

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



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Recommended citation: Clarke, G., 2021. Exploration and mining in the North Central and Northeast regions, British Columbia. In: Provincial Overview of Exploration and Mining in British Columbia, 2020. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Information Circular 2021-01, pp. 65-79.

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 two producing coal mines, Conuma Coal Resources Limited's **Brule** and **Wolverine** operations. Conuma's **Willow Creek** operation shut down in July. 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 copper, gold, silver, zinc, lead, specialty metals, and rare earth elements, mostly in porphyry, vein and stockwork, SEDEX, and carbonatite settings. The **Mt. Milligan** copper-gold operation (Centerra Gold Inc.) is the only producing mine in the region. Both regions also saw numerous exploration projects (Fig. 1). Companies quickly adapted with appropriate protocols after initial disruptions due to Covid-19. Significant results included those reported for Benchmark Metals Inc.'s **Lawyers** project, Kwanika Copper Corporation's **Kwanika** project, and Sun Metals Corp.'s **Stardust** project.

Noteworthy acquisitions and proposed mergers were announced in 2020. Artemis Gold Inc. acquired the **Blackwater Gold** project from New Gold Inc. for approximately \$210 million. The project has both provincial and federal environmental assessment approval. BW Gold Ltd. (a wholly owned subsidiary of Artemis) plans to move the project forward with construction starting in Q2, 2022. In November, Serengeti Resources Inc. and Sun Metals Corp. entered into an agreement

whereby Serengeti would acquire all issued shares of Sun Metals. The transaction would consolidate the contiguous copper-gold exploration and development assets of the **Kwanika** and **Stardust** projects. A financing of \$10.35 million connected with the merger transaction was completed.

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 Low Carbon Innovation, the Association for Mineral Exploration in British Columbia, and EY LLP. For the North Central Region, exploration expenditures were estimated at \$57.0 million and exploration drilling was estimated at approximately 168,960 m. For the Northeast Region, exploration expenditures were estimated at \$11.7 million and exploration drilling was estimated at approximately 14,380 m (Clarke et al., 2021; EY LLP, 2021).

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

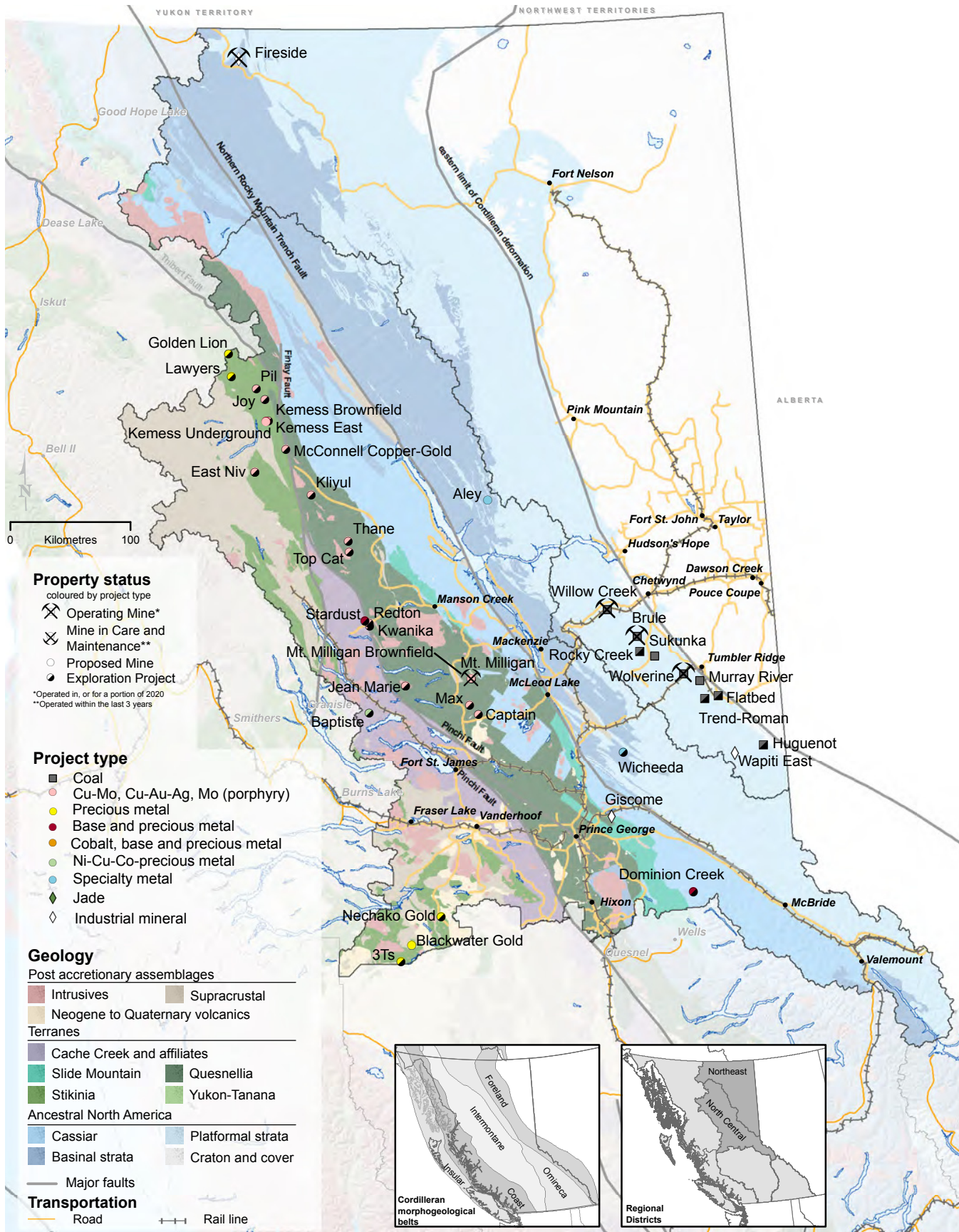


Fig. 1. Mines and selected projects, North Central and Northeast regions, 2020. Terranes after Nelson et al. (2013).

