

# Exploration and mining in the North Central and Northeast regions, British Columbia



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Recommended citation: Clarke, G., 2020. Exploration and mining in the North Central and Northeast regions, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2019. British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Information Circular 2020-01, pp. 59-73 (revised, February 2020).

## 1. Introduction

From northeast to southwest, a transect from the Northeast Region through the North Central Region provides a cross section from undeformed rocks deposited above Precambrian basement to allochthonous terranes accreted to ancestral North America (Fig. 1). Platformal sedimentary rocks in the Northeast Region transition to deep-water basin strata as the eastern limit of Cordilleran deformation is approached, close to the border of the North Central Region. The North Central Region shows a history of ocean opening and closing, island arc volcanism, and terrane accretion onto the western margin of ancestral North America. Terrane emplacement was followed by continued orogeny, magmatism and sedimentation. Both regions were extensively glaciated.

The Northeast Region is prospective for coal and industrial minerals and, at present, has three producing coal mines, Conuma Coal Resources Limited's **Wolverine**, **Brule**, and **Willow Creek** operations and several major coal projects. In the far north of the region, Fireside Minerals Ltd. produces barite from its **Fireside** mine to supply the oil and gas drilling industry.

The North Central Region is prospective for Cu, Au, Ag, Zn, Pb, specialty metals, and rare earth elements, mostly in porphyry, vein and stockwork, SEDEX, and carbonatite settings. The **Mt. Milligan** Cu-Au operation (Centerra Gold Inc.) is the only producing mine in the region. Graymont Western Canada Inc. continues the permitting process for its **Giscome** project. The **Blackwater** epithermal Au-Ag project (New Gold Inc.) received federal and provincial Environmental Assessment Certificates in 2019. Both regions also saw numerous exploration projects (Fig. 1). Significant results included those reported for Benchmark Metals Inc.'s **Lawyers** project, Sun Metals Corp.'s **Stardust** project and ZincX Resources Corp.'s **Akie** project.

Estimates for exploration expenditures, drilling programs, and other metrics were captured in the British Columbia Mineral and Coal Exploration Survey, a joint initiative of the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for Mineral Exploration in British Columbia, and EY LLP. For the North Central Region,

exploration expenditures were estimated at \$35.5 million and exploration drilling was estimated at approximately 92,600 m. For the Northeast Region exploration expenditures were estimated at \$8.8 million and exploration drilling was estimated at approximately 11,050 m (Clarke et al., 2020; EY LLP, 2020).

## 2. Geological overview

The Canadian Cordillera records a protracted history of supercontinent rifting followed by collisions between the westward-driven North American continental plate and a succession of island arc volcanosedimentary and intrusive assemblages (terranes), developed outboard of ancestral North America and accreted to each other and to the continental margin (e.g., Nelson et al., 2013). Terrane evolution continues today as the Juan de Fuca plate slides beneath Vancouver Island. In the Northeast and Central regions, the most easterly rocks are platformal sedimentary units that thicken westward and transition to deep-water basin strata. These rocks are deformed mainly by eastward-vergent thrust faults and folds along northwest-southeast trends. The Rocky Mountain trench marks the site of about 800 km of post-accretion dextral strike slip along the Tintina fault system.

Deformed deep-water basin sedimentary rocks immediately west of the Rocky Mountain Trench are referred to as the Cassiar terrane (Fig. 1). Outboard of the Cassiar terrane is a group of volcanic assemblages referred to (roughly from east to west) as the Slide Mountain terrane, the Quesnel and Stikine terranes (Quesnellia and Stikinia), and the Cache Creek terrane. The Cache Creek terrane is separated from Quesnellia by another major crustal break, the Pinchi fault, along which areas of ultramafic rocks are locally exposed. These terranes are intruded by intermediate to felsic plutonic and volcanic rocks and are in turn overlain by later sedimentary and volcanic rocks.

Mineral deposit types and distributions are intimately related to the geologic evolution of the terranes (e.g., Nelson et al., 2013). Thus, platformal rocks deposited above ancestral North America host coal and potash deposits, and post-accretionary sedimentary rocks overlying the Stikine terrane host coal deposits. Deep-water basin strata host SEDEX and Mississippi

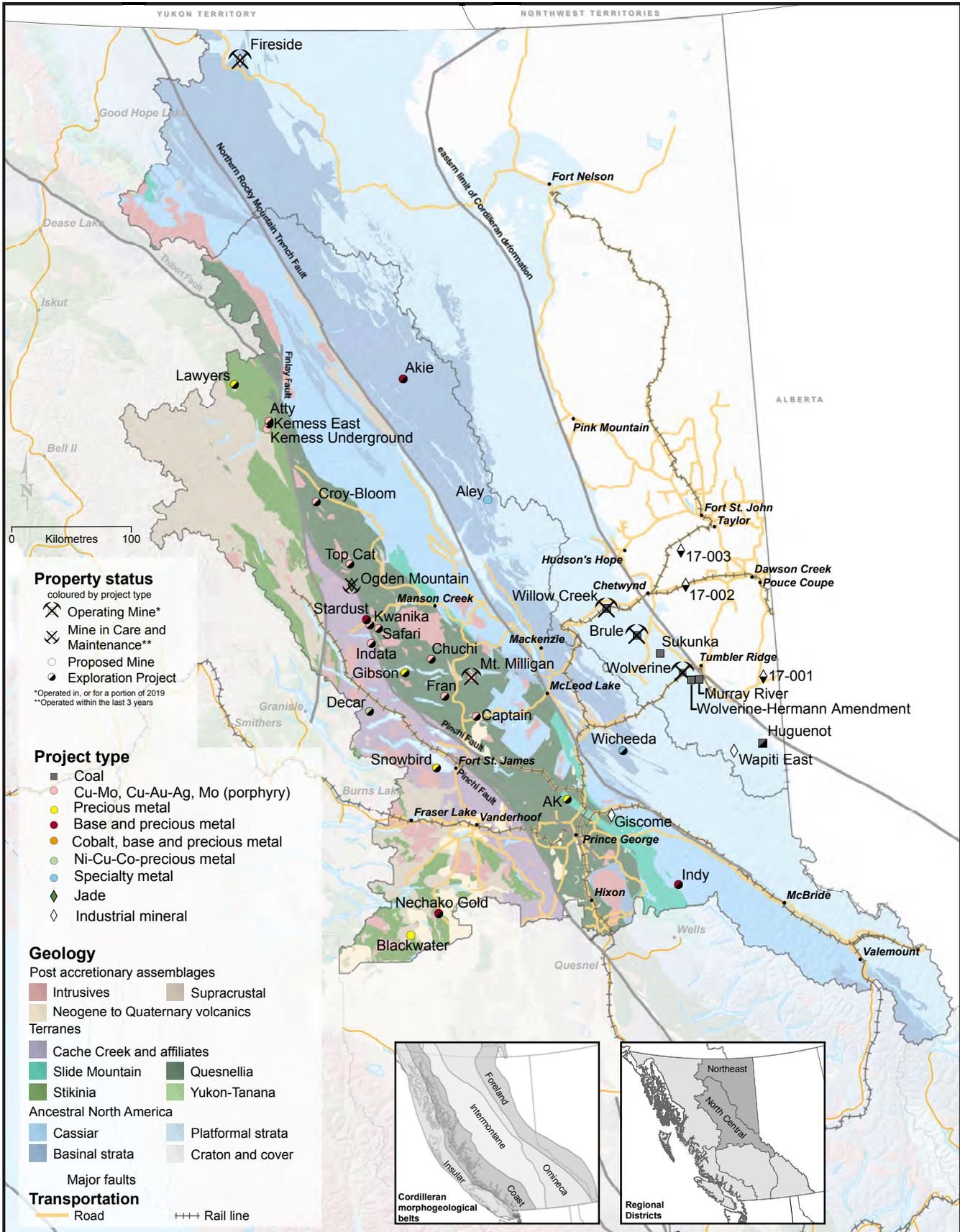


Fig. 1. Mines and selected projects, North Central and Northeast regions, 2019. Terranes after Nelson et al. (2013).

