

# Scandium in Lithium-Ion Batteries? Now it gets interesting...

Scandium International Mining Corp. (TSX: SCY) says that it could have the world's first primary scandium mine at Nyngan, NSW, Australia. The project has received all key approvals, including a development consent and a mining lease necessary to proceed with project construction.

The market should know this, so that's really is not the story here. But let's back up a moment.

As you probably know by now, scandium is a critical material that is used as an additive to aluminum alloys that hardens and strengthens the end product. Not unlike titanium alloys, a scandium alloy allows for lighter weight but equivalent (or better) strength components. The usage is being embraced by specific industries, but notably, two Russian jet fighters (MiG-21 and MiG-29) use scandium alloys in their construction. Other uses for scandium alloys include (but not exclusive to) automobiles, fuel cells, and other defense products.

While the company had an initial 50% interest in 2010, it closed the acquisition to become a 100% owner of the Nyngan Scandium Project in 2014. With an NI 43-101 report on the property in 2014, a Definitive Feasibility Study in 2015 and an updated NI 43-101/Definitive Feasibility Study in 2016, the company conducted process testing as recommended in the 2016 DFS prior to commencing detailed engineering on the project. An initial Mining Lease was granted in 2017 but due to a prior filing of objection by a local landowner, it was not until July 2019 that a revised Mining Lease was received due to local landowner objections.

Here we are in 2021 – that's a long time to work on a mining

project, but it is not uncommon. All the company needs is a product purchaser and capital to fund the mine development.

### **Now it gets interesting**

In the interim, management also commenced work on the processing side of scandium. Like most resource business, the more of the value chain that you can capture, the more return for your shareholders, so that makes sense. The company was successful in its work and successfully demonstrated the ability to manufacture an aluminum-scandium master alloy (Al-Sc2%), from scandium oxide, using a patent-pending melt process involving aluminothermic reactions.

As an offshoot of the process technology work, the company has also developed ion exchange (IX) technology and knowhow to recover scandium, cobalt, and other critical metals from solvent extraction (SX) raffinate and other acidic waste streams in certain acid leach operations of the copper mining process. Copper ore bodies have a number of associated metals that usually wind up in the waste stream. Many of these "waste" metals include nickel, beryllium, scandium, and zinc to name a few which are in low enough concentration to not necessarily be economic to recover. Some might notice that these metals are "critical materials" and can be used in batteries.

As a follow on to their work in metals recovery technology, the company announced in September 2020 that it had filed a provisional patent application with the US Patent Office seeking patent rights on various applications of scandium in lithium-ion batteries. The patent application covers a number of scandium enhancements, including doping potential for both anodes and cathodes and for solid electrolytes.

So you can see that with Scandium International Mining Corp., investors have exposure to a project-ready scandium mine in Australia. But they also have exposure to critical metals

recovery technology and potential usage in lithium-ion batteries as well as solid oxide fuel cells.

It's not just a mining company anymore...and potentially more valuable as a critical materials or battery technology company.

Watch this space!

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## **Lifton, Clausi, Cashin and Putnam on how the time for scandium is now**

The Technology Metals Show hosts Jack Lifton and Peter Clausi talk to Peter Cashin, President and CEO of Imperial Mining Group Ltd. (TSXV: IPG) and George Putnam, President, CEO and Director of Scandium International Mining Corp. (TSX: SCY), about scandium, which is a critical material and the scandium market overall.

The full interview available exclusively to subscribers of the **Technology Metals Show**, this a promo clip from the panel's discussion on the overall scandium market, commercial uses of scandium and the latest research and development that has been done in this area. George said, "Scandium has some unique aspects to it that make it well suited as an aluminum alloy along with some exciting uses in a number of areas specifically in battery technology."

In the interview, Peter Cashin provided an update on the Imperial Mining's Crater Lake Scandium-Rare Earth property located in the Canada's aluminum capital – Quebec.

To access the complete interview subscribe to the **Technology Metals Show** and get exclusive access to member-only content through this exclusive site. Or [Log-In Here](#) for the latest conversations, debates, updates and interviews with the leaders, thought leaders and investors focused on issues relating to sustainability in the critical materials sector.

For more information on the **Technology Metals Show** email us at [info@technologymetals.com](mailto:info@technologymetals.com) or reach us direct at +1 (416) 546-9233.

