Search Minerals expands their rare earths discovery with critical materials' zirconium and hafnium

As the West looks to establish a non-Chinese source of supply of critical rare earth elements, one Canadian company has been successfully expanding its rare earths project, as well as discovering some additional valuable metals like zirconium (Zr) and hafnium (Hf).

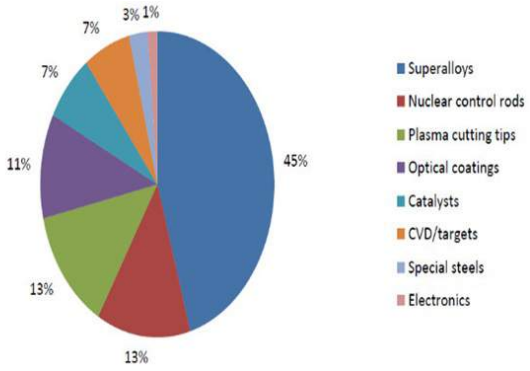
Zirconium dioxide (ZrO_2) is used in laboratory crucibles, metallurgical furnaces, as a refractory material, and in ceramics (including use in dental ceramics); because it is mechanically strong and flexible. Zircon ($ZrSiO_4$) and the cubic zirconia (ZrO_2) are cut into gemstones for use in jewelry. Ceria-zirconia is widely used as a component in current three-way catalytic converters.

Zirconium is used in ceramics, jewelry, dentistry, and catalytic converters

Hafnium is a good absorber of neutrons and is used to make control rods, such as those found in nuclear power plants and submarines.

Hafnium is used in some superalloys for special applications such as jet engine turbines in combination with niobium, titanium, or tungsten. Hafnium oxide is used as an electrical insulator in microchips, filaments and electrodes.

Hafnium is used in superalloys, nuclear rods in nuclear submarines, microchips, and jet engine turbines



Search Minerals discovers zirconium and hafnium

Search Minerals Inc. (TSXV: SMY) recently announced that they have discovered zirconium and hafnium, in addition to their existing valuable rare earths dysprosium (Dy), neodymium (Nd), praseodymium (Pr), terbium (Tb) and yttrium (Y). The discovery was made at their Silver Fox Deposit.

With regards to the Silver Fox discovery Search Minerals stated: “This surface expression is significantly longer, but thinner, than the surface expressions of the nearby and related **FOXTROT** and **DEEP FOX** Resources. The mineralization is similarly hosted by peralkaline volcanic rocks and contains slightly lower grades of the REE magnet materials (Nd, Pr, Tb and Dy) but significantly higher grades of Zr and Hf.”

Dr. David Dreisinger commented: “The objective of metallurgical testing of the **SILVER FOX** (and other deposits) will be to recover a high grade zirconium by-product for sale with minimal processing cost and complexity. Search is engaged with our technology advisor, SGS Canada, to identify process flowsheet options.”

Search Minerals expands the mineralized zone at Fox Meadow

Search Minerals also recently announced that they have successfully expanded the critical rare earth element mineralized zone at Fox Meadow. The Company stated:"The trenching/channelling programs at **FOX MEADOW** have outlined a mineralized zone of up to 123.6 m wide and at least 500m in strike length; mapping and airborne magnetic anomalies suggest that the zone is up to 650m long. In contrast, both the **DEEP FOX** and **FOXTROT** mineralized resources are about 350-450m long and up to 40m thick."

About Search Minerals

Search is focused on finding and developing critical rare earth element mineral assets in Labrador, Canada. The Company controls properties in three distinct areas of this region; the Port Hope Simpson (PHS) Critical Rare Earth Element District in SE Labrador; the Henley Harbour Area in Southern Labrador; and the Red Wine Complex located in Central Labrador.

Within the Port Hope Simpson District, Search's main discoveries are the Foxtrot Resource, Deep Fox, Fox Meadow, and Silver Fox deposits which contain rare earths including dysprosium (Dy), neodymium (Nd), praseodymium (Pr), terbium (Tb) and yttrium (Y).

The flagship Foxtrot Resource covers a 70 km long and 8 km wide belt. At Foxtrot the Total Indicated Resource is 7.392 million tonnes with grades of neodymium oxide (1,732ppm), neodymium (1,485ppm), praseodymium (397ppm), and dysprosium (191ppm).

The 14 year LOM Foxtrot Project offers an IRR of 16.7% on an after tax NPV10% of $48 million, with a CapEx of $152 million.

