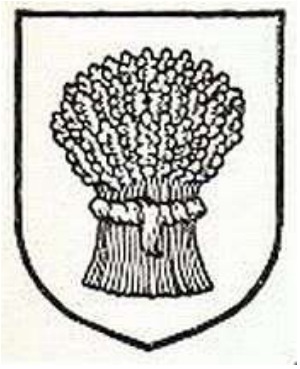
Monday, December 4, 2023



HALLGARTEN + COMPANY

Initiation of Coverage

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Imperial Mining

(TSX-v: IPG, OTCQB: IMPNF)

Strategy: LONG

Key Metrics	
Price (CAD)	$0.09
12-Month Target Price (CAD)	$0.24
Upside to Target	167%
12mth high-low	$0.045 to $0.115
Market Cap CAD mn)	$18.54
Shares Outstanding (mns)	206.0
Fully diluted	258.0

Imperial Mining

Lightweighting Drives Development

- ➕ Scandium (Sc) has made the leap from the realm of the unlikely to the realm of the very doable with one stroke, as Rio Tinto weighed into the sub-space two years ago
- ➕ The Crater Lake project has had a long-fuse, starting out as a Rare Earth deposit over 12 years ago, it has gradually come to be seen as one of the largest doable Sc projects in North America
- ➕ PEA outcome was an after-tax NPV (10%) of $1.72bn and an after-tax IRR of 32.8%
- ➕ The expected LoM in the PEA is 25 years, but recent increase in Mineral Resource Estimate (Sept 2023) could underpin a 40-year mine life
- ➕ Perversely, rethinking the project without pandering to the REE component potentially lowers the CapEx and boosts the IRR
- ➕ Scandium is on most critical minerals lists, but mainly as an afterthought, though uptake by the aerospace industry will make necessitate a break away from Chinese/Russian sourcing
- ✘ Access is a major issue, as the project is isolated with no road connection and located in territory with harsh winters that will necessitate mining year-round and a winter road to ship material only during the winter
- ✘ Scandium in some minds is still something we can do without
- ✘ The effect on the price of Sc of RIO TINTO, and new entrants like Imperial, is a total mystery depending on the level of as yet, uncreated demand from end-users
- ✘ The environment financing is tough with investors being willing to fund only projects with a realistic perspective of production

From Obscure to Critical

When we first started covering Scandium it could not have been seriously termed “critical” even by its boosters as its main usages in solid oxide fuel cells (SOFC) or stadium-lighting was neither going to save the world nor stop (or win) a war. In one fell swoop, an action taken by RIO TINTO moved the metal from Never-Never Land into the realms of the possible and the sought-after.

The number of players/wannabes in the Scandium space may be numbered (just) on more than the fingers of one hand, but they are still mainly concentrated in Australia (all in NSW) or in Canada. The US claimant to have Scandium potential we roundly reject. The producer in Canada is Rio Tinto, while the developer is Imperial Mining. The latter is a Canadian mineral exploration & development company focused on the advancement of its Crater Lake project (see map on following page) in northern Québec.

In this initiation of coverage, we shall look at the Crater Lake project, its progress and next steps, its economics, the other players and the curious dynamics of Scandium.

Crater Lake

The Crater Lake project, owned 100% by Imperial Mining, is located 200 km northeast of Schefferville, Québec. The property consists of 96 contiguous claims covering 47 km^2.

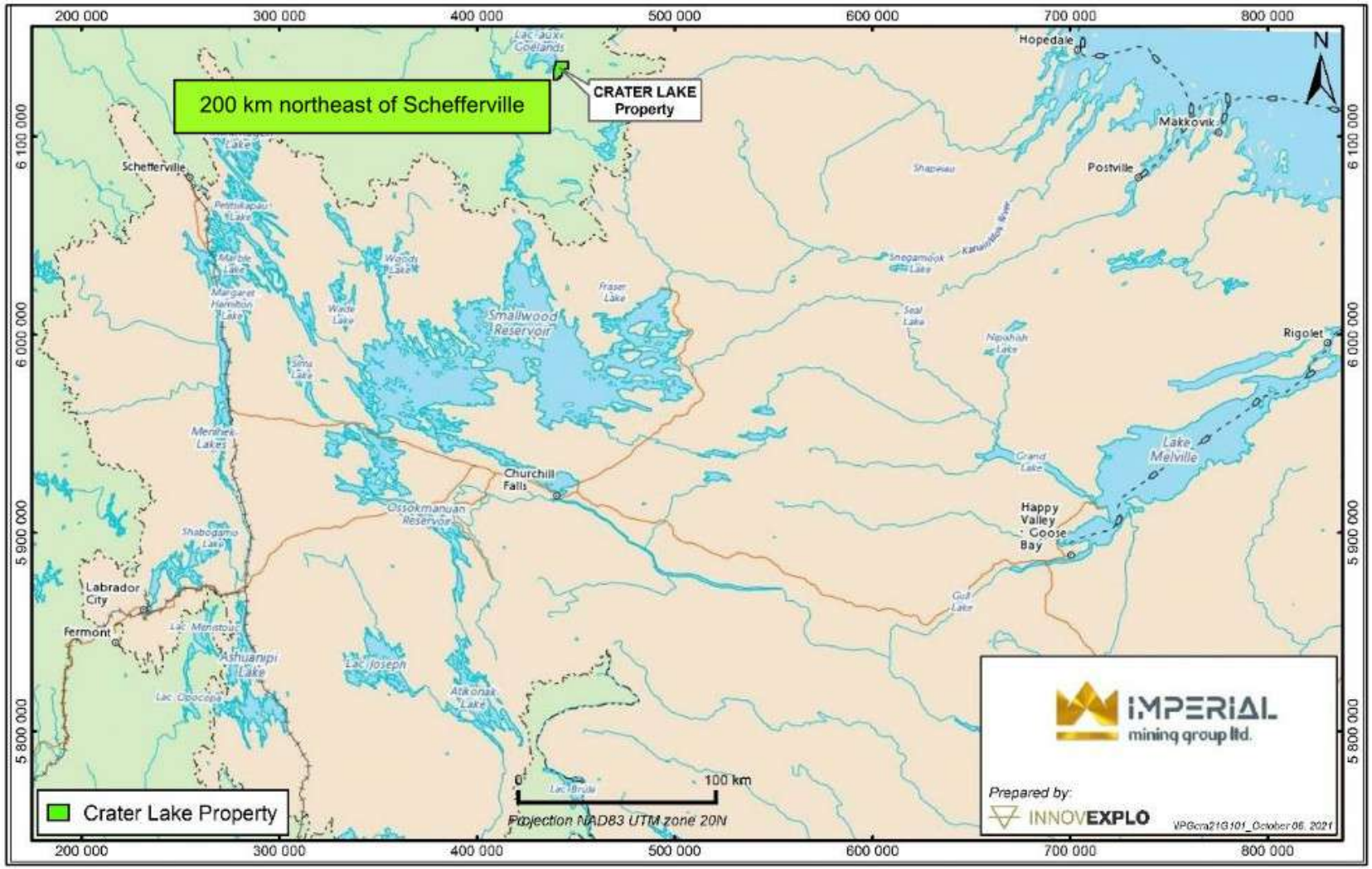
The project is currently accessible via fixed-wing aircraft or helicopter.

History

Our first encounter with this asset came during the "first" Rare Earths boom of 2009-2011. At the time the asset was a prime target of Quest Rare Minerals (TSX-v: QRM).

In 2007, as part of a regional evaluation program, one sample collected in the area that is now the Crater Lake project returned high concentrations of iron oxide and REE. This information was inherited by Quest and lead to the *Discovery Outcrop* in 2009. Since 2009, various geochemical and geophysical programs were conducted followed by numerous prospecting, mapping, and diamond drilling programs.

As is well-known the Rare Earth boom came to grief in 2012 when the Chinese sabotaged the REE prices, and a drastic cull of the surviving players began. Quest soldiered on and in 2014, its exploration efforts intersected a 225m long Scandium- and REE-bearing zone and thus a pivot towards Sc being the main target metal began.

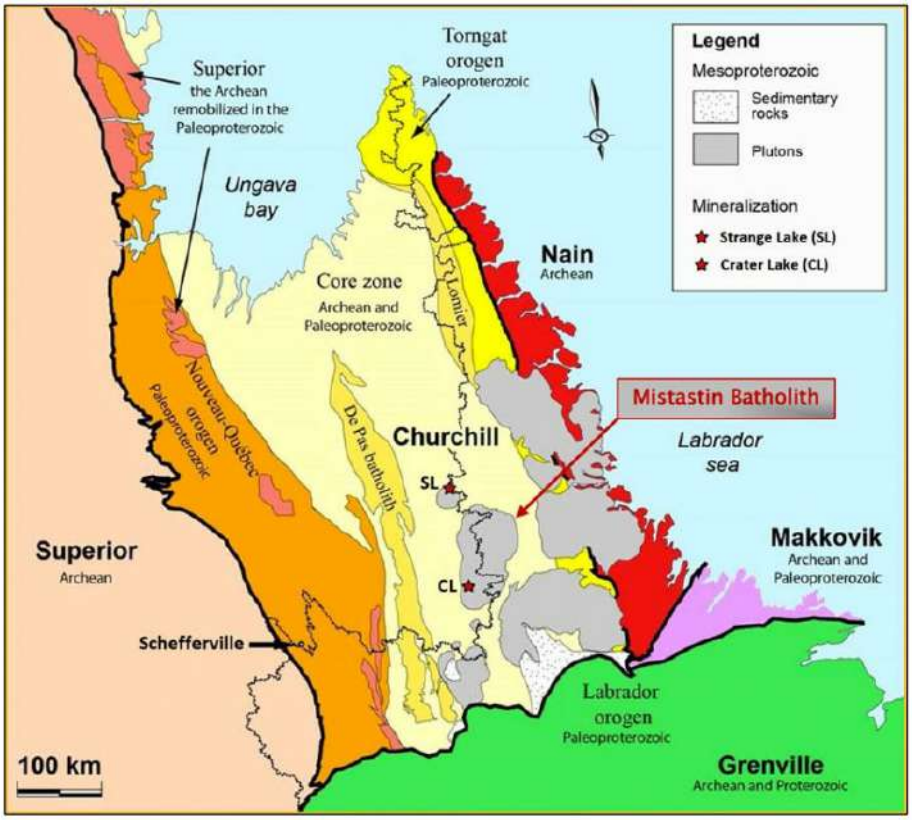

200 km northeast of Schefferville
CRATER LAKE Property
Schefferville
Hopedale
Makkovik
Postville
Rigolet
Churchill Falls
Happy Valley Goose Bay
Lake Melville
Smallwood Reservoir
Ossokmanuan Reservoir
Labrador City
Fermont
Crater Lake Property
0
100 km
Projection NAD83 UTM zone 20N
IMPERIAL mining group ltd.
Prepared by:
INNOVEXPLO
VPGcra21G101_October 06, 2021
N
200 000
300 000
400 000
500 000
600 000
700 000
800 000
6 100 000
6 000 000
5 900 000
5 800 000

Eventually QRM too became financially troubled and the asset passed into the hands of an entity called Peak Mining Corporation (PMC), an arm's-length private mining exploration company.

