



Provincial Overview of Exploration and Mining in British Columbia, 2017



Ministry of
Energy, Mines and
Petroleum Resources



Ministry of Energy, Mines and Petroleum Resources
British Columbia Geological Survey
Information Circular 2018-1

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**Ministry of Energy, Mines and Petroleum Resources
Mines and Mineral Resources Division
British Columbia Geological Survey**

Front Cover: Drill rig at Kemess East (AuRico Metals Inc.).
Photo by Paul Jago.

Back Cover: Sampling Stuhini Group rocks, north side of Castle Mountain, Baker project
(Sable Resources Ltd.).
Photo by Paul Jago.

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Victoria
British Columbia
Canada

January 2018

Foreword

This volume is the latest in a series of annual reviews that dates back to 1874, when the first Annual Report of the Minister of Mines was published. Detailing significant projects region-by-region, the volume complements the British Columbia Coal Industry Overview (British Columbia Geological Survey Information Circular 2018-2).

To prepare the district chapters in this volume, the Regional Geologists visit project sites to view outcrops and drill core and to discuss results and progress. A significant amount of information is gleaned from corporate press releases, websites and reports. Exploration expenditures, drilling estimates and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey. The survey is a joint initiative between the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for Mineral Exploration, and Ernst & Young LLP.

Grassroots exploration commonly does not require permitting, and the activities and expenditures assigned to this category are less likely to be reported because they are typically below Mines Act permit thresholds.

- Early-stage exploration includes such as geophysics, geochemistry, trenching, and drilling.
- Advanced-stage exploration is concerned with resource definition, emphasizing drilling and bulk sampling. It may include baseline environmental studies, economic pre-feasibility work, and secondary target exploration.
- Mine evaluation begins with a commitment to develop a resource. It usually coincides with an application to government to open a mine and concentrates on the environmental, social, engineering, and financial assessments of a project.
- Mine lease exploration represents work on a mining property beyond known reserves. It may have characteristics of early-stage or advanced exploration.

Founded in 1895, the British Columbia Geological Survey integrates historical data with active research programs and, drawing on continuously advancing concepts and technologies in the Earth sciences, supports the mineral and coal industries. The British Columbia Geological Survey preserves, archives, and provides free web-based access to over a century's worth of geoscience information. For details visit www.empr.gov.bc.ca/geology.

We appreciate the information and access to project sites provided by industry representatives and thank George Owsicki of Total Earth Science Services for desktop publishing.



Gordon Clarke
Director, Mineral Development Office
British Columbia Geological Survey
January, 2018

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Exploration and Mining in British Columbia, 2017: A summary



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1. Introduction

Reflecting its complex geological history, British Columbia is endowed with diverse minerals and deposit types. British Columbia is Canada's largest exporter of coal, leading producer of copper, and only producer of molybdenum. Also produced are significant amounts of gold, silver, lead, and zinc, and over 30 industrial minerals including gypsum, magnesite, limestone, and dimension stone. Numerous quarries produce sand and gravel or crushed aggregate. An increase in commodity prices and an improved venture capital market meant numerous mineral exploration projects remained active in 2017 (Fig. 1).

Flanked by the Pacific Ocean, British Columbia offers easy access to global markets. Mine operations benefit from tax incentives and a well-developed infrastructure, including low-cost electricity, an integrated road and rail network, and large deep-water ports. Exploration benefits from an extensive geoscience database and a web-based mineral tenure system.

This summary uses information from the British Columbia Coal Industry Overview (British Columbia Geological Survey Information Circular 2018-2) and incorporates reports, presented in this volume, from Regional Geologists. The Regional Geologists (Fig. 2; Table 1) represent the provincial government on geological matters at a regional level. Within their communities, they provide information on exploration trends, possible investment opportunities, land use processes, First Nation capacity building, and public outreach.

2. Mine production

The Ministry of Energy, Mines and Petroleum Resources forecasts the total value of mine production for 2017 at \$9.82 billion (Fig. 3) including coal, copper, industrial minerals, aggregate, gold, molybdenum, and silver. This is an increase of \$3.19 billion over the 2016 preliminary NRCan estimate of \$6.63 billion (Fig. 4). The increase is due to three coal mines reopening and higher commodity prices, particularly for coal and, to a lesser degree, copper and gold. As in previous years, coal was the highest value mine product (61%) followed by copper (23%).

In 2017, ten metal mines operated during at least part of

the year (Table 2). Coal was produced at five large open-pit operations in the southeastern part of the province, two open-pit operations in the northeastern part of the province and one underground mine on Vancouver Island (Table 3). About 30 industrial mineral mines and more than 1000 aggregate mines/quarries were in operation.

3. Mining highlights

3.1. Metal mines

Metal mines accounted for \$3.07 billion (forecast) of all mine production in 2017, representing about 31% of total output (Fig. 3). Eight metal mines were producing at the start of 2017 but, by the end of the year, one had ceased production (Silvertip) and two had started up (Brucejack and Bonanza Ledge).

In the Northwest Region commercial production was announced for the **Brucejack** mine in July. For the third quarter, ending September 30th, the process plant averaged 2840 tpd and mill feed averaged 10.5 g/t Au. The mill feed grade is expected to increase as processing switches from low-grade stockpiles and development muck to stope ore. Also in the Northwest Region, Imperial Metals Corporation's **Red Chris** copper-gold mine had a 2017 production target of 76-80 million pounds of copper and 33-37,000 ounces of gold. In the North Central Region, the **Mt. Milligan** open-pit copper-gold mine was in its fifth year of production. Feed throughput in 2017 was forecast to be 59,600 tpd, and for 2018 to be 60,700 tpd.

In the South Central Region, operating mines included **Bonanza Ledge**, **Copper Mountain**, **Gibraltar**, **Highland Valley**, **Mount Polley** and **New Afton**. Barkerville Gold Mines Ltd. restarted the **Bonanza Ledge** mine. They expect to mine about 30,000 t in 2017 and 150,000 tpy thereafter. Initial life of mine is a planned 3.5 years, but exploration potential remains. Ore is trucked to Barkerville's QR mill. Copper Mountain Mining Corporation reported mill throughput for the **Copper Mountain** mine averaged more than 38,000 tpd, with feed grade 0.31% Cu and about 78% recovery for the first nine months of the year. A multi-year exploration program resumed at the mine site to extend Pit 2 westward and test mineralization below the

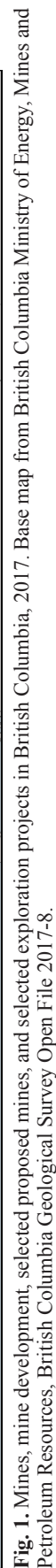
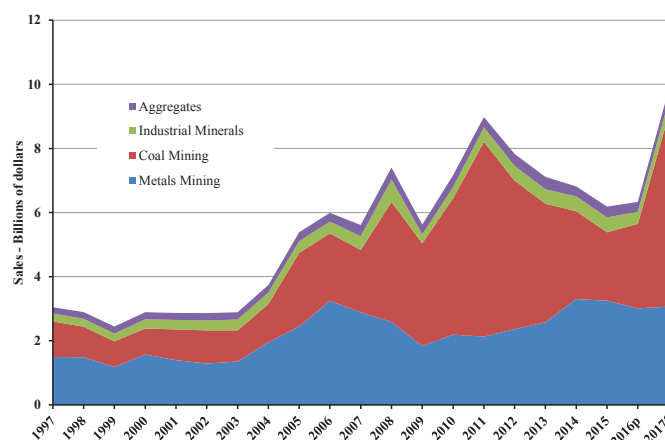
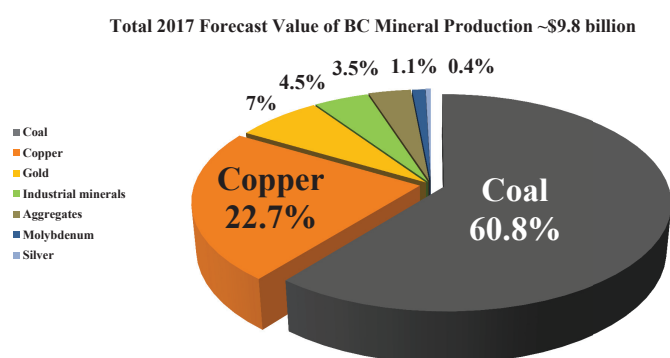


Table 1. Regional Geologists contact information.

Region	Community	Regional Geologist	Phone	email
Northwest	Smithers	vacant	-	-
Northeast and North Central	Prince George	John DeGrace	250-565-4316	John.Degrace@gov.bc.ca
South Central	Kamloops	vacant	-	-
Southeast	Cranbrook	Fiona Katay	250-417-6010	Fiona.Katay@gov.bc.ca
Southwest	Vancouver	Bruce Northcote	604-660-2713	Bruce.Northcote@gov.bc.ca
Mineral Development Office	Vancouver	Gordon Clarke	604-660-2094	Gordon.Clarke@gov.bc.ca

**Fig. 2.** Geographic regions and Regional Geologist offices.**Fig. 4.** Value of British Columbia mineral production by year 1996-2017.**Fig. 3.** Estimated value of British Columbia mineral production for 2017.

pit with 8900 m of drilling. Drilling then moved to the New Ingerbelle deposit with a 5000 m program to confirm historical resources and, potentially, extend mine life by 10 years. At the **Gibraltar** mine 22 Mtons was milled in the first nine months of 2017 at grades of about 0.3% Cu and 86% recovery. Operations were affected by wildfires in July, preventing personnel from travelling to the mine site and temporarily stopping rail traffic and the ability to ship concentrate. In the first nine months

of 2017, Teck Resources Ltd's **Highland Valley** mine milled 38,525 Mt at a copper grade of 0.22% and recovery of 73.5% as it processed low-grade ore from the Lornex pit. A project to install an additional ball mill that began in September is projected to increase mill throughput by 5% and copper recovery by 2%. Imperial Metals Corporation's **Mount Polley** mine reported that ore milled was just over 18,000 tpd in the first nine months of 2017, for 4.9 Mt at 0.207% Cu, 0.337 g/t Au and recoveries of 67% and 71%. Imperial anticipates producing 22-24 million lb Cu and 51-55 thousand oz. Au in 2017, an 8-9% decrease due to operations being suspended in the second half of July because of forest fires. New Gold Inc. reported that ore processed at their **New Afton** mine was just over 4.5 Mt at 0.55 g/t Au and 0.82% Cu (80% and 81% recovery) for the first nine months of 2017.

3.2. Coal mines

Eight operating coal mines (Table 3) accounted for a forecast \$5.96 billion of production for 2017, up sharply relative to \$2.63 billion (preliminary estimate) in 2016. This is due to an increase in the coal price and increased production. Production represents about 61% of all total mineral output in the province. Coal was produced at five large open-pit operations of Teck

Table 2. Operating metal mines, 2017, forecast mine production, reserves, and resources.

Mine	Region	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Brucejack	Northwest	Pretium Resources Inc.	Au, Ag; Au-quartz veins; Quartz stockwork breccia; Epithermal; 104B 193	na	P+Pr: combined VOK zone and West zone 18.5 Mt at 14.6 g/t Au, 53.5 g/t Ag	M+I: VOK zone 16.4 Mt at 17.2 g/t Au and 15.0 g/t Ag M+I: West zone 4.9 Mt at 5.85 g/t Au and 267 g/t Ag	Mine declared official production in July.
Red Chris	Northwest	Red Chris Development Company Ltd.	Cu, Au, Ag; Porphyry Cu-Au; 104H 005	68.5 Mlbs Cu and 27,000 oz Au	na	M+I: 1.035 Bt at 0.35% Cu, 0.35 g/t Au and 1.14 g/t Ag	First year of full production achieved in 2016. Resource figures are for combined open pit and planned underground operations and do not take into account any mining since start- up.
Silvertip	Northwest	JDS Silver Inc./ Coeur Mining Inc.	Ag, Pb, Zn, Au; Polymetallic manto; 104O 038	na	na	2.35 Mt at 352 g/t Ag, 6.73% Pb, 9.41% Zn	Operations suspended in April. Purchased by Coeur Mining Inc. in October for approximately \$250 million.
Mt. Milligan	Northeast	Centerra Gold Inc. (Centerra B.C. Holdings)	Cu, Au, Ag; Alkalic porphyry Cu- Au; 093N 194, 093N 191	55-65 Mlbs Cu; 235,000- 255,000 oz Au	P: 256.8 Mt at 0.187% Cu and 0.424 g/t Au Pr: 239.4 Mt at 0.188% Cu and 0.293 g/t Au	M+I: 243.9 Mt at 0.16% Cu and 0.2 g/t Au (additional to reserves)	Concentrator design capacity 62,500 tpd. Estimated mine life 22 years. Over 350 employees.
Bonanza Ledge	South Central	Barkerville Gold Mines Ltd.	Au; Au- quartz veins; 093H 140	30,000 t (2017 target)	na	M: 248,000 t 8.07 g/t Au I: 436,700 t 6.72 g/t Au Inf: 108,100 t 5.34 g/t Au	Mining began last week of August 2017. Planned 150,000 tpy 6.5 g/t Au diluted for 3.5 years.
Copper Mountain	South Central	Copper Mountain Mining Corporation 75%, (Mitsubishi Materials Corporation 25%)	Cu, Au, Ag; alkalic porphyry; 092HSE001	53.6 Mt mined, 10.4 Mt milled Q1-Q3	P: 53 Mt 0.36% Cu, 1.43 g/t Ag, 0.11 g/t Au Pr: 69 Mt 0.30% Cu, 1.15 g/t Ag, 0.11 g/t Au	M+I: 221 Mt 0.33% Cu, 1.3 g/t Ag, 0.10 g/t Au Inf: 228 Mt 0.27% Cu, 1.01 g/t Ag, 0.14 g/t Au	Resources inclusive of reserves. Company projects 36,287 t Cu production 2017.

Table 2. Continued.

Gibraltar	South Central	Taseko Mines Limited 75%, (Sojitz Corp. 12.5%, Dowa Holdings Co. Ltd. 6.25%, Furukawa Co. Ltd. 6.25%)	Cu, Mo; porphyry; 093B 012	66.2 Mtons mined, 22.0 Mtons milled Q1-Q3	P+Pr: 688 Mtons 0.26% Cu, 0.008% Mo	M+I: 1031 Mtons 0.25% Cu, 0.008% Mo	Resources inclusive of reserves.
Highland Valley	South Central	Teck Resources Limited	Cu, Mo; porphyry; 092ISW012, 045	87.4 Mt mined, 38.525 Mt milled Q1-Q3	P: 334.7 Mt 0.31% Cu, 0.007% Mo Pr: 211.9 Mt 0.26% Cu, 0.010% Mo	M: 517.4 Mt 0.31% Cu, 0.008% Mo I: 953.7 Mt 0.23% Cu, 0.010% Mo Inf: 501.2 Mt 0.24% Cu, 0.008% Mo	Resources exclusive of reserves. 2017 copper production projected 275,000-290,000 t, molybdenum 7.5-8.0 Mlb.
Mount Polley	South Central	Imperial Metals Corporation	Cu, Au, Ag; alkalic porphyry; 093A 008	4.917 Mt milled Q1-Q3	P+Pr: 73.613 Mt 0.274% Cu, 0.293 g/t Au, 0.562 g/t Ag	M+I: 180.5 Mt 0.26% Cu, 0.251 g/t Au, 0.904 g/t Ag Inf: 14.7 Mt 0.21% Cu, 0.188 g/t Au, 0.904 g/t Ag	Reserves in 5 zones, effective Jan. 1, 2016. Resources (excluding reserves) are as of Aug. 14, 2017 including updated Martel zone. 2017 production targets 20-22 Mlb Cu, 51-55,000 oz Au.
New Afton	South Central	New Gold Inc.	Au, Ag, Cu; alkalic porphyry; 092INE023	4.596 Mt mined, 4.510 Mt milled Q1-Q3	Pr: 60.336 Mt 0.6 g/t Au, 2.0 g/t Ag, 0.78% Cu	M+I: 56.592 Mt 0.64 g/t Au, 2.1 g/t Ag, 0.76% Cu Inf: 15.219 Mt 0.41 g/t Au, 1.3 g/t Ag, 0.41% Cu	2017 targets 70,000-80,000 oz Au, 85-95 Mlb Cu. Resources exclusive of reserves.

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

Coal Limited in southeastern British Columbia, two open-pit operations of Conuma Coal Resources Limited in northeastern British Columbia, and one underground operation of Quinsam Coal Corporation on Vancouver Island. Wolverine restarted in January and Quinsam restarted in September.

At the start of 2017, global coal prices were at the high levels reached in late 2016, which followed five years of low prices. Prices dropped slightly, but then spiked again to more than US\$300 per t for premium coking coal in late March, when Cyclone Debbie struck the coal-producing regions of Australia. Prices stabilized over the summer to about US\$150 per t. The average prices for the year (as of mid-November 2017) were US\$178 for hard coking coal and US\$141 for PCI coal.

3.3. Industrial minerals, aggregates, and jade

About 30 industrial mineral mines and more than 1000 aggregate operations are active in British Columbia (Table 4).

With forecast production figures for industrial minerals of \$443 million (4.5% of total mineral production) and for aggregates of \$343 million (3.5% of total mineral production), these operations are important to the economy of the province. British Columbia produces the world's best quality nephrite jade.

The Northwest Region was the most active for jade producers. In the Northeast Region, Fireside Minerals Ltd. mined veins of massive white barite. Mined barite is crushed and bagged on site and trucked to Fort St. John, British Columbia and Alberta for use in the drilling industry. In the South Central Region, industrial mineral commodities produced include roofing granules (from basalt), limestone, dimension stone, opal, railway ballast, diatomaceous earth, and zeolite. The Southeast Region hosts several industrial mineral mines, the largest of which are in the Rocky Mountain foreland belt. Commodities produced include magnesite, silica, gypsum, graphite, mineral wool, and abrasives. Northern Silica Corporation

Table 3. Operating coal mines, 2017, forecast mine production, reserves, and resources.

Mine	Region	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1- Q3)	Reserves	Resource	Comments
Brule	Northeast	Conuma Coal Resources Limited	PCI; Bituminous coal; 093P 007	2.33 Mt	P: 16.3 Mt	na	Restart activities began in Sept. 2016, ramp-up complete June 2017. About 550 employees, Brule and Perry Creek combined.
Wolverine (Perry Creek)	Northeast	Conuma Coal Resources Limited	HCC; Bituminous coal; 093P 025	1.14 Mt	P: 8.8 Mt	na	Placed on care and maintenance in 2014. Restart process began Jan. 2017, ramp-up complete June 2017.
Coal Mountain	Southeast	Teck Coal Limited	PCI; Bituminous coal; 082GNE001	2.7 Mt	PCI P: 2.7 Mt	M: 56.1 Mt, I: 23.1 Mt, Inf: 4.9 Mt	Mineable resource is nearing depletion and expected mine shut down in early 2018, reclamation begun, facilities to be placed on Care and Maintenance.
Elkview	Southeast	Teck Coal Limited (95%); Nippon Steel & Sumitomo Metal Corp. (2.5%), POSCO (2.5%)	HCC Bituminous coal; 082GNE017	6.3 Mt	HCC P: 11.2 Mt Pr: 254.8 Mt	HCC M: 432.5 Mt, I: 157.5 Mt, Inf: 246 Mt	Baldy Ridge Extension (BRE) approved in 2016, pre- stripping at BRE, exploration drilling in active pits, development progressing in new approved mining areas.

Table 3. Continued.

Fording River	Southeast	Teck Coal Limited	HCC Bituminous coal; 082JSE012	9.1 Mt	HCC P: 169 Mt Pr: 220.5 Mt	HCC M: 486.7 Mt I: 945.8 Mt Inf: 789 Mt	EA approval of Swift expansion (2015), permit amendments to align mine design with improved efficiencies, exploration drilling in active pits, coal quality testing in expansion areas.
Greenhills	Southeast	Teck Coal Limited (80%); POSCAN (20%)	HCC Bituminous coal; 082JSE007	6.2 Mt	HCC P: 25.4 Mt Pr: 147.9 Mt	HCC M: 220.1 Mt I: 269.5 Mt Inf: 182.6 Mt	Cougar Pit Expansion (CPX) approved in 2016, coal quality testing.
Line Creek	Southeast	Teck Coal Limited	HCC, TC Bituminous coal; 082GNE020	3.7 Mt	HCC P: 3 Mt Pr: 61.7 Mt TC P: 1.2 Mt Pr: 9.5 Mt	HCC M: 320.6 Mt I: 419.4 Mt Inf: 413.4 Mt TC M: 4.8 Mt I: 4 Mt Inf: 2.7 Mt	Burnt Ridge Extension (BRX) approved in 2016, pre-stripping on Mount Michael begun (Line Creek Phase II expansion), Commissioning of West Line Creek water treatment facility (February, 2016), with process and design optimization underway. Annual production records set in 2016.
Quinsam	Southwest	Quinsam Coal Corporation (ERP Compliant Fuels LLC)	TC; Bituminous coal; 092F 319	Approximately 50,000 t clean coal	na	na	Resources and reserves are unpublished. Resumed operations Sept. 2017.

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 4. Selected operating industrial mineral mines and quarries, 2017, forecast mine production, reserves, and resources.

Mine	Region	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1- Q3)	Reserves	Resource	Comments
Burning Daylight	Northwest	Stone Ridge Quarries Ltd.	Columnar Basalt; dimension stone	unknown	na	na	Basalt quarrying.
Cassiar Jade	Northwest	Dynasty Jade Ltd.	Nephrite Jade; Gems and semi-precious stones; 104P 005	unknown	na	na	Trenching, quarrying, placer production.
Jade Valley	Northwest	United Oriental Mining Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 048	unknown	na	na	Trenching, quarrying, placer production.
Kalum	Northwest	Kalum Quarry Ltd. Partnership	Industrial rock; crushed rock	unknown	na	na	Drilling, blasting, crushing, production for CN railway bed.
Kutcho Creek Jade	Northwest	Continental Jade Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 078	unknown	na	na	Mining, trenching.
Letain	Northwest	Cassiar Jade Contracting Inc.	Nephrite Jade; Gems and semi-precious stones; 104I 079	unknown	na	na	Mining, trenching
Provencher	Northwest	Glenpark Enterprises Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 092	unknown	na	na	Mining, trenching.
Wolverine	Northwest	Cassiar Jade Contracting Inc.	Nephrite Jade; Gems and semi-precious stones	unknown	na	na	Mining, trenching.
Fireside	Northeast	Fireside Minerals Ltd.	Barite, Vein barite; 094M 003, 094M 019	38,800 t	P+Pr: 475,000 t (non-NI 43-101 compliant)	na	Mined from the Moose Pit. With possible extension to north.
Ogden Mountain	North Central	Green Mountain Jade Inc.	Nephrite Jade; Gems and semi-precious stones; 093N 156, 093N 157, 093N 165	20 t	na	na	Exploration placer and open pit mining of alluvial jade boulders, excavation of in situ jade.
Ashcroft	South Central	IG Machine and Fibers Ltd. (IKO Industries Ltd.)	Basalt (roofing granules); 092INW104	250,000 t	na	Approximately 13.3 Mt in 2002	10 days lost to wildfire related causes.

Table 4. Continued.

Bromley Creek (Zeotech)	South Central	Canadian Zeolite Corp.	Zeolite; Open system zeolites; 092HSE243	na	na	M+I: (as of 2013-06-30): 550,000 t	Producing in 2017.
Bud	South Central	Absorbent Products Ltd.	Bentonite; 092HSE162	na	na	na	Operating, but volumes not published.
Decor	South Central	Pacific Bentonite Ltd.	Alumina, landscape rock; 092INW084	na	na	na	
Falkland	South Central	Lafarge Canada Inc.	Gypsum; 082LNW001	na	na	na	Production affected by shut down of Lafarge's Kamloops Cement Plant, however, alternative markets found for 2017-2018.
Kettle Valley Quarries	South Central	Kelowna Sand and Gravel Ltd./Kettle Valley Stone Company	Ashlar, flagstone, thin veneer; 082ENW109, 111, 112	na	na	na	
Klinker	South Central	Opal Resources Canada Inc.	Opal; 082LSW125	Intermittent operation	na	na	
Lady King Basalt	South Central	Opal Resources Canada Inc.	Basalt columns; na	Intermittent operation	na	na	
Nazko	South Central	Can Lava Mining Corporation	Lava Rock; Cinder cone; 093B 060	na	na	Historical 45 Mt	Product shipped from quarry in 2017. 1998 resource estimate.
Red Lake	South Central	Absorbent Products Ltd.	Diatomaceous earth; Lacustrine diatomite; 092INE081	na	na	na	Operating, but volumes not published.
Z-1	South Central	ZMM Canada Minerals Corp.	Zeolite; Open system zeolites; 092INW095	9000 t	na	Approximately 800,000 t	Historical resource.
4J	Southeast	Georgia-Pacific Canada Limited	Gypsum; evaporitic bedded gypsum; 082JSW009	na; Processing stockpiled ore	na	Estimated 20 Mt	Processing stockpiles; updating mine expansion plans.

Table 4. Continued.

Elkhorn	Southeast	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; 082JSW021	400,000 t	na	na	3 years mine-life remaining; the company will replace production by developing the Kootenay West mine (EA review period).
Grand Forks Slag	Southeast	Granby River Mining Company Inc.	Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264	Quarrying for abrasives and roofing granules	na	na	Crushing, screening, environmental.
Horse Creek Silica	Southeast	HiTest Sand Inc.	Silica, industrial use, aggregate; 082N 043	na	na	Estimated: 3 Mt at 99.5% Silica (1987)	Variety of aggregate and industrial use products.
Moberly Silica	Southeast	Northern Silica Corporation	Silica; industrial use silica, frac sand; 082N 001	78,000 t	20 to 140 mesh frac sand (dry) P: 8.9 Mt of 64% frac sand + Pr: 4.6 Mt of 64% frac sand (2014)	M+I: 30 to 140 mesh frac sand (dry): 37.5 Mt at 70% frac sand + 11.3 Mt silica as frac sand residues (2016)	USD \$25M capital cost for Phase I plant construction and upgrades to existing facility (for frac sand operation); 300,000 tpy capacity; Phase II expansion to 600,000 tpy will cost an additional USD \$15M; Construction started on frac sand processing plant in 2015, commissioned in 2017.
Mount Brussilof	Southeast	Baymag Inc.	Magnesite; hydrothermal sparry magnesite; 082JNW001	230,000 t	P: 50 Mt	na	MgO, and MgOH; sediment-hosted sparry magnesite.
Winner; Friday Quarry	Southeast	Roxul Inc.	Gabbro/basalt; crushed rock for mineral wool; 082ESE265	Quarrying to supply feed stock for mineral wool plant	na	na	Crushing, screening, stockpiling; environmental.
Blubber Bay	Southwest	Ash Grove Cement Company	Limestone, dolostone; Limestone; 092F 479	24,500 t	na	100+ years	Care and maintenance, continues to ship dolomite on contract.

Table 4. Continued.

Garibaldi Pumice	Southwest	Garibaldi Pumice Ltd.	Pumice; Volcanic ash; 092JW 039	15,000 m ³	na	11,396,000 m ³ Pumice 4,990,000 m ³ pumicite (fines)	2014 resource. Additional exploration 2015. Future work proposed and permitted.
Imperial Limestone	Southwest	Imperial Limestone Co. Ltd.	Limestone; Limestone; 092F 394	263,000 t	na	50+ years	Production number is their high quality product. Resource estimated at roughly 200 Mt.
K2	Southwest	K2 Stone Quarries Inc.	Dimension stone, flagstone; Flagstone; 092C 159	19,662 t	na	na	Number represents material extracted.
Mount Meager Pumice	Southwest	Great Pacific Pumice Inc.	Pumice; Volcanic ash; 092JW 039	2100 t	na	na	Sales about 1600 t.
Sumas Shale	Southwest	Sumas Shale Ltd. (Lafarge Canada Inc., Clayburn Industrial Group)	Shale, clay, sandstone; Residual kaolin; 092GSE024	Approximately 500,000 t	na	50+ years	Approximately 55% shale, 45% sandstone for cement production.
Texada Quarry	Southwest	Texada Quarrying Ltd. (Lafarge Canada Inc.)	Limestone, aggregate; Limestone; 092F 395	na	na	100+ years	Mostly produces limestone for cement manufacture. High brightness carbonate and aggregates also produced.

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

commissioned their frac sand processing plant in 2017. In the Southwest Region, a number of operations remained in steady production and continue to be a major employer.

4. Mine development projects

As used herein, the term ‘mine development project’ refers to those where the decision to produce has been made, necessary permits have been acquired, financing has been secured, and on-site construction has started. In 2017, **Brucejack** was the only mine considered a development project, until it declared commercial production in July.

5. Selected proposed mine or quarry projects

Projects at the proposed mine or quarry (or mine evaluation) stage have a resource defined or largely defined, and are at

least preparing to submit a project description to initiate the environmental assessment process, or are waiting on permit amendments. Projects that have permits in place but have yet to obtain financing to begin site construction are also considered to be at the proposed stage. Selected projects (Table 5) discussed below are grouped by region.

5.1. Northwest Region

5.1.1. Proposed metal mines

The Northwest Region has a number of proposed metal mine projects. Gavin Mines Inc. continues to work towards restarting the historic **Dome Mountain** gold and silver mine. The project has Mines Act and Environmental Management Act permits in good standing and is allowed to mine up to 75,000 tpy. In early 2013, the project submitted applications to amend their

Table 5. Selected proposed mine projects.

Project	Region	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Dome Mountain	Northwest	Dome Mountain Resources of Canada Inc.	Au, Ag; Vein breccia and stockwork; 093L 022	na	M+I: 144,144 t grading 17.7 g/t Au	Announced plans to negotiate processing ore at Nicola Mining Inc.'s custom mill.
Galore Creek	Northwest	Galore Creek Mining Corp.	Au, Cu; Alkalic porphyry; 104G 090	P+Pr: 528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag	M+I: 814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.2 g/t Ag	Baseline monitoring.
Kitsault	Northwest	Alloycorp Mining Inc.	Mo, Ag, Pb; Porphyry Mo (low F type); 103P 120	P+Pr: 228.2 Mt at 0.083% Mo, 5.0 g/t Ag	M+I: 321.8 Mt at 0.071% Mo, 4.8 g/t Ag	Baseline monitoring.
KSM	Northwest	Seabridge Gold Inc.	Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 191	P+Pr: 2.198 Bt at 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag, 0.00426% Mo	M+I: 2.902 Bt at 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag, 0.0044% Mo	Updated resource estimate in May. 10,383 m of drilling in 11 holes at Iron Cap deposit. Highlights include 858 m of 0.86 g/t Au and 0.51% Cu including 113 m of 2.98 g/t Au and 1.56% Cu.
Morrison	Northwest	Pacific Booker Minerals Inc.	Cu, Mo; Calc-alkalic porphyry; 093M 007	na	M+I: 208.3 Mt at 0.39% Cu, 0.19 g/t Au, 0.005% Mo (at a 0.30% Cu Eq cut-off)	Baseline monitoring, EA ongoing. Resource information from 2009 NI 43-101 technical report.
Red Mountain	Northwest	IDM Mining Ltd.	Au, Ag; Porphyry related gold; 103P 086	na	M+I: 2.075 Mt at 8.75 g/t Au, 25.00 g/t Ag	Positive feasibility study completed. Resource updated. Drilling in 2017 expanded mineralization to north, south and down dip. EA application submitted. Construction start planned for 2018.
Schaft Creek	Northwest	Teck Resources Limited (75%), Copper Fox Metals Inc. (25%)	Cu, Au; Calc-alkalic porphyry; 104G 015	P+P: 940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag	1.229 Bt at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag	Resource re-modelling in progress. Environmental baseline data collection, permitting.
Murray River	Northeast	HD Mining International Ltd.	HCC; bituminous coal; 093I 010	P: 261.6 Mt mineable	M+I: 314.2 Mt in situ	Proposed underground longwall mine with average annual production of 4.8 Mt of saleable coal over 25-year mine life. Provincial EA Certificate issued 2015; Federal EA Decision Statement issued December 2017.

Table 5. Continued.

Wapiti East	Northeast	Fertoz International Inc.	P ₂ O ₅ ; Sedimentary phosphate deposits; 093I 039, 093I 022, 093I 008	na	I: 0.81 Mt at 22.3% P ₂ O ₅ ; Indicated	Mines Act permit application, bulk sample (17,500 t permitted), temporary road (2.2 km). Proposed seasonal shallow open-pit mine with average annual production of less than 75,000 t phosphate rock over a 20+ year mine life; organic certification obtained.
Aley	North Central	Taseko Mines Limited (Aley Corporation)	Nb; carbonatite hosted deposit; 094B 027	P+Pr: 83.8 Mt at 0.50% Nb ₂ O ₅ ; containing 293 Kt* Nb *calculated by Jago, 2017	285.8 Mt at 0.37% Nb ₂ O ₅ ; containing 739.2 Kt* Nb (including reserves) *calculated by Jago, 2017	Environmental Assessment (pre-application), geochemical characterization studies, environmental baseline monitoring. Proposed open-pit mine with 10,000 tpd ore processing rate and average annual production of 9000 t niobium over a 24-year mine life.
Blackwater	North Central	New Gold Inc.	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037	P: 124.5 Mt at 0.95 g/t Au, 5.5 g/t Ag, Pr: 169.7 Mt at 0.68 g/t Au, 4.1 g/t Ag	M: 117 Mt at 1.04 g/t Au, 5.6 g/t Ag I: 189 Mt at 0.78 g/t Au, 6.0 g/t Ag, additional to reserves	Environmental Assessment (under review), engineering and environmental studies. Proposed open-pit mine with 60,000 tpd ore processing rate and life-of-mine average annual production of 12.8 t (413 Koz) Au and 54.2 t (1.74 Moz) Ag over a 17-year mine life.
Giscome	North Central	Graymont Western Canada Inc.	CaCO ₃ ; Limestone; 093J 041, 093J 025	na	I: >100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ	Environmental Assessment under review. Proposed 600,000 tpy limestone quarry to feed a vertical lime kiln producing 198,000 t of lime annually over a 50+ year mine life.
Kemess Underground (KUG)	North Central	Centerra Gold Inc.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 021	Pr: 107.38 Mt at 0.27% Cu, 0.54 g/t Au, 1.99 g/t Ag	I: 246.4 Mt at 0.22% Cu, 0.42 g/t Au, 1.75 g/t Ag inclusive of reserves	New NI 43-101 report, EA certificate granted, engineering and environmental studies ongoing. Major Mine permit application submitted Aug. 31. Proposed underground panel cave mine with 24,600 tpd ore processing rate and life-of-mine average annual production of 3.30 t (106,000 oz) Au and 21 Kt (47 Mlbs) Cu over a 12-year mine life. Centerra Gold Inc. acquired Aurico Metals Inc. on Jan. 8, 2018.
Ajax	South Central	KGHM Ajax Mining Inc.	Cu, Au; Alkalic porphyry; 092INE012, 013	P+Pr: NSR cutoff US\$7.10/t; 426 Mt grading 0.29% Cu, 0.19 g/t Au, 0.39 g/t Ag	(M+I: NSR cutoff US\$7.10/t); 568 Mt grading 0.26% Cu, 0.18 g/t Au, 0.35 g/t Ag	In December, the project was denied certification by the British Columbia Ministries of Environment and Climate Change Strategy and Energy, Mines and Petroleum Resources. The company has not yet announced a response.

Table 5. Continued.

Bethlehem	South Central	Teck Resources Limited	Cu, Mo; Porphyry; 092ISE001	na	na	Project at application review stage. Resource informally stated as 100 Mt, but without grades.
Harper Creek	South Central	Yellowhead Mining Inc.	Cu, Au, Ag; Noranda/Kuroko; 082M 008, 009	(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 grading 0.28% Cu, 0.030 g/t Au, 1.3 g/t Ag	Project at application review stage. Company suspended review in October 2015 for economic reasons.
New Prosperity	South Central	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 certificate but denied federal approval.
Ruddock Creek	South Central	Ruddock Creek Mining Corporation	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 pre-application stage.
Spanish Mountain	South Central	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	Project at pre-application stage.
Bingay Main	Southeast	Centermount Coal Ltd.	Coal (HCC); open pit and underground; 082JSE011	na	M: 42.43 Mt I: 52.9 Mt (2012)	Pre-application of EA (2012); resubmitted project description (2017); 13 Mt; 15-year mine life; 1 Mtpy.
Coal Mountain Phase II (Marten Wheeler)	Southeast	Teck Coal Limited	Coal (PCI and TC); open-pit and underground; 082GNE006	na	HCC: M+I: 173.9 Mt Inf: 7.9 Mt PCI: M+I: 6.5 Mt Inf: 0.9 Mt (2015)	Pre-application of EA (2014); Potential of 76.5 Mt; 34-year mine life; 2.25 Mtpy; EA withdrawn in late 2015; project on hold.
Crown Mountain	Southeast	NWP Coal Canada Ltd. (Jameson Resources Limited)	Coal (HCC and PCI); open-pit; 082GNE018	HCC: P: 42.60 Mt Pr: 4.91 Mt PCI: P: 7.13 Mt Pr: 1.19 Mt (2014)	HCC+PCI: M: 68.9 Mt I: 6.0 Mt (2014)	Pre-application of EA (2014); nearing end of comment period for Application Information Requirements (AIR); 16-year mine life; 1.7 Mtpy; review of pre-feasibility study identified upside in lower capital costs for contract mining and additional resources in Southern extension.

Table 5. Continued.

Driftwood Magnesite	Southeast	MGX Minerals Inc.	Magnesite; hydrothermal sparry magnesite; quarry; 082KNE068	na	M+I: 8.028 Mt grading 43.3% MgO (2016; using cutoff grade of 42.5% MgO)	Preliminary Economic Assessment; environmental baseline studies; 100 t bulk sample; Preliminary test work indicates recovery rates of 93.4% reverse flotation and removal of up to 70% silica and 30% calcium oxides; bulk of resource is within 100 m of surface; 2016 drilling extended the zone; 20 year mine lease acquired.
Kootenay West	Southeast	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; quarry; 082JSW005, 082JSW020	na	North and South Quarries: Total 15 Mt (at average quality of 83-85%)	Entered 180-day review period of Environmental Assessment in March (2017); temporarily suspended the review in order to respond to comments and submit additional information; 400,000 tpy; 43-year mine life; blended product to market specifications.
Michel Creek (Loop Ridge)	Southeast	North Coal Limited (formerly CanAus Coal Limited)	Coal (HCC and PCI); open-pit and underground; 082GSE050	na	HCC: M: 44.6 Mt I: 42.5 Mt; open-pit and underground (2015)	Drilling (5212 m, 38 holes); 7 large diameter core holes for coal quality testing; environmental and baseline work; mine design and permitting. Coal quality testing indicates coal has similar characteristics to Elk Valley hard coking coal; drilling has identified 20 coal seams with cumulative thickness of 70 m (14% of a 504 m section in the Mist Mountain Fm). EA pre-application submitted in 2015.
Black Bear	Southwest	Polaris Materials Corporation	Aggregate; n/a	na	na	Orca environmental certificate amendment for an adjacent quarry applied for.
BURNCO Aggregate	Southwest	BURNCO Rock Products Ltd.	Aggregate; Sand and Gravel	na	Approx. 20 Mt	Late in environmental assessment review.
Sechelt Carbonate	Southwest	Ballinteer Management Inc.	Limestone, dolostone, aggregate; Limestone, Dolomite, Crushed rock; 093GNW031	na	Carbonate Rock: 76.1 Mt Gabbro: >700 Mt	Environmental assessment pre-application stage.
Tahsis	Southwest	Callache Stone Quarries Inc.	Marble; Dimension stone; 092E 020	na	na	Quarry permit and lease application for commercial production.

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal

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

existing permits, which would allow for onsite milling and tailings storage. Due to various delays, including regulatory changes arising from the 2014 Mount Polley tailings breach, the permit amendments remain outstanding. In 2017, they announced plans to negotiate processing ore at Nicola Mining Inc.'s custom mill.

Seabridge Gold Inc. continued work on their **KSM** copper-gold porphyry deposit. Seabridge received federal and provincial approval of the project environmental assessment in 2014 and is actively seeking partnership to advance into construction. Proven plus Probable reserves are reported as 2.198 Bt grading 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag and 42.6 g/t Mo. An updated Measured plus Indicated resource estimate (inclusive of reserves) completed in May totals 2.903 Bt grading 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag and 46.6 ppm Mo. In 2017, Seabridge completed 10,383 m of drilling in 11 holes at the Iron Cap deposit. Highlights include 858 m of 0.86 g/t Au and 0.51% Cu including 113 m of 2.98 g/t Au and 1.56% Cu. Seabridge reported that Iron Cap is approaching parity in size with other deposits in the project, but with zones of considerably higher metal values. KSM considers the early development of Iron Cap a high priority for further study due to its grade, location, and size. Results may result in a revision of the project's mine plan and enhance KSM's projected economics.

Pacific Booker Minerals Inc.'s **Morrison** copper-gold-molybdenum-silver porphyry project has Measured plus Indicated resources reported as 208.3 Mt at 0.39% Cu, 0.19 g/t Au, 0.005% Mo (at a 0.30% Cu Eq cut-off). After the Mount Polley tailings breach in 2014, the Morrison environmental assessment review was suspended, but it resumed in June 2015. In July 2015, a letter from the British Columbia Minister of Environment and Minister of Energy and Mines stated that concerns still remained regarding the project design. The project continues to undergo review.

In 2017, IDM Mining Ltd. continued work on their **Red Mountain** gold project with step-out drilling, a feasibility study, and a project application and an environmental impact statement, which were submitted to regulators and stakeholders. A total of 29,312 m of drilling was completed, consisting of 104 underground, eight surface, and three geotechnical core holes. Drilling highlights include 25.0 m grading 13.7 g/t Au and 30.9 g/t Ag and their highest grade intersection to date: 1400 g/t Au and 437 g/t Ag over 0.5 m, in an interval of 149.24 g/t Au and 59.88 g/t Ag over 4.88 m. Current Proven plus Probable reserves are 1.953 Mt at 7.53 g/t Au and 21.86 g/t Ag. IDM is targeting production for the first quarter of 2020.

The **Galore Creek** copper-gold-silver project is owned by the Galore Creek Partnership, in which a wholly owned subsidiary of Novagold Resources Inc. and Teck Resources Ltd. are equal partners. In 2017, work was limited to baseline monitoring. Alloycorp Mining Inc.'s past producing **Kitsault** molybdenum-silver mine is fully permitted, but requires project financing.

Work at the **Schaft Creek** copper-molybdenum-gold-silver porphyry project, owned by Teck Resources Ltd. (75%) and

Copper Fox Metals Inc. (25%), included updating resource models, collecting environmental baseline data, and continuing First Nations consultations.

5.2. Northeast Region

5.2.1. Proposed coal mines

HD Mining International Limited's **Murray River** project is a proposed underground mine that would produce 4.8 Mt of saleable coal annually during a 25-year mine life. Proven mineable reserves are 261.6 Mt, and Measured plus Indicated resources are 314.2 Mt. In December 2017, the Government of Canada issued an Environmental Assessment Decision Statement that approved the project, subject to legally binding conditions. These included: consulting with First Nations on implementing the conditions; avoiding, mitigating or offsetting impacts on caribou habitat; and limiting methane emissions to less than 500,000 t of equivalent CO₂ annually. The provincial Environmental Assessment Certificate had been issued in October 2015.

5.2.2. Proposed industrial mineral mines or quarries

Fertoz International Inc. continued progress on its Mines Act permit for the **Wapiti East** phosphate project. In 2017, the company focused on completing infrastructure. Once permit and infrastructure are in place, Fertoz would mine from a seasonal, shallow open pit, with a 20-year mine life, producing up to 75,000 tpy of phosphate-bearing rock.

