

Avalon's lithium project moves to center stage

Avalon Advanced Materials Inc. (TSX: AVL | OTCQX: AVLNF) is something prismatic as, if one looks at it from different angles at different times, one sees different things. Management cannot be accused of not being nimble, neither can they be accused of short-termism. The company's main three targets it has had since last decade or before with the three *foci* being long-terms cultivars of the company, Nechalacho in the REE space, East Kemptville in the Tin space and Separation Rapids in the Lithium space.

When the latter project was just a twinkle in Avalon's eye late last century (sounds a long time ago!) the goal was the mining of Petalite as Lithium ion batteries were around but were not moving the needle in investors' Moodometers. Now the sex has been put into the Lithium equation it is timely for Avalon to breathe life into a project that had migrated to the backburner. The action here has been intense since last year and the project is now centre-stage at Avalon so we shall give it a look here and see what has been going on.

Petalite

Petalite is the preferred lithium mineral feedstock for certain specialty glass-ceramic products. Petalite is preferred over other lithium alternatives in glass-ceramic products for technical reasons, notably its consistently low impurity levels.

The petalite found at the Separation Rapids deposit contains very low levels of impurities, also offering potential for a high purity lithium chemical product at a relatively low-cost, to serve the needs of lithium ion re-chargeable battery manufacturers. A PEA was completed in September 2016,

confirming a technically viable process and that the recovery of a battery-grade lithium hydroxide product from Separation Rapids' petalite was a viable option.

Separation Rapids

The Separation Rapids deposit is one of the largest "complex-type" lithium-cesium-tantalum pegmatite deposits in the world, unusual in its enrichment in the rare, high-purity Lithium mineral petalite.

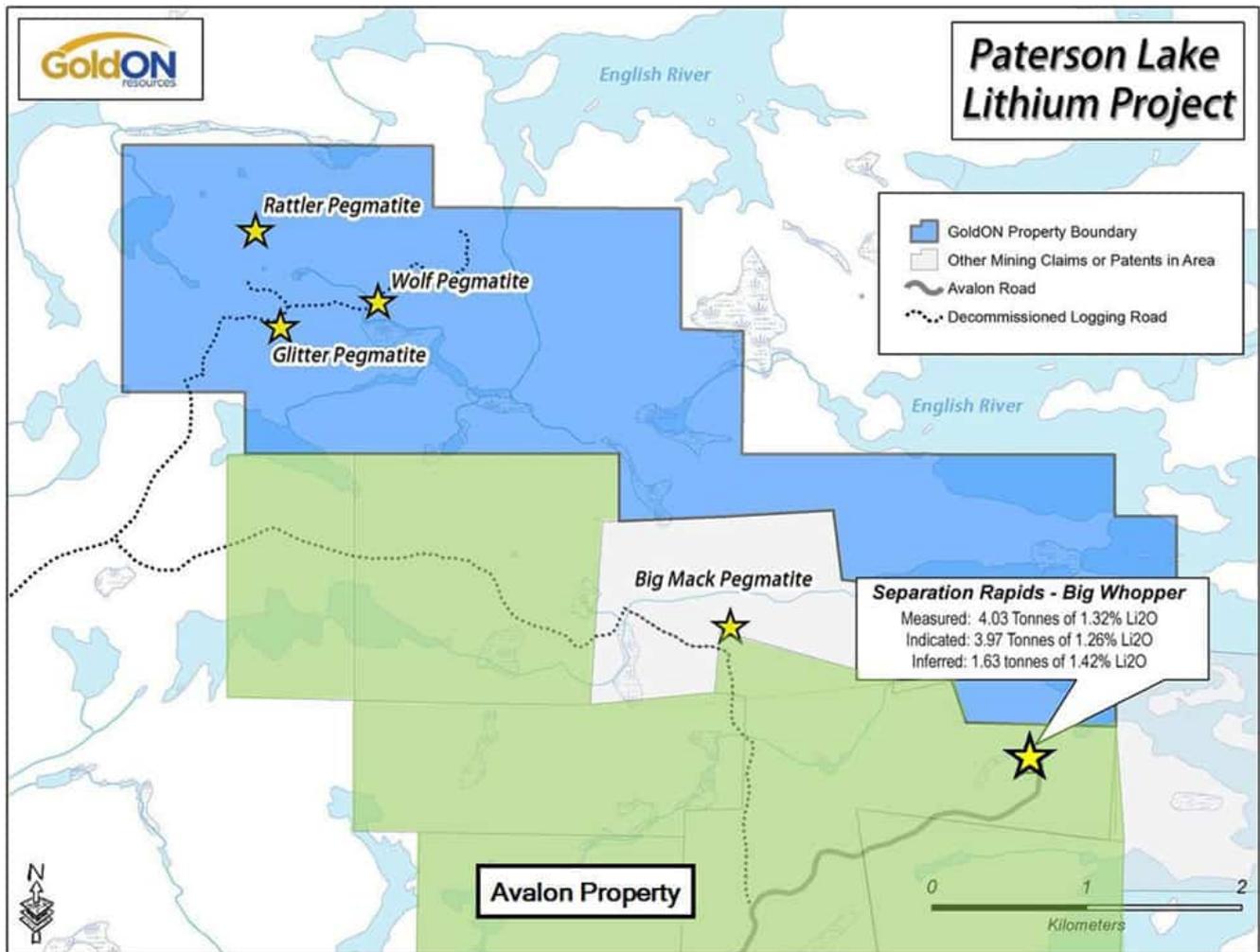
The 100%-owned Separation Rapids property is situated approximately 70 km by road north of Kenora, Ontario. The property consists of 15 Mineral Claims and one Mining Lease covering approximately 2,421 hectares. Tenure for the mineral resource is held under a 421 hectare, 21-year Mining Lease. Avalon also added three claims to the property covering 28 units (448 hectares), covering a corridor over the property access road.