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 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 2020, one metal mine operated in the North Central Region, three coal mines operated in the Northeast Region (one shut down in July) 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 2020 is in the North Central Region; **Mt. Milligan** (copper-gold) 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 copper and gold (with accessory silver) 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 (2019) combined Measured and Indicated mineral resources were

Table 1. Metal mines, North Central Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2020 Production (based on Q1-Q3)	Reserves	Resource	Comments
Mt. Milligan	Centerra Gold Inc.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194, 191	83.2 Mlbs Cu 159 Koz Au	P+Pr: 191.0 Mt 0.23% Cu, 0.39 g/t Au	M+I: 125.4 Mt 0.19% Cu, 0.35 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 2020 Production (based on Q1-Q3)	Reserves	Resource	Comments
Brule	Conuma Coal Resources Limited	PCI; Bituminous coal; 093P 007	2.1 Mt	P+Pr: 12.26 Mt	na	About 230 employees.
Willow Creek	Conuma Coal Resources Limited	HCC, PCI; Bituminous coal; 093O 008	700,000 t	P+Pr: 11.04 Mt	na	Placed on care and maintenance in July.
Wolverine	Conuma Coal Resources Limited	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 2020 Production (based on Q1-Q3)	Reserves	Resource	Comments
Fireside (Northeast Region)	Fireside Minerals Ltd.	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.

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

reported as 125.4 Mt at 0.19% Cu and 0.35 g/t Au. Year-end (2019) combined Proven and Probable Mineral reserves were reported as 191.0 Mt at 0.23% Cu and 0.39 g/t Au. The mine has a projected +20-year mine life.

3.2. Coal mines

Conuma Coal Resources Ltd. produced from the **Brule**, **Willow Creek**, and **Wolverine** mines (Fig. 2; Table 2). The Willow Creek mine suspended operations in July.

3.2.1. Brule Mine (Conuma Coal Resources Ltd.)

Forecast production for the **Brule mine** was 2.1 Mt of pulverized coal injection (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.

3.2.2. Willow Creek Mine (Conuma Coal Resources Ltd.)

The **Willow Creek** mine produced 700,000 t of hard coking coal (HCC) and pulverized coal injection (PCI) product before suspending operations in July due to low prices.

3.2.3. Wolverine Mine (Conuma Coal Resources Ltd.)

Forecast production for the **Wolverine** mine was 2.1 Mt of hard coking coal (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 Herman pit and use the existing Wolverine processing plant and loadout facilities. The proposed Herman pit is approximately 16 km from the Wolverine mine Perry Creek pit and coal processing plant.

3.3. Industrial mineral mines and quarries

In 2020, only the **Fireside** barite mine was in operation in the Northeast Region (Fig. 1; Table 3). In the North Central Region, there may have been some minor jade production, but it was not monitored.

3.3.1. Fireside (Fireside Minerals Ltd.)

At the **Fireside** mine, 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% BaSO₄. 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 because production is not reported, these operations are not tracked.

5. Mine or quarry development

There were no mines or quarries under development in the North Central and Northeast regions in 2020.

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, Taseko Mines Limited's **Aley** project, Artemis Gold Inc.'s **Blackwater Gold** 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, HD Mining International Ltd.'s **Murray River** project and Glencore plc's **Sukunka** project. Ferto International Inc.'s **Wapiti East** project is a proposed industrial mineral mine in the Northeast Region (Fig. 1; Table 4).