5.3. North Central Region

5.3.1. Proposed metal mines

Taseko Mine Ltd.'s **Aley** niobium-bearing carbonatite project is a proposed open pit mine processing 10,000 tpd to produce ferroniobium. Reserves stand at 84 Mt grading 0.5% Nb₂O₅. The projected mine life is 24 years and environmental assessment is underway.

In 2017, New Gold Inc. continued with the environmental assessment process for its **Blackwater** project. Permitting is coordinated with both federal and provincial governments, with the aim of meeting the requirements for an Environmental Assessment Certificate from the Province of British Columbia, and a Decision Statement from the federal Minister of the Environment. Proven and Probable reserves stand at 8.2 Moz of Au, and 60.8 Moz Ag. As proposed, Blackwater would be a 60,000 tpd operation with a 17-year mine life.

AuRico Metals Inc. continued to advance its proposed **Kemess Underground** (KUG) copper-gold-silver block cave mine project. In early January of 2018, it was announced that AuRico Metals had been purchased by Centerra Gold Inc. In a technical report issued in July 2017, KUG was estimated to contain 246.4 Mt of Indicated resource containing 1.195 Mlbs of Cu, 3.3 Moz of Au, and 13.9 Moz of Ag. Within this resource are Probable reserves of 107.4 Mt containing 629.6 Mlbs of Cu, 1.9 Moz of Au and 6.7 Moz of Ag. On 1 September, 2017, AuRico Metals Inc. applied to the Major Mines Permitting Office, with all applications to be reviewed concurrently. The

Canadian Environmental Assessment Agency had already issued a positive decision statement, and the Environmental Assessment Office had granted an Environmental Assessment Certificate. On 2 November 2017, KUG's permit applications passed screening and were accepted for review by the Mine Review Committee.

5.3.2. Proposed industrial mineral mines or quarries

At their **Giscome** limestone project, Graymont Western Canada Inc. plans to exploit a high-purity Paleozoic limestone deposit. Crushed stone would be transported about 5 km by conveyor 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 British Columbia Environmental Certificate is in place, and the Mines Act Permit process is underway. The company anticipates starting construction in 2019 or 2020, with up to 600 Kt of limestone quarried annually.

5.4. South Central Region

5.4.1. Proposed metal mines

The **Ajax** copper-gold porphyry project is owned by KGHM Ajax Mining Inc., which is an 80:20 joint venture between KGHM Polska Miedź S.A. (KGHM SA) and Abacus Mining and Exploration Corporation. A revised feasibility study, released at the start of 2016, modelled the project as a 65,000 tonne-per-day open-pit mine with a projected 18-year life. In December, the project was denied certification by the British Columbia Ministries of Environment and Climate Change Strategy and Energy, Mines and Petroleum Resources. The company has not yet announced a response.

Teck Resources Ltd. may reopen the past-producing **Bethlehem** mine, which is 2 km east of its Highland Valley Copper operations. During the past few years, Teck has defined 100 Mt of new ore at Bethlehem. If approved, the mine would produce additional feed for its 140,000 tpd mill. A Mine Development Review Committee commenced formal review of the Bethlehem Phase 1 proposal in 2016.

The **Harper Creek** copper-gold-silver project is owned by Yellowhead Mining Inc. Proven and Probable mineral reserves stand at 716 Mt grading 0.26% Cu; 0.029 g/t Au and 1.2 g/t Ag. The feasibility study proposed a 70,000 tpd operation with a mine life of 28 years. Initial capital costs would exceed \$1 billion. The environmental assessment review remains on hold while the company evaluates if financing can be secured to complete the review.

The **New Prosperity** gold-copper porphyry project of Taseko Mines Limited has defined 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 reject 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. However, the

Canadian Environmental Assessment Agency warned Taseko that they would consider the proposed work in violation of federal law and the company did not proceed.

Ruddock Creek Mining Corporation, owned by Imperial Metals Corporation (50%) and joint venture partners Mitsui Mining and Smelting Co. Ltd. (30%) and Itochu Corporation (20%), continued environmental baseline studies at its **Ruddock Creek** zinc-lead project. A mineral resource estimate, released in March 2012, reported 4.65 million tonnes grading 6.77% Zn and 1.38% Pb (Indicated) and 5.38 million tonnes grading 6.69% Zn and 1.31% Pb (Inferred), using a 4.0% combined Pb+Zn cut-off. The project remains in the pre-application phase of environmental assessment.

Spanish Mountain Gold Ltd.'s **Spanish Mountain** gold project has been in the pre-application phase of environmental assessment since 2011. In April 2017, the company released the results of an updated preliminary economic assessment. The study was based on a 20,000 tpd, 24-year operation focused on a pit-delineated higher grade core (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 gold production would be 92,000 oz/y. The company acquired a permit for future mineral exploration and archaeological studies.

5.5. Southeast Region

5.5.1. Proposed coal mines

Centermount Coal Ltd. proposes an open pit and underground coal mine for its **Bingay Creek** project. The mine would produce approximately 1 Mt/year during an estimated 15-year lifespan, with a total resource of approximately 13 Mt of clean coal. The project entered pre-application of environmental assessment in 2013; the company resubmitted the project description in 2017. Environmental baseline studies are ongoing.

In 2015, Teck Coal Limited withdrew from the pre-application phase of environmental assessment for their **Coal Mountain Phase II** (Marten Wheeler) project, and the project remains on hold. The project was designed to replace production at the Coal Mountain mine, which is now scheduled to shut down in early 2018.

The **Crown Mountain** property of NWP Coal Canada Ltd., (a wholly owned subsidiary of Jameson Resources Ltd.) is in the pre-application stage of environmental assessment and is currently nearing the last round of comments for the application information requirements. The proposal is for an open-pit mine with an estimated production capacity of 1.7 Mtpy of clean coal and a 16-year mine life. In 2014, the company completed a resource estimate of 74.9 Mt (Measured+Indicated) and a preliminary prefeasibility study. In 2017, the company began preliminary engineering design, continued environmental baseline studies, and worked on updating the mine plan.

The **Michel Creek (Loop Ridge)** project of North Coal Limited (formerly CanAus Coal Ltd.), a wholly owned subsidiary of CoalMont Pty Ltd., is in the pre-application stage of environmental assessment. The project consists of

coal licenses at Loop Ridge, Loop South, Tent Mountain, and Michel Head. In 2017, work included testing for waste rock and developing water management strategies, and preparing an updated project description. The project will use new techniques for managing waste rock to mitigate selenium, and ensure that targets identified in the Elk Valley Water Quality Plan can be met. The company is focused on optimizing all coal deposits for development and will be issuing an amended application in 2018.

5.5.2. Proposed industrial mineral mines or quarries

The **Driftwood Magnesite** project is owned by MGX Minerals Inc. In 2016, a NI 43-101 compliant resource estimate reported Measured and Indicated resources of 8.028 Mt grading 43.3% MgO (using a cut-off grade of 42.5% MgO). In 2017, the company focused work on a preliminary economic assessment and continued environmental baseline studies for their quarry application. CertainTeed Gypsum Canada Inc. continued to advance their **Kootenay West** project. The mine will have an average production rate of 400,000 t per year, over a 43-year mine life. The total mineral reserve is estimated at 18.7 Mt, and product will be blended to a product specification of 83-85% gypsum for market. The project entered the 180-day review period of environmental assessment in March, 2017. The company temporarily suspended the review to submit additional technical information, and address comments from the Environmental Assessment Office, the Working Group, and First Nations. A decision is expected in June, 2018.

5.6. Southwest Region

5.6.1. Proposed industrial mineral mines or quarries

Polaris Materials Corporation is including the **Black Bear** aggregate project near its Orca sand and gravel quarry in an environmental certificate amendment for Orca. BURNCO Rock Products Ltd. continues to undergo Environmental Assessment for the **BURNCO Aggregate** project. The proposed sand and gravel mine would ramp up to a 1.5 Mt per year operation, initially barging product to BURNCO Rock Products Ltd.'s ready-mix concrete plants in South Burnaby and Port Kells. BURNCO submitted its application for environmental assessment with both provincial and federal agencies in 2016. The British Columbia Environmental Assessment Office issued a draft Summary Assessment Report in October 2017 and a public comment period on the report followed.

Ballinteer Management Inc. now holds the property comprising the **Sechelt Carbonate** project. They filed engineering, archeological, and baseline environmental studies for assessment in 2016; no activity was reported for 2017. Callache Stone Quarries Inc. is applying for a quarry permit and lease near Tahsis for their **Tahsis marble** quarry and intend to enter production. Meanwhile they continue with surface preparation, bulk sampling, testing, and marketing.

6. Exploration expenditures

In 2017, exploration expenditures, drilling estimates, and

other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey. The survey is a joint initiative between the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for Mineral Exploration, and Ernst & Young LLP. A full report will be available in March (www.ey.com/ca/bcminingsurvey).

Total metal, industrial mineral and coal exploration expenditures are estimated at \$246.6 million for 2017, up \$41.6 million from the 2016 survey total of \$205 million. Of this, \$31.8 million was contributed by coal projects and \$214.8 million by metal and industrial mineral projects (Fig. 5). Exploration expenditures by region for 2017 are illustrated in Figure 6. Exploration expenditures can be further divided into five categories: grassroots, early stage, advanced stage, mine evaluation, and mine lease (Figs. 7-13). The provincial combined total result for grassroots and early stage exploration in the 2017 survey is 34.7%. The total reported metres drilled

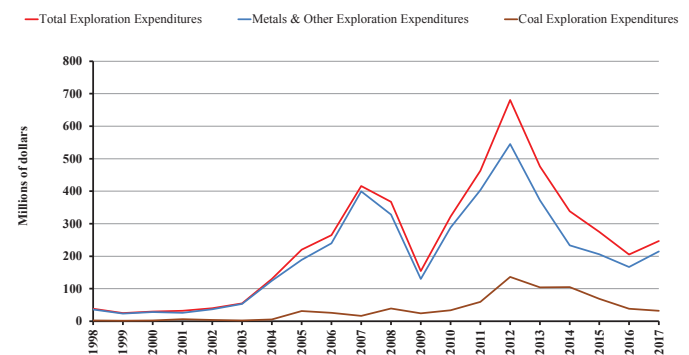


Fig. 5. Total exploration expenditures, metals plus other expenditures, and coal expenditures by year.

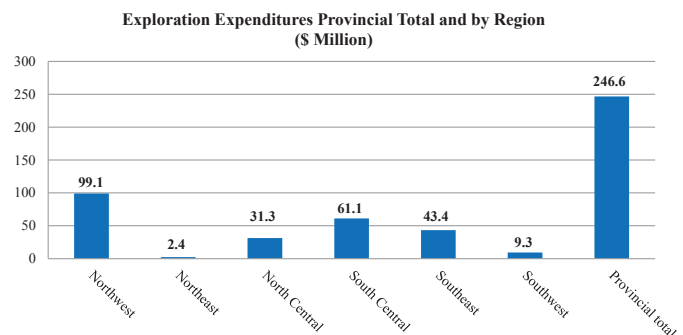


Fig. 6. Exploration expenditures, provincial total and by region.

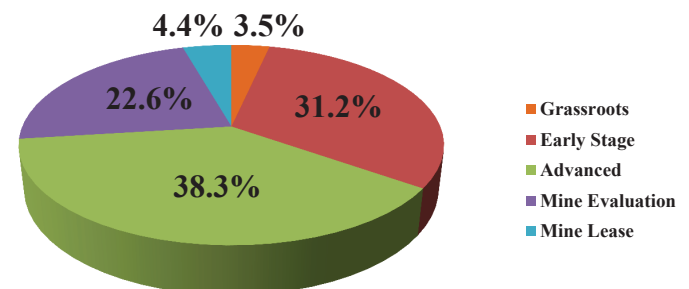


Fig. 7. Provincial exploration expenditures by exploration category.

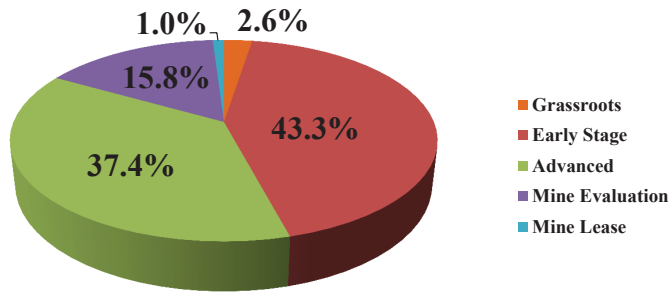


Fig. 8. Northwest Region exploration expenditures by exploration category.

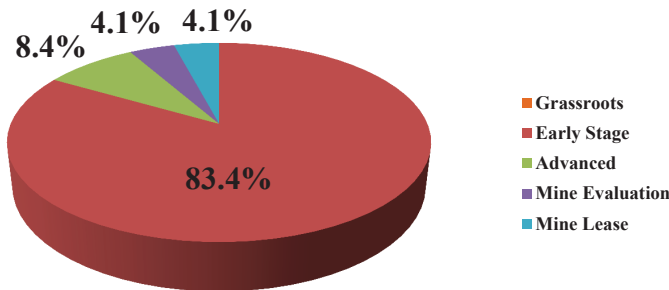


Fig. 9. Northeast Region exploration expenditures by exploration category.

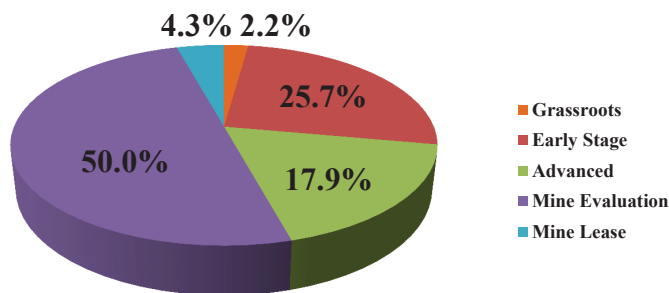


Fig. 10. North Central Region exploration expenditures by exploration category.

for the province was 626,897 up significantly from the 2016 total of 290,702 (see Fig. 14 for regional breakdown).

7. Exploration land tenure

Acquisition of new mineral claims in 2017 was up significantly compared to 2016 (Fig. 15). The total for 2017 was 1,613,486 hectares vs. 1,167,303 hectares for the previous year. New coal licenses issued in 2017 totalled 48,118 hectares, down from the 2016 total of 105,991 hectares (Fig. 16).

8. Selected exploration project highlights

For the first time since 2012 the province saw an increase in recorded exploration expenditures. Explorationists continued to discover, define, and expand porphyry and porphyry-related copper-gold and copper-molybdenum deposits, gold deposits

of various types, and stratiform base-metal, specialty metals, industrial minerals, and coal deposits. Data from the British Columbia Mineral and Coal Exploration Survey suggest that grassroots and early stage projects may have increased. Below, selected exploration projects are grouped by project type and region (Table 6). Project locations are illustrated on Figure 1. A more comprehensive list of selected exploration projects active in 2017 are described in the individual regional sections of this volume.

8.1. Selected precious metal projects

8.1.1. Northwest Region

In 2017, the price of gold increased interest in gold exploration in the Northwest Region.

In the Atlin area, Brixton Metals Corporation collected 200 rock samples, 120 soil samples and flew 4571 line-km of airborne magnetic survey at a line spacing of 200 m at their **Atlin Gold** project. One sample returned Au values greater than 100 g/t (293 g/t), six greater than 10 g/t, and eight greater than 1 g/t.

Outside of the Brucejack mine area, evaluation of the surrounding 1250 km² of mineral claims continued (**Brucejack Regional**). Work in previous years included airborne geophysical surveys, regional sampling, mapping, prospecting, ground geophysics and diamond drilling. To date three zones have been identified with potential to host epithermal mineralization (American Creek, Koopa and Boulder). In 2017, new work included prospecting, mapping, and ground geophysics. Data analysis will define targets for drilling in spring 2018.

At their **Forest Kerr** project, Aben Resources Ltd. diamond drilled nine holes totalling 2445 m. Highlight results from the newly discovery Boundary North zone included 1.2 g/t Au, 1.8 g/t Ag and 0.21% Cu over 122 m that includes 10.9 g/t Au, 14.6 g/t Ag and 1.5% Cu over 12 m with a high grade core of 21.5 g/t Au, 28.5 g/t Ag and 3.1% Cu over 6 m.

Auryn Resources Inc. diamond drilled 37 holes (total, 14,850 m) at their **Homestake Ridge** project. Drill result highlights include 30 m of 2.00 g/t Au (including 4 m of 6.03 g/t Au and 2 m of 11.80 g/t Au), 10 m of 4.12 g/t Au (including 2 m of 18.01 g/t Au), 18 m of 1.29 g/t Au (including 4 m of 4.18 g/t Au), 8 m of 2.67 g/t Au (including 2 m of 7.4 g/t), and 14 m of 1.23 g/t Au.

The **Silver Coin** project is owned by Jayden Resources (Canada) Inc. (80%) and Mountain Boy Minerals Ltd. (20%). In 2017, a 2225 m, 14 hole diamond drill program was carried out in a new zone 550 m to the northeast of the main Silver Coin deposit. Drilling intersected altered andesite with a quartz-sericite-chlorite altered breccia zone exhibiting quartz stringers with visible gold grains, 5-6% sphalerite, up to 1% galena and 7-8% pyrite. Assay results for this altered andesite included 8.63 g/t Au over 7.7 m including several higher-grade intervals up to 37.1 g/t Au. Additional zones of siliceous breccia returned 6.5 g/t Au over 1.5 m and 8.25 g/t Au over 1.0 m. These results are from a new zone 550 m to the northeast of

Table 6. Selected exploration projects.

Project	Region	Operator (partner)	Commodity; Deposit type MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Atlin Gold Project	Northwest	Brixton Metals Corporation	Au; precious metal veins	na	Rock and soil sampling. Gold values for rock samples returned up to 293 g/t Au. One sample returned Au values greater than 100 g/t, six greater than 10 g/t, and eight greater than 1 g/t.
Ball Creek	Northwest	Evrin Resources Corp.	Cu-Au-Ag±Mo; porphyry, Au-Ag epithermal veins	na	Definitive agreement with a wholly owned subsidiary of Antofagasta Plc by which Antofagasta can earn up to a 70% interest in the Ball Creek property by spending up to an aggregate of US\$31 million or delivering a prefeasibility study.
Brucejack Regional	Northwest	Pretium Resources Inc.	Au, Ag; epithermal vein	na	Prospecting, mapping, and ground geophysics.
Dolly Varden	Northwest	Dolly Varden Silver Corporation	Ag, Zn; Noranda / Kuroko massive sulphide; 103P 188	I: 3.073 Mt at 321.6 g/t Ag Inf: 898,500 t at 373.3 g/t Ag	12,000 m diamond drilling program. New discoveries include the Central zone returning 16.10 m (13.19 m true thickness) grading 269.0 g/t Ag, 0.30% Pb, and 0.21% Zn and an eastern fault offset of the Torbit deposit (Torbit East), returning assays including 13.00 m (9.96 m true thickness) grading 244.8 g/t Ag, 0.14% Pb, 0.09% Zn.
Duke	Northwest/ Northeast	Amarc Resources Ltd.	Cu, Mo, Au; porphyry Cu-Au; 093M 009 093M 121 093M 163	historic non-NI 43-101 compliant I: 41 Mt at 0.25% Cu, 0.01% Mo	2 holes, total 1045.5 m, with several intersections over 1.1 g/t.
E&L	Northwest	Garibaldi Resources Corp.	Ni, Cu, Pt, Ag; Tholeiitic intrusion; 104B 006	na	Diamond drilling program intersected a sequence of mafic and ultramafic rocks and highlight results included 8.3% Ni and 4.2% Cu over 16.75 m.
Forest Kerr	Northwest	Aben Resources Ltd.	Au, Ag, Cu; Precious metal veins	na	Diamond drilling, nine holes, 2445 m. Highlight results from the newly discovery Boundary North zone included 1.2 g/t Au, 1.8 g/t Ag and 0.21% Cu over 122 m that includes 10.9 g/t Au, 14.6 g/t Ag and 1.5% Cu over 12 m with a high grade core of 21.5 g/t Au, 28.5 g/t Ag and 3.1% Cu over 6 m.
GJ	Northwest	Skeena Resources Limited	Cu, Au; calc-alkalic – porphyry; 104G 034	M+I: 133.67 Mt at 0.32% Cu, 0.36 g/t Au; Inf: 53.69 Mt at 0.26% Cu, 0.330 g/t Au	One of two deposits that form the Spectrum-GJ project. Updated mineral resource estimate and a preliminary economic assessment.
Hank	Northwest	Golden Ridge Resources Ltd.	Au, Ag; Epithermal veins, Cu, Au porphyry	na	Announced a 9000 m diamond drilling program. Final meterage not reported but results included 4.13 m of 19.74 g/t Au, 193.9 g/t Ag, 0.77% Pb, 1.97% Zn and 60.27 m of 2.14 g/t Au, 6.9 g/t Ag, 0.11% Pb, 0.45% Zn.

Table 6. Continued.

Homestake Ridge	Northwest	Auryn Resources Inc.	Au, Ag, Cu; epithermal veins	I: 0.624 Mt at 6.25 g/t Au, 47.9 g/t Ag, 0.18% Cu Inf: 7.245 Mt at 4.00 g/t Au, 90.9 g/t Ag, 0.11% Cu. Resources at a 2.0 g/t AuEq cut-off)	Produced a new mineral resource estimate. A 37 hole, 14,850 m diamond drilling program. Drill result highlights include 30 m of 2.00 g/t Au (including 4 m of 6.03 g/t Au and 2 m of 11.80 g/t Au), 10 m of 4.12 g/t Au (including 2 m of 18.01 g/t Au), 18 m of 1.29 g/t Au (including 4 m of 4.18 g/t Au), 8 m of 2.67 g/t Au (including 2 m of 7.4 g/t), and 14 m of 1.23 g/t Au.
Kutcho	Northwest	Kutcho Copper Corp.	Cu, Pb, Zn; VMS; 104I 060	M+I: 16.853 Mt of 1.89% Cu, 2.87% Zn, 0.36 g/t Au and 32.8 g/t Ag (at a 1.0% Cu cut-off)	Kutcho (formerly Desert Star Resources Ltd.) signed an agreement to acquire 100% interest in the project from Capstone Mining Corp. for \$28.8 million. Announced a positive prefeasibility study with updated resource figures.
Premier/Dilworth	Northwest	Ascot Resources Ltd.	Au, Ag; Au in quartz veins; 104B 044	na	A 379 hole, 118,800 m diamond drilling program. Drilling discovered a new high-grade subzone (Ben) of the Northern Lights zone in the Premier mine area. Numerous high-grade intersections were reported, including 36.31 g/t Au over 16.15 m.
Red Cliff	Northwest	Decade Resources Ltd. (65%), (Mountain Boy Minerals Ltd. (35%))	Cu, Au, Ag, Zn; polymetallic veins; 104A 037	na	Chip sampling results of 19.9 g/t over 4 m for the Waterpump zone and 390 g/t Au over 5 m for the Lower Montrose zone. Reported drilling results for the Montrose zone include 14.93 g/t Au over 8.38 m and 9.5 g/t Au over 10.98m.
Silver Coin	Northwest	Jayden Resources (Canada Inc.) (80%), (Mountain Boy Minerals Ltd. (20%))	Ag, Zn, Pb, Cu; Intrusion related Au pyrrhotite veins, Subaqueous hot spring Ag, Au, Polymetallic veins; 104B 095	na	A 14 hole, 2225 m diamond drilling program. Assay results included 8.63 g/t Au over 7.7 m, 6.5 g/t Au over 1.5 m and 8.25 g/t Au over 1.0 m.
Silver Queen	Northwest	New Nadina Explorations Ltd.	Ag, Cu, Au, Zn, Pb; Polymetallic veins; 093L 002	na	A 3 hole, 2158 m diamond drill program. Results included 0.4 m of 120 g/t Ag, 1.29 g/t Au, 1.41% Cu and 3 m of 120 g/t Ag, 0.24 g/t Au and 0.5% Cu.
Snip	Northwest	Skeena Resources Limited	Au, Ag; Mineralized quartz veins; 104B 250	na	A 72 hole, 9000 m underground diamond drill program. Highlight results included 341.00 g/t Au over 1.50 m, 67.68 g/t Au over 2.03 m and 10.76 g/t Au over 4.30 m including 14.80 g/t Au over 1.49 m and 9.47 g/t Au over 1.50 m.
Spectrum	Northwest	Skeena Resources Limited	Au, Cu; mineralized quartz veins, high K calc-alkalic porphyry 104G 036	I: 8.59 Mt at 1.04 g/t Au, 6.58 g/t Ag, 0.11% Cu Inf: 22.63 Mt at 1.03 g/t Au, 3.85 g/t Ag, 0.11% Cu (0.50 g/t eAu cut-off)	One of two deposits that form the Spectrum-GJ project. Updated mineral resource estimate and a preliminary economic assessment.

Table 6. Continued.

Tatogga	Northwest	GT Gold Corp.	Au, Ag, Cu; polymetallic veins, porphyry	na	Two new grassroots exploration discoveries; the high grade Saddle South gold discovery and the Saddle North copper-gold-silver porphyry discovery. Saddle South results include 51.53 g/t Au over 6.95 m and 5.10 g/t Au over 23.66 m. Saddle North results include 210.3 m of 0.14 g/t Au, 0.28 g/t Ag and 0.16% Cu including 0.22 g/t Au, 0.36 g/t Ag and 0.24% Cu over the last 33.73 m of the hole. The Saddle North discovery also included epithermal veins that assayed 13.55 g/t Au over 2.58 m including 61.10 g/t Au and 30.90 g/t Ag over 0.61 m. In 2018, drilling programs will continue on all the current target discoveries.
Telkwa Coal	Northwest	Telkwa Coal Limited	Bituminous coal; 093L 156	M: 89.113 Mt I: 42.037 Mt Inf: 33.412 Mt	In 2017, a favourable pre-feasibility study was released and plans for a feasibility study and permit applications were announced. Telkwa Coal Limited is a wholly owned subsidiary of Allegiance Coal Limited.
Treaty Creek	Northwest	Tudor Gold Corp. (80%), (Teuton Resources Corp. (20%), American Creek Resources Ltd. (20%))	Au, Ag; Epithermal high sulphidation; 104B 078	na	A 27 hole, 13,722 m diamond drill program. The target was the Copper Belle zone and highlight results from five holes included 115.1 m of 1.31 g/t Au, 4.4 g/t Ag, 0.022% Cu including 39 m of 2.38 g/t Au, 8.3 g/t Ag, 0.026% Cu. Assays for the remaining 22 holes are pending.
Flatbed	Northeast	Colonial Coal International Corp.	Coal; Bituminous; 093I 049	Inf: 298 Mt	5 vertical holes on approximately 1800 m centres, total 2832 m. Flat-lying Gates Formation coal at about 700 m depth.
Huguenot	Northeast	Colonial Coal International Corp.	Coal; Bituminous	M: 96.2 Mt surface, 18.9 Mt underground. I: 35.8 Mt surface, 126.9 Mt underground	Continued environmental monitoring.
Akie	North Central	Canada Zinc Metals Corp.	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag; 094F 031	I: 19.6 Mt at 8.17% Zn, 1.58% Pb, 13.6 g/t Ag	Structural reinterpretation of satellite imagery. Eight diamond drill holes on Cardiac Creek zone, 4700 m total. 1100 samples taken. All holes intersected mineralization; final two expanded indicated resource.
CAP Claims	North Central	Arctic Star Exploration Corp.	Nb ₃ O ₅ ; Carbonatite hosted deposits	na	4 diamond drill holes, totalling 647.5 m, prospecting. Discovered a new carbonatite deposit. Drilling highlights include 0.63% Nb ₂ O ₅ over 2.26 m.
Decar	North Central	FPX Nickel Corp.	Ni; Ultramafic-hosted; 093K 039, 093K 072	2013 I: 1160 Mt at 0.124% Ni Inf: 870 Mt at 0.125% Ni	8 holes total 1197 m, along strike from previous drilling. Results support expansion of Baptiste deposit 650 m to SE. 2017 and previous drilling in the southeast portion of the Baptiste deposit defined a zone approximately 1000 m long east-west by 200 to 600 m wide of near-surface mineralization.

Table 6. Continued.

Duke	North Central	Amarc Resources Ltd.	Cu, Mo, Au; Porphyry Cu-Au; 093M 009, 093M 121, 163	Historic non-NI 43-101 compliant I: 41 Mt at 0.25% Cu, 0.01% Mo	2 holes, totalling 1045.5 m, with several intersections over 1.1 g/t Au.
Joy	North Central	Amarc Resources Ltd.	Cu, Mo, Au; Porphyry Cu-Mo-Au; 094E 106	na	Completed 3 holes totalling 1527 m to test coincident IP and geochem anomalies. Airborne mag, 49 line km IP, 638 talus fines samples for analysis, mapping. Farm-in agreement with Hudbay Mining (Amarc was 2017 operator).
Kemess East	North Central	Centerra Gold Inc.	Cu, Mo, Au; Porphyry Cu-Mo-Au; 094E 315	I: 113.12 Mt at 0.38% Cu, 0.46 g/t Au, 1.94 g/t Ag	New NI 43-101 Technical Report, July 2017. 10 diamond drill holes (8 on Kemess East and 2 on “offset zone,” totalling 13,923 m. Centerra Gold Inc. finalized purchase of AurRico Metals Inc. in January 2018.
Kwanika	North Central	Kwanika Copper Corp. (65%) Serengeti Resources Inc. (35%) Daewoo Minerals Canada Corp.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 093N 073	I: Central Zone pit: 101.5 Mt at 0.31% Cu, 0.32 g/t Au, 0.96 g/t Ag Central Zone UG: 29.7 Mt at 0.34% Cu, 0.36 g/t Au, 1.05 g/t Ag	New NI 43-101 released April 2017. Serengeti and Daewoo formed joint venture company, Kwanika Copper Corp., agreement completed October 2017.
Panorama North	North Central	Atrum Coal Ltd. (JOGMEC (Japan Oil, Gas, and Metals National Corporation))	Coal; Anthracite; 104A 085, 104A 089	na	5 wide-spaced drill holes, total 227.5 m, extensive surface mapping, core studies and interpretation. JOGMEC entered a farm-in agreement in 2016.
Snowbird	North Central	Omineca Gold Ltd.	Au; epithermal in quartz veins; 093K 036	na	10 diamond drill holes, focus on Main and North zones, total 1212 m. 50 line km ground mag, mapping, soil (139) and rock (111) sampling. 8 holes showed multi-gram Au intervals. Deposit open below 50 m.
Stardust	North Central	Sun Metals Corp.	Ag, Pb, Zn; Skarn Ag-Pb-Zn; 093N 009	na	3 diamond drill holes totalling 500 m, 28 line km IP and Mag surveys, 744 soil samples, ZTEM heli survey reinterpretation. June 2017, optioned by Lorraine Copper Corp. to 1124245 BC Ltd. Nov. 2017, acquired by Sun Metals Corp.
BC Sugar	South Central	Lithium Corporation	Graphite	na	Permitting, sampling, geophysics.
Cariboo Gold	South Central	Barkerville Gold Mines Ltd.	Au; Au-quartz veins; 093H 006, 140, 139, 019	(Cow Mountain at 0.5 g/t Au cut off) I: 35.8 Mt 2.4 g/t Au Inf: 27.5 Mt 2.3 g/t Au	Up to 160,000 m diamond drilling in 3 areas with recent focus on Island Mountain area. Barkerville Mountain and Cow Mountain also drilled. Regional target generative program in addition. Resource here is 2015 estimate for Cow Mountain. See table 2 for Bonanza Ledge.

Table 6. Continued.

Fox	South Central	Happy Creek Minerals Ltd.	W; W skarn; 093A 259, 260, 258	I: 486,000 t 0.818% WO ₃ Inf: 361,000 t 1.568% WO ₃	Diamond drilling (11,249 m in 66 holes), geological mapping. Resource estimate precedes 2017 drilling. Combined underground and surface. Indicated is Ridley Creek, Ridley creek and BN zone included in inferred.
Gold Creek	South Central	Eureka Resources Inc.	Au, Ag; Au-quartz veins; 093A 127	na	Drilling 331 m in 3 holes.
Ike	South Central	Amarc Resources Ltd. (Hudbay Minerals Inc.)	Cu, Mo; Porphyry Cu±Mo±Au; 092O 025, 067	na	Geological mapping; IP (82 line km), diamond drilling 2702 m in 9 holes.
Lac La Hache	South Central	Engold Mines Ltd.	Cu, Au, Ag, Fe; Cu skarn; 092P 120, 108, 002	I: 7.6 Mt 0.28% Cu, 0.05 g/t Au, 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	Approximately 20,000 m diamond drilling, gravity, magnetic and airborne geophysics. 2017 drilling focused on a recent skarn discovery. Resource estimate is for Spout deposit (2012), which is mineralogically similar. Property also hosts a porphyry prospect and hydrothermal Au-Ag-Cu.
Miner Mountain	South Central	Sego Resources Inc.	Cu, Au; Alkalic porphyry Cu-Au; 092HSE203, 078	na	Diamond drilling 600 m in 2 holes.
Rabbit North	South Central	Tower Resources Ltd.	Cu, Au; Alkalic porphyry Cu-Au	na	Diamond drilling (approximately 3400 m, 11 holes).
Rateria	South Central	Happy Creek Minerals Ltd.	Cu, Mo, Ag; Porphyry Cu±Mo±Au; 092ISE199	na	Diamond drilling 1764 m in 6 holes.
Shovelnose	South Central	Westhaven Ventures Inc.	Au; Epithermal Au-Ag-Cu; 092HNE309, 308	na	Geological mapping, geochemistry, core drilling (3269 m in 7 holes).
Trans Canada	South Central	ZMM Canada Minerals Corp.	Zeolite; Open-system zeolites; 082LNW096	na	Bulk sample started.
Alpine	Southeast	Braveheart Resources Inc.	Au-Ag-Pb-Zn; mesothermal Au and polymetallic veins; 082FNW127, 257, 292	na	Mapping, rock sampling, re-sampling of historic core, diamond drilling (1600 m in 11 holes). Drill program results included 1.7 m grading 19.1 g/t Au, 1.5 m grading 11.8 g/t Au, and 1.4 m grading 38.0 g/t Au.
Bayonne	Southeast	Margaux Resources Ltd.	Au+/-Ag-Pb-Zn-Cu; Au-quartz veins, polymetallic veins; 082FSE030, 031, 034, 025	na	LiDAR, mapping, grab and chip sampling, diamond drilling (2089 m in 13 holes). Grab sample results included 27.5, 23.3, 18.1, 15.0 and 10.6 g/t Au. A 1.0 m chip sample of the Main vein assayed 24.6 g/t Au. Grab samples from the Maggie Aikens vein assayed 51.6, 46.6 and 41.1 g/t Au. Drill results included 1.85 m grading 15.31 g/t Au, 1.0 m grading 12.7 g/t Au, and 0.32 m grading 18.2 g/t Au.

Table 6. Continued.

Frances Creek	Southeast	Voyageur Minerals Ltd.	Ag-Pb-Zn-Ba; Mississippi valley type, polymetallic vein breccia; 082KNE061	53,856 to 215,422 t grading 95.86% to 99.26% BaSO ₄	Mapping, sampling, diamond drilling (>1200 m in >17 holes). Drill results included (true width) 36.03 m 19.47% BaSO ₄ , 11.86 m at 60.32% BaSO ₄ , 23.88 m at 27.05% BaSO ₄ , 18.7 m at 37.39% BaSO ₄ , 22.88 m at 23.94% BaSO ₄ , 14 m at 38.41% BaSO ₄ , 15.22 m at 37.65% BaSO ₄ .
Gold Drop	Southeast	GGX Gold Corp.	Au; Alkalic intrusion associated Au; 082ESE055, 150, 152, 153, 285, 286, 287	na	Prospecting, rock sampling, trenching, channel sampling, soil sampling and diamond drilling (1449 m in 27 holes). Drilling results included 0.3 m of 10.8 g/t Au, 123 g/t Ag and 16.3 m of 4.59 g/t Au, 38.64 g/t Ag.
Greenwood Precious Metals	Southeast	Golden Dawn Minerals Inc.	Au-Ag-Pb-Zn+/-Cu; Cu-Au-Ag skarns, polymetallic veins, epithermal Au-veins, Porphyry; 082ESE041, 042, 032, 045, 020, 130, 116	Golden Crown: M+I: 163,000 t grading 11.09 g/t Au, 0.56% Cu (2016)	At the Golden Crown property as of Dec. 4th, 31 holes totalling 2954 m were drilled. Highlight assays include 12.3 m of 3.53 g/t Au, 0.11% Cu, including 4.6 m of 7.60 g/t Au, 0.13% Cu. At the May Mac property 22 underground holes totalled 3018 m and eight surface holes totalled 1886 m. Results include 2.57 m grading 252.6 g/t Ag, 0.93 g/t Au, 9.9% Pb, 4.3% Zn, 3.71 m grading 246.0 g/t Ag, 2.69 g/t Au, 1.3% Pb, 0.9% Zn, 1.20 m grading 174.3 g/t Ag, 8.2 g/t Au, 3.7% Pb, 2.6% Zn.
Jackpot	Southeast	Margaux Resources Ltd.	Pb-Zn-Ag+/-W, Au, Mo, Bi; Stratiform replacement; 082FSW012, 013, 014, 015, 255, 256	na	LiDAR, rock and chip sampling, compilation of historical data into 3D model, diamond drilling (1394 m in 9 holes); mineralization exists along a 600 m strike length; grab sample results up to 30% Zn, with associated Pb, Ag, and Cd. Chip sampling results included 3.4 m grading 13.35% Zn, 2 m grading 15.58% Zn, and 3 m grading 8.97% Zn. Drilling results included 61.1 m grading 1.01% Zn, 49.2 m grading 1.04% Zn, 8.5 m grading 6.66% Zn, and 36.3 m grading 1.48% Zn.
Jersey-Emerald	Southeast	Margaux Resources Ltd.	Pb-Zn-Ag+/-W, Au, Mo, Bi; stratiform replacement, skarn; 082FSW010, 009	Emerald-Dodger Tungsten: M+I: 3.071 Mt grading 0.34% WO ₃ , 0.028 Mt grading 0.1% Mo; Inf: 5.48 Mt grading 0.27% WO ₃ , 0.481 Mt grading 0.1% Mo (2006-2015) Jersey: I: 1.9 Mt grading 4.1% Zn, 1.96% Pb; Inf: 4.98 Mt grading 3.37% Zn, 1.95% Pb (2010)	Results from 2016 diamond drilling released in 2017 included 10.2 m grading 24.98 g/t Au, 0.65 m grading 68.3 g/t Au, and 0.25 m grading 59.1 g/t Au. Work in 2017, dewatering of underground workings at Emerald, rock and silt sampling, LiDAR surveys, data compilation and 3D geological modeling, re-logging of historic core, diamond drilling (1121 m in 6 holes). Drilling results included 6.1 m grading 2.61% Pb, 0.44% Zn, and 3.11 m grading 2.02% Pb, 0.48% Zn. Rock sampling from the Comet and Tungsten King showings returned results of 32.8% Zn, 1.2% Pb; and 2.69% Zn, 0.65% Pb, with elevated gold and bismuth. A 3500 kg sample of historic Emerald mine tailings was collected. A partnership agreement with CRONIMET Mining Group is in place to evaluate the economic viability to re-process historic tailings.

Table 6. Continued.

Kena-Daylight	Southeast	Prize Mining Corporation (Apex Resources Inc.)	Au-Cu+/-Pb-Zn-Ag; porphyry, Au-veins, polymetallic veins; 082FSW379, 173, 174, 175, 294	Kena: I: 24.89 Mt grading 0.6 g/t Au; Inf: 85.79 Mt grading 0.48 g/t Au	Option agreement to acquire 80% in Kena-Daylight (Apex Resources Inc. owns 20%) and option to acquire 100% of Toughnut property. Mapping, soil geochem, rock sampling, ground magnetics and VLF surveying, trenching and historical data compilation. Rock sample results at Toughnut included 20.6 g/t Au, 188 g/t Ag and 9.05 g/t Au, 8.6 g/t Ag. Diamond drilling at Kena-Daylight, 18 holes (2695 m) and at Toughnut, 11 holes (1730 m).
Swift Katie	Southeast	Valterra Resource Corporation	Cu-Au+/-Pb-Zn-Ag-Mo; 082FSW290, 291, 350	na	Rock sampling and diamond drilling (1392 m in 8 holes). Drilling tested surface mineralization along a 1000 m strike length; results include 2.5 m grading 11.5 g/t Au and 6.7 g/t Ag, including 0.8 m grading 30.9 g/t Au and 17.8 g/t Ag and 8.6 m grading 3.1 g/t Au and 2.0 g/t Ag.
Thor	Southeast	Taranis Resources Inc.	Ag-Pb-Zn+/-Au; polymetallic veins and breccia, stratiform volcanogenic massive sulphide; 082KNW030, 031, 060, 061	I: 640,000 t grading 0.88 g/t Au, 187 g/t Ag, 0.14% Cu, 2.51% Pb, and 3.51% Zn Inf: 424,000 t grading 0.98% Au, 176 g/t Ag, 0.14% Cu, 2.26% Pb, and 3.2% Zn (2013)	VLF surveying, trenching and channel sampling, test milling. Channel sample results include 2.04 m grading 26.6 g/t Au, 1246 g/t Ag, 3.1% Pb, 4.3% Zn, and 0.55% Cu.
Goldstar	Southwest	DSM Syndicate	Au, Ag, Zn, Cu	na	Prospecting, sampling. Discovery of gold mineralization.
Ladner Gold	Southwest	New Carolin Gold Corp.	Au, Ag; Au quartz veins; 092HWN003 092HWN007 092HWN018 092HSW034	Carolin Inf: 12,352,124 t 1.53 g/t Au McMaster Inf: 3,575,000 t 0.69 g/t Au Tailings I: 445,378 t 1.83 g/t Au Inf: 93,304 t 1.85 g/t Au	Underground rehabilitation and preparation for drilling.
OK	Southwest	Lorraine Copper Corp.	Cu, Mo; Porphyry Cu±Mo±Au; 092K 008 092K 057 092K 168	Inf: 86,800,000 t 0.31% Cu, 0.014% Mo	Induced polarization survey started.

Table 6. Continued.

North Island	Southwest	Northisle Copper and Gold Inc.	Cu, Au, Mo; Porphyry Cu±Mo± Au; 092L 240 092L 200	Red Dog I: 23.6 Mt 0.32% Cu, 0.46 g/t Au Hushamu I: 304 Mt 0.21% Cu, 0.29 g/t Au, 0.01% Mo Inf: 205.6 Mt 0.18% Cu, 0.26 g/t Au, 0.008% Mo	Diamond drilling (1800 m in 6 holes), preliminary economic assessment.
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M = Measured; I = Indicated; Inf = Inferred

the main Silver Coin deposit. Assays are still pending for four holes.

In July 2017, Skeena Resources Limited acquired 100% interest in the **Snip** past-producing gold mine from Barrick Gold Corporation. The Snip mine operated from 1991 to 1999 and produced over 1.1 million ounces of Au. Exploration in 2017 included a 72 hole, 9000 m underground diamond drill program. Highlight results included 341.00 g/t Au over 1.50 m, 67.68 g/t Au over 2.03 m and 10.76 g/t Au over 4.30 m including 14.80 g/t Au over 1.49 m and 9.47 g/t Au over 1.50 m. Skeena reported that drilling verified historical data. For 2018, they plan to expand the known mineralized zones and to examine previously overlooked areas.

GT Gold Corp.'s **Tatogga** project is approximately 14 km west of the Red Chris copper-gold mine, less than 1 km west of Iskut, and close to a paved road (Highway 37). The project has two new grassroots discoveries, Saddle South (high-grade gold) and Saddle North (porphyry copper-gold-silver). The initial discovery was Saddle South, which was drilled to follow up on anomalous soil sample results. The 2017 work program included 28 reverse circulation drill holes (1527 m) on Saddle South, 32 line km of induced polarization surveying, 165 line km of helicopter-borne magnetic surveying, 86 diamond drill holes (15,998 m) on Saddle South and six diamond drill holes (1713 m) on Saddle North. The Saddle south discovery won the prestigious Mines and Money "Exploration Discovery Award".