In mid-2017, via a very complicated transaction, Imperial Mining was born out of NQ Exploration (TSX-v:NQE) as a spin out (SpinCo) containing NQ's Quebec-based resource properties. Then the Crater Lake property was acquired by the new public company (New NQ). New NQ became Imperial Mining.

Simultaneously, NQ Exploration had a Colombian-based private coal mining exploration company folded into in via an RTO.

In late December 2017, Imperial completed the acquisition of a 100% interest in the Crater Lake claim block from Peak Mining in consideration of 7,500,000 Imperial shares at a deemed price of $0.16 per share. Imperial assumed from Peak Mining, their rights and obligations under Quest's royalty agreement. Ergo, Imperial acquired Crater Lake in 2017. Quest filed for bankruptcy in 2018.



Source: Hammouche et. al. (2012)

Regional Geology

The property lies in the Churchill Province in the southwestern region of the Mistastin Batholith, which covers an area of approximately 5,000 km^2. The dominant lithologies are granite and pyroxene-bearing quartz monzonite. It is cut by younger biotite hornblende granite, which is in turn cut by a 6 km

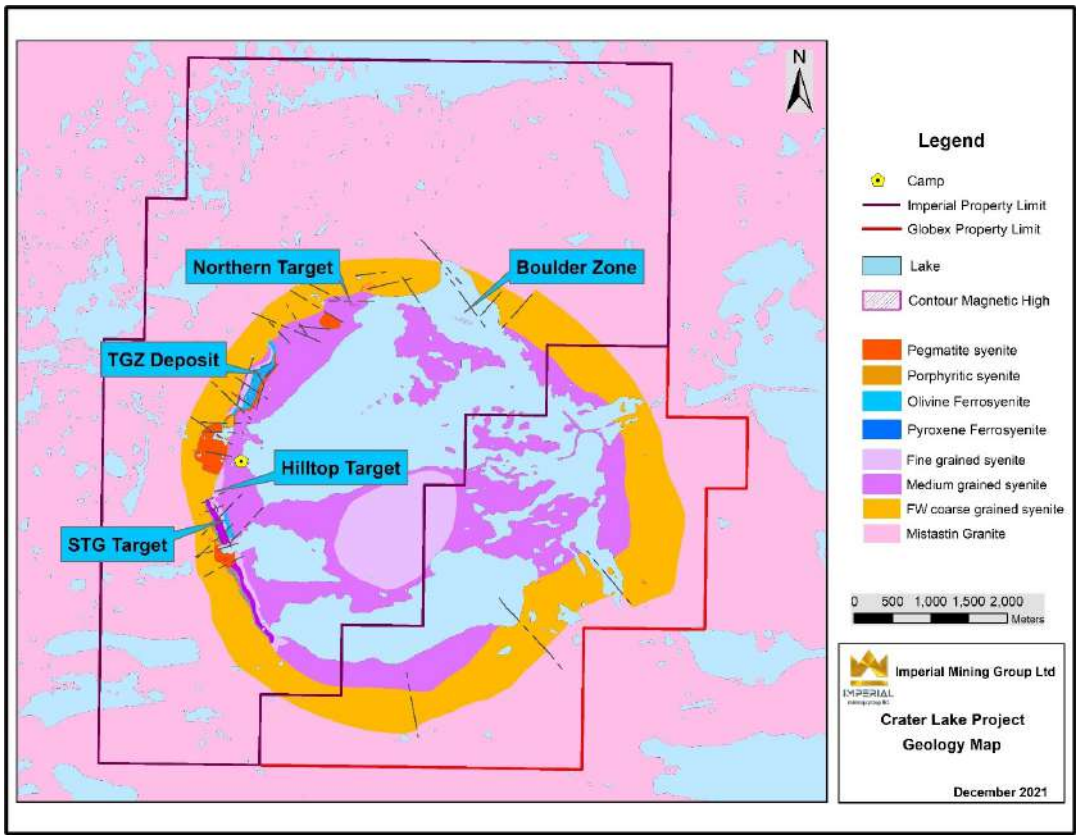
diameter olivine quartz syenite, the Crater Lake Intrusive Complex. The dominant exposed lithology is a massive syenite, which contains 1% to 10% of interstitial ferromagnesian minerals.

A melanocratic unit, ferrosyenite to alkali pyroxenite, contains more than 50% ferromagnesian minerals, including cumulate fayalite, hedenbergite and ferropargasite, occurs as discontinuous layers, sills and amoeboid-like inclusions or dikes.

The unit appears to correspond to several concentric magnetic high features observed at the periphery of the Complex related to a caldera collapse ring-dyke structure.

Project Geology

The target zones, up until now, have been on the northern and western sides of Crater Lake as shown in the map on the following page. The initial target for production is the TG Zone, where the mineralization is characterized by the strong continuity of the iron-rich syenitic intrusive (Ferrosyenite) sill and dyke system and was drilled over a strike length of 300 m, to a vertical depth of 200 m.



Intersection lengths through the zone varied between 10 m and 145 m, representing a true thickness of up to 100 m. There was an observed general increase in resource grade and true thickness to mineralization at depth below the pit-shell and towards the north.

Exploration

As mentioned earlier, in 2007, as part of a regional evaluation program, one sample collected in the area that is now the Crater Lake project returned high concentrations of iron oxide and REE. This data was inherited by Quest and lead to its so-called *Discovery Outcrop* in 2009. Since 2009, various geochemical and geophysical programs were conducted followed by numerous prospecting, mapping, and diamond drilling programs.

In 2014, QRM intersected a 225 m long Scandium (Sc) and REE-bearing zone within a thick ferrosyenite layer at the Boulder Zone with a 27.6 m interval grading 351 g/t Sc_2O_3 and 1.72% REE. Review of the drilling data also returned a 19 m long interval grading 506 g/t Sc_2O_3 along the western side of the Crater Lake intrusion.

In addition, numerous Scandium-Rare-Earth resource opportunities remain to be drill-defined on the property and will be evaluated in future exploration programs.

Since the acquisition of Crater Lake in 2017, Imperial has performed the following exploration programs.

- In 2018: Geophysical modelling provided a better understanding of the 3D geometry of the Crater Lake intrusive complex and the vertical and lateral extent of the known areas of Scandium mineralization on the property. Detailed prospecting and geological mapping over three highly prospective Scandium targets (the TGZ, STG and North Target areas). The prospecting and mapping program was followed by mechanical stripping and channel sampling. Scandium-rich outcrops and boulders in the vicinity of the TGZ and STG targets confirmed that both zones correspond to a similar Scandium-rich target discovered in 2014 at the Boulder Scandium Zone. A total of 39 grab samples and 41 channel samples were collected. An additional 24 historical core samples were selected for a mineralogical study to be completed at McGill University in Montreal
- In 2019: A drilling program of five holes totaling 1,014 m was completed on the TGZ target to evaluate the Scandium potential of a high-intensity magnetic anomaly. Drilling took place 600 m north of a historical drill hole that had returned Scandium grades of up to 506 g/t Sc_2O_3 over 19 m along the western side of the Crater Lake intrusion along the same magnetic trend. The program intercepted wide intervals of Scandium and TREO+Y mineralization at the TGZ target. Highlights being:
    - CL19035 intersecting 314 g/t Sc_2O_3 and 0.371% TREO+Y over 95.5 m
    - CL19032 intersecting 341 g/t Sc_2O_3 and 0.421% TREO+Y over 47.9 m
- In 2020: A detailed ground magnetic survey was completed on the western half of the Property. The survey covered 130 line-km at a line spacing of 50 m. The survey better defined the Scandium-bearing ferro-syenite rock units and fault structures controlling the concentration of Scandium mineralization on the Property. Several new magnetic bodies were identified to the

east and south of the STG target. A prospecting and mapping program was conducted over 38.2 km of unexplored terrain on the property. Some eight grab samples, 304 historical core samples and 17 new channel samples were selected for a detailed mineralogical and geochemical study at McGill University in Montreal, Quebec. Furthermore, strongly magnetic, boulders of ferro-syenite were found in the Hilltop target area and 300 m northeast of the STG target.

- A drilling program totalling 676 m in four holes was completed to test the Scandium potential of high-intensity magnetic anomalies in the STG, TGZ and Northern target areas. CL20037 confirmed the lateral continuity of the TGZ target by intersecting intervals grading up to 253 g/t Sc_2O_3 over 29.14 m. CL20038 intersected multiple, narrow Scandium-bearing ferrosyenite intervals grading up to 244 g/t Sc2O3 and 0.71% TREO+Y over 2.6 m and 192 g/t Sc2O3 and 0.50% TREO+Y over 3.6 m.

- In 2020-2021: A 14-hole drilling program totalling 2,049 m was completed on the TGZ target. The mineralization has been traced by drilling over 300 m in total strike length down to a vertical depth of up to 200 m. Highlights were:

    - CL21048 intersecting 298 g/t Sc2O3 and 0.355% TREO+Y over 111.93 m

    - CL21052 intersecting 299 g/t Sc2O3 and 0.342% TREO+Y over 99.8 m.

- In 2021: A total of 23 channel samples representing a cumulative length of 23.4 m were collected at the STG Target olivine ferrosyenite, located 2 km south of the TGZ Target. A two-hole drilling program for 345 m was undertaken to undercut channel sampling and geophysical results over the STG Target. In terms of drill results, most notable was:

    - Hole CL21054 intersected 252 g/t Sc_2O_3 and 0.366% TREO+Y over 115.8 m.

The company's summer exploration drilling in 2023 was intended to convert the Inferred Mineral Resources from the TG North Lobe deposit reported in September 2021 to Indicated and, potentially, Measured Mineral Resources. Work on the TG Southern Lobe, where drilling in 2019 returned 113.9 m grading 310 g/t Sc_2O_3, is also planned with the prospect of linking the North and South Lobes of the deposit.

Resource Estimate

In mid-September of 2023, Imperial announced an updated Mineral Resource Estimate (MRE) with Indicated Resources of 11.8mn tonnes grading 275.9 g/t Sc_2O_3, and Inferred Resources of 15.9mn tonnes grading 268.4 g/t Sc_2O_3 for the Northern Lobe of the TG Scandium Zone.

This outcome represented a 58% increase in total Sc tonnage for the Indicated Resources category and a 22% increase in total Scandium tonnage for the Inferred Resources category.

Determinations of magnet REOs (Nd, Pr, Dy, Tb) were made for both resource categories.

Crater Lake - Resource Estimate

Category	Cut-off NSR ($/t)	Tonnage mn tonnes	NSR total ($/t)	Sc2O3 (g/t)	Dy2O3 (g/t)	La2O3 (g/t)	Nd2O3 (g/t)	Pr2O3 (g/t)	Tb4O7 (g/t)
Indicated	110.1	11.8	426	275.9	66.4	605.5	596.9	160.1	11.7
Inferred	110.1	15.9	414	268.4	66.1	606.9	595.6	159.8	11.6

The MRE was prepared by Marina Lund, P.Geo. (Resource Geologist, InnovExplo), Paul Daigle, P.Geo. (Associate Resource Geologist, InnovExplo) and Carl Pelletier, P.Geo. (Resource Geologist, InnovExplo).

