China Weaponizes Gallium

written by | July 9, 2023

CMI Director Alastair Neill begins with: “I think it caught a lot of people by surprise. There was no forewarning, which sometimes comes out of China – they signal things, but not in this case. And of course, I think we’ve always talked that we expected China to weaponize Rare Earths first, not a critical mineral like gallium.

Weaponizing Critical Minerals, China Selects Gallium as Tool of Choice

written by | July 9, 2023

Yesterday there was an announcement out of China that will have massive ramifications for the semiconductor industry. China’s Ministry of Commerce and General Administration of Customs decided to implement export controls on items related to gallium and germanium (Ge) to take effect on August 1, 2023. Furthermore, this same announcement as translated by Google states: “If exporters export without permission this constitutes a crime and will be held criminally responsible.”

Solvay starts making noise in the rare earths sector with a Hastings MOU

written by | July 9, 2023

Solvay S.A. (BRU: SOLB | OTCQX: SLVYY) ('Solvay') has started making news in the rare earths space. Solvay, a Belgian chemical company, acquired Rhodia in 2011 and with it the rare earth division with plants in France and China. Since Ilham Kadri was appointed the new CEO of Solvay in March, 2019, their only press releases on its rare earth division have been about three patent infringement cases surrounding materials for catalytic converters and their treatment of exhaust gases from internal combustion engines. Then suddenly over September-October of this year, there were 3 news releases that were focused on developments in Solvay's rare earths division.

On October 11, 2022, Solvay announced the signing of a non-binding offtake memorandum of understanding (MOU) with Hastings Technology Metals Ltd. (ASX: HAS) ('Hastings') where Hastings will initially supply Solvay with 2,500 tonnes per year of mixed rare earth concentrate (MREC) from its Western Australian Yangibana Project. The Solvay plant in La Rochelle, France was founded in 1948 and originally was built for the separation of rare earths from monazite. The reported capacity for La Rochelle is 10,000-15,000 tonnes per annum of rare earths concentrate, which if accurate, made it a significant producer in the 1980s and 1990s. This would mean however that the agreement with Hastings alone would not bring the plant back to full capacity, unless Hastings expands production over time or Solvay sources concentrate from other producers.

This new MOU follows Hastings' recent move to take a significant

position in Neo Performance Materials Inc. (TSX: NEO). NEO and Solvay compete vigorously in all aspects of rare earths but as noted above the main area is in the materials for catalytic converters. This move by Solvay with Hastings comes on the heels of Solvay announcing its plans to expand and upgrade its plant in La Rochelle to process rare earths and recycle rare earth magnets. NEO has also announced its plan to put magnet production capabilities in Estonia where it has a rare earth separation facility in Sillamae.

NEO's plant in Estonia has traditionally received its rare earth concentrate from Russia but given current political circumstances, it begs the question how long can this last? NEO does have an arrangement with Energy Fuels Inc. (NYSE American: UUUU | TSX: EFR) to supply concentrate from Energy's uranium operation in White Mesa, Utah. This is the only uranium production facility in the USA. Energy Fuels is going to process monazite to produce RE concentrate. To that end, Energy Fuels announced a deal in May of this year to take a position in a heavy minerals deposit in Bahia, Brazil, which contains monazite.

Another announcement from Solvay this October was that it took 100% control of Solvay Special Chem Japan (SSCJ) through its purchase of the remaining 33% from Santoku Corporation. This facility, like La Rochelle, is focused on catalyst and semiconductor industries. Decades ago this plant was processing RE concentrate from China. When China stopped exporting concentrate in the late 1990s Anan Kasei, a Japanese joint venture between Santoku Chemical and Rhodia, stopped the separation of rare earths and bought intermediate products from China again to produce more value-added products. Ilham Kadri, Solvay's CEO, commented on the transaction saying: "This transaction marks a logical step forward in our global plan to expand our leadership in Rare Earths specialties."

