

Coal and Mineral Development in Alberta

2018 Year in Review

Metallic and industrial mineral activity · Coal mining and projects ·
Lithium potential · Industrial mineral and coal production and royalty ·
Online staking and royalty reporting

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Contents

| | |
|---|-----------|
| Introduction | 3 |
| Metallic and industrial minerals | 4 |
| 2018 metallic and industrial mineral exploration highlights | 4 |
| 2018 industrial mineral quarry activities | 8 |
| Coal | 9 |
| 2018 coal exploration and advanced project highlights | 10 |
| 2018 coal mine activities | 10 |
| Alberta Energy Updates | 14 |
| Online staking and royalty reporting | 14 |
| Lithium workshop | 14 |
| Energy and Mines Ministers' Conference | 14 |
| Alberta Geological Survey | 15 |
| 2018 Geological Framework | 15 |
| 2018 Mineral Resources of Alberta Map | 16 |
| Alberta Interactive Minerals Map | 16 |
| AGS Open Data Catalogue | 17 |
| Mineral Core Research Facility | 17 |
| Selected new publications | 17 |
| Alberta Geological Survey | 17 |
| Land-use planning | 17 |
| South Saskatchewan Regional Plan and the Castle Parks | 17 |
| Caribou range planning | 19 |
| Mineral sales restriction and tenure extensions | 19 |

The information contained within this report has been collected from publicly available government information, company websites, press releases, and reports filed on Sedar (www.sedar.com). All figures quoted are current as of the time of publication. Please consult the company websites for specific information regarding any projects outlined in this report. Any other references are noted within the document. The authors make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

Introduction

Lithium was the main focus of metallic and industrial mineral exploration in Alberta in 2018. This past year, however, the focus shifted from identifying potential lithium resources and acquiring rights to development of technology to recover lithium from brines. The technology to economically recover low concentrations of lithium from large volumes of water in a short time remains the main hurdle to lithium development in Alberta. If this can be accomplished, it would be a major advantage over traditional brine extraction operations, which require 18 to 24 months of evaporation in large evaporation ponds.

Another prospective unconventional mineral source, which saw increased interest in 2018, is vanadium as an oil sands by-product. There is ongoing research into recovery of vanadium from bitumen, petroleum coke, and fly ash from the oil sands. This is in addition to the vanadium resource already being explored in the Clear Hills deposit.

There was advancement on a number of coal mines or coal mine projects in 2018. The Grassy Mountain coal mine project formally entered into a joint review panel process after having all of its regulatory applications accepted by federal and provincial regulators. Exploration continued on Ram Coal's Aries metallurgical coal project near Rocky Mountain and on Altitude Resource's Palisades property.

The Grande Cache coal mine was purchased by CST Canada Coal and resumed coal mining operations in 2018. Teck Resources completed work and submitted regulatory applications to extend the life of its Cardinal River mine. The mine expansion would be on the currently active Cheviot coal mine permit and they will continue to process coal at the current plant on the Luscar coal mine permit. The Vista coal mine has announced that it will start mining operations on the greenfield site near Hinton in 2019.

Metallic and industrial minerals permits

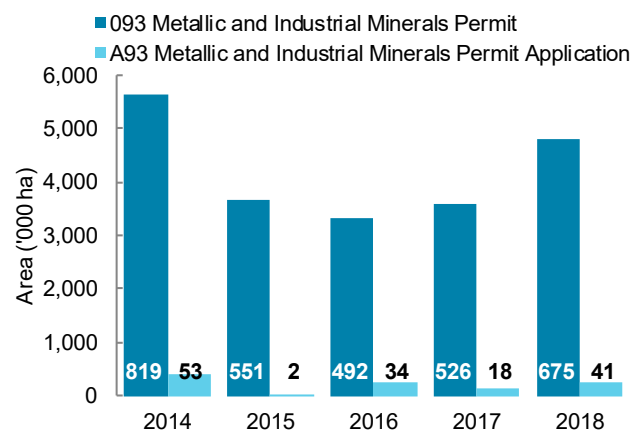


Figure 1. A bar graph with the total area of metallic and industrial minerals permits and permit applications from 2014 through 2018 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual permits or applications.

Metallic and industrial minerals leases

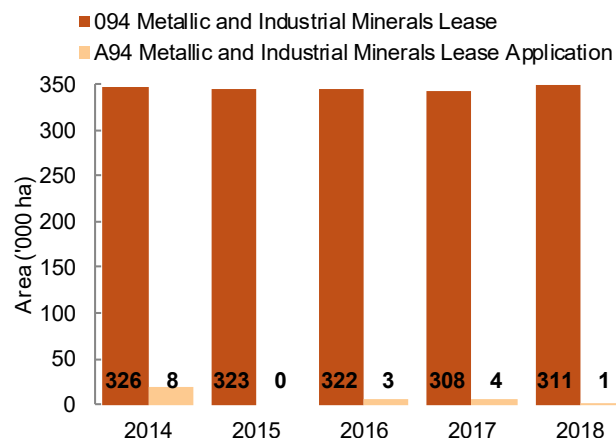


Figure 2. A bar graph with the total area of metallic and industrial minerals leases and lease applications from 2014 through 2018 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual leases or applications.

Metallic and industrial minerals

Lithium exploration activity remained high in 2018. Interest in exploration and development of lithium is being driven by increased demand for battery-powered devices and vehicles. In addition to identifying lithium resources, companies focused on the development of technology of lithium extraction methods. Alberta is also seeing increased interest in vanadium. This is being driven in large part by battery needs to support large scale electricity storage for renewable electricity generation. There was also continued development of frac sand prospects to support the increasing consumption in Alberta, and elsewhere, of frac sand needed for the increasing use of hydraulic fracturing.

The total land area held as metallic and industrial minerals permits increased in 2018, which reverses a declining trend and was likely driven by new tenure acquired for lithium prospects (Figure 1). The total area held as metallic and industrial minerals leases remained consistent from 2017 to 2018 (Figure 2). The number of metallic and industrial minerals licences (required for recreational placer gold mining) decreased in 2018 (Figure 3). Mineral assessment expenditures filed in 2018 were up from 2017 (some are still pending acceptance by the Alberta Energy), as were the number of assessment reports submitted (Figure 4). The first mineral assessment reports from the 2016 staking rush for lithium tenure were submitted in 2018 and will be released in 2019 after their reviews are finalized and the confidentiality periods end.

2018 metallic and industrial mineral exploration highlights

Iron

Ironstone Resources Ltd. changed its name to **PRISM Diversified** in January 2018 as it expands its interests from developing its Clear Hills iron project. PRISM continued to develop their metallurgical process to upgrade the iron ore to a carbonyl powder product. They now report that the process recovers cobalt as a by-product along with vanadium.

Metallic and industrial minerals licences

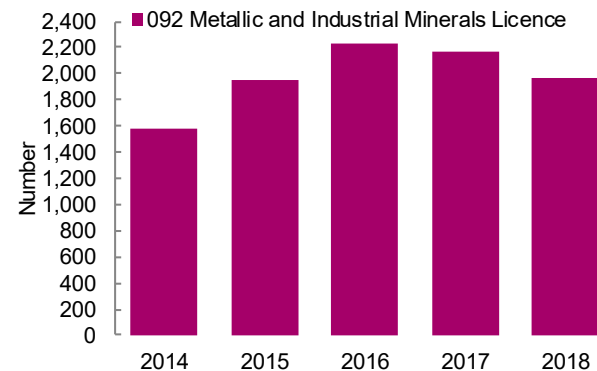


Figure 3. A bar graph with the total number of active metallic and industrial minerals licences from 2014 through 2018 (the report period is October 1 through September 30). Metallic and industrial minerals licences are issued for the right to recover gold through recreational placer mining for a period of five years.

