

Exploration and mining in the South Central Region, British Columbia



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1. Introduction

With five major mines, the South Central Region is currently the most productive copper mining district in Canada. In addition, an underground gold mine re-started in 2017. The region's varied geology, well-established infrastructure, and access to markets also make it an important industrial minerals centre. The Cariboo area is the province's largest placer gold camp, with active permits numbering in the hundreds. Thermal coal resources in Cenozoic basins were last mined in 2013.

The region has six major proposed metal mines. About 70 exploration projects were tracked in 2018, although this is a minimum because not all exploration work is recorded, and 2018 work that must be recorded for regulatory compliance is not necessarily reported in the calendar year.

Exploration expenditures for the region are estimated at \$56.0 million; exploration drilling is estimated at 186,600 m (Clarke et al., this volume; Ernst & Young LLP (EY), 2019, in press).

2. Geological overview

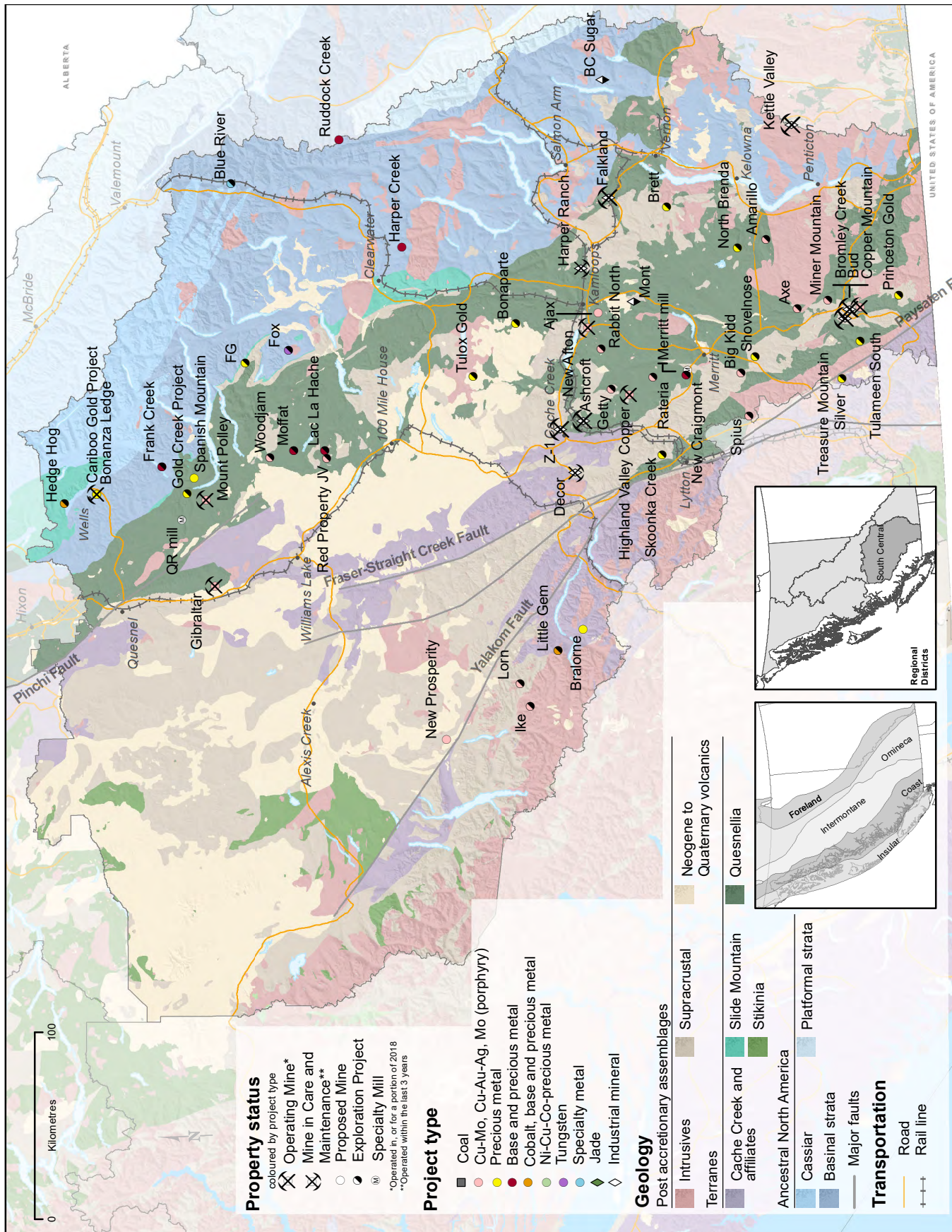
The tectonic and metallogenic evolution of the Canadian Cordillera are intimately linked (Fig. 1, e.g., Colpron and Nelson, 2011; Nelson et al., 2013). The South Central Region straddles three of British Columbia's five morphogeological belts (from west to east: Coast; Intermontane; Omineca). The mid-Mesozoic and older geological framework is represented by cratonic and pericratonic rocks in the east, and a series of Late Paleozoic through mid-Mesozoic arc and oceanic terranes to the west (Fig. 1). Younger rocks include Jura-Cretaceous siliciclastic and local volcanic rocks, Eocene volcanic rocks, Neogene and Quaternary basalt, and Middle Jurassic to Eocene granitic intrusions.

The oldest rocks in the region are Paleoproterozoic basement gneiss complexes at the eastern boundary, such as in the Monashee complex. These are interpreted as parts of the North American craton (Armstrong et al., 1991), overlain by Neoproterozoic to Paleozoic cover deposited following rifting that formed the western margin of Ancestral North America (McDonough and Parrish, 1991; Murphy et al., 1991). To the northwest, the Cassiar terrane consists of Neoproterozoic to mid-

Paleozoic siliciclastic and carbonate rocks interpreted as distal facies of the North American platform (Struik, 1988a). Also affiliated with Ancestral North America, the Kootenay terrane (deep-water basin strata on Fig. 1) include Neoproterozoic to mid-Paleozoic deep-water facies equivalents deposited west of the North American platform. Lower Cambrian and older rocks are similar to North American strata to the east, but the overlying lower Paleozoic succession is characterized by units of coarse siliciclastic and mafic volcanic rocks that may reflect intermittent crustal extension (Colpron and Price, 1995). This belt also includes Devonian-Mississippian calc-alkaline to alkaline volcanic rocks and associated granitoid intrusions, found mainly in the Eagle Bay assemblage (Schiarrizza and Preto, 1987), which reflect the initiation of east-dipping subduction beneath the North American plate margin. These rocks host polymetallic volcanogenic massive sulphide occurrences, and the **Harper Creek** bulk tonnage copper deposit.

Slide Mountain terrane is the easternmost tract of oceanic rocks in the Canadian Cordillera. These rocks may be the remnant of a Late Paleozoic marginal basin that formed behind a westward-retreating volcanic arc in Quesnel terrane. The Fennell Formation hosts copper-zinc-silver massive sulphide mineralization at the Chu Chua occurrence.

Quesnel terrane is a Late Triassic to Early Jurassic island arc complex (e.g., Mortimer, 1987; Struik, 1988a, b; Unterschutz et al., 2002). It also includes a Late Paleozoic arc sequence, represented by the Harper Ranch Group (Beatty et al., 2006) and, in the south, assemblages of oceanic rocks (Tempelman-Kluit, 1989). The Mesozoic rocks are represented mainly by Middle to Upper Triassic volcanic and sedimentary rocks of the Nicola Group, together with abundant Upper Triassic to Lower Jurassic calc-alkaline to alkaline intrusions (Preto, 1977, 1979; Mortimer, 1987; Panteleyev et al., 1996; Schiarizza et al., 2013). The Nicola Group consists mainly of volcanic and volcanic-derived sedimentary rocks, but also includes an eastern sedimentary facies of siltstone and slate intercalated with quartzite and limestone (Bloodgood, 1990; Schiarizza et al., 2013; Mihalynuk et al., 2015; Schiarizza, 2019). The volcanic rocks are mainly augite-phyric shoshonitic basalts, but the western part of the group locally includes a belt of calc-



alkaline volcanic rocks with substantial amounts of rhyolite and dacite (Mortimer, 1987; Preto, 1977, 1979). A younger stratigraphic component of Quesnel terrane consists of Lower to Middle Jurassic sedimentary rocks that unconformably overlie the western parts of the Nicola Group (Travers, 1978; Logan and Moynihan, 2009; Schiarizza et al., 2013).