It will be interesting to watch Solvay and NEO position themselves in the European market which currently only has one metal/alloy producer, Less Common Metals, and one magnet manufacturer, Vacuumschmelze, a German producer. Let the games begin.

Ucore Steps into the American Rare Earths Processing Ring in Louisiana.

written by | July 9, 2023

Ucore Rare Metals Inc. (TSXV: UCU | OTCQX: UURAF) just announced a mutual commitment between themselves and the State of Louisiana to establish a rare earth separation facility in the state which Ucore refers to as a Strategic Metals Complex (SMC). This is a change in direction from the earlier management drive to build a facility in Alaska. The government of Alaska had committed to supporting this approach through a bond of US$145 million to develop the Bokan Project for infrastructure and construction costs. This is a significant shift – which, I view as positive.

From their news release, they point to some advantages "Critical markers for success, such as streamlined inbound and outbound freight, ample supply and proximity of chemicals and reagents, attractive energy costs, the robustness of labor pools, room for ramp-up and production expansion and community support, including technical education infrastructure were all part of the size-up." In addition, they are evaluating several

brownfield sites which typically come with infrastructure already in place like power and buildings which would reduce the capital investment.

The Louisiana Economic Development (LED) sent a non-binding Letter of Intent (LOI) to Ucore last week. The LED laid out a 10-year US$9.6 million economic incentive package in consideration for Ucore's projected investment of US$55 million. There may also be additional incentive's once a site has been chosen which could bring the total package up to US$11 million from the LED.

According to the LOI, the following were identified:

- The financial, economic and tax incentive offers described in the LOI are estimates based on the Company's commitment to and fulfillment of its capital investment, employment and expected payroll schedules for the Louisiana SMC. This includes: (i) a total capital investment by the Company for the Louisiana SMC of at least US$55 million by December 31, 2026; and (ii) new jobs in Louisiana at the Louisiana SMC in the amount of 45 jobs in 2025 with an annual payroll of US$2.4 million rising to 80 jobs in 2034 with an annual payroll of US$5.2 million.
- Louisiana's Industrial Tax Exemption Program can offer up to a 10-year tax exemption to the Company. LED estimates that the exemption may result in up to US$6.0 million in tax savings for the Company. The State's Industrial Tax Exemption Program is administered by and will be subject to a contract to be finalized between the Company and the Louisiana Board of Commerce and Industry and requires approval from Parish and municipal governing bodies as well as the Parish school board.
- Louisiana's Quality Jobs Program provides a 4% or 6% payroll rebate on the gross annual payroll for qualifying

new jobs for up to 10 years. The program also refunds state sales/use tax paid on construction materials purchased during construction or a 1.5% project facility expense rebate on certain capital expenditures. LED estimates that the value of this program could be up to US$3.6 million for the Company. The Quality Jobs Program is administered by and will be subject to a contract to be finalized between the Company and the Louisiana Board of Commerce and Industry.

Initial plans are to build a plant that will produce 2,000 tonnes per year (TPY) of separated rare earths by the second half of 2024. Plans would be to expand to a world scale production level of 5,000 TPY by 2026. The technology to be used is Ucore's wholly owned Innovation Metals Inc. Rapid SX™ technology. This has been piloted for some time now at Kingston Process Metallurgy (KPM) to develop knowledge of the process and design parameters.

This appears to be the first major investment in rare earth separation processes in the USA, although there are others also talking about this including Lynas Rare Earths Ltd. (ASX: LYC) and MP Materials Corp. (NYSE: MP) with grants from the Department of Defense (DoD). MP received US$35 million and Lynas US$120 million. This begs the question of whether or not the DoD will support Ucore with this plan of action. With a current market cap of approximately US$30 million raising the funds through equity financing would be very dilutive to existing shareholders so either the DoD assists or Ucore gains a strategic partner or a combination of these two will allow the financing of the SMC.

I am sure more news will be forthcoming as engineering and construction will likely need to start by mid-2023 to achieve the stated target of production in 2024-H2.