Since acquiring the property in 1996, Avalon has expended approximately CAD\$10mn on exploration and development work. Initial exploration work conducted in 1997-2001 included geological mapping, trenching, ground magnetic surveys, mineralogical studies and diamond drilling totalling 10,152 m in 69 holes. Subsequent work focused on tantalum potential and other potential industrial mineral products.



Early exploration work culminated in 1999 with the completion of a comprehensive Pre-Feasibility Study on the viability of producing petalite with by-product feldspars, by independent consultant Micon International Inc.

Back in March 2017 Avalon announced it had closed a transaction with GoldON Resources Ltd. to acquire a 100% interest in the seven-claim, 1,008 hectare, Paterson Lake property (shown in blue above) located adjacent to the north and west of the Separation Rapids Lithium Project.



The Paterson Lake claims host three known lithium pegmatite occurrences known as the Glitter, Wolf and Rattler, along with a number of other, smaller, under-explored lithium – tantalum – rubidium – tin bearing pegmatites. These have never been drilled. These lithium pegmatite occurrences are between 5 and 6 kilometres away on trend with the Separation Rapids deposit along with a number of other, smaller less explored pegmatite occurrences. One of these, called the Glitter pegmatite, according to the Ontario Geological Survey, contains both petalite and lepidolite, has yielded assays of between 1.03 and 1.64% Li₂O over five successive 1m samples.

The Resource

At Separation Rapids the Measured and Indicated Mineral Resources are eight million tonnes averaging 1.29% lithium oxide and 39% feldspar. The Inferred Mineral Resources

contribute an additional 1.63 million tonnes at 1.42% lithium oxide and 39% feldspar to a maximum vertical depth of 260 metres. The deposit is open to depth and along strike.

The PEA

In September 2016 the results of Preliminary Economic Assessment on project were announced. The goal here was to investigate the potential for recovery of a lithium product suitable for the battery market. The results confirmed a technically viable process for the recovery of a battery-grade lithium hydroxide product.

The PEA development concept includes an open-pit mine, with milling onsite to produce a lithium mineral concentrate and by-product feldspar. The lithium mineral concentrate would then be processed in a hydrometallurgical plant (presently contemplated for Kenora) to produce lithium hydroxide for the battery industry or sold directly into the ceramics industry.

The metrics of the mooted operation were:

- 10 year mine life
- An average mining rate of 950,000 tonnes per year would yield an average annual production of 14,600 tonnes of lithium hydroxide for 10 years and 100,000 tonnes per year of feldspar mineral concentrate for 20 years (recovered from previously processed material for an additional 10 years)
- IRR of 19% on a pre-tax basis and a 16% IRR on an after-tax basis, assuming 100% equity financing.
- NPV at an 8% discount rate is CAD\$343 million pre-tax and CAD\$228 million after-tax.
- Total capital cost of \$514mn, inclusive of \$86 million in contingencies and \$7 million in sustaining capital
- Average lithium hydroxide price assumption of US\$11,000/tonne and the CAD:USD exchange rate assumption was US\$1.00 = CDN\$1.30.