Drilling on Saddle South returned a high density of high-grade intersections. Highlight results include 51.53 g/t Au over 6.95 m and 5.10 g/t Au over 23.66 m. Drilling on Saddle North was designed to test a large-scale, high-intensity, coincident IP-magnetic anomaly. Drilling results included a new porphyry discovery and the intersection of high-grade epithermal veins (on the western end of the Saddle North trend). The porphyry mineralization discovery hole returned 210.3 m of 0.14 g/t Au, 0.28 g/t Ag and 0.16% Cu. Grades improved downhole and the hole ended in mineralization. The last sample interval of 33.73 m returned 0.22 g/t Au, 0.36 g/t Ag and 0.24% Cu. Highlight intersections for the epithermal vein discovery

included 13.55 g/t Au over 2.58 m including 61.10 g/t Au and 30.90 g/t Ag over 0.61 m. In 2018, drilling programs will continue on all the current target discoveries.

8.1.2. North Central Region

Gitennes Exploration Inc. has an option with a private company to earn a 100% interest in the **Snowbird** project. Gold occurs in quartz veins and stringer zones associated with the Sowchea fault zone. Gitennes carried out ground geophysics, and rock and soil sampling. Ten boreholes were completed, totalling approximately 1212 m. Eight of these intersected multi-gram gold intervals, including Hole SB14-04 (16.20 g/t Au over 1.0 m), Hole SB17-02 (9.73 g/t Au over 1.0 m), and Hole SB17-08 (8.24 g/t Au over 0.52 m).

8.1.3. South Central Region

Barkerville Gold Mines planned to drill up to 160,000 m in 2017 on their **Cariboo Gold** project and came close by December. Most drilling was in the Island Mountain area, northwest of Cow Mountain and Barkerville Mountain, which were also target areas. All are sites of past producers. Results include high-grade intersection of typically 10s of g/t Au over 5 m or more.

Eureka Resources Inc. drilled three diamond drill holes at their **Gold Creek** property. Results included 33.20 g/t Au over 1.25 m and 17.95 g/t Au over 1.5 m. Targets are orogenic gold veins in Mesozoic phyllites and greywackes.

In October, Westhaven Ventures Inc. began a 3269 m drill program at their **Shovelnose** project. Five holes focused on the Tower zone and two on the Alpine zone 0.5 km to the east. Other 2017 work included a ground magnetic survey, geological mapping, prospecting, soil sampling, and a clay mineralogical study. Shovelnose hosts epithermal style mineralization in Spences Bridge Group volcanic rocks (Cretaceous).

8.1.4. Southeast Region

Margaux Resources Ltd. began work on their **Bayonne** property in 2017 with mapping, rock sampling, LiDAR

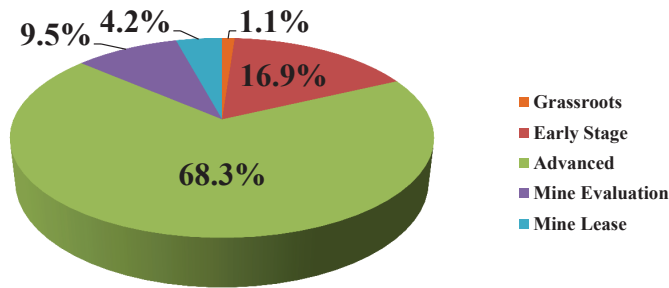


Fig. 11. South Central Region exploration expenditures by exploration category.

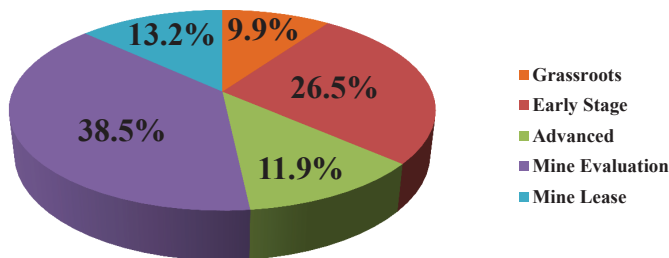


Fig. 12. Southeast Region exploration expenditures by exploration category.

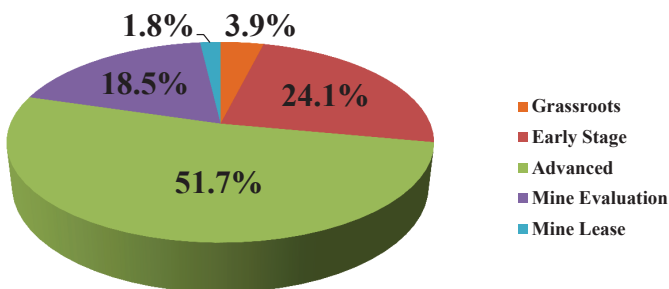


Fig. 13. Southwest Region exploration expenditures by exploration category.

surveying, and diamond drilling. Historic production on the property (1936-1942) was mainly from the Main vein and a splay known as the A vein. The company drill tested three main targets (2089 m, 13 diamond drill holes) to test below the limits of historic mining, and previous undrilled areas. Results include 1.85 m grading 15.31 g/t Au, 1.0 m grading 12.7 g/t Au, and 0.32 m grading 18.2 g/t Au.

GGX Gold Corp. conducted prospecting, rock sampling, trenching, channel sampling, soil sampling and diamond drilling (1449 m, 27 holes) on their **Gold Drop** project. Drilling results included 0.3 m of 10.8 g/t Au, 123 g/t Ag and 16.3 m of 4.59 g/t Au, 38.64 g/t Ag.

Golden Dawn Minerals Inc. diamond drilled on their Golden Crown and May Mac properties, part of their **Greenwood Precious Metals** project. At Golden Crown, 31 holes totalling 2954 m were drilled. Highlight assays include 12.3 m of 3.53 g/t Au, 0.11% Cu, including 4.6 m of 7.60 g/t Au, 0.13%

Cu. At May Mac, 22 underground holes totalled 3028 m and eight surface holes totalled 1886 m. Results include 2.57 m grading 252.6 g/t Ag, 0.93 g/t Au, 9.9% Pb, 4.3% Zn, 3.71 m grading 246.0 g/t Ag, 2.69 g/t Au, 1.3% Pb, 0.9% Zn, 1.20 m grading 174.3 g/t Ag, 8.2 g/t Au, 3.7% Pb, 2.6% Zn.

8.1.5. Southwest Region

DMS Syndicate prospected and sampled on their **Goldstar** project south of Bella Coola. Out of 16 samples, four returned more than 10 g/t Au with Ag, Cu and Pb values. This area has no record of previous exploration. New Carolin Gold Corp. carried out underground rehabilitation, channel sampling, and geological mapping on their **Ladner Gold** project.

8.2. Selected porphyry (Cu-Au, Cu-Mo, Mo) projects

8.2.1. Northwest Region

Evrin Resources Corp. signed an agreement with a wholly owned subsidiary of Antofagasta Plc by which Antofagasta can earn up to a 70% interest in their **Ball Creek** property by spending up to an aggregate of US\$31 million or delivering a prefeasibility study.

Skeena Resources Limited filed a mineral resource update and a preliminary economic assessment for their **Spectrum-GJ** project. The project consists of two deposits, separated by about 14 km, one porphyry copper-gold deposit (Donnelly, at GJ), the other porphyry gold-copper deposit (Spectrum).

8.2.2. North Central Region

Amarc Resources Ltd.'s **Duke** property straddles the Northwest and North Central regions. The property includes a copper+-molybdenum porphyry deposit that was the subject of an historic (NI 43-101 non-compliant) inferred resource estimated at 40.8 million tons at 0.25% Cu and 0.01% Mo. In late autumn 2017, the company diamond drilled two holes (1045 m) and reported several intersections with more than 1.1 g/t Au.

Amarc's **Joy** project is a copper+-molybdenum+-gold porphyry target. Amarc completed a farm-in agreement with Hudbay Minerals, with Hudbay to spend \$15 million on the property by the end of 2020, including \$1.9 million in 2017. Drilling consisted of three boreholes totalling 1527 m to test coincident IP and geochemical anomalies. Amarc also completed an airborne magnetometer survey, 49 line km of IP, geological mapping, and a geochemical survey.

Centerra Gold Inc.'s **Kemess East** project is about 1 km east of the Kemess Underground project. In July, a NI 43-101 report was released identifying an Indicated resource of 113.12 Mt grading 0.38% Cu, 0.46 g/t Au, and 1.94 g/t Ag. In 2017, ten diamond drill holes totalling 13,923 m were completed. Highlight intersections included 338 m of 0.64 g/t Au, 0.45% Cu, including 120 m of 1.05 g/t Au, 0.60% Cu, 846.5 m of 0.25 g/t Au, 0.28% Cu, including 208 m of 0.37 g/t Au, 0.41% Cu, 853.8 m of 0.24 g/t Au, 0.25% Cu, including 147.5 m of 0.40 g/t Au, 0.42% Cu and 461.9 m of 0.27 g/t Au, 0.22% Cu, including 75 m of 0.61 g/t Au, 0.41% Cu.

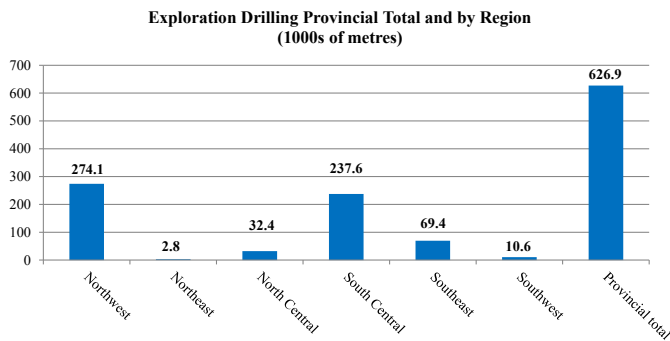


Fig. 14. Exploration drilling metres, provincial total and by region.

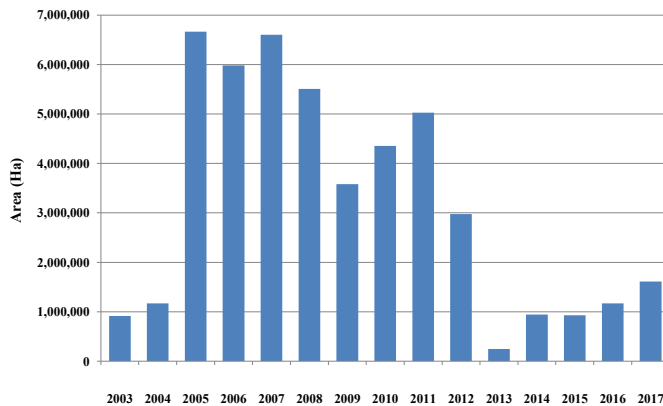


Fig. 15. Tenure, new mineral claims (area Ha) by year.

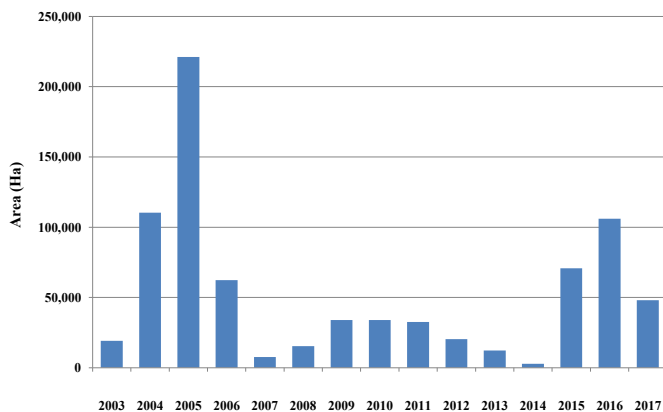


Fig. 16. Tenure, new coal license issuances (area Ha) by year.

In April 2017, Serengeti Resources Inc. released a NI 43-101 report and preliminary economic assessment for the **Kwanika** project. The report proposes a combined open pit and underground operation with an estimated mineral resource of 131.2 Mt Measured and Indicated, and 73.1 Mt Inferred. The projected mine life is 15 years, with a milling rate of 15,000 tpd. In October, Serengeti completed an agreement with POSCO Daewoo and Daewoo Minerals Canada (DMC) to form a joint venture company, the Kwanika Copper Corporation (65% Serengeti, 35% Daewoo), to pursue development.

The **Stardust** project was acquired by Sun Metals Corp. from Lorraine Copper Corp. in November. Earlier in 2017 Lorraine collected 744 soil samples to extend existing grids, ran 28 line-km of IP and magnetic surveys, reinterpreted a 2011 ZTEM survey, and completed a 3 borehole drilling program.

8.2.3. South Central

The **Ike** Cu-Mo-Ag project is owned by Hudbay Minerals Inc., (60%) and Amarc Resources Ltd., (40%). In 2017, work included 2702 m in nine diamond drill holes, 82 line km of induced polarization, 20 km² of geological mapping and fine-grained talus sampling. Hudbay was a new partner in the project in 2017. Amarc remains the operator. Between 2014 and 2016 they drilled approximately 12,000 m in 21 widely spaced holes.

Sego Resources Inc. began an initial 600 m, 2-hole drill program in mid-October at their **Miner Mountain** project, an alkalic Cu-Au porphyry prospect. The new drilling follows 2012 percussion and core drilling which returned high copper assays and gold, including 100.4 m of 0.946% Cu, 0.55 g/t Au and 3.473 g/t Ag.

Tower Resources Ltd. drilled about 3400 m in 11 holes at their **Rabbit North** project in 2017. They reported porphyry-style mineralized intersections, including 247 m 0.51% Cu and 0.34 g/t Au, and 88 m of 0.35% Cu and 0.27 g/t Au in the Western Magnetite zone. They also reported 133 m of 0.19% Cu and 0.31 g/t Au in the Chrysocolla zone to the south.

Happy Creek Minerals Ltd. drilled at their **Rateria** project in 2017 (1754 m in 6 holes). Step-out holes expanded Zone 2, including 105.5 m of 0.37% Cu and 0.14 g/t Au. Rateria is an early-stage project without a current resource estimate.

8.2.4. Southeast Region

In 2017, Valterra Resource Corporation released results of their 2016 drill program (1954 m, 6 DDH), and continued drilling on their **Swift Katie** project (1392 m, 8 DDH). Results included 2.5 m grading 11.5 g/t Au and 6.7 g/t Ag, (including 0.8 m grading 30.9 g/t Au and 17.8 g/t Ag); and 8.6 m grading 3.1 g/t Au and 2.0 g/t Ag. One of the holes is offsetting a 2014 hole that assayed 3.5 m grading 13.3 g/t Au, 201 g/t Ag and 0.33% Cu. Drilling tested three areas along a 1000 m strike length that has been traced on surface by rock and soil sampling, and historical trenching.

8.2.5. Southwest Region

Lorraine Copper Corp. acquired 100% of the **OK** copper molybdenum prospect north of Powell River in 2016. Late in 2017, they began an induced polarization survey. Known mineral occurrences extend along a roughly 5 km north northwest trend. The northernmost, North Lake Zone, has an Inferred resource of 86.8 million tonnes grading 0.31% Cu and 0.014% Mo. The mineralization is open with untested step-out geophysical and geochemical drill targets.

Northisle Copper and Gold Inc.'s **North Island** project has two deposits, Hushamu and Red Dog. Hushamu, a copper-molybdenum-gold porphyry prospect, is the most advanced,

with Indicated 304,000,000 t of 0.21% Cu, 0.29 g/t Au, 0.010% Mo, and 0.56 ppm Re and Inferred 205,600,000 t of 0.18% Cu, 0.26 g/t Au, 0.008% Mo and 0.38 ppm Re. The Red Dog deposit is approximately 7.5 km west-north-west of the Hushamu deposit. In 2016, they drilled to verify an historical resource estimate. At a 0.20% Cu cut off, the updated Red Dog estimate has 23,633,000 t at 0.32% Cu, 0.46 g/t Au and 0.007% Mo Indicated and 848,000 t at 0.23% Cu, 0.33 g/t Au and 0.003% Mo Inferred. The Red Dog and Hushamu resources together were subject of a 2017 preliminary economic assessment, which modelled a 75,000 tpd open-pit operation with a 22-year life. Drilling in 2017 (1800 m in 6 holes) included testing a southeastern extension of the Hushamu deposit, testing an area in the Hushamu deposit previously considered occupied by late- or post-mineral breccia and barren, and testing for deep mineralization at Red Dog. Mineralization at Hushamu does appear to be open to the southeast and north and the infill drilling encountered mineralization above cut off. The hole at Red Dog was lost before reaching target depth but did encounter porphyry style alteration and increasing mineralization at depth.

8.3. Selected polymetallic base and precious metal projects

8.3.1. Northwest Region

In 2017, Dolly Varden Silver Corporation announced plans for 12,000 m of diamond drilling at the **Dolly Varden** silver project. The project consists of the Torbrit, Dolly Varden, Wolf, and North Star deposits. Drilling between the Torbrit and Wolf deposits resulted in a new discovery (Central zone), with results that included 16.10 m (13.19 m true thickness) grading 269.0 g/t Ag, 0.30% Pb, and 0.21% Zn. Follow-up drilling confirmed this discovery, returning results of 7.15 m (6.72 m true thickness) grading 1180.7 g/t Ag, 1.83% Pb and 0.26% Zn. Drilling also discovered an eastern fault offset of the Torbrit deposit (Torbrit East), with assays including 13.00 m (9.96 m true thickness) grading 244.8 g/t Ag, 0.14% Pb, 0.09% Zn. Within this interval was 5.00 m (3.83 m true thickness) grading 481.9 g/t Ag, 0.21% Pb, 0.12% Zn.

In 2017, Golden Ridge Resources Ltd. announced plans for 9000 m of diamond drilling at the **Hank** project. Results reported to date include 4.13 m of 19.74 g/t Au, 193.9 g/t Ag, 0.77% Pb, 1.97% Zn and 60.27 m of 2.14 g/t Au, 6.9 g/t Ag, 0.11% Pb, 0.45% Zn.

In June of 2017, Kutcho (formerly Desert Star Resources Ltd.) announced signing an agreement to acquire 100% interest in the **Kutcho** project from Capstone Mining Corp. for \$28.8 million. In July, they announced a prefeasibility study with updated resource figures. At a 1.0% copper cut off, combined Measured and Indicated resources are estimated at 16.853 Mt of 1.89% Cu, 2.87% Zn, 0.36 g/t Au and 32.8 g/t Ag. Kutcho plans to advance the project to a completed feasibility study and permitted for construction within 2.5 years.

In 2017, Ascot Resources Ltd. carried out a 379 hole, 118,800 m diamond drilling program at the **Premier/Dilworth** project, which includes the past-producing Premier gold mine. Until operations were suspended in 1996, the Premier mine

produced 2 million ounces of gold and 42.8 million ounces of silver. Target areas include Big Missouri, Northern Lights, and Premier. The drilling discovered a new high-grade subzone (Ben) of the Northern Lights zone in the Premier mine area. Numerous high-grade intersections were reported, including 36.31 g/t Au over 16.15 m. Plans for 2018 include continued drilling and a new NI 43-101 resource calculation.

Decade Resources Ltd. reported rock sampling results of 19.9 g/t over 4 m for the Waterpump zone at the **Red Cliff** gold-copper project. Drill core from the Waterpump zone is described as having sphalerite-galena-chalcopryrite veins in the wall of a breccia that contains quartz, pyrite, and minor chalcopryrite over 15-20 m true width. Visible gold has been observed in sphalerite-galena-chalcopryrite veinlets and in quartz-pyrite veinlets. Drill result highlights for the Montrose zone include 14.93 g/t Au over 8.38 m and 9.5 g/t Au over 10.98 m.

In 2017, New Nadina Explorations Ltd. diamond drilled a total of 2158.5 m in three holes at their **Silver Queen** project. Results included 0.4 m of 120 g/t Ag, 1.29 g/t Au, 1.41% Cu and 3 m of 120 g/t Ag, 0.24 g/t Au and 0.5% Cu.

The **Treaty Creek** project is owned by Tudor Gold Corp. (80%), Teuton Resources Corp. (20%), and American Creek Resources Ltd. (20%). The project is adjacent to Seabridge's KSM project and Pretium's Brucejack mine. In 2017, Tudor carried out a 27 hole, 13,722 m diamond drill program. The target was the Copper Belle zone and highlight results from five holes included 115.1 m of 1.31 g/t Au, 4.4 g/t Ag, 0.022% Cu including 39 m of 2.38 g/t Au, 8.3 g/t Ag, 0.026% Cu.

8.3.2. North Central Region

Canada Zinc Metals Corp.'s **Akie** property contains the Cardiac Creek SEDEX deposit. In 2016, the company issued a NI 43-101 report on Akie that defined an Indicated resource of 19.6 Mt grading 8.2% Zn, 1.6% Pb and 13.6 g/t Ag (at a 5% zinc cut-off grade) and an Inferred resource of 8.1 Mt grading 6.8% Zn, 1.2% Pb and 11.2 g/t Ag (at a 5% Zn cut-off grade). In 2017, the company conducted a drilling program on the Cardiac Creek deposit, aimed at extending the resource, completing eight holes totalling 4700 m. All holes intersected the mineralized zone and two expanded the indicated resource. Noteworthy results included 67.79 m grading 11.79% Zn+Pb and 19.1 g/t Ag, including 15.44 m grading 22.61% Zn+Pb and 36.1 g/t Ag.

8.3.3. Southeast Region

At their **Alpine** property, Braveheart Resources Inc. mapped, sampled, and diamond drilled (1600 m, 11 holes) to test the extension and continuity of mineralization in quartz veins. Drill results included 1.7 m grading 19.1 g/t Au, 1.5 m grading 11.8 g/t and 1.4 m grading 38.0 g/t Au.

In 2017, Margaux Resources Ltd. compiled all historical data into a 3D model, conducted a LiDAR survey, resampled historic drill core, chip sampled, and diamond drilled at their **Jackpot** property. Results of chip sampling included 3.4 m

grading 13.35% Zn, 2 m grading 15.58% Zn, and 3 m grading 8.97% Zn. Diamond drilling (1397 m, 9 holes) targeted an area 500 x 1000 m and 3 main zones (Jackpot Main, Lerwick, and Jackpot East) and included results of 61.1 m grading 1.01% Zn, 49.2 m grading 1.04% Zn, 8.5 m grading 6.66% Zn, and 36.3 m grading 1.48% Zn. Margaux Resources Ltd. also continued work at their **Jersey-Emerald** project. Results of 2016 drilling were released early in 2017, with 10.2 m grading 24.98 g/t Au, 0.65 m grading 68.3 g/t Au, and 0.25 m grading 59.1 g/t Au. Gold is strongly associated with bismuth and tellurium. Further diamond drilling in 2017 (1121 m, 6 holes) followed up on gold, and lead-zinc targets, with 6.1 m grading 2.61% Pb, 0.44% Zn, and 3.11 m grading 2.02% Pb, 0.48% Zn.

Taranis Resources Inc. continued work at the **Thor** property, which has several targets including past-producing mines (True Fissure, Great Northern, Broadview, and Blue Bell). Work included VLF surveying and channel sampling. Channel sample results include 2.04 m grading 26.6 g/t Au, 1246 g/t Ag, 3.1% Pb, 4.3% Zn, and 0.55% Cu.

Prize Mining Corporation's **Kena-Daylight** project includes the Kena, Daylight and Toughnut properties. Prize Mining entered into two separate option agreements in 2017, to acquire an 80% interest in the Kena and Daylight gold-copper properties (20% owned by Apex Resources Inc.), and 100% of the adjoining Toughnut property. At Toughnut, rock sampling highlight results included 20.6 g/t Au, 188 g/t Ag and 9.05 g/t Au, 8.6 g/t Ag. At the Toughnut property, 11 diamond drill holes were completed totalling 1730 m. At the Daylight property 18 diamond drill holes were completed totalling 2695 m.

8.4. Selected skarn projects

8.4.1. South Central Region

At the **Fox** tungsten skarn property, Happy Creek Minerals Ltd. continued to define the extent, grade, and continuity of scheelite mineralization. From north to south, seven known mineralized zones are: North; BK; Ridley Creek; BN; 708; Nightcrawler-Discovery; and South Grid. In January 2017, the company updated its resource estimate for the Ridley Creek zone. Resources stand at an Indicated 486,000 t grading 0.817% WO₃ and Inferred 361,000 t grading 1.568 WO₃ with a 0.2% WO₃ cut-off for material potentially amenable to open-pit extraction and 0.55% for underground resources. The initial resource for the BN zone, approximately 1 km south of the RC zone, is an Inferred 245,000 t of 1.892% WO₃ at a 0.55% cut off. The resource is 20-80 m below surface. Drilling in 2017 focused on the BN zone (4336.3 m in 38 holes). Significant results included 5.05 m 2.980% WO₃ in a step out to the east and 7.81 m 1.36% WO₃ in a step out to the southwest.

Engold Mines Ltd.'s **Lac La Hache** property hosts several prospects including the Aurizon (Au-Ag-Cu vein and breccia), the Spout (magnetite-Cu skarn), the Berkey (porphyry), and a recent Fe-Cu-Ag-Au discovery at their G1 gravity anomaly target. Their first hole of 2017 drilled this anomaly and intersected skarn-type mineralization with 26.57 m 1.76% Cu, 0.27 g/t Au, 10.29 g/t Ag and 35.8% Fe. This led to an additional

ground gravity survey and an airborne gravity and magnetic survey (274 line-km at 50 m line spacing) and substantial drilling (~20,000 m). Drilling continued into December. The company is also working on a resource estimate for the Aurizon zone.

8.5. Selected mafic- and ultramafic-hosted projects

8.5.1. Northwest Region

Diamond drilling at the **E&L** property in 2017 intersected a sequence of mafic and ultramafic rocks. Highlight results included 8.3% Ni and 4.2% Cu over 16.75 m.

8.5.2. Northeast Region

FPX Nickel Corp. (formerly First Point Minerals Corp.) continued exploration on their **Decar** project, with the technical support of Equity Exploration Consultants. The host rocks are tectonically emplaced serpentinized ultramafic rocks that are mineralized by disseminated awaruite (Ni₃Fe). In 2017, the company drilled eight boreholes totalling 1197 m at the Baptiste deposit. Near-surface mineralization was extended 500 m beyond previous drill coverage, and supported possible extension of the mineralized zone by 650 m to the southeast. Highlights included 96 m grading 0.167% Ni, which represents the second-highest grade, near-surface interval intersected at the deposit.

8.6. Selected specialty metal projects

8.6.1. North Central Region

In 2017, Arctic Star Exploration Corp. drilled four holes totalling 647.5 m to test coincident geochemical and geophysical anomalies on its **CAP** (formerly Carbo) property. A carbonatite-syenite was discovered in outcrop and in one of the boreholes. Between surface exposures and drilling, the deposit has a strike length of up to 3 km. In the borehole, at least 138.5 m of carbonatite was intersected: 0.35% Nb₂O₅ across 10.42 m (including 2.26 m of 0.63% Nb₂O₅); 19.63 m of 9.94% P₂O₅ (including 2.55 m of 20.97% P₂O₅); and 2.4 m of 0.81% TREOs (total rare earth element oxides).

8.7. Selected coal projects

8.7.1. Northwest Region

Telkwa Coal Limited is a wholly owned subsidiary of Allegiance Coal Limited. A technical report for the **Telkwa** coal project filed in February of 2015 reported a total resource estimate of 165 Mt of semi-soft coking coal including 131.2 Mt of Measured plus Indicated resources and 33.4 Mt of Inferred resources. In 2017, a favourable pre-feasibility study was released and plans for a feasibility study and permit applications were announced.

8.7.2. Northeast Region

Colonial Coal International Corp. worked on their **Flatbed and Huguenot** projects. The Flatbed project is adjacent to Anglo American's Trend mine. In 2017, the company drilled five vertical holes on 1800 m centres totalling 2830 m. The

holes encountered flat-lying coal units, with common shaly interbeds, at depths of about 700 m. Downhole geophysical logs were completed, and core sampled. A NI 43-101 report on the project released in late November outlined an underground mineable Inferred resource of 298 Mt of bituminous coal that were referred to as having “coking properties after beneficiation.” Colonial continued environmental monitoring studies on its **Huguenot** project south of the Trend Mine. The property contains combined Measured and Indicated surface resources of 131.95 Mt, and combined underground resources of 145.73 Mt.

8.7.3. North Central

The **Panorama North** project is about 15 km west of the Groundhog coalfield and, similar to Groundhog, it hosts anthracitic coal seams. In 2016, Atrum Coal Ltd. entered a farm-in agreement in which JOGMEC agreed to contribute \$5 million in cash or in-kind support for three years to earn a 35% interest in the project. In 2017, extensive surface mapping was undertaken to identify and trace coal seams, and five wide-spaced boreholes were completed, totalling 1227 m.

8.8. Selected industrial mineral projects

8.8.1. South Central Region

Lithium Corporation received a permit for trenching at their **BC Sugar** graphite property. The work planned for 2017 was deferred due to forest fires. They collected a small bulk sample late in the year, and submitted it for metallurgical study. ZMM Minerals Canada Corp. is collecting a bulk sample at their **Trans Canada** property. They describe the target as a suite of iron bearing zeolites. Currently, zeolites are widely used for water filtration and soil amelioration and as catalysts, biological growth media, pozzolans in cement, and additives to detergent; other uses are being explored.

8.8.2. Southeast Region

At their **Frances Creek** property Voyageur Minerals Ltd. continued drilling late into the year (more than 17 diamond drill holes) targeting barite in a brecciated vein to test mineralization to a depth of about 60 m and extend the strike length. Drill results indicate barite mineralization extends over a 20.4 m width, for 60 m along strike, averaging 30.57% BaSO₄. Purity testing indicates that the barite, in addition to being used for drilling in the oil and gas industry, may qualify for the pharmaceutical market. The company plans bulk sampling.

9. Publically funded geoscience

9.1. The British Columbia Geological Survey

Established in 1895, the British Columbia Geological Survey (BCGS) links government, the minerals industry, and British Columbians to the province’s geology and mineral resources. The key roles of the Survey are to: 1) create, maintain, and deliver geoscience knowledge to lead informed decision making; 2) attract exploration for new mineral and coal resources; 3) act as the public steward of mineral and coal

resources; and 4) guide public policy by providing assessments on mineral exploration and mining activities. The activities of the Survey and its geoscience products are profiled annually at the AMEBC’s Mineral Exploration Roundup in Vancouver, and at regional, national, and international geoscience conferences.

Headquartered in Victoria, the BCGS is a branch in the Mines and Mineral Resources Division of the Ministry of Energy, Mines and Petroleum Resources. The Cordilleran Geoscience Section is responsible for generating new geoscience knowledge, largely through field-based studies and surveys. The Resource Information Section maintains and develops the provincial geoscience databases and disseminates geoscience data online. The Section is also responsible for evaluating, approving, and archiving mineral and coal exploration assessment reports filed by the exploration and mining industry. From a satellite office in Vancouver, the Mineral Development Office links the province’s mineral and coal resources to the investment community, distributes and promotes BCGS technical data, and coordinates the technical outputs of the Regional Geologists Program.

The Survey supports the minerals industry through many of the projects that it undertakes. In 2017, field projects focused on the northwestern part of British Columbia, in the famed Golden Triangle. Mapping continued in the Atlin and Dease Lake areas, collaborating with the Geological Survey of Canada (GSC) under the second iteration of the Geo-mapping for Energy and Minerals (GEM) program. A joint BCGS-GSC-Geological Survey of Japan collaboration is investigating specialty metals under the Targeted Geoscience Initiative (TGI4) program. Another project is directed at understanding the Upper Fir rare earth element deposit, near Blue River, that will be featured in a field trip at the Resources for Future Generations conference being held in Vancouver, June 2018. Also part of the TGI4, BCGS has partnered with the GSC to assess gold deposits near the Llewellyn fault in BC and its possible extension with the Tally Ho shear zone in Yukon. BCGS, Geoscience BC, and the Mineral Deposits Research Unit (MDRU) at the University of British Columbia are working to deliver a new geological map near Terrace, part of the SeArch project area. Multi-year studies to unravel the architecture of the Nicola arc (Quesnel terrane) continue in central BC. These rocks host some of BC’s most prolific porphyry deposits. Other studies examined Ni-Cu-PGE ore-forming processes in mafic-ultramafic systems at Tulameen, and mapping of the Trembleur ultramafic rocks of Cache Creek terrane, host to the nickel-iron alloy bearing awaruite at the Decar property. Other projects are developing new exploration methods, emphasizing indicator minerals from till. The results of Survey projects are published annually in Geological Fieldwork (Fig. 17) and in publications by partners including Current Research (GSC), and Summary of Field Activities (Geoscience BC).

The BCGS continues to update its databases, including MINFILE, COALFILE, Property File, the Assessment Reports Indexing System (ARIS), digital bedrock geology map, and regional geochemical surveys. BCGS databases are available

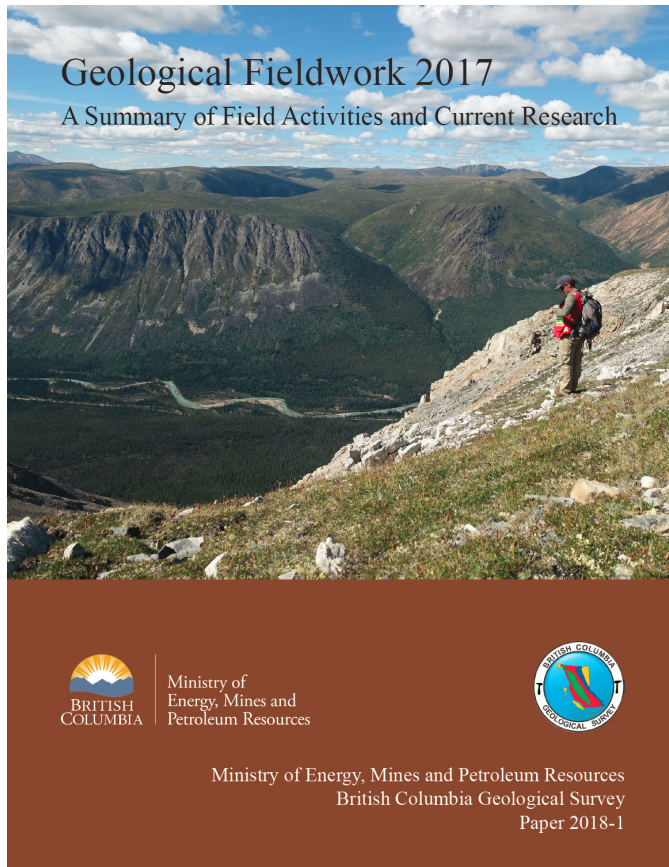


Fig.17. Geological Fieldwork contains peer-reviewed papers that summarize field activities and current research by the British Columbia Geological Survey.

through MapPlace 2. MINFILE documents more than 14,600 metallic mineral, industrial mineral, and coal occurrences. ARIS has over 35,600 mineral exploration reports representing about \$2.5 billion of reported exploration expenditures. Property File now has more than 65,500 reports and maps, documenting exploration activity in British Columbia since the late 1800s. BC's lithogeochemical (nearly 11,000 samples), till geochemical (nearly 10,500 samples), and regional geochemical survey (nearly 65,000 samples with about 5 million determinations) databases were updated in 2017. The province-wide bedrock compilation map (BC Digital Geology) saw substantial updates.

9.2. The Geological Survey of Canada

The BCGS and the Geological Survey of Canada (GSC) continue to collaborate on large and small geoscience projects. The second phase of the Geo-mapping for Energy and Minerals program (GEM-2) commenced in 2014 and the program will run until 2020. The BCGS is participating in the Cordilleran Regional project that is a collaboration between the geological surveys of Yukon, Alaska, British Columbia, and the Canadian government. Multidisciplinary field-based studies in poorly understood areas focus on bedrock geology, crustal architecture,

Cordilleran tectonics, and metallogeny. The TGI-5 projects are targeted topical studies directed at understanding ore systems from metals source to deposit emplacement. Together, these efforts help drive the discovery of new mineral deposits and increase known resources. In addition, surficial geology and glacial history studies will provide vital knowledge for mineral exploration in covered regions.

9.3. Geoscience BC

Geoscience BC is a not-for profit, non-governmental, geoscience organization established in 2005 with grants from the provincial government. Geoscience BC has a board of directors and technical advisors largely drawn from industry. It is mandated to promote mineral, oil and gas, and geothermal exploration in British Columbia by generating and distributing geoscience data. Open and targeted requests for proposals generate geoscience projects and work is done by contractors, consultants, and other providers of public geoscience.

10. Foreign investment initiatives

Opportunities exist for companies to attract foreign investment using government services and staff. The province participates in international investment missions showcasing mineral and coal opportunities. If you are interested in profiling your projects or investment opportunities in upcoming events, connect with the Mineral Development Office in Vancouver for more information.

11. Concluding remarks

Exploration expenditures were up for the first time since 2012 and exciting new discoveries were being made. Explorationists continued to define, and expand porphyry and porphyry-related copper-gold and copper-molybdenum deposits, gold deposits of various types, and stratiform base-metal, specialty metals, industrial minerals, and coal deposits.

Eight metal mines were in production at the start of 2017. During the year the Silvertip mine was shut down but production started up at the Brucejack and Bonanza Ledge operations, bringing the total of operating metal mines at the end of the year to nine. Seven open-pit coal mines were in production at the start of the year, five in the Southeast Region and two in the Northeast Region. In the fall, the Quinsam underground mine on Vancouver Island re-started production.

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



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1. Introduction

From northeast to southwest, a transect from the Northeast Region to the North Central Region provides a cross section from undeformed rocks deposited above Precambrian basement to allocthonous 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** (Perry Creek) operations, two on care and maintenance status, and several other major coal projects. In the far north of the region, Fireside Minerals Ltd. produces barite from its **Fireside** mine to supply the oil and gas drilling industry. One small project, the **Wapiti East** phosphate deposit (Fertoz International Inc.) is in the mine evaluation phase.

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 region has one producing mine, Centerra Gold Inc.'s **Mt. Milligan** copper-gold mine and one mine on care and maintenance, Centerra Gold's **Endako** molybdenum mine. One major mine application, for AuRico Gold Inc.'s **Kemess Underground** mine (a copper-gold porphyry) was submitted in 2017, and an application to open a limestone quarry (Graymont Western Canada Inc.) near Giscome was under consideration. New Gold Inc.'s **Blackwater** gold-silver porphyry deposit remained in mine evaluation status, as did Taseko Mines' **Aley** niobium (carbonatite) project (Fig. 1).

Only one early-stage exploration project was active in the Northeast Region in 2017. In contrast, exploration projects in the North Central Region included 7 advanced, 24 early, and

7 grassroots (Fig. 1). One of the early exploration projects resulted in a significant discovery, a carbonatite deposit on Arctic Star Exploration's **CAP claims** north of Prince George. Diamond drilling was undertaken at the one Northeast Region project, and at 16 of those in the North Central Region.

As in 2016, estimates for exploration expenditures, drilling programs, and other metrics were captured in the British Columbia Mineral and Coal Exploration Survey, a joint initiative of the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for Mineral Exploration in British Columbia, and Ernst and Young LLP. For the North Central Region, exploration expenditures were estimated at \$31.3 million and exploration drilling was estimated at approximately 32,350 m. For the Northeast Region exploration expenditures were estimated at \$2.4 million and exploration drilling was estimated at approximately 2830 m (Clarke et al., 2018; Ernst & Young LLP, in press).

2. Geological overview

The Canadian Cordillera records a protracted history of supercontinent breakup and collisions between the westward-driven North American continental plate and terranes accreted to its western margin (e.g., Nelson et al., 2013). A succession of island arc volcanosedimentary and intrusive assemblages developed outboard of ancestral North America and accreted to each other and the continental margin. Terrane emplacement continues today as the Juan de Fuca plate slides beneath Vancouver Island.

In the Northeast and North 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

Provincial Overview of Exploration and Mining in British Columbia, 2017. British Columbia Geological Survey, Information Circular 2018-1

east to west) as the Slide Mountain terrane, the Quesnel and Stikine terranes (Quesnellia and Stikinia), and the Cache Creek terrane. The Cache Creek terrane is separated from Quesnellia by another major crustal break, the Pinchi fault, along which areas of ultramafic (upper mantle) rock are locally exposed. These terranes are intruded by intermediate to felsic plutonic rocks, and are 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; Jago, 2017). Thus, Ancestral North America platform strata are host to coal and potash deposits, and postaccretionary sedimentary rocks overlying the Stikine terrane host coal deposits. Deep-water basin strata host SEDEX and Mississippi Valley-type lead-zinc deposits. The island arc assemblages of Quesnellia and Stikinia host the known large polymetallic porphyry deposits in the region.

Both regions were extensively glaciated during successive Quaternary glacial periods (e.g., Hickin et al., 2017). In North Central and Northeast British Columbia, glaciation resulted in significant topographic modification so that, especially in mountainous areas, glacial valleys, cirques and arêtes, and attendant deposits are widespread. In the Interior Plateau, till thickness commonly extends to several metres. Glaciofluvial deposits are widespread, and glacial lakes formed in some low lying areas, in particular near confluence of the present day Nechako and Fraser Rivers.

The geology of North Central and Northeastern British Columbia is treated in more detail by Jago (2017).

3. Mines and quarries

3.1. Metal mines

In 2017, the only producing metal mine was the copper-gold producer **Mt. Milligan**, wholly-owned by Centerra Gold Inc. (Table 1) in the North Central Region (Fig. 1). Also in the North Central Region, the **Endako** molybdenum mine (75% Centerra, 25% Sojitz Moly Resources Inc.) remained on care and maintenance.

3.1.1. Mt. Milligan (Centerra Gold Inc.)

The **Mt. Milligan** mine, in Quesnel terrane (Fig. 1,) is hosted by mafic to intermediate volcanic and pyroclastic rocks of the Takla Group (Triassic to Early Jurassic) that are intruded by Early Jurassic monzonite porphyry stocks. The ore body (2500 x 1500 m) is a silica-saturated alkalic porphyry copper-gold deposit contained in two principal zones. At the Main Zone, mineralization is mainly in volcanic rocks, and at the Southern Star Zone, mineralization is in a monzonite stock and volcanic rocks. Copper-gold (with accessory silver) mineralization occurs as sulphides in the host rocks (Fig. 2). Combined Measured and Indicated resources total 243.9 Mt at 0.134% Cu and 0.226 g/t Au containing 717.7 Mlb of Cu and 1.77 Moz of Au (Andrews et al., 2017).

Commissioned in 2013, the mine was up to its full design capacity of 60,000 tpd by 2016. Phase 3 mining (Fig. 3) was underway in 2017, and phase 4 extraction began. Before milling

and flotation, ore is processed through primary and secondary crushers (Fig. 4) in a concentrator upgraded to a 62,500 tpd design capacity. Mill feed throughput in 2017 was forecast to be 59,600 tpd, and for 2018 to be 60,700 tpd (Andrews et al., 2017), with full capacity being reached by 2019. 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. Average annual payable production, as forecast for the period 2017-2019, is 76.8 Mlb of Cu and 253,700 oz of Au, and the estimated mine life is 22 years (Andrews et al., 2017).



Fig. 2. Ore specimen from Phase 3, Mt. Milligan mine, chalcopyrite and pyrite.



Fig. 3. Loading ore at Mt. Milligan mine, Phase 3 development.

Table 1. Metal mines, North Central and Northeast regions.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Mt. Milligan	Centerra Gold Inc. (Centerra B.C. Holdings)	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194, 093N 191	55-65 Mlbs Cu; 235,000-255,000 oz Au	P: 256.8 Mt at 0.187% Cu and 0.424 g/t Au Pr: 239.4 Mt at 0.188% Cu and 0.293 g/t Au	M+I: 243.9 Mt at 0.16% Cu and 0.2 g/t Au (additional to reserves)	Concentrator design capacity 62,500 tpd. Estimated mine life 22 years. Over 350 employees.
Endako	75% Centerra Gold Inc. (25% Sojitz Moly Resources Inc.)	Mo; Porphyry Mo (Low F-type); 093K 006	na	na	M+I: 3.4 Mt at 0.049% Mo	Placed on care and maintenance in July 2015. Mineral reserves were re-classified as mineral resources in the 2015 mineral resources statement (Dec. 31, 2015).