Quesnel terrane is metallogenically important for its porphyry copper deposits (e.g., Logan, 2013; Logan and Mihalynuk, 2014). The plutons that host these deposits conform, in part, to a pattern defined by parallel belts of calc-alkaline and alkaline plutons that become progressively younger from west to east (Schiarizza, 2014). The western (Late Triassic) calc-alkaline belt includes the Guichon Creek batholith, host to the **Highland Valley** copper-molybdenum mines, and the Granite Mountain batholith, host to the **Gibraltar** copper-molybdenum mine. A well-defined belt farther east comprises younger, latest Triassic alkaline plutons, which host alkalic porphyry copper-gold deposits, including producing mines at **Copper Mountain**, **New Afton**, and **Mount Polley**. A third belt, younger and farther to the east, is defined by several large, Lower Jurassic calc-alkaline plutons.

Cache Creek terrane, consisting of Carboniferous to Early Jurassic chert, argillite, basalt, limestone, sandstone, gabbro and serpentinized ultramafic rocks of the Cache Creek complex, forms a belt to the west of Quesnel terrane in the central and northern parts of the region. It is interpreted, at least in part, as a subduction complex responsible for generating the Quesnel magmatic arc (Travers, 1978; Struik et al., 2001).

Cadwallader terrane, as interpreted by Schiarizza (2013), underlies parts of the Intermontane and eastern Coast belts, west of Cache Creek and Quesnel terranes. It includes a Late Permian-Early Triassic primitive oceanic arc complex, and an overlying Late Triassic-Middle Jurassic arc complex and associated siliciclastic apron.

Bridge River terrane occurs in the eastern Coast belt, west of Lytton and Lillooet, where it is partially enveloped by Cadwallader terrane. It is represented mainly by the Bridge River complex, comprising structurally interleaved slivers of chert, argillite, basalt, blueschist, gabbro, serpentinite, limestone, and sandstone (Schiarizza et al., 1997). Both Cadwallader and Bridge River terranes are shown as 'Cache Creek affiliates' on Figure 1.

Stikine terrane is a mid-Paleozoic to Middle Jurassic arc terrane that is markedly similar to Quesnel terrane, and forms a predominant component of the Cordillera in central and northern British Columbia. It is represented in the northwestern part of the South Central Region by a few scattered exposures of volcanic and sedimentary rocks correlated with the Hazelton Group (Upper Triassic to Middle Jurassic; Tipper, 1959, 1969).

Younger stratigraphic units overlap older terranes and cover large parts of the region. These units include: Upper Jurassic to Upper Cretaceous siliciclastic rocks of the Tyaughton-Methow basin, which overlap Cadwallader and Bridge River terranes in the eastern Coast belt (Schiarizza et al., 1997); and mid-Cretaceous arc volcanic rocks of the Spences Bridge

Group, which form a northwest-trending belt that overlaps Quesnel and Cache Creek terranes in the Merritt-Lillooet area (Monger and McMillan, 1989), and continues westward across the Fraser River where it overlaps Cadwallader and possibly Stikine terranes (Mahoney et al., 2013). Eocene volcanic and subordinate sedimentary rocks (e.g., Kamloops Group, Penticton Group, Princeton Group) are predominant in some locations. Neogene basalt of the Chilcotin Group overlaps Quesnel, Cache Creek, Cadwallader and Stikine terranes throughout much of the central part of the region (Dohane et al., 2010). Granitic plutons, ranging from late Middle Jurassic to Eocene, occur throughout the region and, in some cases, are responsible for significant mineralization (e.g., **IKE**, **New Prosperity**).

3. Mines and quarries

The region produces copper, molybdenum, gold, and silver from five large mines, gold from a small mine, and a variety of industrial minerals (limestone; bentonite; zeolite; diatomaceous earth; high-alumina shale; precious opal; and dimension stone) from about ten quarries. Almost 1000 placer mines and gravel pits have active permits, but not all produce in any given year.

3.1. Metal mines

The South Central Region hosts six of the province's metal mines (Fig. 1; Table 1). These include the province's two largest copper-molybdenum producers (**Gibraltar** and **Highland Valley Copper** mines) and three major copper-gold mines (**Mount Polley**, **New Afton** and **Copper Mountain**). The region hosts one operating precious metal mine, **Bonanza Ledge**.

3.1.1. Bonanza Ledge (Barkerville Gold Mines Ltd.)

Barkerville restarted the **Bonanza Ledge** mine (Fig. 1; Table 1) in 2017 as an underground long-hole and cemented-fill operation below the existing pit. They mined 120,000 t as of December 2018 at a diluted grade of 6.65 g/t Au. Initial life of mine is a planned 3.5 years at 150,000 tpy, but there is exploration potential. Ore is trucked to Barkerville's QR mill, which is permitted for up to 875 tpd. They report throughput up to 800 tpd and 91.6% recovery, which may improve with recommissioning of a gravity circuit.

Two types of mineralization are of interest: pyrite replacement and vein mineralization consisting of native gold in quartz veins in pyrite-bearing, carbonaceous and chloritic phyllite of the Snowshoe Group (Proterozoic-Paleozoic).

3.1.2. Copper Mountain (Copper Mountain Mining Corporation 75% and Mitsubishi Materials Corporation 25%)

The **Copper Mountain** copper-gold mine (Fig. 1; Table 1), has been producing since August 2011. In the first nine months of 2018 they mined 54,060,000 t, including 16,159,000 t ore. Mill throughput was 10,661,000 t at a feed grade of 0.31% Cu and 79.4% recovery. Holbek et al. (2015) described the deposit

Table 1. Metal mines, South Central Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2018 Production (based on Q1- Q3)	Reserves	Resource	Comments
Bonanza Ledge	Barkerville Gold Mines Ltd.	Au; Au quartz veins; 093H 140	120,000 t at 6.65 g/t Au diluted (as of December)	na	M: 264,000 t 7.3 g/t Au I: 508,300 t 6.2 g/t Au Inf: 173,400 4.6 g/t Au	Long hole and cemented rock fill.
Copper Mountain	Copper Mountain Mining Corporation 75%, Mitsubishi Materials Corporation 25%	Cu, Au, Ag; porphyry Cu- Au, alkalic; 092HSE001	80 Mlb Cu 27,500 oz Au 300,000 oz Ag (management's guidance)	P+Pr: 210,079 Kt 0.26% Cu, 0.08 g/t Au, 0.89 g/t Ag	M+I: 322,755 Kt 0.26% Cu, 0.08 g/t Au, 1.05 g/t Ag Inf: 112,339 Kt 0.21% Cu, 0.08 g/t Au, 0.58 g/t Ag	Resources inclusive of reserves. Excludes New Ingerbelle- M+I: 195,647 Kt 0.26% Cu, 0.16 g/t Au, 0.50 g/t Ag Inf: 93,459 Kt 0.23% Cu, 0.14 g/t Au, 0.43 g/t Ag.
Gibraltar	Taseko Mines Limited 75%, Sojitz Corp. 12.5%, Dowa Holdings Co. Ltd. 6.25%, Furukawa Co. Ltd. 6.25%	Cu, Mo; porphyry Cu+/- Mo+/-Au; 093B 012	130 Mlb Cu+Mo (management's guidance)	P+Pr: 668 million tons 0.26% Cu, 0.007% Mo	M+I: 1011 million tons 0.25% Cu, 0.008% Mo	Resources inclusive of reserves.
Highland Valley	Teck Resources Limited	Cu, Mo; porphyry Cu+/- Mo+/-Au; 092ISW012, 45	102,500 t Cu, 3266 t Mo (management's guidance)	P+Pr: 589.5 Mt 0.300% Cu, 0.008% Mo	M: 488.4 Mt 0.31% Cu, 0.009% Mo I: 882.6 Mt 0.23% Cu, 0.009% Mo Inf: 382.4 Mt 0.23% Cu, 0.007% Mo	Resources exclusive of reserves.
Mount Polley	Imperial Metals Corporation	Cu, Au, Ag; porphyry Cu- Au, alkalic; 093A 008	15.6 Mlb Cu 39,500 oz Au (management's guidance)	P+Pr: 58.272 Mt 0.33% Cu, 0.30 g/t Au, 0.86 g/t Ag	M+I: 206.22 Mt 0.285% Cu 0.28 g/t Au, 0.67 g/t Ag Inf: 7.519 Mt 0.308% Cu, 0.24 g/t Au, 1.66 g/t Ag	Reserves in 5 zones. Resources inclusive of reserves.
New Afton	New Gold Inc.	Au, Ag, Cu; porphyry Cu- Au, alkalic; 092INE023	55,000- 65,000 oz Au, 75-85 Mlb Cu (guidance) 64.3 Mlb Cu, 58.551 Koz Au, 200 Koz Ag (Q3 actual)	P+Pr: 54.867 Mt 0.61 g/t Au, 2.0 g/t Ag, 0.78% Cu	M+I: 58.038 Mt 0.63 g/t Au, 2.1 g/t Ag, 0.76% Cu Inf: 15.253 Mt 0.39 g/t Au, 1.3 g/t Ag, 0.41% Cu	A, B and C zones + HW lens resources. Resources exclusive of reserves.