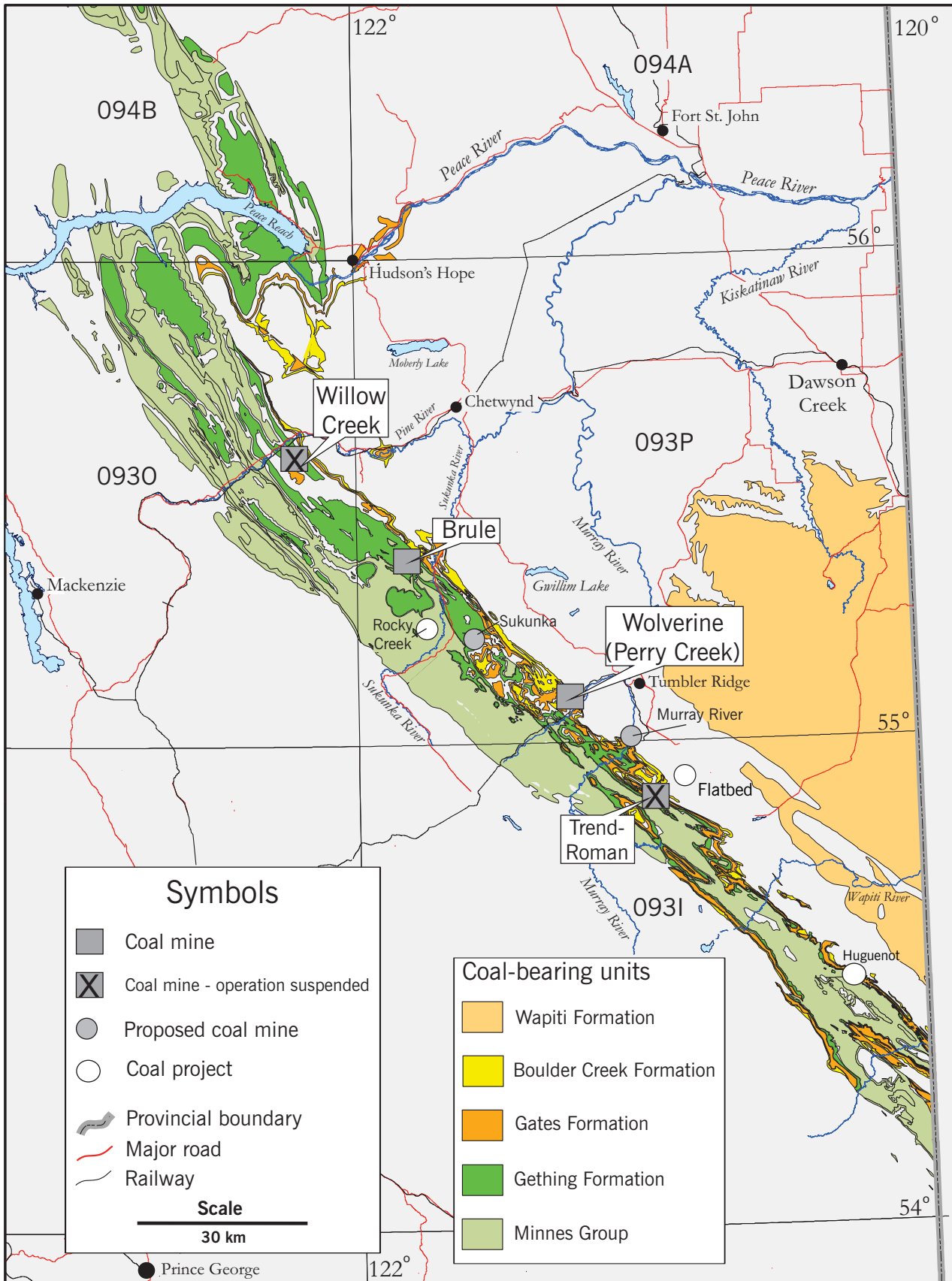


Fig. 2. Coal mines, proposed coal mines and coal exploration projects, northeastern British Columbia, 2020. After British Columbia Geological Survey (2021).

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

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Aley (North Central Region)	Taseko Mines Ltd.	Nb; Carbonatite-hosted; 094B 027	P+Pr: 83.8 Mt 0.50% Nb ₂ O ₅ (at 0.30% Nb ₂ O ₅ cut-off)	M+I: 285.8 Mt 0.37% Nb ₂ O ₅ (at 0.20% Nb ₂ O ₅ 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.
Blackwater Gold (North Central Region)	Artemis Gold Inc.	Au, Ag; Epithermal Au-Ag-Cu, intermediate sulphidation; 093F 037	P+Pr: 334.4 Mt 0.75 g/t Au, 5.8 g/t Ag at a 0.20 g/t AuEq cut-off containing 8.0 Moz Au, 62.3 Moz Ag	M+I: 597 Mt (including reserves) 0.61 g/t Au, 6.4 g/t Ag at a 0.20 g/t AuEq cut-off containing 11.7 Moz Au, 122.4 Moz Ag	Federal and Provincial Environmental Assessment certificates in place. Project acquired by Artemis from New Gold Inc. for approximately \$210 million. A 35,000 m grade control reverse circulation drill program began in late fall.
Giscome (North Central Region)	Graymont Western Canada Inc.	CaCO ₃ ; Limestone; 093J 041, 25	na	I: >100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ	Environmental Assessment in place. 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.
Kemess Underground (KUG) (North Central Region)	Centerra Gold Inc.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 021	Pr: 107.38 Mt 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: 173.7 Mt (including reserves) 0.182% Cu, 0.3 g/t Au, 1.55 g/t Ag, containing 1195 Mlbs Cu, 3.33 Moz Au, 13.87 Moz Ag	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.
Murray River (Northeast Region)	HD Mining International Ltd.	Coal; Bituminous; 093I 035	P: 261.1 Mt 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.
Sukunka (Northeast Region)	Glencore Canada Corporation	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.
Wapiti East (Northeast Region)	Fertoz International Inc.	P ₂ O ₅ ; Sedimentary phosphate deposits; 093I 008, 22, 15	na	I+Inf: 1.54 Mt 21.6% P ₂ O ₅	Permitting in progress. Proposed seasonal shallow open pit mine with annual production of less than 75,000 t over a +20year mine life.

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

6.1. Proposed metal mines

There are three proposed metal mines, all in the North Central Region: Taseko Mines Ltd.'s **Aley** Niobium project; Artemis Gold Inc.'s **Blackwater Gold** 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 carbonatite project is near the western extremity of platformal strata. The carbonatite intrusion is oval in map view, measuring about 2.0 by 2.8 km. Within that body, reserves stand at 84 Mt grading 0.5% Nb₂O₅. 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 2020, Taseko continued with technical work, environmental monitoring, and product marketing initiatives.

