Developing the Supply Chain for the Clean Economy in Canada

Lithium, Tin & Rare Earths

April, 2019
Don Bubar
President & CEO
Safe Harbour Statement

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Who is Avalon Advanced Materials?

› Toronto-based, operating in Canada since 1995
› Mineral exploration and development company focused on clean technology metals and minerals
  • 20 years of experience with specialty minerals
› Listed: TSX (AVL), OTCQB (AVLNF), Frankfurt (OU5)
  • Market Cap: CAD$16.5M (237 million S/O @ $0.07)
  • Fully diluted: 279.5 million
  • Shareholders: >20,000 shareholders worldwide (15% Insiders, 15% Institutional, 70% Retail)

Tin is increasingly used in solar panel technology
Avalon’s Vision and Mission

Establish a diversified clean technology metals business, built on strong environmental and social performance.

Create shareholder value and long term growth through sustainable development of our lithium, tin and REE assets.
Avalon’s Sustainable Resource Development Strategy

› Focus on materials that enable clean technology
› Design the operation to minimize environmental impacts and plan for productive use of the land post closure
› Minimize GHG emissions and water impacts
› Focus on process efficiency, minimizing waste and maximizing productive use of the resource
› Engage in dialogue early and often with local indigenous communities to listen to their concerns and identify opportunities for partnerships, job creation and training.
› Apply a staged development approach, starting at a modest scale, to minimize project footprint and potential risks to environment, while also reducing investment risk
Technology Metals and Minerals

Project Pipeline

**Lithium**
Critical ingredient both for energy storage and high strength glass products

**Cesium**
A rare element in high demand for space technology and specialty drilling fluids

**Tin**
An emerging technology metal vital in electronics with potential in batteries

**Rare Earths, Lithium**
‘Energy Metals’ vital to electric vehicle technology
Many non-traditional commodities are now vital to modern electronics and clean technology.
Experienced Management Team and Diversified Board of Directors

MANAGEMENT
› Donald S. Bubar, P.Geo.
  President & CEO
› Jim Andersen, CA, CPA
  V.P. Finance, CFO & Corporate Secretary
› David Marsh, FAusIMM (CP)
  Senior V.P. Metallurgy & Technology Development
› Bill Mercer, Ph.D., P.Geo.
  V.P. Exploration
› Mark Wiseman, B.Sc., MBA
  V.P. Sustainability
› Pierre Neatby, BA Econ
  V.P. Sales and Marketing
› Cindy Hu, CA, CPA
  Controller
› Mary Kita, BA, M.Sc.
  Director of Communications
› Melanie Smith, LLB
  Senior Legal Counsel
› Ron Malashewski, P.Eng (AB)
  Community Relations, Kenora

BOARD OF DIRECTORS
› Brian D. MacEachen, C.A.
  Chairman and Audit Committee Chair
› Donald S. Bubar, P.Geo.
  CEO
› Alan Ferry, CFA
  Governance/Compensation Committee Chair
› Jane Pagel, M.Sc.
History of leadership in health & safety, Indigenous relations and environmental protection

Donald Bubar, President & CEO
› Advocate for increased Indigenous participation in the mineral industry
  • Chair / Co-founder of PDAC Aboriginal Affairs Committee from its creation in December 2004 until 2013
  • Recipient of Queen Elizabeth II Diamond Jubilee Medal for work on Aboriginal Affairs
› Serves on the Board of Directors of PDAC Mining Matters that promotes geoscience education
› Recipient of PDAC Distinguished Service Award for his contribution to building awareness of Indigenous issues

Mark Wiseman, VP Sustainability
› Biologist with extensive experience in Social and Environmental Impact Assessments, permitting, HSEC management systems, risk management and closure planning
› Has developed and implemented innovative environmental protection measures
› Participated and chaired numerous multi-stakeholder committees in the development of standards and regulations, as well as managing relationships and requirements of local, national and international stakeholders

Dr. Bill Mercer, VP Exploration
› Chairs the PDAC Health and Safety Committee
› Recipient of the David Barr Award from the AMEBC for excellence in leadership and innovation in mineral exploration health and safety
› Recipient of the “Award for Environmental Excellence” of the NWT and Nunavut Association of Professional Engineers and Geoscientists in recognition of his environmental efforts relating to renewable energy use
› Recipient of the Queen Elizabeth II Diamond Jubilee Medal for his service to the Canadian mining industry
Corporate Knights