Assessment report expenditures

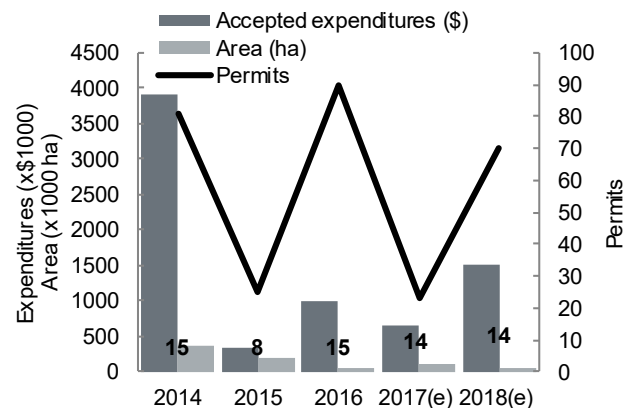


Figure 4. A graph of mineral assessment report statistics for 2014 through 2018. The number of permits and area are those reported in submitted reports. The accepted expenditures are those accepted by Alberta Energy; the total amount claimed is not reported, but is higher than the accepted expenditure value. Numbers at the base of each bar are the number of reports received. (e) Accepted values for 2017 and 2018 are preliminary because not all report reviews were completed at the time of publication.

| Year | Reports | Permits | Area (ha) | Accepted expenditures (\$) | Payment in lieu |
|---------|---------|---------|-----------|----------------------------|-----------------|
| 2014 | 15 | 81 | 282,960 | \$3,905,340 | \$0 |
| 2015 | 8 | 25 | 116,519 | \$347,853 | \$0 |
| 2016 | 15 | 90 | 376,621 | \$987,590 | \$0 |
| 2017(e) | 14 | 23 | 87,254 | \$641,085 | \$0 |
| 2018(e) | 14 | 70 | 324,761 | \$1,500,000 | \$0 |

Vanadium

With the growth of renewable energy resources in Alberta and globally, there has been a related need for energy storage technology, such as batteries, to hold the generated energy until it is required. Vanadium redox flow batteries are emerging as potential candidate for this technology. While lithium ion batteries are currently the most familiar battery technology, redox flow batteries have several advantages that make them more suited to grid storage applications. The potential for the vanadium redox flow battery has piqued interest in possible sources of vanadium in Alberta to supply battery manufacturers with vanadium electrolyte. Possible sources in Alberta include primary sources, such as the Clear Hills iron-vanadium project in northwest Alberta, or secondary sources, such as bitumen, petroleum coke, and fly ash from the oil sands.

In 2018, Alberta Innovates launched an open call for expressions of interest to further the development of non-combustion products and production technologies derived from bitumen contained in Alberta's extensive oil sands. Ongoing efforts by **Shell Canada** in partnership with the University of Alberta and University of Calgary are exploring opportunities of extracting vanadium from Alberta's bitumen resources.

Lithium

With much of the prospective area for lithium brines staked in previous years, the work in 2018 on lithium shifted focus from identifying the location of resources to technology development for extracting the lithium from the host brines. There is currently no economically viable technology to extract lithium from water at the concentrations found within Alberta. This requires the development of new technology or the novel adaptation of existing technology to extract commercial volumes of lithium from brines.

E3 Metals Corp explored resources and technology to develop their "petro-lithium" play in central Alberta. On September 26, E3 announced the development of a pilot plant to test their extraction methodology. In December, they reported that the pilot plant concentrated the lithium content in the brine up to 1498 mg/L from an original concentration of 73 mg/L. E3 has focused on an ion-exchange process and has partnered with a lab at the University of Alberta to develop its technology. Alberta Innovates and Natural Resources Canada's Industrial Research Assistance Program have supported this research.

E3 is exploring three different project areas and have defined NI 43-101 compliant resource estimates in each: 1.9 million tonnes (inferred) lithium carbonate equivalent (LCE) in the Central Clearwater area, 0.9 million tonnes (inferred) LCE in the North Rocky area, and 3.9 million tonnes (inferred) LCE in the Exshaw West area.

MGX Minerals Inc. continued work on a number of lithium projects in Alberta including their main Sturgeon Lake project in west-central Alberta. As with other lithium exploration companies, MGX worked to develop a lithium extraction technology to economically remove lithium from the host brine.

MGX has also explored the potential to recover lithium from oil sands wastewater. This work is with their partner PurLucid Treatment Solutions, which has developed filtration technology to clean wastewater from in situ oil sands operations, particularly steam assisted gravity drainage projects. The oil sands producer Connacher Oil & Gas received regulatory approval to install a PurLucid pilot plant at their Great Divide project. MGX will look to recover lithium from the treated wastewater.

PRISM Diversified, through its subsidiary **Lithalta Ltd.**, continued to expand its land holdings targeting lithium exploration from oil field brines by adding an additional 64 permits overlying the well developed Devonian reefs that fringe the Peace River Arch. The Devonian reefs have the potential to produce large volumes of lithium brine. PRISM released a NI 43-101 Technical Report on its Clear Hills – Peace River Arch lithium brine project in April 2018. They announced plans to continue geological and engineering work to lead to the development of a resource report.

Power Metals Corporation continues to hold three properties (South Leduc, Drumheller, and Peace River) as part of their Alberta lithium brine project. However, the company did not report any new work or results on the project in 2018.

Empire Metals Corp. reported results in March 2018 of a brine sampling program on their Fox Creek lithium brine property. Sampling targeted the Beaverhill Lake formation. Results were consistent with historical sampling of the aquifer, and indicate a homogeneous brine composition across the sampled area. As with other lithium exploration programs, Empire relied on agreements with oil and gas producers to access brine samples from existing oil and gas wells. Empire is also

Metallic & Industrial Minerals Agreement Activity

Lithium (mg/L)

- 30 - 50
- 50 - 75
- 75 - 100
- >100

Agreements

- Permit
- Lease
- Permit Application

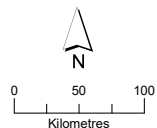
- National Park
- Municipality
- ~ Hydrography



SOURCE INFORMATION:
 Mineral Agreements: Alberta Energy, January 11, 2019
 Lithium: Alberta Geological Survey (downloaded January 11, 2019)
 Base Map Data Provided by the Government of Alberta under the Alberta Open Government Licence.