6.1.2. Blackwater Gold (Artemis Gold Inc.)

Artemis Gold Inc. acquired the **Blackwater Gold** project from New Gold Inc. for approximately \$210 million. At a 0.20 g/t AuEq cut-off, the total Measured and Indicated mineral resource is estimated at 597 Mt at 0.65 g/t AuEq (0.61 g/t Au, and 6.4 g/t Ag) for a total of 12.4 million AuEq oz. Revised pre-feasibility study results included an unlevered after-tax Net Present Value of \$2.2 billion, an after tax Internal Rate of Return of 35% and payback on initial capital costs of two years. The project has both provincial and federal Environmental Assessment approval. BW Gold Ltd. (a wholly owned subsidiary of Artemis) plans to start construction in Q2, 2022. The 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. In the fall, Artemis began a planned 35,000 m reverse circulation grade control drill program and continued with metallurgical test work.

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

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 copper-gold mineralization.

The deposit is estimated to contain an Indicated resource of 173.7 Mt grading 0.182% Cu, 0.3 g/t Au, and 1.55 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 177.5 Mt grading 0.36% Cu, 0.4 g/t Au, and 1.97 g/t Ag and an Inferred resource of 29.3 Mt grading 0.314% Cu, 0.3 g/t Au, and 2.00 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 has not declared a timeline.

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'.

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. In 2020, HD Mining applied for and received an Environmental Act Certificate extension to October 2025. 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’.

6.3. 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 project has environmental assessment approval, but due to weak markets for lime in the region, Graymont has not yet decided to initiate construction.

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% P₂O₅ (at a 7% cut-off). Permitting is ongoing but has faced delays due to caribou issues.

7. Selected exploration activities and highlights

Exploration activity and expenditures in 2020 for both the North Central and Northeast regions (Fig. 1; Tables 5, 6) increased compared to 2019. Companies adapted quickly to implement Covid-19 protocols. Large programs included drilling at **Lawyers** (Benchmark Metals Inc.), Kwanika Copper Corporation’s **Kwanika** project, Sun Metals Corp.’s **Stardust** project and CTI Plus Resources Ltd.’s **Rocky Creek** coal project.

7.1. Selected precious metal projects

In 2020, the Northeast Region saw no precious metal projects; all were in the North Central Region (Fig. 1; Table 5). Projects included **3Ts** (Independence Gold Corp.), **Golden Lion** (Evergold Corp.), **Lawyers** (Benchmark Metals Inc.), and **Nechako Gold** (Tower Resources Ltd.).

7.1.1. 3Ts (Independence Gold Corp.)

Independence Gold Corp. announced that approximately 2200 m in 11 holes would be drilled in the fall at its **3Ts** project. Drill collar location selection was largely based on an extensive compilation and a 3D geological model of the known epithermal vein system, in addition to magnetic and spectral surveys that were completed in 2019. Highlight results

included 3.0 m grading 30.94 g/t Au and 130.0 g/t Ag and 67.6 m grading 3.63 g/t Au and 132.83 g/t Ag.

7.1.2. Golden Lion (Evergold Corp.)

At their **Golden Lion** project, Evergold Corp. reported broad intersections of epithermal mineralization from more than 2500 m of drilling in ten holes at the GL1 “Main” prospect. The company also carried out an IP survey that defined a resistivity and chargeability anomaly encompassing 100s of m of strike length, broad widths, and untested down-dip potential. Results included 73.12 m grading 0.69 g/t Au and 61.70 m grading 0.76 g/t Au.

7.1.3. Lawyers (Benchmark Metals Inc.)

Benchmark Metals Inc. planned to complete up to 100,000 m of diamond drilling in 2020 at their **Lawyers** project (Fig. 3). The 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. The project has four discrete zones (Cliff Creek, Duke’s Ridge, Phoenix and AGB) targeted for their bulk tonnage potential. Highlight results included: 57.91 m grading 1.90 g/t Au and 91.96 g/t Ag; 31 m grading 2.98 g/t Au and 72.77 g/t Ag; 128.10 m grading 1.65 g/t Au and 110.02 g/t Ag; and 15 m grading 7.01 g/t Au and 307.9 g/t Ag. Results will be used to prepare a global resource estimate and a preliminary economic assessment in early 2021.



Fig. 3. Lawyers project, drill pad setup. Photo courtesy of Benchmark Metals Inc.

7.1.4. Nechako Gold (Tower Resources Ltd.)

Tower Resources Ltd. completed 1590 m of diamond drilling in 11 holes and 350 m of reverse circulation drilling in 41 holes on epithermal gold and silver targets at their **Nechako Gold** project. Results included 7.1 m of core grading 2.75 g/t Au and 40.2 g/t Ag.

7.2. Selected porphyry projects

Porphyry projects continued to be the principal focus of mineral exploration in the Quesnel and Stikine terranes of

Table 5. Selected exploration projects, North Central Region.