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Critical mineral Vanadium finds new interest in grid energy storage battery applications

written by | July 9, 2023

Vanadium (V) is a critical mineral element named after the Scandinavian goddess of beauty and fertility Vanadis. It is the 20th most abundant element in the earth's crust. Global production in 2020, according to Statista, was about 105,000 tonnes. China accounted for 70,000 tonnes or two-thirds of global production. Russia was next at just over 19,500 tonnes, followed by South Africa at 8,584, and Brazil at 7,582. India produced 100 tonnes and the USA 17 tonnes. Vanadium occurs in magnetite and in China and Russia it is produced from steel smelter slag. Other sources are bauxite, crude oil, coal and tar sands, or as a byproduct of uranium mining.

About 85% of all vanadium is used as an alloy for steel to improve its strength and wear resistance, particularly in tool steel where the amount of vanadium used ranges from 1% to 5%. A few years ago China passed requirements for rebar to use vanadium but the advent of COVID and the current malaise of the Chinese construction/real estate business has not seen the potential increase in demand that the industry widely expected. Vanadium is also used in titanium/aluminum alloys in jet engines and dental implants. Recently there has been renewed interest in the large potential capacity of the vanadium redox battery, also known as the vanadium flow battery (VFB), for grid energy storage. An advantage of vanadium flow batteries is they have no limit on energy capacity and long charge/discharge cycle lives of between 15,000-20,000 cycles making them useful for power plants and electrical grids. Also, Lithium vanadium oxide has been explored for a high-density anode.

Earlier this year the Ferrovanadium price in Europe was $62.8/kg but recently has fallen to about half at $31/kg. In late 2018 and early 2005 Ferrovanadium prices spiked over $120/kg but these were short lived peaks. It has short periods where producers can make significant profits.

There are two producers of vanadium outside China and Russia that are of particular interest. The first is Largo Inc. (TSX: LGO | NASDAQ: LGO), which listed on the Nasdaq last year. Largo is a Toronto based company with operations in Brazil from one of the world's highest grade vanadium deposits. Largo reported revenues in Q2 of this year at $84.8 million, which was due to the spike in vanadium prices. Volume sold was 3,291 of V2O5 equivalents while production of V2O5 was 3,084 tonnes. Expected production for the full year is estimated at 11-12,000 tonnes of V2O5. Their cash operating cost is reported at $4.10-4.50/lb. V2O5 ($9.03-9.92/kg). Recent pricing inside China is shown to be $16.80/kg, so Largo is in a good position relative to the

market. In addition, Largo is investigating diversification in 2022-23 in an ilmenite concentration plant with a nameplate of 150,000 TPY. This will feed a titanium oxide (TiO_2) pigment at a rate of 30,000 TPY beginning in 2024. This is a very small operation compared to the size of the TiO_2 industry, but this will diversify their product line and possibly soften the impact of the swings in vanadium pricing.

Another part of Largo's business is Clean Energy Storage. They boast a "unique, vertically integrated business model" to "supply some of the world's most advanced vanadium redox flow battery solutions for the integration of renewable energy." By supplying their own vanadium Largo can lower the upfront cost to its customers. To that end Largo signed a non-binding MOU with Ansaldo Green Tech to negotiate the formation of a Joint Venture for making and deployment of Vanadium Redox Flow Batteries in the European, African and Middle East markets. In their latest press release Largo announced it had completed its qualifying transaction for Largo Physical Vanadium Corp. (TSXV: LPV). According to Largo's President and CEO Paulo Misk, "this listing will allow investors direct exposure to vanadium."

Another vanadium company is Bushveld Minerals Limited (LSE: BMN), a South African company, which owns 2 of the 4 world's operating primary vanadium processing facilities. Last year they produced just under 3,600 metric tonnes of vanadium. Bushveld has announced they plan to grow production by 40-50% this year, and subject to funding and market conditions they would increase their output to 8,000 TPY.