The MRE encompasses three mineralized zones, across a resource area with a NE-SW strike length of 500 m, a width of 120 m, and a vertical extent of 250 m below the surface. The MRE is pit-constrained, with a bedrock slope angle of 45° and an overburden slope angle of 30°.

The estimate employed an NSR cut-off value of CAD$110.11 per tonne for potential open pit extraction method. The value of the mineralization was determined to range between CAD$414-$426 per tonne.

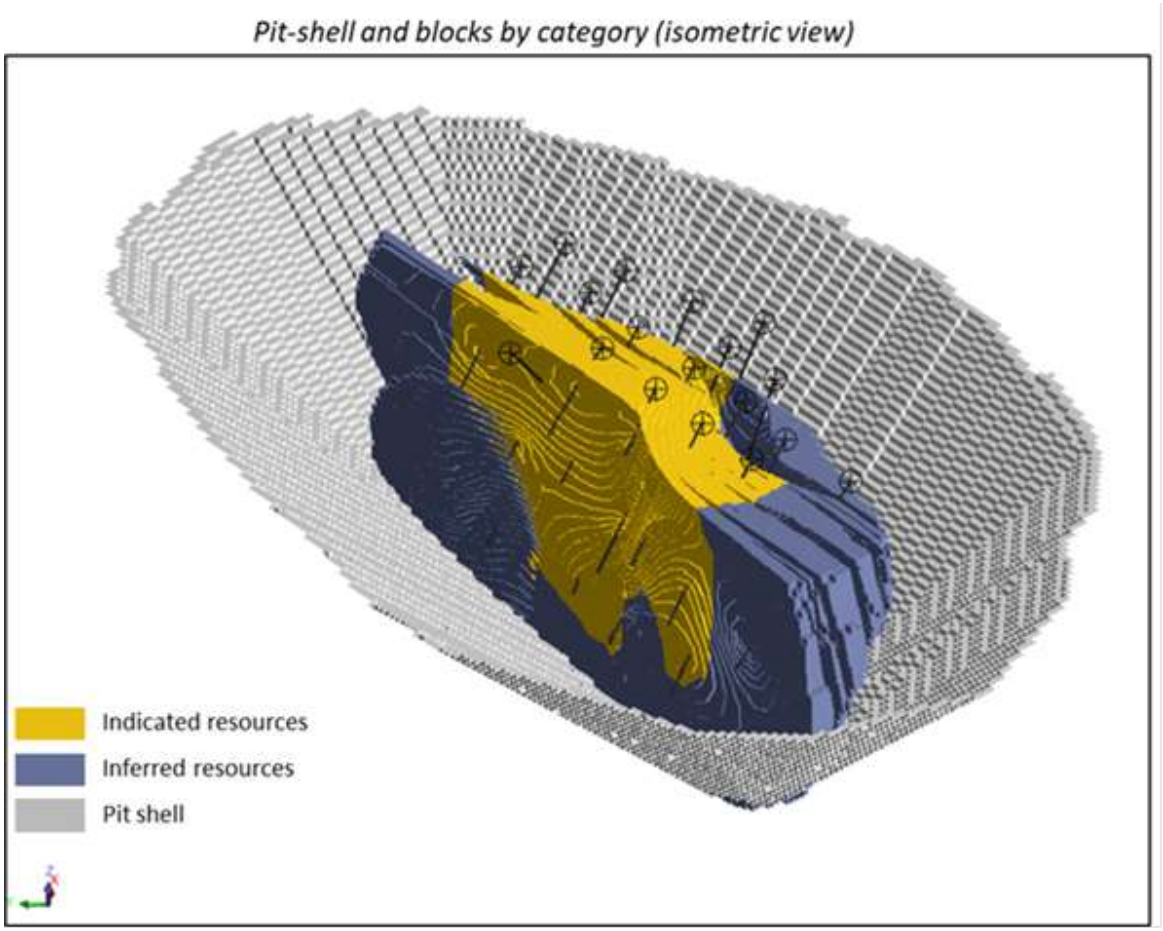
Mineralization remains open laterally and at depth, demonstrating the potential to increase the mineral resource with additional drilling.

The mineral resource estimate underwent a revision, incorporating data from the most recent drilling program conducted in 2023. This program consisted of seven drillholes with a cumulative depth of 1,588 meters and was conducted within the Northern Lobe of the TG Scandium-Rare-Earth mineralized Zone. Notably, resource estimation efforts have been concentrated exclusively on the Northern Lobe of the TG Zone, which constitutes approximately half of the magnetic anomaly. Although drilling activity in the Southern Lobe has been relatively limited, the available data from these operations has yielded intercepts that are consistent with those observed in the Northern Lobe.

The resource estimation was undertaken using the diamond drillhole data completed over the Northern Lobe of the TG Scandium-Rare-Earth mineralized Zone.

Mineralization is related to an iron-rich syenitic intrusive (Ferrosyenite) sill and dyke system and was drilled over a strike length of 300 m, to a vertical depth of 200 m. Intersection lengths through the zone varied between 10.7 m and 111.9 m, representing a true thickness of up to 100 m. There was an observed general increase in resource grade and true thickness to mineralization at depth below the pit-shell and towards the north.

The definition drilling was completed over the northern half (Northern Lobe) of the magnetic target that defines the TG Zone. Drilling on a single section (100N) on the south half of the TG target (Southern Lobe) returned 113.9 m grading 310 g/t Sc2O3 at a vertical depth of 90 m and is open to resource expansion in all directions.



The PEA

In mid-June of 2022, the company published the findings of a Preliminary Economic Assessment (PEA) showing positive cash-flow, a strong Internal Rate of Return (IRR) and Net Present Value (NPV) metrics at discount rates of up to 15% for the envisaged potential mining operation.

The PEA study was prepared by the Montreal-based consultants, WSP. It was based on the original Mineral Resource Estimate undertaken by InnovExplo of Val d'Or, Quebec.

The PEA study focused on the TG North Lobe and the projected mining and processing costs to produce Sc2O3, ScAl Master alloy and REE hydroxide concentrate.

Other inputs to the study included prices and market segments based on estimates from market studies by Ernst & Young for Scandium and by Roskill for REE.

The key outcomes were:

- Gross metal revenue of the minerals produced from the operation totaling $15.2bn over the life of the operation

- Gross earnings after-tax at $6.25bn
- Pre-tax net present value (NPV) of $2.97bn and an after-tax NPV of $1.72bn @10% discount rate
- Pre-tax internal rate of return (IRR) of 42.9% and an after-tax IRR of 32.8%
- Net revenues average $608mn per annum from the sale of high-purity Scandium oxide (Sc_2O_3), Scandium-aluminum Master alloy (ScAl) and REE hydroxide concentrate
- Pre-tax capital payback is 2.5 years from the start of production
- Total mined metal production over a minimum 25-year mining life based on the present resource base is expected to be 110 tonnes of Sc_2O_3, 57,298 tonnes of ScAl Master alloy and 23,578 tonnes of REE hydroxide concentrate

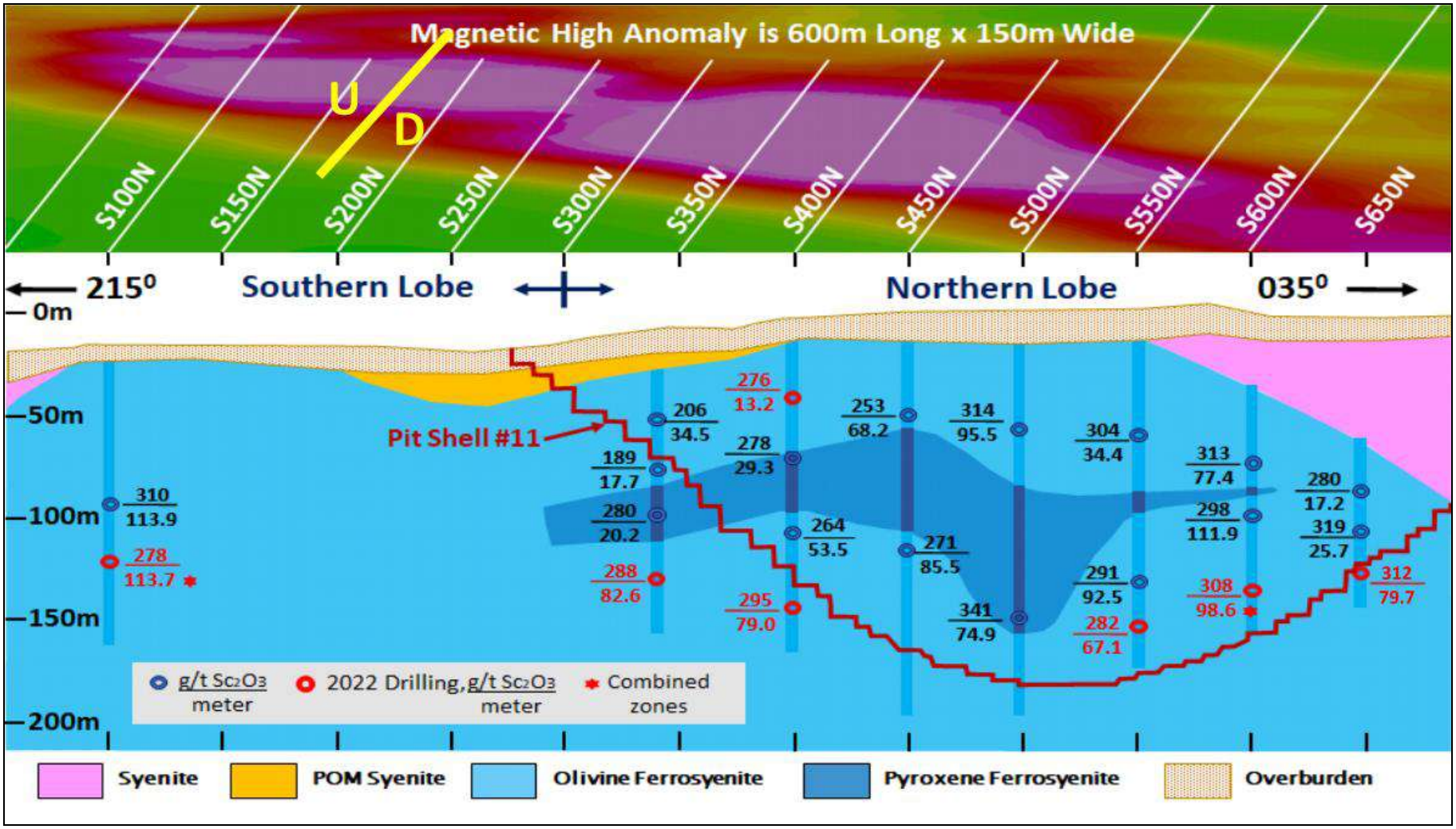
Pricing in the Model

The WSP study utilized a Scandium price deemed conservative (i.e. below the 2021 USGS trailing five-year average price). While accepted consensus was that REE prices increased significantly since September 2021 they have also retreated in recent times. Thus, the consultants' decision to discount REEs by 70% for the purposes of the study was a sound one. The REE material will be delivered to a processor on a tolling basis for, interestingly, the magnet rare earths only. The commodity prices employed for this study were as shown below:

Metal Oxides / Alloy	**Price US$/kg**	**Basis**
Scandium Oxide (Sc2O3)	$1500	USGS 5-year trailing average discounted by 61%
Al-2% Sc Master Alloy	$204	USGS 5-year trailing average discounted by 40%
Dysprosium Oxide (Dy2O3)	$128.40	March 2022, Spot Prices, discounted by 70%
Lanthanum Oxide (La2O3)	$1.50	March 2022, Spot Prices, discounted by 70%
Neodymium Oxide (Nd2O3)	$49.20	March 2022, Spot Prices, discounted by 70%
Praseodymium Oxide (Pr2O3)	$49.20	March 2022, Spot Prices, discounted by 70%
Terbium Oxide (Tb4O7)	$584.40	March 2022, Spot Prices, discounted by 70%

As far as REEs are concerned the study considered that the total tonnes of concentrate produced of Neodymium (Nd), Praseodymium (Pr), Dysprosium (Dy) and Terbium (Tb) were marketable and would contribute to revenues in the financial model, as an offset to Scandium (Sc) operating expenses.