Investors should note the NPV quoted above is only for the Foxtrot Project, so once the other projects are combined into

a bigger project the NPV should improve materially.

Closing remarks

Search Minerals is both expanding their existing very promising rare earths project as well as finding other valuable metals zirconium and hafnium. Investors will need some patience, as more exploration work needs to be done to further grow the resource and improve on the economics.

Combined with an excellent management team, and strong Government and local support, the Company continues to advance their Port Hope Simpson District project at a steady pace. Rare earths expert Jack Lifton recently stated about Search Minerals: “I think it may well be Canada’s first commercial rare earth producer.”

With a market cap of just C$9 million there is plenty of potential upside ahead for investors if Jack is right.

NioCorp’s critical materials project achieves another milestone at Elk Creek Nebraska

Niobium is used to produce superalloys as well as high strength, low alloy steel, which is used in automotive, structural, and pipeline applications. Scandium is a superalloy material that can be combined with aluminum to make alloys with increased strength and improved corrosion resistance. Titanium is used in various superalloys and is a

key component used for aerospace applications, armor and medical implants.

NioCorp Developments Ltd. (TSX: NB | OTCQX: NIOBF) is developing North America's only niobium, scandium, and titanium project at their 100% owned Elk Creek Project.

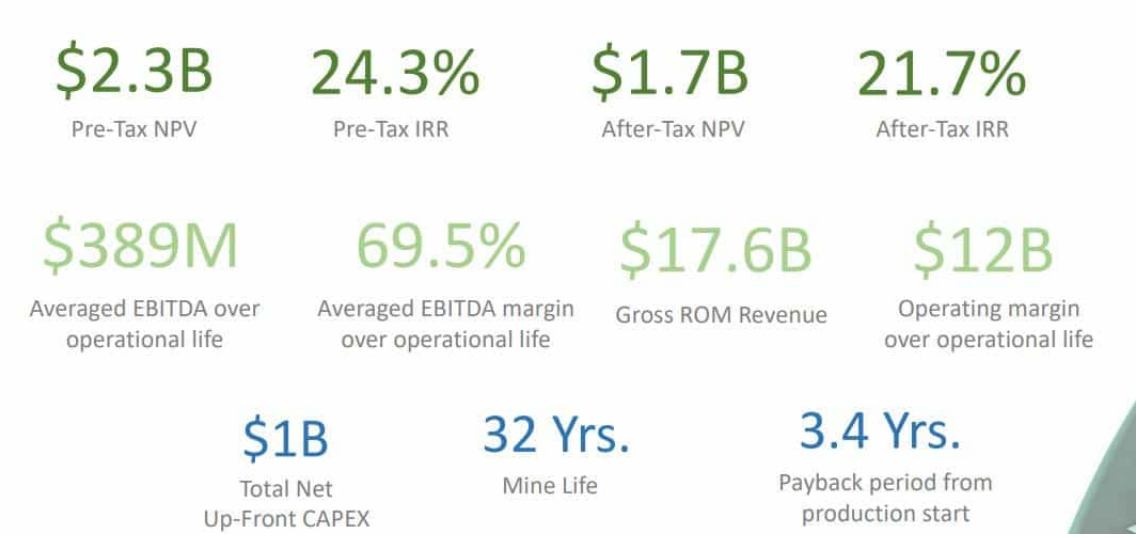
Elk Creek Project

Located near Elk Creek, Nebraska, USA, the Elk Creek Project is the highest grade niobium project in North America, as well as the largest prospective producer of scandium in the world. These elements are unique and valuable superalloy materials that are strategic and critical to many industries and national defense technologies.

Elk Creek's 2017 revised Feasibility Study resulted in an after-tax NPV of US$1.7 billion, with an after-tax IRR of 21.7%. The project has a 32-year mine life with a 3.4 year pre-tax payback period from onset of production, with gross revenue of US$17.6 billion over the mine's operating life. Total net upfront CapEx was estimated at US$1b. The Elk Creek project is a large resource with long term potential with probable reserves of 31.7 million tonnes of ore at 0.79% niobium (Nb2O5), 71.6 grams per tonne (g/t) scandium (Sc), and 2.81% titanium dioxide TiO2. Indicated mineral resources are 90.9 million tonnes at 0.66% Nb2O5, 70 g/t Sc, and 2.59% TiO2 with an inferred mineral resource of 133.6 million tonnes at

0.48% Nb2O5, 59 g/t Sc, and 2.23% TiO2. The project's deposit is open in three directions, to the northwest, southeast, and at depth.