› Avalon is among Corporate Knights’ Future 40 Responsible Corporate Leaders in Canada (2018, 2016, 2015)

› Corporate Knights: a media and research company focused on clean capitalism drivers for decision makers

› Corporate Knights Magazine has track record of providing informed research and analysis to the market
Sustainably Reporting: A leader in best practices

› Reduces social licence risk to investors
› Aligns Avalon’s operating philosophy with its cleantech customers
› Sustainability reporting creates greater transparency and accountability between the company and its stakeholders
› By measuring and tracking its performance, sustainability goals and targets stay a priority in management decisions
› Produced 7th annual GRI-compliant report in November 2018
Leaders in Aboriginal Community Outreach

The name Nechalacho was formally conveyed by the YKDFN in a ceremony held at site in 2009 in respect of the First Nations’ traditional land use.

Accommodation Agreements

- Signed with Deninu K’ue First Nation and NWT Métis Nation (Participation Agreement)
- Negotiations completed with Lutsel K’e Dene
- Continuing engagement with NSMA, Yellowknives Dene, Tli Cho, KFN

Completed and approved Report of Environmental Assessment

Received preliminary construction Class A Land Use Permit (April 2014) and Class B Water License (May 2014) and site preparation initiated.

Final permitting process can be completed when work at the site resumes.
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
Lithium Demand by Application (2017):
Batteries dominate, but ceramics and glass remain a major market

Source: USGS March 2018
Lithium Demand forecast to 2015 (k/tonne)

Estimated Increase in demand of Lithium by 2025

Source: USB Securities 2018 Research Report
Reported Lithium Carbonate Prices

Note: Lithium hydroxide attracts a premium to lithium carbonate

Average of quarterly prices reported by SQM and Orocobre
New Lithium Production: 
Expectations are not always met

Source: Canaccord Genuity, April 2018
Separation Rapids Lithium

A rare LCT type of pegmatite deposit enriched in the lithium minerals **petalite** and **lepidolite**

- Large, high quality resource amenable to open pit mining, discovered in 1996
  - PFS initially completed in 1999 on model to produce petalite for glass-makers
  - Secure Tenure under a Mining 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
Separation Rapids is located close to transportation and power infrastructure.
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 ($\text{Li Al Si}_4\text{O}_{10}$) typically contains 4.5% $\text{Li}_2\text{O}$ with very low impurities.

Lepidolite ($\text{K(Li,Al,Rb)}_2\text{(Al,Si)}_4\text{O}_{10}\text{(F,OH)}_2$) 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.
Lithium Minerals: enable innovation in high strength glass products

Glass and Ceramics

- Lithium creates thermal shock resistance
  - Glass-ceramic stovetops
  - Corningware® Cookware
  - Fireplace Shields
- Lithium additions reduce the melting temperature and lower GHG emissions from furnace
- Lithium additions also strengthen glass and are being used to develop innovative high strength glass products (computer screens and automotive)

Avalon’s *Super Petalite* product (>4.5% Li$_2$O) is well-suited for high-strength glass due to its very low impurity content (very low alkalis & iron<100ppm)
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 Lepidico for lepidolite product
- Drilling to expand resource and map detailed lithium mineralogy
2017-18 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 glass applications
› Produced trial quantities of petalite for glass marketing purposes
› Optimized flotation flowsheet to improve recoveries of lepidolite concentrate to over 90% at a grade of 4.5% Li$_2$O
› Optimize hydromet process by investigating alternative membrane technologies to improve energy efficiency & reduce costs (ongoing) with support from NOHFC
› Diamond drilling in 4 holes to assist with developing new mineralogy-based resource block model
› Completed updated PEA on industrial mineral model
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.
Next Steps:

**Moving toward Phase 1 Production Facility**

- Minimum $3 million program planned to prepare for construction of mine and process plant in 2019-20 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 advance project permitting
- **2020**: Initiate site development & construction work and continue exploration of new Snowbank pegmatite discovery
- **2022**: Begin commercial operations, sales of petalite & lepidolite products
- **2023-25**: Initiate pilot plant work on lithium hydroxide battery material product for potential future production scale-up
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
## Separation Rapids Lithium Deposit
### Mineral Resources Estimate (May 22, 2018)