Project	Operator (partner)	Commodity; Deposit type; MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
3Ts	Independence Gold Corp.	Au, Ag; Epithermal Au-Ag: low sulphidation; 093F 055	Tommy and Ted-Mint veins Inf: 5.45 Mt 2.52 g/t Au, 71.5 g/t Ag (at a cut-off grade of 1 g/t Au)	Drilling, 11 DDH, 2200 m. Results included 3.0 m grading 30.94 g/t Au and 130.0 g/t Ag and 67.6 m grading 3.63 g/t Au and 132.83 g/t Ag.
Baptiste (Decar)	FPX Nickel Corp.	Ni, Fe; na; 093K 116	Baptiste deposit I: 1996 Mt 0.122% Ni, DTR (Davis Tube Recoverable) Inf: 593 Mt 0.114% Ni, DTR Ni (0.06% Ni cut-off)	New Preliminary Economic Assessment released. Potential for robust operating margins.
Captain	Orestone Mining Corp.	Cu, Au; Alkalic porphyry Cu-Au; 093J 026, 094C 180	na	Drilling, three DDH, 942 m.
Dominion Creek	High Range Exploration Ltd.	Au, Ag, Zn, Pb; Polymetallic veins Ag-Pb- Zn+/-Au; 093H 133	na	Plans to extract a 10,000 t bulk sample. Nicola Mining Inc. has entered into a mining and profit- sharing agreement with High Range. As part of their due diligence Nicola collected a 9.7 kg grab sample and chip sampled at the Number 16 vein. The grab sample graded 62.1 g/t Au, 320 g/t Ag, 23.4% Pb, and 12.4% Zn. Chip sample results included 0.5 m grading 34.9 g/t Au, 176 g/t Ag, 12.7% Pb, and 8.6% Zn and 0.75 m grading 13.2 g/t Au, 46 g/t Ag, 2.7% Pb, and 2.7% Zn.
East Niv	Serengeti Resources Inc.	Cu, Au; Alkalic porphyry Cu-Au	na	Mapping, sampling, and IP geophysical surveys. Data identified a 3.5 km ² porphyry Cu- Au target area.
Golden Lion	Evergold Corp.	Au, Ag; Epithermal Au-Ag: low sulphidation; 094E 077	na	Drilling, 10 DDH, 2500 m and IP surveying. Drill results included 73.12 m grading 0.69 g/t Au and 61.70 m grading 0.76 g/t Au.
Jean Marie	Pacific Empire Minerals Corp.	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au; na	na	Rock sampling, ground geophysics, airborne geophysics and reverse circulation drilling (15 holes, 1692 m). Rock sample results included 8.79 g/t Au, 86.6 g/t Ag, and 1.75% Cu from the newly identified Leap target area, and continuous chip sampling results of 4 m grading 1.37% Cu, 0.08 g/t Au, and 67.4 g/t Ag at C zone south.

Table 5. Continued.

Joy	Amarc Resources Ltd.	Cu, Au; Porphyry Cu±Mo±Au; 094E 016, 57	Pine I: historic non NI 43-101 compliant: 70 Mt 0.15% Cu, 0.57 g/t Au (Stealth Mining Corporation 1997)	Project contains the historic Pine deposit and MEX target. Amarc filed a 43-101 report providing details on the project's exploration potential.
Kemess Brownfield	Centerra Gold Inc.	Cu, Mo, Au; Porphyry Cu±Mo±Au; 094E 315	Kemess East I: 177.5 Mt 0.36% Cu, 0.4 g/t Au, 1.97 g/t Ag Inf: 29.3 Mt 0.314% Cu, 0.3 g/t Au, 2.00 g/t Ag	Potential to be integrated into the Kemess Underground project. Diamond drilling, 4257 m at Kemess East and 3302 m at Nugget target.
Kliyul	Pacific Ridge Exploration Ltd.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 094D 023	I: historic non NI 43-101 compliant: 2.3 Mt 1.30 g/t Au, 0.45% Cu, 6.9 g/t Ag	IP and ground magnetic geophysical surveys, sampling and core relogging. Geophysics defined potential to expand Kliyul Main zone and two new targets, Kliyul East and Kliyul West.
Kwanika	Kwanika Copper Corporation (67% Serengeti Resources Inc., 33% Posco International Corporation)	Cu, Au, Ag; Porphyry Cu±Mo±Au; 093N 073	Central zone pit M+I: 104.6 Mt 0.23% Cu, 0.21 g/t Au, 0.78 g/t Ag (at a cut-off grade of 0.13% CuEq) Central zone underground M+I: 118.9 Mt 0.30% Cu, 0.29 g/t Au, 0.96 g/t Ag (at a confining shape basis of 0.27% CuEq) South zone pit Inf: 33.3 Mt 0.26% Cu, 0.08 g/t Au, 1.64 g/t Ag, 0.01% Mo	Drilling, nine DDH, 4350 m. Results included 698 m grading 0.40% Cu, 0.65 g/t Au, 1.9 g/t Ag and new deep mineralization that graded 0.15% Cu, 0.2 g/t Au, 0.6 g/t Ag over 150 m.
Lawyers	Benchmark Metals Inc.	Au, Ag; Epithermal Au-Ag: low sulphidation; 094E 066	Inf: Cliff Creek N zone 550 Kt 4.51 g/t Au, 209.15 g/t Ag Duke's Ridge zone 58 Kt 4.30 g/t Au, 139.13 g/t Ag	Highlight drilling results included 57.91 m grading 1.90 g/t Au, 91.96 g/t Ag, 31 m grading 2.98 g/t Au, 72.77 g/t Ag, 128.10 m grading 1.65 g/t Au, 110.02 g/t Ag and 15 m grading 7.01 g/t Au, 307.9 g/t Ag.
Max	Centerra Gold Inc.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093K 020	na	Drilling, 11 DDH, 5441 m.
McConnell Copper-Gold	GGL Resources Corp.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094D 030	na	20 line-km of IP and ground magnetic surveys over a known porphyry Cu-Au zone.
Mt. Milligan Brownfield	Centerra Gold Inc.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194	na	Drilling, 69 DDH, 32,671 m.
Nechako Gold	Tower Resources Ltd.	Au, Ag; Epithermal Au-Ag: low sulphidation; 093F 060, 4	na	Drilling, 41 RCH, 350 m, 11 DDH, 1590 m. Results included 7.1 m of core grading 2.75 g/t Au and 40.2 g/t Ag.