Next Steps

The company is planning a follow-up drilling program in the second half of 2017 to continue testing the depth extension of the known resource. The deepest intersection to date in Hole SR98-57 encountered 1.47% Li₂O over a true width of 31.7m at a depth of 180m to 270m. As a result a minimum of 2,000m in five deeper holes is currently planned, subject to financing.

In addition, a summer geological mapping, prospecting and sampling program has been carried out to begin evaluation of numerous other known lithium pegmatite occurrences on the western part of the property. This will include the new Paterson Lake claims.

Conclusion

As we have noted in these pages recently Lithium is “taking a breather”... indeed it’s been holding its breath for almost a year now. The underlying dynamic, if anything, gets better and yet the Lithium stocks are almost universally still wallowing in misery as the market tries to work out who is real and who is just following the fad. With Avalon having been involved in this project since the 1990s one could not accuse of Avalon of that.

The dilemma now is the size of the capex. This is still in the upper quartile of Lithium projects and financing just isn’t easy these days. That situation can turn on a dime though if an amenable offtaker walks in the door with a large chequebook and determination to see a project through to production. In the short term it would be good to see some scaled down production scenarios or at least a phased onset of production.

Most of the crop of 2016 Lithium wannabes don’t even have drilling results let alone a PEA or PFS so Avalon has set itself in a category apart. Now the task is to find a partner that might make this one of the few from this latest “go

around” to move to the higher plane of actually having output of Lithium for a burgeoning marketplace.

The Beryllium Advantage: Texas Rare Earth Resources and/or a Materion Junior?

Some months ago I wrote an article on Beryllium, a subject I had not previously had much exposure to. In fact, like the famous Victor Kiam, I liked the product so much I bought the company Materion (NYSE: MTRN)... or rather a few shares and then when they soared I sold them. However, what I was left with, besides a monetary gain, was a fascination with the metal which is the only one in which the US has a total dominance of and the company that controls all that dominance. Such is that dominance that the market values the company at \$764mn at the current time.

In 2014, I also wrote a few times about Texas Rare Earth Resources Corp. (OTCQX: TRER). The startling thing to me was that its Round Top asset had originally started out at a Beryllium prospect, with first Cabot Corp. and then Cyprus Mining doing the exploration work, and then crafting a mine plan in the late 1980s. In coming back to revisit the story recently I would note that TRER have moved forward with building their management team and the technology for the REE business, but that the investing public have largely overlooked the potential of TRER to become what one might call a Materion Junior. The two ways that this might happen are either by building the Beryllium vertical organically themselves or by dressing themselves (or that part of Round

Top that is Be-rich) as a target for Materion or someone else. Materion faces the danger that if it does not have another project up its sleeve then it may go from being one day a rooster, next day a feather duster.

We thought it might be useful to revisit Round Top and its vicinity to see what might be done to cultivate the Beryllium angle while moving the REE-side forward simultaneously.

The Round Top Back-Story

The first records of exploration in Sierra Blanca date back to the 1970s when W.N. McNulty initiated trenching and limited drilling of fluorite deposits in the vicinity of TRER's project. The prospector identified beryllium mineralization associated with the massive fluorite. Adverse economic conditions for fluorite precluded development. In the 1970s, several uranium companies identified anomalous radiation and associated mineralization associated with the beryllium-fluorite deposit.

During the 1980s, Cabot Corporation, the major specialty chemicals company with a beryllium fabrication division, initiated exploration at Round Top for beryllium. In 1987, Cyprus Metals entered into a joint venture with Cabot and took over the project. The Cyprus exploration program drilled Sierra Blanca, Round Top and Little Round Top. The resources it identified consisted of:

✘ Eventually, Cyprus focused on the Round Top Project, specifically the "west end ore zone". Extensive development drilling (82,000 feet), underground exploration drift (1,115 feet) and trial mining resulted in the completion of a feasibility study in June 1988.

During the Cabot-Cyprus development project, the Texas Bureau of Economic Geology conducted extensive research at Round Top and the surrounding area. The study identified beryllium

mineralization and REE mineralization in the rhyolite.

Beryllium – A Brief Recap

Beryllium (Be) is a relatively rare element in both the universe and in the crust of the Earth. As a free element it is a steel-gray, strong, lightweight and brittle alkaline earth metal.

Beryllium increases hardness and resistance to corrosion when alloyed with aluminium, cobalt, copper (notably beryllium copper), iron and nickel. In structural applications, high flexural rigidity, thermal stability, thermal conductivity and low density make beryllium a vital aerospace material for high-speed aircraft, missiles, spacecraft, and communication satellites. Because of its low density and atomic mass, beryllium is relatively transparent to X-rays and other forms of ionizing radiation; therefore, it is the most common window material for X-ray equipment and in particle physics experiments. The high thermal conductivities of beryllium and beryllium oxide have led to their use in heat transport and heat sinking applications.