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

**Fig. 4.** First-stage crusher at Mt. Milligan mine.

3.1.2. Endako (Centerra Gold Inc., 75%; Sojitz Moly Resources Inc., 25%)

The **Endako** mine has been on care and maintenance status since July 2015. Endako is a large (200 x 800 m) low-fluorine porphyry molybdenum deposit, about 320 m deep, hosted by Endako batholith quartz monzonites. The open pits extend across four structural blocks in a northwesterly direction.

3.2. Coal mines

Metallurgical coal mining returned to the Northeast Region with the reopening of two of three mines that Conuma Coal Resources Ltd. acquired in 2016 from Walter Energy Canada Holdings Inc. (Fig. 5; Table 2). The **Brule** mine, on care and maintenance since June 2014, reopened in late 2016, and the **Wolverine** (Perry Creek) mine, on care and maintenance since April 2014, reopened in January 2017. The third mine, **Willow Creek**, also placed on care and maintenance in 2014, is projected to return to production in late April 2018. Peace River Coal's **Trend-Roman** mine has been on care and maintenance since December 2014.

3.2.1. Brule mine (Conuma Coal Resources Ltd.)

The **Brule** mine (Table 2) releases pulverized coal injection (PCI) coal from three seams in the lower part of the Gething Formation (Cretaceous; Bullhead Group), with a cumulative thickness of about 12 m. The coal was transported by truck on a dedicated haul road and, later in the year, by rail to Conuma's loadout facility at its **Willow Creek** mine. The remaining mine life is about seven years. Like current and previously operating mines in Northeast British Columbia, the coal is contained in folded rocks modified by thrust faulting, so that the seams are commonly steeply dipping.

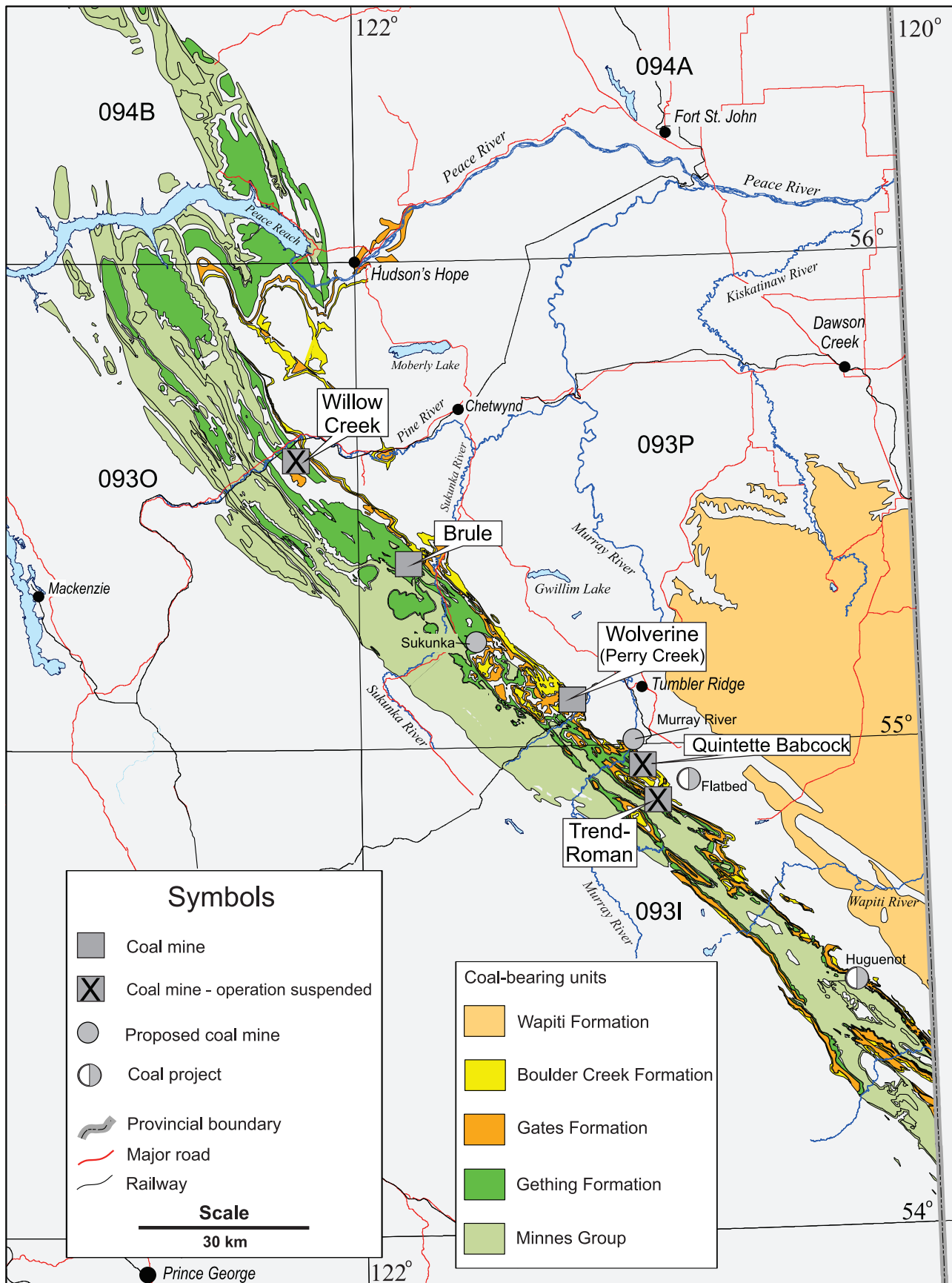


Fig. 5. Coal mines and exploration projects, northeastern British Columbia, 2017. From British Columbia Geological Survey (2018).

Table 2. Coal mines, North Central and Northeast regions.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1- Q3)	Reserves	Resource	Comments
Willow Creek	Conuma Coal Resources Limited	HCC, PCI; Bituminous coal; 093O 008	na	P+Pr: 16.6 Mt	na	Placed on care and maintenance in 2013. Anticipated to re-open late April 2018 with about 230 employees when in full production.
Brule	Conuma Coal Resources Limited	PCI; Bituminous coal; 093P 007	2.33 Mt	P: 16.3 Mt	na	Restart activities began in Sept. 2016, ramp-up complete June 2017. About 550 employees, Brule and Perry Creek combined.
Wolverine (Perry Creek)	Conuma Coal Resources Limited	HCC; Bituminous coal; 093P 025	1.14 Mt	P: 8.8 Mt	na	Placed on care and maintenance in 2014. Restart process began Jan. 2017, ramp-up complete June 2017.
Trend (Trend-Roman)	Anglo American plc (Peace River Coal Inc.)	HCC; Bituminous coal; 093I 043	na	P: 8.3 Mt	na	Placed on care and maintenance in 2014, 50,000 t mined inventory shipped in January 2015.
Roman Mountain (Trend-Roman)	Anglo American plc (Peace River Coal Inc.)	HCC; Bituminous coal; 093I 043	na	P: 25.8 Mt	na	Placed on care and maintenance in 2014.
Quintette (Babcock)	Teck Coal Limited	HCC, TC; Bituminous coal; 093I 011	na	P: 39.1 Mt	120.3 Mt mineable in situ (additional to reserves)	Placed on care and maintenance in 2014.

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

3.2.2. Wolverine (Perry Creek) mine (Conuma Coal Resources Ltd.)

Mining at **Wolverine** (Fig. 6) is from the Gates Formation in the Fort St. John Group (Cretaceous). The product is medium-volatile bituminous hard coking coal (HCC), which was trucked on Conuma's haul road and, later in 2017, moved by rail, to its load-out facility at the Willow Creek mine. The approximate remaining mine life is three years, but activity in the area will be extended if Conuma elects to move its operation to the nearby EB deposit.

3.2.3. Willow Creek mine (Conuma Coal Ltd.)

The **Willow Creek** mine (Fig. 7) was placed on care and maintenance by Walter Energy in 2014 and is forecast to resume production under Conuma's management in late April 2018. In the interim, the wash plant and load-out facility at Willow Creek continues to serve operations at Brule and Perry Creek. As with the Brule Mine, at Willow Creek coal is extracted from the Gething Formation. Structure is more complex at Willow Creek than at the other mines, making production more expensive.



Fig. 6. Coal mining operations at the Wolverine mine, Conuma Coal Resources Limited.



Fig. 7. Stockpiled coal at the Willow Creek mine, Conuma Coal Resources Limited.

3.2.4. Trend and Roman Mountain mines (Peace River Coal Inc.)

Peace River Coal's **Trend** mine (and nearby Roman Mountain deposit) were placed on care and maintenance in December 2014, with Trend ceasing production, and development activities on Roman Mountain halted.

3.3. Industrial mineral mines and quarries

In 2017, two industrial mineral producers, Fireside Minerals Ltd. and Green Mountain Jade Inc., operated in the North Central Region (Fig. 1; Table 3).

3.3.1. Fireside Barite (Fireside Minerals Ltd.)

Fireside Minerals Ltd, quarries massive white barite from veins cutting Paleozoic sedimentary rocks of the Kechika Group near the Yukon border. The barite veins are steeply dipping, trend north to northeast, and have a combined true thickness of 6.5 m. Barite concentrations in the veins ranges 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. In 2017 production amounted to 38,800 t, from the Moose Pit opened in 2016. A small resistivity survey was conducted at the north end of the pit.

3.3.2. Ogden Mountain (Green Mountain Jade Inc.)

Green Mountain Jade Inc. continued its mining and exploration for jade at **Ogden Mountain**, north of Fort St. James. This nephrite jade deposit is hosted by serpentinite lenses emplaced along the Pinchi fault and is also found as boulders (Fig. 8). Only a small percentage of jade meets quality standards and, in 2017, only 20,000 kg were shipped of the 400,000 kg extracted.



Fig. 8. Jade boulders cut for evaluation at Ogden Mountain mine.

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 2017, about 98 placer gold operations were approved in British Columbia, 23 of which were in the

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

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1- Q3)	Reserves	Resource	Comments
Fireside (Northeast region)	Fireside Minerals Ltd.	Barite; Vein barite; 094M 003, 094M 019	38,800 t	P+Pr: 475,000 t (non-NI 43-101 compliant)	na	Mined from the Moose Pit. With possible extension to north.
Ogden Mountain (North Central region)	Green Mountain Jade Inc.	Nephrite jade; Jade; 093N 156, 093N 157, 093N 165	20 t	na	na	Exploration placer and open pit mining of alluvial jade boulders, excavation of in situ jade.

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

North Central Region. These were distributed primarily in the Manson Creek, Fort St. James to Mackenzie, and Hixon areas, with total surface disturbance estimated at 23.18 ha. 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. These paleochannels do not necessarily follow modern drainage patterns.

5. Mine or quarry development

Although several mines and quarries are proposed for development in the North Central and Northeast regions (see section 6 below, and Table 4), none was as yet under construction in 2017. To be formally considered an operation under development, all government permits for construction and operation must be in place. Teck Coal's **Quintette** (Babcock) coal mine was in a combined development and early production stage when the operation was placed on care and maintenance in 2014. Development had been underway for the **Roman Mountain** expansion at Anglo American's Trend Mine, when Trend was placed on care and maintenance late in that year.

6. Proposed mines or quarries

At the point of a mine proposal (Fig. 1; Table 4), the character and content of a mineral deposit has been established to a degree of confidence that the proponent considers that mining would be economically feasible. Environmental review typically will have been ongoing for some time, but at this stage the proponent submits an application for an Environmental Assessment Certificate and/or receipt of a Section 10 permit, which states that a project is reviewable by the Environmental Assessment Office (EAO). For proposed small-scale operations that do not meet the EAO threshold criteria for review, a Mines Act permit application may be submitted directly. This category also includes projects that have received their Environmental Certificate but are in the final Mines Act permit application review process before development and production.

In 2017, the North Central and Northeast regions combined had five projects at various stages and activity in the pre-application phase of environmental assessment leading to the major mine application (Table 4). In December, the **Murray River** coal mining project received a positive environmental assessment decision from the federal government, although the **Sukunka** project ended the year on hold because of environmental concerns.

6.1. Proposed metal mines

6.1.1. Kemess Underground (AuRico Metals Inc.)

The **Kemess Underground** (KUG) is a calc-alkaline porphyry copper-gold-silver 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 to 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.

On 1 September, 2017, AuRico Metals Inc. applied to the Major Mines Permitting Office, with all applications to be reviewed concurrently. The Canadian Environmental Agency had already issued a positive decision statement, and the Environmental Assessment Office had granted an Environmental Assessment Certificate. On 2 November 2017, KUG's permit applications passed screening and were accepted for review by the Mine Review Committee.

In a technical report issued in July 2017, KUG was estimated to contain 246.4 Mt of Indicated resource containing 1.195 Mlbs of Cu, 3.3 Moz of Au, and 13.9 Moz of Ag. Within this resource are Probable reserves of 107.4 Mt containing 629.6 Mlbs of Cu, 1.9 Moz of Au and 6.7 Moz of Ag.

The former **Kemess South** (KS) mine closed in 2011. However, KS infrastructure remains in place, and both the camp and ore processing plant would be used to service the newly developed mine. About 6.5 km north of the KS process plant, KUG is considered a stand-alone operation for permitting purposes, to be mined by panel caving with crushed ore conveyed underground to the process plant. A nearby deposit, **Kemess East** (KE) is about 1 km east of KUG, KE is also being treated as a stand-alone underground operation, but would use facilities developed for KUG. Waste rock and tailings from KUG would be placed in the KS 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.

In November 2017, Centerra Gold Inc. announced its intent to purchase AuRico in a \$243 million cash payment of \$1.80 per share. Finalizing the arrangement will require court and regulatory approvals, and the approval of two-thirds of voters at a special meeting of AuRico shareholders expected in January 2018.

6.1.2. Blackwater (New Gold Inc.)

New Gold Inc. is 100% owner of the **Blackwater** project, about 110 km southwest of Vanderhoof. It is accessible by existing roads, but development would require construction of a 140 km transmission line from a substation south of Endako. The mine operation, once completed, would consist of an open pit, ore processing facility, waste rock dump, tailings pond, water management facilities, offices, employee accommodations, warehouses, and a truck shop.

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

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

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Blackwater (North Central region)	New Gold Inc.	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037	P: 124.5 Mt at 0.95 g/t Au, 5.5 g/t Ag, containing 3.79 Moz Au, 22.1 Moz Ag. Pr: 169.7 Mt at 0.68 g/t Au, 4.1 g/t Ag, containing 3.73 Moz Au, 22.3 Moz Ag	M: 117 Mt at 1.04 g/t Au, 5.6 g/t Ag containing 3.90 Moz Au, 21.06 Moz Ag. I: 189 Mt at 0.78 g/t Au, 6.0 g/t Ag, containing 4.73 Moz Au, 36.47 Moz Ag, additional to reserves	Environmental Assessment (under review), engineering and environmental studies. Proposed open-pit mine with 60,000 tpd ore processing rate and life-of-mine average annual production of 12.8 t (413 Koz) Au and 54.2 t (1.74 Moz) Ag over a 17-year mine life.
Kemess Underground (KUG) (North Central region)	AuRico Metals Inc.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 021	Pr: 107.38 Mt at 0.27% Cu, 0.54 g/t Au, 1.99 g/t Ag; containing 285.6 Kt (629.6 Mlbs) Cu, 58.1 t (1.87 Moz) Au, 214 t (6.88 Moz) Ag	I: 246.4 Mt at 0.22% Cu, 0.42 g/t Au, 1.75 g/t Ag; containing 542.2 Kt (1195 Mlbs) Cu, 103 t (3.33 Moz) Au, 431.3 t (13.87 Moz) Ag; inclusive of reserves	New NI 43-101 report, EA certificate granted, engineering and environmental studies ongoing. Major Mine permit application submitted Aug. 31. Proposed underground panel cave mine with 24,600 tpd ore processing rate and life-of-mine average annual production of 3.30 t (106,000 oz) Au and 21 Kt (47 Mlbs) Cu over a 12-year mine life.
Aley (North Central region)	Taseko Mines Limited (Aley Corporation)	Nb; Carbonatite-hosted deposit; 094B 027	P+Pr: 83.8 Mt at 0.50% Nb ₂ O ₅ ; containing 293 Kt* Nb *calculated by Jago, 2017	285.8 Mt at 0.37% Nb ₂ O ₅ ; containing 739.2 Kt* Nb (including reserves) *calculated by Jago, 2017	Environmental Assessment (pre-app), geochemical characterization studies, environmental baseline monitoring. Proposed open-pit mine with 10,000 tpd ore processing rate and average annual production of 9000 t niobium over a 24-year mine life.
Giscome (North Central region)	Graymont Western Canada Inc.	CaCO ₃ ; Limestone; 093J 041, 093J 025	na	I: >100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ.	Environmental Assessment under review. Proposed 600,000 tpd limestone quarry to feed a vertical lime kiln producing 198,000 t of lime annually over a 50+ year mine life.
Wapiti East (Northeast region)	Fertoz International Inc.	P ₂ O ₅ ; Sedimentary phosphate deposits; 093I 039, 093I 022, 093I 008	na	I: 0.81 Mt at 22.3% P ₂ O ₅ ; Indicated	Mines Act permit application, bulk sample (17,500 t permitted), temporary road (2.2 km). Proposed seasonal shallow open-pit mine with average annual production of less than 75,000 t phosphate rock over a 20+ year mine life; organic certification obtained.
Murray River (Northeast region)	HD Mining International Ltd.	HCC; bituminous coal; 093I 010	P: 261.6 Mt mineable	M+I: 314.2 Mt in situ	Proposed underground longwall mine with average annual production of 4.8 Mt of saleable coal over 25-year mine life. Provincial EA Certificate issued 2015; Federal EA Decision Statement issued December 2017.

P = Proven; Pr = Probable; M = Measured; I = Indicated; Inf = Inferred; HCC = hard coking coal

In 2017, the company continued advancing its environmental assessment process and coordinated with both federal and provincial governments, with the aim of meeting the requirements for an Environmental Assessment Certificate (EAC) from the Province of British Columbia, and a Decision Statement from the federal Minister of the Environment. In addition, New Gold continued collecting baseline data, completed additional soil and till sampling, and undertook geotechnical work related to mine design. Proven and Probable reserves stand at 8.2 Moz of Au, and 60.8 Moz Ag. As proposed, Blackwater would be a 60,000 tpd operation with a 17-year mine life.

6.1.3. Aley (Taseko Mines Ltd.)

Taseko Mines Ltd.'s wholly-owned **Aley** niobium-bearing carbonatite project is near the western extremity of platformal strata, about 140 km north of Mackenzie in the North Central Region (Fig. 1). The dolomite carbonatite intrusion (with minor calcite carbonatite) is oval in surface intersection, measuring about 2.0 x 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.

6.2. Proposed coal mines

Two coal mines are proposed, both in the Northeast Region.

6.2.1. Murray River (HD Mining International Ltd.)

Murray River is a proposed underground mine that would extract coal from the Gates Formation by longwall methods, producing 4.8 Mt of saleable coal annually during a 25-year mine life. Proven mineable reserves are 261.6 Mt, and Measured plus Indicated resources are 314.2 Mt. In 2015, HD Mining International Ltd. completed bulk sampling for testing coal quality, processing, and marketability and in December 2017, the Government of Canada issued an Environmental Assessment Decision Statement that approved the project subject to legally binding conditions. These included: consultation with First Nations on implementing the conditions; avoiding, mitigating or offsetting impacts on caribou habitat; and limiting methane emissions to not more than 500,000 t of equivalent CO₂ annually. The provincial Environmental Assessment Certificate had been issued in October 2015.

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

The **Sukunka** project had been planned as both an open pit and underground operation, extracting coal from the Gething Formation. The environmental assessment process was suspended in January 2016, pending further study on the effects to caribou and water quality. The project did not have an active permit in 2017.

6.3. Proposed industrial mineral mines or quarries

6.3.1. Giscome (Graymont Western Canada Inc.)

At the **Giscome** project in the North Central Region (Fig. 1), Graymont Western Canada proposes to exploit a high-purity Paleozoic limestone deposit in basaltic rocks of the Antler Formation (Slide Mountain Group). Crushed stone would be transported about 5 km by conveyor 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 British Columbia Environmental Certificate for the project is in place, and the Mines Act Permit process is underway. The company anticipates starting construction in 2019 or 2020, with up to 600 Kt of limestone quarried annually. The product would service mining and pulp and paper operations in northern British Columbia. Once in operation, the project would provide about 10 seasonal jobs at the quarry and a further 15 or more at the lime plant, and would remain in production for about 50 years.

6.3.2. Wapiti East (Fertoz International Inc.)

Fertoz International Inc. continued progress on its Mines Act permit for the **Wapiti East** phosphate project in the Northeast Region. The deposit is of pelloidal and nodular phosphate-bearing units interbedded with siltstones of the Spray River Group (Triassic). The product is intended for direct crop application in organic food production. From a 17,500 t bulk sample permitted in 2016, the company offered 1100 t for sale in early 2017, with more material to be extracted during the year. In 2017, the company focused on completing infrastructure. Once permit and infrastructure are in place, Fertoz would mine from a seasonal, shallow open-pit, with a 20-year mine life, producing up to 75,000 tpy of phosphate-bearing rock.

7. Selected exploration activities and highlights

Mineral exploration projects are classified as grassroots, early-stage exploration, or advanced-stage exploration. Grassroots exploration is at the level of a first look, and may include prospecting, mapping, airborne geophysics, and sampling for geochemistry. At the early-stage level, work may include continued grassroots work and also ground geophysical surveys, systematic soil and/or stream geochemistry, trenching, and drilling. Advanced-stage exploration progresses to resource delineation, preliminary economic assessment, and prefeasibility work. Drilling may be at the level of infill to define a resource, a bulk sample may be collected, and environmental baseline work might begin. Encouraging advanced stage exploration work progresses to mine evaluation, where much more detailed environmental, engineering, financial, and social impact studies are undertaken. The culmination of successful exploration is submission of an application to mine: for larger projects, to the Major Mines Permitting Office; for smaller projects (extracting <75,000 tpy), to the Regional Office of the Ministry of Energy, Mines and Petroleum Resources.

Although exploration activity was slow in the Northeast

Region, the North Central Region saw a significant increase from 2016, with 38 Notices of Work (excluding placer and aggregate) approved in 2017, and a further 16 under consideration. Not all of these permits saw exploration in 2017 (most are multi-year permits). Work on many of the projects begun in 2017 was at a preliminary level, with the proponents intending to ramp up activity as new funding was attracted. Among the active projects in the North Central Region, seven were at the grassroots level, 24 were early exploration, seven were advanced exploration, and two were on-lease mine site exploration projects aimed at expanding the resource (Tables 5, 6).

7.1. Selected precious metal projects

With the exception of the proposed Blackwater mine (see Section 6.2.1. above), seven significant precious metal exploration projects were active in the North Central Region in 2017.

7.1.1. Aspen (ML Gold Corp.)

Aspen is a low-sulphidation gold-silver (copper) epithermal prospect about 25 km northwest of New Gold's Blackwater project. It is at the margins of a large, potentially mineralizing pluton, with gold and silver intersections trending onto the property, which is also the site of multi-element geochemical anomalies. Work in 2017 consisted of 9.6 km of IP survey with the aim of developing drill targets.

7.1.2. Prophecy (Joe Hirak)

Prophecy is an early-stage exploration prospect in the Manson Creek area. The deposit consists of gold-bearing quartz veins and galena-bearing veins. In 2017, nine boreholes totalling 700 m were drilled in a 200 m radius around the surface showings.

7.1.3. Snowbird (Omineca Gold Ltd., Gitennes Exploration Inc.)

At the **Snowbird** project, gold is in quartz veins and stringer zones associated with the Sowchea fault zone. Nearby showings contain stibnite veins and disseminations. In 2017, 11 km of ground magnetics were carried out, following-up on a 1994 airborne survey. A 2.5 km magnetic low was considered related to gold mineralization. Soil samples (139) were collected on 100 m line spacings, and rock samples (111) were collected for assay. Ten boreholes were completed, totaling approximately 1212 m. Eight of these intersected multi-gram gold intervals, including Hole SB14-04 (16.20 g/t Au over 1.0 m), Hole SB17-02 (9.73 g/t Au over 1.0 m), and Hole SB17-08 (8.24 g/t Au over 0.52 m). The exploration focus was on the North and Main Zones, and the deposit remains open below a depth of 50 m.

7.1.4. Gibson (CANEX Metals Inc., Vector Resources Inc.)

The **Gibson** prospect is a gold-silver-copper high sulphidation mesothermal deposit hosted by quartz-carbonate veins, stockworks, and breccias. In 2017, access was established,

eight exploration trenches were dug, and 157 rock and 445 soil samples were collected. Trenching exposed mineralization in a 400 x 150 m area, and soil sampling showed strong anomalies over an 850 x 500 m area. Significant gold and silver values were reported through the sampled area. The proponents have defined drill targets and expect to initiate drilling in the spring of 2018.

7.1.5. Nechako Gold (Tower Resources Ltd.)

The Nechako Gold property is about 30 km northeast of New Gold's Blackwater project. In June 2017, the company completed an IP survey that defined a 1000 x 500 m anomaly over an untested till-covered area. In October 2017, Tower began a 30-hole reverse circulation drill program to test the till cover and top of bedrock.

7.1.6. 3Ts (Independence Gold Corp.)

The **3T's** project is a low sulphidation gold-silver bearing epithermal vein system hosted by rhyolitic units in Hazleton Group volcanic rocks. About 126 km southwest of Vanderhoof, the operation is readily accessible by resource roads. The deposit consists of more than a dozen north-striking subvertical veins along faults. Individual veins are up to 900 m long and 20 m wide. Mineralization in mainly quartz-calcite veins consists of pyrite, possible gold-silver sulphosalt disseminations and veinlets, and accessory chalcopyrite, sphalerite, and galena. In 2017, Independence gold completed a MMI soil survey that identified new drill targets. The company is seeking a partner for 2018.

7.1.7. Toodoggone Gold (Sable Resources Ltd.)

Sable Resources has a long history in the Toodoggone region, as operator of the Shasta mine (now on care and maintenance) and Baker mill, and proponent of several mineral occurrences. The area, north of the Kemess projects, is readily accessible by forest service and mineral exploration roads in its southern (Baker) area; but more northerly prospects, such as Bot, are not accessible by road. In 2017, the company came under new management, acquired new funding, and partnered with JDS Energy and Mining Inc. and Talisker Exploration Services Inc. The Baker project includes the Shasta mine.

The **Toodoggone Gold** projects lie along the eastern limb of the Stikine arch, which in its western limb hosts advanced exploration targets in the so-called 'golden triangle' of northwestern British Columbia. Deposit types of interest in the Baker area are copper-gold porphyry systems and low-to intermediate-sulphidation gold-silver (+/-copper) vein systems. The Bot project is 43 km northwest of Baker, and the initial target is copper-zinc-lead-silver-gold-barite stockworks in a sheared volcanic host rock, related to the emplacement of a mineralized monzonite. Sable Resources is committed to cleanup and site stabilization in the Baker area, including dam and spillway inspection. In October, the company was permitted for a significant diamond drilling program and an IP survey.

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-Cu (low sulphidation); 093F 055, 093F 068	I: 5.452 Mt at 2.52 g/t Au, 71.5 g/t Ag; containing 13.7 t (441,000 oz) Au and 390.0 t (12.54 Moz) Ag	MMI soil survey. New drill targets identified; considering further work in 2018.
Akie	Canada Zinc Metals Corp.	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag; 094F 031	I: 19.6 Mt at 8.17% Zn, 1.58% Pb, 13.6 g/t Ag; containing 1.6 Mt (3540 Mlbs) Zn, 311 Kt (685 Mlbs) Pb, 267 t (8.6 Moz) Ag	Structural reinterpretation of satellite imagery. 8 holes on Cardiac Creek zone, 4700 m total. 1100 samples taken. All holes intersected mineralization; final two expanded indicated resource.
Aspen	ML Gold Corp.	Au, Ag; Low sulphidation epithermal; 093F 038, 093F 028	na	9.6 km IP survey.
Blackwater	New Gold Inc.	Au, Ag, Cu; Low sulphidation epithermal Au-Ag-Cu; 093F 037	M: 117Mt at 1.04 g/t Au, 5.6 g/t Ag containing 3.90 Moz Au, 21.06 Moz Ag. I: 189 Mt at 0.78 Mg/t Au, 6.0 g/t Ag, containing 4.73 Moz Au, 36.47 Moz Ag, additional to reserves	Continued to advance EA process, geotechnical site investigations, soil and till sampling, reclamation. EA approval anticipated 2017.
BT	Porpoise Bay Minerals Ltd.	Ni, Cu, Au, Co; Serpentine-hosted; 093G 063, 064, 073, 074	na	Rock samples over 6 years averaged 0.185% Ni. Backpack drilling and sampling for analysis. 2017: sampling over 24 m in serpentinite returned over 1% Cu values, with anomalous cobalt.
CAP claims (formerly Carbo)	Arctic Star Exploration Corp.	Nb ₃ O ₅ ; Carbonatite- hosted deposits	na	4 drill holes, total 647.5 m, prospecting. Discovered a new carbonatite deposit. Drilling highlight 0.63% Nb ₂ O ₅ over 2.26 m.
Cat	Cat Syndicate	Cu, Au, Ag; Alkaline porphyry Cu-Au; 094C 069	na	Prospecting sampling.
Chuchi	AuRico Metals Inc.	Cu, Au; Alkaline porphyry Cu-Au; 093N 159	I: historic non-NI 43-101 compliant: 50 Mt at 0.21- 4.0% Cu, 0.21-0.44 g/t Au (Digger Resources Inc., 1991)	Property inspection for familiarize and to outline 2018 exploration targets. AuRico Metals Inc. purchased the property from Kiska Metals Corp.
Coral	Minfocus Exploration Corp.	Zn, Pb; Mississippi Valley-type Pb-Zn; 094B 008, 094B 021	na	Completed a 16 km ² LiDAR survey over the property.

Table 5. Continued.

Decar	FPX Nickel Corp.	Ni; Ultramafic-hosted; 093K 039, 093K 072	2013 I: 1160 Mt at 0.124% Ni Inf: 870 Mt at 0.125% Ni	8 holes total 1197 m, along strike from previous drilling. Results support expansion of Baptiste deposit 650 m to SE. 2017 and previous drilling in the southeast portion of the Baptiste deposit defined a zone approximately 1000 metres long east-west by 200 to 600 metres wide of near-surface mineralization.
Duke	Amarc Resources Ltd.	Cu, Mo, Au; Porphyry Cu-Au; 093M 009, 093M 121, 093M 163	historic non-NI 43-101 compliant I: 41 Mt at 0.25% Cu, 0.01% Mo	2 holes, total 1045.5 m, with several intersections over 1.1 g/t Au.
Fran East	MGX Minerals Inc.	Cu, Au; Alkaline porphyry Cu-Au; 093K 108, 093N 207	na	3 holes total 112.6 m intersected mostly overburden, except one that bottomed in mineralized Takla volcanic rocks. Deeper drilling planned for 2018.
Gibson	Canex Metals Inc.	Au, Ag, Cu; High sulphidation epithermal Au-Ag-Cu; 093N 185	na	8 trenches; Au values across 400 x 150 m. Strong Au soil anomalies across 500 x 850 m.
Groundhog North	Atrum Coal Ltd.	Coal; Anthracite; 104A 086, 104A 078	M+I: 349 Mt in situ Western Domain Inf: 260 Mt in situ Eastern Domain	Environmental baseline water survey and monitoring. Permit on hold in context of new management board.
JD	Freeport McMoRan Mineral Properties Canada Ltd.	Au, Ag; Epithermal vein Au-Ag; 094E 171	na	13.8 line km IP, mapping.
Joy	Amarc Resources Ltd.	Cu, Mo, Au; Porphyry Cu-Mo-Au; 094E 106	na	Completed 3 holes total 1527 m to test coincident IP and geochem anomalies. Airborne mag, 49 line km IP, 638 talus fines samples for analysis, mapping. Farm-in agreement with Hudbay Mining (Amarc was 2017 operator).
Kemess East	AuRico Metals Inc.	Cu, Mo, Au; Porphyry Cu-Mo-Au; 094E 315	I: 113.12 Mt at 0.38% Cu, 0.46 g/t Au, 1.94 g/t Ag, containing 954 Mlb Cu, 1680 Koz Au, 7066 Koz Ag.	New NI 43-101 July 2017. 10 holes (8 on Kemess East and 2 on “offset zone,” total 13,923 m. AuRico Metals purchased by Centerra Gold, subject to final approval Jan. 2018.
Kliyul	Aurico Metals Inc.	Cu, Au, Ag; Au skarn, subvolcanic Cu-Ag-Au (As-Sb); 094D 023, 094D 182	I: historic non-NI 43-101 compliant: 2.3 Mt at 6.9 g/t Ag, 1.3 g/t Au, 0.45% Cu.	350 m grid total 383 rock/soil samples for analysis, surface ELF survey. AuRico acquired Kiska Metals Corp. March, 2017.

Table 5. Continued.

Kwanika	Kwanika Copper Corp. (65%) Serengeti Resources Inc. (35%) Daewoo Minerals Canada Corp.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 093N 073	I: Central Zone pit: 101.5 Mt at 0.31% Cu, 0.32 g/t Au, 0.96 g/t Ag, containing 316.2 Kt (697.2 Mlbs) Cu, 32.3 t (1.04 Moz) Au, 97.0 t (3.12 Moz) Ag; Central Zone UG: 29.7 Mt at 0.34% Cu, 0.36 g/t Au, 1.05 g/t Ag, containing 100.8 Kt (222.3 Mlbs) Cu, 10.9 t (350 Koz) Au, 31.4 t (1.01 Moz) Ag	New NI 43-101 released April 2017. Serengeti and Daewoo formed joint venture company, Kwanika Copper Corp., agreement completed October 2017.
Longworth	MGX Minerals Inc.	Silica; Silica-rich rocks; 093H 038	na	3 drill holes total 500 m, 28 line km IP and Mag, 744 soil samples, ZTEM heli survey reinterpretation. 99.5% SiO ₂ average value (Snow zone boreholes).
Milligan West	Serengeti Resources Inc. (56%) Fjordland Exploration Inc. (44%)	Cu, Au; Alkalic porphyry Cu-Au; 093N 131	na	3-hole, total 1220 m drill program. Further work indicated.
Mt. Milligan	Centerra Gold Inc. (Centerra BC Holdings)	Cu, Au, Ag; Alkalic porphyry Cu-Au; 094N 194, 093N 091	Producing mine; see Table 1	On-lease exploration 13 holes total 6100 m, Off lease, 68.6 line km IP, 320 line km ground magnetics.
Nechako Gold	Tower Resources Ltd.	Au, Ag; Epithermal; 093F 060, 093F 004	na	IP survey detected 1000 x 500 m anomaly over untested area. 38 RC drill holes to test till and top of bedrock in area of anomaly, results pending.
OGK (Nova Block)	Cat Syndicate	Cu, Au, Ag; Alkalic porphyry Cu-Au; 094C 177, 094C 138, 094C 174	na	Geochemical sampling (rock), prospecting.
Orbit	Jonathan Rempel	Mo; Porphyry; 093K 115, 093K 106	na	Mechanical till sampling.
Panorama North	Atrum Coal Ltd. (JOGMEC (Japan Oil, Gas, and Metals National Corporation))	Coal; Anthracite; 104A 085, 104A 089	na	5 wide-spaced drill holes, total 1227.5 m, extensive surface mapping, core studies and interpretation. JOGMEC entered a farm-in agreement in 2016.
Pil (Pillar East)	Finlay Minerals Ltd.	Cu, Au, Ag; Porphyry Cu±Mo±Au, Au-Ag-Cu (low sulphidation); 094E 213, 094E 215, 094E 216, 094E 217	na	Airborne magnetometer survey. Permitted for heli-supported drill program.

Table 5. Continued.

Pinnacle Reef (formerly Later)	Pacific Empire Minerals Corp. (ML Gold Corp.)	Cu, Au; Alkalic porphyry Cu-Au; 093N 169	na	5 holes from 3 sites, total 1079.6 m, access trail drill site reclamation.
Snowbird	Omineca Gold Ltd.	Au epithermal in quartz veins; 093K 036	na	10 holes, focus on Main and North zones, total 1212 m. 50 line km ground mag, mapping, soil (139) and rock (111) sampling. 8 holes showed multi-gram Au intervals. Deposit open below 50 m.
Stardust (formerly Lustdust)	Sun Metals Corp.	Ag, Pb, Zn; Skarn Ag-Pb-Zn; 093N 009	na	3 drill holes total 500 m, 28 line km IP and Mag, 744 soil samples, ZTEM heli survey reinterpretation. June 2017, optioned by Lorraine Copper Corp. to 1124245 BC Ltd. Nov. 2017, acquired by Sun Metals Corp.
Toodoggone Gold	Sable Resources Ltd.	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation); 094E 026, 094E 072, 094E 027	na	Airborne geophysics. Permitted for IP, Drilling. 2017 focus was on site cleanup, development of reclamation/closure plans (Baker and Shasta).
UDS	Serengeti Resources Inc.	Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 070	na	3 holes, total 1140 m, roughly triangular layout, 330-650 m apart. Additional work considered warranted.

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 093I 049	Inf: 298 Mt	5 vertical holes on approx. 1800 m centres, total 2832 m. Flat-lying Gates Fm. coal at about 700 m depth.
Huguenot	Colonial Coal International Corp.	Coal; Bituminous	M: 96.2 Mt surface, 18.85 Mt underground. I: 35.75 Mt surface, 126.88 Mt underground	Continued environmental monitoring.

M = Measured; I = Indicated; Inf = Inferred

7.2. Selected porphyry projects

All ten of the porphyry projects discussed below are in the North Central Region.

7.2.1. Mt. Milligan (Centerra Gold Inc.)

Centerra Gold's **Mt. Milligan** mine is the only current producer in the North Central Region. (see section 3.1.1. above). During 2017, Centerra undertook significant on-lease exploration activities close to the open pit. Thirteen boreholes, totalling 6,100 m were completed, all near the west and northwest pit walls, to infill areas of low-density drilling and to test for extensions to the ore body. In addition, about

68.8 line km of IP exploration on 400 m line spacing were completed on Centerra claims south of the open pit, and 320 line km of ground magnetics, southwest of the open pit, on 100 m line spacing.

7.2.2. Duke (Amarc Resources Ltd.)

Amarc's **Duke** (formerly Dorothy) property, includes a copper+/-molybdenum porphyry deposit that was the subject of an historic (NI 43-101 non-compliant) inferred resource estimated at 40.8 million tons at 0.25% Cu and 0.01% Mo. The property was explored intermittently by IP and magnetic surveys, and by shallow drilling, between 1965 and 2010,

and was acquired by Amarc in 2016. The early IP work had suggested that the mineralized system might be offset by faulting, leaving significant prospective areas unexamined. In late autumn 2017, the company had a significant drilling program underway on Duke.

7.2.3. Milligan West (Serengeti Resources Inc. (56.3%), Fjordland Exploration Inc. (43.7%))

The **Milligan West** project is a copper-gold alkalic porphyry in the Quesnel terrane just west of the Mt. Milligan mine site. It has been operated as a joint venture by Serengeti and Fjordland since 2007. In 2016, a deep-penetrating IP survey discovered a strong anomaly 4 km west of the Mt. Milligan mine and, in 2017, a 30-hole, 1220 m program was completed. Sulphide-bearing rocks were intersected, including intrusive rocks that the partners considered part of the Mt. Milligan intrusive suite.

7.2.4. Fran East (MGX Minerals Inc.)

The **Fran East** property, accessible by logging roads, is about 60 km north of Fort St. James in an area underlain mostly by Takla Group sedimentary and volcanoclastic rocks. At the Fran prospect en-echelon shear zones host quartz-sulphide veins, stockworks and replacement mineralization. Fran East is a new target east of Fran. In 2017, three boreholes totalling 112.6 m were drilled to depths ranging from 20.4 to 67.1 m. Most of the drilling intersected Quaternary glacial drift and varved clay, but one hole bottomed in magnetite-bearing Takla Group volcanic rocks containing quartz-calcite veins and sulphide mineralization. The company plans to return to the site with equipment that can penetrate to greater depths.

7.2.5. Pinnacle Reef (ML Gold Corp., Pacific Empire Minerals Corp.)

Pinnacle Reef (formerly referred to as Later) is accessible by resource road about 100 km north of Fort St. James. The prospect is near a fault contact between intermediate volcanic units of the Chuchi Lake succession and the Hagem intrusive complex, where a northeast-trending lineament intersects a discontinuity in the regional fabric. Drilling in 2015 and 2016 targeted a possible gold-rich alkali porphyry coincident with a large IP geophysical anomaly, and encountered gold mineralization in a zone of volcanic rocks with phyllic alteration. Work in 2017, included 12 line km of ground geophysics and drilling of five boreholes at three sites, totalling 1079.6 m.

7.2.6. Kwanika (Serengeti Resources Inc.)

The **Kwanika** project is about 140 km northwest of Fort St. James and can be accessed by resource roads. From work spanning more than a decade, Serengeti has defined two principal porphyry deposits, referred to as the Central (copper-gold-silver) and South (copper-molybdenum-gold-silver) zones. Both are hosted by potassic-altered mostly monzonitic rocks of the Hagem batholith.

In April 2017, Serengeti released a NI 43-101 report and preliminary economic assessment on Kwanika. The report

posits a combined open pit and underground operation with an estimated mineral resource of 131.2 Mt Measured + Indicated, and 73.1 Mt Inferred. The projected mine life is 15 years, with a milling rate of 15,000 tpd. The **Central Zone** is projected to be a combined open pit and underground operation. The open pit Indicated resource is 101.5 Mt grading 0.31% Cu, 0.32 g/t Ag and 0.96 g/t Au, containing 697,200 Mlb Cu, 1040 Moz Au, and 3120 Moz Ag. The underground mine has an Indicated resource of 29.7 Mt grading 0.34% Cu, 0.36 g/t Au, and 1.05 g/t Ag, containing 222,300 Mlb Cu, 350 Moz Au, and 1010 Moz Ag. The proposed **South Zone**, proposed as an open pit, contains an Inferred resource of 33,300 Mt, grading 0.26% Cu, 0.08 g/t Au, 1.64 g/t Ag, and 0.01 % Mo, containing 191,400 Mlb Cu, 80 Moz Au, 1760 Moz Ag, and 7470 Mlb Mo.

In October, Serengeti completed an agreement with POSCO Daewoo and Daewoo Minerals Canada (DMC) to form a joint venture company, the Kwanika Copper Corporation (65% Serengeti, 35% Daewoo), to pursue development. Under the agreement, DMC will contribute \$7 million and its 5% interest in Serengeti, and Serengeti will contribute the balance of its interest in the project. Serengeti will continue as project operator.

7.2.7. UDS (Serengeti Resources Inc.)

The **UDS** prospect is about 7 km south of the former Kemess South mine. The district contains both vein-type epithermal precious metal occurrences and porphyry gold-copper deposits, and the UDS has a geological setting similar to that of Kemess (see section 6.1.1.). An IP program in 2016 defined a target area about 1500 x 900 m that was investigated in 2017 by 1140 m of drilling in three holes 330-650 m apart. Additional work was considered warranted.

7.2.8. Kemess East (AuRico Metals Inc.)

Subject to shareholder approval, AuRico Metals was sold to Centerra Gold Inc. in 2017. The **Kemess East** (KE) deposit is about 1 km east of Kemess Underground (KUG; see section 6.1.1.).