Valley-type lead-zinc deposits and are intruded by carbonatite bodies hosting niobium and rare earth elements (REE). The island arc assemblages of Quesnellia and Stikinia host the known large polymetallic porphyry and orogenic precious metal deposits in the region.

### 3. Mines and quarries

During 2019, one metal mine operated in the North Central Region, three coal mines operated in the Northeast Region and one industrial mineral mine operated in the Northeast Region (Fig. 1; Tables 1-3).

#### 3.1. Metal mines

The only producing metal mine in 2019 is in the North Central Region; **Mt. Milligan** (Cu-Au) wholly-owned by Centerra Gold Inc. (Fig. 1; Table 1).

##### 3.1.1. Mt. Milligan (Centerra Gold Inc.)

The Mt. Milligan mine, in the Quesnel terrane (Fig. 1), is hosted by mafic to intermediate volcanic and pyroclastic rocks of the Takla Group (Triassic to Lower Jurassic) that are intruded by Lower Jurassic monzonite porphyry stocks. The ore body (2500 x 1500 m) is a silica-saturated alkalic porphyry deposit in which Cu-Au (with accessory Ag) mineralization is in sulphides. The deposit consists of two principal zones. At the Main zone, mineralization is mainly in volcanic rocks; at the Southern Star zone, mineralization is in a monzonite stock and volcanic rocks.

The mine was commissioned in 2013. Ore is initially processed through primary and secondary crushers, before milling and flotation in a 62,500 tpd design capacity concentrator. The concentrate, averaging about 23% Cu, is moved by truck to Mackenzie, where it is transferred to rail cars and shipped to North Vancouver for transport to markets. Year-end (2018) combined Measured and Indicated mineral resources were reported as 342.23 Mt at 0.136% Cu and 0.2 g/t Au. Year-end (2018) combined Proven and Probable Mineral reserves were reported as 447.56 Mt at 0.186% Cu and 0.3 g/t Au. The mine has a projected +20-year mine life.

#### 3.2. Coal mines

Conuma Coal Resources Ltd. produces from the Willow Creek, Wolverine and Brule mines (Fig. 2; Table 2).

##### 3.2.1. Willow Creek Mine (Conuma Coal Resources Ltd.)

Forecast production for the Willow Creek mine was 820,000 t of hard coking coal (HCC) and pulverized coal injection (PCI) product.

##### 3.2.2. Brule Mine (Conuma Coal Resources Ltd.)

Forecast production for the Brule mine was 2.62 Mt of clean PCI coal. The coal is contained in folded and thrust-faulted rocks. The coal product is moved by rail to the wash plant at the Willow Creek mine site before being shipped by rail for export at Ridley Terminal in Prince Rupert.

##### 3.2.3. Wolverine Mine (Conuma Coal Resources Ltd.)

Forecast production for the Wolverine mine was 1.19 Mt of HCC. Coal from the mine is trucked to Conuma's rail facility at the Brule mine, where it is loaded for rail transport to the company's wash plant at Willow Creek. Coal is mined from the Perry Creek pit which is nearing the end of its resources. Conuma has applied to the Environmental Assessment Office for an amendment that would allow them to mine coal from the Hermann pit and use the existing Wolverine processing plant and loadout facilities.

#### 3.3. Industrial mineral mines and quarries

In 2019, only the Fireside mine, which produces barite, was in operation in the Northeast Region. In the North Central Region, Green Mountain Jade Inc.'s Ogden Mountain mine was on care and maintenance (Fig. 1; Table 3).

##### 3.3.1. Fireside (Fireside Minerals Ltd.)

Fireside Minerals Ltd. quarries massive white barite from veins cutting Paleozoic sedimentary rocks of the Kechika Group near the Yukon border. The barite veins are steeply dipping, trend north to northeast, and have a combined true thickness of 6.5 m. Barite concentrations in the veins range from 96.0 to 99.4% BaSO<sub>4</sub>. The product is bagged and trucked to Fort St. John and to Alberta, where it is used to produce high-density drilling mud.

#### 4. Placer operations

Placer exploration is a widespread activity in parts of British Columbia, and permits are required only when surface disturbance is proposed. In the North Central Region, operations are distributed primarily in the Manson Creek, Fort St. James to Mackenzie, and Hixon areas. Larger scale operations are generally sited on abandoned stream channels and benches, and use backhoes and hydraulic excavators to extract gravel, which is then processed through a wash plant, either on-site or at a remote location. Because of the number of operations and difficulty in obtaining information, these operations are not tracked.

#### 5. Mine or quarry development

There were no mines under development in the North Central and Northeast regions in 2019.

#### 6. Selected proposed mines or quarries

Projects at the proposed mine stage (Fig. 1; Table 4) in the North Central Region include three proposed metal mines, New Gold Inc.'s **Blackwater** project, Taseko Mines Limited's **Aley** project and Centerra Gold Inc.'s **Kemess Underground** project. Also, in the North Central Region, Greymont Western Canada Inc.'s **Giscome** project is a proposed industrial mine. Proposed mine coal projects in the Northeast Region (Fig. 1; Table 4) include Conuma Coal Resources Limited's **Wolverine-Herman** amendment project, HD Mining International Ltd.'s **Murray River** project and Glencore plc's **Sukunka** project.

**Table 1.** Metal mines, North Central Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2019 Production (based on Q1-Q3)	Reserves	Resource	Comments
<b>Mt. Milligan</b>	<b>Centerra Gold Inc.</b>	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194, 191	74 Mlbs Cu 190 Koz Au	P+Pr: 447.56 Mt at 0.186% Cu and 0.3 g/t Au	M+I: 342.23 Mt at 0.136% Cu and 0.2 g/t Au (additional to reserves)	Concentrator design capacity 62,500 tpd. Estimated mine life +20 years. More than 350 employees.

P = Proven; Pr = Probable; M = Measured; I = Indicated; Inf = Inferred

**Table 2.** Coal mines, Northeast Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2019 Production (based on Q1-Q3)	Reserves	Resource	Comments
<b>Willow Creek</b>	<b>Conuma Coal Resources Limited</b>	HCC, PCI; Bituminous coal; 093O 008	820,000 t	P+Pr: 11.04 Mt	na	About 220 employees, mine and plant.
<b>Brule</b>	<b>Conuma Coal Resources Limited</b>	PCI; Bituminous coal; 093P 007	2.62 Mt clean	P+Pr: 12.26 Mt	na	About 230 employees.
<b>Wolverine</b>	<b>Conuma Coal Resources Limited</b>	HCC; Bituminous coal; 093P 025	1.19 Mt	P+Pr: 26.99 Mt	na	About 300 employees, mine and plant.

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal; ULV = ultra low volatile  
P = Proven; Pr = Probable; M = Measured; I = Indicated; Inf = Inferred

**Table 3.** Selected industrial mineral mines and quarries, North Central and Northeast regions.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2019 Production (based on Q1-Q3)	Reserves	Resource	Comments
<b>Fireside</b> (Northeast Region)	<b>Fireside Minerals Ltd.</b>	Barite; Vein barite; 094M 003, 19	na	na	na	Product is bagged and trucked to Fort St. John and to Alberta, where it is used to produce high-density drilling mud.
<b>Ogden Mountain</b> (North Central Region)	<b>Green Mountain Jade Inc.</b>	Nephrite jade; Jade; 093N 156, 157, 165	na	na	na	Placed on care and maintenance in late 2017.