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

as a structurally complex, alkalic porphyry Cu-Au system with mineralization mainly in Nicola Group (Triassic) volcanic rocks with subordinate amounts in coeval intrusive rocks. Mineralization shows strong vertical continuity.

An exploration program at the mine site continued in 2018 with four holes in the east wall of Pit 3. Northwest of current mining at New Ingerbelle, a second phase of drilling included 10,616 m in 29 holes. The Measured and Indicated resource estimate for New Ingerbelle stands at 151.3 Mt 0.29% Cu and 0.18 g/t Au applying a 0.16% Cu cut off or 195.6 Mt 0.26% Cu and 0.16 g/t Au applying a 0.12% Cu cut off. A base case preliminary economic assessment indicated favorable economics using the existing mill.

3.1.3. Gibraltar (Taseko Mines Limited 75% and Cariboo Copper Corp. 25%)

The **Gibraltar** copper-molybdenum mine (Fig. 1; Table 1) is operated by Taseko Mines Limited and Cariboo Copper Corp., whose 25% interest is divided between Sojitz Corp. (12.5%), Dowa Holdings Co. Ltd. (6.25%) and Furukawa Co. Ltd (6.25%). Production began in 1972, but was suspended from 1999 to 2003. In 2013, the mine completed its first full year of operation after extensive modernization, which included expanding mill capacity to 85,000 tpd. Part of the modernization plan was building a separate molybdenum circuit. Gibraltar mined 83.1 Mtons in the first nine months of 2018 and milled 23 Mtons for 99.4 Mlbs Cu, 1.64 Mlbs Mo.

Ore comes from five pits (Connector, Gibraltar, Granite, Extension, and Pollyanna), but not all operate at all times. The deposit is in the Granite Mountain batholith (Upper Triassic; see van Straaten et al., 2013) in a fault-bounded section of Nicola Group sedimentary and volcanic rocks (Quesnel terrane; Schiarizza 2014, 2015).

3.1.4. Highland Valley Copper (Teck Resources Limited)

Ore from the **Highland Valley Copper** copper-molybdenum mine (Fig. 1; Table 1) comes from the Valley and Lornex pits (Fig. 2). In the first nine months of 2018 it milled 36.964 Mt at a Cu grade of 0.23% and recovery of 78.9%. Management's projection is for 100 to 105 Mt Cu and 7.7 Mlb Mo in concentrate for the full 2018 year.

Following ground geophysical survey and drilling programs

that started in 2012, Teck has continued to explore targets near the past-producing Bethlehem mine, the Valley pit, the southern end of the Lornex pit, and the Jericho zone on the northeast edge of the Highmont pit. Teck now proposes to extend mining to the past-producing Bethlehem deposit and an application for a first phase of development is under review with the Ministry of Energy, Mines and Petroleum Resources. Teck has defined about 100 Mt of ore at Bethlehem, which would feed the 140,000 tpd mill. Exploration began late in 2017 between the Highmont and Lornex pits and several km to the east of current operations at their Athena target area.

All mineralization at Highland Valley is in the Guichon Creek batholith (Upper Triassic), which has been divided into a number of pre-, syn- and post-mineral phases (see Byrne et al., 2013).

3.1.5. Mount Polley (Imperial Metals Corporation)

Because of a labour disruption, mining was suspended from May to August at the **Mount Polley** copper-gold-silver mine (Fig. 1; Table 1), and mill feed came from low-grade stockpiles. The 2018 target is 15.6 Mlb Cu and 39,500 oz Au, about 87% of the target set earlier in the year. The Mount Polley mill processes approximately 16,800 tpd and the mine currently has a projected life to 2026. In January 2019, management announced mining would be suspended due to low metal prices.

The alkalic intrusive complex (Upper Triassic) at Mount Polley has at least eight discrete mineralized zones that have contributed to previous production or resource calculations. Rees (2013) and Brown et al. (2016) provide reviews of Mount Polley geology and mineralization.

3.1.6. New Afton (New Gold Inc.)

The **New Afton** gold-copper mine (Fig. 1; Table 1) is a block cave operation that opened in mid-2012 (Hall and May, 2013). In mid-2015, the company installed a 14,000 tpd mill. In the first three quarters of 2018 the mine produced 58,551 oz Au, 0.2 Moz Ag, and 64.3 Mlb Cu. The mine is on target to meet the high end of management's 2018 guidance of 55,000-65,000 oz Au and 75-85 Mlb Cu. The company is conducting optimization studies on the C-zone, a down-plunge extension of the currently mined B-zone. Satellite targets were drilled from surface elsewhere in the mine lease area. The known



Fig. 2. Highland Valley Copper copper-molybdenum mine. The Valley pit looking southwest from a viewpoint off Highway 97C. Ore is currently mined from the Valley pit and Lornex pit to the south. The past-producing Bethlehem pit (to the east, out of view) is a proposed expansion area.

New Afton deposits form a high-grade keel beneath the past-producing Afton open-pit mine, an alkalic porphyry in the Iron Mask batholith (Upper Triassic).

3.2. Selected industrial mineral mines

More than a dozen industrial mineral quarries and processing plants are in the region (Fig. 1; Table 2). These operations employ more than 250 people. In addition, nearly 300 sand and gravel pits and 45 quarries have active Mines Act permits. Many of these are intermittently active.

3.2.1. Ashcroft (IG Machine and Fiber Ltd.)

IG Machine and Fiber Ltd, a subsidiary of IKO Industries Ltd, operates the **Ashcroft** basalt quarry and roofing granule plant. They began production in 2001 and now typically produce around 300,000 tpy. The quarry is permitted to mine 500,000 tpy and about 60% is processed into granule products.

3.2.2. Decor (Pacific Bentonite Ltd.)

The **Decor** pit of Pacific Bentonite Ltd. was a supplier of alumina-rich burnt shale to the Lafarge cement plant in Kamloops. This operation is now on care and maintenance because of the Lafarge plant's shutdown. The Decor property also hosts a large bentonite deposit, which has been investigated for other applications.

3.2.3. Harper Ranch and Falkland (Lafarge Canada Inc.)

After operating intermittently for many years, supplying cement to western Canada, the **Kamloops** cement plant and **Harper Ranch** limestone quarry of Lafarge Canada Inc. are now on care and maintenance. The facility will continue to serve as a distribution point for cement produced in Alberta and other industrial uses. Apart from limestone, the cement plant used gypsum and anhydrite mined at the **Falkland** quarry, which still supplies gypsum for other uses.