It is also worth mentioning that Glencore International AG, one of the world's largest global diversified natural resource companies, is also in the V_2O_5 market with production around 6,900 tonnes in 2021.

Vanadium is an interesting element, though the pricing swings make it challenging to plan budgets and investments, but the use in vanadium redox flow batteries has given a new growth market for the industry.

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Molten Metals sees opportunity in bringing antimony projects back into production

written by | July 9, 2023

Molten Metals Corp. (CSE: MOLT) is a relative newcomer to the world of antimony (Sb) and tin (Sn). Formed by Christopher Ecclestone in 2021 to look at near term production of lesser-known battery material antimony, the focus of the company is to look at previously operating mines to develop non-Chinese sources of material.

Molten Metals' first target was the historic West Gore

antimony/gold mine in Nova Scotia, Canada, that produced antimony and gold from the 1880s to 1917. From 1915 to 1917 operations were expanded, and over 35,000 tons of ore were milled yielding 7,761 tons of concentrate at 46% antimony. The total amount of gold obtained from the deposit up to 1917 was 6,861 oz. According to reports, high grade material (46% Sb) was shipped to England but lower grade material was kept on site, which would be readily available with no mining cost. The mine site is located one hour by road north of the provincial capital, Halifax.

Molten Metals' second move was to incorporate a company in Slovakia, Slovak Antimony Corporation. Slovakia was the key source of antimony for the Soviet Union. They have purchased a processing plant in July in Eastern Slovakia. It is planned to process material from the tailings from their Tienesgrund project. Samples from this project show antimony levels of 39.4% and 9.69 g/t of Au.

I am a strong believer in looking at ex-producing mines or mine tailings as new sources of raw material. Typically, they have infrastructure and possibly tailings that were processed using old technology which can be economically recovered with today's improved processes.

The largest applications for metallic antimony are in alloys with lead and tin, which have improved properties for solders, bullets, and plain bearings. It improves the rigidity of lead-alloy plates in lead–acid batteries. Antimony trioxide is a prominent additive for halogen-containing flame retardants. Antimony is used as a dopant in semiconductor devices. It is increasingly important as an essential element in high-capacity molten metal batteries. Antimony production in 2016 was 130,000 tonnes with China producing 100,000 tonnes. A recent report from the USGS shows that total global production

of antimony fell to 110,000 tonnes in 2021, and Chinese production dropped to 60,000 tonnes, with Russia in second at 25,000 tonnes and Tajikistan at 13,000 tonnes. Some of the reduction in China was due to COVID production problems and China's focus on environmental issues. As a result, antimony prices rose from an average of $2.67 per pound versus $6.65 per pound in October of last year.

A growing fear is that China can use rare earths as a weapon against the USA by throttling back or even banning rare earth exports to the USA. However, I believe there would be a more direct and immediate impact on American industry if China curtails shipments other key minerals like antimony, which would result in problems for the manufacturing of bullets and electronics plus lead-acid batteries. The USA buys components and assemblies with rare earths in them but not much of key rare earth oxides/carbonates. However, antimony goes directly into manufacturing companies like East Penn, which is the world's largest lead-acid battery producer. It is not hard to imagine the consequences of a sudden reduction in bullet manufacturing and batteries for new vehicles.

On the corporate side, Molten Metals recently announced additions to their advisory board. An impressive group has been assembled including Donald Sadoway, an inventor of the liquid metal battery for large scale stationary storage and Professor Emeritus in the Department of Materials Science and Engineering, Massachusetts Institute of Technology ("MIT"). Also on the board is Anthony Balmmeis who is active in both private and public companies and David Henderson who is very familiar with opaque markets and critical materials over his 35-year career. The fourth member is Alon Davidov, an Angel investor in several companies in the construction-tech, FMCG, natural resources and media industries.