P = Proven; Pr = Probable; M = Measured; I = Indicated; Inf = Inferred

Fertoz International Inc.'s **Wapiti East** project is a proposed industrial mineral mine in the Northeast Region (Fig. 1; Table 4).

### 6.1. Proposed metal mines

There are three proposed metal mines, all in the North Central

Region: Taseko Mines Ltd.'s **Aley** Niobium project; New Gold Inc.'s **Blackwater** Au-Ag project; and Centerra Gold Inc.'s Cu-Au-Ag **Kemess Underground** project.

#### 6.1.1. Aley (Taseko Mines Ltd.)

Taseko Mines Ltd.'s wholly-owned **Aley** niobium-bearing

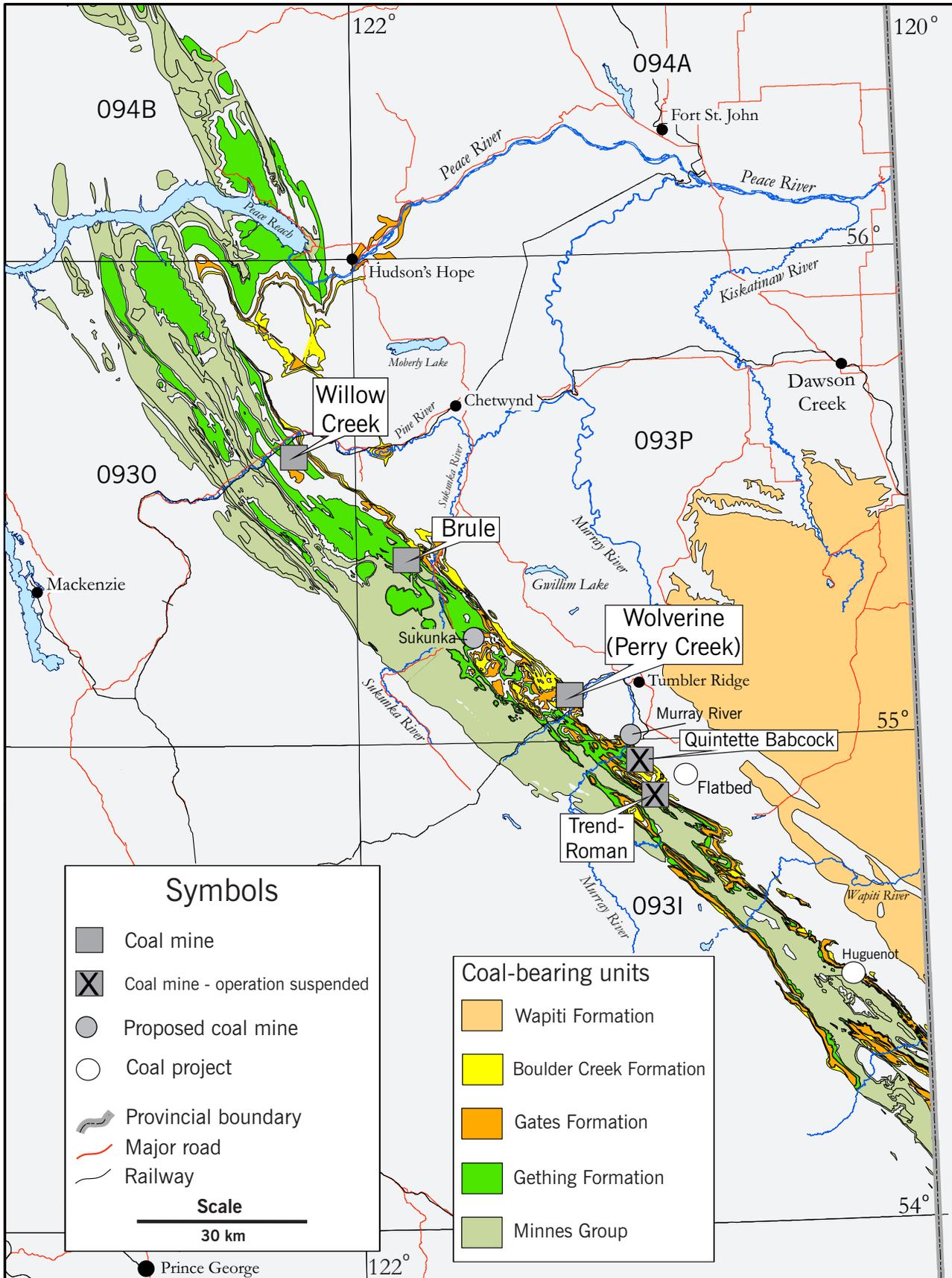


Fig. 2. Coal mines and exploration projects, northeastern British Columbia, 2019. From British Columbia Geological Survey (2020).

**Table 4.** Selected proposed mines and quarries, North Central and Northeast regions.

<b>Project</b>	<b>Operator (partner)</b>	<b>Commodity; deposit type; MINFILE</b>	<b>Reserves</b>	<b>Resource</b>	<b>Comments</b>
<b>Aley</b> (North Central Region)	<b>Taseko Mines Ltd.</b>	Nb; Carbonatite-hosted; 94B 027	P+Pr: 83.8 Mt at 0.50% Nb <sub>2</sub> O <sub>5</sub> (at 0.30% Nb <sub>2</sub> O <sub>5</sub> cut-off)	M+I: 285.8 Mt at 0.37% Nb <sub>2</sub> O <sub>5</sub> (at 0.20% Nb <sub>2</sub> O <sub>5</sub> cut-off)	Proposed open-pit mine with 10,000 tpd ore processing rate and average annual production of 9000 t Nb over a 24-year mine life. In 2019, environmental monitoring, pilot plant to provide product samples.
<b>Blackwater</b> (North Central Region)	<b>New Gold Inc.</b>	Au, Ag; Epithermal Au-Ag-Cu, intermediate sulphidation; 093F 037	P+Pr: 334.4 Mt at 0.74 g/t Au, 5.5 g/t Ag, containing 8.17 Moz Au, 60.8 Moz Ag (combined direct processing and low grade)	M+I: 61.32 Mt at 0.71 g/t Au, 4.4 g/t Ag, containing 1.40 Moz Au, 8.73 Moz Ag (combined direct processing and low grade, exclusive of reserves)	Received Federal and Provincial Environmental Assessment certificates. Drilling (3 DDH, 342 m, 12 sonic/air rotary, 750 m). Proposed open-pit mine with 60,000 tpd ore processing rate and life-of-mine average annual production of 413 Koz Au and 1.74 Moz Ag over a 17-year mine life.
<b>Giscome</b> (North Central Region)	<b>Graymont Western Canada Inc.</b>	CaCO <sub>3</sub> ; Limestone; 093J 041, 25	na	I: >100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ	Environmental Assessment under review. Proposed 600,000 tpy limestone quarry to feed a vertical lime kiln producing 198,000 t of lime annually over a 50+ year mine life.
<b>Kemess Underground (KUG)</b> (North Central Region)	<b>Centerra Gold Inc.</b>	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 021	Pr: 107.38 Mt at 0.27% Cu, 0.54 g/t Au, 1.99 g/t Ag; containing 629.6 Mlbs Cu, 1.87 Moz Au, 6.88 Moz Ag	I: 246.4 Mt at 0.22% Cu, 0.42 g/t Au, 1.75 g/t Ag; containing 1195 Mlbs Cu, 3.33 Moz Au, 13.87 Moz Ag (inclusive of reserves)	Permitted, proposed underground panel cave mine with 24,600 tpd ore processing rate and life-of-mine average annual production of 106,000 oz Au and 47 Mlbs Cu over a 12-year mine life.
<b>Murray River</b> (Northeast Region)	<b>HD Mining International Ltd.</b>	Coal; Bituminous; 093I 035	P: 261.1Mt mineable coal	M+I: 314.2 Mt coal in situ Inf: 373.9 Mt coal in situ	Provincial and Federal EA certificates in place. Mine plan and reclamation program approved April 2018. Would produce 6 Mtpy from two longwall faces over 25-year mine life with 764 direct jobs.
<b>Sukunka</b> (Northeast Region)	<b>Glencore Canada Corporation</b>	Coal; Bituminous; 093P 014	na	145.0 Mt coal in situ	20+ year mine life at 1.5-2.5 Mt saleable coal per year, 250 permanent jobs once operational. Permitting in progress.
<b>Wapiti East</b> (Northeast Region)	<b>Fertoz International Inc.</b>	P <sub>2</sub> O <sub>5</sub> ; Sedimentary phosphate deposits; 093I 008, 22, 15	na	I+Inf: 1.54 Mt 21.6% P <sub>2</sub> O <sub>5</sub>	Permitting in progress. Proposed seasonal shallow open pit mine with annual production of less than 75,000 t over a +20year mine life.