Table 5. Continued.

Pil	Finlay Minerals Ltd.	Cu, Au, Ag; Porphyry Cu±Mo±Au, Alkalic porphyry Cu-Au; 094E 310, 377	na	Geological mapping and soil and rock sampling. Targets included the Pil South, Copper Ridge, WG, Gold and Spruce zones.
Redton	Pacific Ridge Exploration Ltd.	Cu, Au, Ag; Porphyry Cu±Mo±Au	na	Drilling, one DDH, 434 m.
Stardust	Sun Metals Corp.	Cu, Au, Ag, Zn; Cu skarn; 093N 009	Canyon Creek I: 985,000 t 1.34% Cu, 1.59 g/t Au, 36.8 g/t Ag, 0.62% Zn	Drilling, 17 DDH, 11,988 m. Results included 1.57% Cu, 1.08 g/t Au, 28.2 g/t Ag over 44 m and 4.45 m grading 5.58% Cu, 5.99 g/t Au, 190.5 g/t Ag.
Thane	International Mining Corp.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 094C 181, 72	na	Ground geophysics, alteration mapping, rock, soil, and silt sampling.
Top Cat	Serengeti Resources Inc.	Cu-Au; Alkalic porphyry Cu-Au; 094C 174	na	Mapping, sampling, IP surveying and data compilation.
Wicheeda	Defense Metals Corp.	Nb, REE; Carbonatite-hosted deposits; 093J 014	I: 4.89 Mt 3.02% LREO Inf: 12.1 Mt 2.90 % LREO Resources at a cut-off grade 1.5% total metal LREO=sum of Ce ₂ O ₃₊ +La ₂ O ₃ +Nd ₂ O ₃ +Nd ₂ O ₃ +Pr ₂ O ₃ +Sm ₂ O ₃ Total metal % = sum of Ce+La+Nd+Pr+Sm+Nb percentages	Baseline environmental studies, flotation pilot plant studies and a 43-101 report updating resources.

M = Measured; I = Indicated; Inf = Inferred

Table 6. Selected exploration projects, Northeast Region.

Project	Operator (partner)	Commodity; Deposit type; MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Flatbed	Colonial Coal International Corp.	Coal; Bituminous coal; 0931 049	na	Permitting, First Nations consulting, environmental monitoring and data review.
Huguenot	Colonial Coal International Corp.	Coal; Bituminous coal; 093I 036	M+I: 132.0 Mt (in situ surface mineable)	Permitting, First Nations consulting, environmental monitoring and data review.
Rocky Creek	CTI Plus Resources Ltd.	Coal; Bituminous coal; 093P 004	na	Drilling, 50, DDH, 818 m, 19 RCH, 3154 m. Coal quality testing. Trench sampling and mapping.
Trend-Roman	Peace River Coal Inc. (subsidiary of Anglo American plc)	Coal; Bituminous coal; na	na	Drilling, six DDH, 3204 m. Testing for underground potential near the former Trend-Roman mine.

M = Measured; I = Indicated; Inf = Inferred

the North Central Region (Fig. 1; Table 5). Projects included Orestone Mining Corp.'s **Captain** project, Serengeti Resources Inc.'s **East Niv** and **Top Cat** projects, Pacific Empire Minerals Corp.'s **Jean Marie** project, Amarc Resources Ltd.'s **Joy** project, Centerra Gold Inc.'s **Mount Milligan Brownfield**, **Kemess Brownfield** and **Max** projects, Pacific Ridge Exploration Ltd.'s **Kliyul** and **Redton** projects, Kwanika Copper Corporation's **Kwanika** project, GGL Resources Corp.'s **McConnell Copper-Gold** project, Finlay Minerals Ltd.'s **Pil** project and International Mining Corp.'s **Thane** project.

7.2.1. Captain (Orestone Mining Corp.)

Orestone's **Captain** project is 30 km south of the Mt. Milligan mine. Mineralization is hosted in an altered alkaline monzonite porphyry. Target areas are outlined by strong magnetic anomalies with spatially associated moderate IP chargeability anomalies that are potentially related to mineralized monzonite porphyries and breccias. In late 2020, a total of 942 m of diamond drilling was completed in three holes.

7.2.2. East Niv (Serengeti Resources Inc.)

Serengeti carried out mapping, sampling, and IP geophysical surveys at their **East Niv** project. New data identified a 3.5 km² target area for porphyry Cu-Au mineralization and a drilling program is planned for 2021.