The model assumes REE sales as a mixed bulk hydroxide product.


Magnetic High Anomaly is 600m Long x 150m Wide
U
D
S100N
S150N
S200N
S250N
S300N
S350N
S400N
S450N
S500N
S550N
S600N
S650N
215⁰
Southern Lobe
Northern Lobe
035⁰
0m
50m
100m
150m
200m
Pit Shell #11
310 / 113.9
278 / 113.7
206 / 34.5
189 / 17.7
280 / 20.2
288 / 82.6
276 / 13.2
278 / 29.3
264 / 53.5
295 / 79.0
253 / 68.2
271 / 85.5
314 / 95.5
341 / 74.9
304 / 34.4
291 / 92.5
282 / 67.1
313 / 77.4
298 / 111.9
308 / 98.6
280 / 17.2
319 / 25.7
312 / 79.7
g/t Sc2O3 / meter
2022 Drilling, g/t Sc2O3 / meter
Combined zones
Syenite
POM Syenite
Olivine Ferrosyenite
Pyroxene Ferrosyenite
Overburden

Proposed Mining Operation

WSP applied a conventional Truck & Shovel open-pit mining operation model to the TG North Lobe Deposit at a production rate of 2,350 tonnes per day during a six-month per year operation period using the $110.80 NSR cut-off presented in the MRE of September 2021.

The mine operation infrastructure, storage and tailings facilities would be developed at Crater Lake. The open-pit mine, crushing, milling, kilning and magnetic concentration plants would be built on-site, with mineral concentrate transported during winter months to a storage in Emeril, NL by road to the twelve months operational metallurgical and alloys plants to be located in Sept-Iles, Quebec by rail.

Existing road infrastructure will be accessed from the Crater Lake mine area via winter road for the initial years of production as a means to reduce project CapEx. Imperial has future plans to establish a permanent road that would be financed from operating revenues.

Project Optimization Opportunities

These PEA results have demonstrated the economic viability of the project and the project's capability in achieving high Scandium and REE recoveries. However, there are still several process improvement opportunities and infrastructure development options that should benefit the project.

Future project optimization programs and trade-off studies that are expected to yield further reduction in CAPEX and/or OPEX include:

- Completion of the ongoing SGS hydrometallurgical program. The objective of this work is to improve the Scandium recovery, lower mine operating costs and reduce the carbon footprint of Imperial's metallurgical process.
- Further investigation of magnetic separation as a pre-concentration step in mineral processing to reduce ore milling cost.
- Development of the Al-2%Sc Master Alloy technology
- Economic trade-off study focused on mineral concentrate transportation from the mine site to the processing plant at Sept Iles evaluating simplification of the design of concentrate storage, loading and unloading using silos
- Converting winter road access to the property from the existing road infrastructure to a permanent road to be financed from the operation revenues
- Source electrical power from renewable sources at the mine site (wind, solar, in-river hydro power) to reduce energy costs and carbon emissions

The exploration team feels that there are numerous Scandium-Rare-Earth resource opportunities still remaining to be drill-defined on the property and these will be evaluated in future exploration

programs.

It is reported at a Net Smelter Return (NSR) cut-off of CAD$110.80/t. This cut-off was calculated using the following parameters:

- processing cost = CAD$14.89/t
- transportation cost (concentrate transportation from mine site to processing plant): CAD$17.01/t of ore milled
- G&A = CAD$7.19/t
- refining and selling costs = CAD$ 88.71/t

A USD:CAD exchange rate of 1.25 was applied.

- Scandium recovery to high-grade Scandium oxide product = 76%
- REE recovery to mixed REE carbonate = 63%

These cut-off grades will need to recalibrated considering future prevailing market conditions (metal prices, exchange rates, mining costs etc.).

CapEx

At the right can be seen the latest CapEx projections. They are quite sizeable.

Transport Infrastructure

Now for the bad news. There is no developed infrastructure in or around the project. The nearest development infrastructure is in the town of Schefferville (the nearest railhead) and the seaport of Nain (some 200 km east of the property). The latter is a coastal community that also

Crater Lake - CapEx

	CAD$ mns	($/t milled)
Direct Costs		
Mine Equipment, Crater Lake	$13.7	$1.29
Mill Plant Construction, Crater Lake	$63.7	$6.02
Hydrometallurgical Facility Construction, Sept-Iles	$160.1	$15.13
Electrical Distribution, At Both Crater Lake and Sept-Îles Sites	$14.1	$1.33
Infrastructure, At Both Crater Lake and Sept-Îles Sites	$113.5	$10.73
Tailings Storage Facilities including Water Management, At Both Crater Lake and Sept-Îles Sites	$69.3	$6.55
Initial Winter Road plus Orma Lake Road Rehabilitation	$46.6	$4.40
Between Sites Concentrate Handling Infrastructure	$27.5	$2.60
Crater Lake Camp (200 Person Capacity)	$26.5	$2.50
Pre-Production Mining Licenses	$0.2	$0.02
Pre-Production Mine and Mill Expenses to Capital	$67.9	$6.42
Subtotal Direct Costs	**$602.9**	**$57.00**
Owner's Costs	$6.8	$0.64
Indirect Costs (19% of Directs) *	$102.0	$9.64
Contingency (25% of Directs and Indirects) *	$159.2	$15.05
Total Capital Cost (All In, Taxes Extra)	**$870.1**	**$82.33**

serves as the local supply and service centre for Voisey's Bay mine. Nain has no road access, but it is serviced by regular, year-round flights from Happy Valley–Goose Bay and by coastal freighters during the summer months.

Schefferville, 200 km southwest of the projects, has access to the seaport of Sept-Îles on the Bay of St. Lawrence. Shefferville and the neighbouring communities of Matimekush (pop. 850) and Naskapi (pop. 900) act as local service and supply centers for several iron mines and hydro-electric dams in the area. They are serviced year-round by passenger and freight train service and have regularly scheduled flights to Quebec City and Sept-Îles, QC, and Wabush, NL.

As mentioned earlier, ideally the company shall construct a road at some future date out of cashflows generated.

Power & Water

There is no source of electricity on or near the Crater Lake project therefore power must be generated on-site. The nearest sources of electricity are in Schefferville, supplied by the hydro-electric generating stations of Menehek (200 km southwest) and Churchill Falls (210 km south).

Water sources, at least, are abundant on and adjacent to the project.

Logistics

The isolation of the project is a prompt for some imaginative logistical solutions. Necessity is the mother of invention and, to this end, concentrate produced during the summer will be stored in a dome at Crater Lake until winter. Concentrate will be hauled in bulk carrier trucks 152km over a single lane width winter road from Crater Lake to the end of the Orma Lake Road, four months of the year, from the start of December to the end of March. With the winter road being mainly an overland route, passing lanes will be established every 9.5km along the route such that convoys of four trucks each will meet at these passing lanes every 30 minutes.

The 150km Orma Lake Road to Churchill Falls will be refurbished for use during the winter months. The bridges and culverts along the existing Orma Lake Road will be retained.

At Churchill Falls the bulk carrier trucks will travel 199km to offload into a storage dome to be constructed at a newly established siding at the existing Emeril Railway station.

With a 501 km one-way distance, each round trip will take 19.7 hours per truck requiring two operators being assigned each truck to avoid doubling up of the truck requirements. At the Emeril station, the IPG-owned railway wagons will be loaded from the storage dome for rail transport to the hydrometallurgical facility, at Sept-Îles, as a year-round operation.

Sensitivity Analysis

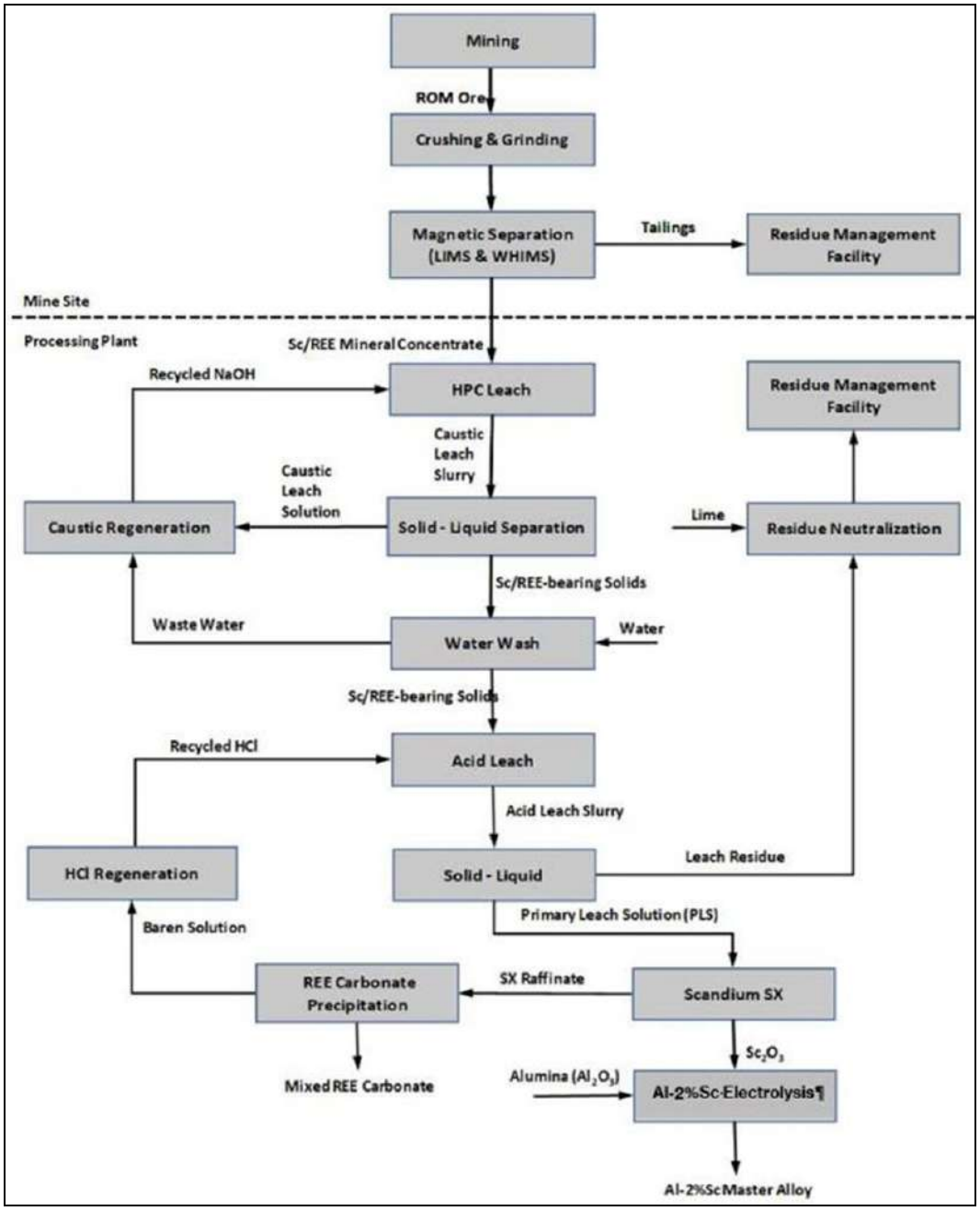
The expected project cash flows were modelled using a simple discounted cashflow model, using