Table 4. Continued.

<b>Wolverine-Herman Amendment</b> (Northeast Region)	<b>Conuma Coal Resources Limited</b>	Coal; Bituminous; 0931 031	P: 10.7 Mt Pr: 3.6 Mt	M: 15.0 Mt I: 15.6 Mt Inf: 9.6 Mt	Drilling (6 DD, 1937 m, 6 RC, 721 m, Sonic, 26,780 m).
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P = Proven; Pr = Probable; M = Measured; I = Indicated; Inf = Inferred

carbonatite project is near the western extremity of platformal strata. The carbonatite intrusion is oval in map view, measuring about 2.0 x 2.8 km. Within that body, reserves stand at 84 Mt grading 0.5% Nb<sub>2</sub>O<sub>5</sub>. An open-pit mine is proposed, processing 10,000 tpd and producing ferroniobium. The projected mine life is 24 years with an output of about 9 Mkg of niobium annually, making it among the largest niobium deposits in the world. Environmental assessment is underway. In 2019, Taseko continued environmental monitoring and began product development and marketing initiatives. A pilot plant program was initiated, to build on bench-scale niobium flotation and converter processes and to provide product samples for marketing.

### 6.1.2. Blackwater (New Gold Inc.)

The **Blackwater** project is accessible by existing roads, but development would require construction of a 140-km power transmission line from a substation south of the community of Endako.

Combined direct processing and low grade Proven and Probable reserves stand at 344.4 Mt grading 0.74 g/t Au and 5.5 g/t Ag. As proposed, Blackwater would be a 60,000 tpd operation with a 17-year mine life. Once completed, the operation would consist of an open pit, an ore processing facility, a waste rock dump, a tailings pond, water management facilities, offices, employee accommodations, warehouses, and a truck shop.

The Blackwater deposit is hosted by a sequence of intermediate to felsic volcanic rocks in the Kasalka Group (Upper Cretaceous; the Stikine terrane). In this intermediate sulphidation, epithermal system, the host rocks are pervasively fractured and sericitized, and sulphides include pyrite, sphalerite, marcasite and pyrrhotite. These occur as disseminations and pore fillings, which are strongly controlled by a set of northeast- and northwest-trending faults.

In 2019, New Gold received both provincial and federal Environmental Assessment Certificates but has not yet decided when to initiate the final mine permitting process as they re-evaluate project sizing and processing options. New Gold continued collecting baseline data and drilled three diamond drill holes totalling 342 m and 12 sonic/air rotary drill holes totalling 750 m.

### 6.1.3. Kemess Underground (Centerra Gold Inc.)

The **Kemess Underground** (KUG) project is a calc-alkaline porphyry Cu-Au-Ag deposit in the North Central Region. The

deposit comprises a low-grade ore zone at a depth of 150 m on its western flank; and a higher-grade zone, at 300 m depth, 550 m to the east. KUG is hosted by a porphyritic monzodiorite/diorite pluton and related dikes that intrude potassically altered Takla Group volcanic rocks and Black Lake plutonic rocks. Secondary biotite alteration in the volcanic rocks and the eastern plutonic rocks characterize the higher-grade Cu-Au mineralization.

The deposit is estimated to contain an Indicated resource of 246.4 Mt grading 0.22% Cu, 0.42 g/t Au and 1.75 g/t Ag. Within this resource are Probable reserves of 107.4 Mt grading 0.27% Cu, 0.54 g/t Au and 1.99 g/t Ag.

The former Kemess South mine closed in 2011. However, infrastructure remains in place, and both the camp and ore processing plant will be used to service KUG, which is about 6.5 km north of the former processing plant. KUG is considered a stand-alone operation, to be mined by panel caving with crushed ore conveyed underground to the processing plant. Processing rate would be 24,600 tpd with a life of mine average production of 106,000 oz au and 47 Mlbs Cu over a 12-year mine life.

**Kemess East** (KE), about 1 km east of KUG, is an underground operation that could be integrated into the KUG project and use facilities developed for KUG. KE has an Indicated resource of 113.1 Mt grading 0.38% Cu, 0.46 g/t Au and 1.95 g/t Ag and an Inferred resource of 63.8 Mt grading 0.34% Cu, 0.31 g/t Au and 1.90 g/t Ag.

Waste rock and tailings from KUG will be placed in the former open pit modified by a 25 m high dam, along with a small amount of KE tailings. Non-acid generating tailings from KE would be placed in dry-stack storage. The KUG project has approval for development but Centerra is currently concentrating resources elsewhere. In 2019, drilling in four diamond drill holes totalled 5347 m.

## 6.2. Selected proposed coal mines

HD Mining International's **Murray River** project received its Mines Act approval in 2018 and awaits a final investment decision. The British Columbia Environmental Assessment Office lists Glencore plc's **Sukunka** project as 'in progress'. Conuma Coal Resources Ltd.'s **Wolverine-Herman Amendment** project is a proposed satellite operation for Conuma's Wolverine mine.

### 6.2.1. Murray River (HD Mining International Ltd.)

Murray River is a proposed underground mine that would

extract metallurgical coal from the Gates Formation. In 2015, HD Mining International Ltd. completed bulk sampling for testing coal quality, processing, and marketability. In April 2018, the company received its Mines Act permit. An adit, driven to collect the bulk sample in 2015 but also to be used for the mining conveyor, descends 1.3 km down a decline. Two vertical shafts are to be completed, one for moving staff and equipment, and the other for ventilation. HD Mining plans to construct its own wash plant and use existing rail facilities. The project is expected to provide about 764 jobs in direct employment during a 25-year mine life. Chinese miners experienced in longwall methods would start production but would be replaced within 10 years once Canadian miners are trained. Murray River awaits a final investment decision by HD Mining's parent company, China Huiyong Holdings.

### 6.2.2. Sukunka (Glencore plc and JX Nippon Oil and Energy Corporation)

The **Sukunka** project has been planned as both an open-pit and underground operation, extracting coal from the Gething Formation. The project is listed on The British Columbia Environmental Assessment Office website as 'in progress'.