3.2.4. Kettle Valley quarries (Kelowna Sand and Gravel Ltd.)

Decorative rock and dimension stone are produced at small quarries throughout the region. Kelowna Sand and Gravel Ltd. mines gneiss, dacite ash, and basalt at the **Nipple Mountain**, **Kettle Valley**, **Canyon** and **Gemini** quarries and has been issued permits to explore other sites. Kettle Valley Stone Company of Kelowna produces flagstone, ashlar, facing stone, and landscape rock.

3.2.5. Mount Polley (Craigmont Industries Ltd.)

In January 2014, Craigmont Industries Ltd. started producing magnetite from their recovery plant at the **Mount Polley** mine. Operations stopped in August 2014, due to the tailings dam breach. Poor markets have delayed its restart. The plant captures magnetite from the mine tailings stream and produces a dense media used for coal washing.

3.2.6. Red Lake and Bud (Absorbent Products Ltd.)

Absorbent Products Ltd. produces diatomaceous earth from the **Red Lake** quarry, and bentonite from the **Bud** quarry and uses them to manufacture cat litter, barn deodorizer, industrial absorbents, and carriers for agricultural products at their plant in Kamloops

3.2.7. Bromley Creek (Canadian Zeolite Corp.)

In 2014, Canadian Mining Company Inc. a subsidiary of Canadian Zeolite, concluded its option agreement with Heemskirk Canada Ltd and regained control of the **Zeotech/Bromley Creek** zeolite quarry. Zeolite from the quarry has agricultural and absorbent applications. Mining is by Absorbent Products Ltd.

3.2.8. Z-1 (Progressive Planet Solutions Inc.)

The **Z-1** mine is now owned by Progressive Planet Solutions, Formerly Ashburton ventures Inc. ZMM Canada Minerals Corp. is the operator. Their product is currently used as an agricultural feed additive, a growth medium, a filtration medium, a component of lightweight concrete, and for soil remediation.

4. Placer mines

The region has more than 650 placer mines, including one that is underground (Wingdam). Most of these operations are small, intermittent or seasonal, and lack production data.

5. Mine development

Mine development projects are those that have a positive production decision and key government approvals and on-site construction has begun. No major projects meet these criteria in the South Central Region.

6. Proposed mines

Proposed mines are defined as feasibility-stage projects for which the process of formal socioeconomic and environmental review has begun. For projects that exceed thresholds set by the British Columbia Environmental Assessment Act (or its federal equivalent), reviews are coordinated by the British Columbia Environmental Assessment Office and Canadian Environmental Assessment Agency. Smaller projects are reviewed by an interagency Mine Development Review Committee (MDRC) chaired by the Ministry of Energy, Mines and Petroleum Resources. Six projects are in this category: **Ajax**, **Bralorne**, **Harper Creek**, **New Prosperity**, **Ruddock Creek**, and **Spanish Mountain** (Fig. 1; Table 3).

6.1. Ajax (KGHM Ajax Mining Inc.)

The **Ajax** porphyry copper-gold project is owned by KGHM Ajax Mining is an 80:20 joint venture between KGHM Polska Miedź S.A. and Abacus Mining and Exploration Corporation. Mineralization is in the Iron Mask batholith, a multi-phase Triassic alkaline intrusive complex. A revised feasibility study

Table 2. Selected industrial mineral mines and quarries, South Central Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2018 Production (based on Q1-Q3)	Reserves	Resource	Comments
Ashcroft	IG Machine and Fibers Ltd. (IKO Industries Ltd.)	Basalt (roofing granules); 092INW104	300,000 t (approx.)	na	Approx. 13.3 Mt in 2002	Typically mines 500,000 t with 60% processes into granule products.
Bromley Creek (Zeotech)	Canadian Zeolite Corp.	Zeolite; open system zeolites; 092HSE243	na	na	M+I: (as of 2013-06-30): 550,000 t	Operated by Absorbent Products Ltd.
Bud	Absorbent Products Ltd.	Bentonite; 092HSE162	na	na	na	Operating, but volumes not published.
Decor	Pacific Bentonite Ltd.	Alumina, landscape rock; 092INW084	na	na	na	
Falkland	Lafarge Canada Inc.	Gypsum; 082LNW001	na	na	na	Production affected by shut down of Lafarge's Kamloops Cement Plant. Alternative markets found for 2018.
Harper Ranch	Lafarge Canada Inc.	Limestone; 092INE001	na	na	na	On care and maintenance as of November 2016.
Kettle Valley quarries	Kelowna Sand and Gravel Ltd./Kettle Valley Stone Company	Ashlar, flagstone, thin veneer; 082ENW109, 111, 112	na	na	na	
Klinker	Opal Resources Canada Inc.	Opal; 082LSW125	Intermittent operation	na	na	Not producing 2018.
Lady King Basalt	Opal Resources Canada Inc.	Basalt columns; na	Intermittent operation	na	na	Not producing 2018.
Mount Polley Magnetite	Craigmont Industries Ltd.	Magnetite (recovered from tailings); 093A 008	na	na	na	
Nazko	Can Lava Mining Corporation	Lava Rock; Cinder cone; 093B 060	na	na	Historical 45 Mt	1998 resource estimate.
Pavilion	Graymont Western Canada Inc.	Limestone; 092INW081	na	na	na	On care and maintenance as of June 2016. Developing closure and reclamation plan.
Red Lake	Absorbent Products Ltd.	Diatomaceous earth; lacustrine diatomite; 092INE081	na	na	na	Operating, but volumes not published.
Z-1	ZMM Canada Minerals Corp.	Zeolite; open system zeolites; 092INW095	na	na	Approx. 800,000 t	Historical resource.

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

Table 3. Selected proposed mines or quarries, South Central Region.

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Ajax	KGHM Ajax Mining Inc. (KGHM Polska Miedź SA 80%, Abacus Mining and Exploration Corporation 20%)	Cu, Au; alkalic porphyry; 092INE012, 13	P+Pr: NSR cut-off US\$7.10/t: 426 Mt grading 0.29% Cu, 0.19 g/t Au, 0.39 g/t Ag	M+I: NSR cut-off US\$7.10/t: 568 Mt grading 0.26% Cu, 0.18 g/t Au, 0.35 g/t Ag	Environmental certification denied by provincial (2017) and federal ministers (2018).
Bralorne	Avino Silver and Gold Mines Ltd.	Au; Au quartz veins; 092JNE001	na	M+I: 273,123 tons 0.33 opt Au Inf: 363,527 tons 0.22 opt Au, 0.1 opt Au cut-off	Past producer 1900-1971. Operated on a trial basis 2010-2014. New 100 tpd permit in 2017. Exploration in 2018 included drilling, airborne and ground geophysics, mapping, and geochemical sampling.
Harper Creek	Yellowhead Mining Inc.	Cu, Au, Ag; Noranda/Kuroko; 082M 008, 9	P+Pr: cut-off 0.14% Cu: 716 Mt grading 0.26% Cu, 0.029 g/t Au, 1.18 g/t Ag	M+I: cut-off 0.2% Cu: 815 Mt 0.28% Cu, 0.030 g/t Au, 1.3 g/t Ag	BC Environmental Assessment Office terminated EA process 2018. Taseko Mines Limited offer to buy Yellowhead Mining late 2018.
New Prosperity	Taseko Mines Ltd.	Cu, Au; porphyry; 092O 041	P+Pr: NSR cut-off \$5.50/t: 831 Mt grading 0.23% Cu and 0.41 g/t Au containing (recoverable) 3.6 Blb Cu, 7.7 Moz Au	M+I: cut-off 0.14% Cu: 1010 Mt grading 0.24% Cu, 0.41 g/t Au	Project at post-decision stage. Granted provincial environmental certificate but denied federal approval. Exploration and site evaluation proposed 2018 but a BC Supreme court decision declaring a work permit valid, was appealed. Pending the appeal, an injunction preventing work is in place.
Ruddock Creek	Ruddock Creek Mining Corporation (Imperial Metals 50%, Mitsui Mining and Smelting Co. 30%, ITOCHU Corp. 20%)	Pb, Zn, Ag; Broken Hill-type; 082M 082	na	M+I: cut-off 4.0% Pb+Zn: 6.2 Mt grading 6.50% Zn, 1.33% Pb	Project at environmental assessment pre-application stage. Exploration drilling 2018. Japan Oil, Gas and Metals National Corporation earning an interest.
Spanish Mountain	Spanish Mountain Gold Ltd.	Au, Ag; Au quartz veins; 093A 043	na	M+I: cut-off 0.15 g/t Au: 306.5 Mt grading 0.39 g/t Au, 0.64 g/t Ag Inf: 450.64 Mt 0.28 g/t Au, 0.61 g/t Ag	Project at environmental assessment pre-application stage. Exploration in 2018 included drilling.

