and processing, and no radioactive waste streams.

The Board and Management are highly experienced and include renowned rare earths expert Dudley Kingsnorth. The stock price has already taken off given the excitement behind the Company's potential. Despite this, the market cap is still reasonable at A\$122 million. One to follow closely.

With recent moves in the USA towards supporting key critical mining projects, will NioCorp Developments make the list?











Critical metals scandium, titanium, and niobium are all doing well as global demand for metals remains robust in 2021. In May 2018, the U.S Interior Department moved to include niobium, scandium, and titanium onto its list of critical minerals. These three critical metals have targeted applications in clean energy, aerospace/commercial aviation,

defense, and automotive. Generally speaking, they are used to lighten and strengthen alloys. For example, scandium is a key lightweighting metal used in aluminum alloys as well as in fuel cells. Niobium is used to strengthen stainless steel. Titanium is very well known for its strength-to-weight ratio, as it is as strong as steel but weighs about half as much.

As we move to a world of electric vehicles (EVs), lightweighting is a key component to improve performance and range. For example, \$9 of niobium added to a mid-sized car reduces weight by 100kg, increasing fuel efficiency by 5%. \$1-1.5 million of scandium in a single airliner offers >\$9 million of net present value in fuel savings. (source)

Niobium and scandium uses

Niobium and Scandium are Key Enablers of Sustainability

 <p>Growing demand for lighter-weight and more fuel efficient cars, trucks, and buses</p>	 <p>Increasing focus on lighter-weight and more fuel efficient commercial jetliners</p>	 <p>Emphasis on stronger and lighter steels for buildings and infrastructure mega-projects</p>	 <p>Global adoption of increasingly tighter air quality and greenhouse gas standards</p>	 <p>Higher spending on defense systems that use NioCorp's superalloy materials</p>	 <p>Ever-growing deployment of clean energy systems such as Solid Oxide Fuel Cells</p>
 <p>\$9 of Niobium added to a mid-sized car reduces weight by 100kg, increasing fuel efficiency by 5%.¹</p>	 <p>\$1-1.5 million of scandium in a single airliner offers >\$9 million of net present value in fuel savings.²</p>	 <p>0.025% Niobium in the steel of the Millau Viaduct bridge reduced the weight of steel and concrete by 60% in the overall project.³</p>	 <p>Both Niobium and Scandium increase fuel economy in surface transportation and in aerospace, reducing air emissions.</p>	 <p>Niobium, Scandium, and Titanium are all vital to the performance of a variety of high-performance defense systems.</p>	 <p>Scandium helps solid oxide fuel cells achieve unmatched reliability in mission-critical power supply markets.⁴</p>

Today we take a look at a USA based junior miner that has all three of these valuable critical elements.

NioCorp Developments Ltd (TSX: NB | OTCQX: NIOBF) ("NioCorp") is developing North America's only niobium, scandium, titanium, rare earths elements project, located near Elk Creek, Nebraska, USA. The Elk Creek Superalloy Materials Project is the highest grade niobium project in North America, as well as the largest prospective producer of scandium in the

world. The Project is a large underground hard-rock deposit containing an estimated 250,000 tons of niobium pentoxide, 2,300 tons of scandium, and 891,000 tons of titanium dioxide. There are also some rare earths, as discussed later.

Some reasons why NioCorp's Elk Creek Superalloy Materials Project is unique:

- A pure-play critical minerals and rare earths element company.
- All of NioCorp's planned products have been designated as "critical minerals" by the U.S. government.
- Tier one project location in Nebraska, USA.
- The Project enjoys strong community, as well as state and local government support.
- Strong focus on sustainability and ESG principles.
- Large resource with a 36-year long mine life.
- Feasibility Study – Post-tax NPV of US\$1.7 billion, post-tax IRR of 21.7%, initial CapEx US\$1 billion.
- Much of the planned production in the first 10 years is pre-sold.
- 100% of the Project's projected FeNb production in the first 10 years is under sales contract or Letter of Intent, and 12% of its projected scandium is under sales contract.
- All permits needed to start construction have been secured.
- The NioCorp Board and management team have more than 200 years of collective experience in minerals development.