There is much to applaud in Molten Metals' enlightened approach to pursuing opportunities in some of the less-followed elements. I am sure there are other opportunities out there in tailings and old mines which traditionally have been shunned by the markets just waiting to be recognized for their potential.

Murchison Minerals explores camp scale potential for nickel and zinc at HPM and BMK projects

written by | July 9, 2023

Murchison Minerals Ltd. (TSXV: MUR | OTCQB: MURMF) has recently announced results of its summer exploration program at its wholly owned HPM (Haut-Plateau de la Manicouagan) property. This included an aerial geophysical survey of the 648 km2 (250 square miles), ground prospecting and diamond drilling with the plan to produce a maiden resource early 2023. The original discovery by Falconbridge of a Nickel-Copper-Cobalt mineralization dates to 1999.

What is interesting about the location is that it is only 8 kms (5 miles) to the rail line from Fermont/Labrador city and Port Cartier:

Source: Company website

As you can see it is also close to hydro-electric power which gives this opportunity two very important and strategic advantages over a lot of other potential mining opportunities in the Canadian north. It should also reduce CAPEX and OPEX as power will not have to be generated on site and material can be shipped in and out with relative ease. It is also 40 kms (25 miles) from the provincial Highway 389.

Two years ago, the Quebec government started the Quebec Action Plan on Critical Materials, which this deposit would fall under should the project move forward. The Quebec government is very supportive and proactive in the mining industry and the development of projects, particularly in the northern part of the province.

There are several targets of interest at HPM, the key one being their Barre de Fer target which reported an intercept of 43.15 meters grading 1.74% Ni, 0.90% Cu and 0.09% Co. By comparison, Voisey's Bay on average was 1.63% nickel, 0.85% copper and 0.09% cobalt. On September 7th Murchison reported the pXRF results from a new 404 m drill hole that intersected four broad zones of Ni-Cu-Co sulphide bearing mineralization totalling 130.00 m of composite thickness, and returning 18.05 m estimated at 1.98% pXRF Ni Eq. (89.95 to 108.0 m) including 8.1 m at 3.45% pXRF Ni Eq., and 69.90 m estimated at 0.68% pXRF Ni Eq. (267.0 to 336.90 m) including 16.1 m at 1.4% pXRF Ni Eq. This ongoing exploration, the company says, is aimed at completing a maiden resource on Barre de Fer by early Q1 of 2023. The question is will they approach the 141 million tonnes of ore of Voisey's Bay, which made it a world class discovery.

The other project Murchison is working on is the 100% – owned Brabant McKenzie (BMK) zinc-copper-silver project in Northern Saskatchewan, located about 170km northeast of La Ronge. This is a VMS (volcanogenic massive sulphide) Zn-Cu-Pb-Ag-Au deposit

which was originally prospected in the 1950s and 1960s. In September 2018 there was a NI 43-101 upgraded report with an indicated resource of 2.1 million tonnes at 9.98% zinc equivalent and an inferred resource of 7.6 million tonnes at 6.29% zinc equivalent. This was based on 138 drill holes with a cutoff of 3.5% zinc equivalent.

VMS deposits are widely distributed with major deposits in Canada being Kidd Creek, near Timmins, Ontario, and Bathurst in New Brunswick. The Kidd Creek mine, which has operated since 1966, is run by Glencore and is the deepest base metal mine in the world at 2,735 meters (8,973 feet) below sea level. The Bathurst mine suspended operations last month and the owner, Trevali, has delisted its shares from the TSX. The following table compares the Murchison deposit to Kidd Creek:

	Tonnes	**Zinc %**	**Copper %**	**Silver g/t**
Kidd Creek 2020	5 million	3.60%	1.80%	44.0
Murchison indicated	2.1 million	7.08%	0.69%	39.6
Murchison inferred	7.6 million	4.46%	0.57%	18.42

Murchison's Brabant Lake project has a maintained road – Saskatchewan Highway 102 – and existing power lines running through the property, which again points to management looking at projects with strong infrastructure. The drive from the local community of Brabant Lake to Saskatoon is about six hours. Last year's preliminary metallurgical work produced a 50% zinc concentrate with an 85% recovery.