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Published Date: January 16, 2019
 Author: Resource Mapping and Analysis (ch)



Transverse Mercator Projection (10TM)
 North American Datum 1983 (NAD83)

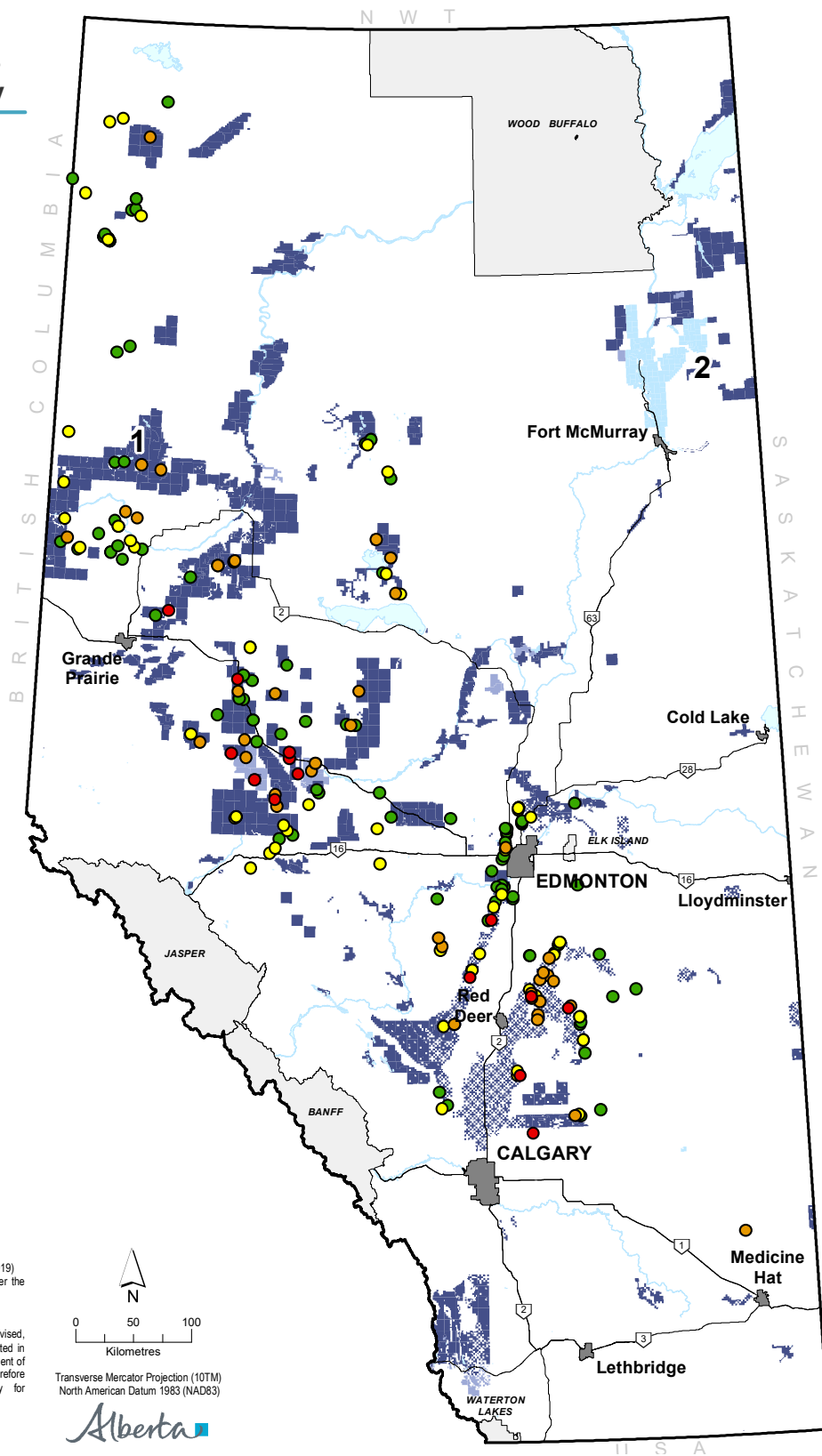


Figure 5. A map of Alberta showing metallic and industrial mineral tenure activity as of January 2018. An interactive, real-time version of this map is available at <https://www.energy.alberta.ca/AU/Services/Pages/InteractiveMaps.aspx>. The coloured circles show oil field brine samples with greater than 30 mg/L lithium. The lithium data is from the Alberta Interactive Minerals Map (see page 16).

investigating the concentration of potassium, boron, bromine, calcium, magnesium, and sodium in the Beaverhill Lake brine.

Aggregate

Athabasca Minerals Inc. continued development of their Richardson granite and dolomite project. The winter road accessible project south of Wood Buffalo National Park is being explored for its potential to supply crushed aggregate to support oil sands and regional development in northeast Alberta. Athabasca has reported that the material meets provincial transportation requirements. The company has reported that the project is a corporate priority and they hired a business development director in 2018 to focus on the development of the Richardson and Firebag (see below) projects. The company's outlook for 2018 included front-end development planning for Richardson.

Frac Sand

With increasing oil and gas development activity in the tight Montney and Duvernay formations, which utilizes hydraulic fracturing of horizontal wells, there is an increasing demand for frac sand in the region and for other unconventional development in Alberta. The majority of frac sand used in Alberta is imported from Wisconsin. This has led a number of companies to explore opportunities to increase the local supply from sand deposits in Alberta. The production of frac sand requires a relatively pure source material such as pure quartz sandstone or aeolian sand deposits. This raw material is then processed to remove any non-quartz fraction and sort the material into specific grain sizes.

Athabasca Minerals announced that they plan to have an operational frac sand project at their Firebag property in 2019. They report that the mine location is fully permitted and ready to start operating pending an investment decision. The

Industrial mineral quarries

| Mine/Quarry | Commodity | Location | Operator |
|--------------------|---------------------|------------------------|------------------------------|
| Bay Tree | Shale | Grande Prairie | WK Ventures Ltd. |
| Calling Lake* | Salt | North of Athabasca | Calcium Inc. |
| Clearwater | Limestone | Rocky Mountain House | Burnco Rock Products Ltd. |
| Cougar Ridge | Limestone | Rocky Mountain House | Fish Creek Excavating Ltd. |
| Exshaw | Limestone | Exshaw | Lafarge Canada Ltd. |
| Fish Creek | Limestone | Nordegg | Fish Creek Excavating |
| Gap | Limestone | Exshaw | Graymont Western Canada Inc. |
| McLeod | Limestone | Cadomin | Lehigh Hanson Materials Ltd. |
| Mitsue* | Salt | Slave Lake | Tiger Calcium Services Inc. |
| Muskeg | Limestone | North of Fort McMurray | Hammerstone Corporation |
| Peace River Silica | Silica Sand | Peace River | Contractors Leasing Corp. |
| Riverview* | Salt | Riverview | K+S Windsor Salt Ltd. |
| Rundle Stone | Dolomitic Siltstone | Canmore | Kamenka Quarries Ltd. |
| Seebe | Shale | Kananaskis | Lafarge Canada Ltd. |
| Sheep Creek | Sandstone | Grande Cache | CST Coal Canada Ltd. |
| Sprayfalls | Sandstone | Exshaw | Thunderstone Quarries Ltd. |
| Steepbank | Limestone | North of Fort McMurray | Hammerstone Corporation |
| Summit Lake | Limestone | Coleman | Graymont Western Canada Inc. |
| Sunnynook* | Salt | Drumheller | Jarodon Resources Ltd. |
| Yamnuska | Sandstone | Kananaskis | Lafarge Canada Ltd. |

Table 1. A table of the active industrial mineral quarries in Alberta that produced in 2018; there are no metallic mines. *Salt is produced through in situ leaching or from subsurface brines.

Frac sand is an industrial mineral with detailed technical specifications. In Alberta the development of a resource project to produce frac sand is regulated in one of two ways. If sandstone is the source material, rights are granted as a metallic and industrial mineral and production is regulated as a quarry. If the source material is unconsolidated surface sand, rights are granted as a surface material and production is regulated as a pit.

main work remaining is the design and construction of a processing plant to process surface sand into frac sand.

Sil Industrial Minerals is one of the larger local producers of frac sand in Alberta. Sil is currently looking to expand their current operations (which produce frac sand from sand resources) to take advantage of the increasing demand.

Source Energy Services is a major importer of frac sand into Alberta. Source acquired a metallic and industrial minerals permit in the Peace River area of Alberta in order to explore the potential to quarry sandstone resources in the area to produce frac sand.

Canadian Silica Industries is currently quarrying sandstone of the Paddy member near Peace River to produce frac sand.