NioCorp is hoping to begin producing superalloy metals by 2021.



Feasibility Study highlights

Elk Creek is a de-risked project having 75% of its primary product ferroniobium, already under contract for the first 10 years of production. The project is located on private land with extensive nearby infrastructure (roads, rail, water, and utilities). The U.S. Government have declared all three superalloy metals from the Elm Creek Project as "critical minerals", as all three have key uses in national defense and civilian technologies.

NioCorp Developments Ltd. recently announced (August 27, 2018) a new proposed design by the Nordmin Group of companies for the underground portion of its Elk Creek Project. The new mine design confirms the technical feasibility of several innovative approaches to mining Elk Creek's critical minerals which could further streamline the process of moving the project to initial construction.

Mark A. Smith, CEO and Executive Chairman of NioCorp, said:

“Completing this phase of the design engineering for the Elk Creek underground mine marks a major milestone for the project. I was especially pleased to see that Nordmin clearly focused its efforts on proposing a mine design that maximizes value and minimizes environmental impacts. As a result, this design approach should result in a significant reduction in the government permits that the Elk Creek Project will need to secure while also potentially improving key aspects of the project.”

Mine design recommendations are now being analysed. If approved, they will then be integrated into the Elk Creek Project plan and overall impacts to the economics of the project can be assessed. The Elk Creek Project has already secured all ‘major’ federal permits required.

Addressable markets

All three of the Company’s products (niobium, scandium, and titanium) have targeted applications in clean energy, aerospace/commercial aviation, defense, automotive, and more. This should make NioCorp “critical” to US needs for years to come.

NioCorp Developments Ltd. is headquartered in Tecumseh, Nebraska, USA; and has a market cap of US$ 94.4 m.

The dawn of a niobium and scandium renaissance

Humanity’s dependable need for progress has long motivated engineers to improve commonly used materials, and metallic alloys are no exception. The pressure to reduce emissions and increase efficiency could create a renaissance of sorts for two of the least mined elements on Earth.

One of our subjects, scandium, can be used to lighten aircraft by up to 20%, but difficulties relating to its extraction keep current consumption to a minimum. Similarly, niobium is a prime candidate for decreasing material weights, but economical deposits are so rare that only three primary producers of niobium exist globally, none of which are in the US, and zero new niobium mines have come online since the 1970s.

The evidence currently suggests that uptake would be vastly higher if the supply side was able to provide the necessary goods, since the monetary and ecological savings of lightening large metallic bodies are obvious. This is borne out by the fact that NioCorp Developments Ltd. (TSX: NB | OTCQX: NIOBF) (“NioCorp”) has already shifted 75% of its ferroniobium product-to-be in the form of offtake agreements with two major metallurgical companies.

The material will come from the company’s Elk Creek deposit in Nebraska which, already being in possession of a full feasibility study, is on the brink of construction. In fact,

the CEO of NioCorp recently ploughed another $180,000 of his own money into the development of the project; confidence is high all round.

The study reveals that Elk Creek is expected to produce 7,055 tonnes per annum (tpa) of ferroniobium, 103 tpa of scandium trioxide, as well as 11,445 tpa of titanium dioxide over its 32-year operating life. Given that the current scandium market is only good for around 15 tpa, these are indeed some ambitious numbers, but they are supported by the fact that new patents involving scandium applications have increased dramatically in recent years in anticipation of the cost savings. And besides, it would only take a tiny fraction (0.1 percent) of the annual aluminum market to reasonably create around 350 tonnes of annual global scandium demand. The NI 43-101 compliant report also states that the resource could attract a total lifetime revenue of $17.6 billion, so anyone interested in helping to fund this project should be amply rewarded.

Numerous new applications for scandium have been identified and are under research; most notably high intensity stadium lighting, high voltage power transmission and 3D printing could all benefit massively from increased scandium supply.

The need for these materials is clearly strong, but the United States currently produces neither. The state military applications alone could give rise to billions of dollars worth of offtake if scandium and niobium alloys were applied to their fullest potential, and the resulting fuel savings could have a positive environmental impact of colossal proportions. The pursuit of lighter metals is therefore not simply a cold economics game to benefit shareholders, but an all-round-good-for-everyone affair.

The USA’s commitment to construction in the near-future creates an opportunity to employ more superalloys in pipelines, rail networks, buildings, aircraft and many other

areas. Despite the low production rates of these elements, there really is no shortage of applications for lighter metals, and this is why Elk Creek appeals to me so strongly; it exists in a complete vacuum.