Both projects are early stage but have promising potential and looking forward to additional results. Certainly worth keeping an eye on this company as more updates come out on these

properties.

Molybdenum – securing a domestic supply of the vital but underappreciated mineral

written by | July 9, 2023

Element 42 on the periodic table is Molybdenum (Mo), commonly referred to in the industry as the easier to pronounce moly. Most of the world's moly production comes as a byproduct from copper or tungsten mining. Most people know it as a lubricant. The main use of moly is in steel production as it gives weather and acid resistance in certain steel alloys, particularly stainless steel. This is an element largely overlooked as current production is in the range of 290,000-300,000 metric tonnes per year, which makes it a $10 billion annual business at its current pricing of $16/lb. Pricing earlier this year reached $20 per pound. Those are prices that have not been seen since 2008. Two years ago, the price was under $8 per pound.

According to the CPM Group, there are 76 mines globally that produce moly and 36 are inside China, with China producing over 40% of the world's output. Between 70-80% of that output is from copper mines. In 2021 the world's top 10 moly producing countries were:

Outside China, there are only two pure moly plays, and both of these are in Colorado and operated by Freeport-McMoRan (NYSE:

FCX) subsidiary Climax Molybdenum. 90% of western-sourced moly comes from copper production. This means that the main driver for moly production is copper production, so output and pricing can be counterintuitive. An example of this was in 2020 when prices dropped 30% but production went up, while in 2021 prices climbed 96% but production went down.

According to a World Bank report on the impact of low carbon technologies (LCT) in 2018, 21 million tonnes of copper were produced compared to 0.3 million tonnes of moly, or about 1 tonne of moly per 7,000 tonnes of copper. Moly is used in wind turbines, with one megawatt of output requiring 130 kilograms of moly. A typical offshore turbine is 12MW, which requires 1.56 tonnes of molybdenum.

One of the issues facing the industry is Chile's production. According to CPM, moly production in 2021 dropped 7.5% from 2020. The main drop was from Codelco, a state owned Chilean company, whose production declined 24%. A presentation by Codelco in 2019 indicated they needed new investment, otherwise production would fall by 74% by 2029. The Chilean government has asked Codelco to find $1 billion in annual savings and make a $8 billion cut in planned investments. This may delay investments. The Chilean government is talking about privatizing the mining industry and taking a royalty of up to 12%. These steps will likely give companies pause for thought on new investments. Based on this, the CPM Group is looking at a deficit position for moly over the next five years.

There is one potential new moly mine opportunity that is intriguing – Stuhini Exploration Ltd. (TSXV: STU) based in British Columbia. The CEO, David O'Brien, pulls a monthly salary of $2,000 which is different than a lot of junior mining companies. The share structure is very tight with 26.1 million shares issued and fully diluted at 28.3 million shares. Insiders

hold 43% and Eric Sprott is a strategic investor.

Stuhini's project is in Northwestern British Columbia and is called Ruby Creek. It has an option to earn 100% interest with a 1% NSR. There is a $22 million road built by a previous operator so there is access to the site. The mine was under construction by Adanac Molybdenum Corp. when it went bankrupt because of the 2008 financial crisis. This is a pure moly play, like the two mines in Colorado. A resource was released earlier this year with a measured and indicated resource of 433 million pounds. This gives an in situ value of $6 billion at current prices. Additionally, there are gold and silver indications on the property. Interestingly the market cap is $14 million while the previous operator had a market cap of $300 million.

It bears keeping an eye on this moly as low carbon technologies expand and what decisions Chile makes over the next few years. At present pricing, it can support new mines but there are few stand-alone opportunities. It is well worth keeping an eye on this market.