All that is left to do is for NioCorp to raise the project funding. Given the recent moves in the USA towards supporting key critical mining projects, it is hoped that soon NioCorp can be a beneficiary.

NioCorp recently raised C\$6.2 million, extended their land at Elk Creek, and works on recovering rare earths

Regarding the C\$6.2 million raise, NioCorp stated: "Proceeds of the private placement will be used for continued advancement of the Company's Elk Creek Superalloy Materials Project, including ongoing detailed engineering efforts, conducting technical assessments of potentially adding rare earth products to the planned product offering, and for working capital and general corporate purposes."

NioCorp now owns the surface land on which the Elk Creek Project's mine infrastructure and support operations will be located. Ownership of the land also gives NioCorp ownership of the mineral rights to more than 90% of the Project's Mineral Resource and Mineral Reserve. The purchase price was approximately \$6.2 million.

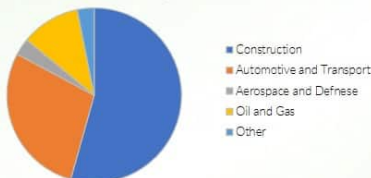
In other recent news, NioCorp is working on enhancing their metallurgical processes to potentially also recover rare earth oxides. NoCorp stated: "The Company is currently evaluating next steps in its overall metallurgical test work program, which will focus on optimizing and streamlining the existing processing flowsheet as well as establishing process routes for the potential recovery of rare earth products. The rare earth products that are of most interest to the Company at present are Neodymium-Praseodymium ("NdPr") oxide, Terbium oxide and Dysprosium oxide."

The niobium, scandium, and titanium markets summary

Niobium

- The global Niobium market is currently ≈125kt per annum with a value of ≈\$5.0bn and is forecast to achieve 6% CAGR between 2020 and 2025¹
- Market growth is expected to be underpinned by a shift toward an increasing use of light-weight high strength steel alloys in construction
- Continued use in aircraft engines and additional long-term growth through light-weighting in transportation, defense, space applications and use in battery technology

Global Niobium Sales by Sector²
≈\$5.0 bn per annum¹

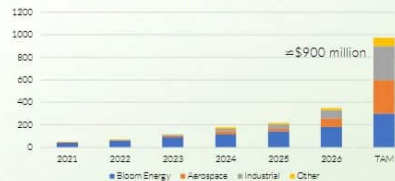


NioCorp
SUPERALLOY MATERIALS

Scandium

- Momentum building in the market – new pilot production from Rio Tinto and planned production from others
- Demand exceeding supply
 - ≈22t per annum demand growing at 23% CAGR for battery applications from one supplier (Bloom Energy)¹
 - Aerospace and industrial ≈5t per annum forecast to reach 50t per annum over next 5 years¹
 - Forecast demand based on current applications expected to exceed 100t per annum by 2026¹
- Supply is expected to lag demand by approx. 30%¹
- Many aluminum suppliers planning to produce aluminum – scandium alloys
- Ultimate demand potential for several hundred tons per year of scandium oxide subject to scandium availability
- Growing market from ≈\$50million to ≈\$1billion¹

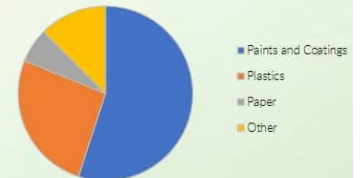
Scandium Market Potential
≈\$0.9 bn per annum¹



Titanium

- The global Titanium market is currently approximately 15.8mtpa with a value of ≈\$11.4 bn and is forecast to achieve 6.0% CAGR between 2020 and 2025⁴
- Supply and demand are tight, and lack of new titanium dioxide feedstock has put upward pressure on prices
- Growing demand for lightweight high strength titanium alloy products.

Global Titanium Dioxide Sales by Sector³
≈\$11.4 bn per annum¹



¹ S&P Partners Research, ONG Commodities, Global Newswire Report Linker May 2020
² Mordor Intelligence March 2021

6

Source: NioCorp company presentation

Closing remarks

NioCorp is now an advanced stage critical metals developer, located in Nebraska USA. Their Elk Creek Superalloy Materials Project contains economically viable niobium, scandium, titanium, and potentially some rare earths.