discount rates of 5%, 7%, 10%, 11%, 12% and 15%. Imperial is using at 10% discount rate as its base assumption. The project cashflow is scheduled annually and uses an exchange rate of 1.25 CAD to USD.

The sensitivity analysis of the model indicates that the operation would be most sensitive to changes in metal pricing and CAD:USD exchange rate and least sensitive to changes in operating costs.

Metallurgical Process Development

Technology, rather than mineralisation, seems to be the watchword these days in the specialty metals space. Imperial believes it has developed an innovative process for extraction of Sc and REE from its Crater Lake Scandium mineralization as part of its Hydrometallurgical Development Program. Results from this work show very high recovery of both Sc & REE all mineralization types defined in diamond drilling on the property.



The two-stage hydrometallurgical extraction method entails a high-pressure caustic leach (HPC) followed by hydrochloric acid leach of the HPC residue. The new method showed remarkable recovery of Scandium and the REE with samples of material from Crater Lake.

The method showed Sc recovery to primary leach solution (PLS) of 84% for the metallurgical sample with the recovery of total REE, including Yttrium (TREE+Y) of 84%.

The high recoveries of Sc and TREE+Y from the sample showed that the method had high efficacy in

extracting Sc and REE from samples representing the mineralization observed in drilling.

The NaOH and the hydrochloric acid used in the leaching process are regenerated and recycled back to the process. Caustic is regenerated using lime, while HCl is recovered with the addition of sulphuric acid.

The Scandium oxide would be converted into an Al-2%Sc master alloy product using co-electrolysis of Al and Sc from alumina and scandia in a process similar to the Hall–Heroult method used for the production of primary aluminum metal.

Imperial commissioned a hydrometallurgical flowsheet development program based on its patent-pending two-stage hydrometallurgical method for the extraction of Scandium and REE with SGS Canada. The program, beginning in late January of 2022, was partially financed from a CAD$245,355 grant from the Quebec Ministry of Energy and Natural Resources.

The optimization work by SGS Canada is advancing and has shown success in improving the metallurgical processing method than was previously announced for the Scandium-REE mineralization. The results of this program will be input into Imperial's final patent submission to the US Patent Office.

In late October of 2023 the company presented an update in which it announced that it had received a CAD$500,000 grant from Le Consortium de recherche et d'innovation en transformation métallique (CRITM), which is one of the nine industrial research sector groups (RSRIs) in Québec. CRITM is funded by the Ministère des Ressources Naturelles du Québec and is a network dedicated to industrial research offering companies strategic support and financial assistance to carry out their research projects.

This money will go towards work on the optimization of its mineral processing and hydrometallurgical flowsheet, at SGS Lakefield, to support the preparation of the PFS.

A 600 kg representative bulk sample from Crater Lake was shipped from Sept-Îles, Quebec, to the laboratory of SGS Canada Inc. in Lakefield, Ontario. This sample is part of a 15-tonne bulk sample from Crater Lake that Imperial has stored in Sept-Îles to complete the development of its flowsheet.

The Albecour Collaboration

In mid-July of 2023, the company signed with Albecour Inc. an MOU to investigate the potential of producing specialty Scandium-Aluminum alloys in the province of Québec.

Albecour Inc. is a 100%-owned subsidiary of Investissement Québec, a Provincial Crown Corporation with the role to support businesses with their development in Québec, by providing guidance through every phase of their project. Albecour holds a 6.67% stake in the Aluminerie Alouette (pictured below) in Sept-Iles, Québec, which purchases raw material (alumina), supervises alumina transport logistics, sells its share of aluminum produced and ships it to customers in Québec and globally.

Under the terms of the MOU, the parties will evaluate, and if deemed commercially viable, enter into a commercial agreement for the manufacturing of Scandium-Aluminum master alloys with an aluminum production plant to be identified by the parties.

Albecour hopes to develop specialty Scandium-Aluminum alloys using Sc products from the Crater Lake project with the EV, aeronautic, space, offshore wind, and defence sectors as the target markets for Scandium-Aluminium alloy products.

The parties have been meeting regularly since the signing of the MOU with no update on a commercial agreement at the time of writing.

Further Uses

Beyond Sc-Al products in aeronautics and EVs, the company is investigating the potential uses of Scandium-Aluminum in light-weighting applications such as electrical distribution wires. To that end, it is working with technical experts to understand better the different applications of Al-Sc alloys and targeting the companies that would most benefit from larger volumes of the alloy.

Imperial is also working with McMaster University (Hamilton, Ont) to use Scandium-Aluminum alloys in 3D printing. We are exploring a new approach for generating scandium-aluminum powders suitable for the 3D printing of aluminum components that are costly to produce using traditional manufacturing methods. It is supporting the research work of a PhD candidate at McMaster.

To REE or not to REE, that is the Question

As we have noted this project started off as a REE project over ten years ago during the first flush of

Rare Earths. Most of the players in that First REE Boom have fallen victim to the Grim Reaper of reality scything through the ranks of the (estimated) 300 REE wannabes extant in 2011. The drastic culling included, as we have noted, Quest.

With the repositioning of Crater Lake as a primary Scandium mine, the REEs have been pushed to a minor status as a by-product. As the PEA would indicate, using the prices in the model, some 22% of revenues would emanate from the output of magnet REEs.

Royalties

The property comprises two contiguous mineral claim blocks (Crater Lake and Crater Lake Extension) covering approximately 47.0 km² (over 11,600 acres) with a total of 96 mineral claims. The Crater Lake claim block consists of 57 contiguous claims spanning 27.9 km², fully owned by Imperial Mining. A 2% net smelter return (NSR) royalty applies to these claims.

Quest retains a 2% NSR royalty in the Crater Lake claim block from the acquisition and transfer of the mining rights from Peak Mining on December 28, 2017. Those royalties are retained from the original acquisition and transfer of the property from Quest to Peak Mining in July of 2017. The royalty may be purchased at any time by the payor for an aggregate of $2mn or in two transactions, each for 50% of the royalty in exchange for the sum of $1mn.

As mentioned earlier, Quest filed for bankruptcy in 2018. The status of the Quest's royalty has not been clarified but some investigations indicate the royalty may now be held by Torngat Metals, owners of the Strange Lake REE project, another blast from the past.

It is worth noting that an additional 39 mining claims, covering around 19.1 km², were obtained as the Crater Lake Extension claim package. Imperial Mining owns these claims without any royalties.

Financing

In early July of 2023, the company closed on a non-brokered private placement consisting of 17,777,776 units at a price of $0.09 per Unit for total gross proceeds of CAD$1.6mn. Each Unit is comprised of one share and one share purchase warrant, with each whole warrant entitling the holder to acquire one share at a price of $0.14 over a period of 24 months from the closing date.

Two directors acquired units in the offering. All securities had a hold period of four months from the closing date.

Next Steps

The Crater Lake project has reached a stage where continuing to expand the resource is not an interesting option. The project has sufficient Scandium to rank in the very largest assets in this category. The focus must now be on funding and development.

To this end, in October of 2023, the company announced that it had hired a consultant to introduce the

project to specific companies in Asia that have shown interest in Imperial and Crater Lake.

The company has been exploring funding from different levels of government. In October 2023, it submitted an Expression of Interest for a CAD$5mn grant to Natural Resources Canada under the Critical Minerals Research, Development and Demonstration Program.

In October 2022, it submitted a white paper for funding to the US Government under Title III. It received a reply in September 2023 that while our project is of interest, funding to the level that Imperial requested is currently out of reach.

In October 2023, the company applied to the 2024 BHP Xplor cohort (up to $500,000) to help fund the Crater Lake Project.

Naturally, the company has held discussions with representatives of the Quebec government as there exist programs for which it may qualify to help fund some of the work.

PFS & Environmental Work

The first actions under the Pre-Feasibility relate to the environmental permitting. Weather data collection from the Crater Lake site, started in September 2022, and will continue for four more seasons. AtkinsRealis (formerly SNC-Lavalin) have been hired to undertake this work.

In October 2023, WSP Canada was retained to prepare desktop reviews of the effect of mining at Crater Lake and transporting ore over winter roads on fauna, flora and indigenous lifestyles in Quebec and Labrador in anticipation of environmental permitting from the governments of Quebec, Newfoundland and Labrador and Canada.

Imperial is currently engaged in negotiating with a consulting firm to advance social and environmental data collection in anticipation of the 2024 field season, which includes geotechnical and negative drilling for environmental permitting and mine tailings localization.

Work began on optimizing the mineral processing and hydrometallurgical flow sheet, in October of 2023, at SGS Lakefield to support the preparation of a PFS. This optimization will be done using the aforementioned 600kg ore sample.

The optimization will begin with the base-case flow sheet used in the 2022 PEA and work to improve the recovery of the payable metals (Sc & REEs) while improving the flow sheet's capital and operating costs. The result of this optimization work will guide the engineering design of the larger pilot testing to be used in the Feasibility Study. The optimization work is supported by a CAD$500,000 grant from *Le Consortium de recherche et d'innovation en transformation métallique* (CRITM), which is one of the nine industrial research sector groups (RSRIs) in Québec. CRITM is funded by the Ministère des Ressources Naturelles du Québec.

In 2024, Imperial will be hiring the engineering firm that will author the PFS report.

The Gold Projects

The company has retained two gold properties (Opawica and La Ronciere) in the Province of Quebec, which it feels have monetizable value. There has been exploration activity in the region of both gold projects this year, with a significant gold company making deals to acquire assets. Although the properties are not the strategic priority for Imperial, it is in conversations with interested parties to move these projects forward while and generating cash to deploy on Crater Lake.