#### Petalite Zone (PZ)

<table>
<thead>
<tr>
<th></th>
<th>Mt</th>
<th>% Li₂O</th>
<th>% Ta₂O₅</th>
<th>% CsO</th>
<th>% Rb₂O</th>
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<tr>
<td>Measured</td>
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<tr>
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<td>0.012</td>
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<tr>
<td>Measured + Indicated</td>
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<td>0.011</td>
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<tr>
<td>Inferred</td>
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<td>0.007</td>
<td>0.017</td>
<td>0.342</td>
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</tbody>
</table>

#### Lepidolite-Petalite Zone (LPZ)

<table>
<thead>
<tr>
<th></th>
<th>Mt</th>
<th>% Li₂O</th>
<th>% Ta₂O₅</th>
<th>% CsO</th>
<th>% Rb₂O</th>
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<td>Indicated</td>
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<td>1.402</td>
<td>0.009</td>
<td>0.025</td>
<td>0.469</td>
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<td>Measured + Indicated</td>
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<td>1.406</td>
<td>0.009</td>
<td>0.026</td>
<td>0.471</td>
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<tr>
<td>Inferred</td>
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<td>1.346</td>
<td>0.008</td>
<td>0.020</td>
<td>0.427</td>
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</tbody>
</table>

#### Total PZ+LPZ

<table>
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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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</thead>
<tbody>
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<td>Measured</td>
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<td>0.015</td>
<td>0.365</td>
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<td>Indicated</td>
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<td>1.393</td>
<td>0.007</td>
<td>0.014</td>
<td>0.366</td>
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<td>Measured + Indicated</td>
<td>8.405</td>
<td>1.408</td>
<td>0.007</td>
<td>0.015</td>
<td>0.365</td>
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<tr>
<td>Inferred</td>
<td>1.791</td>
<td>1.349</td>
<td>0.007</td>
<td>0.018</td>
<td>0.365</td>
</tr>
</tbody>
</table>

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 totalling 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 115 x 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 ≥ 24 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

PZ (yellow)

LPZ (purple)

Open to depth
Separation Rapids Lithium will have a very small environmental footprint

- **Non-Toxic**
  - 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 hydro electric 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

- **Small Footprint**

- **Advantageous Location**
Only 10% of the lithium ore is likely to be waste

99.5% of the ore from a typical gold mine ends up as waste

96% of the ore from a typical nickel/copper mine ends up as waste

10% of the ore from Separation Rapids lithium plan will end up as waste. 90% will become product (petalite, lithium chemicals, feldspar, aggregate, etc.)*

*According to Avalon’s current project plan
East Kemptville Tin Recovery and Site Rehabilitation Project

› Opportunity to sustainably fully rehabilitate the site through recovery of tin from stockpiles
› Mine produced from 1985-92, when it closed prematurely due to low tin prices
› Significant mineral resources left both in the ground and in large surface stockpiles
› 10,000 tpd mill removed and pits flooded
› Operated as a closed mine site since 1992 with water treatment system to manage acid mine drainage from stockpiles and tailings
› AVL acquired 100% of mineral rights in 2005
East Kemptville Location and Regional Infrastructure

- On paved highway
- Grid power on site
- Yarmouth (55 km) & other communities within commuting distance
- Ample water
- Skilled labour available locally
- Strong local community support (TREPA, AFN)
East Kemptville Site Rehabilitation Concept

› Remove or isolate historical sources of acid mine drainage “AMD” (Low-grade stockpile, waste piles and stacked tailings) by new processing and recovery of tin concentrates
  • Eliminate long term environmental liabilities
  • Minimize closure and financial assurance costs
  • No new environmental impacts
  • Create new productive uses for the land such as agriculture and solar power generation

› Project has strong local community and government support including ENGO & FN
**East Kemptville Site Layout and surface resources**

- **Main Zone Pit**
- **Baby Zone Pit**
- **Low-grade Stockpile Inferred Resource:**
  - 5.87M tonnes @ 0.112% tin*

- **Existing Tailings Dam with spare capacity:**
  - 18.8 M tonnes historical tailing

- **North Waste Pile:**
  - 1.29M tonnes @ 0.089% tin`

- **In-ground resources:**
  - Indicated: 18.5Mt @ 0.176% tin
  - Inferred: 17Mt @ 0.148% tin

(Resources as of October 31, 2014 (NR 14-13)

Don Hains (P.Geo) is QP under NI 43-101)

*Historic resource prepared by previous operators, not treated by the Company as NI43-101 defined resource estimates and should not be relied upon.*