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

released in 2016 modelled Ajax as a 65,000 tpd open-pit mine with a projected 18-year life. In December 2017, the project was denied certification by the British Columbia Ministries of Environment and Climate Change Strategy and Energy, Mines and Petroleum Resources. In June 2018, the Ministers of Natural Resources and Fisheries, Oceans and the Canadian Coast Guard denied federal certification. The company has not announced plans for the site.

6.2. Bralorne (Avino Silver & Gold Mines Ltd.)

Avino Silver & Gold Mines Ltd. acquired the **Bralorne** gold mine in 2014 and suspended mining shortly thereafter because the tailings storage facility reached capacity. The mine had been operating at a 100 tpd trial basis between 2010 and 2014. Since then, Avino has carried out upgrades and planning to meet permitting requirements. In 2017, they received an updated permit for a 100 tpd throughput mining operation. Avino anticipates operating the mine at more than 100 tpd. However, they report that much of their existing infrastructure is inadequate for higher throughput and they are proceeding with re-development. The dam for the tailings storage facility was raised in 2015 and the impoundment buttressed in 2016. A new water treatment plant was built in 2016, electrical systems upgraded and various retired equipment and buildings removed or demolished. Other engineering and infrastructure upgrades and replacements are ongoing. Within the new permit boundary, exploration is ongoing, including a 28,000 m drill program, airborne and ground geophysics, mapping and structural modelling and geochemical sampling.

6.3. Harper Creek (Taseko Mines Limited)

The **Harper Creek** copper-gold-silver project is described as a stratiform, disseminated volcanogenic deposit in metamorphosed volcanic and sedimentary rocks of the Eagle Bay assemblage (Devono-Mississippian). Although Yellowhead Mining Inc.'s application for an environmental assessment certificate was accepted in January 2015, the company suspended work on the application later that year. The British Columbia Environmental Assessment Office denied Yellowhead's request for an extension of the suspension time limit and the process terminated in July 2018. In December 2018, Taseko Mines Limited announced an agreement to acquire all outstanding shares of Yellowhead. Proven and Probable mineral reserves stand at 716 Mt grading 0.26% Cu; 0.029 g/t Au and 1.2 g/t Ag (Merit Consultants, 2014). The 2014 feasibility study proposed a 70,000 tpd operation with a mine life of 28 years.

6.4. New Prosperity (Taseko Mines Limited)

The **New Prosperity** project of Taseko Mines Limited, is a porphyry gold-copper deposit with Proven and Probable reserves of 830 Mt grading 0.42 g/t Au and 0.23% Cu. Taseko continues to seek a judicial review of the February 2014 federal decision to deny the project. British Columbia granted Taseko a

project certificate in November 2013 and has extended its expiry date by five years. In 2017, the British Columbia Ministry of Energy, Mines and Petroleum Resources issued a permit for a detailed site investigation of proposed mine infrastructure. Although a 2018 British Columbia Supreme Court decision would have allowed this work to proceed, opponents of the project have appealed and obtained an injunction preventing the work pending the appeal.

6.5. Ruddock Creek (Imperial Metals Corporation 50%; Mitsui Mining and Smelting Co. Ltd. 30%; Itochu Corporation 20%)

At the **Ruddock Creek** massive sulphide prospect, Japan Oil, Gas and Metals National Corporation (JOGMEC) funded Imperial's share of a drill program designed to test a deep extension of the V zone, one of several west of the main E zone. The first of three, nearly horizontal holes intersected 21.7 m 16.99% Zn, 3.44% Pb and 2.41 g/t Ag. The project remains in the pre-application phase of environmental assessment. The deposit is described as sedimentary exhalative, Monashee or Broken Hill-type, in marble, gneiss, and calc-silicate rocks. A mineral resource estimate, released in March 2012, reported 4.65 Mt grading 6.77% Zn and 1.38% Pb (Indicated) and 5.38 Mt grading 6.69% Zn and 1.31% Pb (Inferred), using a 4.0% combined Pb+Zn cut-off. Ruddock Creek Mining Corporation is the operator and manager of the joint venture. By funding the 2018 program, JOGMEC earns a right to participate.

6.6. Spanish Mountain (Spanish Mountain Gold Ltd.)

The **Spanish Mountain** project had a field program in 2018 including an archaeological impact assessment, metallurgical testing, step out drilling at the Phoenix zone and infill drilling at First zone. Highlight intersections include: 27.43 m 1.76 g/t Au, 67.06 m 0.82 g/t Au, 16.76 m 1.03 g/t Au.

A 2017 updated preliminary economic assessment was based on a 20,000 tpd, 24-year operation focussed on a pit at First zone. Initial capital expenditure was estimated at \$507 million, pre-tax net present value \$597 million (at 5% discount rate) and initial rate of return 22%. Average annual gold production would be 92,000 oz. The objective of the new work was to upgrade some of the inferred resources and investigate the possibility of achieving a higher grade and lower throughput operation with a lower projected capital cost. The project has been in the pre-application phase of environmental assessment since 2011.

7. Selected exploration activities and highlights

In 2018, as in 2017, the largest exploration project in the region was Barkerville Gold's **Cariboo Gold**. Exploration continued for other gold targets, porphyry copper deposits, skarn deposits (copper; tungsten), stratiform base and precious metals, cobalt-bearing veins and industrial minerals (Fig. 1; Table 4).

Table 4. Selected exploration projects, South Central Region.

Project	Operator (partner)	Commodity; deposit type; MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Amarillo	Troubadour Resources Inc.	Cu; porphyry Cu±Mo±Au; 082ENW108	na	Soil geochemistry, 3D IP, diamond drilling (planned 2000 m began December).
Axe	Evrmin Exploration Canada Corp. (Antofagasta PLC)	Cu; 092HNE040, 142, 143	I: 39 Mt 0.38% Cu Inf: 32 Mt 0.38% Cu (gold not included)	Mapping, diamond (2113.6 m) and RC (695.3 m) drilling.
BC Sugar	Lithium Corporation	Graphite; crystalline flake graphite	na	Trenching. Results included weak to moderate graphite mineralization; up to 2.62% graphitic carbon.
Big Kidd	Jiulian Resources Inc.	Cu, Ag, Au; porphyry Cu-Au; 092HNE072, 73, 74, 109	na	Ground magnetic survey. Drilling permitted late in 2018.
Bonaparte	WestKam Gold Corp.	Au; Au quartz veins; 092P 050	na	Diamond drilling 591 m in 8 holes.
Brett	Ximen Mining Corp.	Au, Ag; epithermal Au- Ag-Cu, low sulphidation; 082LSW084, 131	na	Metallurgy. A gold recovery batch test of stockpiled material (34 kg) returned a weighted average grade of 4.20 g/t Au.
Cariboo Gold Project	Barkerville Gold Mines Ltd.	Au; Au quartz veins; 093H 140, 139, 19, 6	M+I: 8.1099 Mt 6.1 g/t Au Inf: 12.7312 Mt 5.2 g/t Au	Diamond drilling 123,021 m in 439 holes. Updated resource estimate.
Fox	Happy Creek Minerals Ltd.	W; W skarns; 093A 259, 260, 261, 211	I: 582,000 t 0.826% WO ₃ Inf: 565,400 t 1.231% WO ₃	Geology, geochemistry, updated resource estimate.
FG	Kore Mining Ltd.	Au, Ag; Au quartz veins; 093A 150, 61	M: 5.6 Mt 0.812 g/t Au I: 9.57 Mt 0.755 g/t Au Inf: 27.493 Mt 0.718 g/t Au	Diamond drilling 1077 m.
Frank Creek	Barker Minerals Ltd.	Cu, Pb, Zn, Ag, Au; Besshi massive sulphide Cu-Pb-Zn; 093A 152	na	Geology, geochemistry. Grass roots work on Frank Creek and area properties.
Getty	Getty Copper Inc.	Cu, Mo; porphyry Cu±Mo±Au; 092INE038, 43	I: 114.41 Mt 0.373% Cu Inf: 41.76 Mt 0.275% Cu	Geophysics in 2018. Mo not included in combined Getty North and Getty South resource estimate.
Gold Creek	Kore Mining Ltd.	Au, Ag; Au quartz veins; 093A 127	na	Diamond drilling 940 m in 4 holes. Highlights included 9.0 m grading 5.8 g/t Au including 1.5 m grading 32.2 g/t Au.
Hedge Hog	Surge Exploration Inc.	Cu, Pb, Zn, Co; Cyprus massive sulphide Cu (Zn); 093H 156	na	Geology, geochemistry

