An Emerging Canadian Producer of Technology Metals: Lithium

June 2020
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President & CEO
Safe Harbour Statement

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Avalon Advanced Materials: Corporate Info

› Toronto-based, operating in Canada since 1995
› Listed: TSX (AVL), OTCQB (AVLNF), Frankfurt (OU5)
› Market Cap: CAD$15m (341m S/O, 374m fully-diluted) with over 20,000 shareholders worldwide
› Working Capital: CAD $1.2 million

**Sustainability: committed to environmentally and socially responsible mineral resource development**

› Avalon’s 8th annual GRI compliant Sustainability Report released November 2019 - addresses GRI framework, UN 17SDGs and MAC’s TSM
› Aligns Avalon’s operating philosophy with its cleantech customers and reduces social licence risk
› Attracting interest from growing Impact/ESG investment community
Avalon is a leader in the implementation of sustainability in mineral development

› Focused on the supply of the critical materials that enable clean technology, such as:
  • renewable energy (tin, indium, REE)
  • energy storage (lithium, tin)
  • electric vehicle motors (REE)
  • space technology, drilling fluids (cesium)
› Excellent track record for Indigenous community engagement and project participation
› Sustainability principles fully integrated into corporate culture at all levels
› Project development philosophy: staged approach to minimize environmental footprint and reduce risk
› Management team well-experienced in social, environmental best practice and health and safety
Lithium Demand forecast to 2040

Source: Benchmark Minerals Lithium Forecast 2020
Lithium Demand by Application (2019):
Batteries dominate with demand growing rapidly, but ceramics and glass and ceramics remain major markets that are also growing.

Source: Roskill
Advanced Ceramics Industry (US)

IBIS World, April 2020

- Ceramics Industry Revenue: $2.6 billion; advanced ceramics products account for 37% of total industry revenues
  - IBISWorld expects industry revenue to increase at an annualized rate of 1.5% to $2.8 billion by 2025
- Ceramics are one of three broad classes of materials used to produce almost every product available today (with metals and polymers)
- No viable substitutes for applications that require semi-conductive properties or resistance to extreme heat, corrosion
- Advanced ceramic components vital in aerospace, electronic and defence technology products
- Increased demand expected to be supported by high-tech and innovative markets, such as semi-conductor and circuit manufacturing
  - CoorsTek Inc. plans to build a $120m R&D facility for advanced ceramics, other companies expected to follow
Lithium is not just a battery material: also critical for high strength glass-ceramic products

Glass-Ceramics

› Lithium additions create thermal shock resistance in: Stovetops, Corningware® Cookware, Fireplace Shields

› Now being used in many new high strength glass products, such as Corning’s Gorilla Glass (display screens and automotive) and high strength flexible glass

› Glass-ceramic products are also being used in advanced aerospace and defense technologies (hermetic seals)

› Petalite, as a very high purity lithium aluminum silicate mineral, is the ideal form of lithium addition to the batch
  • Petalite is a very rare mineral and Separation Rapids is the only potential large supply source in North America

› Lithium additions can also strengthen traditional container glass formulations to extend the life of the container
Separation Rapids Lithium
A large LCT type of pegmatite deposit enriched in the lithium minerals petalite and lepidolite with at least 10 million tonnes of resources

- Large, high quality resource amenable to open pit mining, discovered in 1996
  - PFS initially completed in 1999 on model to produce petalite for glass and ceramics, model updated in 2018 as a PEA
  - Secure Tenure under Lease: 100% owned
  - 6,000 acres of exploration lands
  - Road access, proximity to clean hydro-power allow low carbon intensity
  - Strong community support: will diversify local economy and create jobs
  - No acid mine drainage or toxic heavy metals in the deposit

Discovery outcrop after clearing for mapping in 1998
First Nations Relationships: Separation Rapids Lithium Project

2013: Renewed MOU with Wabaseemoong Independent Nations (WIN) first signed in 1999

Committed to maximizing business & partnership opportunities for WIN during operations and post closure

WIN leadership are supportive of the Project

Community members continue to have active involvement

Original MOU signing in 1999
Separation Rapids is located close to transportation and power infrastructure.
Separation Rapids Mineral Tenure and Regional targets

Regional trend of lithium pegmatites, where exploration commenced in summer 2018 and several new targets developed

Map includes new claims acquired in 2017 to the north and west of existing land holdings