Who Makes It?

As mentioned earlier, the United States is the world's leading source of beryllium. The Spor Mountain mine in Utah (owned by Materion) produced more than 85% of the 230 tpa of beryllium mined worldwide. It is thought that Materion mines 1% BeO ore at Spor Mountain (and reports 75 years of reserves at current mining rate). China produced most of the remainder, and less than 2% came from Mozambique and other countries.

National stockpiles also provide significant amounts of beryllium for processing. Three countries (China, Kazakhstan, and the United States) process beryllium ore. In 2005, the U.S. Department of Defense began a partnership with Materion to build a new processing facility in Ohio to produce high-purity beryllium metal. The processing facility was completed

in 2011, and up to two-thirds of its output was to be allocated for defense and other government-related end uses. The United States imported approximately 34% of the beryllium raw materials it used in 2011, including beryllium metal and other processed beryllium materials used in manufacturing; two-thirds of this material came from Russia and Kazakhstan. This is clearly a less than ideal situation and makes a potential captive market for Be output from Round Top and gives the project national strategic importance.

Total world reserves of beryllium ore are estimated to be greater than 400,000 tonnes.

Pricing is usually set between the mine and the production facility based on the usual factors of supply and demand. Increased demand led to increasing prices for beryllium over the last decade. Based on the beryllium content in imported beryllium-copper master alloy, an alloy for which there is a reliable reported price, the USGS estimated the average annual price per pound of contained beryllium was US\$230 per pound in 2010, up from US\$154 in 2009. The metal is reputedly trading currently on the Shanghai Metals Exchange at \$374,000 per tonne.

The Beryllium at Round Top

The current situation at Round Top is the efforts of Cabot and Cyprus left not only a data-set on the deposit but also physical infrastructure in the form of a “starter mine” (still usable and pictured below) consisting of a 867 ft long, 10ft x 10ft decline with vent fan & services in place.

 Recently I waded through the Cyprus mine plan dating from 1988, which is still in the possession of TRER. In this iteration (Round Top only, the previous resource was three sites) the Round Top deposit represents a high grade mineralization – 298,000 tons at 1.9% BeO (non NI43-101 compliant) of contained Be of 11mn lbs.

The latest PEA from TRER envisages 36 tpa of BeO production. This would represent 7.4% of global production. This would be as a REE by-product.

When Cyprus did the work at Round Top the environment in which it was working was one in which the Brush-Wellman company (now Materion) had dominated US (and indeed international) supplies of Beryllium for decades. The report was written on the back of a perception that the owners of Round Top had gained from the marketplace that end-users very much wanted to see an alternative to Brush Wellman in the space. In fact, who wouldn't want to have some price competition in such a tightly supplied metal? However thinking about it, it's now some 27 years later and there is still not an alternative supply to Materion. Going back to the mine plan of those days, it is interesting to note that Cyprus felt that it would have a cost advantage at Round Top over production by Materion.

The metrics of the proposed operation by Cyprus were:

- One million llbs per annum of Be output
- Capex of \$15.8mn (remember this is 1988 dollars)
- Opex was \$236 per ton or \$6.71 per lb

In light of global consumption of the metal and to not upset the market it would be better to use a smaller production number and interestingly they also gave a scaled down version (showing it was NOT Canadians doing it!). In the 300,000 llbs per annum version the capex was \$12.6mn. Opex in this scenario was understandably higher because of lower economies of scale. These were \$371 per ton or \$9.59 per lb. Once again, it's 1988 dollars.

Using an inflation calculator, the 1988 capex becomes \$25.21mn while production cost of \$9.59 becomes \$19.19 per lb.

Conclusion

Let's do a simple (or simplistic) equation for the USGS says

that Materion had in 2011, some 33.5mn lbs of in situ Beryllium resources while Cabot had calculated 25mn lbs across three deposits and Cyprus had calculated 11mn at Round Top alone. While conceding that Materion had the value added chain and TRER as yet does not have any of that infrastructure we might also note that Round Top has a much higher grade. So if Materion is worth over \$700mn in the market's eyes then what is TRER's Beryllium potential worth?

We would humbly argue that not only is TRER a fascinating REE opportunity but that it is also has the potential to be a scaled down, souped-up Materion Junior.