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## **As Chinese rare earths' stock prices rally, pressure rises for the rest of the world...**

Rising US-China tension has resulted in some rare earths' stock prices rising sharply, particularly those in China. Given the recent US moves to introduce critical materials legislation it seems likely that the non-Chinese rare earth stocks will also rally strongly this year, particularly if the new bills and financial support are passed.

Let's start with a recap of the recent US support highlights for rare earths:

- May 18, 2018 – The US declared a list of 35 critical materials. A large part of the list includes rare earths.
- May 2, 2019 – U.S. Sen. Lisa Murkowski and others submitted the American Mineral Security Act
- In mid May, 2020, Senator Ted Cruz submitted the Onshoring Rare Earths Act – the 'ORE Act'

- On May 28, 2020 US Representative Michael Waltz submitted the American Critical Mineral Exploration and Innovation Act of 2020

The ORE Act focuses on six critical materials – **Rare earths**, scandium, lithium, cobalt, graphite, and manganese. The Critical Mineral Exploration and Innovation Act directs the U.S.G.S. to complete updated resource assessments for each critical mineral. It has been reported that there will be a focus on **rare earths** and other so-called strategic minerals.

Then just last week rare earths expert and Technology Metals Show host Jack Lifton stated exclusively to InvestorIntel: “The US Defense Department has announced last week that it will seek \$1.7 billion for rare earths purchases in the 2021 National Defense Authorization Act that means the budget for fiscal 2021. In addition they will ask for another \$300 million (**a total of \$2 billion**), for rare earths for specialized weapons which they name as hypersonic missiles...”

Given all of the above proposed support to the rare earths sector, it is abundantly clear that the US is now finally moving rapidly to secure critical rare earths supply, particularly from US deposits, where possible. Current rare earths producers and listed rare earths stocks stand to be beneficiaries. Especially if they have US rare earths projects, but quite likely any non-Chinese rare earth juniors that can achieve funding and production should find very strong western demand for their products. Most of the western world is now looking to diversify their supply chains especially after the trade war and COVID-19 problems of the past 2 years.

Some rare earth miners with US projects include:

- MP Materials (private)
- Rare Element Resources Ltd. (OTCQB: REEMF)
- Texas Mineral Resources Corp. (OTCQB: TMRC)

- Ucore Rare Metals Inc. (TSXV: UCU | OTCQX: UURAF)

Some miners with US rare earth processing potential include:

- Energy Fuels Inc. (NYSE: UUUU | TSX: EFR) recently stated their White Mesa Mill in the USA could be used in future for rare earths processing.
- Lynas Corporation (ASX: LYC) has received US support for a planned US rare earths processing facility.
- Peak Resources (ASX: PEK) plan to have a US rare earths processing facility.

Some rare earth miners with Canadian projects include:

- Avalon Advanced Materials Inc. (TSX: AVL | OTCQB: AVLNF)
- Appia Energy Corp. (CSE: API | OTCQB: APAAF)
- Search Minerals Inc. (TSXV: SMY)

Some rare earth miners with Australian projects include:

- Alkane Resources Ltd. (ASX: ALK | OTCQX: ALKEF)
- Scandium International Mining Corp. (TSX: SCY)

## Rare earths are vital ingredients for modern technology



## Closing remarks

The massive recent news of two new rare earth/critical

materials related Acts and a proposed “US\$2 billion towards rare earths in 2021”, appears to have been somewhat missed by the market. The Chinese rare earths stocks have already bounced leaving the potential rest of the world rare earth miners to play catch up.

News flow in future months should continue to be extremely promising for the rare earths sector following on from the tremendous news from the last few weeks.

Investors should not wait too long as any further increased US-China tensions, threats of China supply loss, or passing of rare earths related Bills, will likely send non-Chinese rare earth miners stock prices higher.

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## **Putnam on the US-China Trade Deal and its effect on scandium developers**



“Scandium and yttrium have been called out specifically in the latest trade deal between China and the US. I think this is very encouraging to scandium developers...We are laser-focused on building the markets for scandium sales from our Australian project, the Nyngan Scandium Project.” States George Putnam, President, CEO, and Director of Scandium International Mining Corp. (TSX: SCY), in an interview with InvestorIntel’s Tracy Weslosky.