Heavy Minerals

Titanium Corporation Inc. continued development of their Horizon project to implement their technology at Canadian Natural Resources Horizon mine through 2018. This work stems from the grant that Titanium received from Emissions Reduction Alberta (ERA) in 2017. Titanium is working to accomplish the milestones set out in their funding agreement with ERA. Work through 2018 included front-end engineering design. Titanium also reported that they commissioned and received an independent minerals market study. This study is critical for the company to market and sell any zircon or titanium-minerals that they may recover from the project.

Titanium proposes to process froth tailings from oil sands mining operations to recover heavy minerals (zircon and titanium-bearing minerals), solvent, and residual bitumen.

Uranium

Areva Resources Canada changed their name to **Orano Canada**. Orano Canada is a subsidiary of the Orano group, which is headquartered in France. They hold the Maybelle River uranium property in the Canadian Shield area of northeast Alberta.

Brazil Resources Inc. changed its name to **GoldMining Inc.** GoldMining has the Rea uranium property, which is surrounds the Maybelle River deposit held by Orano Canada.

2018 industrial mineral quarry activities

Production and royalty. The production of quarriable minerals (including limestone,

Metallic and Industrial Minerals Royalty Rates

| | |
|--------------------------------|---|
| Metallic Pre-Payout: | 1% mmm ^a |
| Post-Payout: | greater of 1% mmm or 12 % nr ^b |
| Placer | 5% of value after the first troy ounce |
| Quarriable Bentonite: | \$0.11/t |
| Other clay, marl, | |
| volcanic ash: | \$0.131/m ³ |
| Pottery clay, fireclay: | \$0.0655/ m ³ |
| Limestone, shale, granite, | |
| slate, gypsum, building stone: | \$0.0441/t |
| Silica sand: | \$0.37/t |
| Salt Dry salt, solute salt | \$0.45/t |

dolomitic siltstone, sandstone, and silica sand) increased in 2018 from a dip in 2017 (Figure 6). Limestone continues to be the most significant quarriable commodity produced in Alberta during the last five years. Salt production remained approximately the same year over year from 2017 (Figure 7). Salt production, from the Devonian Elk Point Group, is from in-situ leach and brine extraction operations (rather than traditional mining methods).

Table 1 lists all operating industrial mineral quarries in Alberta.

Coal

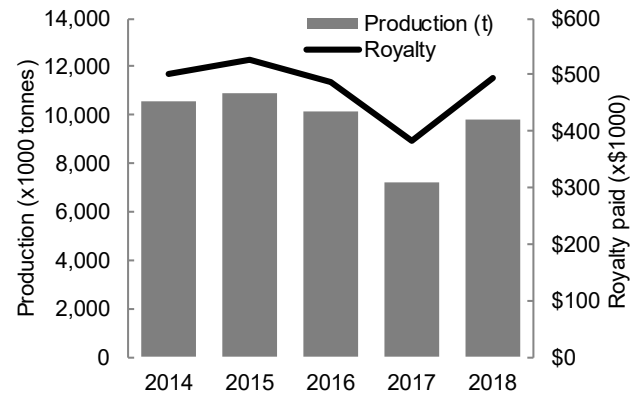
Most new activity in Alberta's coal sector in 2018 was focused on bituminous coal in the Eastern Slopes. After a decrease in bituminous coal mining activity in the past few years, there was a move to restart mining operations, review proposed new mining, and begin greenfield operations in 2018. This has likely been driven by an improvement in global coal prices, specifically a recent improvement for thermal coal.

Coal exploration activity was focused on the continued exploration of existing projects rather than the start or announcement of new projects. Similarly, coal exploration activity was almost exclusively focused in the Eastern Slopes area of the province where there is bituminous, particularly metallurgical, coal.

The total area and number of coal leases in the province decreased in 2018 (Figure 8), which continues a five year trend. The number and area of coal lease applications has followed the same trend and decreased further in 2018. Coal lease applications are located in areas classified as Coal Category 2 or 3 in *A Coal Development Policy for Alberta* (1976), which places restrictions on the issuance of new leases. Therefore, requests for coal rights in these areas remain as applications. See Figure 9 for a map of Alberta's coal fields, coal ranks, mines, and projects.

Bituminous coal (for both thermal and metallurgical use) mined in the Foothills/Mountain region is exported overseas, primarily to the Asian market for use in steelmaking. Subbituminous coal is mined in the Plains region and used domestically for electricity generation.

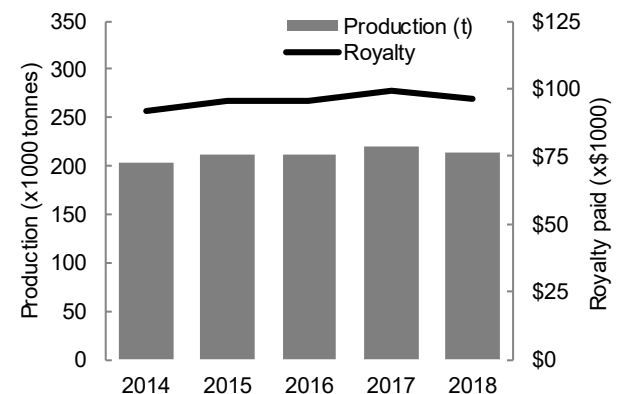
Quarriable mineral production



| Year | Production (t) | Royalty |
|------|----------------|-----------|
| 2014 | 10,583,127 | \$500,671 |
| 2015 | 10,934,343 | \$527,966 |
| 2016 | 10,121,480 | \$486,514 |
| 2017 | 7,244,297 | \$382,601 |
| 2018 | 9,811,775 | \$495,163 |

Figure 6. The total quarriable mineral production and royalty collected for the last five years, including 2018. The report period is from October 1 to September 30. Quarriable minerals include dolomitic siltstone, limestone, sandstone, shale, and silica sand.

Salt Production



| Year | Production (t) | Royalty |
|------|----------------|----------|
| 2014 | 203,659 | \$91,647 |
| 2015 | 213,004 | \$95,852 |
| 2016 | 212,826 | \$95,772 |
| 2017 | 221,067 | \$99,480 |
| 2018 | 214,751 | \$96,638 |

Figure 7. The total salt production and royalty collected for the last five years, including 2018. The report period is from October 1 to September 30.

2018 coal exploration and advanced project highlights

Riversdale Resources (through their wholly owned subsidiary Benga Mining) made a significant step forward with their **Grassy Mountain** coal mine project with the formal announcement of a joint Alberta-Canada review panel for the project on August 16, 2018. The joint review panel requires a public hearing and will deal with a number of approvals under the Alberta *Coal Conservation Act*, *Environmental Protection and Enhancement Act*, *Water Act* and *Public Lands Act*, and the federal *Canadian Environmental Assessment Act 2012*. The joint review covers the regulatory responsibility of the Alberta Energy Regulator and the Canadian Environmental Assessment Agency.

The project will include surface mine pits, waste disposal areas, a coal preparation plant, a coal conveyor system, an access corridor, maintenance shops, a rail load-out facility, and other associated facilities. Riversdale has completed reconstruction of the Crowsnest Pass golf course to make room for the proposed rail load-out facility.

If the project is approved, Riversdale plans to employ 385 people at the mine, which would produce 4.5 million tonnes of metallurgical coal per year over a 24 year mine life. The prepared coal would be shipped by rail to the Westshore coal terminal in Vancouver, BC for export to international customers.

Ram River Coal Corp. continued baseline environmental work and assessment of the coal resource at their **Aries** metallurgical coal project in the Nordegg area.