A strong Feasibility Study has been produced, all permits to construction are in place, and the project now awaits funding. As a sign of support for the project, Nebraska Governor Pete Ricketts nominated the Project as a “National High-Priority Infrastructure” Project to the White House.

NioCorp Developments trades on a market cap of C\$333 million (US\$269 million) and is well worth following.

Rare earths directed Appia Energy embarking on a fully funded drilling program at Alces Lake

Rare earths companies are starting to gain attention as demand for the magnet rare earths in particular is forecast to boom this decade as we move further towards renewable energy and electric vehicles. The market for magnet Rare Earth Oxides (REO) is expected to increase five-fold by 2030. Two key magnet metals, Neodymium (Nd) and Praseodymium (Pr) have seen their prices rise strongly in 2021 and notably again the past month after a recent dip.

Neodymium (Nd) oxide and Praseodymium (Pr) oxide prices have spiked higher the past month



Praseodymium Oxide (Pr) ask price chart



Click and drag in the plot area to zoom in

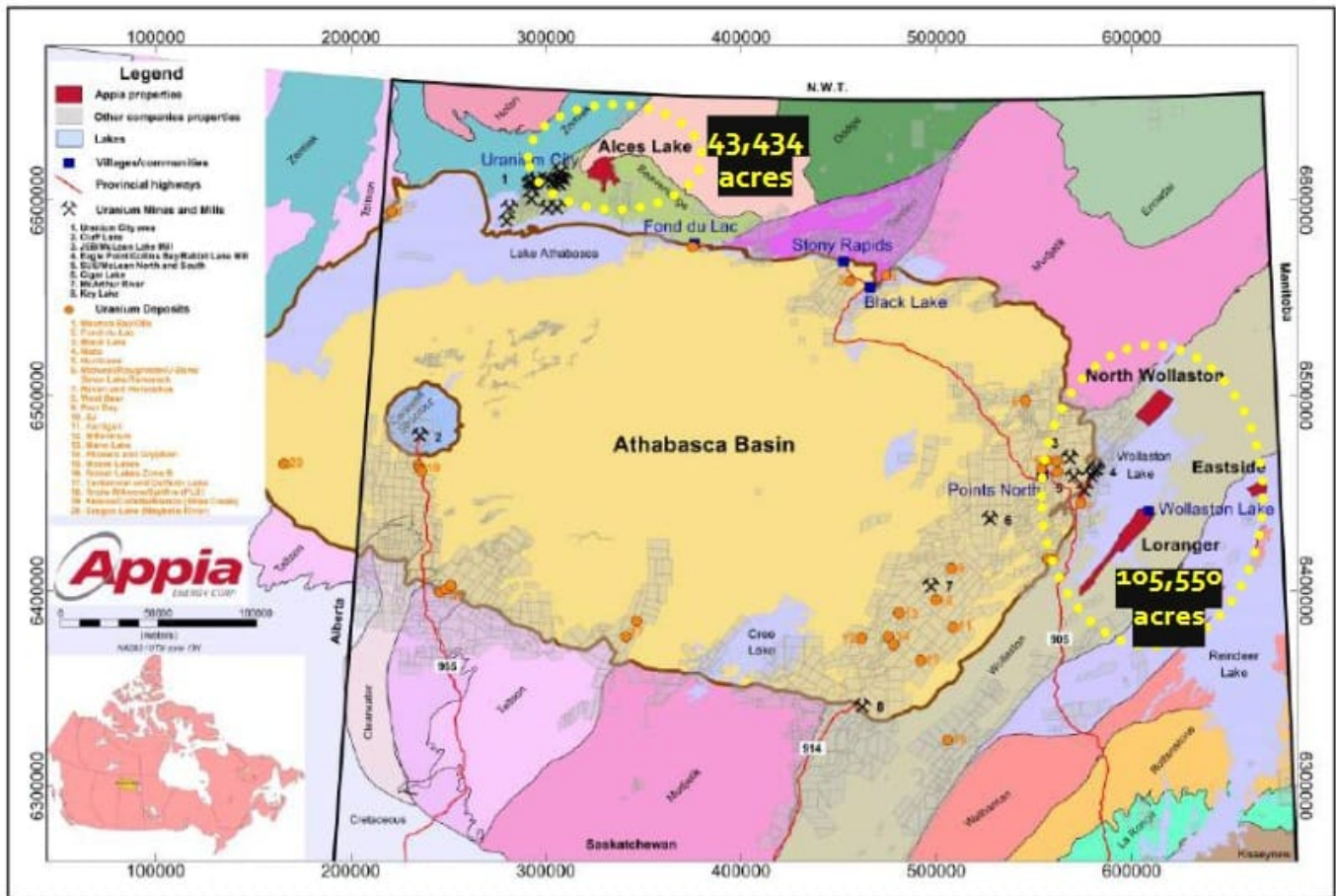


Source: Kitco

One rare earth junior (Appia Energy) has 2nd highest average rare earth element (REE) grade in the world, at 16.65 wt% TREO, hosted in favorable monazite ore.

Appia Energy Corp. (CSE: API | OTCQB: APAAF) (“Appia”) is focused on rare earths at their 100% owned, 43,434 acre, Alces Lake Project in the Athabasca Basin area of northern Saskatchewan, Canada. They also have uranium prospects in the region as you can read here.

Appia Energy’s project portfolio in Northern Saskatchewan, Canada



Source

The Alces Lake project has 'monazite ore' containing valuable rare earths Neodymium (Nd), Praseodymium (Pr), Dysprosium (Dy), and Terbium (Tb). Exploration since 2017 has identified high-grade Total Rare Earth Oxide (TREO) with up to 49 wt% TREO (average grades of 16.65 wt% TREO and 3.85 wt% CREO) on or near surface. Less than 1% of the property has been explored with diamond drilling.

On July 15, 2021, Appia announced that they are now embarking on a fully funded ~5-6,000m drilling campaign at Alces Lake, which is as much drilling as they have ever drilled before at the Project. The first phase of ground geology and geophysics is completed and the drilling team is about to mobilize to the Alces Lake camp, where two drilling rigs and crews will be working 24/7 on this phase of the helicopter-supported diamond drilling program.