Board & Management

Jeff Swinoga, Chairman, has more than 25 years of executive and management experience in the areas of finance, project development and project construction. He was the National Mining and Metals co-leader at EY Canada and was also the chief financial officer of Torex Gold where, during his four-year tenure, he led the US$400 million financing of Torex's US$800 million El Limon-Guajes gold mine on the Morelos property and led his team during Torex's transition from an exploration and development company to a mid-tier gold producer.

Prior to that, he spent four years as the CFO of North American Palladium, during which time NAP financed and constructed the underground offset zone expansion project for the Lac des Iles mine and acquired and built two gold producing mines in Québec. In addition, he spent three years as CFO of HudBay Minerals Inc and spent seven years at Barrick Gold as a senior officer with responsibilities that included project financing of Barrick's Bulyanhulu and Veladero projects.

He has served on boards of listed companies, such as First Cobalt and Tonbridge Power. He holds an MBA degree from the University of Toronto and an Honours Economics degree from the University of Western Ontario and is a Chartered Professional Accountant. He was elected to the Board of PDAC and is a member of its audit committee.

Pierre Neatby, President & CEO, has over 30 years of experience in the base and critical metals business. He spent 20 years with Noranda in various commercial roles including aluminum sales on behalf of Noranda and on behalf of Albecour. He spent nine years at Avalon Advanced Materials focusing on rare earths and critical metals fostering relationships with end users. He has lived and worked in Toronto, London and Madagascar. He is a graduate of Queen's University in Kingston.

Brooke DeLong, non-executive director, is a Canadian communication and change management leader with more than 20 years of corporate and operations experience within the mining industry. Her expertise is in communications, change management and global governance matters through her roles as Director, Change Management & Internal Communications at Centerra Gold and previously, as Manager, Communications at Vale, where she led the change management and governance practices for the company's Base Metals business.

She holds a Bachelor of Arts (Hons) from the University of New Brunswick (UNB) and a Bachelor of Public Relations from Mount St. Vincent University. She has been a member of UNB's Board of

Governors since 2017.

Philippe Cloutier, a non-executive director, holds a B.Sc. in Geology from the University of Montreal in 1986 and a certificate in Human Resource Management at University of Quebec Abitibi-Temiskaming and has over 25 years of experience in the mining exploration and development business. He is currently the President & CEO of Cartier Resources and had previously worked for industry leaders such as Noranda, Aur Resources, and Soquem.

He played a significant role in the discovery and delineation of the Bell-Allard South Cu-Zn Mine in Matagami, Quebec.

Nick Nikolakakis, a non-executive director, has over 26 years of senior management, strategic and capital planning, and finance and accounting experience within the mining sector and has raised over $2 billion in capital. He was Vice President, Finance and Chief Financial Officer of Battle North Gold from October 2013 until May 2021 when it was acquired by Evolution Mining. He has also served as a senior officer of several publicly listed mining companies, including Rainy River Resources, Barrick Gold, Placer Dome Canada, and North American Palladium. He holds an Applied Science degree in Geological Engineering from the University of Waterloo and a MBA from the University of Western Ontario's Ivey School of Business.

Alain Bureau, a non-executive director, is an engineer with over 20 years of experience in the mining and construction sector, having worked in 11 countries across the Americas. He has significant experience in the junior mining industry through his roles as President & CEO of Pershimco Resources and President of Atico Mining. He also received numerous important industry acknowledgements, including TSX's Top 10 exploration companies award in 2012 and the prestigious PwC's Top performing mining explorers award in 2013. He has been involved in numerous large construction projects, including the Glencore's Raglan Mine located in the extreme limit of Northern Quebec.

While with Agnico Eagle, he was the plant construction manager for the Pino's Alto mine in the remote Mexican mountains as well as in the Atacama Desert, working on BHP's Escondida mine expansion, currently the largest copper producer in the world. His exploration and construction abilities as well as his M&A experience and understanding of the capital markets allowed him to successfully deliver growth through the development of logistically challenging projects by providing technical solutions and financial alternatives to create value for shareholders.

He graduated in Mechanical Engineering from the Royal Military College of Canada and is a member of the OIQ "Ordre des Ingénieurs du Quebec". He also currently serves on the Mining Chamber of Ecuador Board of Directors.

Risks

It is important to highlight some of the potential risks for Imperial Metals and thus one should consider:

- Financing challenges

- Scandium price fluctuations in what is an opaque market
- Price fluctuations for other metals that are primary drivers in some projects (i.e. Nickel & Cobalt)
- Failure of demand to match rising production (i.e. build it and no-one comes)
- Excessive number of competing projects could crowd the scene and dissipate capital going to the most viable projects

Financing challenges come with the territory in the mining space. Trying to time an upswing in sentiment in the specialty metals segment is even more difficult. The company is of the opinion that the project requires one or two significant partners to move towards production. These might be consumers of aluminium, producers of aluminium or large companies in the critical metals space wanting to diversify. This would liberate the project from a dependence on financing from stock sales or debt financing.

Scandium prices are somewhat akin to the old adage of whether anyone sees a tree fall in a dense forest. The prices are almost unknown to anyone except the buyers and sellers, at this time, and they are not telling. One of the services that Rio Tinto might potentially do for the market would be to reveal, at some point, what prices it is achieving for its product sales. This would pull back the veil on the space to a large degree and give a better idea of potential “real” economics.

One thing that has become clear to us is that for end-users to tool up for a shift to Aluminium-Scandium alloy use in serious quantities (ergo the aerospace industry) there will need to be at least two producers. One alone will not give them comfort of supply.

Sunrise Energy Metals, for instance, might start producing but if Nickel (or Cobalt) prices tank such a mine would be shuttered for the duration and the Scandium by-product users would be hung out to dry. This would be the point at which other primary mines for Scandium are “enabled” (such as Nyngan and Crater Lake) to give end-users diversity of supply and a source decoupled from the vagaries of the Nickel market.

Conclusion

It is not unreasonable to have seen the push ten years to make Crater Lake into a mine justified on purely Rare Earth grounds as a quixotic quest (pardon the pun) as it was at best an ordinary REE project in a challenging location. There are far more dynamics working in favour of the project now that it has pivoted to Scandium, not least of which is its (relative) proximity to the major players in the aluminium industry in Quebec and the support mining projects receive in Quebec.

The challenging location remains but the economics have been transformed. It will interesting to see whether a tradeoff will be made in an upcoming study to reduce capex by moving REE production to the backburner.

Scandium came in from the cold when Rio Tinto announced that it had decided to join the production side of this metal some two years ago. This totally flipped perceptions of this metal and opened the door for wider adoption if not mass adoption. Then more recently, the same company buying up one of the

most advanced development projects in Australia reaffirmed its commitment and signalled a longer-term intention to increase production beyond their mere by-product flows, thus far. This opens the door to more production and indeed almost invites it. As the commitment of a major player potentially major offtakers into the equation.

After soldiering on for a decade when few were interested, Imperial Mining is now positioned to potentially join the movement towards greater Scandium production and consumption in the West. However, in order for the Crater Lake project to be built there will have to be an offtake agreement that establishes a price high enough for the project to be built and reasonable enough so that the customers receive a competitive advantage in using Scandium.

Therefore, we are initiating Imperial Mining with a **LONG** rating with a 12-month target price of CAD 24 cents.

Appendix I: Scandium

Unobtainium No More

- ➕ RIO TINTO have shown their hand in the space with a plan to start producing Scandium from Titanium streams/waste in Quebec
- ➕ This development lays to rest the long-time bugbear of unavailability assuring potential users, like big aerospace companies, of future supply from a reliable source
- ➕ Strong potential for expansion of demand based upon increased availability at current or lower prices – applications follow supply
- ➕ RIO TINTO recently acquired the Owendale project in NSW from Platina which if advanced rapidly would be the first primary Scandium mine ever
- ➕ Perversely, RIO TINTO entering the space is good for juniors as it will spur expansion of usage and in turn raise demand and bring Scandium into the mainstream
- ✖ Financing environment remains challenging
- ✖ Some of the new projects are predicated by Cobalt as a by-product and that metal has seen wild price fluctuations in recent years
- ✖ With six Scandium hunters (and one producer) already in the race there is a lot of noise and misinformation

The Eternal Chicken or Egg Dilemma

The problem potential end-users of Scandium have is that a chicken-or-egg-like dilemma arises. Does a major aircraft manufacturer tool up for a switch to Scandium in its Aluminium alloy usage when it can be guaranteed little more than scraps in the current scenario? While for potential miners the dilemma is do they build a mine on faith alone that end-users will tool up even when there is a reliable source of Scandium in size? For end-users there is another dilemma. Do you rely upon only one supplier when that miner is more subject to the vagaries of the Nickel price than the Scandium price? If Nickel prices deteriorate, for whatever reason, then a Scandium source could be shuttered as it is only a by-product.

The evolution of the Scandium space we have long-posited is that a would-be producer of Scandium as a by-product, would produce several tens of tons per annum and then escalating, with a primary producer (or two) probably then joining the fray. Scandium, in that circumstance, goes from being an “obscure object of desire” in high-tech industries to being a conventional specialty metal like Tungsten or Tellurium.

RIO TINTO stepping into the space (and then acquiring Owendale) has been a potentially game-changing development for Scandium and its applications and adoption.

On Scandium

At the time, some of those less conversant with the Periodic Table referred to Scandium as one of the Rare Earths, despite it not belonging to the Lanthanide series and rarely appearing in their company in mineralisations. We note with some amusement that the swathe of US tariffs (under Trump) against Chinese metals exports targeting Rare Earths, repeated the error and included Scandium in the targeted metals, despite China (to our knowledge) not being a notable producer of Scandium and certainly not an exporter of any note.

Despite this, Scandium seemed to be the closest thing that we have to *Unobtainium,* with its very scarcity being its own worst enemy. This is a situation that has seemingly been remedied from an unexpected quarter, i.e. RIO TINTO's move into the space.

The potential of Aluminium Scandium alloys in the aerospace and transportation industry has been well understood for decades. But what has likely been lacking is a clear path to the supply growth needed from the current tens to hundreds of tons of oxide per year, and with it a production cost basis to support a mass application where development timelines run into decades.

It has the potential to provide light-weighting properties to rival composites and Titanium alloys across a wide range of applications. But much depends upon the eventual price because there has never been an organised transparent market as both production (by-product) and demand have been low volume and opaque. And as Scandium has been produced occasionally as a by-product of Rare Earth mining it was exposed to the same volatility risks as Rare Earth prices, which spiked in 2010 on political factors and then slumped.

The Friedland Effect?

Scandium was, until 2017, one of the lesser talked about technology metals. Since then it has received increased focus and mention, not least because of the peripheral involvement of Robert Friedland in the metal. This interest is despite the fact that the supply situation is severely limited with literally only a few tons of product hitting the market per annum, and even that is as a by-product of the refining and processing of other metals. The applications for the element are known, particularly in Aluminium alloys, solid oxide fuel cells and lighting but it's just that manufacturers will not tool up for the metal if they cannot be guaranteed greater (reliable) supply.