### 6.2.3. Wolverine-Herman Amendment (Conuma Coal Resources Ltd.)

In July 2019, Conuma applied to the Environmental Assessment Office to open-pit mine coal at the **Wolverine-Herman Amendment** project, as a satellite to the Wolverine mine. If approved the Hermann pit would produce 1.5 to 3 Mt of coal per year and add up to 7 years to the life of the wash plant at the Wolverine mine. At the site, Conuma completed six diamond drill holes totalling 1937 m, six reverse circulation drill holes totalling 721 m and 26 sonic drill holes totalling 780 m.

## 6.3. Selected proposed industrial mineral mines or quarries

Proposed industrial mineral mines or quarries include Graymont Western Canada Inc.'s **Giscome** project in the North Central Region and Ferto Ltd.'s **Wapiti East** project in the Northeast Region.

### 6.3.1. Giscome (Graymont Western Canada Inc.)

At the **Giscome** project, Graymont Western Canada proposes to exploit a high-purity limestone deposit in basaltic rocks of the Antler Formation (Triassic; Slide Mountain Group). Crushed stone would be transported about 5 km by truck to lime kilns at a former stone quarry, owned and operated by CN Rail, in the community of Giscome. An existing CN Rail line would be used for transporting the product.

The environmental assessment review for the project is in place, and the Mines Act Permit process is underway. The company anticipates starting construction in about 2025, with up to 600 Kt of limestone quarried annually. The product would service mining and pulp and paper operations in northern British Columbia. Once in operation, the project would provide

about 10 seasonal jobs at the quarry and a further 15 or more at the lime plant and would remain in production for about 50 years.

### 6.3.2. Wapiti East (Ferto Ltd.)

Ferto Ltd.'s **Wapiti East** project is a proposed phosphate mine. Combined Indicated and Inferred resources are 1.54 Mt grading 21.6% P<sub>2</sub>O<sub>5</sub> (at a 7% cut-off). Permitting is ongoing but the process has faced delays due to caribou issues. In 2019, water monitoring was undertaken as part of the permitting process.

## 7. Selected exploration activities and highlights

Exploration activity in 2019 for both the North Central and Northeast regions (Fig. 1; Tables 5, 6) was down slightly compared to the previous year but overall expenditures for both regions were up slightly. Significant programs included drilling at **Lawyers** (Benchmark Metals Inc.), **Fran** (MGX Minerals Inc.), **Mt. Milligan, Brownfield and Greenfield programs** (Centerra Gold Inc.) and **Stardust** (Sun Metals Corp.).

### 7.1. Selected precious metal projects

Precious metals projects were underway in 2019, all in the North Central Region (Fig. 1; Table 5). Projects included **AK** (Exodus Mineral Exploration Ltd.) **Lawyers** (Benchmark Metals Inc.), and **Snowbird** (Gitennes Exploration Corp.).

#### 7.1.1. AK (Exodus Mineral Exploration Ltd.)

The **AK** gold prospect was discovered by prospectors Max Keogh and Andreas Angele in early 2018. It consists of a set of quartz veins with associated shear zones, intruding Takla Group volcanic rocks. Analysis of one specimen from the 'discovery vein' returned 8 g/t Au. In 2019, work include additional trenching and sampling.

#### 7.1.2. Gibson (CANEX Metals Inc.)

In early 2019, CANEX reported new and updated results for a 10-hole, 1001 m drill program carried out in late 2018. All holes were within about 1 km of the Hogem batholith, and targeted silver mineralization with associated galena. A new zone of quartz-sulphide veins was discovered adjacent to the main Gibson trend. Highlight results included 1.0 m of 11.9 g/t Au and 301 g/t Ag and 0.5 m of 2.7 g/t Au and 872 g/t Ag.

#### 7.1.3. Lawyers (Benchmark Metals Inc.)

The **Lawyers** project is a regional-scale prospect that follows northwest-trending linear magnetic and radiometric anomalies with multiple gold-silver showings for more than 20 km. Showings include the Cliff Creek, Dukes Ridge, Phoenix, Marmot and AGB (Fig. 3) zones. Except for Marmot, all zones are considered part of the same system.

In 2019, Benchmark drilled 47 diamond drill holes totalling 11,000 m. Highlight assays included 4.4 m grading 11.73 g/t Au and 476 g/t Ag at the Cliff Creek zone, 25.0 m grading 2.79 g/t Au and 177 g/t Ag and 2.95 m grading 30.2 g/t Au and

**Table 5.** Selected exploration projects, North Central Region.

<b>Project</b>	<b>Operator (partner)</b>	<b>Commodity; Deposit type; MINFILE</b>	<b>Resource (NI 43-101 compliant unless indicated otherwise)</b>	<b>Comments</b>
<b>AK</b>	<b>Exodus Mineral Exploration Ltd.</b>	Au-quartz veins	na	Trenching and sampling.
<b>Akie</b>	<b>ZincX Resources Corp.</b>	Zn, Pb, Ag; Sedimentary exhalative Zn- Pb-Ag; 094F 031	I: 22.7 Mt at 8.32% Zn, 1.81% Pb, 14.1 g/t Ag Inf: 7.5 Mt at 7.04% Zn, 1.24% Pb, 12.0 g/t Ag (at 5% Zn cut-off)	PEA proposed 18-year mine life, mine production rate 4000 tpd, 25.8 Mt total mined, initial capital cost \$302.3 million. In 2019, four DDH holes, 2347 m. Results included 10.94 m (true width) of 10.85% Zn, 2.23% Pb and 17.0 g/t Ag and 14.65 m (true width) of 16.20% Zn, 3.39% Pb and 27 g/t Ag.
<b>Atty</b>	<b>Serengeti Resources Inc.</b>	Cu, Mo, Au; Porphyry Cu±Mo±Au	na	Geophysics, 29.8 line-km IP. Drilling six DDH, 2318 m. Results included 87.7 m of 0.04% Cu, 0.14 g/t Au and 0.4 g/t Ag.
<b>Captain</b>	<b>Orestone Mining Corp.</b>	Cu, Au; Alkalic porphyry Cu-Au; 093J 026, 094C 180	na	Drilling, seven DDH, 1900 m. Results included 91 m of 0.065% Cu and 0.26 g/t Au.
<b>Chuchi</b>	<b>Centerra Gold Inc.</b>	Cu, Au; Alkalic porphyry Cu-Au; 093N 159	I: historic non-NI 43-101 compliant: 50 Mt at 0.21- 4.0% Cu, 0.21-0.44 g/t Au (Digger Resources Inc., 1991)	Geophysics, 731 line-km low altitude aeromagnetic survey. Drilling four DDH, 1755 m.
<b>Croy-Bloom</b>	<b>Serengeti Resources Inc.</b>	Cu, Au; Alkalic porphyry Cu-Au; 094D 015, 25, 094C 039, 156	na	Geophysics, 12 line-km of IP. Mapping and sampling.
<b>Decar</b>	<b>FPX Nickel Corp.</b>	Ni; Ultramafic-hosted; 093K 039, 72, 89	2018 I: 1843 Mt at 0.143 DTR (Davis Tube Recoverable) Ni Inf: 391 Mt at 0.115% DTR Ni, at 0.06% cut-off	Bench-scale metallurgical testing produced clean nickel concentrates grading 63 to 65% Ni with improvements in recovery relative to previous testing. By-product iron ore concentrates graded 60 to 65% cent Fe.
<b>Fran</b>	<b>MGX Minerals Inc.</b>	Cu, Au; Alkalic porphyry Cu-Au; 093K 108, 093N 207	na	Drilling, 11 DDH, 4200 m. Results included 1.3 m of 13.5 g/t Au, 2.23 m of 23.26 g/t Au and 8.85 m of 1.0 g/t Au.
<b>Gibson</b>	<b>Canex Metals Inc.</b>	Au, Ag, Cu; Epithermal Au-Ag-Cu, low sulphidation; 093 185	na	Results reported for 10-hole, 1001 m DD carried out in late 2018. Results included 1.0 m of 11.9 g/t Au and 301 g/t Ag and 0.5 m of 2.7 g/t Au and 872 g/t Ag.
<b>Indata</b>	<b>Prophecy Potash Corp.</b>	Cu, Au; na	na	Prospecting and sampling. Rock grab sample results included 3.64% Cu and 5.95 g/t Au. Project under option from Eastfield Resources Ltd.