KE is a copper-gold-silver-molybdenum calc-alkaline porphyry deposit hosted mostly by potassic-altered Black Lake plutonic rocks, with mineralization extending from about 900 m below surface to 1500 m below surface. In July 2017, a NI 43-101 report identified an Indicated resource of 113.12 Mt grading 0.38% Cu, 0.46 g/t Au, and 1.94 g/t Ag, containing 954 Mlb Cu, 1680 Koz Au, and 7066 Koz Ag. Since its discovery in about 2007, Kemess East has been explored by 91 boreholes, including ten holes in 2017. Of the 13,923 m drilled in 2017, eight holes tested the deposit's northern and southern extents, and two tested the northern extent of the Kemess Offset Zone (KOZ). On Kemess East itself, hole KE: KH-17-05 intersected 338 m of 0.64 g/t Au and 0.45% Cu, including 120 m of 1.05 g/t Au and 0.60% Cu. KH-17-08B intersected 846.5 m of 0.25 g/t Au and 0.28% Cu, including 208 m of 0.37 g/t Au and 0.41% Cu. KH-17-09 intersected 853.8 m of 0.24 g/t Au and 0.25% Cu, including 147.5 m of 0.40 g/t Au and 0.42% Cu. On KOZ,

KH-17-10 intersected 461.9 m of 0.27 g/t Au and 0.22% Cu, including 75 m of 0.61 g/t Au and 0.41% Cu.

7.2.9. Joy (Amarc Resources Ltd., Hudbay Minerals Inc.)

Amarc's **Joy** project is a copper+/-molybdenum+/-gold porphyry target. Based primarily on soil surveys, Deposit Target 1 was outlined in 2016, with a core area of 4.5 km² within a larger cluster extending across approximately 9 km². The extensive coincident copper-molybdenum-gold-silver-lead-zinc soil anomalies at Joy are interpreted to represent a potential shallowly buried copper-gold porphyry deposit.

In August 2017, Amarc completed a farm-in agreement with Hudbay Minerals, with Hudbay to spend \$15 million on the property by the end of 2020, including \$1.9 million in 2017. Drilling was undertaken, consisting of three boreholes totalling 1527 m, to test coincident IP and geochemical anomalies. Amarc also completed an airborne magnetometer survey, 49 line km of IP, geological mapping, and a geochemical survey that included 638 fine-grained talus samples.

7.2.10. Pil (Finlay Minerals Ltd.)

The **Pil** property is about 34 km northwest of AuRico Metals' Kemess project, and is accessible by resource roads from Mackenzie. Pil has been extensively explored for alkali copper-silver porphyry mineralization and epithermal gold-silver. The property encompasses several areas of mineralization, with the Pillar East and Atlas Zones being of greatest current interest. Pillar East is a north-northeast oriented quartz breccia epithermal system spatially and temporally associated with an alkalic copper-silver monzonite porphyry. In 2017, the company completed an airborne magnetometer survey over the Pillar East zone, and was permitted to begin a helicopter-supported drill program.

7.2.11. Orbit (Jonathan Rempel)

The **Orbit** project is about 15 km northeast of the Endako Mine (now on care and maintenance). In 2017, the proponent followed up on a 2016 program to sample basal till and near-surface bedrock, with mechanical till sampling. A low-level copper and iron anomaly and a small molybdenum anomaly were identified.

7.3. Selected polymetallic base and precious metal projects

Polymetallic base and precious metal projects in the North Central region include SEDEX and Mississippi Valley-type lead-zinc deposits. Although the **Akie** SEDEX project (Canada Zinc Metals) at Cardiac Creek saw significant exploration activity, the geologically related Cirque, Cirque East, Pie and Yuen prospects were idle, apart from being included in a regional structural analysis. Minfocus Exploration Corp.'s Coral Mississippi Valley-type lead-zinc prospect was idle except for completion of a LiDAR survey.

7.3.1. Akie (Canada Zinc Metals Corp.)

The **Akie** property, which contains the Cardiac Creek SEDEX

deposit, is underlain by siliciclastic and carbonate rocks of the Kechika, Road River and Earn groups near the western margin of ancestral North America. The property is accessible by resource roads, although a washout complicated access for much of the field season. The Cardiac Creek SEDEX deposit is in shales of the Gunsteel Formation (Earn Group). It is a steeply southwest-dipping stratiform baritic zinc-lead-silver body, averaging about 20 m thick. The principal economic minerals are sphalerite and galena. In 2016, the company issued a NI 43-101 report on Akie that defined an Indicated resource of 19.6 Mt grading 8.2% Zn, 1.6% Pb and 13.6 g/t Ag (at a 5% zinc cut-off grade) and an Inferred resource of 8.1 Mt grading 6.8% Zn, 1.2% Pb and 11.2 g/t Ag (at a 5% Zn cut-off grade). In 2017, the company conducted a drilling program on the Cardiac Creek deposit, aimed at extending the resource, completing eight holes totalling 4700 m. All holes intersected the mineralized zone and two expanded the indicated resource (Fig. 9). Noteworthy is borehole A-17-132, which returned 10.38% Zn+Pb and 14.2 g/t Ag over a true thickness of 28.67 m, including 12.39% Zn+Pb and 15.9 g/t Ag over a true thickness of 19.81 m, which further included 14.42% Zn+Pb and 17.2 g/t Ag over a true thickness of 10.16 m. Borehole A-17-133 returned 12.11% Zn+Pb and 16.0 g/t Ag over a true thickness of 9.42 m in a broader mineralized interval of 25.63 m. Borehole A-17-137 intersected 67.79 m grading 11.79% Zn+Pb and 19.1 g/t Ag, including 15.44 m grading 22.61% Zn+Pb and 36.1 g/t Ag. Borehole A-17-142, returned an envelope of mineralization grading 11.15% Zn+Pb and 15.5 g/t Ag over a true thickness of 32.65 m including 23.32% Zn+Pb and 30.9 g/t Ag over a true thickness of 11.31 m from the Footwall Zone. Borehole A-17-143 returned 7.77 % Zn+Pb and 9.8 g/t Ag over a true thickness of 20.49 m, including 10.41% Zn+Pb and 15.0 g/t Ag over a true thickness of 7.90 m. In 2017, Canada Zinc Metals completed a structural interpretation of satellite imagery over the Kechika trough, including Akie. The interpretation identified predominantly northeast-vergent thrust faults, except for a zone along the eastern margin of the area with structures



Fig. 9. Mottled high-grade sphalerite and galena, hole A-17-137, at approximately 529 m depth (courtesy of Canada Zinc Metals Corp.).

that verge southwest, and major transverse faults. Forty-one new exploration targets were identified.

7.4. Selected skarn projects

Exploration was carried out on two skarn projects, both in the North Central Region.

7.4.1. Stardust (Sun Metals Corp.)

The **Stardust** (formerly **Lustdust**) property is a few kilometers to the northwest of Serengeti Resources' Kwanika project. The principal system, the Canyon Creek deposit, consists of copper, gold, and silver mineralization in a limestone, dolomite and dolomitized limestone skarn. A NI 43-101 compliant report, completed in 2010, stated an Indicated resource of 1.253 Mt grading 1.33% Cu, 1.426 g/t Au and 33.0 g/t Ag. An additional 3.124 Mt grading 1.12% Cu, 1.366 g/t Au, and 25.4 g/t Ag was classified as Inferred.

Lorraine Copper acquired the claims in 2016 from ALQ Gold Corp. In June 2017, Lorraine optioned the property to 1124245 B.C. Ltd.; with the numbered company to purchase 100% of its interest by the end of 2017 for cash and \$500,000 property expenditure, and to continue \$6 million in expenditures by the end of 2021. In November 2017, the property was acquired by Sun Metals Corp. In 2017, Lorraine collected 744 soil samples to extend existing grids, ran 28 line km of IP and magnetic surveys, reinterpreted a 2011 ZTEM survey, and completed a 3 borehole drilling program to complete existing holes and to verify the continuity of three known mineralized zones.

7.4.2. Kliyul (AuRico Metals Inc.)

Kliyul (Fig. 10) is a copper-gold prospect hosted by Takla Group volcanic and sedimentary rocks that are cut by small Jurassic mid-Cretaceous diorite plutons. Mineralization comprises gold-bearing quartz veins, magnetite-rich skarn, and mineralized shear zones in altered andesite units. The skarn is most prominent, containing disseminated gold-bearing chalcopyrite and pyrite.

AuRico Metals acquired the property from Kiska Metals Corp. in March 2017, then entered into an agreement with First Quantum to conduct early-stage exploration for one year. AuRico and First Quantum completed a 30-day field program



Fig. 10. Kliyul Camp 2017 (courtesy of AurRico Metals Inc.).

that included sampling bedrock (294), subcrop (28) and soil/talus-fines (60) on a 350 m grid across the entire property. A surface ELF grid was completed across much of the property.

7.5. Selected mafic and ultramafic hosted projects

Zones of tectonically emplaced nickel-bearing ultramafic rock (serpentinite) occur along the Pinchi Fault, which separates the Quesnel and Cache Creek terranes. These serpentinite units host jade deposits and nickel mineralization.

7.5.1. Decar (FPX Nickel Corp.)

FPX Nickel Corp. (formerly First Point Minerals Corp.) continued exploration on the **Decar** project west of Fort St. James, with the technical support of Equity Exploration Consultants. The site is readily accessible by resource roads. The host rocks are tectonically emplaced serpentinized ultramafic rocks that are mineralized by disseminated awaruite (Ni_3Fe ; Fig. 11). In 2017, the company drilled eight boreholes totalling 1197 m at the **Baptiste** deposit. Near-surface mineralization was extended 500 m beyond previous drill coverage, and supported possible extension of the mineralized zone by 650 m to the southeast.

Borehole 67 intersected 96 m grading 0.167% Ni, starting at an approximate vertical depth of 42 m below surface, representing the second-highest grade, near-surface interval intersected at the deposit. Borehole 68 intersected 124 m grading 0.133% Ni, starting at an approximate vertical depth of 20 m below surface. To date, drilling in the southeast part of the Baptiste deposit has defined a zone of near-surface mineralization approximately 1000 m long and 200 to 600 m wide.

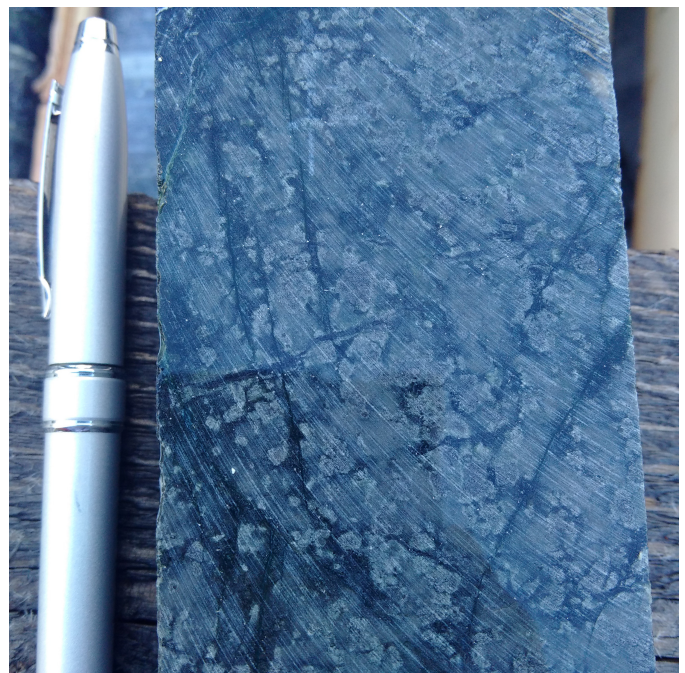


Fig. 11. Awaruite-bearing serpentinite in pseudobreccia, hole 17-BAP-063, at approximately 184 m depth.

7.5.2. BT (Porpoise Bay Minerals Ltd.)

Porpoise Bay Minerals' **BT** property is a nickel-copper-gold in serpentinite deposit about 60 km southwest of Prince George. Detailed sampling and prospecting over several years returned rock samples that averaged 16.98% Mg and 0.195% Ni. The occurrences have been extensively prospected but await detailed investigation. In 2017, outcrops were explored by backpack drilling, and samples were collected for analysis.

7.6. Selected specialty metal projects

The Western margin of continental platformal rocks is host to at least two carbonatite deposits. Taseko Mines Ltd.'s Aley project (described above), and a new discovery by Arctic Star Exploration Corp.

7.6.1. CAP Claims (Arctic Star Exploration Corp.)

In 2017, Arctic Star drilled four holes totalling 647.5 m to test coincident geochemical and geophysical anomalies on its **CAP** (formerly Carbo) property. A carbonatite-syenite (Fig. 12) was discovered in outcrop and in one of the boreholes. Between surface exposures and drilling, the deposit has a strike length of up to 3 km. In the borehole, at least 138.5 m of carbonatite was intersected: 0.35% Nb_2O_5 across 10.42 m (including 2.26 m of 0.63% Nb_2O_5); 19.63 m of 9.94% P_2O_5 (including 2.55 m of 20.97% P_2O_5); and 2.4 m of 0.81% TREOs (total rare earth element oxides).



Fig. 12. Boudin-like feature in limestone (above) intruded by carbonatite (below), CAP claims.

7.7. Selected coal projects

Coal exploration in the Northeast Region remained at a low level, with only one significant project near the Trend Mine (now on care and maintenance). In the Klappan coalfield north of Smithers, Atrum Coal continued work on its Groundhog and Panorama North projects.

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

Colonial Coal's **Flatbed** project is adjacent to Anglo American's Trend Mine. The project targets flat-lying coal in the Gates Formation (Middle Cretaceous) at depth. In 2017, the company drilled five vertical holes on 1800 m centres totalling 2830 m (Fig. 13). The holes encountered flat-lying coal units, with common shaly interbeds, at depths of about 700 m. Downhole geophysical logs were completed, and core sampled. The core was stored frozen in the company's facility near Tumbler Ridge until sampling was complete. An NI 43-101 report on the project released in late November 2017 outlined an underground mineable Inferred resource of 298 Mt of bituminous coal that were referred to as having "coking properties after beneficiation." Colonial continued environmental monitoring studies on its **Huguenot** project south of the Trend Mine. The property contains combined Measured and Indicated surface resources of 131.95 Mt, and combined underground resources of 145.73 Mt.



Fig. 13. Coarse sandstone with pebble overlying Gates Formation D seam, 726 m.

7.7.2. Groundhog North (Atrum Coal Ltd.)

The Groundhog coalfield consists of an estimated 1.57 Bt in total Measured, Indicated and Inferred categories of high- and ultra high-grade anthracite in the Groundhog unit of the Upper Bowser Lake Group (Jurassic-Lower Cretaceous). The host rocks are folded in an open northwest-trending synclinorium within which the target seams are about 2 m thick at a depth of 72 m, and about 3 m thick at a depth of 265 m.

7.7.3. Panorama North (Atrum Coal Ltd., JOGMEC (Japan Oil, Gas, and Metals National Corporation))

The **Panorama North** project is about 15 km west of the Groundhog coalfield and, similar to Groundhog, it hosts anthracitic coal seams. In 2016, Atrum entered a farm-in agreement in which JOGMEC agreed to contribute \$5 million

in cash or in-kind support for three years to earn a 35% interest in the project. During the initial program (2016), multiple shallow coal seams were encountered, including a 2.3 m thick seam at only 12 m depth. In 2017, extensive surface mapping was undertaken to identify and trace coal seams, and five wide-spaced boreholes were completed, totalling 1227.5 m.

7.8. Jade project: Ogden Mountain (Green Mountain Jade)

Ogden Mountain, in the North Central Region, was the only active Jade project in 2017. Green Mountain Jade Inc. continued mining and exploring on the property.

7.9. Selected industrial mineral projects

7.9.1. Longworth (MGX Minerals Inc.)

The **Longworth** quartzite project is in the North Central Region about 82 km east of Prince George, adjacent to the northern Rocky Mountain trench. It is hosted by Silurian greenstone, carbonate, and quartzite units of the Nonda Formation, in a steeply northeast-dipping, northwest-trending synform. Ridges of white quartzite are exposed intermittently for 6 km. Each of four high-purity zones (Snow, Rain, Long and Doll) extend along strike for 300 to 800 m and are about 400 m thick. The quartzite is massive and homogeneous; it contains muscovite, limonite and calcite as minor impurities. In 2017, the company completed three boreholes to depths ranging from 51.5 to 69 m, for a total of 186.1 m. Results indicated an average of 99.5% SiO₂ in the Snow Zone, which compares closely with surface samples.

8. Geological research

As part of a British Columbia Geological Survey project to better understand ultramafic rocks in the Cache Creek terrane, Milidragovic et al. (2018) undertook a mapping project near FPX Nickel's Decar property (see section 7.5.1.) to update existing maps, establish the petrological evolution of the mantle tectonites that host prospective awaruite mineralization, and develop a chemostratigraphic framework for Permo-Triassic volcanic and related intrusive rocks. Buckingham et al. (2017) integrated a set of gravity maps to help delineate subsurface faults in a part of Geoscience BC's TREK (Targeting Resources for Exploration and Knowledge) project area that includes the Blackwater gold deposit (see section 6.1.2.), and Angen et al. (2017) released a geological compilation map of the same area.

9. Summary

Relative to previous years, the North Central and Northeast regions saw increased levels of mining and exploration activity in 2017. Two of the coal mines in the Northeast Region that had been on care and maintenance status reopened, and a third is expected to resume in 2018. A major mine application was submitted the North Central region. The pace at which Notices of Work (exploration permits) were being issued increased through the year, and preliminary work began on ground held under multi-year permits. Major highlights in 2017 include the following.

- Re-opening of Brule and Perry Creek (Wolverine Project) metallurgical coal mines by Conuma Coal Resources Ltd.
- Issuance of an Environmental Assessment Decision Statement by the Government of Canada, subject to conditions, in favour of HD Mining International Ltd.'s proposed Murray River underground metallurgical coal mine.
- Submission of a Major Mine Permit application for the Kemess Underground project by AuRico Metals Inc.
- Continued extensive drilling on AurRico's Kemess East project.
- Completion of an agreement between Serengeti Resources Inc. and POSCO Daewoo and Daewoo Minerals Canada (DMC) to form a joint venture company, the Kwanika Copper Corporation, to pursue development of the Kwanika Central and South Zones.
- Reactivation of FPX Nickel Corp's Decar project, and extension of the mineralized zone to the southeast by drilling.
- Discovery of a new carbonatite deposit on the CAP claims by Arctic Star Exploration Corp.

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Exploration and mining in the Southeast Region, British Columbia



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1. Introduction

The Southeast Region, in the southeast corner of the province (Fig. 1), offers a variety of mining and exploration opportunities accessible by well-developed infrastructure. Five operating metallurgical coal mines in the Elk Valley account for most of Canada's coal production and exports. Several mines produce industrial minerals including silica, magnesite, gypsum, graphite, and phosphate. Placer mining occurs throughout the region, and several small operations produce aggregate, sand and gravel, and dimension stone. The region also hosts the historic lead-zinc-silver Sullivan Mine, which operated from 1909 to 2001, and produced more than 7.9 Mt of zinc, 8.4 Mt of lead, and 298 Moz of silver. The Trail smelter (Teck Resources Limited) is still in operation, and produces approximately 305,000 t of refined zinc, 99,000 t of refined lead, and up to 25 Moz of silver annually.

As in 2016, estimates for exploration expenditures, drilling programs and other metrics were captured in the British Columbia Mineral and Coal Exploration Survey, a joint initiative of the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for Mineral Exploration in British Columbia, and Ernst and Young LLP. For the Southeast Region, exploration expenditures were estimated at \$43.4 million and exploration drilling was estimated at approximately 69,450 m (Clarke et al., 2018; Ernst & Young LLP, in press).

2. Geological overview

The Canadian Cordillera has long been of interest to the exploration industry for the mineral resources it contains. It has witnessed a history spanning more than 1.8 billion years during which time diverse plate tectonic and metallogenic processes generated the equally diverse deposit types that contribute to the mineral endowment of British Columbia (Nelson et al., 2013).

The Southeast Region (Figs. 1, 2) contains autochthonous and parautochthonous elements of ancestral North America (Laurentia) including: Archean to Mesoproterozoic basement rocks; Proterozoic rift and intracratonic basin successions (Belt-Purcell and Windermere supergroups); Paleozoic to Jurassic

passive-margin, shelf, and slope carbonate and siliciclastic successions that were deposited on the western flank of the ancient continent (Kootenay terrane, and North American platform); and Jurassic to Cretaceous foreland basin deposits. It also contains parts of the Slide Mountain terrane, which records mid- to late- Paleozoic back-arc extension that split the western flank of ancestral North America to form the Slide Mountain ocean, and Quesnellia and its basement (Okanagan subterrane), which are entirely exotic to North America (Nelson and Colpron, 2007; Nelson et al., 2013). By mid-Jurassic, the emerging Canadian Cordillera had been transformed from a set of loosely connected arc and pericratonic terranes, to a progressively thickening and complexly structured accretionary wedge. Some magmatic rocks (Fig. 3) such as those formed in the Proterozoic (Moyie intrusions) and Devonian (diatremes and volcanic rocks) represent periods of extension along the margin of ancestral North America, whereas others (Jurassic, Cretaceous, and Cenozoic), are related to subduction, crustal thickening, and post-orogenic extension.

Historically, the Canadian Cordillera has been divided into five northwest-trending physiographic belts. The Southeast Region includes two of these belts (Fig. 2): the Rocky Mountain Foreland belt, which consists mainly of unmetamorphosed sedimentary successions that were thrust northeastward in thin-skinned sheets; and the Omineca belt, which includes more deformed and higher grade (greenschist to amphibolite) siliciclastic and volcanic rocks, and basement-cored gneiss domes (Monger, 1999). For further details about the geology of the Southeast Region see Katay (2017).

3. Mines and quarries

The Southeast Region produces metallurgical coal from five mines in the Elk Valley, and continues to be an important source of industrial minerals such as gypsum, magnesite, silica sand, phosphate, mineral wool, dolomite, limestone, graphite, flagstone, railroad ballast, rip rap, smelter slag and aggregate (Fig. 1).

3.1. Metal mines

In 2017, no metal mines operated in the Southeast Region.

Provincial Overview of Exploration and Mining in British Columbia, 2017. British Columbia Geological Survey, Information Circular 2018-1

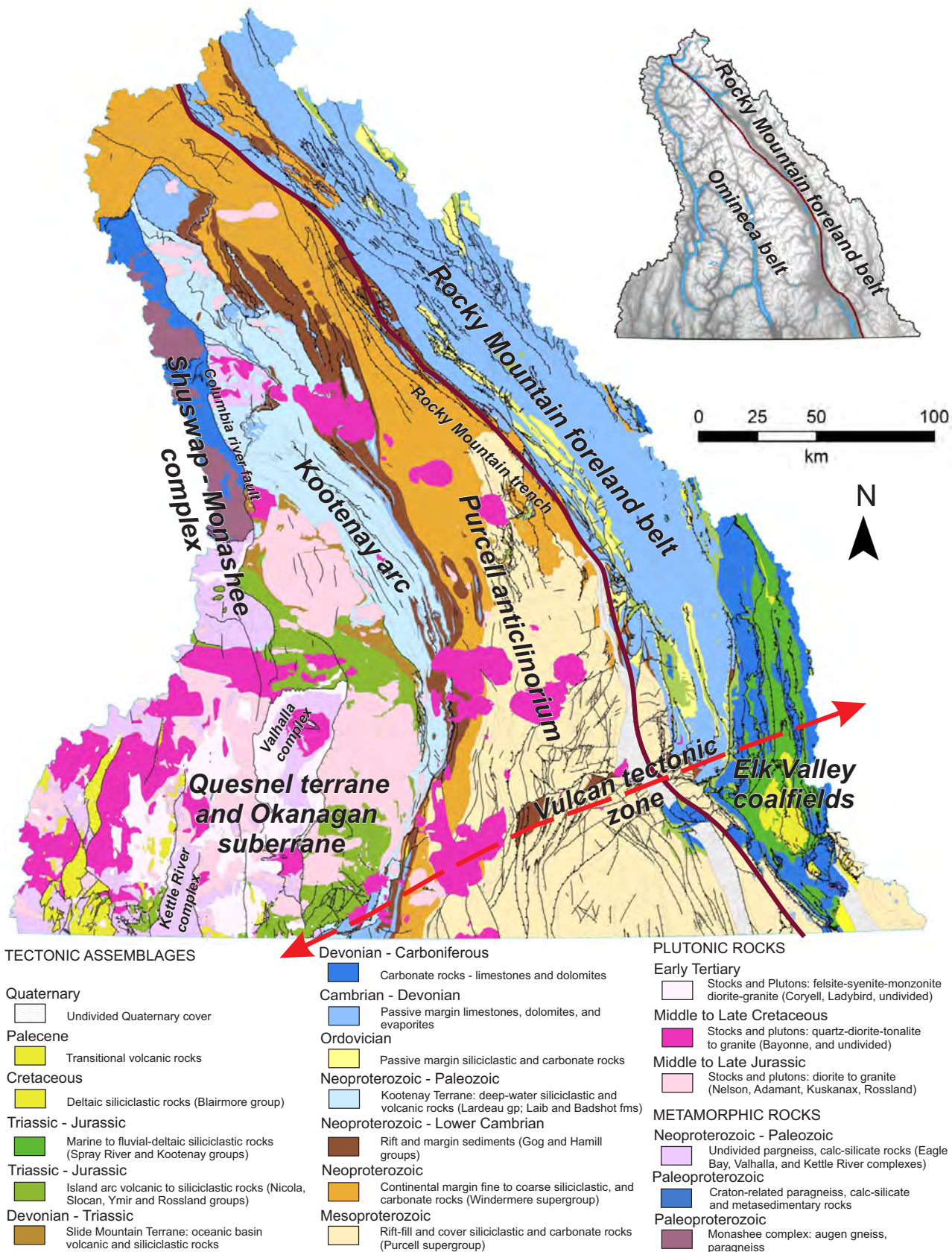


Fig. 2. Geology and physiographic belts of the Southeast Region. Physiographic belts after Nelson et al. (2013). Bedrock units are after Wheeler and McFeely (1991) and Cui et al. (2013) and generalized to highlight temporal and lithological differences in the region. Vulcan tectonic zone is after McMechan (2012).

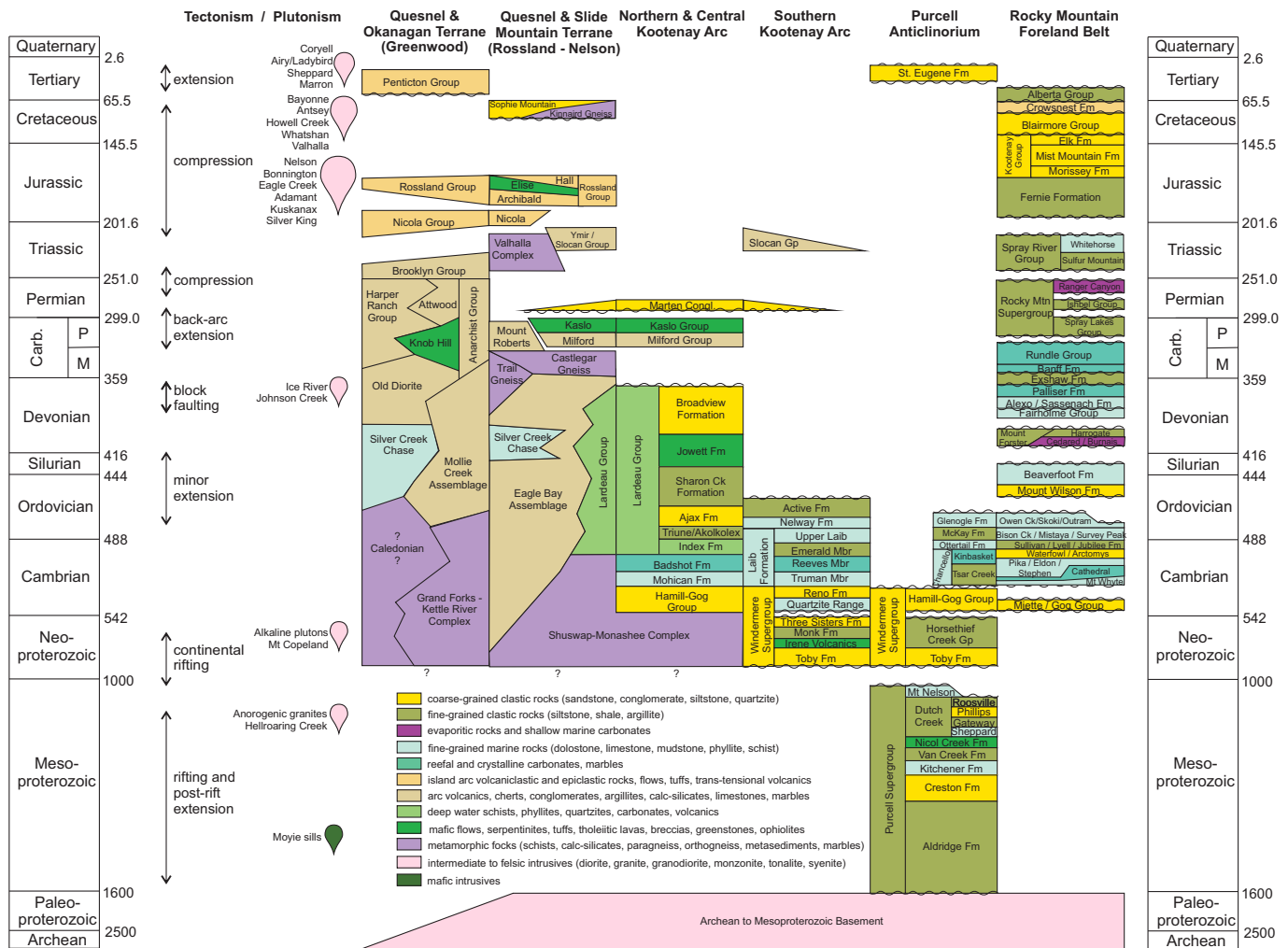


Fig. 3. Generalized stratigraphy Southeast Region. Tectono-stratigraphic events modified from Nelson et al. (2013). Selected stratigraphy and approximate ages derived from Fyles (1967, 1990), Norford (1981), Stott (1984), Monger et al. (1991), Warren and Price (1992), Grieve (1993), Sevigny and Parrish (1993), Höy and Dunne (1997), Logan (2002), Colpron and Nelson (2009), Hein and McMechan (2012), McMechan (2012), Poulton et al. (2012), Price (2012), and Slind et al. (2014). Geological timescale from Walker and Geissman (2009).

3.2. Coal mines

Southeastern British Columbia has a long history of coal mining that dates back to the 1800s, with reports of coal discovered in the Elk Valley around 1845. Today, Teck Coal Limited operates five large open-pit mines in the Elk Valley area (Table 1; Figs. 1, 4), from coal seams in the Mist Mountain Formation (Jurassic; Fig. 3). The main product is metallurgical coal (85%), with some thermal and pulverized coal injection (PCI) coal (15% combined). Teck Coal Limited's mines in the Southeast Region account for more than 70% of Canada's annual coal exports.

Coal prices continued to recover from lows in 2015-2016, and remain strong in 2017. Teck's 2017 Q3 report forecasted a quarterly benchmark price of \$185 USD/tonne, which is up from an annual average of \$93 USD/tonne in 2015, and the low of \$81 USD/tonne in Q1 2016. The coal mines in the Southeast Region remained open during the 2015-2016 down turn by reducing costs and optimizing processes. In the latter

half of 2016, Teck ramped up production in response to a rapid commodity price increase in November 2016, when coal peaked briefly around \$300USD/tonne. Record production levels were achieved in late 2016, and continued into 2017, with Q1 realized prices of \$285 USD/tonne (Teck, 2017a, b).

In 2017, total annual production from the mines in the Southeast Region was approximately 28 Mt of clean metallurgical coal. Approximately 95% of sales are transported by rail and shipped westward to Asia (75%), and to other international customers (20%), while approximately 5% is shipped via rail eastward through Thunder Bay (with a small amount through Coutts, Alberta), to North American customers (Teck, 2017a).

In recent years, environmental assessment approval of major mine projects in the Elk Valley has been conditional on developing a regional watershed management plan. In November, 2014, Teck received approval from the British

Table 1. Coal mines, Southeast Region.

Mine	Operator; Partner	Commodity	Forecast 2017 Production (based on Q1-Q3)	Reserves (as of December 31, 2016)	Resource (as of December 31, 2016)	Comments
Fording River	Teck Coal Limited (100%)	HCC	9.1 Mt	HCC P: 169 Mt, Pr: 220.5 Mt	HCC M: 486.7 Mt, I: 945.8 Mt, Inf: 789 Mt	EA approval of Swift expansion (2015); permit amendments to align mine design with improved efficiencies; exploration drilling in active pits; coal quality testing in expansion areas.
Greenhills	Teck Coal Limited (80%); POSCAN (20%)	HCC	6.2 Mt	HCC P: 25.4 Mt, Pr: 147.9 Mt	HCC M: 220.1 Mt, I: 269.5 Mt, Inf: 182.6 Mt	Cougar Pit Expansion (CPX) approved in 2016; coal quality testing.
Line Creek	Teck Coal Limited (100%)	HCC, TC	3.7 Mt	HCC P: 3 Mt, Pr: 61.7 Mt TC P: 1.2 Mt, Pr: 9.5 Mt	HCC M: 320.6 Mt, I: 419.4 Mt, Inf: 413.4 Mt TC M: 4.8 Mt, I: 4 Mt, Inf: 2.7 Mt	Burnt Ridge Extension (BRX) approved in 2016; pre-stripping on Mount Michael begun (Line Creek Phase II expansion); Commissioning of West Line Creek water treatment facility (February, 2016), with process and design optimization underway; Annual production records set in 2016.
Elkview	Teck Coal Limited (95%); Nippon Steel & Sumitomo Metal Corp. (2.5%), POSCO (2.5%)	HCC	6.3 Mt	HCC P: 11.2 Mt, Pr: 254.8 Mt	HCC M: 432.5 Mt, I: 157.5 Mt, Inf: 246 Mt	Baldy Ridge Extension (BRE) approved in 2016; pre-stripping at BRE; exploration drilling in active pits; development progressing in new approved mining areas; Annual production records set in 2016.
Coal Mountain	Teck Coal Limited (100%)	PCI	2.7 Mt	PCI P: 2.7 Mt	M: 56.1 Mt, I: 23.1 Mt, Inf: 4.9 Mt	Mineable resource at CMO is nearing depletion and expected mine shut down in early 2018; reclamation begun; facilities to be placed on Care and Maintenance; Coal Mountain Phase II (CMO2/Marten Wheeler) would utilize facilities from CMO, but currently remains on hold.

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

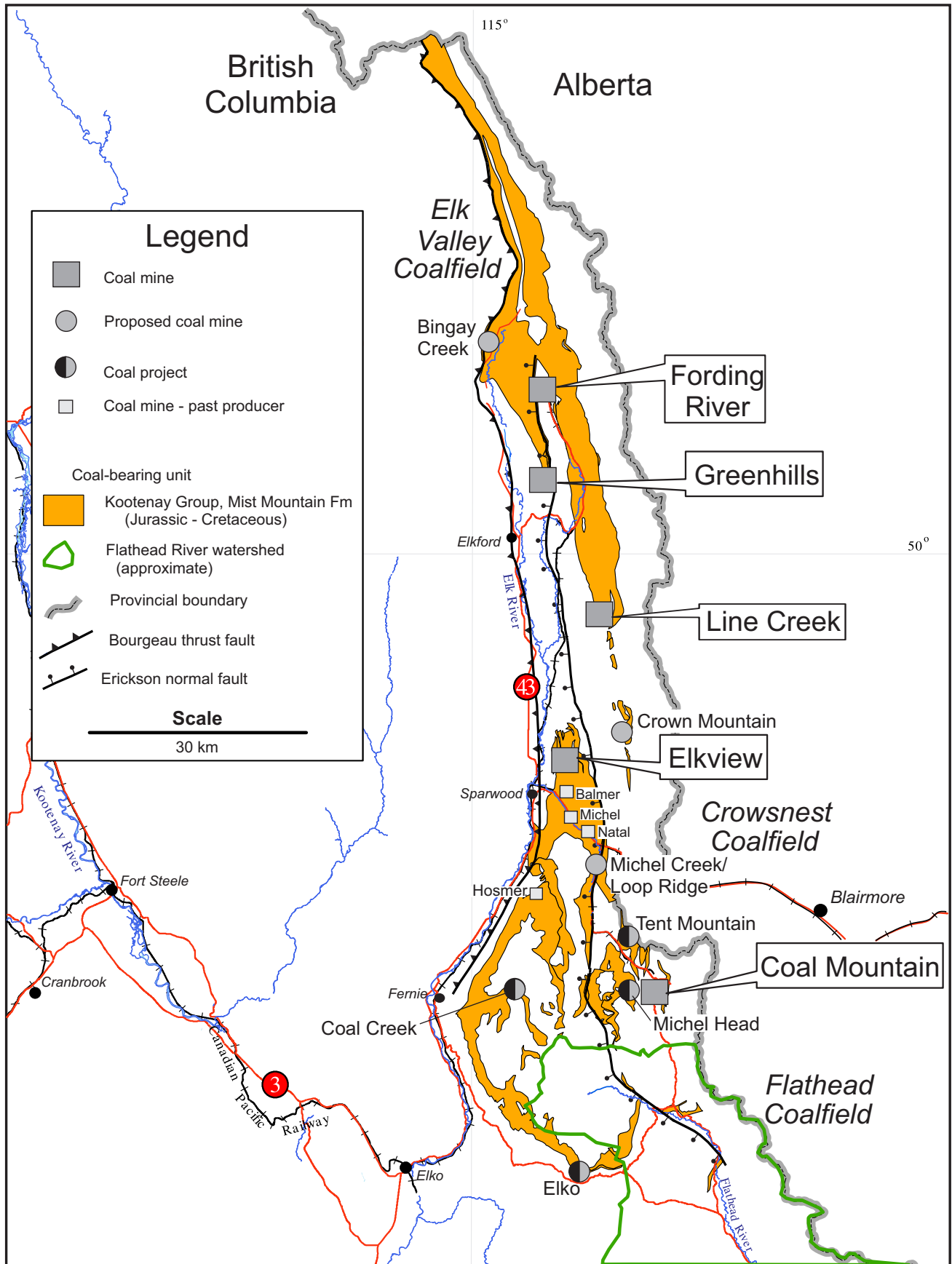


Fig. 4. Map of the Kootenay Group and East Kootenay Coalfields, including the major coal mines and projects in southeastern British Columbia.

Columbia Ministry of Environment for the Elk Valley Water Quality Plan which addresses the management of selenium and other substances released by mining activities. It is a public policy document that will guide future regulatory decisions about water quality and all mining in the Elk Valley. It includes statements about water diversion and treatment, and establishes water quality targets for selenium, nitrate, sulphate, cadmium, and calcite.

The selenium management plan was projected to cost about \$600 million over five years, and \$40 million to operate annually. In 2016, Teck spent approximately \$40 million on mitigation measures and treatment facilities; in 2017, they estimate spending \$100 million (Teck, 2017a). The West Line Creek water treatment facility (**Line Creek** mine), the first of six facilities planned for the Elk Valley has been operating since February 2016. Design and process changes since the beginning of its operation will be integrated into plans for the second water treatment facility, which will be constructed at **Fording River** (Fig. 4).

3.2.1. Fording River (Teck Coal Limited)

The **Fording River** mine (Fig. 4) consists of approximately 23,000 ha of coal lands, and produces primarily metallurgical coal, and a small amount of thermal coal. The current annual production capacity of the mine is 8.5 Mt; the preparation plant has a capacity of 9.5 Mt of clean coal. In 2017, production at **Fording River** was mainly from their Eagle Mountain pit, with a small amount of production from Lake, Swift-Lake, and Swift pits in their **Swift** expansion area (Fig. 5).

In September 2015, the **Swift** expansion received conditional environmental assessment approval, and construction and pit design has begun. Located west of the current mine area at **Fording River**, the project comprises both previously mined (last in the 1990s) and unmined zones of the Fording property, and multiple seams along both limbs of the Greenhills syncline. The area is along strike and directly north of the **Greenhills**



Fig. 5. Truck and shovel operations in the Swift expansion area.

Cougar North project; eventually the two will merge and collectively become the **Swift**. Initial construction costs are approximately \$88.5 million dollars and operating costs will be around \$16.9 billion over the planned 25-year mine life. The open-pit project will use the existing Fording mine facilities and is expected to produce 175 Mt of clean coal. To meet specifications outlined in the Elk Valley Watershed Management Plan, construction of a selenium water treatment facility on site is expected to begin in 2018. The plant will incorporate design modifications that are currently being tested at the first facility that was constructed at **Line Creek**.

Large diameter (9 inch) coring for coal quality testing was conducted in their new pits, and also on Turnbull Mountain, where mine models indicate that relatively thick, gently dipping seams extend into the mountain. Future expansions would include highwall pushback at the Turnbull and Henretta pits, and expansion at their Castle Mountain and Greenhills Ridge areas. Current Proven and Probable reserves are projected to support a further 52 years of mining.

3.2.2. Greenhills (Teck Coal Limited, 80%; POSCO Canada Limited (“POSCAN”), 20%)

The **Greenhills** mine produces mainly metallurgical coal and lesser thermal coal, and consists of approximately 11,800 ha of coal lands. The mine is on the west limb of the Greenhills syncline (Fig. 4). Coal seams generally grade in rank from medium-volatile bituminous in the lower parts of the section, to high-volatile-A bituminous at higher intervals. The current annual production capacity of the mine and preparation plant is 6.2 Mt of clean coal. Production is mainly from the Cougar pit area, and Proven and Probable reserves are projected to support another 39 years of mining at the current planned production rate.

The **Cougar Pit Extension (CPX)** project (Fig. 4) is the expansion area for Greenhills Operations and was approved in 2016. It lies immediately north of the existing operations, and has similar coal characteristics. At full development, the **CPX** project will merge with the Fording River **Swift** expansion. Drilling in 2017 focused mainly on active pits in order to determine seam thickness and structure, update the mine model, and improve coal quality definition. Large diameter (9 inch) core was also used to obtain bulk samples for coal quality and coke testing.

3.2.3. Line Creek (Teck Coal Limited)

The **Line Creek** mine (Fig. 4) consists of approximately 8200 ha of coal lands, and produces mainly metallurgical coal and small amounts of thermal coal. Coal seams are predominantly medium-volatile bituminous in rank, with some high volatile-A bituminous coals near the top of the section. The current annual production capacity of the mine and preparation plant is approximately 4.0 Mt of clean coal.

The **Line Creek Phase II** expansion (approved in 2013) extends operations at Line Creek northward along the Mount Michael and Burnt Ridge North areas, and adds approximately

67 Mt of clean coal to the mine. In 2017, production was mainly from their Burnt Ridge extension (BRX), North Line Creek extension (NLX), and Mine Services extension (MLX) pits. Pre-stripping also began on Mount Michael in late Q2, in preparation for the next phases of mining. Exploration drilling focused mainly in active pits to design new reserve shells, and update geological modeling. Further exploration drilling is also planned on their Saddle Ridge area. Proven and Probable reserves at Line Creek are projected to support mining at planned production rates for a further 19 years.

The West Line Creek water treatment facility was commissioned in February 2016, and was the first facility constructed under the Elk Valley Watershed Management plan. Work in 2017 focused on implementing design changes and adding an additional treatment process into the circuit, to mitigate an issue with selenium compounds found in the effluent. The effectiveness of these design changes is being monitored, and may delay the construction of the second facility at **Fording River**.