Rare earths expert Alastair Neill on Vital Metals

written by | July 9, 2023

"Overall Vital appears well on the way to producing commercial quantities of rare earth concentrate, a first in Canada." – Alastair Neill, President, Critical Minerals Institute

Vital Metals Limited (ASX: VML | OTCQB: VTMXF) is an Australian

listed company whose subsidiary, Cheetah Resources, is developing the Nechalacho project in the Northwest Territories of Canada. The deposit was previously owned by Avalon Advanced Materials Inc. (TSX: AVL | OTCQB: AVLNF), and they sold the rights in 2019 to Cheetah for the material 150 meters above sea level. Avalon retained the rights to the basal zone deposit which is underground. The deposit is reported to have 94.7 million tonnes at 1.46% REO (0.1% Nd/Pr cutoff). The mineral hosting the rare earths is bastnaesite, which is good as this mineral has been processing successfully for many years.

Vital raised A$45 million recently through a targeted share placement at A$0.04 per share. According to their press release the funds will be used for:

- Finalisation of construction activities and undertake commissioning, ramp-up and operations at its Rare Earth Extraction Facility in Saskatoon, which will produce a rare earth carbonate product
- Accelerated development of Tardiff deposit at Nechalacho, Canada, including mining studies

A strong balance sheet for ongoing working capital requirements

This project is the most advanced rare earth project currently in Canada. The initial focus is the North T zone which has a resource of 101,000 metric tonnes at 9.01% contained Total Rare Earth Oxides (TREO). Based on tests run at their Saskatoon rare earth extraction plant they can get a 75% recovery to produce a 43.7% concentrate. Based on this, the deposit would produce 6,825 metric tonnes of TREO which would contain 1,600 tonnes of Neodymium (Nd) and Praseodymium (Pr). Tests have been done using X-ray Transmission (XRT) to sort the ore as the ore is hosted in quartz, which is white, and the rare earth mineral which is red. This is a simple way to upgrade the TREO content at site.

There is an offtake agreement with REEtec, a Norwegian company that is developing a new rare earth separation process. The agreement is for Vital to deliver 1,000 tonnes per year (TPY) of TREO (excluding Cerium (Ce)). Based on that Ce will be eliminated before shipping the concentrate to Norway. This is a step that has been done before by Molycorp in the 1980s. It reduces the material handling by 50% and obviously the size of downstream processing equipment. The North T zone will provide 3,400 of the 5,000 tonnes which means Cheetah will have to open the Basal zone to meet the balance of the supply contract.

Looking at today's prices on Shanghai Metal Market (SMM) the separated value of this contract is over US$286 million. Assuming Vital gets 1/3 of the value for the concentrate this would produce revenues of over US$95 million of which US$92 million would come from Nd/Pr. Details of the agreement are not revealed so REEtec may be a toll arrangement which could produce more revenue for Vital though I expect the initial target would be to sell La, Nd and Pr in Europe as there are customers in Europe.

Interestingly the extraction plant is located beside the Saskatchewan Research Council (SRC) which has announced that they will be building a rare earth separation facility to process monazite by 2024. SRC has two rare earth experts from China on staff. SRC is also putting in an Nd/Pr metal facility which takes the oxide to the next level in the supply chain.

In addition to the Nechalacho project, Vital has a project in Tanzania called Wigu Hill. Vital has signed a project development and option agreement with Montero Mining & Exploration Ltd. (TSXV: MON), to acquire and develop the Wigu Hill project. The Wigu Hill project is a light rare earth element deposit and consists of a large carbonite complex with bastnaesite mineralization with a NI 43-101 Inferred resource

estimate of 3.3Mt at 2.6% light REOs. This is also a bastnaesite mineral.

Overall Vital appears well on the way to producing commercial quantities of rare earth concentrate, a first in Canada. Questions that do need to be answered are what are the costs of operating an open pit mine in Northern Canada and the costs to transport material to Saskatoon.