7.2.3. Jean Marie (Pacific Empire Minerals Corp.)

Pacific Empire carried out rock sampling, ground geophysics, airborne geophysics and reverse circulation drilling at their **Jean Marie** project. Rock sample results included 8.79 g/t Au, 86.6 g/t Ag, and 1.75% Cu from the newly identified Leap target area. At the C zone south target area, continuous chip sampling results returned 4 m grading 1.37% Cu, 0.08 g/t Au, and 67.4 g/t Ag. A ground magnetic survey was carried out over C zone south. A total of 1692 m of reverse circulation drilling in 15 holes was carried out at the A zone. A high-resolution airborne magnetic survey along 100 m spaced lines was flown over most of the property.

7.2.4. Joy (Amarc Resources Ltd.)

Amarc Resources Ltd. filed a 43-101 report providing details on the exploration potential of the company's **Joy** porphyry Cu-Au project.

7.2.5. Kemess Brownfield (Centerra Gold Inc.)

Centerra drilled at the Kemess East (4257 m) and Nugget (3302 m) targets that are part of their **Kemess Brownfield** project.

7.2.6. Kliyul (Pacific Ridge Exploration Ltd.)

At their **Kliyul** project Pacific Ridge carried out 9.1 line-km of IP and ground magnetometer surveys, surface and drill core sampling to identify alteration and geochemical trends, and

historical core re-logging to identify porphyry-style veining. Geophysics outlined potential to expand the Kliyul Main zone and defined two new targets, Kliyul East and Kliyul West. Targets are defined by moderate to high chargeability and resistivity and variable magnetic signatures along a strike length of 1.5 km.

7.2.7. Kwanika (Kwanika Copper Corporation)

Kwanika Copper Corporation (67% Serengeti Resources Inc., 33% 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 2020, Serengeti completed a nine-hole 4350 m diamond drilling program to test exploration targets and expand the known resource. Posco elected not to participate in the 2020 program and their ownership diluted to 33%. Highlight results included an infill hole that intersected 698 m grading 0.40% Cu, 0.65 g/t Au, and 1.9 g/t Ag, and new deep mineralization that graded 0.15% Cu, 0.2 g/t Au, and 0.6 g/t Ag along 150 m.

7.2.8. Max (Centerra Gold Inc.)

Centerra Gold Inc. drilled 5441 m in 11 holes at their **Max** property. The Max project consists of 12 mineral claims (4869 ha) under option from Jama Holdings Inc., 21 km south of the Mount Milligan mine.

7.2.9. McConnell Copper-Gold (GGL Resources Corp.)

GGL Resources carried out 20 line-km of IP and ground magnetic surveys over a known porphyry Cu-Au zone at their **McConnell Copper-Gold** project. The IP survey follows up on an older reconnaissance IP survey. New work was designed to better define the known chargeability target, and to expand geophysical coverage to evaluate the potential for other nearby targets under overburden cover.

7.2.10. Mt. Milligan Brownfield (Centerra Gold Inc.)

Centerra carried out a 69-hole 32,671 m diamond drilling program.

7.2.11. Pil (Finlay Minerals Ltd.)

At their **Pil** project, Finlay carried out detailed geological, alteration, and structural mapping, and soil and rock sampling. Targets included the PIL South, Copper Ridge, WG, Gold and Spruce zones.

7.2.12. Redton (Pacific Ridge Exploration Ltd.)

At Pacific Ridge's **Redton** project, one 434 m diamond drill hole tested a 550 by 250 m magnetic and IP chargeability anomaly and coincident 500 by 100 m copper-molybdenum soil survey anomaly. The drill hole encountered a magnetite-bearing mafic intrusion and returned no significant copper or gold assays. Sources for the chargeability and the copper-molybdenum soil survey anomalies remain unexplained.

7.2.13. Thane (International Mining Corp.)

IMC International carried out ground geophysics, alteration mapping, and rock, soil, and silt sampling at their **Thane** property to guide future diamond drilling.

7.2.14. Top Cat (Serengeti Resources Inc.)

Mapping and sampling were carried out at the Nova zone at Serengeti's **Top Cat** project. In addition, IP surveying was carried out over the Nova and Cat Mountain zones. Cat Mountain is an advanced gold-copper prospect that has seen more than 10,000 m of historical drilling, with results including grades of 1.15 g/t Au and 0.15% Cu along 95.4 m. Serengeti completed data compilation and 3D modelling for Cat Mountain and interpreted that mineralization potential remains open to the northwest and that there is a potential offset to the southeast.

7.3. Selected polymetallic base and precious metal projects

Active projects included High Range Exploration Ltd.'s **Dominion Creek** project and Sun Metal Corp.'s **Stardust** project, both in the North Central Region (Fig. 1; Table 5).

7.3.1. Dominion Creek (High Range Exploration Ltd.)

High Range Exploration Ltd. announced plans to extract a 10,000 t bulk sample from its **Dominion Creek** property. The sample would be shipped to Nicola Mining Inc.'s mill and Nicola would be responsible for negotiating the sale of concentrate to a smelter or third-party purchaser. Nicola entered into a mining and milling profit share agreement with High Range and signed a letter of intent to acquire 50% of the property and a 75% economic interest. As part of their due diligence, Nicola collected a 9.7 kg grab sample and chip sampled at the Number 16 vein. The grab sample graded 62.1 g/t Au, 320 g/t Ag, 23.4% Pb, and 12.4% Zn. Chip sample results included 0.5 m grading 34.9 g/t Au, 176 g/t Ag, 12.7% Pb, and 8.6% Zn and 0.75 m grading 13.2 g/t Au, 46 g/t Ag, 2.7% Pb, and 2.7% Zn.