3.2.4. Elkview (Teck Coal Limited 95%; Nippon Steel & Sumitomo Metal Corporation, 2.5%; POSCO, 2.5%)

The **Elkview** mine (Figs. 4, 6) produces mainly high-quality mid-volatile hard coking coal from thrust repeats of mineable seams in a southwest plunging syncline. The mine site consists of approximately 27,100 ha of coal lands. The current annual production capacity of both the mine and preparation plant are approximately 7.0 Mt of clean coal. Record production was achieved at the mine in 2016, with a total of 7.2 Mt of clean coal mined, and production in 2017 is forecasted at 6.2 Mt. Teck estimates a remaining reserve life of approximately 41 years at the current production rate. Production is derived primarily from the Baldy Ridge and Natal Ridge pit areas.

The **Baldy Ridge Extension (BRE)** received an Environmental Assessment Certificate in September 2016, and the company began pre-stripping in 2017. The project will

include expansion of their current permit boundary, mining of Baldy Ridge BR3, BR4, BR6, and BR7 pits, expansion of Adit Ridge AR1 and further expansion at Natal Ridge NP2 pit. New dump and tailings facility expansions are also included in the plan. Capital cost estimates for the project have been reduced from \$600 million (over 5 years) to approximately \$60 million, primarily by re-sequencing the mine plan to defer movement of critical site infrastructure to later in the mine life. The **BRE** expansion, expected to be brought on stream by 2018, will maintain production at Elkview at about 6.8 Mt per year, extending the mine life by approximately 25 years.

In 2017, mining occurred mainly in Baldy Ridge (BR1, BR2, and BR6), and in Natal (NP1 and NP2) pits. Drilling continued in active pits, and in their NP3 area for highwall design purposes. Exploration drilling for 2018 is currently being planned outside of the current permitted mine, for geological modeling and coal quality testing of future expansion areas.

3.2.5. Coal Mountain (Teck Coal Limited)

Coal Mountain (Figs. 4, 7) consists of approximately 3000 ha of coal lands, and produces mainly PCI (metallurgical) and thermal coal. Opened around 1905 as the Corbin mine, coal was mined underground intermittently until 1935. Consolidated Mining and Smelting operated an open pit for a brief period in the 1940s. Large-scale, open-pit mining didn't begin until 1970s, when large-scale equipment and hydraulic shovels were brought to the area. In 2004, the five Elk Valley mines consolidated into the Elk Valley Partnership and, in 2008, Teck Coal Limited acquired the majority of this partnership and began operating the mines.

The **Coal Mountain** mine is now nearing the end of its reserve life, and is expected to shut down in early 2018. **Coal Mountain Phase II (Marten Wheeler)** was designed to replace production after the resource at **Coal Mountain** is depleted, but the project was suspended in 2015 because of market conditions. With recently approved expansion areas at



Fig. 6. Dipping Mist Mountain Formation coal seams at the Elkview mine.



Fig. 7. Coal Mountain mine.

the other four operational mines in the Elk Valley, Teck Coal Limited intends to optimize and expand production and facility capacity at their other metallurgical coal mines to replace about 2.25 Mt of lost production.

Reclamation of the mine is well underway on the final lifts of the dry stacked tailings facility, and waste dump spoils, and will continue in 2018. With the possibility of **Coal Mountain Phase II** coming online, the current preparation plant and facilities at **Coal Mountain** (with an annual capacity of approximately 3.5 Mt) will be maintained operational, but on care and maintenance.

3.3. Industrial mineral mines and quarries

The Southeast Region hosts several industrial mineral mines, the largest of which are in the Rocky Mountain foreland belt, where steeply dipping strata are easily mined. A variety of smaller mines and quarries exist throughout the region; graphite is mined from rocks of the metamorphic core complexes (Fig. 2; Table 2).

3.3.1. Mount Brussilof (Baymag Inc.)

Baymag Inc. produces high-quality magnesite year-round from their open-pit mine at **Mount Brussilof** (Fig. 8). The deposit was discovered in 1966, and the mine has been in production since 1982. The Mount Brussilof deposit is in Cambrian carbonate rocks of the Cathedral Formation (Fig. 3) that were originally deposited on the edge of the Cathedral escarpment, at the continental shelf edge. The deposit considered to have been produced by magnesium hydrothermal alteration, and displays characteristics similar to Mississippi Valley type mineralization (Paradis and Simandl, 2017). Several phases of magnesite (and pyrite) at the mine, suggests that hydrothermal fluid flow along fault structures of the Cathedral escarpment was episodic.

Sulphides (mainly pyrite) are removed as impurities from the product. Magnesite ore is transported by truck to the company's

processing facilities in Exshaw, Alberta for production of magnesium oxide (MgO) and magnesium hydroxide (MgOH). Annual magnesite production is approximately 230 kt.

3.3.2. Moberly Silica (Northern Silica Corporation)

In 2017, Northern Silica Corporation purchased the **Moberly Silica** operation from Heemskirk Canada Limited. The silica deposit is in regionally extensive orthoquartzites of the Mount Wilson Formation (middle to upper Ordovician; Fig. 3). The formation occurs over a 300 km length along the western portions of the Rocky Mountain fold and thrust belt (Fig. 2). Moberly Mountain is the northern extent of the unit, where it is terminated by a thrust fault. At Moberly, the unit is nearly vertical, about 200 m thick, extends along an 800 m strike length, and is de-cemented and friable. The deposit was mined from the early 1980s to 2008 for silica sand, glass making, and other industrial uses. In 2011, the company completed feasibility and engineering studies to produce 30-mesh to 140-mesh frac sand for the western Canadian oil and gas industry, and outlined a mine plan with a 35-year mine life. Phase I of the \$25 million USD project began in 2015 and included redeveloping the current silica operations, redesigning and upgrading the haul roads, and constructing a new 300,000 tpy frac sand processing plant. The plant was commissioned in 2017, and the company resumed quarry operations and began processing saleable product. The plant has the potential for expansion to a 600,000 tpy capacity.

3.3.3. Horse Creek Silica (HiTest Sand Inc.)

At the **Horse Creek Silica** mine, HiTest Sand Inc. operates a seasonal quarry in Mount Wilson orthoquartzites (Fig. 3), producing a variety of industrial use and aggregate products. The Mount Wilson orthoquartzites are more consolidated than at Moberly. The company is also evaluating processes for the production of alternate products, including silicon metal.

3.3.4. Elkhorn (CertainTeed Gypsum Canada Inc.)

Gypsum is produced near the western edge of the Rocky Mountains east of Windermere. Gypsum-bearing, evaporitic strata of the Burnais Formation (middle Devonian; Figs. 3, 9) were deposited in a restricted, shallow-marine embayment during the Middle Devonian, and later thrust upwards during the Mesozoic. Steeply dipping, mineable sections are 30 to 180 m thick (Butrenchuk, 1991). The **Elkhorn** mine, nearing the end of its reserve life, is expected to continue production for another 3 years. The company plans to replace gypsum production after mine closure with their new **Kootenay West** mine, which is currently under environmental assessment review.

3.3.5. 4J (Georgia-Pacific Canada Limited)

Georgia-Pacific Canada Limited operates the **4J** gypsum mine and a rail load-out facility southeast of Canal Flats. The deposit is in Burnais Formation evaporites (middle Devonian; Fig. 3). The company has been re-evaluating their mine design



Fig. 8. Mount Brussilof mine.

Table 2. Selected industrial mineral mines and quarries, Southeast Region.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Mount Brussilof	Baymag Inc.	Magnesite; hydrothermal sparry magnesite; 082JNW001	230,000 t	P: 50 Mt	na	MgO, and MgOH; sediment- hosted sparry magnesite.
Moberly Silica	Northern Silica Corporation	Silica; industrial use silica, frac sand; 082N 001	78,000 t	20 to 140 mesh frac sand (dry) P: 8.9 Mt of 64% frac sand + Pr: 4.6 Mt of 64% frac sand (2014)	M+I: 30 to 140 mesh frac sand (dry): 37.5 Mt at 70% frac sand + 11.3 Mt silica as frac sand residues (2016)	US \$25M capital cost for Phase I plant construction and upgrades to existing facility (for frac sand operation); 300,000 tpy capacity; Phase II expansion to 600,000 tpy will cost an additional US \$15M; Construction started on frac sand processing plant in 2015, commissioned in 2017.
Horse Creek Silica	HiTest Sand Inc.	Silica; industrial use, aggregate; 082N 043	na	na	Estimated: 3 Mt at 99.5% Silica (1987)	Variety of aggregate and industrial use products.
Elkhorn	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; 082JSW021	400,000 t	na	na	3 years mine-life remaining; the company will replace production by developing the Kootenay West mine (EA review period).
4J	Georgia- Pacific Canada Limited	Gypsum; evaporitic bedded gypsum; 082JSW009	na; Processing stockpiled ore	na	Estimated: 20 Mt	Processing stockpiles; updating mine expansion plans.
Black Crystal	Eagle Graphite Corp.	Graphite; metamorphic hosted flake graphite; 082FNW260, 082FNW283	na; Quarry on Care and Maintenance; company focused on process optimization	na	Regolith: M+I: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: I: 4.765 Mt at 1.21% fixed carbon	Process optimization at plant; produced sample of 99.995% pure spheronized graphite from flake graphite; product suitable for Li-Ion battery specifications; research and development.
Winner; Friday Quarry	Roxul Inc.	Gabbro/basalt; crushed rock for mineral wool; 082ESE265	Quarrying to supply feed stock for mineral wool plant	na	na	Crushing, screening, stockpiling; environmental.
Grand Forks Slag	Granby River Mining Company Inc.	Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264	Quarrying for abrasives and roofing granules	na	na	Crushing, screening; environmental.

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



Fig. 9. Bedded gypsum (dark layers) with interbedded mudstone (light) in the middle part of the Burnais Formation (Devonian).

for the next stages of pit expansion as they wait for commodity prices to improve, and producing mainly from stockpiled material for use in agricultural.

3.3.6. Black Crystal (Eagle Graphite Corp.)

Eagle Graphite Corp. operates the **Black Crystal** flake graphite operation where graphite ore is mined from the open-pit quarry on Hodder Creek and processed at a pilot plant 10 km west of Passmore. The property is in the central part of the Valhalla complex (Fig. 2) in the Valhalla dome, a structural complex of upper amphibolite-grade gneisses in Paleozoic rocks of the Kootenay terrane that was exhumed during Tertiary extension. Disseminated fine- to coarse-flake graphite is distributed along foliation in organic-rich calcsilicates and marbles, across an area of about 500 m². The graphitic horizon is 80 to 100 m thick. Carbon grades up to 6.95% in two zones: a 'hard rock' zone, and an overlying regolith zone. Most of the deposit, especially the regolith zone, is friable and blasting is not required. Sand and aggregate are produced as by-products during the mining and refining process. In 2017, the open-pit quarry was on care and maintenance, and efforts were focused on a research partnership with Queen's University to produce multi-layered graphene.

3.3.7. Winner and Friday quarries (Roxul Inc.)

Roxul Inc. operates two small seasonal quarries near Grand Forks, extracting gabbro from **Winner**, and basalt from Friday (North Fork). The material is trucked to the Roxul Inc. manufacturing plant in Grand Forks, where it is blended with other mineral material to make mineral wool insulation, construction board, blankets, and pipe covering.

3.3.8. Grand Forks Slag (Granby River Mining Company Inc.)

The Granby River Mining Company Inc. operates the **Grand**

Forks Slag quarry, producing abrasives and roofing granules from smelter slag. The historic smelter operated between 1900 and 1918, and processed copper-gold ore from the historic Phoenix mine.

4. Placer operations

Placer mines have operated in southeastern British Columbia since the gold rush began in 1864. Although activities were not tracked in 2017, 62 placer projects currently have active Mines Act permits that allow mechanized work, consisting of more than simple hand panning.

5. Mine development

With the exception of the coal mine expansion projects that are currently in construction phases (see above) no new mine development projects are under construction.

6. Proposed mines and quarries

The Southeast Region has four proposed coal mines (Table 3): **Michel Creek/Loop Ridge** (North Coal Limited, formerly CanAus Coal Limited), **Crown Mountain** (NWP Coal Canada Ltd.), **Coal Mountain Phase II** (on hold; Teck Coal Limited), and **Bingay Main** (Centermount Coal Ltd.). In addition, it has two proposed industrial mineral projects: **Kootenay West** (CertainTeed Gypsum Canada Inc.), and **Driftwood Magnesite** (MGX Minerals Inc.).

6.1. Proposed metal mines

There are currently no proposed metal mines in the region.

6.2. Proposed coal mines

6.2.1. Michel Creek/Loop Ridge (North Coal Limited, formerly CanAus Coal Limited)

In October 2015, North Coal Limited, a wholly owned subsidiary of CoalMont Pty Ltd., entered the pre-application phase of environmental assessment for their **Michel Creek** project. The project consists of licenses at **Loop Ridge**, **Loop South**, **Tent Mountain**, and **Michel Head** (Fig. 4). The company is focused optimizing all coal deposits for development and will be issuing an amended application in 2018. The company entered pre-application of environmental assessment in 2015. In 2017, work included testing for waste rock and developing water management strategies, and working on an updated project description. The project will use new techniques for managing waste rock to mitigate selenium, and ensure that targets identified in the Elk Valley Water Quality Plan can be met.

Exploration drilling in 2017 (8850 m; 61 holes) focused on the **Loop South** and **Tent Mountain** areas, and included 9 large diameter core holes for coking quality analysis. Results and coal quality testing from their 2016 drill program (**Loop Ridge** and **Michel Head**) were compiled and updated into 3D models for resource modeling and mine planning. Drilling identified 20 coal seams, between 5 and 20 m thick, and confirmed that coal is representative of typical Elk Valley hard coking coals

Table 3. Selected proposed mines and quarries, Southeast Region.

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Michel Creek (Loop Ridge)	North Coal Limited (formerly CanAus Coal Limited)	Coal (HCC and PCI); open-pit and underground; 082GSE050	na	HCC: M: 44.6 Mt I: 42.5 Mt; open-pit and underground (2015)	Drilling (5212 m, 38 holes); 7 large diameter core holes for coal quality testing; environmental and baseline work; mine design; permitting; Pre-application of EA (2015); Coal quality testing indicates coal has similar characteristics to Elk Valley hard coking coal; drilling has identified 20 coal seams with cumulative thickness of 70 m (14% of a 504 m section in the Mist Mountain Fm).
Crown Mountain	NWP Coal Canada Ltd. (Jameson Resources Limited)	Coal (HCC and PCI); open-pit; 082GNE018	HCC: P: 42.60 Mt Pr: 4.91 Mt PCI: P: 7.13 Mt Pr: 1.19 Mt (2014)	HCC+PCI: M: 68.9 Mt I: 6.0 Mt (2014)	Pre-application of EA (2014); nearing end of comment period for Application Information Requirements (AIR); 16-year mine life; 1.7 Mtpy; review of pre-feasibility study identified upside in lower capital costs for contract mining and additional resources in Southern Extension.
Coal Mountain Phase II (Marten Wheeler)	Teck Coal Limited	Coal (PCI and TC); open-pit and underground; 082GNE006	na	HCC: M+I: 173.9 Mt Inf: 7.9 Mt PCI: M+I: 6.5 Mt Inf: 0.9 Mt (2015)	Pre-application of EA (2014); Potential of 76.5 Mt; 34-year mine life; 2.25 Mtpy; EA withdrawn in late 2015; project on hold.
Bingay Main	Centermount Coal Ltd.	Coal (HCC); open pit and underground; 082JSE011	na	M: 42.43 Mt I: 52.9 Mt (2012)	Pre-application of EA (2012); resubmitted project description (2017); 13 Mt; 15-year mine life; 1 Mtpy.
Kootenay West	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; quarry; 082JSW005, 082JSW020	na	North and South Quarries: Total 15 Mt (at average quality of 83-85%)	Entered 180-day review period of Environmental Assessment in March (2017); temporarily suspended the review in order to respond to comments and submit additional information; 400,000 tpy; 43-year mine life; blended product to market specifications.
Driftwood Magnesite	MGX Minerals Inc.	Magnesite; hydrothermal sparry magnesite; quarry; 082KNE068	na	M+I: 8.028 Mt grading 43.3% MgO (2016; using cutoff grade of 42.5% MgO)	Preliminary Economic Assessment; environmental baseline studies; 100 t bulk sample; Preliminary test work indicates recovery rates of 93.4% reverse flotation and removal of up to 70% silica and 30% calcium oxides; bulk of resource is within 100 m of surface; 2016 drilling extended the zone; 20-year mine lease acquired.

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

(HCC). Structure and spacing of the seams gives the project a low (~6:1) strip ratio. The company released an updated NI 43-101 resource estimate with 44.6 Mt Measured and 42.5 Mt Indicated (open-pit and underground), and is working towards an updated pre-feasibility engineering and design report.

The site is considered a brownfields operation, with previous mining at the **Loop Ridge** area from the McGillivray Pit. In 1969, the Crow's Nest Pass Mining Company mined 60,000-

100,000 t. A further 20,000 t was extracted in 1995 by McGillivray Mining Ltd., and then 30,000 t by Fording Coal Ltd. between 1996 and 2000. Fording dropped the asset in 2000 when it was merged into Teck Coal Limited.

6.2.2. Crown Mountain (NWP Coal Canada Ltd.)

The **Crown Mountain** property (NWP Coal Canada Ltd., a wholly owned subsidiary of Jameson Resources Limited)

is along strike with Line Creek, but separated by complex geology and thrust faulting. The property contains seven major Mist Mountain Formation coal seams, with combined average thicknesses of 15 to 35 m. In October 2014, the project advanced to the pre-application stage of environmental assessment, and is currently nearing the last round of comments for the application information requirements. In 2017, the company also began preliminary engineering design work, continued environmental baseline work, and worked on updating the mine plan. The project proposal is for an open-pit mine with an estimated production capacity of 1.7 Mt per year of clean coal and a 16-year mine life. In 2014, the company completed a resource estimate of 74.9 Mt (Measured+Indicated) and a preliminary prefeasibility study. In 2016, the study was updated with improved economics related to coal pricing and operating and capital expenditure costs. Coal quality test work indicates that approximately 84% of the coal is hard coking coal, the remainder PCI coal.

6.2.3. Coal Mountain Phase II (Teck Coal Limited)

At Teck Coal's **Coal Mountain Phase II** (Marten Wheeler) project, the Mist Mountain Formation contains up to 15 coal seams, 1-8 m thick, with a cumulative average thickness of 75 m on Marten and Wheeler ridges (Fig. 4). The project entered pre-application stages of environmental assessment in September, 2014, but was withdrawn in 2015 and put on hold. The project was proposed to replace production and use infrastructure from the **Coal Mountain** mine, which is scheduled to be shut down in early 2018. Facilities at **Coal Mountain** will be placed on care and maintenance, but maintained in a ready to operate state.

6.2.4. Bingay Main (Centermount Coal Ltd.)

Centermount Coal Ltd.'s Bingay Main is a proposal for an open-pit mine on the **Bingay Main** property (Fig. 4). The project entered pre-application of environmental assessment in 2013; the company resubmitted the project description in 2017. Environmental baseline studies are ongoing. The mine would produce approximately 1 Mtpy over an estimated 15-year lifespan, with a total resource of approximately 13 Mt of clean coal. At **Bingay**, the coal-bearing Mist Mountain Formation is preserved in a tight, asymmetric syncline in the immediate footwall of a west-dipping thrust fault (Bourgeau thrust). The coal is medium-volatile to high volatile-A bituminous in rank.

6.3. Proposed industrial mineral mines

6.3.1. Kootenay West (CertainTeed Gypsum Canada Inc.)

CertainTeed Gypsum Canada Inc. continued to advance the proposed **Kootenay West** project. The project entered the 180-day review period of environmental assessment in March, 2017. The company temporarily suspended the review to submit additional technical information, and address comments from the Environmental Assessment Office, the Working Group, and First Nations. A decision is expected in June, 2018. The quarry would have two pits and target gypsum from a deformed

hydrated evaporite layer 20-25 m thick, with beds of 75-95% gypsum in the Burnais Formation (Fig. 3). The mine would have an average production rate of 400,000 tpy, over a 43-year mine life. The total mineral reserve is estimated at 15 Mt, and product would be blended to a product specification of 83-85% gypsum for market. Gypsum would be drilled, blasted, and crushed, then transported by truck to Exshaw, Alberta or Washington State, or by rail to Vancouver. In 2016 and 2017, the company focused on environmental work and mine design. Phase 1 construction, with estimated capital costs of \$20 million, is projected for 2018.

6.3.2. Driftwood Magnesite (MGX Minerals Inc.)

At the **Driftwood Magnesite** property, cliff-forming, steeply dipping beds of sparry magnesite (Fig. 10) are interlayered with dolostones and dolomitic limestones of the Mount Nelson Formation (Proterozoic; Fig. 3). The deposit is 100 to 300 m in width, to a depth of approximately 110 m, and has been traced along strike for 2000 m. In recent years, the company drilled and resampled both the East and West zones of the deposit. In 2016, they took a 100 tonne bulk sample from a zone near surface (up to 15 m depth). They released a NI 43-101 compliant resource estimate in September, 2016 with updated results from their 2014 and 2015 drill programs, and drilled additional holes in the fall of 2016 to test the depth and extend the known mineralization. They also acquired a pilot test mill, including a jaw crusher, ball mill, floatation cells, cyclone dewatering equipment, and tailings filtration system. The mill was used to process the bulk sample material to a high-purity magnesite (MgCO_3), and a silica by-product using reverse flotation techniques. In 2017, the company focused work on a preliminary economic assessment and continued environmental baseline studies for their quarry application.

Magnesium is a non-metallic alkaline earth metal that is 75% lighter than steel and 33% lighter than aluminum, with comparable strength-to-weight ratios. Magnesium oxide (MgO)



Fig. 10. Sparry magnesite at the Driftwood Magnesite project.

is also used to produce fire-retardant wallboard, fertilizer, and animal feed; and used for environmental water treatment and as a refractory material in the steel industry.

7. Selected exploration activities and highlights

Exploration continued in the Southeast Region in 2017 for a variety of targets, including base and precious metals, industrial minerals, and coal (Fig. 1; Table 4).

7.1. Selected precious metal projects

Dating back to the 1880s, exploration for precious metals is ongoing in the East Kootenays along the Kimberley Gold trend, where fault and vein structures, and Mesozoic intrusions are coincident with deeper basement structures along the Vulcan low (Höy, 1982; McMechan, 2012; Seabrook, 2015). In the West Kootenays and Boundary regions, precious metal exploration is also ongoing for vein (epithermal and mesothermal), porphyry, and skarn systems. Precious metals are explored for throughout the region.

7.1.1. Dewdney Trail (PJX Resources Inc.)

PJX Resources Inc. identified a new target area at their **Dewdney Trail** property in 2016, and continued mapping and sampling in 2017. The target is upstream from current and historic placer mining in the Wildhorse Valley. Heavy mineral stream samples collected from two previously unexplored drainage areas contained sharply angular visible gold. The company reported that scanning electron microprobe analysis found the grains to be fairly consistent in chemical composition, with gold as the major element followed by silver and trace quantities of copper and iron, suggesting a single bedrock source. In addition, the chemistry of sample residue material suggests that the gold may be associated with felsic intrusive rocks and/or sericite alteration.

The property is underlain by folded, faulted, and altered Mesoproterozoic sandstones and argillites of the Fort Steele, Aldridge, Creston and Kitchener formations, cut by Cretaceous, and possibly Tertiary, felsic to mafic intrusions (Fig. 3). The property contains several mineral showings, including: 1) large-tonnage sediment-hosted vein type gold prospects at the Spirit, Tac, and Lewis showings; 2) vein-type prospects at the Jack Leg showing; and 3) skarn and stockwork Cu-Au prospects at the Dew Drop showing. Past exploration efforts included prospecting, soil geochemistry, rock sampling, VLF-EM ground magnetic surveys, ground IP surveys, airborne geophysics, hand trenching, and diamond drilling. The best sample to date was collected from a 4 to 5 m wide altered syenite dike, which returned 1953 g/t Au. Other rock samples have yielded up to 18 g/t Au.

7.1.2. Zinger (PJX Resources Inc.)

In 2017, PJX Resources Inc. continued exploration on their **Zinger** property, where grab samples from multiple quartz veins have returned anomalous assays for gold. The quartz veins occur along a six to eight km trend, and are coincident

with geophysical anomalies. The property is adjacent to the Perry Creek fault, and hosts gold mineralization in multiple NW-trending folds, veins, and shear zones. Host rocks are the Purcell Supergroup (Proterozoic; Fig. 3), predominantly metasedimentary quartzites, argillites, and siltstones of the Creston Formation, argillites of the Kitchener Formation, and gabbro sills and dikes. Quartz veins form stockworks and stringers with iron carbonate, sericite, and minor sulphides. Sulphide mineralization is mainly pyrite (weathered to limonite near the surface), galena, and chalcopyrite. Historic drilling intersected near-surface gold mineralization including 2.9 g/t Au over 2 m, within a broader interval of 0.50 g/t Au over 22.38 m. Soil sampling was carried out in 2016 on two grids. The eastern grid identified an anomaly approximately 100 m wide and more than 300 m long with gold in soil values ranging from 0.1 g/t to 4.94 g/t. Samples taken on the west grid returned anomalous gold values up to 0.743 g/t. Heavy mineral separation of soil samples discovered hackly gold grains that the company interpreted to be near their bedrock source (within 50 to 400 m). Further VLF and VTEM geophysical work in 2017 outlined dipping conductors that coincide with these soil anomalies at surface. The anomalous soil geochemical results and geophysical responses also coincide with the regional NW trend of folds and faults mapped on surface. The company plans follow-up work that includes both trenching and drilling.

7.1.3. Bayonne (Margaux Resources Ltd.)

Margaux Resources Ltd. began work on their **Bayonne** property in 2017 with mapping, rock sampling, and LiDAR. The Bayonne property hosts several high-grade, steeply dipping gold-bearing orogenic quartz veins in a granodiorite roof-pendant of the Bayonne batholith (Mine stock; Middle Jurassic, 171 Ma) that cuts Neoproterozoic argillaceous quartzites and limestones of the Horsethief Creek Group (Fig. 3). Historic production (1936-1942) was mainly from the Main vein and a splay known as the A vein. The mine produced 81,782 t, at an average grade of 16 g/t Au and 45.9 g/t Ag.

In 2017, the company mapped 10 veins (e.g., Fig. 11), focusing mainly on the areas between the Main vein, which extends for approximately 950 m along strike, the A vein (a splay off the Main vein; 550 m strike length), and the Maggie Aikens vein (100 m strike length). Grab sample results include 27.5, 23.3, 18.1, 15.0 and 10.6 g/t Au from the Main vein, and 51.6 g/t Au, 46.6 g/t Au and 41.1 g/t Au from the Maggie Aikens vein, along with anomalous silver, zinc, lead and tungsten values. The company drill tested three main targets on the property (2089 m, 13 DDH), to test below the limits of historic mining, and previous undrilled areas. Results include 1.85 m grading 15.31 g/t Au, 1.0 m grading 12.7 g/t Au, and 0.32 m grading 18.2 g/t Au.

7.1.4. Sheep Creek and Ore Hill (Margaux Resources Ltd.)

Margaux Resources Ltd. acquired additional land under an option agreement with Yellowstone Resources, and continued further exploration for Late Jurassic orogenic gold on their

Table 4. Selected exploration projects, Southeast Region.

Project	Operator (partner)	Commodity; Deposit type MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Alpine	Braveheart Resources Inc.	Au-Ag-Pb-Zn; mesothermal Au and polymetallic veins; 082FNW127, 257, 292	na	Mapping; sampling; drilling (1600 m, 11 DDH); re-sampling of historic core, includes: 1.5 m grading 11.8 g/t Au, 1.7 m grading 19.1 g/t Au, 1.4 m grading 38.0 g/t Au.
Bayonne	Margaux Resources Ltd.	Au+/-Ag-Pb-Zn-Cu; Au-quartz veins, polymetallic veins; 082FSE030, 031, 034, 025	na	LiDAR; mapping; grab and chip sampling; drilling (2089 m, 13 DDH); grab sample results include up to 27.5, 23.3, 18.1, 15.0 and 10.6 g/t Au, and chip sampling of 1.0 m grading 24.6 g/t from the Main vein, and grab samples of 51.6, 46.6 and 41.1 g/t Au from the Maggie Aikens vein; Drill intercepts of 1.85 m grading 15.31 g/t Au, 1.0 m grading 12.7 g/t Au, and 0.32 m grading 18.2 g/t Au.
Coal Creek	Crowsnest Pass Coal Mining Ltd.	Coal (HCC and PCI); underground; 082GSE035	HCC+PCI: 616 Mt in the upper 3 near-surface seams (2014)	Prefeasibility studies; geological modeling; resource evaluation; baseline studies; potential for an underground mine; review of the historical mine workings of Coal Creek colliery (operated from 1897 to 1958).
Dewdney Trail	PJX Resources Inc.	Au; Au-veins; 082GNW094	na	Geological mapping; heavy mineral stream sampling; sampling; following up on heavy mineral stream sediment survey from 2016; sharply angular gold grains indicate grains in stream samples near bedrock source.
Duncan	Rokmaster Resources Corp.	Zn-Pb-Ag; carbonate- hosted; 082KSE023, 022	na	Mapping; sampling; data compilation; re-logging historic drill core; results include 14.7 m grading 8.20% Zn+Pb, 13.4 m grading 8.00% Zn+Pb, and 12.2 m grading 8.31% Zn+Pb; drill permits received late in 2017.
Elko	Pacific American Coal Limited	Coal (HCC, PCI); 082GSE029	M: 19.2 Mt; I: 57 Mt; Inf: 181.3 Mt (JORC 2015)	Mine design and CAPEX study; environmental baseline studies and permitting; mapping of 5 coal seams over the property; 3 seams have hard coking coal quality, 2 seams have PCI coal.
Frances Creek	Voyageur Minerals Ltd.	Ag-Pb-Zn-Ba; Mississippi valley type, polymetallic vein breccia; 082KNE061	53,856 to 215,422 t grading 95.86% to 99.26% BaSO ₄	Mapping, sampling, drilling (>1200 m, >17 DDH); drill intercepts include (true width) 36.03 m 19.47% BaSO ₄ , 11.86 m at 60.32% BaSO ₄ , 23.88 m at 27.05% BaSO ₄ , 18.7 m at 37.39% BaSO ₄ , 22.88 m at 23.94% BaSO ₄ , 14 m at 38.41% BaSO ₄ , 15.22 m at 37.65% BaSO ₄ .

Table 4. Continued.

Gold Drop/ C.O.D.	GGX Gold Corp.	Au; Alkaline intrusion- associated Au; 082ESE055, 150, 152, 153, 285, 286, 287	na	Rock sampling; trenching; channel sampling; drilling (27 DDH, 1449 m); option agreement with Ximen Mining Corp.; property hosts numerous low- sulphide, gold-bearing quartz veins; steeply dipping, and striking roughly northward; small scale historic production dates back to 1919. Drilling results included 0.3 m of 10.8 g/t Au, 123 g/t Ag and 16.3 m of 4.59 g/t Au, 38.64 g/t Ag.
Irishman/Panda/ Sweet Spot	Teck Resources Limited	Pb-Zn-Ag+/-Cu; SEDEX, polymetallic veins; 082FSE110, 082GSW077	na	Mapping, soil geochem; sampling; re- logging historic core; initial stages of exploration on the property identified fragmental units, alteration assemblages, and indicators of SEDEX-style mineralization.
Jackpot	Margaux Resources Ltd.	Pb-Zn-Ag+/-W, Au, Mo, Bi; stratiform replacement; 082FSW012, 013, 014, 015, 255, 256	na	LiDAR; rock and channel sampling; compilation of historical data into 3D model; drilling (1394 m, 9 DDH); mineralization exists along a 600 m strike length; grab sample results up to 30% Zn, with associated Pb, Ag, and Cd; chip sampling included 3.4 m grading 13.35% Zn, 2 m grading 15.58% Zn, and 3 m grading 8.97% Zn. Drilling results included 61.1 m grading 1.01% Zn, 49.2 m grading 1.04% Zn, 8.5 m grading 6.66% Zn, and 36.3 m grading 1.48% Zn.
Jersey-Emerald	Margaux Resources Ltd.	Pb-Zn-Ag+/-W, Au, Mo, Bi; stratiform replacement, skarn; 082FSW010, 009	Emerald-Dodger Tungsten: M+I: 3.071 Mt grading 0.34% WO ₃ , 0.028 Mt grading 0.1% Mo; Inf: 5.48 Mt grading 0.27% WO ₃ , 0.481 Mt grading 0.1% Mo (2006-2015) Jersey: I: 1.9 Mt grading 4.1% Zn, 1.96% Pb; Inf: 4.98 Mt grading 3.37% Zn, 1.95% Pb (2010)	Results from 2016 diamond drilling released in 2017 included 10.2 m grading 24.98 g/t Au, 0.65 m grading 68.3 g/t Au, and 0.25 m grading 59.1 g/t Au. Work in 2017, dewatering of underground workings at Emerald, rock and silt sampling, LiDAR surveys, data compilation and 3D geological modeling, re-logging of historic core, diamond drilling (1121 m in 6 holes). Drilling results included 6.1 m grading 2.61% Pb, 0.44% Zn, and 3.11 m grading 2.02% Pb, 0.48% Zn. Rock sampling from the Comet and Tungsten King showings returned results of 32.8% Zn, 1.2% Pb; and 2.69% Zn, 0.65% Pb, with elevated gold and bismuth. A 3500 kg sample of historic Emerald mine tailings was collected. A partnership agreement with CRONIMET Mining Group is in place to evaluate the economic viability to re- process historic tailings.

Table 4. Continued.

Kena-Daylight/ Toughnut	Prize Mining Corporation (Apex Resources Inc.)	Au-Cu+/-Pb-Zn-Ag; porphyry, Au-veins, polymetallic veins; 082FSW379, 173, 174, 175, 294	Kena: I: 24.89 Mt grading 0.6 g/t Au; Inf: 85.79 Mt grading 0.48 g/t Au	Mapping; soil geochem; rock sampling; ground magnetics and VLF; trenching; historical data compilation; 18 DDH (2695 m) at Kena-Daylight; 11 DDH (1730 m) at Toughnut; option agreement to acquire 80% in Kena-Daylight (Apex Resources Inc. owns 20%); option to acquire 100% in Toughnut; Rock sample results: 2.45 g/t Au, 33.4 g/t Ag; 20.6 g/t Au, 188 g/t Ag; 5.28 g/t Au, 2.85 g/t Ag; 6.25 g/t Au, 5.74 g/t Ag; 9.05 g/t Au, 8.6 g/t Ag; 5.58 g/t Au, 1.73 g/t Ag; 2.87 g/t Au, 8.59 g/t Ag; drill results pending.
LH	Magnum Goldcorp Inc.	Cu-Ag-Au; subvolcanic, skarn, Au-veins; 082FNW212	na	SP, magnetometer and EM surveys; drilling (ongoing late in the year); gold mineralization appears to be associated with pyrrhotite +/-arsenopyrite, providing conductive targets; identification of drill targets on ground geophysics.
May Mac/ Golden Crown/ Lexington/ Phoenix	Golden Dawn Minerals Inc.	Au-Ag-Pb-Zn+/-Cu; Cu-Au-Ag skarns, polymetallic veins, epithermal Au-veins, Porphyry; 082ESE041, 042, 032, 045, 020, 130, 116	Golden Crown: M+I: 163,000 t grading 11.09 g/t Au, 0.56% Cu (2016); Lexington-Grenoble: M+I: 372,000 t grading 6.4 g/t Au, 1.05% Cu (2016)	May Mac drilling (22 U/G DDH 3028 m; 8 surface DDH, 1886 m); Golden Crown drilling (31 DDH, 2954 m as of Dec. 4th); dewatering of Lexington underground; mapping; rock sampling; PEA released on Lexington- Golden Crown; NI 43-101 report; acquisition of Merit Mining assets in Greenwood area, including the historic Phoenix mine and surrounding claims; May Mac drill intercepts include 2.57 m grading 252.6 g/t Ag, 0.93 g/t Au, 9.9% Pb, 4.3% Zn, 3.71 m grading 246.0 g/t Ag, 2.69 g/t Au, 1.3% Pb, 0.9% Zn, 1.20 m grading 174.3 g/t Ag, 8.2 g/t Au, 3.7% Pb, 2.6% Zn. Golden Crown drill intercepts include 4.6 m grading 7.66 g/t Au, 0.13% Cu, and 7 m grading 5.14 g/t Au, 1.18% Cu; Engineering assessments of Lexington mill (C&M) suggest a cost estimates of \$270,000 to put plant back in operation.
Monroe	Highway 50 Gold Corp.	Pb-Zn-Ag+/-Au, Cu; SEDEX; 082GSW069, 035, 041	na	Drilling (4 DDH; 4000 m) to follow up on 2015-2016 drill programs; encountered fragmentals, moderate to intense albitization; bedded pyrrhotite- sphalerite; disseminations and veinlets of sphalerite and galena.

Table 4. Continued.

Mount Attwood/ Midway	KG Exploration (Canada) Inc.	Au-Cu-Pb-Zn-Ag+/- Mo; Cu-Au-Ag skarn, polymetallic vein, Au- vein, porphyry; 082ESW022, 210, 034, 221	na	Drilling (1160 m; 7 DDH); detailed mapping of mineral zonation and alteration assemblages; option agreement with Grizzly Discoveries Inc. to gain 75% interest in 27,346 ha; fulfilled 2 nd year agreement to drill; following up on targets identified in 2016 airborne, ground EM and magnetics, geological mapping and sampling; prospected new area.
Sheep Creek/Ore Hill	Margaux Resources Ltd.	Au+/-Ag, Pb, Zn; Au-quartz veins; 082FSW040, 048, 050, 051, 052, 053	na	LiDAR; mapping; soil geochem; sampling; drilling (2000 m, 6 DDH); historic Sheep Creek camp; veins are typically 10 cm to >2 m; grab samples returned up to 36.4, 21.8, and 12.8 g/t Au; other samples contained up to 1021 g/t Ag, up to 33.7% Pb, and up to 13.6% Zn.; soil anomaly 450 x 100 m, averaging 2.95 g/t, with gold values of >5 g/t in 13 samples; Ore Hill rock sampling: 119 g/t Au, 105 g/t Au, 60.2 g/t Au, and 50.5 g/t Au.
Silver Fox	Antofagasta plc (Kootenay Silver Inc.)	Cu-Ag; Sediment- hosted copper; 082GSW070, 072, 073	na	Drilling (3000 m); mapping, sampling, ground geophysics; entered option agreement to earn 80%, with Kootenay Silver Inc.; 3 rock samples assayed 0.104% Cu and 2.9 g/t Ag; 0.127% Cu and 9.9 g/t Ag; and 0.55% Cu, 14 g/t Ag, and 0.208 g/t Au; drill results pending.
Slocan Silver (Silvana)	Klondike Silver Corp.	Ag-Pb-Zn+/-Au; polymetallic veins; underground; 082FNW050, 013, 082KSW006	na	Rehabilitation of the 4625 portal at the Silvana; geological mapping, and sampling; compilation of historical data and underground workings into a 3D model; facility upgrades; environmental monitoring; mill on care and maintenance; work focused on identifying exploration targets; environmental baseline work.
Sully	Kootenay Zinc Corp.	Pb-Zn-Ag+/-Au; Gravity anomaly, sediment-hosted	na	Drilling (6 DDH; 1464 m); mapping; ground magnetic surveys and gravity; soil geochemistry; downhole magnetic and EM survey; geophysical modeling; mass models suggest two gravity anomalies may be stratiform sulphide mineralization in Aldridge formation; property lies at intersection of St. Mary-Boulder Creek fault and Rocky Mountain Trench fault with complex faulting on property, including overturned normal faults.

Table 4. Continued.

Swift Katie	Valterra Resource Corporation	Cu-Au-/-Pb-Zn-Ag-Mo; 082FSW290, 291, 350	na	Released 2016 drill results (1954 m, 6 DDH); 2017 drilling (1392 m, 8 DDH); rock sampling; drill tested surface mineralization along a 1000 m strike length; results include 2.5 m grading 11.5 g/t Au and 6.7 g/t Ag, (including 0.8 m grading 30.9 g/t Au and 17.8 g/t Ag); and 8.6 m grading 3.1 g/t Au and 2.0 g/t Ag.
Teddy Glacier/Spider Mine	Jazz Resources Inc.	Ag-Pb-Zn+/-Au; polymetallic veins; 082KNW069	Inf: 44,000 t grading 4.46 g/t Au, 7.94% Pb, 6.74% Zn (2007; non-compliant)	Bulk sample permitting; environmental baseline studies; Pb flotation concentrate with 62% Pb, 83% Au and 92% Ag; Zn flotation concentrate with 48.7% Zn; Permitting for a 5000 t bulk sample from the Teddy Glacier, to be processed at pilot mill and tailings pond at historic Spider mill.
Thor	Taranis Resources Inc.	Ag-Pb-Zn+/-Au; polymetallic veins and breccia, stratiform volcanogenic massive sulphide; 082KNW030, 031, 060, 061	I: 640,000 t grading 0.88 g/t Au, 187 g/t Ag, 0.14% Cu, 2.51% Pb, and 3.51% Zn; Inf: 424,000 t grading 0.98% Au, 176 g/t Ag, 0.14% Cu, 2.26% Pb, and 3.2% Zn (2013)	VLF; trenching and channel sampling; test milling; channel sample results include 2.04 m grading 26.6 g/t Au, 1246 g/t Ag, 3.1% Pb, 4.3% Zn, and 0.55% Cu; extension of SIF gold zone; discovery of new mineralization between Great Northern and Broadview.
Vine	PJX Resources Inc.	Pb-Zn-Ag+/-Au; polymetallic vein, SEDEX; 082GSW050, 049, 035	1.3 Mt grading 2.2 g/t Au, 3.12% Pb, 36.3 g/t Ag, 3.12% Zn (1990; non-compliant)	Drilling (6000 m, 15 DDH); geophysical and geological modeling; focus on East gravity anomaly; infilled gravity survey grid; detailed geophysical and geological model; drilling intersected sphalerite, as well as massive sulphide (pyrite, pyrrhotite) near Moyie fault zone.
Zinger	PJX Resources Inc.	Ag-Pb-Zn+/-Au; polymetallic veins; 082FSE122, 065	na	Geological mapping; 2 soil grids (East and West); East grid soil anomaly approximately 100 x 300 m, with Au ranging from 100 to 4941 ppb; hackly gold grains heavy mineral separation of soil samples suggest near bedrock source; VLF and VTEM; dipping VLF conductors coincident at surface with soil geochem anomalies.

M = Measured; I = Indicated; Inf = Inferred

Sheep Creek and **Ore Hill** properties in 2017. The company now holds 1200 ha of contiguous mineral tenure that includes 60 known veins and 34 past producers. Mineralization (pyrite with lesser amounts of pyrrhotite, chalcopyrite, galena, sphalerite and rare visible gold) is found in quartz veins along northeast trending faults that cut quartzites. Historic production from the camp (1899-1951) totalled 736,000 oz Au, 356,000 oz Ag, 377,000 lbs Pb, and 312,000 lbs Zn (with an average grade of 13 g/t Au) (Allan et al., 2017).

The **Sheep Creek** showings are in a 7 x 1.2 km NNE-trending corridor, with veins concentrated at the crests of folds, and preferentially hosted in competent Neoproterozoic quartzite

units. Veins are typically 10 cm to >2 m wide, strike ENE, and are steeply dipping to near vertical. Margaux Resources Ltd. sampled (rock and soil), conducted LiDAR, and began drilling late in the year (2000 m, 6 DDH) to test zones along strike from known veins. Drilling also tested the Kat vein (Fig. 12), which was newly discovered in Cambrian limestones (Laib Formation, Fig. 3) stratigraphically above the main quartzite host units. Surface grab samples of the Kat vein returned up to 36.4 g/t Au, with anomalous Ag, Pb, and Zn. Soil sampling also identified a 450 x 100 m anomaly, averaging 2.95 g/t, with gold values of >5 g/t in 13 samples in an area underlain by Laib limestones. At the **Ore Hill**, located at the southern end



Fig. 11. Oxidized mineralized quartz vein from the Bayonne. Photo courtesy of Margaux Resources Ltd.