Applications

The largest current user of Scandium, as we noted in our coverage of Bloom Energy (NYSE:BE) last year, is this producer of solid oxide fuel cells (SOFCs). Scandium-stabilized zirconia (ScSZ - usually 9 mol% Sc_2O_3 – 9ScSZ) enjoys a growing market demand for use as a high-efficiency electrolyte in SOFCs, including those of the leading commercial supplier, Bloom Energy. These natural gas powered electrical generation systems are highly efficient, reliable, clean, and completely independent of traditional electrical grid systems.

The SOFC business has been the fastest emerging application, accounting for maybe as much as three quarters (in some estimations) of the current world Scandium consumption.

Traditionally the main application of Scandium, by weight, has been as a grain-refining agent in Aluminium-Scandium alloys for minor aerospace industry components. The positive effects of Scandium on Aluminium alloys were discovered in the 1970s. These alloys, composed of as little as 0.5% Scandium, make a significant difference in strength. It can be added to most of the standard alloy grades to improve tensile strength, corrosion resistance, weldability and heat working tolerance. It reduces temperature creep in alloys and combines particularly well with magnesium and zirconium to add unique enhancements to alloy performance. Scandium does not reduce electrical conductivity in aluminum alloys to the extent other alloy combinations suffer degradation.

Aircraft designers in constant search for performance gains with weight reduction (with no performance loss) being the key goal.

- ✓ Weight loss improves range, payload capacity and economy
- ✓ One kilo of weight savings in an aircraft = $60 p.a. fuel saving ($1/gal)
- ✓ AlMgSc alloy payback is < 1 year (10% weight reduction assumption)

Aircraft materials costs are secondary to performance.

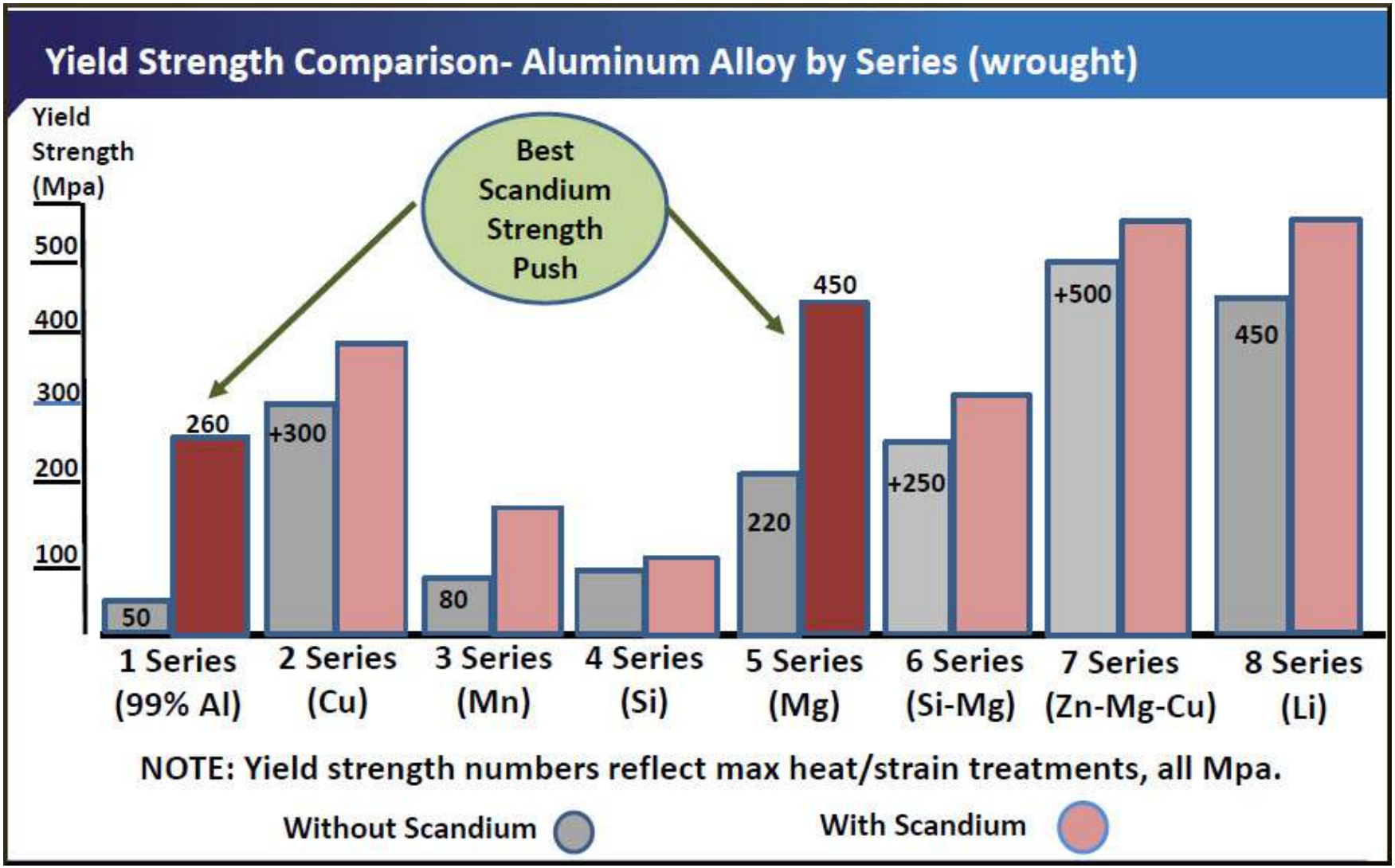
- ✓ Single aisle plane (US$100mn) contains about US$300k in Al alloy
- ✓ Designers predict 15-20% lower weight + lower mfg. cost using AlMgSc
- ✓ Maximum Scandium additions would cost $200k-$300k. (50kg/$100k)

Alloy cost is often not the driver in other industries as well. For example:

- ✓ Bicycle frame (high-end) alloy @ <1% cost Sc addition = 1.5%
- ✓ Automobile parts properties will drive selective adoption

Thus Aluminium Scandium alloys could find a new growth area in the electric vehicle (EV) industry, which is the major demand driver for Rare Earths. In electric and hybrid vehicles weight reduction is critical to reducing the size and cost of batteries. And EV materials need stronger resistance to electricity and corrosion. Competition between structural materials, metals, alloys and composites is intense, and the demands on their properties across all sectors will only increase.

On the following page can be seen a comparison of various Scandium alloys by strength:



Source: Scandium International

One area that intrigues us is the Sc_2O_3 that is used annually in the United States to make high-intensity discharge lamps. Scandium iodide, along with sodium iodide, when added to a modified form of mercury-vapor lamp, produces a form of metal halide lamp. This lamp is a white light source with high color rendering index that sufficiently resembles sunlight to allow good color-reproduction with TV cameras. The USGS estimates that around 80 kg of Scandium is used in metal halide lamps/light bulbs globally per year. This would seem to be an application where a greater, more reliable supply of the metal might result in a significant expansion in usage, particularly into more household applications. We could also see potential in sports arena lighting.

Another little-recognised application, that should be on the rise over the next few years, is the use of Scandium in switches in 5G networks.

Even more obscurely, Scandium also has uses in sports equipment, guns and dental inputs. Some of its applications though can be substituted with Titanium.

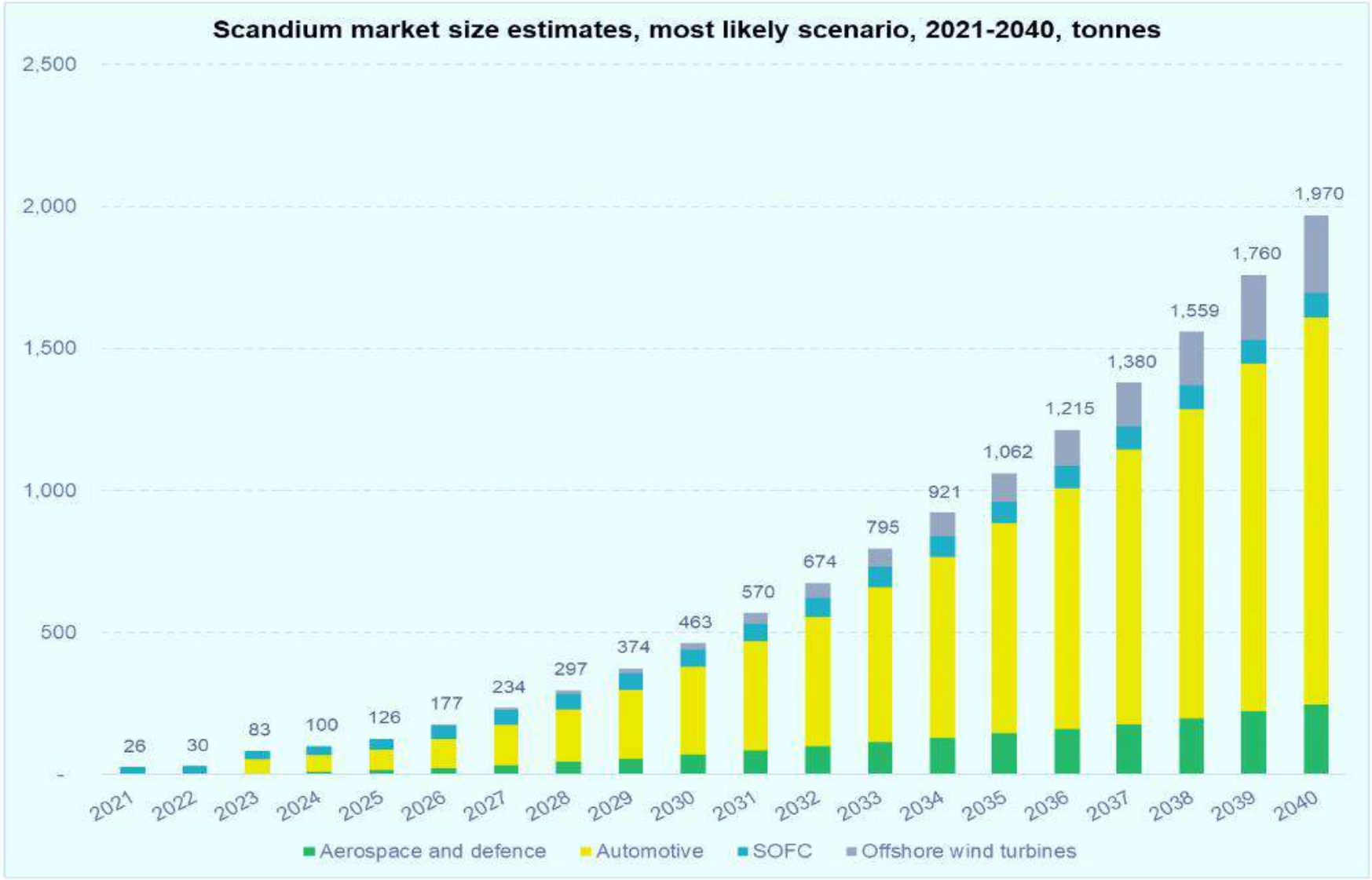
Build It and They Will Come?