7.3.2. 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. In 2020, Sun Metals continued drilling, completing 11,988 m in 17 holes. Work also included geophysical surveys, geotechnical work, and core logging and sampling. Drilling results established continuity between the 421 and Canyon Creek zones along a 900 m corridor of continuous high-grade copper-gold mineralization. Results included 1.57% Cu, 1.08 g/t Au, and 28.2 g/t Ag along 44 m. The 421 zone was also

expanded to the south with drilling intersecting 4.45 m grading 5.58% Cu, 5.99 g/t Au, and 190.5 g/t Ag.

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

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

7.4.1. Baptiste (FPX Nickel Corp.)

FPX Nickel's **Baptiste** project (Fig. 4) contains ultramafic rocks mineralized with a naturally occurring nickel-iron alloy called awaruite. In 2020, FPX Nickel released a new Preliminary Economic Assessment. The project has the potential to be an operation with an average annual production of 99 Mlbs of contained nickel. Baptiste's large scale, combined with operating costs of US\$2.74/lb, has the potential to generate average earnings (before royalties, taxes and depreciation) of US\$481 million per year and an after-tax Net Present Value of US\$1.7 billion. Tailings produced by the proposed mining and milling process have potential to sequester significant quantities of CO₂.



Fig. 4. Baptiste project area. Photo courtesy of FPX Nickel Corp.

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** niobium-bearing carbonatite proposed mine (see section 6.1.1.) and Defense Metals Corporation's **Wicheeda** light rare earth element (LREE) project (Fig. 1; Table 5).

7.5.1. Wicheeda (Defense Metals Corp.)

Defense Metals Corp. filed an updated 43-101 technical report, began baseline environmental studies, and carried out flotation pilot plant studies for its **Wicheeda** rare earth element project. The updated report includes an Indicated mineral resource of 4.89 Mt averaging 3.02% Light Rare Earth Oxide (LREO) and an additional Inferred mineral resource of 12.1 Mt averaging 2.90% LREO. LREO % equals sum of light rare earth elements expressed as oxides

$Ce_2O_3 + La_2O_3 + Nd_2O_3 + Nd_2O_3 + Pr_2O_3 + Sm_2O_3$. Resources reported at a cut-off grade of 1.5% total metal. Total metal % equals the sum of Ce+La+Nd+Pr+Sm+Nb percentages.

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.

7.6. Selected coal projects

In 2020, coal exploration in the Northeast Region included Colonial Coal International Corp.'s **Flatbed** and **Huguenot** projects, CTI Plus Resources Ltd.'s **Rocky Creek** project, and Peace River Coal Inc.'s **Trend-Roman** project.

7.6.1. Flatbed and Huguenot (Colonial Coal International Corp.)

Colonial Coal's **Flatbed** project is adjacent to the former Trend mine; the **Huguenot** project is south of Trend. In 2020, work on these projects consisted primarily of permitting, First Nations consulting, environmental monitoring, and data review.

For **Huguenot**, Measured and Indicated surface mineable coal resources total 132.0 Mt, with an additional Inferred resource of 0.5 Mt. A conceptual open pit would yield 72 Mt of product coal during a mine life of 27 years.

7.6.2. Rocky Creek (CTI Plus Resources Ltd.)

At their **Rocky Creek** project, CTI Plus Resources Ltd. drilled 50 diamond-drill holes totalling 818 m and 19 reverse circulation holes totalling 3154 m. Diamond drilling included both HQ and PQ core. Coal seams were sampled and sent for testing. Also, ten trenches were geologically mapped and sampled. Data will be used for a feasibility study.

7.6.3. Trend-Roman (Peace River Coal Inc.)

Peace River Coal Inc. (a subsidiary of Anglo American plc) carried out a six hole diamond drilling program totalling 3204 m near the **Trend-Roman** mine, which closed in 2014. The program was designed to test underground potential near the former mine.

7.7. Selected industrial mineral projects

Apart from the proposed **Giscome** limestone quarry (see section 6.3.1.), no significant industrial mineral exploration projects were tracked.

8. Geological research

Logan et al. (2020) reviewed the geology of Hogen batholith and related porphyry deposits. Work on a multi-year mapping project in the northern part of Hogen batholith designed to better understand the origin and timing of batholith emplacement and base- and precious-metal mineralization

continued with the release of geochemical, isotopic, and geochronologic data by Ootes et al. (2020) and Jones et al. (2021) and a surficial geology summary by Ferbey and Elia (2021). Nixon et al. (2020a) reviewed magmatic Ni-Cu-PGE deposits hosted by Alaskan-type ultramafic-mafic intrusions in the Canadian Cordillera, including Polaris and Turnagain. Nott et al. (2020) published a detailed (1:15,000) map of the Polaris intrusion, and Nixon et al. (2020b) reported new U-Pb zircon and $^{40}Ar/^{39}Ar$ ages from the Turnagain intrusion.

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 whereas in the Northeast Region the predominant commodity explored for is coal. In 2020, despite initial interruptions due to Covid-19, exploration expenditures increased in both regions.

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