Fig. 12. Mineralization at the Kat vein, Sheep Creek property. Photo courtesy of Margaux Resources Ltd.

of the Sheep Creek camp, gold veins also occur in Cambrian limestone. Rock samples returned 119 g/t Au, 105 g/t Au, 60.2 g/t Au, and 50.5 g/t Au.

7.1.5. Mount Attwood, and Midway (KG Exploration (Canada) Inc.)

KG Exploration (Canada) Inc. (a wholly owned subsidiary of Kinross Gold Corporation) continued to build on work done in 2015 and 2016 in the 27,346 ha of land optioned from Grizzly Discoveries Inc. The area is underlain by rocks of the Knob Hill and Anarchist groups (Paleozoic), Brooklyn Formation

(Triassic), and Penticton Group syenites and andesites (Eocene; Fig. 3). Jurassic, Cretaceous, and Eocene intrusions occur throughout the area. Exploration targets include epithermal gold, skarn, and VMS mineralization in the northern extensions of the Republic and Toroda graben. Kinross can earn a 75% interest by spending US\$3 million over a five year period. The company focused on three key areas, including Tertiary rocks in the northern portion of the Toroda graben, pre-Tertiary rocks northwest of **Midway** (the ‘Midway Window’), and pre-Tertiary rocks surrounding the historic Phoenix-Golden Crown-Lexington district (**Mount Attwood**), where a number of nearby geochemical anomalies with elevated Au-Ag-Bi-Sb-Hg-Mo-Te have been outlined.

In 2016, previously unrecognized epithermal quartz veins and precious metal mineralization were recognized in the **Attwood-Overlander** area, hosted in Permian limestone and siltstone of the Attwood Group (Fig. 3). Bands of sulphide mineralization in altered limestone yielded up to 9.27 g/t Au, with elevated Ag, Cu, Hg, Sb and Te. Rock grab samples from exposed epithermal veins, from 0.75 to 2 m wide, returned up to 29.8 g/t Au. Detailed mapping was conducted in 2017 to follow up on anomalies identified on airborne and ground electromagnetic and magnetic data, and to further understand vein and skarn zonation.

At **Midway**, surface sampling and mapping identified additional zones of alteration and veining. Pre-Tertiary rocks yielded a strong Au-Ag-As-Hg-Sb-Mo geochemical anomaly in the area of Ingram Creek that is spatially related to a northeast-trending structure, and potential precious metal epithermal and skarn mineralization.

Drilling in 2017 (1160 m, 4 DDH at **Attwood**, 3 DDH at **Midway**) intersected alteration and mineralized zones similar to those seen at surface in both areas. At March Creek, Bruce Creek, and Kerr Creek, stream-sediment samples were anomalous for precious metals and indicator minerals of a potential epithermal system. Triassic sediment-hosted VMS and skarn mineralization was also mapped and sampled on the Rads claim group, along the northern extension of the Republic graben.

7.1.6. May Mac, Golden Crown, Lexington, and Phoenix (Golden Dawn Minerals Inc.)

Golden Dawn Minerals Inc. has been evaluating several historic mineralized areas near their Greenwood project, including the **May Mac**, **Golden Crown**, and **Lexington**. The area is underlain by rocks of the Knob Hill and Anarchist groups (Paleozoic), the Brooklyn Formation (Triassic), and the Penticton Group (Eocene; Fig. 3); Jurassic, Cretaceous, and Eocene intrusions occur throughout the area. Mineralization includes: Cu-Au-Ag skarn; Au-Ag epithermal, Ag-Pb-Zn±Au shear hosted, carbonate replacements, stockworks, and breccias, and alkalic porphyry Cu-Au-Ag.

In 2016 and 2017, Golden Dawn focussed on acquiring and expanding their land package. In 2016, they acquired assets from Huakan International Mining Inc., including the

Lexington (Greenwood) mill, and the former **Lexington** and **Golden Crown** underground Cu-Au mines. In 2017, they acquired Kettle River Resources Ltd. from New Nadina Explorations Ltd., and an additional 11,000 ha, including the historic **Phoenix** mine, and surrounding claims and historic producers. They also signed a letter of intent to acquire the Lone Star, which is just across the border in Washington State, through the acquisition of BGP Resources Ltd..

The company has begun mapping and sampling and is compiling all historic records to evaluate and identify areas of focus. Drilling continued at the **May Mac** (polymetallic vein; Ag-Au-Pb-An-Cu; 3028 m in 22 underground DDH; 1886 m in 8 surface DDH), as a follow-up to work in 2015 and 2016. Underground and surface drilling extended the known mineralization down dip for an additional 250 m, and along strike for 215 m, and intersected multiple mineralized quartz vein zones with iron, lead, and zinc sulphides. Significant intersections include up to 1.2 m grading 174 g/t Ag, 8.2 g/t Au, 3.7% Pb, and 2.6% Zn. Historic production from the **May Mac** (1903 to 1983) is reported to be 4228 t averaging 5.35 g/t Au and 227 g/t Ag. Samples were also taken for metallurgical testing, and bulk sampling. Further underground drilling is planned for 2018. The company also drilled at the **Golden Crown** (2954 m, 31 DDH; ongoing late in the year), to test the deposit and extend zones of known mineralization. Initial results included 12.3 m grading 3.53 g/t Au, 0.11% Cu, and 7.0 m grading 5.14 g/t Au, 1.18% Cu.

Golden Dawn also began dewatering the **Lexington** mine late in the year, with plans for mapping and sampling of the underground workings. The mine produced 5486 oz of Au, 3247 oz of Ag, and 860,259 lbs of Cu from April to December 2008. The ore was processed 17 km away, at the **Lexington (Greenwood) mill**, a 200 ton-per-day gravity-flotation facility. The mill (Fig. 13), which was built in 2007, is now on care and maintenance; the cost of putting the plant back in operation is estimated at \$270,000.

Initial chip sampling and mapping was also conducted on the **Phoenix** group of properties, which includes several historic producers. The sampling program highlighted several gold-silver and gold-copper targets for future drilling at the Sylvester K, JD, Minnie Moore, Summit, Gilt Edge and Oro Denoro past producers and showings with several samples ranging between 8 and 25 g/t Au, and 0.1% to 0.4% Cu over intervals of 1 m.

7.1.7. Gold Drop/C.O.D (GGX Gold Corp.)

GGX Gold Corp. entered an option agreement with Ximen Mining Corp. for the **Gold Drop** property. The property is underlain by metamorphic rocks of the Knob Hill complex (Paleozoic) that have been intruded by granodiorite and diorite of the Nelson plutonic suite and by biotite syenite and diorite/andesite dikes of the Coryell suite (Fig. 3). Gold-bearing veins in the area post-date the Nelson intrusives and pre-date the Coryell suite. The Gold-Drop-North Star veins are 10 cm to 2 m thick. North-trending, steeply dipping strike-slip and normal faults, and low-angle detachment faults post-date mineralization. The



Fig. 13. The 200 ton-per-day Lexington mill (gravity-flotation) and tailings facility. Golden Dawn Minerals Inc. has entered into a purchase agreement with Huakan International Mining Inc. to acquire both the Lexington mine and mill, as well as the nearby Golden Crown mine. Both mines are underground Cu-Au mines.

property hosts numerous low-sulphide, gold-bearing veins, and hundreds of metres of historic underground workings. Between 1919 and 1941, the area saw small-scale production (Gold Drop, North Star, Amandy, and Rhoderick Dhu veins).

Trenching in 2015 at the North Star and Gold Drop vein systems returned a grab sample assay of 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 1.7% Pb. Near the **C.O.D** vein, on the Tel 2 occurrence, a 1988 grab sample from a quartz vein was reported to return 20.8 g/t Au and 115.6 g/t Ag. Historically, most samples that were elevated in Au also had elevated Ag, Pb, and Cu. In 2017, GGX Gold Corp. focused mainly on the southwest portion of the property and conducted rock sampling, trenching, channel sampling, and drilling (1449 m, 27 DDH), at the **C.O.D** vein. Drilling results included 0.3 m of 10.8 g/t Au, 123 g/t Ag and 16.3 m of 4.59 g/t Au, 38.64 g/t Ag. They also undertook prospecting, soil sampling, and rock sampling near the **Gold Drop** main vein, and southwest of the historic Dentonia mine.

7.1.8. LH (Magnum Goldcorp Inc.)

In 2017, Magnum Goldcorp Inc. continued work on their **LH** property, as a follow up to their drilling and geophysical programs in 2014 and 2015. Mineralization appears to follow an east-west trending zone of fracturing, faulting, and silicification in a roof pendant of what are interpreted as Slocan Group sedimentary rocks and Rossland Group metavolcanic rocks, in granodiorites of the Nelson batholith (Fig. 3). Gold occurs in a structural zone up to 13.7 m wide that contains mesothermal quartz lenses and veins 30 to 60 cm wide, and in silicified breccias and stockworks in hornfelsed volcanic rocks. Both styles of mineralization have elevated sulphides, including pyrite, pyrrhotite, arsenopyrite, and chalcopyrite.

In 2017, ground geophysical surveys were conducted to

expand their survey grid. One magnetic anomaly coincides with the surface projection of a gold-bearing pyrrhotitic vein system that was intersected in 2015 drilling. Additional anomalies are interpreted to represent potential sub-parallel and en-echelon veins. Multi-year drill permits were received late in 2017 and the company began drilling.

7.2. Selected polymetallic base and precious metal projects

Base metals are explored for throughout the Omineca belt as SEDEX, VMS, manto and replacement deposits, and along structures in vein and fault systems.

7.2.1. Vine (PJX Resources Inc.)

PJX Resources Inc. continued drilling in 2016 at the **Vine** property, and updated their geological-geophysical model. The property lies immediately north of the Moyie fault, a northeasterly trending structure in the Vulcan tectonic zone (Fig. 2), and a small north-trending graben. The property is underlain by argillites and quartzites in the middle part of the Aldridge Formation (Fig. 3). Historic trenching and drilling at the Vine vein revealed disseminated and bedded sulphides (pyrite, sphalerite, and galena) along a strike length of more than 1000 m, and to a depth of more than 700 m.

Gravity surveys identified two target areas (East and West) that are interpreted to have potential for massive sulphide mineralization (Pb-Zn-Ag±Au). Recent drilling on these targets identified disseminated and replacement sphalerite along fractures and associated with carbonate-rich beds. The West target lies parallel to the Vine vein, which is a shear-related vein system (Pb-Zn-Ag-Au) that was discovered in the late 1970s. Two holes drilled on the **Vine** vein in 1990 and 1994 encountered thin zones of massive sulphides at depth. Additional geophysical work was conducted in 2017, and drilling (6000 m; 15 DDH) focused mainly on the East target. Drill holes intersected sulphide (sphalerite, pyrite, pyrrhotite) mineralization with chlorite and albite, typical of distal SEDEX mineralization in the Belt-Purcell basin, and complexly deformed massive sulphides in the Moyie fault zone.

7.2.2. Monroe (Highway 50 Gold Corp.)

Highway 50 Gold Corp. drilled at the **Monroe** property, targeting base metal sulphide mineralization in the Aldridge Formation (Fig. 3). The property lies in a structural corridor at the intersection of two major fault zones, with numerous other showings, vent and breccia complexes, and abundant sericite, albite, chlorite, garnet and biotite alteration. Isopach variations, hydrothermal alteration, and distal-style mineralization may indicate proximity to growth faults and SEDEX mineralization in the Belt-Purcell basin (Lydon, 2007; Lydon, 2010).

The company has been drilling since 2015, as a follow up on geochemical soil anomalies and geophysics, with an additional four holes (4000 m) in 2017. Drilling intersected bedded pyrrhotite and sphalerite (Fig. 14) and pyrrhotite-biotite-chlorite-albite±-chalcopryrite veins across intervals of more than 170 m. Drilling also intersected thickened sequences



Fig. 14. Bedded sulphides in drill core on the Monroe property.

within the Aldridge Formation, albitized sedimentary and sulphide clast fragmentals, carbonate beds, and abundant sericite and chlorite alteration. One hole drilled a 40 m section of argillite with abundant pyrrhotite laminations, followed by 6 m of albitized rock, and underlain by a 40 m zone of sphalerite and galena in tension cracks and veinlets.

7.2.3. Irishman, Panda, Sweet Spot, and DD (Teck Resources Limited)

Teck Resources Limited continued work on their properties in the Purcell anticlinorium. The company staked claims in 2015 and has optioned other surrounding claims for SEDEX mineralization. Teck has the option to acquire 75% of the nearby **DD** property from PJX Resources Inc.

The area is underlain by Purcell Supergroup rocks, with extensive stratabound and discordant fragmental units and widespread albite-tourmaline-chlorite-sericite alteration. Recent focus in the Purcell anticlinorium has been on geophysical methods to further identify structures and thickness variations in the Aldridge Formation that may indicate sub-basin development and potential SEDEX mineralization. A recent study by Cook (2017) indicates that magnetotellurics could highlight conductive subsurface horizons and provides another tool for SEDEX targeting.

In 2016, the company re-logged core, mapped, and sampled over their claims, and identified target areas. In 2017, their focus was on geophysics. Using magnetotellurics, they ran a test line to determine the signature surrounding the Sullivan deposit, and ran three other lines across their target areas between Moyie and Creston. The company hopes to identify areas for drilling in 2018.

7.2.4. Silver Fox (Antofagasta plc)

Antofagasta plc entered into an option agreement with Kootenay Silver Inc. to acquire 80% interest in the **Silver Fox** property (Fig. 1). The area is underlain by sedimentary rocks of the Purcell Supergroup (Mesoproterozoic); mainly rusty weathering argillites in the upper part of the Aldridge Formation and quartzite, siltstone and argillite of the Creston Formation. Mineralization is thought to be penecontemporaneous, formed by hot, metal-enriched brines moving through porous sediments before lithification, with metals deposited at redox interfaces.

The property lies along the northern extension of the Western Montana copper belt, where copper-silver is hosted in three main deposits (Troy-Spar Lake, Rock Creek, Montanore; averaging 1.45 oz/ton Ag, 0.65% Cu, <2% sulphides) in the Revett Formation (Creston Formation equivalent).

Mapping and prospecting at the **Silver Fox** has identified strata-bound copper mineralization, with chalcopyrite and malachite, and accessory galena, arsenopyrite, bornite and pyrite occurring as disseminations, fracture fillings, and/or blebs in quartzites, calcareous siltstones, and sericite-altered siltstones. Three samples assayed 0.104% Cu and 2.9 g/t Ag; 0.127% Cu and 9.9 g/t Ag; and 0.55% Cu, 14 g/t Ag, and 0.208 g/t Au. Pyrolusite and jarosite alteration are associated with the mineralization. Between 2007 and 2013, Kootenay Silver completed mapping and sampling, ground electromagnetic and magnetic surveying, a 500 line km airborne magnetic survey, and a 500 line km seismic survey. In 2017, Antofagasta plc, together with Kootenay Silver Inc., delineated five main targets with further mapping, sampling, and ground geophysics, and drilled (3000 m).

7.2.5. Sully (Kootenay Zinc Corp.)

Kootenay Zinc Corp. continued work on their **Sully** property in 2017, where two subsurface gravity anomalies in the Aldridge Formation were identified. Previous drilling intersected traces of Pb-Zn-Cu sulphide mineralization, sericite alteration, and complex faulting. Overturned strata and low-angle faults have been mapped at surface and intersected in drilling. The low-angle faults, which have an apparent thrust sense, are considered to have originated as normal faults that were rotated during later deformation (Ransom et al., 2017). Minor zinc mineralization has been located in outcrop. Geological and geophysical model interpretations suggest the gravity anomalies may represent fault repetition of an overturned, near-vertical stratabound sulphide horizon in the Aldridge Formation.

In 2017, the company expanded their ground magnetic and gravity survey coverage, conducted additional soil geochemistry,

and drilled (1464 m; 6 DDH). Downhole magnetics and EM were run in two drill holes to better understand the geology and update the geophysical model

7.2.6. Thor (Taranis Resources Inc.)

Taranis Resources continued work at the **Thor** property, which has several targets, and showings, including the True Fissure, Great Northern, Broadview, and Blue Bell past-producing mines. The company acquired the property in 2006 and released a NI 43-101 resource estimate in 2013 based on 152 holes that were drilled between 2007 and 2008 at three main zones (Broadview, Great Northern and True Fissure). Their 2016 drill program encountered stacked zones of mineralization beneath the Great Northern, and as step-out mineralization in previously undrilled areas. Additional work identified other targets that appear as VLF conductors and gossans, and the company expanded their VLF grid further in 2017. They followed up several targets with trenching, expanded the known mineralization at their SIF zone, and discovered new mineralization beyond the Great Northern. Channel sample results include 2.04 m grading 26.6 g/t Au, 1246 g/t Ag, 3.1% Pb, 4.3% Zn, and 0.55% Cu. A portable test mill was used to produce a heavy minerals concentrate with gold. The company has updated their 3D modeling of the deposit to identify peripheral targets, and plans to update the resource after drilling in 2018.

The **Thor** property lies at the northern end of the Kootenay arc (Fig. 2), and is underlain by a thick succession of folded and faulted sedimentary and volcanic rocks of the Badshot Formation and Lardeau Group (Fig. 3). Stratiform sulphide mineralization (Ag-Pb-Zn-Au-Cu) predates folding and faulting and is interpreted as primary, possibly of volcanogenic massive sulphide origin. Parallel horizons of massive and disseminated galena, chalcopyrite, pyrite, and sphalerite extend along a 2 km strike length of a sheared, northwesterly trending anticline. The zone of mineralization is commonly intercalated with tuffaceous pyroclastic rocks. Drilling encountered foliated quartz-feldspar porphyry, which is considered to pre-date structures and possibly be related to the mineralizing event. High-grade gold is also found in late quartz veins and breccia zones that flank the main zone of sulphide mineralization (Fig. 15).

7.2.7. Teddy Glacier and Spider mill (Jazz Resources Inc.)

The **Teddy Glacier** property lies at the northern end of the Kootenay Arc (Fig. 2) and has been intermittently explored since the 1920s. The property is underlain by tightly folded and sheared limestones, carbonaceous phyllites, and grits of the Index and Jowett formations (Lardeau Group; Fig. 3). Mineralization occurs as irregular Ag-Pb-Zn±Au polymetallic veins, and stratabound massive galena-pyrite-chalcopyrite in silicified limestones.

Samples from **Teddy Glacier** assayed from 0.082-1.88 oz/ton Au, 7.23-22.9 oz/ton Ag, 8.86-27.5% Pb, and 5.11-22.1% Zn. The company has been moving towards rehabilitating the



Fig. 15. Quartz breccia on the Thor property.

historic **Spider mill** site, and moved a pilot mill on site. The company plans to collect a 5000 t bulk sample from **Teddy Glacier** and process it at the **Spider mill**.

In 2017, the company continued environmental baseline studies, upgraded the historic tailings facility, and worked on mitigation plans to obtain permits for the site.

7.2.8. Slocan Silver (Klondike Silver Corp)

Klondike Silver Corp's **Slocan Silver** project consists of 25,000 ha with more than 68 past producers, in the silver-rich historic Slocan (Ag-Pb-Zn) mining camp, with production that dates back to 1891. The area is underlain by sheared and brecciated metasedimentary rocks of the Slocan Group (Late Triassic) that are cut by granodiorite and quartz monzonite dikes and at the edge of the Nelson batholith (Middle Jurassic; Fig. 3). Ag-Pb-Zn mineralization is in a series of east to northeast-trending, shear zone-hosted polymetallic quartz-carbonate veins, and as replacements in Slocan Group limestones. Klondike's holdings include the Sandon, Hewitt, Silverton Creek, Cody Creek, Payne, and Jackson Basin camps, and the Silvana, Wonderful and Hinckley past producers. The main vein at **Silvana** is in an eight km long structure that yielded about 242 t Ag, 28,691 t Pb, 26,299 t Zn and 72 t Cd from 510,964 t mined between 1913 and 1993, at an average grade of 13.87 oz/t Ag, 5.62% Pb, and 5.15% Zn. Considerable underground work, including rehabilitating old workings, extending exploration drifts, underground drilling and sampling, and bulk testing and processing of ore was done by Klondike Silver until 2013. The company's mill at Sandon is a 100 tpd flotation mill that operated at an average rate of 40 tpd that is currently on care and maintenance. The company has been sampling, mapping, and compiling all the historic data into a 3D model, including all underground workings, mined stopes, faults, geology, and drill hole data (~1150 underground and surface holes).

In 2017, LiDAR was flown over the area, and the company

began rehabilitating the 4625 ft mine level portal of the **Silvana**, and the 5480 and 6100 ft mine levels of the Carnation, in preparation for further underground work. Access road upgrades have also begun to the Ruth-Hope and Silversmith. Environmental work and engineering upgrades to the tailings facility, mill, and underground structures are ongoing.

7.2.9. Jersey-Emerald (Margaux Resources Ltd.)

Margaux Resources Ltd. continued work at **Jersey-Emerald**. The property lies at the south end of the Kootenay Arc, and is underlain by interstratified carbonates and pelites of the Laib (Cambrian) and Active (Ordovician) formations (Figs. 2, 3). Coarse-grained marble to garnet-pyroxene skarn occurs in the Truman and Reeves members at contacts with small Cretaceous biotite granite stocks, Nelson intrusions (Jurassic to Cretaceous), and pegmatitic stocks. The main structure is a NNE-trending anticline known locally as the Jersey anticline. The property contains: stratiform lead-zinc-silver mineralization; tungsten (with minor molybdenum and copper) skarn mineralization; quartz veins, silicified limestone, and greisen-type alteration with gold, bismuth, cadmium and barium; and molybdenum porphyritic stocks. The **Emerald Tungsten** mine has stratabound Pb-Zn mineralization in the Reeves member, and a W-skarn zone in the Truman member. The **Jersey** mine has stratiform Pb-Zn mineralization at the base of the Reeves member (Fig. 16). The surrounding historic Dodger, Invincible, and Feeny mines also display tungsten mineralization.

In 2016, Margaux completed LiDAR over the property, worked on dewatering the underground workings at the Emerald, and compiled all the available historical data (including surface and underground mapping and surveys, over 5300 drill collars, logs, and assay data). They began expanding their 3D modelling, and drilled late in the year focussing on higher grade gold-bismuth targets and lead-zinc targets. Drill results were released early



Fig. 16. Stratiform mineralization in the Reeves Member (Cambrian) at the Jersey mine.

in 2017, with 10.2 m grading 24.98 g/t Au, 0.65 m grading 68.3 g/t Au, and 0.25 m grading 59.1 g/t Au, with gold strongly associated with bismuth and tellurium. They also discovered an historic drift, along strike with the Pb-Zn **Jersey** mine that was 12.8 m long, with continuous galena-rich mineralization. Further drilling in 2017 (1121 m, 6 DDH) was done to follow up on gold, and lead-zinc targets, with 6.1 m grading 2.61% Pb and 0.44% Zn, and 3.11 m grading 2.02% Pb, 0.48% Zn. Further follow-up work included geological mapping and sampling on the property, along with re-logging and sampling historical drill core. Silt sampling near the tungsten skarn mill site, which was not designed to recover gold, revealed that the skarn mineralizing system contains a previously unidentified gold component. Rock sampling from the Comet and Tungsten King showings returned results including 32.8% Zn, 1.2% Pb; and 2.69% Zn, 0.65% Pb, with elevated gold and bismuth.

Margaux Resources Ltd. has entered into a partnership agreement with CRONIMET Mining Group to evaluate the potential to re-process tailings from the historic **Emerald** tungsten mine (1942-1943, operating intermittently until 1973). At the time of operation, the mine was the second most productive tungsten mine in North America, and mined 1.077 Mt averaging 0.86% WO_3 . In 2017, the company excavated and shipped approximately 3500 kg of material for testing, and will move to a more comprehensive bulk sampling proposal pending technical and economic viability of the project.

7.2.10. Jackpot (Margaux Resources Ltd.)

Margaux Resources Ltd. entered into an option agreement in 2016 to acquire 100% of the **Jackpot**/Oxide property, 17 km north of their **Jersey** property. The Jackpot orebodies are currently thought to be Kootenay Arc-type carbonate-hosted syngenetic deposits. The orebodies are concentrated in complex fold structures in dolomitized limestones of the Laib Formation (Lower Cambrian), Reeves member (Fig. 3). Several historic Pb-Zn showings occur in the Laib formation, and historic work includes two exploration drifts (1858 m; two levels), and 143 surface and underground drill holes. Grab sample results from late in 2016 include up to 30% Zn, with associated Pb, Ag, and Cd.

In 2017, the company compiled all historical data into a 3D model, identifying a zone of mineralization along a 600 m strike length. They also conducted a LiDAR survey, sampled outcrops, re-sampled historic drill core, and identified several targets for drilling. Results of chip sampling included 3.4 m grading 13.35% Zn, 2 m grading 15.58% Zn, and 3 m grading 8.97% Zn. Their drill program (1397 m, 9 DDH) targeted an area of 500 x 1000 m and three main zones, including the Jackpot Main, Lerwick, and Jackpot East, and included results of 61.1 m grading 1.01% Zn, 49.2 m grading 1.04% Zn, 8.5 m grading 6.66% Zn, and 36.3 m grading 1.48% Zn. Mineralized core is shown in Figure 17.



Fig. 17. Zinc-lead mineralized drill core from the Jackpot property. Photo courtesy of Margaux Resources Ltd.

7.2.11. Kena/Daylight/Toughnut (Prize Mining Corporation)

Prize Mining Corporation entered into two separate option agreements in 2017, to acquire an 80% interest in the **Kena** and **Daylight** gold-copper properties (20% owned by Apex Resources Inc.), and 100% of the adjoining **Toughnut** claims. The area is underlain by sheared and highly schistose augite basalt flows and subvolcanic intrusions of the Elise Formation (Rossland Group), and Silver King intrusions (Late to Middle Jurassic; Fig. 3). Porphyry style gold and copper-gold mineralization is low grade, bulk tonnage. In addition, bonanza-grade gold mineralization has four distinct settings: a high-grade corridor, associated with volcanic and intrusive rocks; volcanic-intrusive contact areas; bonanza shoots; and bulk tonnage haloes around shoots. Northwest-trending shears also

host quartz veins with sulphides. Shear-zone mineralization occurs as vein, stockwork, and porphyry-style Au and Au-Cu. Historic production includes the Starlight, Victoria, Daylight, and Great Eastern mines, which operated intermittently from 1937 to 1949 and produced mainly gold, silver, and copper.

In 2017, Prize Mining Corporation mapped, sampled (rock and soil), conducted ground based magnetic and VLF surveys, and trenched. Soil sample results yielded samples up to 1 g/t Au, and one sample at 8 g/t Au. Results from the soil grid were combined with historical data. Rock samples yielded results up to 33 g/t Au, with one sample at 188 g/t Au. Based on the initial exploration program, 41 targets were prioritized. Later in the year, they drilled (2695 m, 18 DDH) at the **Daylight-Kena**, and also began a drill program late in the year at the **Toughnut** (1730 m, 7 drill pads). Environmental baseline water quality surveys were also undertaken in preparation for further exploration.

7.2.12. Swift Katie (Valterra Resource Corporation)

In 2017, Valtterra Resource Corporation released results of their 2016 drill program (1954 m, 6 DDH), and continued drilling on their **Swift Katie** project (1392 m, 8 DDH). Results included 2.5 m grading 11.5 g/t Au and 6.7 g/t Ag, (including 0.8 m grading 30.9 g/t Au and 17.8 g/t Ag); and 8.6 m grading 3.1 g/t Au and 2.0 g/t Ag. One of the holes is offsetting a 2014 hole that assayed 3.5 m grading 13.3 g/t Au, 201 g/t Ag and 0.33% Cu. Drilling tested three areas along a 1000 m strike length that has been traced on surface by rock and soil sampling, and historical trenching.

The property is underlain by volcanic and synvolcanic intrusive rocks of the Elise Formation (Early Jurassic), Nelson intrusions (Jurassic to Cretaceous), Eocene intrusive rocks (Coryell), and Tertiary felsic to mafic and lamprophyre dykes. Historically the property was explored as two separate mineralizing systems. The northern claims host the **Katie** alkalic Cu-Au porphyry target, with pyrite, chalcopyrite, bornite, pyrrhotite, sphalerite, tetrahedrite and chalcocite. Polymetallic (Pb-Zn-Ag±Au,Cu) shear-hosted quartz-calcite veins cut the deposit. Alteration consists of a potassic core, with elevated copper and gold, surrounded by a broad propylitic zone. Drilling on the **Katie** identified zones of copper-gold mineralization along a 1800 m strike length, with numerous other untested soil anomalies. The southern claims host the **Swift** Au-Ag vein targets, in highly deformed and strongly quartz-sericite-pyrite-altered rocks of the Elise Formation, and at the contact between andesite and a diorite intrusion. Vein mineralization is mainly pyrite-pyrrhotite-chalcopyrite, with elevated copper and lead.

7.2.13. Alpine (Braveheart Resources Inc.)

Braveheart Resources Inc.'s **Alpine** property is underlain by Nelson intrusions (Jurassic to Cretaceous). Mineralization (Au-Ag-Pb-Zn) is found in shear zone-hosted mesothermal quartz veins. Numerous small adits exist on the property, and intermittent production from the historic Alpine mine from 1915 to 1988 totalled 16,810 t containing 222 kg Ag, 356 kg Au,

49,329 kg Pb, and 17,167 kg Zn (BC MINFILE 082FNW127). In 2017, they mapped, sampled, and drilled (1600 m, 11 DDH) on the property to test the extension and continuity of mineralization within quartz veins on the property. Drill intersections include: 1.5 m grading 11.8 g/t Au, 1.7 m grading 19.1 g/t Au, and 1.4 m grading 38.0 g/t Au.

7.2.14. Duncan (Rokmaster Resources Corp.)

The **Duncan** property has been intermittently explored since the 1950s. The property is along the Kootenay arc (Fig. 2), and underlain mainly by the Mohican and Badshot formations (Fig. 3), but include the upper part of the Hamill Group and lowermost rocks of the Index Formation (Lardeau Group). Structures are mainly tight, asymmetric and overturned folds, and steeply dipping faults. Mineralized zones consist of pyrite, sphalerite, galena and minor pyrrhotite disseminated in dolomite and siliceous dolomite of the Badshot Formation.

Drilling by Cominco between 1989 and 1997 outlined zinc-lead mineralization along a 650 m strike length. Several zones of mineralization exist on the property as steeply dipping, stratiform, tabular bodies, separated by high-angle fault zones, within the east limb of the Duncan anticline.

In 2017, Rokmaster compiled historic data and re-sampled historic drill core. Results include 14.7 m grading 8.2% Zn+Pb, 13.4 m grading 8% Zn+Pb, and 12.2 m grading 8.31% Zn+Pb, and suggest that mineralization is open along strike. The company received drilling permits late in the year, and intends to begin drilling in early 2018.

7.3. Selected industrial mineral projects

Industrial minerals are explored for throughout the region, including graphite, gypsum, magnesite, silica, rip rap, dimension stone, sand and gravel, limestone, dolomite, tufa, smelter slag, basalt, gabbro, marble, and phosphate.

7.3.1. Frances Creek (Voyageur Minerals Ltd.)

At the **Frances Creek** property, barite is found in fault-controlled breccia cutting dolomitic rocks of the Mount Nelson Formation (Mesoproterozoic; Purcell Supergroup; Fig. 3).

Voyageur Minerals Ltd. continued drilling late into the year (more than 1200 m, >17 DDH) targeting barite in a brecciated vein. Drill results indicate barite mineralization extends over a 20.37 m width, for 60 m along strike, averaging 30.57% BaSO₄. Drilling is ongoing and designed to extend the strike length farther, and test mineralization to a depth of about 60 m. Purity testing indicates that the barite, in addition to being used for drilling in the oil and gas industry, may qualify for the pharmaceutical market. The company plans for bulk sampling.

7.4. Selected coal projects

Coal exploration is ongoing in the Elk Valley, Crowsnest, and Flathead coalfields.

7.4.1. Coal Creek (Crowsnest Pass Coal Mining Ltd.)

Crowsnest Pass Coal Mining Ltd. continued geological

modeling, environmental baseline studies, engineering review, resource, and pre-feasibility work at their **Coal Creek** property.

The project is underlain by 11 coal zones 2 to 20 m thick. The company is evaluating three near-surface seams in the uppermost part of the Mist Mountain Formation that dip gently to the east for underground room-and-pillar mining potential. Drilling in 2012 indicated high-quality hard coking and PCI coal in the upper seams.

7.4.2. Elko (Pacific American Coal Limited)

Pacific American Coal Limited has been working on their **Elko** project since 2015, when they began mapping, sampling, and compiling historical geological data, including drill locations, and historical adits. In 2017, the company updated their geological model, outlined drill locations, and conducted environmental baseline work. Permitting is currently underway for drilling in 2018.

The project is in the Crowsnest Coal field, targeting Mist Mountain Formation (Fig. 3) coal seams in the McEvoy syncline. Five seams outcrop on the property, with thicknesses of ca. 2.6 to 5.0 m, and quality ranging from hard coking coal to PCI coal. Block modeling of the project indicates the potential for a small open cut operation, with potential development of a larger underground operation. The company released a JORC resource estimate of 181.3 Mt Inferred, 57 Mt Indicated, and 19.2 Mt Measured (2015), and has been working to get drill permits in place for 2018.

8. Selected geological research

Ransom et al. (2017) released a study highlighting that some of the normal faults related to extension along the Rocky Mountain trench fault in the Hughes Range were rotated during later deformation and now have an apparent thrust sense. Cook (2017) is using magnetotellurics to image structures and subsurface conductors in the Purcell anticlinorium. In the West Kootenays, Allan et al. (2017) released a study on orogenic gold systems in the Cariboo, Cassiar, and Sheep Creek camps, and Webster et al. (2017) has been studying polyphase metamorphism and deformation between Nelson and Creston. In the Boundary region, updated geological mapping is being done in 082E/7, 082E/8, 082E/9 and 082E/10 (Höy et al., 2016). Mackay et al. (2017) studied reducing the amount of chemicals used in cleaning coal by using a water-based jig.

9. Summary

In 2017, exploration and mining continued in the region. Major mine development, expansion plans, and projects in the East Kootenay coalfields continue to advance. Several mine development projects for industrial minerals continue to move forward. Exploration for SEDEX-style base metals in the Purcell Anticlinorium, and base and precious metal mining projects in the region remain active. Commodity prices were up in 2017, and activity in the region was increased. Several late drill programs continued late into the year throughout the region.

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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, infrastructure, and access to markets have made it an important industrial minerals centre as well. 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, and 80 exploration projects were tracked in 2017, although the number of mineral properties with some level of activity was likely greater.

For the South Central region, exploration expenditures are estimated to be \$61.1 million; exploration drilling is estimated at 237,600 m (Clarke et al., 2018; Ernst & Young LLP, in press). This represents a significant rebound from 2016 although the increase is mainly attributable to the Cariboo Gold project (Barkerville Gold Mines Ltd.).

A combination of geologic potential, accessibility, and other infrastructure accounts for the region's productivity. The porphyry copper potential of the area is largely hosted by the Quesnel terrane, mineralized by Triassic-Jurassic intrusions. Gold mineralization is, for the most part, younger (Cretaceous) and found in different orogenic vein and epithermal settings.

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; for a detailed summary of the South Central Region see Britton, 2017). 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 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 Cariboo terrane (shown as Cassiar in Fig. 1) comprises 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 basinal strata on Fig. 1) comprise Neoproterozoic to mid-Paleozoic deep-water basin facies equivalent rocks that were 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 extensional deformation (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 east and southeast of Clearwater (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

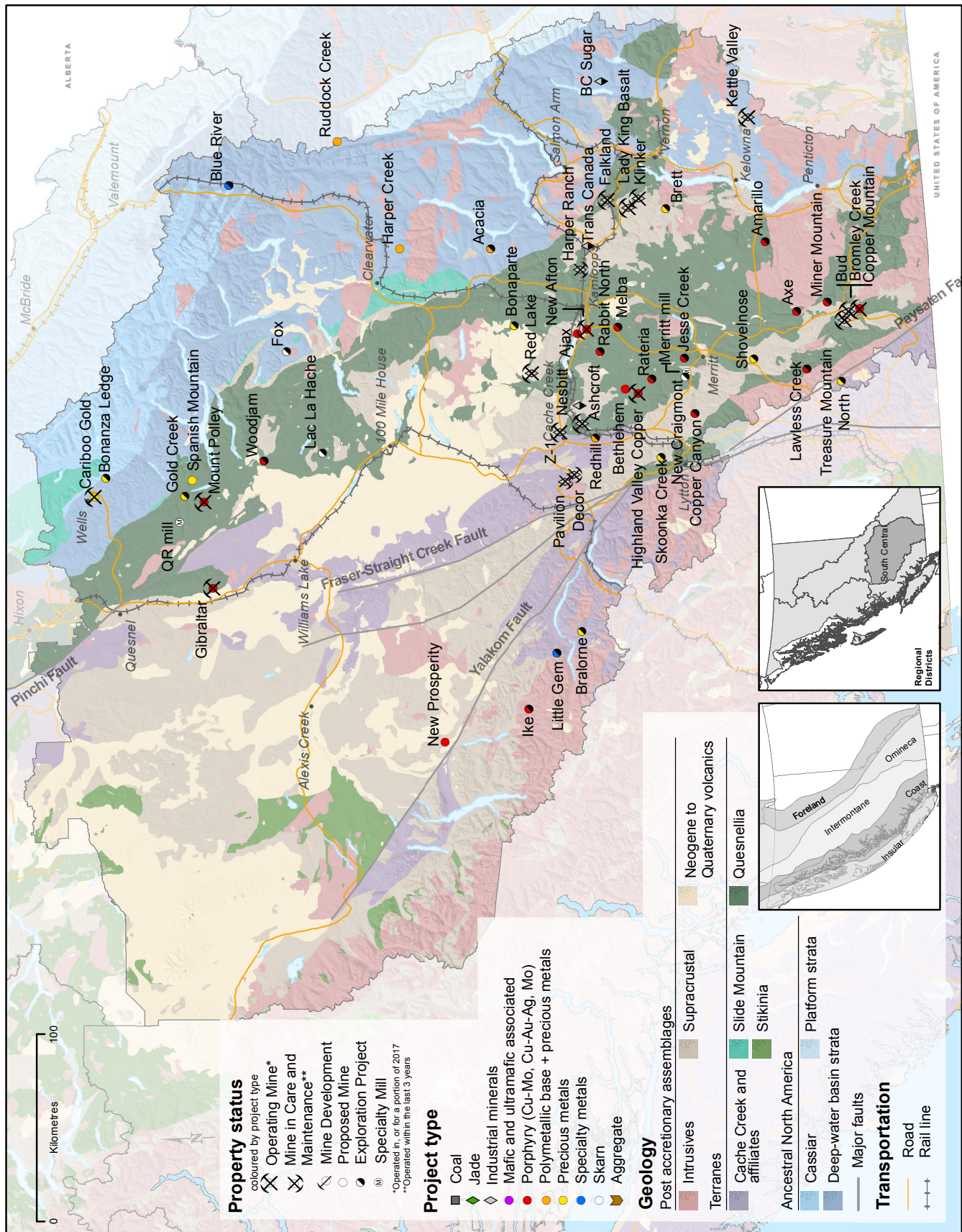


Fig. 1. Mines and selected exploration projects, South Central Region, 2017. Terranes from British Columbia digital geology map (Cui et al., 2017).

the Nicola Group, together with abundant Late Triassic to Early 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, 2018). 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 comprises Lower to Middle Jurassic sedimentary rocks that unconformably overlie western parts of the Nicola Group or (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 or 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, Afton and Mount Polley. A third belt, younger and farther to the east, is defined by several large, Early Jurassic calc-alkaline plutons.

Cache Creek terrane, comprising 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 (Lower 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 (Dohaney 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 only a minority 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 Highland** and **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**. **Bralorne**, near Gold Bridge, is moving toward a restart with a permit to mill 100 tpd.

3.1.1. 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 2017 mill throughput averaged more than 38,000 tpd, with feed grade 0.31% Cu and about 78% recovery. Holbek et al. (2015) described the deposit as a structurally complex, alkalic porphyry copper-gold system with mineralization mainly

Table 1. Metal mines, South Central Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Bonanza Ledge	Barkerville Gold Mines Ltd.	Au; Au-quartz veins; 093H 140	30,000 t (2017 target)	na	M: 248,000 t 8.07 g/t Au I: 436,700 t 6.72 g/t Au Inf: 108,100 t 5.34 g/t Au	Mining began last week of August 2017. Planned 150,000 tpy 6.5 g/t Au diluted for 3.5 years.
Copper Mountain	Copper Mountain Mining Corporation 75%, (Mitsubishi Materials Corporation 25%)	Cu, Au, Ag; alkalic porphyry; 092HSE001	53.6 Mt mined, 10.4 Mt milled Q1-Q3	P: 53 Mt 0.36% Cu, 1.43 g/t Ag, 0.11 g/t Au Pr: 69 Mt 0.30% Cu, 1.15 g/t Ag, 0.11 g/t Au	M+I: 221 Mt 0.33% Cu, 1.3 g/t Ag, 0.10 g/t Au Inf: 228 Mt 0.27% Cu, 1.01 g/t Ag, 0.14 g/t Au	Resources inclusive of reserves. Company projects 36,287 t Cu production 2017.
Gibraltar	Taseko Mines Limited 75%, (Sojitz Corp. 12.5%, Dowa Holdings Co. Ltd. 6.25%, Furukawa Co. Ltd. 6.25%)	Cu, Mo; porphyry; 093B 012	66.2 Mtons mined, 22.0 Mtons milled Q1-Q3	P+Pr: 688 Mt 0.26% Cu, 0.008% Mo	M+I: 1031 million tons 0.25% Cu, 0.008% Mo	Resources inclusive of reserves.
Highland Valley Copper	Teck Resources Limited	Cu, Mo; porphyry; 092ISW012, 045	87.4 Mt mined, 38.525 Mt milled Q1-Q3	P: 334.7 Mt 0.31% Cu, 0.007% Mo Pr: 211.9 Mt 0.26% Cu, 0.010% Mo	M: 517.4 Mt 0.31% Cu, 0.008% Mo I: 953.7 Mt 0.23% Cu, 0.010% Mo Inf: 501.2 Mt 0.24% Cu, 0.008% Mo	Resources exclusive of reserves. 2017 Cu production projected 275,000-290,000 t, Mo 7.5-8.0 Mlb.
Mount Polley	Imperial Metals Corporation	Cu, Au, Ag; alkalic porphyry; 093A 008	4.917 Mt milled Q1-Q3	P+Pr: 73.613 Mt 0.274% Cu, 0.293 g/t Au, 0.562 g/t Ag	M+I: 180.5 Mt 0.26% Cu, 0.251 g/t Au, 0.904 g/t Ag Inf: 14.7 Mt 0.21% Cu, 0.188 g/t Au, 0.904 g/t Ag	Reserves in 5 zones, effective Jan. 1, 2016. Resources (excluding reserves) are as of Aug. 14, 2017 including updated Martel zone. 2017 production targets 20-22 Mlb Cu, 51-55,000 oz Au.
New Afton	New Gold Inc.	Au, Ag, Cu; alkali porphyry; 092INE023	4.596 Mt mined, 4.510 Mt milled Q1-Q3	Pr: 60.336 Mt 0.6 g/t Au, 2.0 g/t Ag, 0.78% Cu	M+I: 56.592 Mt 0.64 g/t Au, 2.1 g/t Ag, 0.76% Cu Inf: 15.219 Mt 0.41 g/t Au, 1.3 g/t Ag, 0.41% Cu	2017 targets 70,000-80,000 oz Au, 85-95 Mlb Cu. Resources exclusive of reserves.

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

in Nicola Group (Triassic) volcanic rocks with subordinate amounts in coeval intrusive rocks. Mineralization shows strong vertical continuity.