Table 5. Continued.

<b>Indy</b>	<b>InZinc Mining Ltd.</b>	Zn, Pb, Ag; Sedimentary exhalative Pb-Zn-Ag; 093N 240	na	Soil surveys (1194 samples), mapping and prospecting.
<b>Kemess East</b>	<b>Centerra Gold Inc.</b>	Cu, Mo, Au; Porphyry Cu±Mo±Au; 094E 315	I: 113.12 Mt at 0.38% Cu, 0.46 g/t Au, 1.94 g/t Ag, containing 954 Mlb Cu, 1680 Koz Au, 7066 Koz Ag	Potential to be integrated into the Kemess Underground project.
<b>Kwanika</b>	<b>Kwanika Copper Corp. (65% Serengeti Resources Inc., 35% Posco International Corporation)</b>	Cu, Au, Ag; Porphyry Cu±Mo±Au; 093N 073	I: Central Zone pit: 11.8 Mt at 0.37% Cu, 0.39 g/t Au, 1.07 g/t Ag. Central zone underground: 41.4 Mt at 0.46% Cu, 0.52 g/t Au, 1.36 g/t Ag	Working on an interim study report.
<b>Lawyers</b>	<b>Benchmark Metals Inc.</b>	Au, Ag, Cu, Zn; Epithermal Au-Ag-Cu, low sulphidation; 094E 066	Inf: Cliff Creek N zone, 550 Kt at 4.51 g/t Au, 209.15 g/t Ag; Duke's Ridge zone, 58 Kt at 4.30 g/t Au, 139.13 g/t Ag	Drilling, 47 DDH, 11,000 m. Results included 4.4 m grading 11.73 g/t Au and 476 g/t Ag at the Cliff Creek zone, 25.0 m grading 2.79 g/t Au and 177 g/t Ag, and 2.95 m grading 30.2 g/t Au and 1361 g/t Ag at the AGB zone, 2.87 m grading 46.9 g/t Au and 3056 g/t Ag at the Phoenix zone and 3.34 m grading 7.85 g/t Au and 830 g/t Ag at the Duke's Ridge zone.
<b>Mt. Milligan on-lease (brownfield) and off-lease (greenfield)</b>	<b>Centerra Gold Inc.</b>	Cu, Au, Ag; Alkalic porphyry Cu-Au; 094N 194, 093N 091	na	Geophysics, 640 line-km low altitude aeromagnetic survey, planned 32 line-km IP. Drilling near pit (planned) 25,000 m. Drilling outside ultimate pit, 23 holes, 9900 m.
<b>Nechako Gold</b>	<b>Tower Resources Ltd.</b>	Au, Ag; Epithermal, low sulphidation; 093F 060	na	Drilling, RC, 11holes in till to help define sulphide mineral dispersal. Results used to select sites for seven DDH. Results included 0.2 m grading 2.93 g/t Au, 34.3 g/t Ag, 5.45% Zn, 0.60% Pb.
<b>Safari</b>	<b>Spearmint Resources Inc.</b>	Cu-Au; Alkalic porphyry Cu-Au	na	Rock sampling. Two of 17 grab samples returned assays of 0.23% and 0.14% Cu; in addition to anomalous Au and Ag values of 0.3 g/t Au, and 2.7 and 1.0 g/t Ag.
<b>Snowbird</b>	<b>Gitennes Exploration Inc.</b>	Au; Epithermal in quartz veins; 093K 036	na	Late season drilling, 10 holes, 2000 m.
<b>Stardust</b>	<b>Sun Metals Corp.</b>	Ag, Pb, Zn; Skarn Ag-Pb-Zn; 093N 009	na	Drilling, estimated 27 holes, 15,000 m. Results included 24.85 m of 3.13% Cu, 4.8 g/t Au, and 93.45 g/t Ag, and 58.01 m of 2.49% Cu, 2.61 g/t Au, and 44.3 g/t Ag.

Table 5. Continued.

<b>Top Cat</b>	<b>Serengeti Resources Inc.</b>	Cu-Au; Alkalic porphyry Cu-Au	na	Mapping, prospecting (79 rock samples), geochemical sampling (282 soil and stream samples). Rock samples returned trace to 6.5 g/t Au.
<b>Wicheeda</b>	<b>Defense Metals Corp.</b>	Carbonatite-hosted deposits Nb, REE; 093J 014	Inf: 11.37 Mt 1.14% Ce, 0.53% La, 0.23% Nd, 0.04% Nb, 0.01% Sm and 1.96% LREE (at a 1% LREE cut- off).	Collected 30 t bulk sample. Drilling, 13 holes, 2005 m. Results included 83 m of 4.43% light rare earth oxides (LREO) and 58 m of 4.01% LREO.

M = Measured; I = Indicated; Inf = Inferred

Table 6. Selected exploration projects, Northeast Region.

<b>Project</b>	<b>Operator (partner)</b>	<b>Commodity; Deposit type; MINFILE</b>	<b>Resource (NI 43-101 compliant unless indicated otherwise)</b>	<b>Comments</b>
<b>17-001 to 17-003</b>	<b>Sil Industrial Minerals Ltd.</b>	Sand and gravel (as frac sand)	na	Drill sampling, 90 holes, 600 m.
<b>Huguenot</b>	<b>Colonial Coal International Corp.</b>	Coal; Bituminous	M+I: 132.0 Mt (in situ surface mineable)	Released a Preliminary Economic Assessment.

M = Measured; I = Indicated; Inf = Inferred



Fig. 3. Lawyers project, DDH 19AGBDD001, 233 m, gold mineralized silica-flooded hydrothermal breccia.

1361 g/t Ag at the AGB zone, 2.87 m grading 46.9 g/t Au and 3056 g/t Ag at the Phoenix zone and 3.34 m grading 7.85 g/t Au and 830 g/t Ag at the Duke's ridge zone. Lower grade envelopes around high-grade vein sets may indicate potential for a bulk tonnage resource. Surface sampling identified a new zone (Marmot East) across an area of 500 by 250 m where rock grab samples graded up to 24.2 g/t Au and 1425 g/t Ag.

#### 7.1.4. Snowbird (Gitennes Exploration Inc.)

The **Snowbird** project is an orogenic gold-in-quartz deposit that has seen at least 10 years of exploration. It is about 2 km to the north of the Snowbird antimony (stibnite) former mine. Vein and shear zone mineralization is hosted by argillite,

alpine-type ultramafic rocks (harzburgite), andesite, and diorite along the Sowchea fault zone. Gitennes has explored the property since 2016, and in 2019 completed late-season diamond drilling totalling 2000 m in 10 holes. The deepest hole (400 m) intersected pyrite-arsenopyrite associated with quartz-carbonate veins.

## 7.2. Selected porphyry projects

Porphyry projects continued to be the principal focus of mineral exploration in the Quesnel and Stikine terranes of the North Central Region (Fig. 1; Table 5).