George went on to say that the trade deal is going to benefit both Canada and Australia as both countries have prospects for scandium production in the near to intermediate term. He said that Scandium International is at the front end of that effort in Australia. George also said that the US Commerce Department has published positive initiatives with both Australia and with Canada on encouraging and supporting the development of critical metals projects including scandium.

To access the complete interview, [click here](#)

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## **Making scandium mainstream in the very near future**

**Light weighting of vehicles using aluminium-scandium alloys can reduce costs, increasing range, and reduce emissions**

More than ever before, new innovations are reshaping the automotive industry. One trend that is gaining in importance is “light weighting”. That is, making vehicles lighter, and hence more fuel efficient. Even tiny reductions in aircraft weight can lead to significant fuel cost reductions.

By using composite materials and alloys that are strong, but lighter than steel, companies are able to manufacture vehicles that require less fuel and create fewer emissions to meet tightening emission standards. China and Europe are tightening their emission standards in 2020, so this is of imminent concern for auto manufacturers. In the case of electric vehicles, a lighter vehicle offers a greater range. By using a



lighter vehicle a smaller battery is needed, and the vehicle cost is reduced.

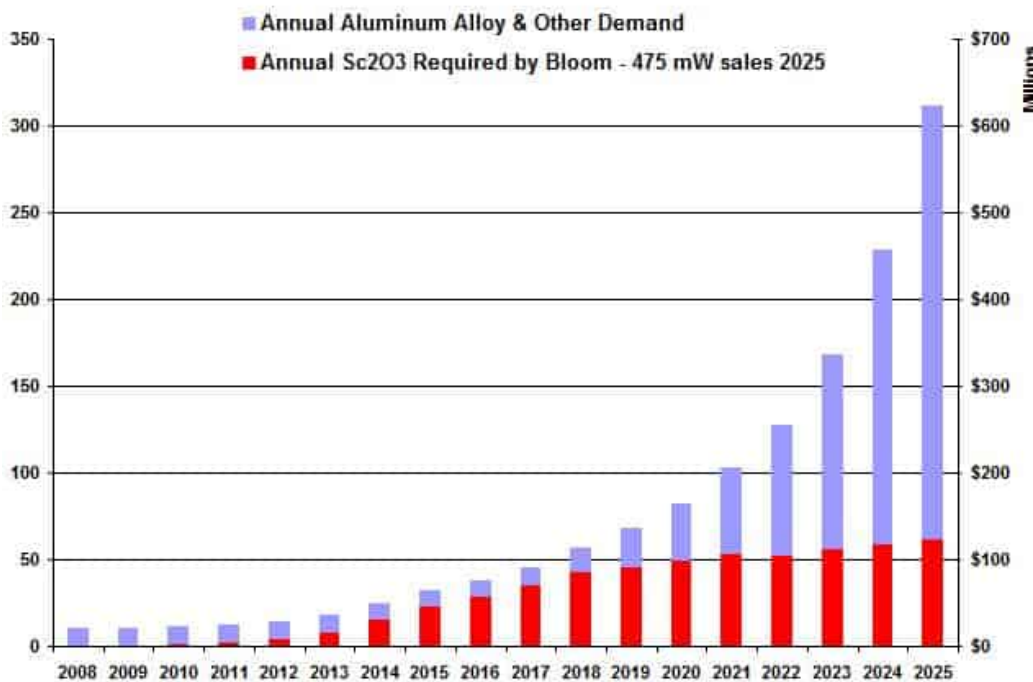
## **Scandium**

Scandium (Sc), combined with aluminium (Al), is an effective way of light weighting vehicles. It can be added to aluminium to make alloys lighter, stronger and more malleable. This can dramatically reduce the weight of parts for not only cars, but also aircraft and ships, helping deliver savings on fuel costs. Right now a lack of scandium supply, and hence an expensive price, is holding back the industry. Scandium supply is a mere <50 tons pa.

Scandium is mostly used in aerospace and high end sports equipment. It has enormous potential to reduce fuel costs in the aviation sector as Al-Sc alloys may reduce aircraft weights by 15%-20%. As the price falls the use could spread into the auto sector, initially into high end electric vehicles.

The chart below highlights the potential enormous growth for the scandium market should lower price (US\$2,000/kg) scandium oxide be available. The potential growth forecast below is a 6 fold increase in the scandium market from 2018 to 2025.