Altitude Resources was granted a deep drill permit on their **Palisades** metallurgical coal project. This will allow for continued exploration on the project, which is a joint venture with JOGMEC (Japan Oil, Gas, and Metals Corporation). The company announced in early 2018 that JOGMEC agreed to proceed with the third farm-in period for the project. This final exploration phase of their current joint venture agreement was planned for the summer or fall of 2018. If the full \$648,000 budget is completed, JOGMEC will earn a full 51% interest in the Palisades project. As of publication, no results have been announced publicly.

JOGMEC is a Crown corporation of the Japanese government with a mandate to fund and develop resource exploration projects of interest to the Japanese through joint venture agreements with non-Japanese partners. Once a project reaches a stage where it can move into more advanced development JOGMEC typically sells or transfers its interest.

Altitude Resources acquired approximately 19,000 hectares of new coal lease applications to increase the size of their **Altitude North** project. This additional area makes their project immediately adjacent to the southwest of the Grande Cache coal mine.

The sale of Elan Coal Ltd. to Atrum Coal Ltd. was completed in April 2018. This sale was announced in 2017.

Coal leases

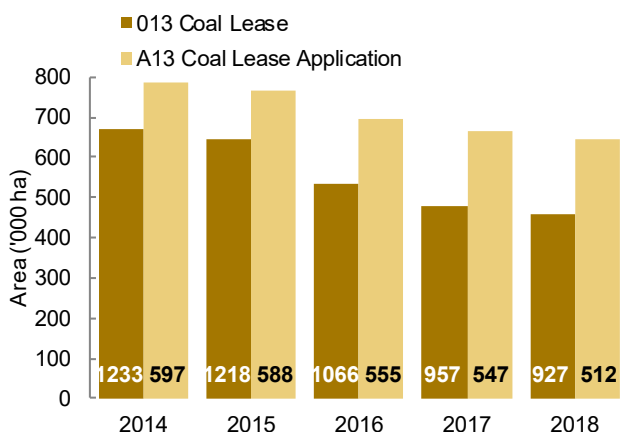



Figure 8. A bar graph with the total area of coal leases and lease applications from 2014 through 2018 (the report period is October 1 through September 30). Numbers at the base of the bars indicate the number of individual leases or applications.

2018 coal mine activities

Production and royalty. Bituminous coal production decreased a small amount from 2017 to 2018; however, the bituminous coal royalty decreased significantly due to a combination of decreased revenue from sales and additional operating costs (Figure 10). Bituminous coal royalty reported in the 2017 *Coal and Mineral Development Year in Review* was adjusted down due to lower than reported royalty owing at year end reconciliation in April 2018. Coal production is expected to increase in 2019 with the restart of the Grande Cache coal mine and commencement of mining at the Vista coal mine.

Export Bituminous & Domestic Subbituminous Coals

-  Coal Mine
-  Advanced Coal Project
-  Export/Domestic Boundary
-  Coal Leases/Applications
-  Coal Fields & Deposits
-  Bituminous Coals
-  Subbituminous Coals
-  Lignites
-  Land Use Framework Boundaries
-  National Park
-  Municipality
-  Hydrography



SOURCE INFORMATION:
 Coal Agreements: Alberta Energy (January 11, 2019)
 Alberta Coal Fields & Deposits and Occurrences: Alberta Energy Regulator (2015)
 Coal Mines in Alberta: Alberta Energy Regulator (January 2019)
 Permitted Major Mines and Selected Major Mine Projects in British Columbia: BC Ministry of Energy, Mines & Petroleum Resources (2018) (<http://mines.nrs.gov.bc.ca/map>)
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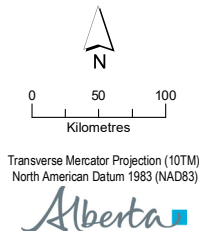


Figure 9. A map of Alberta showing coal tenure activity (dark brown), and coal mines and projects, as of January 2019. Coal fields (light brown) and approximate coal rank distribution (coloured bands) are also shown. An interactive version of the coal tenure on this map is available at <https://www.energy.alberta.ca/AU/Services/Pages/InteractiveMaps.aspx>.

Subbituminous coal production decreased in 2018; there was an associated decrease in subbituminous coal royalty collected (Figure 11). The portion of Crown production from subbituminous coal mines stayed the same from the previous year.

Table 2 lists all operating coal mines in Alberta.

Grande Cache Coal Mine

The Grande Cache coal mine was sold in the summer of 2018. In July 2018, CST Canada Coal Ltd. announced that they had completed the purchase of the mine from the mine's receiver. This followed formal court approval of the sale in January 2018.

The Alberta Energy Regulator (AER) approved the transfer of all Grande Cache coal mine licences, permits, approvals, and dispositions to CST. Alberta Energy approved the transfer of all coal leases from Grande Cache Coal to CST. The AER also authorized the restart of mining operations at the No. 8 surface mine and coal processing plant. CST announced on their website that they had loaded their first train on October 11, 2018.

CST is a subsidiary of Sonicfield Global Ltd.

Until the restart of production in 2018 the Grande Cache coal mine had not produced coal since 2015. Surface operations ceased in early 2015 and underground operations were suspended at the end of that year. The company subsequently went into receivership. The Grande Cache mine produces metallurgical coal for export.

Cardinal River Coal Mine

In May 2018, Teck Resources applied for new approvals at their Cardinal River metallurgical coal mine near Hinton. They applied to the AER for five new pit licences, three waste rock discard piles as part of the final phase of mining at the Cardinal River mine. The expansion would provide an additional nine years of production at 1.5 million tonnes per year on the Cheviot mine permit area. Coal will continue to be processed at the existing coal processing plant located on the Luscar mine permit area. Teck expects work on the new expansion to begin in the second quarter of 2019 if regulatory approvals are received as planned.

The expansion includes regulatory applications to the AER under the *Coal Conservation Act*, the *Environmental Protection and Enhancement Act*, and the *Water Act*.

Bituminous coal production

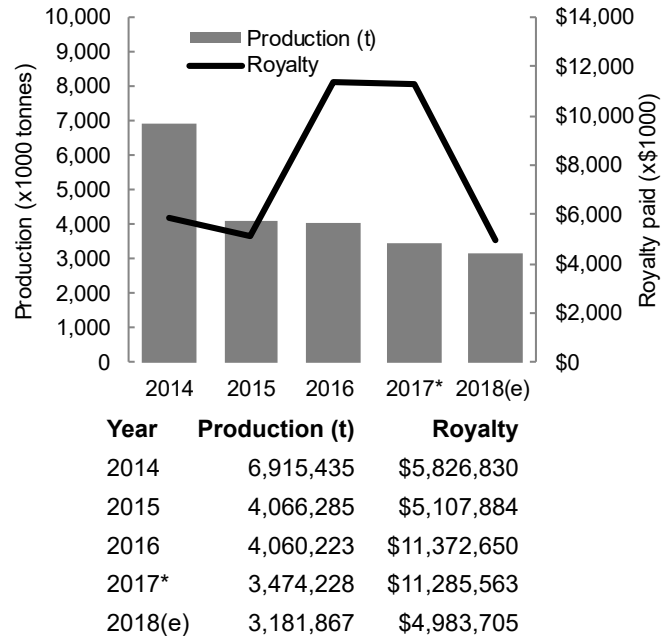


Figure 10. The total bituminous coal production and royalty collected for the last five years, including 2018. The report period is from October 1 to September 30. *2017 royalty is higher than reported in the 2017 edition because of year end reconciliation in April 2018. (e) 2018 royalty and production is an estimate until final reconciliation in April 2019.