Table 4. Continued.

Ike	Amarc Resources Ltd. (Hudbay Minerals Inc.)	Cu, Mo; porphyry Cu±Mo±Au; 092O 025, 67	na	Diamond drilling 3000 m in 5 holes. Results included 138 m grading 0.28% Cu, 0.024% Mo, 2.1 g/t Ag; 222 m grading 0.35% Cu, 0.022% Mo, 2.4 g/t Ag and 147 m grading 0.26% Cu, 0.042% Mo, 1.9 g/t Ag.
Lac La Hache	Engold Mines Ltd.	Cu, Au, Ag, Fe; 092P 120, 108, 2	I: 7.60 Mt 0.28% Cu, 0.05 g/t, 1.26 g/t Ag, 11.4% magnetite Inf: 15.8 Mt 0.21% Cu, 0.04 g/t Au, 0.93 g/t Ag, 8.32% magnetite Inf: 1.073 Mt 2.480 g/t Au, 0.64% Cu, 5.98 g/t Ag (Aurizon)	Diamond drilling (5000 m, 10 holes), geophysics, geochemistry. Highlight intersections include 8.8 m grading 3.26% Cu, 0.88 g/t Au, 16.88 g/t Ag, 26.7% Fe at Spout North; 31 m grading 1.14% Cu 0.28 g/t Au, 6.89 g/t Ag, 24.31% Fe at G1 and 58.5 m grading 0.47% Cu, 0.06 g/t Au, 2.18 g/t Ag, 6.07% Fe at Gap.
Little Gem	Blackstone Minerals Ltd.	Co, Au; five-element veins Ni-Co-As-Ag+/- (Bi, U); 092JNE068, 108	na	Diamond drilling (2918 m, 10 holes), geophysics, geochemistry, geology. Initial drill results included 4.3 m grading 1.0% Co and 15 g/t Au and 3.2 m grading 0.8% Co and 4 g/t Au.
Lorn	Cyntar Ventures Inc.	Cu, Mo; porphyry Cu±Mo±Au; 092O 024	na	Rock and soil geochemistry, mapping.
Miner Mountain	Sego Resources Inc.	Cu, Au; alkalic porphyry Cu-Au; 092HSE203, 78	na	Diamond drilling (3000 m, 9 holes), mapping. Drilling highlights include 57 m grading 0.26% Cu and 18 m grading 0.56% Cu.
Moffat	Pacific Empire Minerals Corp.	Au, Ag, Cu	na	RC drilling (383 m, 7 holes), airborne geophysics.
Mont	Leo Lindinger	Bentonite	na	Test pits.
New Craigmont	Nicola Mining Inc.	Cu, Au; Cu skarns; 092ISE035	na	Drilling (RC 1250 m, 66 holes, DD 5000 m 18 holes). Drilling results included 73.6 m grading 1.05% Cu and 100.6 m grading 1.33% Cu.
North Brenda	Bitterroot Resources Ltd.	Au, Ag; Au quartz veins; 092HNE318, 294	na	Diamond drilling: 1361 m in 9 holes.
Princeton Gold	Tasca Resources Ltd.	Au; Au quartz veins; 092HSE262, 263	na	Trenching.
Rabbit North	Tower Resources Ltd.	Cu, Au; alkalic porphyry Cu-Au; 092INE147, 45		Diamond drilling: 790 m in 2 holes. Highlights include 53 m grading 0.32% Cu and 0.22 g/t Au within a larger interval of 288 m grading 0.18% Cu and 0.12 g/t Au.
Rateria	Happy Creek Minerals Ltd.	Cu, Mo, Au, Ag Re; porphyry Cu±Mo±Au; 092ISE199	na	Mapping, rock sampling.

Table 4. Continued.

Red Property	Pacific Empire Minerals Corp. (Engold Mines Ltd.)	Cu, Ag, Au; porphyry?; 092P 197	na	RC drilling: 403 m in 8 holes.
Shovelnose	Westhaven Ventures Inc.	Au; epithermal Au-Ag-Cu, low sulphidation; 092HNE309, 308	na	Diamond drilling (5721 m in 16 holes), airborne and ground geophysics. A new discovery was made with results including 17.77 m grading 24.50 g/t Au.
Skoonka Creek	Westhaven Ventures Inc.	Au, Ag; epithermal Au-Ag-Cu, low sulphidation; 092ISW104, 129, 105, 126	na	Airborne geophysics.
Spilus	Pacific Ridge Exploration Ltd.	Cu, Mo; porphyry Cu±Mo±Au; 092HNW027	na	Mapping, geochemistry, geophysics.
Treasure Mountain Silver	New Destiny Mining Corp.	Ag, Au, Cu, Zn; polymetallic veins Ag-Pb-Zn±Au; 092HSW066, 117, 092HSE240	na	Trenching.
Tulameen South	Sable Resources Ltd.	PGE, Ni, Cu; Alaskan-type Pt±Os±Rh±Ir	na	Mapping. Grass roots exploration adjacent to reported Pt placer (historical).
Tulox Gold	Sable Resources Ltd.	Au, Cu; intrusion-related Au pyrrhotite veins; 092P 175		Diamond drilling 1322 m in 7 holes targeting blind mineralization. Potential deposit type inferred from geological setting and soil geochemistry.

M = Measured; I = Indicated; Inf = Inferred

7.1. Selected precious metal projects

The South Central Region has many precious metal deposit types including: orogenic veins; transitional veins; epithermal veins; hot spring systems; replacement deposits; skarns; sediment-hosted deposits; and intrusion-related breccias.

7.1.1. Bonaparte (Westkam Gold Corp.)

Westkam Gold Corp. drilled 8 short holes at the **Bonaparte** project, focusing on the Crow vein. They suspended a planned bulk sampling program. In 1994, a 3700 t sample from surface trenches had an average grade of 26.5 g/t Au. In addition to near-surface gold-bearing quartz veins, chargeability anomalies, alteration assemblages, and proximity to Jurassic intrusive rocks suggest porphyry targets on the property.

7.1.2. Brett (Ximen Mining Corp.)

Ximen completed a gold recovery batch test of stockpiled material (34 kg). The sample returned a weighted average grade of 4.20 g/t Au. They are working toward permitting of underground work, starting with re-opening a portal.

7.1.3. Cariboo Gold (Barkerville Gold Mines Ltd.)

Barkerville Gold's multi-target project was the largest in the region in 2018, as it has been for several years. The project included 123,000 m of drilling in 439 holes and an updated resource estimate with 1.6 Moz Au in the Measured and Indicated categories and more than 2 Moz Inferred (Table 4). They describe several styles of orogenic gold mineralization, both vein and replacement. Work on an internal preliminary feasibility study has not been released. In addition to exploration, they are mining the Bonanza Ledge deposit and trucking ore to the QR mill (see above). Their longer term goal is a larger underground operation at Cow Mountain and Island Mountain, with a mill on site.