LEGEND
- Mineral Claims
- Mining Lease
- Pegmatite Occurrences

CRITICAL MINERALS FOR A SUSTAINABLE FUTURE
Lithium Minerals at Separation Rapids

- There are two main lithium ore minerals in the Separation Rapids LCT pegmatite: petalite & lepidolite
- Petalite is the predominant lithium mineral, with lepidolite occurring in distinct subzones comprising 20% of the resource
- **Petalite** (Li Al Si$_4$O$_{10}$) typically contains 4.5% Li$_2$O with very low impurities
- **Lepidolite** (K(Li,Al,Rb)$_2$(Al, Si)$_4$O$_{10}$(F, OH)$_2$) is a lithium mica containing other elements
- They can each be concentrated to make saleable products:
  - Petalite can be used both as an industrial mineral for high strength glass and as a high purity feed to make battery grade lithium hydroxide or carbonate
  - Lepidolite concentrates are being used increasingly for production of battery grade lithium carbonate
Separation Rapids 2015-17 Work programs: 
Focused on metallurgical process and product recovery

› Pilot plant produced 1 tonne of high purity petalite concentrate
  • Petalite product quality confirmed for high strength glass
› New hydromet process produced high purity (99.9%) lithium hydroxide product from petalite
  • Confirmed by NRC lab to be suitable for NMC cathodes
  • Filed application for patent protection in 2017
› Positive PEA prepared on petalite resource for 100% lithium hydroxide production scenario
  • Confirmed low production cost <US$5,000/tonne
› Several by-products identified, notably lepidolite concentrate
  • Off-take interest from Australian company Lepidico for lepidolite product
› Drilling to expand resource and map detailed lithium mineralogy
Avalon’s lithium hydroxide product successfully used as lithium ion battery cathode material

› Proprietary two-step hydrometallurgical process:
  • Reduces Green House Gas generation and reagent use
  • Reduces waste produced
  • Reduces environmental risk and lowers productions costs

› Elemental analysis of Avalon’s product by the National Research Council of Canada (NRC) confirmed that it had low levels of metal impurities, within the range reported by commercial suppliers of battery grade lithium hydroxide materials

› Avalon’s lithium hydroxide product successfully used by the NRC in a NMC-type cathode and subsequently used to make a functional lithium ion battery
2017-19 Work program: Drilling and Metallurgical Process Optimization Work

› Added cleaner stage to petalite flowsheet to produce a high grade (>4.5% Li$_2$O) and very low impurity “Super Petalite” concentrate for specialty glass applications
› Produced quantities of petalite for marketing purposes
› Optimized flotation flowsheet to improve recoveries of lepidolite concentrate to over 90% at a grade of 4.5% Li$_2$O
› Now testing using DMS and sensor based ore-sorting as petalite pre-concentration methods to reduce costs
› Drilling in 4 holes to increase resource and prepare updated mineralogy-based resource block model
› Optimizing hydromet process by investigating alternative membrane technologies to improve energy efficiency & reduce costs (ongoing)
Snowbank Petalite Pegmatite Discovery

- Large exposure of a new petalite pegmatite discovery averaging 6 metres wide and traceable for over 100 metres along strike open on both ends.
- Assays of up to 2.51% Li$_2$O over 1.1m in channel (50% of rock is petalite)
- Other preliminary channel sample highlights include:
  - 1.53% Li$_2$O / 2.6m
  - 1.61% Li$_2$O / 2.3m
  - 1.07% Li$_2$O / 2.9m
- Located just 4km NW of Separation Rapids deposit
2018 Updated PEA Highlights

› Simplified business model with initial focus on production of lithium mineral concentrates for glass and ceramics
› Production of 71,500 tpa petalite, 11,800 tpa lepidolite
› Initial CAPEX: C$77.7 million (475,000 tpa mill capacity)
› Feldspar circuit added in Year 6 (C$13.7 million CAPEX)
› 20 year operational life
› Average Annual Revenues: C$90 million
› Average Annual Costs: C$60 million
› NPV pre-tax (8% discount rate): $156 million
› IRR (pre-tax): 27.1%  IRR (post tax): 22.7%

The PEA is preliminary in nature, includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the PEA will be realized.
Separation Rapids Next Steps: Moving toward Phase 1 Production Facility

› **2019 work**: Continued process optimization work and permitting to extract up to 5,000 tonne bulk sample for pilot plant processing