The absence of reliable, secure, stable and long-term production has limited commercial uptake of Scandium. Despite this low level of use, Scandium offers significant benefits. The potential for substantial expansion in usage and demand clearly exists and to an extent it is one of those “rare” metals stories where the supply could potentially generate the demand rather than the other way around. The most obvious areas where this might happen are in lighting systems, SOFCs and Aluminium alloys.

In some ways a good analogy might be Europium. Its application in colour televisions spurred a surge in REE mining (ironically at Mountain Pass) which then made the “rarer” REEs more abundant, lowering the price but moreover accentuating the supply which meant that new applications arose or were employed that spurred the whole evolution of the permanent magnet and laser usages of the other metals in the Lanthanide series.

It is not too difficult to imagine that greater production will firstly spur the master alloy applications, followed by an expansion in the SOFC demand, lighting and then “new” applications. In aircraft alone the Aluminium alloy demand might totally consume the entirety of the extra metal that nascent producers might bring to market. It is interesting to note that Bloom, probably the world’s major consumer of Scandium, came to market in an IPO in 2018. We undertook a word search of the prospectus yielding no result for Scandium, not even in the risks section.

On the following page can be seen the projections from an Ernst & Young internal survey for Sc demand until 2040:



Source: Internal EY Internal Market Study 2022

The Earth Shakes for Scandium

Rio Tinto has gone from zero to 100, in no time at all, in the thin and opaque Scandium space. The company has announced that through the reprocessing of residues from the Aluminium smelting process it intends to become the world's first large producer of Scandium, which is starting to obtain recognition as a critical metal on which the US, in particular, has an exceptionally tenuous hold despite being the largest consumer, through it pivotal role in the production of Solid Oxide Fuel Cells (SOFC) and the growing recognition of its role in switches in 5G networks.

It is not breaking the mold though as it too will be a secondary producer of Scandium like all the current players as none of the primary Scandium mines have managed to get escape velocity from high-CapEx requirements or flaccid financing markets over the last ten years.

Todd Malan, RIO TINTO's vice-president for corporate relations, told delegates at a joint US-Canadian government online conference on supporting critical mineral supply chains that: "We are progressing plans for industrial-scale production that will draw on Rio Tinto's position as a leading Aluminium producer to provide not only a reliable source for Scandium oxide from North America but also for Aluminium Scandium alloys".

Rio Tinto is producing Scandium oxide to commercial specification and Aluminium/Scandium alloy at a pilot plant at its Sorel Tracy metallurgical plant in Quebec. Located 70km from Montreal, Sorel Tracy processes ore from the Havre-Saint-Pierre mining complex in eastern Quebec province.

RIO TINTO has said that it is in advanced discussions with potential customers. The company is using a process developed to extract it from waste streams from the plant, which produces Titanium dioxide feedstock, pig iron, steel and ferrous powders. This might spur other majors, such as Norilsk, to set up circuits or plants to extract Scandium from their product streams.

Scandium Volumes – A Relatively Unknown Quantity

The USGS has estimated that global Scandium consumption was less than 10 tons per year in 2013. However, as this metal is one of the least intermediated metals around (i.e. most of its trade is directly between end-users and the "producers", one has to wonder how reliable the USGS numbers are. We have spoken to knowledgeable parties in the Scandium trading space that estimate it at 20-25 tonnes per annum. We suspect it is now closer to 30 tonnes.

Prices & Marketing

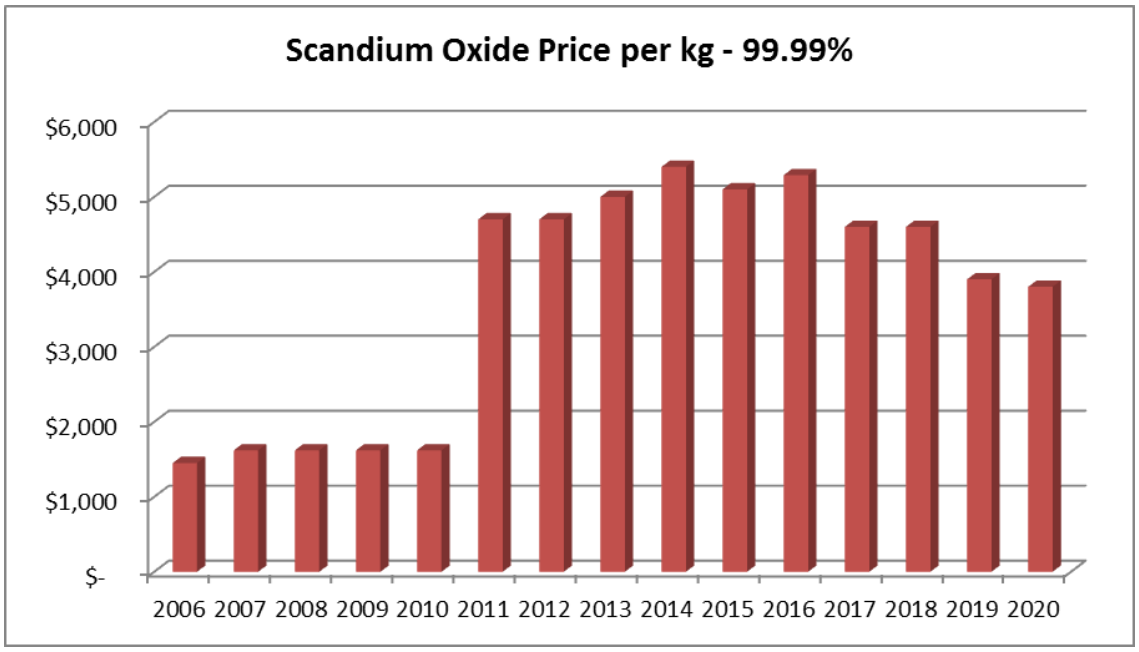
The current price of the metal is another murky area (even more so than many of the minor specialty metals) with indications that Scandium Oxide traded at over US$5,000 per kg in the middle of last decade. This compares with $1,620 per kg as recently as 2010.

Pricing in the metal is somewhat of a "nod, nod, wink, wink" process. One Scandium watcher we spoke to commented that he thought that "$900/kg was a low-wrong number in 2009, and $5,200/kg was a

high-wrong number in 2016".

Since then prices have undoubtedly gone down with everyone getting it (except maybe at Niocorp who "didn't get the memo" or it didn't suit them to read it). The USGS is, alas, the most public price-maker in the Scandium space and yet it seems to be quite out of touch with reality. In fact, the disparity with the word on the street is startling, implying that the USGS should either improve its sources or desist from guesstimating for the metal.

Below can be seen the price estimates in their version:



Source: USGS

An important pricing issue is that the "reported prices" range from $2,000 up to $7,000 per kg but only for small quantities (kgs). There is not yet a market for "tonnes' and therefore no representative price.

In its DFS from June 2018, Sunrise Energy Metals made the comment, "While Scandium oxide prices have historically ranged from US$2,000-4,000/kg, the DFS has assumed a forward price of US$1,500/kg, which is the price at which the company expects significant additional demand growth to be stimulated".

It is important to note that at $1,500/kg oxide pricing, there is around US$50 of Scandium in one kg of Al-Sc 2% master alloy. Is this a punitive cost that would stop adoption by aircraft manufacturers? We suspect not.

Another issue of note is the grade differences in the quotes between 99% and 99.99%. Electrical uses will need 99.9%. Master alloy producers will be content with 98%, and they probably could do with 95%

if they adjusted their mixing and dross management techniques. Most material will go into alloys.

Imperial Mining have used $1,500 per kg as the Scandium Oxide price in their economic models.

The Scandium Space – Comps and "Competitors"

When we first wrote on this metal, Scandium International (SCY.to) was quite clearly a lone voice in the wilderness. Since then, a number of other wannabes have appeared touting their Scandium virtues as either byproduct kickers or attempts to make unviable and unsexy projects (pardon our cynicism) into viable and sexy propositions to potential investors. In some cases, they have attracted investor attention and have had the positive effect of making the metal more high-profile than it has hitherto been. At a workshop we attended at the European Space Agency, Scandium was the metal that was most mentioned with Tellurium a very distant second.

The players in the Scandium space are concentrated in Australian projects, with three claimants that we know of, presenting properties in North America. The seven are:

- Sunrise Energy Metals (the Syerston project in NSW)
- Scandium International (the Nyngan project in NSW)
- Imperial Mining (the Crater Lake project in Quebec)
- American Rare Earths (the La Paz project in Arizona, USA)
- Rio Tinto (the Owendale project in NSW)
- AusMin (Sconi project in NSW)
- Niocorp (the Elk Creek project in Nebraska, USA)

The Scandium sector participants and their grades are summarised in this table:

	Ticker	Location	Project	Mineralisation	Capex	Sc ppm	Sc2O3 ppm	Sc Contained Tonnes
American Rare Earths	ARR.ax	USA	La Paz	Sc/REE	n/a	26	40	4,400
Australian Mines	AUZ.ax	Australia	Sconi	Co/Sc/Ni	US$974mn	35	54	89
Sunrise Energy Metals	SRL.ax	Australia	Sunrise	Ni/Co/Sc	US$1.8bn	76	117	12,334
Imperial Mining	IPG.v	Canada	Crater Lake	Sc/REE	CAD$870.1mn	176	270	7,479
Niocorp	NB.to	USA	Elk Creek	Nb/REE/Sc	US$879mn	54	83	14,200
Scandium Intl	SCY.to	Australia	Nyngan	Sc	US$87.1mn	235	360	3,976

Conclusion

If this hubbub of arm-wavers has any usefulness it is in making Scandium the word of the moment amongst the chattering classes of the mining world. Unfortunately, the average (or even the sophisticated) investor finds it difficult to discriminate between the good, bad and the indifferent. The more information that is available on the metal and its dynamics, then the sooner this fog shall lift.

Scandium has gone from being obscure a couple of years ago to being name-checked frequently in recent times. The irony was that the talk was much ado about nothing as long as the prospect of any

decent boost to supplies remained merely a pipedream.

Excepting Imperial Mining and Scandium International as the only primary Scandium player, the others are all viewing Scandium as a by-product for projects. Certainly, for a while there, the heat generated by Cobalt meant that projects with that metal could promote their virtues while overlooking the fact that Nickel had improved but not to levels where laterite Nickel projects would stand on their Nickel merits alone. The downfall of Cobalt derailed putative Ni-Co-Sc plays, such as Sunrise Energy Metals, despite the project having the added zest provided by having Robert Friedland on board.

However, with RIO TINTO's push (and recognition) this *Wundermetall* has moved into the realm of the possible. The challenge has been that end-users wanted it but weren't prepared to back projects to make it happen. They were happy to talk but talk doesn't put metal on the table. Ironically it long seemed like new supply would come from the linkage to the fortunes of Cobalt and the rise of EVs potentially firing up the production prospects of Nickel/Cobalt mines with Scandium by-product credits. Recent events mean that it might be Titanium streams that eventually bring home the Scandium bacon.

Scandium's potential for much greater penetration of the technology metals space is well-known to any with more than a passing knowledge of the applications to which it can be applied. The move by RIO TINTO into the metal is pivotal and probably ensures that Scandium can make the jump from being *Unobtainium* to being a commonplace specialty metal even if not in everyone's home or garage.

Important disclosures

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