Subbituminous coal production

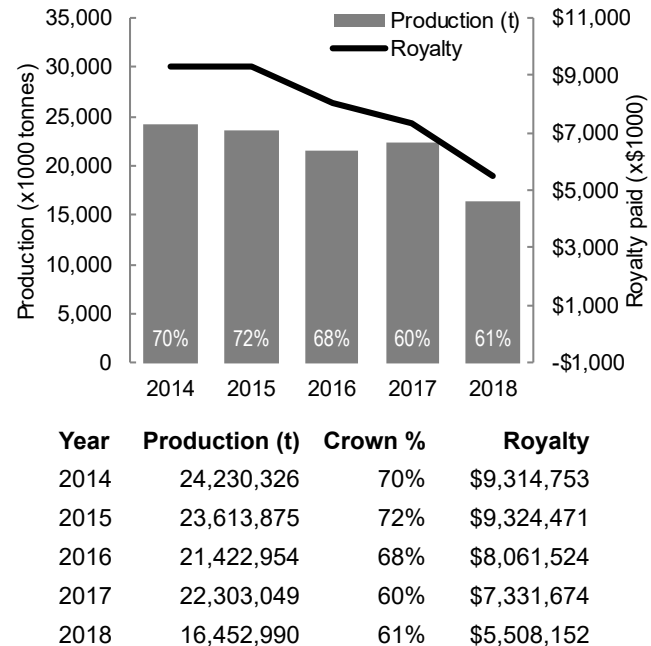


Figure 11. The total subbituminous coal production and royalty collected for the last five years, including 2018. The percentages are the portion of the production from Crown coal rights. Alberta Energy only collects royalty on coal production from Crown-owned coal rights. The report period is from October 1 to September 30.

Coal mines

| Mine | Coal rank | Location | Owner/Operator | Main use |
|--------------------------|---------------|--------------|--|---|
| Cheviot (Cardinal River) | Bituminous | Hinton | Teck Coal Ltd. | Export: metallurgical |
| Coal Valley | Bituminous | Hinton | Westmoreland Coal Co. | Export: thermal |
| Dodds | Subbituminous | Ryley | Dodd's Coal Mining Company Ltd. | Small-scale sales |
| Genesee | Subbituminous | Warburg | Capital Power LP / Westmoreland Coal Co. | Electricity: Genesee generating stations |
| Grande Cache | Bituminous | Grande Cache | CST Canada Coal Ltd. | Export: metallurgical |
| Highvale | Subbituminous | Wabamun | Transalta Corp / SunHills Mining LP | Electricity: Keephills and Sundance generating stations |
| Paintearth/Vesta | Subbituminous | Forestburg | Westmoreland Coal Co. | Electricity: Battle River generating stations |
| Sheerness/Montgomery | Subbituminous | Hanna | Westmoreland Coal Co. | Electricity: Sheerness generating stations |

Table 2. A table of the active coal mines in Alberta.

The Cardinal River mine comprises two coal mine permit areas: the Cheviot mine and the Luscar mine that were in operation prior to Teck's purchase of the property. The Luscar mine originally began operations in 1969. There is no longer any active mining at Luscar; however, it does host the coal processing plant, main shop, and administrative offices for the Cardinal River operation. Old mine workings are currently being reclaimed on the Luscar mine site. Underground mining at the Cheviot mine occurred between 1911 and 1952; it is now where active surface mining operations are located.

Vista Coal Mine

Throughout 2018 the AER approved a number of *Coal Conservation Act* and *Environmental Protection and Enhancement Act* approvals for the Vista coal mine. These included changes to the coal mine permit, coal processing plant, clean coal storage facility, conveyer, and maintenance shop.

The Vista coal mine is being developed by Bighorn Mining Ltd. Bighorn announced that coal exports from the mine would begin in 2019. Vista received formal project approval at the beginning of 2014. These approvals coincided with a significant dip in global thermal coal prices and mining did not proceed as planned at that time. The property was sold to KC Euroholdings (a subsidiary of the Cline Group) in 2015.

Bighorn Mining is a subsidiary of Cutlass Collieries LLC and the Cline Group.

Coal Royalty Rates

Subbituminous coal \$0.55 per tonne

Bituminous coal Pre-payout 1% mmm^a
Post-Payout: sum of 1% mmm and 13% nr^b

^ammm: mine mouth revenue

^bnr: net revenue

Alberta Energy Updates

Online staking and royalty reporting

In spring 2018, Alberta Energy added new functionality to the Electronic Transfer System (ETS; <https://ets.energy.gov.ab.ca>) for coal and metallic and industrial minerals. Coal and metallic and industrial mineral clients now apply for mineral rights and submit royalty reports online through ETS.

The new ETS functionality allows for clients to submit applications and royalty reports easily and when it is convenient. There is no longer any need to wait for mail.

As a result of online applications, the 24-hour overlap system where any overlapping applications for metallic and industrial mineral rights are received in a 24-hour period go to a private bonus bid between the applicants has been discontinued. Because ETS tracks the exact time an application is submitted, there is no longer a need for the overlap process.

Application fees are paid online with credit card. The first year rental (this is not required for metallic and industrial minerals permits) is paid after the application is submitted. Credit cards are not accepted for rental payments.

For more information, Alberta Energy has published several information bulletins outlining these changes. They are available on the Alberta Energy website.

Coal bulletins: <https://www.energy.alberta.ca/Coal/LandG/Pages/IB.aspx>

Metallic and industrial mineral bulletins: <https://www.energy.alberta.ca/Minerals/LGP/Pages/IB.aspx>

Lithium workshop

In Alberta, interest in lithium brine potential initially manifested in 2009 when several companies acquired metallic and industrial mineral permits in the Fox Creek and Valleyview regions of west central Alberta. Some early lithium exploration work was completed at that time; however, when the global mining industry faced a downturn in 2012, Alberta lithium exploration activities diminished.

By the end of 2015 and in early 2016, interest in Alberta's lithium potential rebounded, and several

new companies announced lithium exploration projects in the province. By the end of 2017 lithium exploration accounted for a significant portion of metallic and industrial mineral permits in Alberta (Figure 5).

In response to requests from industry currently involved in lithium exploration in different regions of the province, and to gain a better understanding of this emerging sector, Alberta Energy hosted a workshop on March 28, 2018 at the McDougall Centre in Calgary. The intent of the workshop was to enable industry, academia and government to collectively identify opportunities and challenges, share knowledge, and exchange information on this potential mineral opportunity for the province.

The workshop included presentations by government and industry representatives followed by a panel discussion by subject matter experts. In total, nearly 70 representatives from industry, government and academia participated in the one-day workshop. Presentations provided a wide range of information about lithium from its industrial use, origin and distribution, sampling techniques and protocols, and funding mechanisms, to current initiatives by industry.

While the exchange of information (one of the objectives of the workshop) was positive, ongoing work continues. There was general agreement among workshop participants that a greater understanding of the potential of this resource will become more apparent over the next two to three years as the technology (to extract lithium from the brines) advances. A decision to hold a follow-up workshop in 2019 will depend on industry interest.

Energy and Mines Ministers' Conference

Alberta participated in the Energy and Mines Ministers' Conference (EMMC) in Iqaluit, Nunavut, from August 12-14, 2018. The EMMC is an annual gathering of federal, provincial and territorial ministers responsible for energy and mining portfolios.