MP Materials is riding the rare earths tonnes per year train

written by | July 9, 2023

MP Materials Corp. (NYSE: MP) emerged from the Chapter 11 of Molycorp and is the only producing rare earths mine in the USA. At one time the in the 1990s it was producing upwards of 40% of the world's rare earths. MP has a current market cap of US$5.6 billion, which puts it slightly ahead of Lynas Rare Earths Ltd. (ASX: LYC), which is the biggest producer of separated rare earths outside of China. Combined their market caps exceed the annual revenue of separated rare earths globally.

MP has made some interesting news this year. Q1 revenues of US$166.3 million which is 50% of their revenues from all of 2021. This is due to the high pricing of Neodymium (Nd) and Praseodymium (Pr) in Q1 of this year. Based on Roskill's report of 2015, MP's content of NdPr is 16.3% of the total volume. This may vary a little but it is likely to be the two elements that

set the pricing for their concentrate as the balance of the materials are of little value. Looking at a basket price, NdPr will account for 93-94% of the total value, assuming all elements were sold which is doubtful as the Chinese have lots of the remaining elements, especially Cerium and Lanthanum. Gross margins in Q1 2022 were 88%, up from 81% in 2021, but I expect this will fall for the balance of the year as NdPr prices are now 20-25% lower than Q1 peaks. Either way, MP is poised to improve its Net Income to US$168.4 million. MP has done a good job in their sales price to China for their concentrate. I calculate they are getting somewhere in the range of 40-50% of market value, which is high versus traditional pricing for concentrate which I have seen at 25-30%.

In April a definitive supply agreement was announced between MP Materials and GM to supply rare earth alloy and magnets for GM's EV program. This is significant as it would restore NdPr rare earth metal, alloy and magnet production. The USA does produce Samarium Cobalt magnets but these are typically used in military applications. There is no indication on what technology will be used to produce the metal, which in China is a messy process. Planned capacity is 1,000 metric tonnes of NdFeB magnets. This will require 280-300 tonnes of NdPr. The previous Molycorp plant was designed to produce 20,000 tonnes of REO of which NdPr would account for over 3,000 tonnes.

This does leave the question as to where MP will sell the remaining NdPr. Europe has one metal/alloy producer and one magnet producer, and Japan is the other logical market, but Lynas owns 80% of the Japanese market and has a shorter supply line. What is left is China. Also to supply other US car producers MP would have to expand capacity, and it is not clear what limits or exclusivity GM has with MP Materials.

The challenge is that the original plant was designed as a

single train of 20,000 tonnes per year. Nowhere in China is there a single train much larger than 5,000 tonnes per year (TPY). Lynas built four 5,500 TPY trains. This allows flexibility should there be issues like reduced demand during COVID where one or two trains can be shutdown to allow matching with demand, or if one train has operational issues. I would expect that MP, with the input from Shenghe Resources (a related party of MP whose ultimate parent is Shenghe Resources Holding Co., Ltd., a rare earth company listed on the Shanghai Stock Exchange, and as of its March 31, 2022 quarterly report, a buyer of MP's rare earth concentrate that accounted for more than 90% of MP's product sales), will reconfigure the plant to be more flexible. Also MP, like anyone else, will not go from zero to 20,000 TPY overnight. There will be a qualification process and time to acquire accounts so multiple trains makes sense as one penetrates a market as they can be brought on as the business grows.

The other news was that the US Department of Defense (DOD) granted MP $35 million to build a heavy rare earths at Mountain Pass. I find this interesting as Mt. Pass has 98.6% of its content in light rare earths. This would mean at a run rate of 20,000 TPY the total output of the heavy rare earths would be 280 TPY. The only real valuable heavy rare earths are Terbium (Tb) and Dysprosium (Dy) which would total about 10 TPY combined. At today's pricing, which for Tb is high, in my opinion, this plant would generate revenues of $10-11 million per year.

Overall MP has been doing well – selling concentrate to China. What will happen to profits as they move downstream only time will tell.