› **2020-21**: $3-5 million program planned to prepare for construction of mine and process plant in 2021 to produce lithium mineral concentrates
  - Bulk sample processing to produce more lithium mineral product samples and finalize process flowsheet and plant design parameters
  - Secure off-take agreements and arrange project financing (in progress)
  - Complete FS-level cost estimates and project engineering
  - Complete environmental assessments and project permitting
  - Investigate sites for lithium battery materials processing facility in NWO for production of lithium hydroxide product

› **2022**: Begin commercial operations with sales of petalite & by-products
# Separation Rapids Lithium Deposit
## Mineral Resources Estimate (May 22, 2018)

### Table: Mineral Resources by Zone

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<tr>
<th></th>
<th>Mt</th>
<th>% Li₂O</th>
<th>% Ta₂O₅</th>
<th>% CsO</th>
<th>% Rb₂O</th>
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<tbody>
<tr>
<td><strong>Petalite Zone (PZ)</strong></td>
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<tr>
<td>Measured</td>
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<tr>
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### Total PZ+LPZ

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<th></th>
<th>Mt</th>
<th>% Li₂O</th>
<th>% Ta₂O₅</th>
<th>% CsO</th>
<th>% Rb₂O</th>
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### Footnotes:
1. This resource estimate is valid as of May 22, 2018.
2. CIM definitions were followed for Mineral Resources.
3. The Qualified Person for this Mineral Resource estimate is William Mercer, PhD, P.Geo. (ON).
4. The resource estimate is based on Avalon’s drilling of 74 previous holes totalling 11,644 metres drilled between 1997 and 2017 and a further four holes totaling 1,282 metres in 2018.
5. Drill data was organized in Maxwell DataShed and for estimation purposes was transferred to Geovia GEMS 6.8 software, wherein the block model was developed.
6. The geological units were modeled as outlined by drill core logs.
7. Resources were estimated by interpolating composites within a block model of 10 x 10 x 3 metre blocks oriented along the deposit strike.
8. Grade interpolation used the Ordinary Kriging method combined with variograms and search ellipses modeled for each rock unit. For PZ unit, search ellipses of 50 x 35 x 15 m and 175 x 125 x 45 m were used for Passes 1 and 2, respectively. For LPZ unit, search ellipses of 35 x 25 x 8, 75 x 50 x 15 and 75 x 25 were used for Passes 1, 2 and 3, respectively.
9. Measured material was defined as blocks interpolated using Passes 1 and 2, using composites from ≥ 4 drill holes and a distance ≤ 25 m to the nearest composite and additional blocks with excellent geological and grade continuity. Indicated material includes blocks interpolated with Pass 1 and 2 search ellipses, using ≥ 3 drill holes and a distance ≤ 35 m to the nearest composite and blocks with geological and grade continuity. Inferred material was defined as blocks interpolated with all Passes, composites from ≥ 2 drill holes and interpolated geological continuity up to 40 m below diamond drill holes.
10. Two metre composites were used and no capping was necessary.
11. The mean density of 2.65 t/m³ was used for unit 6ABC and 2.62 t/m³ for unit 6D.
12. The cut-off grade reported in this resource estimate, 0.6% Li₂O, is consistent with the previously published resource estimates by Avalon (Preliminary Economic Assessment, 2016; November 15, 2017 resource estimate).
13. Mineral resources do not have demonstrated economic viability and their value may be materially affected by environmental, permitting, legal, title, socio-political, marketing or other issues.
Separation Rapids Lithium Deposit Block Model (May 22, 2018)

Looking North & showing four 2018 drill holes

LPZ (purple)

PZ (yellow)

Open to depth
Hole 79 demonstrated increased widths of lepidolite-petalite (LPZ) mineralization below 200 metres.

PZ = Petalite Zone

200 metres
Separation Rapids Lithium will have a very small environmental footprint

- Petalite ore contains no sulfides or toxic metals
- Lithium has beneficial pharmaceutical use in human mental health
  - *Wabaseemoong First Nation Traditional Knowledge recognized the area as the “Healing Rock”*
- Water will either be 100% recycled or suitable for discharge without any treatment
- Runoff from waste aggregates will be cleaner than the water runoff from a typical urban shopping mall parking lot and total mine area will be approximately twice the size of a large urban shopping mall
- Plant air emissions will be minor (largely water vapor)
- Will not impact any rare or endangered species
- Site can be re-purposed for wild rice production and fish farming post closure
- Site will use clean, locally produced hydroelectric power
- Easily accessible by road and access to hydro power will give the operation a very low carbon intensity
- Workers able to commute daily to site, reducing social impact

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