Marking the conclusion of the annual three-day EMMC, Canada's energy and mines Ministers agreed to act to increase the country's competitiveness in these respective sectors by eliminating barriers to investment, promoting market diversification, and improving the efficiency and timeliness of regulatory processes. Ministers

committed to explore additional opportunities for federal, provincial and territorial collaboration to advance trade objectives, open up new markets for natural resources, and leverage Canada's technology and innovation, including on the international stage. To the world, the made-in-Canada brand represents sustainable development, further enhancing our competitive advantage.

Ministers highlighted the importance of existing federal, provincial and territorial cooperation across the energy and mining sectors. This includes initiatives to advance Indigenous partnerships, innovation, integrity and public confidence, infrastructure development, inclusive growth, and international cooperation. Through panel discussions with Indigenous leaders, women in the natural resources sector, and other experts, Ministers emphasized the need to consider the range of perspectives from Canadians on the development and operation of natural resources.

During EMMC, mines Ministers approved two mining deliverables:

Assistant to Mining Innovation (AMI) Digital Platform. The Assistant to Mining Innovation is an online tool that allows users to search for information on mining innovation currently underway in Canada, including information on innovation organizations, their areas of expertise, research priorities, key projects, and partnerships.

Canadian Minerals and Metals Plan (CMMP). Achieving the vision of Canada as the leading mining nation requires considerable focus as well as cooperation. Over the course of the last year, federal, provincial and territorial officials have collaborated and engaged with stakeholders in every province and territory to identify challenges, opportunities and the actions needed to position Canada for lasting success. Targeted for release in 2019, the CMMP is based on six pillars to capture the range of activities needed to support a world-leading industry. The CMMP is intended to foster a competitive and sustainable minerals and metals industry that capitalizes on the realities of today's economy and its future, recognize regional strengths, enhance Indigenous participation, and position Canada as the leading mining nation.

These publications can be viewed on Natural Resources Canada's website: www.nrcan.gc.ca/publications/11102.

Alberta Geological Survey

The Alberta Geological Survey (AGS) is the official provincial geological survey of Alberta. The AGS resides within the Alberta Energy Regulator (AER) and is responsible for the systematic description of the geology and resources within the province, as well as providing geoscience information to help inform regulatory decisions.

The AGS delivers geoscience in several key areas, including surficial mapping, bedrock mapping, geological modelling, resource evaluation (hydrocarbons and minerals), groundwater, and geological hazards. The AGS is also responsible for maintaining the Alberta Table of Formations and providing outreach and information to stakeholders and the public.

The AGS website (<https://ags.aer.ca/>) offers a wide range of information and products on the geology of Alberta, including over 2,500 reports, 400 maps, and 1,300 datasets (digital data, shapefiles, and digital imagery). Much of AGS's data is incorporated into an interactive digital environment, which includes GIS maps and 3D geological models that enable the visualisation of surface and subsurface features and allows users to incorporate their own information within the maps and models. Current projects and activities are also highlighted, along with additional geoscience information about Alberta.

2018 Geological Framework

The AGS continues to develop the three-dimensional (3D) Geological Framework of Alberta, which includes multiple geomodels for specific areas of Alberta, as well as a provincial-scale representation of Alberta's subsurface geology that covers 602,825 square kilometres excluding the Rocky Mountains and approximate area affected by Cordilleran deformation. In 2018, the AGS published the first version of the 3D Provincial Geological Framework Model, which includes 32 geological zones (3D PGF model v1; ags.aer.ca/3D_PGF_model.html). Version 2 of this model will be published in early 2019 and will include an additional 30 new geological layers primarily within the Permian to Upper Cretaceous intervals. The 3D Geological Framework acts as a repository for subsurface data and forms the geological foundation for much of the work at the AGS.

The AGS also made significant progress enhancing outreach and stakeholder engagement by leveraging the 3D Geological Framework models to develop

interactive and educational applications such as Minecraft models (<https://ags.aer.ca/geology-alberta-minecraft-edition>), narrated virtual reality tours (https://ags.aer.ca/Peace_River_Minecraft_Virtual_Reality_Tour.html) of the subsurface, and augmented reality applications that allow users to interact with our 3D models in a mixed reality environment. In 2018 the AGS supported the development of an exhibit at Dinosaur Provincial Park to showcase this work, and are currently working with the Leduc Discovery Center to develop an interactive and engaging educational exhibit on Alberta's subsurface geology.

2018 Mineral Resources of Alberta Map

In 2018, the AGS worked on the production of a province-wide Minerals Map of Alberta (Figure 12). This map displays the location of known mineral deposits and selected occurrences as well as of those tracts geologically favourable to potentially contain an undiscovered mineral deposit. This map and its accompanying digital files will constitute a repository of mineral geological data to better inform government, industry, and the public of existing mineral resources and outline potentially favourable areas for exploration and new discoveries.

Since the initial discovery of kimberlitic pipes in northern Alberta in 1989-1990, the AGS and industry have collected abundant kimberlite indicator minerals (KIMs) from sediment and bedrock samples throughout Alberta. In 2018, the AGS completed a compilation of over 33,000 kimberlite and other indicator minerals microprobe analyses from 89 government and industry sources. Microprobe analysis of KIMs, including garnet, chrome diopside, ilmenite, chromite, spinel, and olivine are useful for the delineation and prioritization of targets in diamond exploration.

AGS is also preparing for publication a chemical dataset and report of lithium-rich formation water collected from a number of oil and gas pools in west-central Alberta.

Alberta Interactive Minerals Map

The AGS provides web-based interactive maps which allow users to visualize geological maps and data. Specifically, the Alberta Interactive Minerals Map (AIMM) allows viewing and querying of mineral data and other relevant geological data to inform government, industry and the public. These data are accessible through an open data portal which directs users to the AGS Open Data Catalogue that provides all data displayed in AIMM for free access and download.

In early 2019, AIMM datasets will be updated with mineral occurrences identified in AGS, Government and industry reports. To explore the AIMM site, please visit the interactive geology map page on the AGS website (<http://ags.aer.ca/data-maps-models/interactive-maps>).