### Projected Scandium Market Value at \$2,000/kg Sc<sub>2</sub>O<sub>3</sub>



Source: Kaiser Research

Scandium International Mining Corp. (TSX: SCY) is a junior scandium developer. The Company has a 100% interest in the advanced stage Nyngan Scandium Project, located in New South Wales, Australia. Completing a DFS for the Project in May 2016 they are now focused on advancing the Nyngan Scandium Project to construction, with the goal of being the first company to achieve production from a primary scandium mine.

### The 2016 DFS for the Nyngan Scandium Project

Looking at the DFS results below a key is that the unit cash cost is just US\$557/kg Sc oxide. This means the project is very economic (after tax NPV8% is US\$225 million) at US\$2,000/kg Sc oxide. Also at this price the scandium market can grow strongly if new supply becomes available.

## Nyngan Scandium Project - Feasibility Study Financial Highlights

Summary Nyngan Scandium Project Key Project Parameters	NI 43-101 DFS Result
Capital Cost Estimate (US\$ M)	\$87.1
Average Plant Feed Grade (ppm Sc)	409
Resource Processed (tpy)	71,820
Mill Recovery (%)	83.7%
Oxide Production (kg per year)	37,690
Scandium Oxide (Scandia) Product Grade	98-99.9%
Annual Cash Operating Cost (US\$ M)	\$21.0
Unit Cash Cost (US\$/kg Oxide)	\$557
Oxide Price Assumption (US\$/kg)	\$2,000
Annual Revenue (US\$ millions)	\$75.4
Annual EBITDA (US\$ millions)	\$49.5
NPV (10%i) (After Tax)	\$177.5
NPV (8%i) (After Tax)	\$225.4
IRR (%) (After Tax)	33.1%
Payback (years)	3.3

The Nyngan operation is forecast to produce around 40 tonnes of scandium oxide per annum. Some may say this would flood the market, but the reality is the market can absorb a lot more scandium if prices were lower (US\$2,000/kg Sc oxide).

The Company has completed all required governmental approvals required for construction. The Company also owns a 100% interest in the Honeybugle Scandium property, an exploration property adjacent to the Nyngan Scandium Project.

The absence of a reasonably priced and reliable source of scandium has limited commercial uptake of scandium. Despite this low level of use, scandium offers significant benefits. Both the aircraft and automotive industries discovered in the 1970's that if they alloyed aluminium with scandium it could produce a stronger, more corrosion resistant material. The bonus was the alloy was strong enough to be welded rather than riveted, resulting in lighter, more fuel-efficient crafts that

are cheaper to produce and run.

At current prices scandium remains too expensive for anything more than use in the aerospace industry or sports equipment; however, with increased production comes reduced prices. With Scandium International's projected annual production alongside other Australian projects like Clean TeQ's Sunrise Project we could see scandium become mainstream in the very near future.

Scandium International Mining Corp. will be attending the 2020 PDAC Convention March 1-4, 2020 at the Metro Toronto Convention Centre, Toronto, Canada. Note that InvestorIntel will be one of the PDAC media sponsors.

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## **Pay attention to the media flag on a play for the rare earths market field**

"Is Teenage Head still around?" I asked the doorman incredulously on Saturday evening, as I entered the Rockpile to see a tribute band for The Who that a family member had insisted I attend last night. "Teenage Head?" she started, "are you kidding – we have the Killer Dwarfs returning next month!" she finished enthusiastically. How can early eighties bands survive and just stay the same when so much of the rest of our lives is so very different, I wondered.

Having invested part of my Saturday looking at family photos from the late seventies, early eighties, I was considering how news stories in the seventies arrived only three ways: telephone, mail and the newspaper. Siphoned through media sieves, public perception was easily manipulated – we believed

the news. Today, with endless data outlets and media streams than ever imagined, at moments I feel as if I know less, and trust nothing.

So yesterday, when I examined our Top 10 columns in our Trending section (listed below), I paused as this is a highly unusual week and am calling a flag on a play for the rare earths market field! **With 7 out of the 10 columns that are presently most read on InvestorIntel.com being about rare earths this is indeed a rare readership trend indeed.** So I text messaged an associate in the industry in NYC this morning who is also following this trend – and he text messaged me back an interview with a CNN story on Hong Kong enters 11<sup>th</sup> consecutive weekend, a piece on how rare earths are China's nuclear option in trade war with U.S. and a headline story on how Beijing warns US 'will bear all consequences' after \$8billion jet deal. In doing my own search, I see that the only non-Chinese producing rare earths public company Lynas is headlining with its own issues with Hundreds of protesters gather to slam Malaysia's decision on Lynas.