7.1.4. FG (Kore Mining Ltd.)

Kore Mining combined with Eureka Resources Inc. and became the new owner of the **FG** (formerly Frasergold) and **Gold Creek** properties. They drilled 1077 m at FG late in the year.

7.1.5. Gold Creek (Kore Mining Ltd.)

A four-hole 940 m diamond drilling project at the Camp zone on the Gold Creek property returned a highlight of 9.0 m grading 5.8 g/t Au including 1.5 m grading 32.2 g/t Au.

7.1.6. North Brenda (Bitterroot Resources Ltd.)

Bitterroot drilled below and along strike from Au-Ag bearing sulphide veins exposed by trenching. The drilling encountered anomalous Au, but at values less than at surface.

7.1.7. Princeton Gold (Tasca Resources Ltd.)

Tasca Resources Ltd. obtained high-grade results from trench samples on a quartz vein at the **Princeton Gold** project, including 217 g/t Au over 0.9 m and 99.7 g/t Au over 0.9 m. Prospecting and soil sampling located the target area. Tasca have a permit for drilling. Canarc Resources Corp. signed an option agreement late in the year.

7.1.8. Shovelnose (Westhaven Ventures Inc.)

Westhaven completed 16 holes and more than 5000 m of drilling at **Shovelnose**. Results of the first 10 holes included 17.77 m grading 24.50 g/t Au in the South zone, a 2018 discovery. The 2018 intersections are the first to confirm high grade at depth (Fig. 3). Follow up drilling at the end of the year tested vertical and strike extents of the vein system. In addition to drilling, Westhaven conducted a ground magnetic survey and passive seismic survey. The South zone target originally appeared as a linear magnetic low in 2017. The seismic survey is to estimate overburden thickness in targets areas. Shovelnose hosts epithermal style mineralization in Spences Bridge Group volcanic rocks (Cretaceous).

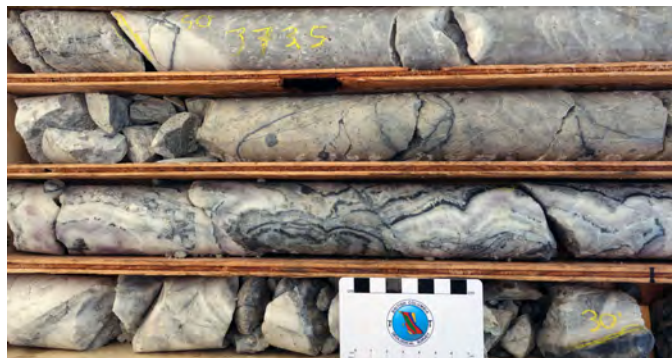


Fig. 3. Epithermal (gingero) textures in core from Shovelnose. The dark sulphide bands can host gold and silver mineralization.

7.1.9. Skoonka (Westhaven Ventures Inc.)

An airborne magnetic survey at **Skoonka** and **Skoonka North** is designed to identify structures and structural trends. Skoonka North is approximately 80 km northwest of Shovelnose, in the same belt of Spences Bridge Group rocks. Between the Skoonka and Shovelnose properties, Westhaven holds the Prospect Valley property. Following results at Shovelnose, a subsidiary of Sable Resources Ltd. staked virtually all open ground in the Spences Bridge belt and formed an alliance with Westhaven. Targets are additional epithermal gold veins.

7.1.10. Treasure Mountain Silver (New Destiny Mining Corp.)

New Destiny's **Treasure Mountain Silver** property partially surrounds Nicola Mining Inc.'s Treasure Mountain Silver past-producer. Rock sampling early in the year returned up to 11.3 g/t Au and 14.5 g/t Ag. They followed with trenching in the southeastern part of the property.

7.1.11. Tulameen South (Sable Resources Ltd.)

Sable Resources acquired **Tulameen South** with the purchase of Western Canada Greenfields Group Inc. They conducted preliminary geological work on this grass roots property. Earlier work in this area considered the potential for platinum group element mineralization or possible Ni-Cu-Co-PGE mineralization.

7.1.12. Tulox (Sable Resources Inc.)

The **Tulox** is a grass roots property with a 2.5 km long Au-in-soil anomaly coincident with an intrusive contact. The target is intrusion-related gold. The first drill program on the property consists of 7 holes and 1322 m.

7.2. Selected porphyry projects

More than 12 exploration projects focussed on porphyry deposits in 2018. Notable among these was Copper Mountain Mining Corporation's **New Ingerbelle**, which could add years to mining operations at Copper Mountain (see section 3.1.2.).

7.2.1. Amarillo (Troubadour Resources Inc.)

Troubadour completed a 3D IP survey on its **Amarillo** porphyry Cu project, followed by drilling in December. Initial drilling is to focus on an IP chargeability anomaly in the area of an historical trench from which previous samplers reported 0.87% Cu across 125 m.

7.2.2. Axe (Evrin Resources Corp. 30%; Antofagasta Plc. 70%)

Evrin Resources Corp. and partner Antofagasta started a 3000 m drill program in May, including diamond drilling and reverse circulation drilling. A resource estimate was last updated in 2006 (Table 4). The last drilling was in 2006-2007 by WestStar Resources Corp. Xstrata Canada Corporation conducted airborne geophysics, induced polarization and soil geochemical surveys in 2012. Axe is an alkalic porphyry Cu prospect.

7.2.3. Big Kidd (Jiulian Resources Inc.)

Jiulian Resources reported a high resolution (25 m line spacing) ground magnetic survey over an alkalic porphyry prospect. The results are to guide drilling which was permitted late in the year.

7.2.4. Getty (Getty Copper Inc.)

Getty Copper reported geophysical work in 2018 for assessment. The two advanced prospects on the property, **Getty**

North and **Getty South**, are about 3 km apart. Getty North has an Indicated 69.258 Mt 0.37% Cu and 0.005% Mo and an Inferred 18.166 Mt 0.271% Cu and 0.005% Mo. Getty South has an Indicated 45.148 Mt 0.377% Cu and Inferred 23.593 Mt 0.278% Cu.

7.2.5. Ike (Hudbay Minerals Inc. 60%; Amarc Resources Ltd. 40%)

Hudbay Minerals funded a program of five widely spaced holes with Amarc as operator. Results included 138 m grading 0.28% Cu, 0.024% Mo, 2.1 g/t Ag; 222 m grading 0.35% Cu, 0.022% Mo, 2.4 g/t Ag and 147 m grading 0.26% Cu, 0.042% Mo, 1.9 g/t Ag. The mineralization remains open.

7.2.6. Lorn (Cyntar Ventures Inc.; Blady 25%; Carlson 25%; Chapman 25%; Paul 25%)

Cyntar Ventures optioned the **Lorn** property and carried out geological mapping and soil and rock geochemistry. They report two new mineralized zones, including a 4 x 2 km Ag-Au-Cu-Mo soil anomaly flanking a magnetic low. The property has porphyry Cu and possible epithermal targets.

7.2.7. Miner Mountain (Sego Resources Inc.)

Sego Resources had two phases of drilling with mapping following the first phase. Among the highlights of the earlier phase were 57 m grading 0.26% Cu and 18 m grading 0.56% Cu. **Miner Mountain** is an alkalic porphyry Cu prospect (Fig. 4), with numerous targets in an area of limited exposure about 18 km northeast of the Copper Mountain mine.

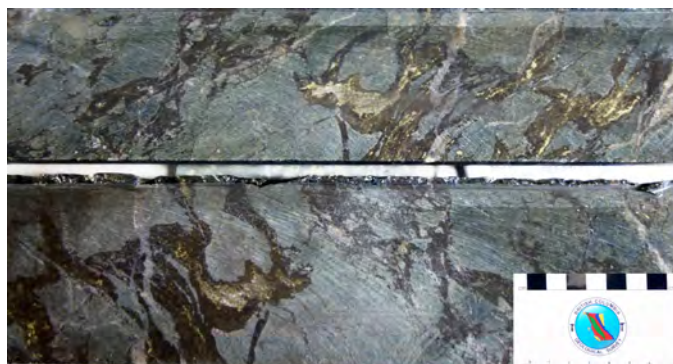


Fig. 4. Chalcopyrite (yellow) and magnetite (black) in Miner Mountain drill core. Crosscut by gypsum (light orange) veinlets.