Alces Lake Project Manager, Nic Guest, commented: “The quality of the data obtained in the first phase of ground exploration is excellent. Our understanding of the various occurrences across the property has grown and we have planned our drill program accordingly. Our first phase of 2021 drilling will give us new and important information.”

Appia President, Frederick Kozak, stated: “Approximately 5,700 metres of drilling has been planned to test the near-surface and down-plunge extents of new and existing rare-earth targets. More than 4,000 metres will be dedicated to identifying the depth potential of the WRCB zone (cumulatively the Wilson-Richard-Charles-Bell discoveries) and help complete the understanding of this significant discovery.”

The Alces Lake Project has excellent local infrastructure including mills, power, labour, highway, air strips, and well established summer and winter access routes. Appia has even recently built a winter camp site to help with all year round operations.

Highlights of Appia Energy’s exciting Alces Lake Project

Alces Lake Project Meets Criteria for a Viable REE Project

Massive Monazite Exposed at Surface

- **Grade** - Alces Lake has a grade of up to 49 wt% TREO
- **Mineralogy** – rare earths are completely hosted in coarse-grained monazite
- **Composition** – 23-25% is Critical Rare Earth Oxide (CREO - Neodymium (Nd), Praseodymium (Pr), Dysprosium (Dy), Terbium (Tb))
- **Location** - Saskatchewan is one of the best mining jurisdictions in Canada and the world
- **Environmental Management and Radiation**– well understood in Saskatchewan
- **Future Processing Facility** – under construction by Saskatchewan Research Council



High-grade REE
mineralization
outline

Wilson Zone (North)

Source: Company presentation

Closing remarks

Appia is sitting on a super high grade REE monazite ore deposit at Alces Lake. A huge summer drilling campaign has just begun and will help the Company potentially build up a Resource estimate. Rare earths expert Jack Lifton has also agreed to join the Appia team as a Strategic Adviser.

Appia is currently trading on a market cap of C\$83 million after a recent stock price dip. For those who missed out on buying Appia earlier, now looks to be a good time to take a second look. We will let you know the drill results as they come in during the following months. Stay tuned.