Upon the launch of the project, the USA should not only receive significant tax revenue (just over $27 million each year), but become one of the world's top suppliers of superalloys. Materials scientists will always strive to improve products wherever possible, and I fully expect this pressure to manifest as a bolstered superalloys market over the next decade.

MDN poised to take advantage of higher than expected niobium demand

MDN Inc. ('MDN', TSX: MDN) is one of the very few North American companies targeting niobium production. Last August, MDN started exploration at its 100% owned Samaqua property, in the Saguenay-Lac-St-Jean area of Quebec, due to its physical proximity to the Crevier niobium and tantalum project (72.5% owned by MDN and 27.5% by Niobec Inc., a subsidiary of Iamgold Corp.). Niobium, formerly known as columbium, is not technically a rare metal, as its atomic number falls outside the boundaries of the lanthanides; however, it is rare and most of it (over 80%) is mined in Brazil. Canada also has significant niobium deposits and Iamgold, thanks to its Niobec mine, is the second largest producer in the world, accounting for 9% of global supply and MDN has an opportunity to become a leading company in the

sector. Last December, MDN announced that it has a high intensity magnetic survey has revealed the presence of several niobium targets at Samaqua. MDN will proceed with drilling activities on the site, pending the necessary permits, while service providers are preparing to start work. The start of drilling, encompassing some 1,500 meters, is expected to start this very January.

Niobium is a metal essential for Europe and the United States and has never been produced in these countries over the last 30 years. It is also essential to China, which has become the largest consumer of niobium in the world, because of the booming infrastructure activity and construction improvements leading to better quality steel. The most recent earthquakes, leaving dramatic loss of life and damage, have highlighted the consequences of the use of inferior construction materials and even a small amount of niobium (0.1%) adds greatly to the quality of any steel alloy. Yet, even as China needs more niobium, unlike the rare earths or graphite, zinc and iron ore, it cannot not produce even a gram of niobium. But it’s not just the Chinese; Japanese and Koreans have joined China in securing exclusive supply contracts with Brazil’s CBMM (Companhia Brasileira de Metalurgia and Mineração, the world’s largest producer of niobium) amounting to 85% of all global supplies. What is most shocking is that Western companies were left completely cut off from the contract negotiations. Clearly more niobium sources must be found and developed and MDN is poised to take advantage from the great demand.

MDN is expected to undertake a feasibility study during the second quarter of 2015 to be followed by a fundraising to the tune of at least CAD$ 300 million, ultimately leading to the construction of a niobium and tantalum processing plant. The Project is some time away from production but there is reason for optimism considering that the property is host to some of the highest quality niobium and tantalum deposits in the world. This suggests that project economics are favorable,

given that the high value potential of the ore is increasingly high. Tantalum and niobium are among the most strategic metals because they are considered essential metals for the high-tech industry as well as the aerospace sector. Niobium is mainly used in steel alloys to create high strength low alloy steels (called “High Strength Low Alloy Steels”), stainless steel and heat resistant steels.

Niobium’s properties have generated considerable demand from advanced industrial sectors because it helps increase steel’s resistance to high temperatures, corrosion while raising superconductivity. Niobium has, therefore, become essential in the automotive industry, heavy engineering and infrastructure (i.e. bridge construction and earthquake resistant buildings), the petrochemical industry, power plants and oil & gas pipelines. Niobium is also an ideal metal for space exploration craft because of its high resistance to heat, making it ideal for use in rocket engines. A smaller percentage of high grade niobium is used exclusively to make superalloys used for the manufacture of aircraft engines. MDN will likely be on the lookout for strategic partners to help raise funding; to this end, the Government of Quebec has sent favorable signals, encouraging mining projects in the Province.

As for the niobium market itself in Canada, last August, Iamgold said that niobium demand was higher than expected in the first half of 2014, prompting it to increase its production forecast for the full year from 4.7-5.1 million to 5.2-5.5 million kilograms of the metal (while its gold output dropped). This suggests that MDN Mines will control a very high demand mineral, whose demand is increasing and whose global competition has been hampered by geopolitical risk. Brazil enjoys an overly dominant – one might say hegemonic – position over niobium. Given that the European Union and the United States consider niobium to be a critical metal, they are both interested in reducing reliance on Brazil and

identifying new sources closer to home. The limited supply and number of plays – and the long supply routes – simply adds too much pressure on prices while CBMM is the only niobium producer that is able to deliver all the varieties, including the highest grades. Therefore, MDN’s new niobium venture will be welcomed by the market.