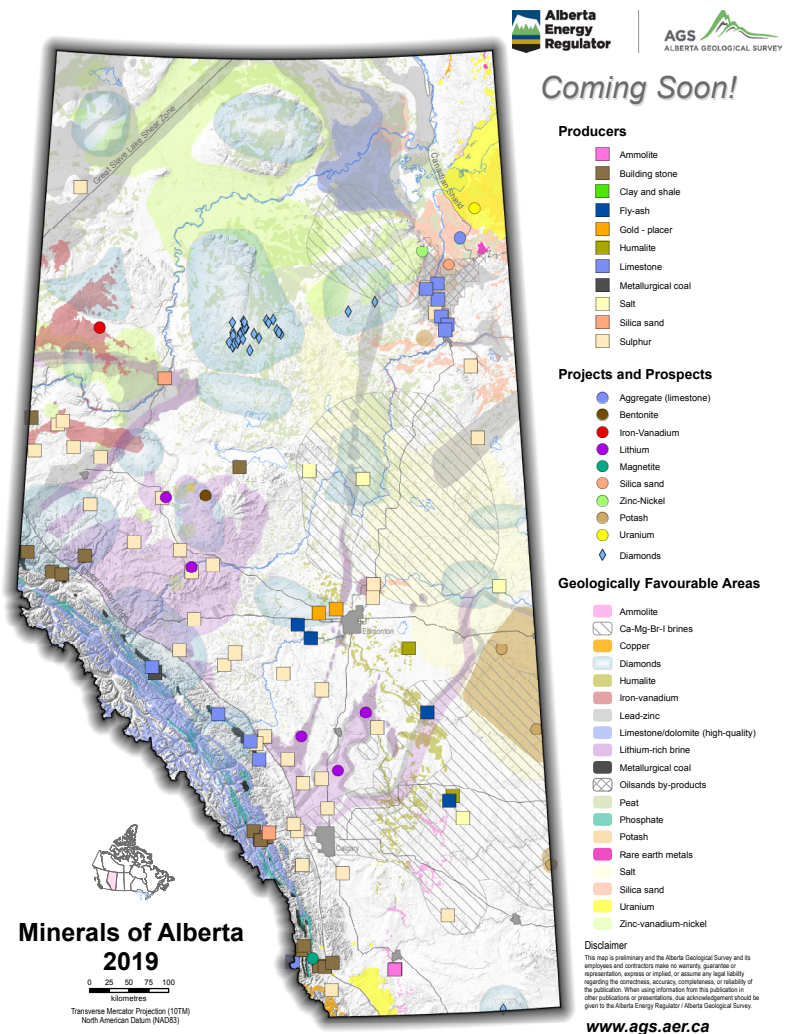


Figure 12. The Mineral of Alberta map that will be published by the Alberta Geological Survey in 2019. The map will be available as a pdf or on the Alberta Interactive Minerals Map. Please visit www.ags.aer.ca.

AGS Open Data Catalogue

The Open Data Catalogue features a subset of GIS data published by the AGS, including mineral-related datasets. Data can be downloaded in spreadsheet, shapefile, or KML format. Each dataset is accompanied by a full metadata record so that users understand the original intent of the data and to help them assess its usefulness for their purposes. The open data catalogue is available at <http://geology.ags-aer.opendata.arcgis.com/> or can be accessed through the AIMM application.

Mineral Core Research Facility

The AGS assists Alberta Energy to administer the collection of mineral core under the Metallic and Industrial Minerals Tenure Regulation. Under this regulation, the Crown can collect mineral core and rock samples from companies working on mineral permits and make these materials publicly available to prospectors, mineral exploration companies, and academia for mineral exploration and research purposes. Core and rock samples are stored at the Mineral Core Research Facility (MCRF).

The MCRF contains 60,671 metres of mineral core, 12,857 metres of coal core, and nearly 17,000 rock samples from various mineral exploration projects in Alberta.

Detailed information on core holdings can now be found on the Alberta Interactive Minerals Map (AIMM). The MCRF is located in southeast Edmonton. For access to the facility, please contact the MCRF at 780-466-1779.

Selected new publications

Alberta Geological Survey

All reports, maps, and digital datasets are available for free from the AGS website: www.ags.gov.ab.ca. Selected releases in 2018 are provided below:

- Mineral Resources of Alberta; AER/AGS Map, to be released in Spring 2019.
- Kimberlite Indicator Mineral Electron Microprobe Dataset; to be released in Spring 2019.

3D Provincial Geological Framework Model of Alberta, Version 1 – Methodology. Branscombe, P., MacCormack, K.E., and Babakhani, M. AER/AGS Open File Report 2017-09, 2018.

3D Provincial Geological Framework Model of Alberta, Version 1 – Methodology. Branscombe, P., MacCormack, K.E., and Babakhani, M. AER/AGS Model 2017-03, 2018.

Architecture and geometry of basal sand and gravel deposits including the 'Grimshaw gravels', northwestern Alberta (NTS 84C and 84D). Slomka, J.M., Hartman, G., and Klassen, J. AER/AGS Open File Report 2018-04, 2018.

An update to the glacial landforms map of Alberta. Atkinson, N., Yusifbayov, C., Chao, D.K., and Shipman, T.C. AER/AGS Open File Report 2018-08, 2018.

Outcrop of the Middle Devonian Keg River Formation on the Firebag River, northeastern Alberta (NTS 74E/11). Schneider, C.L., Grobe, M., and Leighton, L.R. AER/AGS Open File Report 2018-01, 2018.

Land-use planning

South Saskatchewan Regional Plan and the Castle Parks

Three of the eight new South Saskatchewan Regional Plan (SSRP) conservation areas impacted portions of a small number of metallic and industrial mineral (MIM) agreements. The management intent of new conservation areas does not allow MIM or coal exploration and development as defined in the SSRP under the *Alberta Land Stewardship Act*. As such, it is expected that there will be no additional tenure available in the area of the Castle Parks region.

The Castle Provincial Park and Castle Wildland Provincial Park are part of the SSRP and protect valuable watersheds, head waters, and habitat for more than 200 rare species. Alberta Energy continues to work with operators affected by the implementation of the Castle parks to apply for compensation under the Mineral Rights Compensation Regulation.

Caribou Ranges of Alberta

- Caribou Range (provincially managed)
- Caribou Range (federally managed)
- National Park
- Municipality
- Hydrography



SOURCE INFORMATION:
Base Map Data Provided by the Government of Alberta under the Alberta Open Government Licence.

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Published Date: January 17, 2019
Author: Resource Mapping and Analysis (ch)

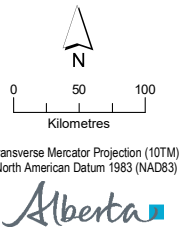


Figure 13. A map showing the caribou ranges within Alberta.

Caribou range planning

Under the federal government's Woodland Caribou Recovery Strategy, all provinces and territories were instructed to develop a plan for each caribou range (Figure 13) that outlines how industrial and recreational activities will be managed over time and space to support self-sustaining caribou populations, and to achieve a target of 65% undisturbed habitat. The Woodland Caribou Recovery Strategy is enabled under the federal *Species at Risk Act*. The federal government released a progress report on October 31, 2017 and touched on the work that Alberta is doing to balance caribou habitat and the socio-economic health of Albertans. On December 19, 2017, Alberta released a Draft Provincial Woodland Caribou Range Plan for public comment.

Since the release of the draft Provincial Woodland Caribou Range Plan, engagement with Indigenous communities, citizens, and affected stakeholders has occurred to gather feedback on proposed tools and approaches.

Alberta Energy continues to investigate broader policy options for ranges, with a focus on how to treat undisposed Crown land.

Mineral sales restriction and tenure extensions

In April 2013, a restriction on mineral tenure sales was placed in the Little Smoky and A La Peche caribou ranges to support and maintain flexibility for range planning. To support the recommendations of the mediator's report, a mineral tenure sales restriction was placed in all caribou ranges in September 2016. The restriction provides government and industry time to align management approaches across all caribou ranges.

In November 2016 the Government of Alberta offered the option for existing agreement holders to apply for extensions until March 31, 2019 for petroleum and natural gas agreements, metallic and industrial mineral permits, and oil sands leases that fall in whole or in part within a caribou range (for further details, please see Alberta Energy Information Letter 2016-34). In April 2018, Alberta Energy approved an additional two-year extension for qualifying Crown mineral agreements in caribou ranges when circumstances have prevented the continuation or validation of an agreement. Extended agreements will now expire on March 31, 2021 (for further details, please see Alberta Energy Information Letter 2018-14).

About Alberta's regulatory system

The Crown owns 81 per cent of the mineral rights in Alberta. The other 19 per cent are freehold mineral rights and are owned by individuals, companies or the federal government on behalf of First Nations and as National Parks. The Coal and Mineral Development unit is responsible for the administration of the Crown's mineral rights for metallic and industrial minerals, and coal.

The mineral rights for coal, and metallic and industrial minerals are managed using a variety of agreements, depending on the specific substance and/or activity a client wishes to pursue. Each agreement type is defined and governed through the Alberta's *Mines and Minerals Act*, and the Metallic and Industrial Minerals Tenure Regulation. Fees and rentals are set out in the Mines and Minerals Administration Regulation.

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