My point? The news feed flow suggests we have another rare earths and critical materials bubble preparing to start. This said, with gold +\$1500, I do not see this translating to the exploration market (yet), is there any reason to believe we are going to see any immediate action in the rare earths market? My answer is – it seems likely.

Let's consider this angle. In my experience investors that play the market need an ability to invest on what's happening geopolitically, and with few rare earths' companies in existence outside of China this should be a bonanza for any shareholder lucky enough to have picked one of the rising stars. And yes, I will publish a list for you of who the front runners are, as there are simply not many to pick from, but let's start by reviewing what the InvestorIntel was reading over the last week -- as its going to be an exciting week it

seems from our Trending indicators.

1. #TrendingNow #1 on @Investor\_Intel – Read: The U.S. #rareearths saga continues... [bit.ly/2XV72wR](http://bit.ly/2XV72wR)
2. #TrendingNow #2 on @Investor\_Intel – Read: #Trump amends #Defense Production Act for #RareEarths [bit.ly/2Z64ete](http://bit.ly/2Z64ete) #DoD #POTUS #Rareearths #DOD
3. #TrendingNow #3 on @Investor\_Intel – Read: Scandium International soars 41.67% last week on positive news from its Nyngan Scandium Project <http://bit.ly/2Yb27YF>
4. #TrendingNow #4 on @Investor\_Intel – Read: The #cobalt market prepares for another ride <http://bit.ly/2MjpNUu> #battery #ElectricVehicle #EV
5. #TrendingNow #5 on @Investor\_Intel – Read: #Avalon on #rareearths and #criticalmaterials in North America <http://bit.ly/2y9X8Ih> @AvalonAdvanced \$AVL \$AVLNF
6. #TrendingNow #6 on @Investor\_Intel – Watch: Don Bubar on the renewed concern about the security of supply of #rareearths in the global markets [https://youtu.be/0\\_XkB-H020g](https://youtu.be/0_XkB-H020g) @AvalonAdvanced \$AVL \$AVLNF
7. #TrendingNow #7 #AlkaneResources' disruptive technology to reduce metallization costs by +50% <https://youtu.be/1cZPdQCA0vY> #RareEarths #zirconium #hafnium #neodymium #praseodymium @AlkaneResources \$ALK.A \$ANLKY
8. #TrendingNow #8 on @Investor\_Intel – Read: The Pikhuutau Agreement marks a key milestone for Critical Elements Lithium <http://bit.ly/2Z610G7> cc: @investor\_Intel #rareearths
9. #TrendingNow #9 on @Investor\_Intel – Watch: Vance White on the next boom in the commodity cycle <http://bit.ly/20gTBCV> cc: @investor\_Intel #gold
10. #TrendingNow #10 on @Investor\_Intel – Watch: If you want to find out what is REAL in the #graphene market versus all of the 'hype' as @TracyWeslosky interviews Dr. Ian Flint on the 'real' graphene market <https://youtu.be/zfQ74JM-iYI>

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# **Scandium International's CEO on the impact of the US-China trade war on the global supply of scandium**

“Depending on what happens in trade talks between the United States and China there could be some disruption of Chinese sources of scandium and I think that is going to be a good thing for Scandium International. It is going to highlight the fact that we are earliest possible producer outside of China, in the Australian clay belt. We are of a good size and of commercial scale to offer scandium to the waiting global markets outside of the disruptions what are apparently going to be caused by this trade dispute...” States George Putnam, President, CEO, and Director of Scandium International Mining Corp. (TSX: SCY), in an interview with InvestorIntel’s Tracy Weslosky.

George went on to discuss Scandium International’s mine lease for its Nyngan Scandium Project. He said that the company is in discussions with the New South Wales’ Department of Planning and Environment and expects that the mine lease will be reissued soon. George also provided an update on the LOIs with customers. He said that Scandium International is expecting full technical success with two of its LOI partners and are working to add more potential customers in the form of LOIs this year.

To access the complete interview, [click here](#)

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