### 7.2.1. Atty (Serengeti Resources Inc.)

Serengeti's **Atty** project is adjacent to Centerra Gold's Kemess property. In 2019, 29.8 line-km of IP geophysics and follow up diamond drilling (six holes, 2318 m) were carried out. Highlight drilling results included 87.7 m of 0.04% Cu, 0.14 g/t Au and 0.4 g/t Ag.

### 7.2.2. Captain (Orestone Mining Corp.)

The **Captain** project is 30 km south of the Mt. Milligan mine. Mineralization is hosted in an altered alkalic monzonite porphyry. In 2019, Orestone completed 1900 m of diamond drilling in seven holes. The holes intersected intervals with sericite alteration and 10-20% very fine disseminated sulphides, including chalcopyrite. Highlight results included 91 m of 0.065% Cu and 0.26 g/t Au.

### 7.2.3. Chuchi (Centerra Gold Inc.)

The **Chuchi** copper-gold property is at the northeast margin of the Hogem batholith (Early Jurassic to Early Cretaceous), where a cluster of porphyritic monzonite stocks, dikes, and sills intrude the Chuchi Lake succession of volcanic and sedimentary rocks. In 2019, Centerra carried out a 731 line-km low-altitude aeromagnetic survey and 1755 m of diamond drilling in 4 holes.

### 7.2.4. Croy-Bloom (Serengeti Resources Inc.)

The **Croy-Bloom** property hosts several Cu-Au porphyry targets. The property is underlain by Middle to Upper Triassic volcanoclastic and volcanic rocks of the Takla Group that are cut by intrusive bodies that comprise the northern end of the Hogem batholith. In 2019, Serengeti completed about 12 line-km of IP surveying, mapping, and sampling.

### 7.2.5. Fran (MGX Minerals Inc.)

MGX carried out a winter 2018-2019 drilling program at its **Fran** project alkalic porphyry target. The target is hosted by volcano-sedimentary rocks of the Takla Group that are cut by en-echelon shear zones containing quartz-sulphide veins and stockworks. In 2019, MGX diamond drilled 4200 m in 11 holes. Highlight results included 1.3 m of 13.5 g/t Au, 2.23 m of 23.26 g/t Au and 8.85 m of 1.0 g/t Au.

### 7.2.6. Kwanika (Kwanika Copper Corporation)

Kwanika Copper Corporation (65% Serengeti Resources Inc., 35% Posco International Corporation) was formed in 2017 to continue exploration on the **Kwanika** property. Since 2006, about 82,650 m of drilling has been done on Kwanika (Central and South zones). In 2019, an updated combined open-pit and underground constrained Central Zone resource was announced as a Measured and Indicated resource of 223.6 Mt grading 0.27% Cu, 0.25 g/t Au and 0.87 g/t Ag containing 1.32 Blbs of Cu, 1.83 Moz of Au and 6.27 Moz of Ag. The company planned to release a prefeasibility study but determined that it lacked the necessary funding and instead will focus on completing an interim study report.

### 7.2.7. Mt. Milligan Brownfield and Greenfield Programs (Centerra Gold Inc.)

Centerra carried out a brownfield-greenfield low-altitude 640 km aeromagnetic survey and planned a 32 line-km IP survey near the mine site. Centerra reported that they had planned to complete 22,500 m of near-pit infill drilling by the end of 2019. Additional brownfield drilling (within mine lease, but outside ultimate pit) of 23 holes totalling 9900 m was completed.

### 7.2.8. Safari (Spearmint Resources Inc.)

The **Safari** project property is adjacent to Serengeti Resources Inc.'s Kwanika project. In 2019, Spearmint carried out rock sampling and two of 17 grab samples returned assays of 0.23% and 0.14% Cu; in addition to anomalous Au and Ag values of 0.3 g/t Au, and 2.7 and 1.0 g/t Ag. Mineralization occurs in

quartz veins with pyrite and chalcopyrite sulphides spatially associated with propylitic and potassic altered granitoids.

### 7.2.9. Top Cat (Serengeti Resources Inc.)

In 2019, Serengeti carried out mapping, prospecting, and geochemical sampling at its **Top Cat** project. In total, 79 rock and 282 soil and stream-sediment samples from six prospective localities were collected. Copper mineralization, in the form of chalcopyrite and/or bornite, was observed at all six localities. Gold assays from trace to 6.50 g/t Au were returned from the sampling.

## 7.3. Selected polymetallic base and precious metal projects

Exploration was carried out on several polymetallic base and precious metal projects, all in the North Central Region (Fig. 1; Table 5). These include ZincX Resources Corp.'s **Akie** project; Prophecy Potash Corp.'s **Indata** project; InZinc Mining Ltd.'s **Indy** project; Tower Resources Ltd.'s **Nechako Gold** project; and Sun Metal's Corp.'s **Stardust** project.

### 7.3.1. Akie (ZincX Resources Corp.)

ZincX Resources continued exploration on its **Akie** SEDEX project, which includes the Cardiac Creek deposit. The deposit is hosted by siliceous, carbonaceous, fine-grained siliciclastic rocks of the Gunsteel Formation (Middle to Late Devonian). At a base case 5% zinc cut-off, the deposit has an Indicated resource of 22.7 Mt grading 8.32% Zn, 1.61% Pb and 14.1 g/t Ag and an Inferred resource of 7.5 Mt grading 7.04% Zn, 1.24% Pb and 12.0 g/t Ag. In 2019, ZincX carried 2347 m of diamond drilling in four holes, focussing on the high-grade core of the deposit. Highlight results included 10.94 m (true width) of 10.85% Zn, 2.23% Pb and 17.0 g/t Ag and 14.65 m (true width) of 16.20% Zn, 3.39% Pb and 27 g/t Ag.

### 7.3.2. Indata (Prophecy Potash Corp.)

The **Indata** project is under option from Eastfield Resources Ltd. To earn 60%, Prophecy is required to complete \$2.0 million in exploration, pay \$250,000 in cash and \$150,000 in cash/share equivalents over a five-year term. Imperial Metals Corporation holds an 8.5% working interest (subject to dilution). In 2019, exploration included prospecting and rock sampling, geochemical sampling, road construction, and excavator trenching. Rock grab sample results included 3.64% Cu and 5.95 g/t Au.

### 7.3.3. Indy (InZinc Mining Ltd.)

The **Indy** project area has been of exploration interest since the early 1980s. Targets have generally been categorized as a Mississippi Valley-type (MVT), although SEDEX affinities have long-been recognized. A maiden drill program in 2018 identified a new SEDEX mineralized discovery (B-9 zone) and results included 6.29 m of 12.33% Zn, 2.98% Pb and 24.5 g/t Ag. In 2019, soil geochemical surveys (1194 samples), mapping and prospecting were carried out. Results identified several targets, the largest being a 1.5 km-long multi-element

geochemical target defined by distinctive SEDEX pathfinder elements in soil samples and rock exposures. This target is 5 km northwest of the B-9 zone.

#### 7.3.4. Nechako Gold (Tower Resources Ltd.)

Tower Resources **Nechako Gold** project is approximately 30 km northeast of the advanced Blackwater project. In the spring of 2019, Tower Resources did RC drilling in 11 holes to collect till samples to better define the dispersal train of sulphide minerals identified by previous drilling. Results were used to select seven sites for diamond drilling in totalling 631 m. Drilling intersected brecciated basalt with narrow veins mineralized with sphalerite and galena. The widest vein (0.2 m) assayed 2.93 g/t Au, 34.3 g/t Ag, 5.45% Zn and 0.60% Pb.