7.2.8. Moffat (Pacific Empire Minerals Corp.)

Pacific Empire had a small RC drill program on magnetic anomalies identified in a 2018 survey. They report no economic intersections but alteration, pyrite, and elevated copper may warrant follow-up on this grass roots property.

7.2.9. Rabbit North (Tower Resources Ltd.)

Tower drilled 760 m in two holes at **Rabbit North** in 2018. A highlight was 53 m grading 0.32% Cu and 0.22 g/t Au within a larger interval of 288 m grading 0.18% Cu and 0.12 g/t Au. They plan a 3D IP survey next. There are several alkalic porphyry Cu targets on the property.

7.2.10. Rateria (Happy Creek Minerals Ltd.)

Following drilling in 2017, Happy Creek conducted geological mapping and rock sampling at the **Rateria** porphyry Cu-Mo-Au-Ag prospect. They report previously unrecorded bornite mineralization at surface.

7.2.11. Red Property JV (Engold Mines Ltd. 50%; Pacific Empire Minerals Corp. 50%)

Pacific Empire drilled 403 m in eight shallow RC holes at the **Red Property** to test geophysical targets. Although they reported no significant Cu mineralization, targets remain on the property.

7.2.12. Spius (Pacific Ridge Exploration Ltd.)

Pacific Ridge reported a Cu in soil anomaly and an enveloping IP chargeability anomaly, which they interpret as a possible pyritic zone consistent with a porphyry copper deposit model. They have obtained a permit for drilling. The property was explored for porphyry mineralization in the 1960s and early 1970s but little work has been recorded since.

7.3. Selected polymetallic base and precious metal projects

Although the region has numerous polymetallic massive sulphide prospects, including those hosted by the Eagle Bay assemblage (e.g., **Harper Creek**, **Samatosum**, **Rea**) and other Paleozoic strata. Only a few were active in 2018.

7.3.1. Frank Creek (Barker Minerals Ltd.)

Barker Minerals reported geochemistry (rock and soil) and geological work on several of their properties including **Frank Creek** and **Ace**.

7.3.2. Hedge Hog (Surge Exploration Inc.)

Surge Exploration optioned Eastfield Resources Ltd.'s **Hedge Hog** Cu-Au-Ag-Co prospect and carried out geological and geochemical work in September. Massive sulphide mineralized boulders and cobbles were discovered in the area in the 1990s.

7.4. Selected skarn projects (tungsten, copper, gold)

Two major skarn projects were active in 2018, **New Craigmont** and **Lac La Hache**, and the **Fox** project released an updated resource estimate (Table 4).

7.4.1. Fox (Happy Creek Minerals Ltd.)

At the **Fox** tungsten skarn property, Happy Creek Minerals Ltd. reported results of surface sampling at a previously untested area at the southern part of the Ridley Creek resource area and points south, toward the BN zone. One sample graded 7.43% WO_3 across 0.35 m. Mineralization is in flat-lying sedimentary rocks of the Snowshoe Group (Neoproterozoic to Lower Paleozoic) cut by the Deception stock, a mid-Cretaceous (106 Ma) pluton that ranges in composition from quartz monzonite to muscovite-biotite granite. Since 2005, work has identified seven, near-surface mineralized zones in a system extending across a 3 x 10 km area. In February, Happy

Creek reported an update to the resource estimate with an Indicated 582,400 t 0.826 WO₃ and Inferred 565,400 t 1.231% WO₃ (Table 4).

7.4.2. Lac La Hache (Engold Mines Ltd.)

The **Lac La Hache** project comprises several target areas including skarn, porphyry, vein and breccia mineralization. Work included diamond drilling and IP surveys at Cu-Au-Ag-Fe skarn targets (Spout North, Spout, G-1, Gap and surrounding targets) and also a gold vein target in the southeastern part of the property (Aurizon). Highlight intersections include 8.8 m grading 3.26% Cu, 0.88 g/t Au, 16.88 g/t Ag, 26.7% Fe at Spout North; 31 m grading 1.14% Cu, 0.28 g/t Au, 6.89 g/t Ag, 24.31% Fe at G1 and 58.5 m grading 0.47% Cu, 0.06 g/t Au, 2.18 g/t Ag, 6.07% Fe at Gap. They obtained up to 25.6 g/t Au in grab samples near the Aurizon and Au in soil anomalies. Drilling continued into late 2018.

7.4.3. New Craigmont (Nicola Mining Inc.)

New Craigmont includes the past producing Craigmont mine and surrounding area. Nicola is exploring for additional copper-iron skarn near the mine and evaluating historical waste dumps as potential ore with reverse circulation drilling. Exploration included diamond drilling, and IP surveys at several zones. An intersection in a hole north of the Craigmont pit returned 73.6 m grading 1.05% Cu. Early in the year, they reported 100.6 m grading 1.33% Cu at the Craigmont West zone. Target mineralization is copper-gold skarn in calcareous Nicola Group rocks cut by a southern border phase of the Giuchon Creek batholith.

7.5. Selected specialty metals and industrial mineral projects

Location near transportation corridors and population centres mean low unit value products such as many industrial minerals are potentially viable targets in the region. The South Central Region also has some relatively unusual prospects such as cobalt-bearing polymetallic veins and carbonatites with tantalum, niobium and rare earth element potential.

7.5.1. BC Sugar (Lithium Corporation)

Lithium Corporation excavated 12 test pits at **BC Sugar**, a grass roots stage graphite property. Three encountered weak to moderate graphite mineralization with up to 2.62% graphitic carbon.

7.5.2. Little Gem (Blackstone Minerals Limited)

Blackstone acquired the **Little Gem** cobalt-gold prospect in 2017. The property includes the Jewel prospect approximately 1 km to the north. Jewel was a minor producer of gold, silver and copper in 1938-1940. Work in 2018 included drilling, an IP survey, rock, soil and stream sediment geochemistry and prospecting. Since acquiring the project, Blackstone reported additional targets, including Roxey, a gold-copper showing, and Erebor, which returned significant cobalt, gold, nickel and

copper assays from rock samples. Some initial drill results include 4.3 m grading 1.0% Co and 15 g/t Au and 3.2 m grading 0.8% Co and 4 g/t Au. The Little Gem hosts vein-type cobalt-gold mineralization with anomalous Ag, Ni, Bi, U and As, in the Coast Plutonic complex near its contact with serpentinite of the Bridge River complex.

7.5.3. Mont (Leo Lindinger)

Mont is a recent discovery of bentonite clay near Stump Lake south of Kamloops. Mr. Lindinger reported starting a series of test pits in November. Aerial imagery and surface observation suggest the area underlain by montmorillonite-rich clay may be significant (Fig. 5).



Fig. 5. An exposure of clay at the Mont bentonite property. Preliminary samples contained a high percentage of montmorillonite.

8. Geological research

Nixon (2018) continued to investigate platinum group element concentrations in sulphides in the Tulameen complex, an Alaskan-type ultramafic intrusive complex west of Princeton, and (Schiarrizza, 2019) continued to develop a comprehensive stratigraphic framework for Nicola Group rocks. Plouffe and Ferbey (2018) published a new surficial geology map of the Highland Valley Copper mine area, and Ferbey et al., (2018) examined the geochemistry and mineralogy of subsurface till samples recovered from a diamond drill hole on the Rateria porphyry Cu±Mo property. Rukhlov et al. (2018) published a field trip guidebook to the Upper Fir carbonatite-hosted tantalum-niobium deposit, and Angen (2018) published results of mapping and mineral potential in part of the region. Previously unpublished geochemical data were released by (Lett, 2018a) from near Lillooet and (Lett, 2018b) from the McLeod Lake area.

Acknowledgments

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