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*The stockpile resources are considered Inferred under NI43-101 guidelines and should therefore not be relied upon.*
Two Composite Views of Low Grade Ore Stockpile at East Kemptville

6 million tonnes of previously mined tin ore now generating AMD

Can be re-processed to recover tin and remove need for perpetual water treatment
East Kemptville Tin Project: PEA Small Scale Re-Development Model

› Process low grade ore stockpile and near-surface, higher grade ore in existing pits at rate of 2,400 tpd for tin recovery only
› Crushing-Milling-Gravity Concentration to recover cassiterite concentrates grading 55% tin using modular plant design
› Produce ave.1,300 tpy of a 55% tin concentrate over 19 years
› Keep operation as simple and cost effective as possible with low CAPEX estimated at C$31.5 million F/X rate: CAD1.30/USD
› Pre-tax IRR of 15%, NPV of C$17.9 million at 8% discount rate
› Average annual revenues of C$17.75 million vs annual production costs of C$11.6 million at average tin price of US $21,038/tonne
› Use existing tailings facilities and infrastructure, pre-fabricated building with flexibility to expand production in future
› Potential to add ore-sorting technology to reduce feed to gravity plant and lower costs

Falcon Gravity concentrator that uses centrifugal force to recover tin

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.
Sensor-based Ore-sorting Technology

Advances in sensor technology now allow for detection of physical properties of minerals, such as specific gravity.

Minerals can be concentrated after crushing without using water or chemical reagents.
East Kemptville Re-development Concept as currently designed:

- Eliminates the historical environmental liability
- Efficiently uses process reagents
- Minimizes financial assurance costs
- Minimizes waste management costs
- Minimizes GHG production
- No new disturbance area
- Has easier and timely permitting
- Generates profits from tin concentrate sales with low CAPEX and OPEX
- Sets a positive precedent for profitable rehabilitation of a closed mine regarded previously as a perpetual liability
Metals Most Impacted by New Technology: 
*Tin is No. 1!*

Source: MIT / Rio Tinto, March, 2018
Nechalacho Rare Earths Property

Regional Infrastructure
Nechalacho Background

- First explored in 1970’s and early 80’s mainly for tantalum and niobium
- High grade beryllium and rare earth North T deposit discovered and explored 1983-85
- Avalon acquired 100% interest in 2005 with initial focus on REE; Basal Zone discovered
- China export quotas created rare earth interest and access to capital. Feasibility Study on Basal Zone completed in 2013
- Project inactive since 2014 after REE demand dropped when China relaxed export quotas
What has changed since 2013?

› Soaring demand for neodymium and praseodymium for use in high strength magnets - now vital for electric motors used in electric vehicles
› Rising prices of neodymium and praseodymium
› Presence of high grade, near surface Nd-Pr and Dy resources in Tardiff and T-Zones
› T-Zone also contains significant lithium resources as lepidolite / polyliithionite - which are in increasing demand to make lithium battery materials
› Potential for near-term, small-scale development to produce Nd-Pr rich concentrates for export
Joint Venture with Cheetah Resources

- January 2019: Avalon and Cheetah Resources Pty Ltd. announced the signing of a binding terms sheet
- Cheetah would acquire ownership of the near surface T-Zone and Tardiff Zone resources for C$5 million
  - High grade, near surface neodymium-praseodymium and dysprosium resources in T-Zone and Tardiff Zones provide potential for near term, small scale development to produce Nd-Pr-rich concentrates
  - Avalon will retain 100% ownership of Basal Zone HREE Deposit (focus of 2013 Feasibility Study)
- Avalon will continue to manage work programs and retain its 3% NSR type royalty
- Formal agreement is expected to be completed in spring 2019

Motors in electric vehicles rely on rare earth magnets to reduce motor size and weight and reduce power consumption. Approximately 30% of the magnet is Nd-Pr metal.
Nechalacho: Plans for 2019

› Complete scoping study on East Arm-YK Road / Hydro infrastructure corridor (in progress)
› Process testwork on low-cost method for Nd-Pr concentrate recovery by ore sorting technology
› Prepare scoping study on small scale Nd-Pr development model for F-Zone and Tardiff Zones
› Confirmation drilling on F-Zone
› Re-sample old drill cores to analyze for lithium and establish initial T-Zone lithium resource estimate
› Resume permitting process and community engagement toward identifying local indigenous business partners
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