#### 7.3.5. Stardust (Sun Metals Corp.)

The **Stardust** property was acquired by Sun Metals in 2017. Historically regarded as a skarn deposit, it was explored intermittently for many years. Historic work included more than 80,000 m of drilling, 5800 soil samples, airborne magnetic surveys, mapping, and prospecting. Mineralization is hosted by the Sowchea, Pope and Copely successions west of the Pinchi fault, in the Cache Creek terrane. In 2018, Sun Metals reported discovering a new zone (421 zone) and drilling results included a 100 m intersection grading 2.51% Cu, 3.03 g/t Au and 52.5 g/t Ag. Sun Metals began drilling in May 2019, which continued into the fall with plans for extension into 2020. Estimated drilling for 2019 was 15,000 m in 27 holes. Highlight 2019 results for the 421 zone (Fig. 4) included 24.85 m of 3.13% Cu, 4.8 g/t Au and 93.45 g/t Ag, and 58.01 m of 2.49% Cu, 2.61 g/t Au and 44.3 g/t Ag. Results confirm continuity of mineralization down dip and to the south of the 2018 discovery hole.

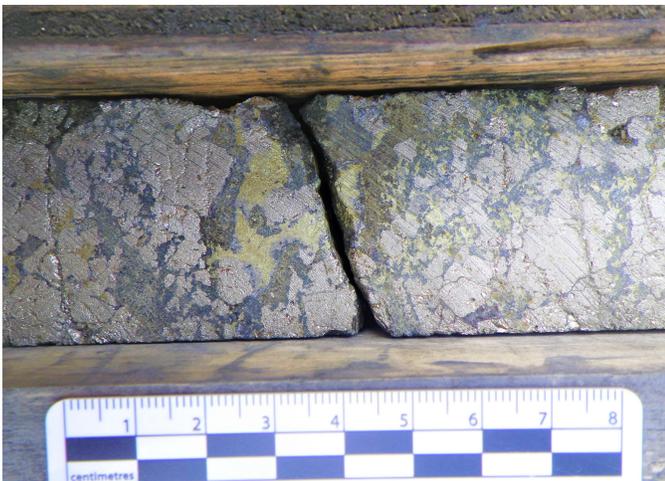


Fig. 4. Stardust project, DDH 19-SD-430P, 579 m, chalcopyrite and pyrite.

#### 7.4. Selected Ni-Cu-Co-precious metal projects

FPX Nickel Corp.'s **Decar** project is in the North Central Region (Fig. 1; Table 5).

##### 7.4.1. Decar (FPX Nickel Corp.)

The **Decar** project contains ultramafic rocks mineralized with a naturally occurring nickel-iron alloy called awaruite. FPX Nickel Corp. reported bench-scale test results for metal extraction and are considering testing a 10,000 t bulk sample. A conventional flow sheet based on grinding, magnetic separation, and flotation processes consistently produced clean nickel concentrates grading 63 to 65% Ni with significant improvements in recovery relative to previous testing. By-product iron ore concentrates graded 60 to 65% Fe.

#### 7.5. Selected specialty metal projects

Deep-water basin strata east of the Rocky Mountain Trench host a number of specialty metal projects, including Taseko Mine Ltd.'s **Aley** Nb-bearing carbonatite proposed mine (see section 6.1.1.) and Defense Metals Corporation's **Wicheeda** (LREE) project (Fig. 1; Table 5).

##### 7.5.1. Wicheeda (Defense Metals Corp.)

The **Wicheeda** carbonatite is a deformed intrusion that hosts light rare earth elements (LREE) in the Kechika Group. The core of the intrusion is a dolomite carbonatite, which transitions outward to a calcite carbonatite. Hydrothermal veins and plugs in the dolomite carbonatite are mineralized with REE fluorocarbonates, ancylite (cerium, lanthanum) and monazite (cerium, lanthanum, neodymium). Minor concentrations of niobium are present as well.

In 2019, Defense Metals completed a 30 t bulk sample and in June released a NI 43-101 report that set out, at a 1% LREE cutoff, an Inferred resource of 11.37 Mt grading 1.14% Ce, 0.53% La, 0.23% Nd, 0.04% Nb, 0.01% Sm and 1.96% LREE. In September, the company completed drilling a total of 2005 m in 13 holes (Fig. 5), which left the deposit open to the north and west. Highlight results included 83 m of 4.43% light rare earth oxides (LREO; lanthanum, neodymium, praseodymium, and samarium oxides) and 58 m of 4.01% LREO.



Fig. 5. Wicheeda project, DDH WI19-21, 57 m, REE-mineralized carbonatite.

## 7.6. Selected coal projects

Exploration for coal in the Northeast Region remained at low levels except at active mine sites. Colonial Coal International Corp. announced a revised Preliminary Economic Assessment for its Huguenot project (Fig. 1; Table 6).

### 7.6.1. Huguenot (Colonial Coal International Corp.)

Colonial Coal announced a Preliminary Economic Assessment for an open-pit only mine for its **Huguenot** project. This revises a previous PEA for a combined open-pit and underground operation. Two scenarios for the open-pit only mine capital expenditures were reported. Based on the purchased equipment scenario the financial analysis suggested that the coal price required to achieve a zero NPV at discount rates of 5%, 7.5% and 10%, respectively, is about US\$113, US\$120 and US\$125 t. A coal price of US\$137 per t is required for an IRR of 15%. Based on the leased equipment option the financial analysis suggested that the coal price required to achieve a zero NPV at discount rates of 5%, 7.5% and 10%, respectively, is about US\$114, US\$119 and US\$125 per t. A coal price of US\$137 per t is required for an IRR of 15%. Measured and Indicated surface mineable coal resources total 132.0 Mt, with an additional Inferred resource of 0.5 Mt. The conceptual open pit would yield 72 Mt of product coal during a mine life of 27 years.

## 7.7. Selected industrial mineral projects

Apart from the proposed **Giscome** limestone quarry (see section 6.3.1.), the only significant industrial mineral project was in the Northeast Region, where Sil Industrial Minerals explored for frac sand resources at its **Sil** project (Fig. 1; Table 6).

### 7.7.1. Sil 17-001 to 17-003 (Sil Industrial Minerals Ltd.)

In 2018, Sil Industrial Minerals Ltd. completed initial exploration in the Northeast Region on a multi-year project in search of frac sand resources in post-glacial sediments. In 2019, the 17-001 target area was sampled with 70 drill holes totalling 500 m, the 17-002 target area was sampled with 10 drill holes totalling 50 m and the 17-003 target area was also sampled with 10 drill holes totalling 50 m.

## 8. Geological research

Ootes et al. (2020 a, b) conducted the second year of a three-year project mapping northern Hogen batholith and surrounding rocks, refining plutonic suite assignments, providing new geochronologic data, and reporting new mineral showings. As an aid to mapping the surficial and bedrock geology of the area, Elia and Ferbey (2020) used a remotely piloted aircraft to produce high-resolution digital elevation models that provided details in near real-time about map units that field crews would not otherwise have gained. Steinthorsdottir et al. (2020) examined serpentized ultramafic rocks of the

Trembleur ultramafite near Decar to better understand controls on the formation, distribution, and abundance of brucite, which is capable of sequestering atmospheric CO<sub>2</sub>, and awaruite, a potential source of nickel. Nott et al. (2020) examined the geology and geochronology of the Polaris ultramafic-mafic complex to better understand Ni-CU-PGE ore-forming processes in such Alaskan-type intrusions.

## 9. Summary

The North Central and Northeast regions are highly prospective for discovering mineral deposits. The North Central Region has three proposed metal mine projects and one proposed industrial mineral mine project. The Northeast Region has several proposed coal mine projects and one proposed industrial mineral mine project. The North Central Region has several active mineral exploration projects while in the Northeast Region the predominant commodity explored for is coal. In 2019, exploration expenditures were down slightly in both regions.

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