A multi-year exploration program resumed at the mine site to extend Pit 2 westward and test mineralization below the pit with 8900 m of drilling. Drilling then moved to the New Ingerbelle (Fig. 2) deposit with a 5000 m program to confirm historical resources and potentially extend mine life by 10 years.



Fig. 2. The Ingerbelle pit at the Copper Mountain mine site.

3.1.2. 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 milled 22 Mtons in the first nine months of 2017 at grades of about 0.3% Cu and 86% recovery. Operations were affected by wildfires in July, preventing personnel from travelling to the mine site and temporarily stopping rail traffic and the ability to ship concentrate.

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 (Late Triassic; see van Straaten et al., 2013 for detailed mine geology) in a fault-bounded section of Nicola Group sedimentary and volcanic rocks (Quesnel terrane; Schiarizza 2014, 2015).

3.1.3. Highland Valley Copper (Teck Resources Limited)

The **Highland Valley Copper** copper-molybdenum mine's (Fig. 1; Table 1) ore comes from three pits (Valley; Lornex; Highmont). Mill throughput capacity is 130,000 tpd. In the first nine months of 2017 it milled 38.525 Mt at a copper grade of 0.22% and recovery of 73.5% as it processed low-grade ore

from the Lornex pit. A project to install an additional ball mill that began in September is projected to increase mill throughput by 5% and copper recovery by 2%.

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 is under review with the Ministry of Energy, Mines and Petroleum Resources. 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 (late Triassic), which has been divided into a number of pre-, syn- and post-mineral phases (see Byrne et al., 2013).

3.1.4. Mount Polley (Imperial Metals Corporation)

The **Mount Polley** copper-gold-silver mine (Fig. 1; Table 1) of Imperial Metals Corporation completed its first year of full operation in 2017 after a breach in its tailings dam in 2014 caused a year of lost production. Normal operations resumed in June 2016. The mine continued through 2017, with the exception of the second half of July when operations were suspended because of a forest fire evacuation order. Ore milled was just over 18,000 tpd in the first nine months of 2017 for 4.9 Mt at 0.207% Cu, 0.337 g/t Au and recoveries of 67% and 71%. Imperial anticipates producing 22-24 million lb Cu and 51-55 thousand oz. Au in 2017, an 8-9% decrease because of the interruption. All 2017 production is coming from open pits, though there are underground resources and reserves.

Late in 2016 the company initiated a 5000 m underground drilling program to test two zones (Martel and Green) from the access ramp to the underground Boundary zone. Exploration continued at the Martel zone into 2017, resulting in a revised resource estimate. The Martel zone lies beneath the Wight pit. In the first half of 2017, Imperial updated the reserve and resource estimates for Mount Polley (Table 1).

The alkalic intrusive complex (Late 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.

3.1.5. 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 2017, ore processed was just over 4.5 Mt at 0.55 g/t Au and 0.82% Cu (80% and 81% recovery). In the first half of 2017, New Gold completed infill drilling of the C zone, a down-plunge extension of the area (B zone) now being mined (Rennie et al., 2015). Satellite targets were also drilled from surface elsewhere in the mine lease area. The New Afton deposits form a high-grade keel beneath the past-producing

Afton open pit mine, an alkalic porphyry in the Iron Mask batholith (Triassic).

3.1.6. Bonanza Ledge (Barkerville Gold Mines Ltd.)

Barkerville restarted the **Bonanza Ledge** mine (Figs. 1, 3; Table 1) as an underground long-hole and cemented-fill operation below the existing pit. They expect to mine about 30,000 t in 2017 and 150,000 tpy thereafter. Initial life of mine is a planned 3.5 years, but there is exploration potential. Ore is trucked to Barkerville's QR mill. 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).



Fig. 3. Portal of the new underground phase of the Bonanza Ledge mine.

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

Avino Silver & Gold Mines Ltd. acquired the **Bralorne** gold mine, near Gold Bridge, 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 necessary to meet permitting requirements. In November, they received an updated permit for a 100 tpd throughput mining operation. Avino anticipates eventually 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. In 2017 they signed a letter of intent with the St'át'imc First Nations on partnerships for the ongoing development of the mine.

Within the new permit boundary are areas of proposed exploration, 8000 m of drilling is scheduled to begin in January, targeting nine veins with existing resources.

3.1.8. Merritt mill (Nicola Mining Inc., 100%)

Nicola operates a 200 tpd custom mill near Merritt and uses tailings storage built for the past-producing Craigmont mine. The mill was originally constructed to process ore from the Treasure Mountain mine, which operated in 2013. The operation was recently upgraded with a gravity jig and concentrating table for processing free gold. In 2017, it underwent modifications and continues to process gold-silver ore from the **Dome Mountain** mine under a contract with Metal Mountain Resources Inc. Nicola also has an agreement with AMA Gold Exploration Ltd. to process a bulk sample from its Dancer property on the Sechelt Peninsula.

3.1.9. QR mill (Barkerville Gold Mines Ltd.)

Barkerville owns the past-producing QR mine. They upgraded the mill and now use the mill and tailings facility to process ore from the Bonanza Ledge mine 110 km away. The tailings facility has capacity for about 900,000 t, adequate for short-term needs.

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 mined 275,000 tons (263,000 t) in 2017. Ashcroft lost 10 days of production because of wildfires (Fig. 4).



Fig. 4. Ashcroft plant of IG Machine and Fiber Ltd. Haze is smoke from wildfires, which affected many exploration projects and mines in the region.

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

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

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Ashcroft	IG Machine and Fibers Ltd. (IKO Industries Ltd.)	Basalt (roofing granules); 092INW104	250,000 t	na	Approx. 13.3 Mt in 2002	10 days lost to wildfire related causes.
Bromley Creek (Zeotech)	Canadian Zeolite Corp.	Zeolite; Open system zeolites; 092HSE243	na	na	M+I: (as of 2013-06-30): 550,000 t	Producing in 2017.
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, however, alternative markets found for 2017-2018.
Harper Ranch	Lafarge Canada Inc.	Limestone; 092INE001	na	na	na	On care and maintenance as of November 2016. Site clean-up.
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	
Lady King Basalt	Opal Resources Canada Inc.	Basalt columns; na	Intermittent operation	na	na	
Mount Polley Magnetite	Craigmont Industries Ltd.	Magnetite (recovered from tailings); 093A 008	na	na	na	Did not produce in 2017. Plan to resume in 2018.
Nazko	Can Lava Mining Corporation	Lava Rock; Cinder cone; 093B 060	na	na	Historical 45 Mt	Product shipped from quarry in 2017. 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.

Table 2. Continued.

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	9000 t	na	Approx. 800,000 t	Historical resource.

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

because of the Lafarge 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. were placed on care and maintenance. The reason cited was poor demand. The facility will continue to serve as a distribution point for cement produced in Alberta. Apart from limestone, the cement plant used gypsum and anhydrite mined at the **Falkland** quarry and alumina-silica silt obtained from a loess deposit. The Falkland quarry continues to supply gypsum.

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. In 2010, Spectral Gold Corp. (now Opal Resources Canada Inc.) began developing the **Lady King Basalt** deposit selling basalt columns for landscaping.

3.2.5. Klinker (Opal Resources Canada Inc.)

Opal Resources Canada Inc. produces gem quality fire opal from the **Klinker** property. Opal forms fracture and vesicle-fillings in andesitic to basaltic lahars and breccias in the Kamloops Group (Eocene).

3.2.6. Mount Polley (Craigmont Industries Ltd.)

In January 2014, Craigmont Industries Ltd. started producing magnetite from their recovery plant at **Mount Polley** mine. Operations stopped in August 2014, due to the tailings dam breach. Poor markets have delayed its expected restart, now anticipated in 2018. The plant captures magnetite from the mine's tailings stream and produces a dense media used for coal washing.

3.2.7. Pavilion (Graymont Western Canada Inc.)

In 2016, Graymont Western Canada Inc.'s **Pavilion** limestone quarry and lime plant was placed on care and maintenance. The operation produced quicklime, high-calcium limestone fines, screened high-calcium stone products, lime kiln dust, and rip rap. Graymont has a forty year lease with the Ts'kw'aylaxw First Nation to mine on their reserve, and most of the operation's employees were Ts'kw'aylaxw. Graymont is now working toward a closure and reclamation plan acceptable to both parties.

3.2.8. 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.

3.2.9. 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.

3.2.10. Z-1 (ZMM Canada Minerals Corp.)

The ZMM mine (Fig. 5) produced 9000 t of zeolite at Z-1 in 2017. It is currently used as an agricultural feed additive, a growth medium, a filtration medium, and a component of lightweight concrete, and for soil remediation. New applications such as for vacuum insulated panels are being investigated. ZMM explored at other sites in 2017 (see below) and constructed a sample preparation facility in Peachland.

3.2.11. Nazko (CanLava Mining Corporation)

CanLava supplies a lightweight vesicular rock from its Nazko quarry, from a young (Pleistocene-Holocene) cinder cone on the easternmost part of the Anahim volcanic belt. Typical uses include construction aggregate, landscaping, soil enhancement, sports field surfaces, masonry bricks, anti-slip road sand. CanLava shipped from the site in 2017.



Fig. 5. ZMM Canada Minerals Corp.'s Z-1 mine near Cache Creek.

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, except Bralorne, which is preparing to resume mining.

6. Proposed mines

Proposed mines are defined as feasibility-stage projects for which proponents have begun the process of formal socioeconomic and environmental review. For projects that exceed thresholds set by the British Columbia Environmental Assessment Act (or its federal equivalent), reviews are co-ordinated by the BC 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. The MDRC review is informally called the Minister's permit process.

Six projects are in this category: **Ajax**, **Bethlehem**, **Harper Creek**, **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. (KGHM SA) and Abacus Mining and Exploration Corporation. Mineralization is in the Iron Mask batholith, a multi-phase Triassic alkaline intrusive complex. A revised feasibility study released at the start of 2016 modelled Ajax as a 65,000 tpd open pit mine with a projected 18-year life. In December, the project was denied certification by the British Columbia Ministries of Environment and Climate Change Strategy and Energy, Mines and Petroleum Resources. The company has not yet announced a response.

6.2. Bethlehem (Teck Resources Limited)

Teck Resources Limited may reopen the past-producing **Bethlehem** mine, 2 km east of its Highland Valley Copper operations. Over the past few years, Teck defined 100 Mt of new ore at Bethlehem. If approved, the mine would feed its 140,000 tpd mill. A Mine Development Review Committee commenced formal review of the Bethlehem Phase 1 proposal in September 2016.

6.3. Harper Creek (Yellowhead Mining Inc.)

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 Formation (Devono-Mississippian). Yellowhead Mining Inc.'s application for an environmental assessment certificate was accepted in January 2015. However, in October 2015, the company suspended further work on the project and the project remains on hold. The company is evaluating if financing can be secured to complete the review, estimated to cost more than \$4.0 million. 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 feasibility study proposed a 70,000 tpd operation with a mine life of 28 years. Initial capital costs would exceed \$1 billion.

6.4. New Prosperity (Taseko Mines Limited)

The **New Prosperity** (also known as Prosperity or Fish Lake) 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 not to authorize 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. However, the Canadian Environmental Assessment Agency warned Taseko that they would consider the proposed work in violation of federal law and the company did not proceed.

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 (Fig. 1), Imperial Metals Corporation carried out environmental studies and monitoring. 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.

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.	Cu, Au; Alkalic porphyry; 092INE012, 013	(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	Project at application review stage.
Bethlehem	Teck Resources Limited	Cu, Mo; Porphyry; 092ISE001	na	na	Project at application review stage. Resource informally stated as 100 Mt, but without grades.
Harper Creek	Yellowhead Mining Inc.	Cu, Au, Ag; Noranda/Kuroko; 082M 008, 009	(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 grading 0.28% Cu, 0.030 g/t Au, 1.3 g/t Ag	Project at application review stage. Company suspended review in October 2015 for economic reasons.
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 certificate but denied federal approval.
Ruddock Creek	Ruddock Creek Mining Corporation	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 pre-application stage.
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 containing 3.9 Moz Au 6.3 Moz Ag	Project at pre-application stage.

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

6.6. Spanish Mountain (Spanish Mountain Gold Ltd.)

The **Spanish Mountain** project has been in the pre-application phase of environmental assessment since 2011. In April 2017 the company released the results of an updated preliminary economic assessment. The study was based on a 20,000 tpd, 24-year operation focussed on a pit-delineated higher grade core (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 gold production would be 92,000 oz/y. A field program

in 2017 was designed to maintain placer claims in the project area. However, the company also acquired a permit for future mineral exploration and archaeological studies.

7. Selected exploration activities and highlights

In 2017, the largest exploration project in the region (and in the province) was Barkerville Gold's **Cariboo Gold**. Exploration continued for other gold targets, skarn deposits (tungsten; copper), porphyry copper deposits, stratiform base and precious metals 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
Acacia	Eagle Plains Resources Ltd.	Zn, Pb, Ag; Noranda/Kuroko massive sulphide; 082M 075	na	Mapping and soil geochemistry.
Amarillo	Troubadour Resources Inc.	Cu; Porphyry Cu±Mo±Au; 082ENW108	na	Soil geochemistry and IP.
Axe	Evrin Exploration Canada Corp.	Cu, Au; Alkalic porphyry Cu-Au 092HNE143	I: 39 Mt 0.38% Cu Inf: 32 Mt 0.38% Cu	Core re-logging, re-processing IP. 2006 resource estimate used historical assays that did not include gold.
BC Sugar	Lithium Corporation	Graphite	na	Permitting, sampling, geophysics.
Blue River	Commerce Resources Corp.	Nb, Ta	I: 48.4 Mt 197 ppm Ta ₂ O ₅ , 1610 ppm Nb ₂ O ₅ Inf: 5.4 Mt 191 ppm Ta ₂ O ₅ , 1760 ppm Nb ₂ O ₅	Metallurgical testing.
Bonaparte	Westkam Gold Corp.	Au, Cu; Au-quartz veins; 092P 050	na	Permitting, First Nations relations, site maintenance and preparation for continuation of underground bulk sample.
Brett	Ximen Mining Corp.	Au, Ag; Epithermal Au-Ag; 082LSW110	na	Core logging and analysis (following 2016 drilling), chip/channel sampling.
Cariboo Gold	Barkerville Gold Mines Ltd.	Au; Au-quartz veins; 093H 006, 140, 139, 019	(Cow Mountain at 0.5 g/t Au cut off) I: 35.8 Mt 2.4 g/t Au Inf: 27.5 Mt 2.3 g/t Au	Up to 160,000 m core drilling in 3 areas with recent focus on Island Mountain area. Barkerville Mountain and Cow Mountain also drilled. Regional target generative program in addition. Resource here is 2015 estimate for Cow Mountain. See Table 1 for Bonanza Ledge.
Copper Canyon	Seven Devils Exploration Ltd. (R. Weicker)	Cu, Ag, Au; Porphyry Cu±Mo±Au; 092ISW076	na	Drilling, 2 holes, approx. 500 m.
Fox	Happy Creek Minerals Ltd.	W; W skarn; 093A 259, 260, 258	I: 486,000 t 0.818% WO ₃ Inf: 361,000 t 1.568% WO ₃	Core drilling (11,249 m in 66 holes), geological mapping. Resource estimate precedes 2017 drilling. Combined underground and surface. Indicated is Ridley Creek, Ridley creek and BN zone included in inferred.
Gold Creek	Eureka Resources Inc.	Au, Ag; Au-quartz veins; 093A 127	na	Drilling 331 m in 3 holes.

Table 4. Continued.

Ike	Amarc Resources Ltd. (Hudbay Minerals Inc.)	Cu, Mo; Porphyry Cu±Mo±Au; 092O 025, 067	na	Geological mapping, IP (82 line km), core drilling 2702 m in 9 holes.
Jesse Creek	Wealth Minerals Ltd. (Dawson/Belik)	Cu, Mo, Au; Porphyry Cu±Mo±Au; 092ISE064	na	Core drilling 4479 m in 18 holes, IP, soil and rock geochemistry.
Lac La Hache	Engold Mines Ltd.	Cu, Au, Ag, Fe; Cu skarn; 092P 120, 108, 002	I: 7.6 Mt 0.28% Cu, 0.05 g/t Au, 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	Approximately 20,000 m core drilling, gravity, magnetic and airborne geophysics. 2017 drilling focused on a recent skarn discovery. Resource estimate is for Spout deposit (2012), which is mineralogically similar. Property also hosts a porphyry prospect and hydrothermal Au-Ag-Cu.
Lawless Creek	Tech-X Resources Inc.	Cu, Mo; Porphyry Cu±Mo±Au; 092HNE039, 017, 129	na	IP survey.
Little Gem	Blackstone Minerals Ltd.	Co, Au; Five element veins; 092JNE068, 108	na	Property exam, prospecting, surface and underground rock sampling. Diamond drilling started late in year.
Melba	Essex Minerals Inc. (G. Crooker)	Au, Cu; Epithermal Au-Ag-Cu; 092INE090, 067	na	3D IP (32 km), ground magnetic (37.3 km), soil geochem (600 samples). Prospective for epithermal and porphyry targets.
Miner Mountain	Sego Resources Inc.	Cu, Au; Alkalic porphyry Cu-Au; 092HSE203, 078	na	Core drilling 600 m in 2 holes.
Nesbitt	ZMM Canada Minerals Corp.	Diatomaceous earth; lacustrine diatomite; na	na	Access and site preparation for proposed bulk sample.
New Craigmont	Nicola Mining Inc.	Cu, Au; Cu skarn; 092ISE035	na	Reverse circulation drilling (testing waste dumps), IP survey, Core drilling (approximately 2500 m, 5 holes).
Rabbit North	Tower Resources Ltd.	Cu, Au; Alkalic porphyry Cu-Au	na	Core drilling (approximately 3400 m, 11 holes).
Rateria	Happy Creek Minerals Ltd.	Cu, Mo, Ag; Porphyry Cu±Mo±Au; 092ISE199	na	Core drilling 1764 m in 6 holes.

Table 4. Continued.

Redhill	Troymet Exploration Corp. (J. Shearer)	Cu, Zn, Au, Ag; Noranda/Kuroko massive sulphide; 092INW042, 057	na	Gravity test line.
Shovelnose	Westhaven Ventures Inc.	Au; Epithermal Au-Ag-Cu; 092HNE309, 308	na	Geological mapping, geochemistry, core drilling (3269 m in 7 holes).
SkoonkaCreek	Westhaven Ventures Inc.	Au, Ag; Epithermal Au- Ag-Cu; 092ISW104, 129, 105, 126	na	Geological mapping, geochemistry.
Treasure Mountain North	Ximen Mining Corp. (New Destiny Mining Corp.)	Au, Cu, Zn; Polymetallic veins; 092HSW066 092HSE240	na	Prospecting, soil geochemistry.
Woodjam	Consolidated Woodjam Copper Corp.	Cu, Au; Alkalic porphyry Cu-Au; 093A 078, 269, 206	Southeast zone Inf: 227.5 Mt 0.31% Cu Deerhorn Inf: 32.8 Mt 0.49 g/t Au, 0.22% Cu Takom Inf: 8.3 Mt 0.26 g/t Au, 0.22% Cu	Prospecting, sampling. Discovery of Canyon zone copper showing.
Trans Canada	ZMM Canada Minerals Corp.	Zeolite; Open-system zeolites; 082LNW096	na	Bulk sample started.

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.)

Following bulk sampling of the **Bonaparte** project beginning in 2016, Westkam Gold Corp. acquired permits for surface and underground drilling and obtained authorizations for dewatering that would allow underground development and continued sampling. Up to 10,000 t are permitted. The property was on care and maintenance for most of 2017. In 1994, a 3700 t sample from surface trenches had an average grade of 26.5 g/t. In addition to near-surface gold-bearing quartz veins, chargeability anomalies, alteration assemblages, and proximity to Jurassic intrusive rocks suggest other porphyry targets.

7.1.2. Brett (Ximen Mining Corp.)

Ximen Mining Corp. continued sampling of core drilled at the **Brett** gold project in 2016. Results included 112 g/t Au and 263 g/t Ag over 0.3 m, 7.23 g/t Au over 0.58 m, 6.04 g/t Au over 0.4 m, and 16 g/t Au over 0.39 m. Fieldwork in 2017 also included chip sampling. Epithermal gold mineralization in Eocene volcanic rocks is the target.

7.1.3. Cariboo Gold (Barkerville Gold Mines Ltd.)

Barkerville Gold Mines planned to drill up to 160,000 m in 2017 on their **Cariboo Gold** project and came close by December. Most drilling was in the Island Mountain area, northwest of Cow Mountain and Barkerville Mountain, which were also target areas. All are sites of past producers. Extensive regional exploration identified several targets for drilling in 2018. Environmental baseline and impact assessment studies have been ongoing since 2016.

Most of the drilling in 2017 was near the past-producing

Aurum mine, at the Shaft zone where high-grade gold was intersected. The Valley zone, to the southeast is also a target. Barkerville has identified three vein corridors at the Shaft zone (alpha, beta and gamma) which they are testing with ~25 m-spaced drilling. They describe the corridors as 5 to 35 m wide anastomosing networks with high vein density. Reported high-grade intersections are typically 10s of g/t Au over 5 m or more. Overall, corridors strike north-easterly and have sub-vertical dips. Gold values correlate with vein hosted pyrite and pyritic, silicified haloes.

Past production in the area came from gold-bearing pyrite replacement deposits (Fig. 6a) and gold-sulphide-quartz veins (Fig. 6b). Host rocks are folded and metamorphosed siliciclastic and subordinate volcanic rocks of the Snowshoe Group (Neoproterozoic-Lower Paleozoic).

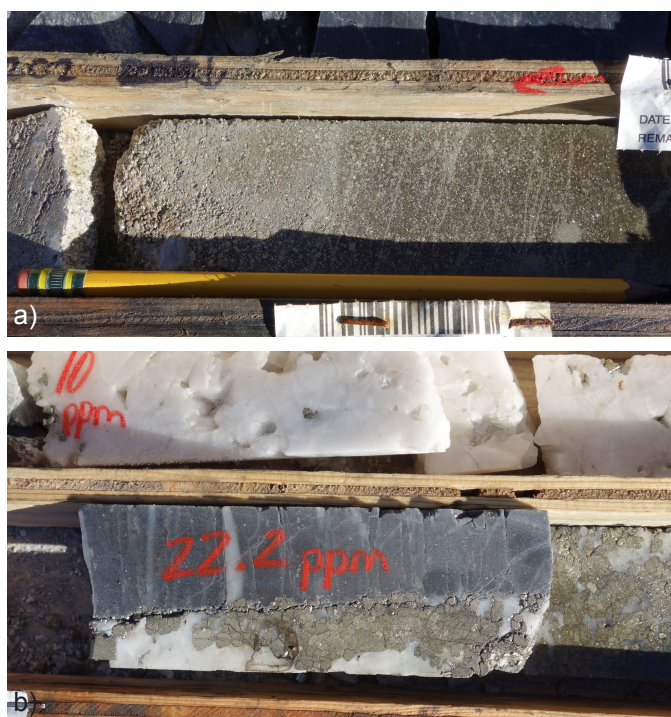


Fig. 6. Barkerville Gold's Cariboo project. **a)** Replacement-style mineralization. **b)** Axial planar vein.

7.1.4. Gold Creek (Eureka Resources Inc.)

Eureka drilled three diamond drill holes at their **Gold Creek** property. Results included 33.20 g/t Au over 1.25 m and 17.95 g/t Au over 1.5 m. Targets are orogenic gold veins in Mesozoic phyllites and greywackes.

7.1.5. Shovelnose (Westhaven Ventures Inc.)

In October, Westhaven began a 3269 m drill program at **Shovelnose**, following 725 m in 2016. Five holes focused on the Tower zone and two on the Alpine zone 0.5 km east. Other 2017 work included a ground magnetic survey, geological mapping, prospecting, soil sampling, and a clay mineralogical study. Shovelnose hosts epithermal style mineralization in Spences Bridge Group volcanic rocks (Cretaceous).

7.1.6. Skoonka Creek (Westhaven Ventures Inc.)

In 2017, Westhaven added **Skoonka Creek** to its properties in the Spences Bridge Group (others are Shovelnose and Prospect Valley), all of which target epithermal gold mineralization. Work at Skoonka Creek included a ground magnetic survey, geological mapping, prospecting, and soil sampling.

7.1.7. Treasure Mountain North (New Destiny Mining Corp.)

Ximen and New Destiny have an option agreement whereby New Destiny may earn 100% interest in the **Treasure Mountain North** property, north of Nicola Mining's Treasure Mountain mine, currently on care and maintenance. Ximen carried out the 2017 exploration on the property, which consisted of rock and soil sampling that included auger sampling in areas of thick overburden. Targets were gold bearing quartz veins.

7.2. Selected porphyry (Cu-Au, Cu-Mo, Mo) projects

More than 15 exploration projects focused on porphyry deposits in 2017. With the exception of Gibraltar, the copper mines all reported exploration programs (see above).

7.2.1. Amarillo (Troubadour Resources Inc.)

Troubadour carried out soil geochemical and induced polarization surveys in 2017 at its **Amarillo** porphyry copper project. The area has seen sporadic activity since the early 1960s, when positive results were reported from sampling a 125 m trench.

7.2.2. Axe (Evrin Resources Corp.)

Evrin Resources Corp. identified target areas at the **Axe** project arising from core re-logging, and reinterpretation of geophysical and geochemical data. A subsidiary of Antofagasta plc entered into an agreement whereby it can acquire a 70% interest during a 10 year period, with exploration proposed for 2018. A resource estimate was updated in 2006 (Table 5). 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. Copper Canyon (Robert Weicker)

Seven Devils Exploration Ltd. drilled two drill holes (approximately 500 m) from two sites and work was filed for assessment. **Copper Canyon** is a Cu-Ag-Au porphyry prospect.

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

Amarc's and Hudbay's 2017 program at **IKE** included 2702 m in nine diamond drill holes, 82 line km of induced polarization, 20 km² of geological mapping and fine-grained talus sampling. The geophysics suggest the mineralized area could be larger than originally thought, leading to plans for wider spaced drilling in 2018. Some regional targets were

explored. Hudbay was a new partner in the project in 2017. Amarc remains the operator. Between 2014 and 2016 they drilled approximately 12,000 m in 21 widely spaced holes. IKE is a Cu-Mo-Ag porphyry prospect.

7.2.5. Jesse Creek (J. Dawson, 50%; G. Belik, 50%)

Wealth Minerals Ltd. drilled 18 holes at the **Jesse Creek** property in 2017 and conducted an IP survey and soil geochemistry. Jesse Creek hosts several skarn and porphyry showings. Wealth, which is primarily a lithium explorer, indicated an intention to terminate their option on the Jesse Creek property in August.

7.2.6. Lawless Creek (Tech-X Resources Inc.)

Tech-X has been exploring its early-stage **Lawless Creek** property for about three years with geological, geochemical, and geophysical surveys. Tech-X is a private company and recent results have not been released, but assessment reports for previous work are available. The principal target is porphyry Cu-Mo (possibly Early Eocene) mineralization (Holtham, 2016).

7.2.7. Melba (Essex Minerals Inc.)

Melba is a target-generation stage project that has been explored intermittently for porphyry and epithermal mineralization types. Essex's 2017 work included 3D induced polarization, magnetic, and soil geochemical surveys. They report a coincident magnetic, resistivity and modest chargeability anomaly as well as copper and gold geochemical responses in soils.

7.2.8. Miner Mountain Miner Mountain (Sego Resources Inc.)

Sego Resources Inc. began an initial 600 m, 2-hole drill program in mid-October at **Miner Mountain**, an alkalic Cu-Au porphyry prospect. The new drilling follows 2012 percussion and core drilling which returned high copper assays and significant gold, including 100.4 m of 0.946% Cu, 0.55 g/t Au and 3.473 g/t Ag.

7.2.9. Rabbit North (Tower Resources Ltd.)

Tower Resources drilled about 3400 m in 11 holes at **Rabbit North** in 2017. They reported significant porphyry style mineralized intersections, including 247 m 0.51% Cu and 0.34 g/t Au, and 88 m of 0.35% Cu and 0.27 g/t Au in the Western Magnetite zone. They reported 133 m of 0.19% Cu and 0.31 g/t Au in the Chrysocolla zone to the south. Rabbit North is an early stage project seeking to delineate alkalic Cu-Au porphyry targets similar to the Ajax and Afton deposits. The Durand Lake stock on the property is alkalic, hosted by Nicola Group rocks and reported to be similar in age to the Iron Mask batholith (Late Triassic-Early Jurassic; Peterson, 2014; Logan, 2013).

7.2.10. Rateria (Happy Creek Minerals Ltd.)

Happy Creek drilled at their **Rateria** project in 2017 (1754 m in 6 holes). Step out holes expanded Zone 2, including 105.5 m of 0.37% Cu and 0.14 g/t Au. Rateria is an early-stage project without a current resource estimate. Rateria is underlain by the Guichon Creek Batholith, which hosts the Highland Valley copper deposits.

7.2.11. Woodjam (Consolidated Woodjam Copper Corp.)

Consolidated Woodjam reported a discovery, the Canyon zone, in the northern part of the **Woodjam** property. A composite grab sample of a malachite-stained quartz feldspar vein in mafic volcanic rocks returned 7.51% Cu, 356 ppm Ag and 589 ppb Au. Further exploration, including a proposed induced polarization survey, was deferred because of forest fires.

7.3. Selected polymetallic base and precious metal projects

Although the region has numerous polymetallic massive sulphide prospects, only a few were active in 2017.

7.3.1. Acacia (Eagle Plains Resources Inc.)

Eagle Plains conducted mapping and soil sampling at the **Acacia** following compilation of historical data. The target is precious metals enriched volcanogenic massive sulphide mineralization in the Eagle Bay assemblage.

7.3.2. Redhill (Troymet Exploration Corp.)

Late in 2015, Troymet Exploration Corp. acquired the **Redhill** property and began exploring VMS copper-zinc and gold targets in suspected Kutcho-Wineglass assemblage equivalent rocks. Historical work had identified three zones (Alpha; Alpha South; Beta) with coincident soil geochemical and geophysical anomalies and sulphide mineralization. In 2017, Troymet's test gravity survey over the Alpha prospect produced anomalies they identify as targets at depth. Their 2016 drilling identified near-surface (5.1 m depth) and deep (206 m downhole) mineralized zones.

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

Skarn projects followed porphyries as the largest projects in 2017, with 3 significant exploration programs, including a major drill program at Lac La Hache, following a discovery early in the year.

7.4.1. Fox (Happy Creek Minerals Ltd.)

At the **Fox** tungsten skarn property, Happy Creek Minerals Ltd. continued to define the extent, grade, and continuity of scheelite mineralization. Mineralization is in flat-lying sedimentary rocks of the Snowshoe Group (Neoproterozoic to Lower Paleozoic) that have been intruded 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. From north to south the zones are: North; BK; Ridley Creek (or “RC”); BN; 708; Nightcrawler-Discovery (or “NC”); and South Grid.

In January 2017, the company updated its resource estimate for the Ridley Creek zone (Desautels and Berndt, 2017). Resources stand at an Indicated 486,000 t grading 0.817 WO₃ and Inferred 361,000 t grading 1.568 WO₃ with a 0.2% WO₃ cut-off for material potentially amenable to open pit extraction and 0.55% for underground resources. The Ridley Creek deposit measures 350 x 175 m, is 5-25 m thick, and comes within 25 m of the surface.

The initial resource for the BN zone, approximately 1 km south of the RC zone, is an Inferred 245,000 t 1.892% WO₃ at a 0.55% cut off. The resource is 20-80 m below surface. Drilling in 2017 focused on the BN zone (4336.3 m in 38 holes). Significant results included 5.05 m 2.980% WO₃ in a step out to the east and 7.81 m 1.36% WO₃ in a step out to the southwest. Overall, the mineralized zone is now approximately 300 x 350 m. As mineralization has a shallow dip, true width is estimated to be 75-95% of reported intervals.

7.4.2. Lac La Hache (Engold Mines Ltd.)

Engold Mines Ltd.’s **Lac La Hache** property covers several prospects including the Aurizon Au-Ag-Cu vein and breccia target, the Spout magnetite-Cu skarn target, Berkey porphyry target, and a recent Fe-Cu-Ag-Au discovery at their G1 gravity target. Their first hole of 2017, targeting a gravity anomaly at G1, intersected skarn-type mineralization with 26.57 m 1.76% Cu, 0.27 g/t Au, 10.29 g/t Ag and 35.8% Fe. This led to an additional ground gravity survey, airborne gravity and magnetic survey (274 line km at 50 m line spacing) and a substantial (~20,000 m) drill program targeting several areas, but largely focused near G1. Drilling continued into December. The company is also producing a resource estimate for the Aurizon zone. The Spout zone has a 2012 resource estimate (Table 4).

7.4.3. New Craigmont (Nicola Mining Inc.)

Nicola Mining Inc. continued to explore the **New Craigmont** (formerly Thule) copper property that surrounds the main pit of the past-producing Craigmont mine, west of Merritt. Work included an induced polarization survey over their Promontory Hill target to confirm an updated three-dimensional model based on a 2005 survey and expand coverage. In October they began core drilling at the Embayment zone and an induced polarization survey on the Titan Queen. A 2016 hole at the Embayment zone intersected 86 m of 1.1% Cu.

The company also used reverse circulation drilling to evaluate Craigmont’s portal stockpiles as potential feed for Teck’s mill at Highland Valley Copper because the former mine’s cut-off grade was as high as 1.2% copper.

7.5. Selected specialty metals and industrial mineral exploration

Location near transportation corridors and population centres mean low unit value products such as many industrial minerals

are potentially viable targets in the region. Varied geology leads to some relatively unusual prospects such as cobalt-bearing polymetallic veins and carbonatites with Ta, Nb and rare earth potential.

7.5.1. BC Sugar (Lithium Corporation)

Lithium Corporation received a permit for trenching at their **BC Sugar** graphite property. The work was planned for 2017 but deferred due to forest fires. They collected a small bulk sample late in the year, and submitted it for metallurgical study.

7.5.2. Blue River (Commerce Resources Corp.)

Commerce signed a memorandum of understanding for delivery of a 1 t sample from their **Blue River** project’s Upper Fir deposit to an Estonian metallurgist to test his proprietary process for separation of niobium and tantalum.

7.5.3. 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. In the course of a property examination, they discovered the Roxey showing west of Little Gem, which returned 24 g/t Au and 1.9% Cu in surface chip samples. Values from surface and underground samples at Little Gem and Jewel were consistent with high-grade samples reported historically. Surface diamond drilling commenced late in the year. The company increased its land position by staking. The Little Gem hosts vein-type cobalt-gold mineralization with anomalous Ag, Ni, Bi, U and As, an unusual occurrence in British Columbia.

7.5.4. Nesbitt (ZMM Minerals Canada Corp.)

ZMM is planning a bulk sample at the **Nesbitt** diatomaceous earth prospect. They began access and site preparation work late in the year.

7.5.5. Trans Canada (ZMM Minerals Canada Corp.)

ZMM is collecting a bulk sample at the **Trans Canada** property. They describe the target material as a suite of iron bearing zeolites. Currently, zeolites are widely used for water filtration and soil amelioration and as catalysts, biological growth media, pozzolans in cement, and additives to detergent; other uses are being explored.

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 Schiarizza (2018) continued to develop a comprehensive stratigraphic framework for Nicola Group rocks. Mao et al. (2017) used the Nechako Plateau as a study area for investigating the use of detrital apatite as an indicator mineral for mineral deposits. Sacco et al. (2017a-f) published basal till potential maps for the northwestern part of the region. Buckingham et al. (2017) published a compilation of gravity data from the Interior

Plateau, and Angen et al. (2017a, b) produced complementary bedrock geology maps, correlated with magnetic data. Hart and Goldfarb (2017) concluded that gold mineralization in the Bridge River camp is Late Cretaceous.

9. Outlook for 2018

The region's largest exploration projects, Cariboo Gold and Lac La Hache, should continue into 2018, as should Rabbit North. Amarc has indicated an intention to continue with widely spaced drilling at IKE, and Avino's program at Bralorne is scheduled to begin in January. A number of exploration projects were either cut short or deferred due to forest fires; some of these may proceed in 2018.

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Exploration and mining in the Southwest Region, British Columbia



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1. Introduction

The Southwest Region (Fig. 1) has a long history of mining. This history includes: the use of native copper by aboriginal people; silver, gold and coal mining by the mid 19th century; mining of iron in the mid 20th century; and substantial copper production throughout the 20th century. Although mining and exploration for metal and coal continue in the region, most mining is for construction materials, mainly aggregates for local markets.

The area has one major polymetallic metal mine, **Myra Falls** (Nyrstar N.V.), one coal mine, **Quinsam** (ERP Compliant Fuels LLC), and numerous industrial minerals and aggregate operations. Both Myra Falls and Quinsam were on care and maintenance until the summer of 2017 when, supported by higher commodity prices, they were put back into production.

Although Nyrstar N.V. was in the process of selling the Myra Falls mine, they ultimately decided to invest in, and operate, the property. The Quinsam mine was purchased by ERP Compliant Fuels LLC in 2017 who resumed production in October. Mine site exploration began at Myra Falls late in the year. A permitted program by Quinsam was deferred but could take place in 2018.

There were two significant off-lease exploration drilling programs in 2017 (**Surespan Gold** and **North Island**) and one major project (North Island) released a preliminary economic assessment. As in 2016, about 25 active exploration projects were tracked; most were small scale. BURNCO Rock Products Ltd.'s large aggregate project on Howe Sound, **BURNCO Aggregate**, is in the environmental assessment review stage, and a draft assessment report is completed. Polaris Materials Corporation sought a permit amendment for its Orca quarry to allow for production of a crushed basalt product near the existing quarry. Polaris shareholders have since approved sale of the company to U.S. Concrete Inc.

As in 2016, estimates for exploration expenditures, drilling programs, and other metrics were captured in the British Columbia Mineral and Coal Exploration Survey, a joint initiative of the Province of British Columbia Ministry of Energy, Mines and Petroleum Resources, the Association for

Mineral Exploration in British Columbia, and Ernst and Young LLP. For the Southwest Region, exploration expenditures were estimated at \$9.3 million and exploration drilling was estimated at approximately 10,600 m (Clarke et al., 2018; Ernst & Young LLP, in press).

Expenditures and exploration drilling are up over the previous year's \$2 million and 3800 m but still reflect a small number of major exploration projects and reduced activity at Quinsam and Myra Falls until late in the year.

2. Geological overview

Metallogeny in British Columbia is closely linked to the tectonic evolution of the Canadian Cordillera, first as an accretionary orogen consisting of allochthonous terranes that were welded to and deformed with the western margin of ancestral North America primarily during the Jurassic and then as the site of post-accretionary tectonism and magmatism (e.g., Nelson et al., 2013).

The Southwest Region includes parts of the Insular, Coast, and Intermontane physiographic regions. Most of the area is underlain by rocks of the Wrangell terrane and the Coast Plutonic complex (Fig. 1). Wrangellia is a Devonian to Jurassic island arc terrane that underlies most of Vancouver Island and Haida Gwaii. The oldest rocks on Vancouver Island are Devonian volcanic arc andesites, basalts, breccias, tuffs and tuffaceous sediments of the Sicker Group and allied intrusive rocks, overlain by Mississippian-Permian limestones, argillites, and minor conglomerate of the Buttle Lake Group. This Paleozoic basement is exposed in two major uplifts on southern and central Vancouver Island. The Cowichan anticlinorium and the Buttle Lake anticlinorium host past and present volcanogenic massive sulphide polymetallic producers at Mount Sicker and **Myra Falls**.

Unconformably overlying the Paleozoic rocks are Middle to Upper Triassic oceanic flood basalts and related sedimentary rocks of the Vancouver Group. The upper part of the Vancouver Group contains numerous skarn occurrences adjacent to Jurassic intrusions (Island Plutonic suite). The Tasu past producer on Haida Gwaii is one of the larger examples of numerous iron



and iron-copper skarns. Between 1914 and 1983, it produced 12 Mt of iron concentrate as well as copper, gold and silver.

The Vancouver Group is overlain by arc rocks of Bonanza Group (Upper Triassic-Middle Jurassic), which consist of a volcano-sedimentary succession and subaerial basalt to rhyolitic flows and tuffs (Nixon and Orr, 2007). The Bonanza Group north of Holberg Inlet host the past-producing Island Copper Cu-Mo-Au porphyry deposit and other undeveloped porphyry and epithermal prospects where they are intruded by Island Plutonic suite granodiorite and quartz diorite.

On the east coast of Vancouver Island, in the Strait of Georgia, and on the western mainland, Wrangellia is buried by rocks of the Nanaimo Group, an Upper Cretaceous continental to marine molassoid succession containing debris derived from unroofing of the Coast Belt and northern Cascades (Mustard, 1994). The Comox Formation, the basal unit of the Nanaimo Group, hosts economically important coal deposits that were mined historically in the Nanaimo area now near Campbell River.

The Coast Mountain range is underlain by the Coast Plutonic complex, a large northwest-trending batholith consisting largely of diorite, quartz diorite, tonalite and granodiorite calc-alkaline rocks with less abundant high-grade metamorphic rocks. For the most part, uplift and erosion have removed the levels at which epithermal and porphyry style mineralization form, with some exceptions. At the southern end of the Coast Plutonic complex, economically important deposits occur in pendants of the Gambier Group, overlapping Late Jurassic to Mid-Cretaceous arc-related volcanic and sedimentary rocks. The most productive of these deposits was the Britannia mine, a Kuroko-type polymetallic volcanogenic massive sulphide deposit that produced 517,000 t of Cu along with Zn, Ag, Au, Pb and Cd between 1905 and 1974. At the southeastern edge of the Coast ranges, the Late Cretaceous Giant Mascot ultramafic-mafic intrusive suite (Manor et al., 2014, 2015, 2016, 2017) hosts the province's only past producing nickel mine, Giant Mascot Nickel, which operated between 1958 and 1974.

Eocene to Miocene ancestral Cascades arc magmatism extended as far northward as southwestern British Columbia, as does present day Cascades magmatism. Evidence of forearc Paleocene to Miocene magmatism can be traced from southern Oregon through Alaska (Madsen et al., 2006). Mount Washington Copper (Eocene) produced 3548 t of Cu, 131 kg Au and 7235 kg Ag. Catface Copper (Eocene) has a significant undeveloped resource. Other presumably Cenozoic targets include Giant Copper and Okeover. Harmony on Graham Island, Haida Gwaii is a Miocene epithermal deposit with a significant undeveloped gold resource. More recent Cascades magmatism has produced pumice and other volcanic rocks quarried for construction, landscaping, and other applications. The Mount Meager area has also been investigated as a possible source of geothermal energy.

On Vancouver Island, the western and southern margins of Wrangellia are structurally juxtaposed with the Pacific Rim terrane, which consists of possible mélange deposits

(Rusmore and Cowan, 1985; Brandon, 1989) and the Leech River complex, an assemblage of greenschist- to amphibolite-grade mudstones, sandstones, and mafic volcanic rocks cut by granitic bodies (Groome et al., 2003). Slate and siltstone is quarried for building stone in the Leech River complex. The Leech River has been an active placer gold camp since 1864. Gold quartz veins have been the subject of recent exploration near the Leech River fault, along the southern margin of the terrane.

The Crescent terrane represents Eocene accretion of Late Cretaceous or Paleocene to Early Eocene seamounts. The Leech River fault marks the boundary of Pacific Rim and Crescent terranes. The Metchosin Igneous complex, a partial ophiolite and northernmost extent of the Coast Range basalt province (Massey, 1986), contains three tholeiitic intrusion-hosted past producers of copper and precious metals, the most significant of which was the Sunro mine.

The southeastern Coast Belt, north of the international border is underlain by the Nooksack-Harrison and Chilliwack terranes (equivalent to Stikinia; Monger and Struik, 2006), and the Bridge River, Cadwallader and Methow terranes, allied with the main Cache Creek terrane (Fig. 1). These represent slices of oceanic and arc-related rocks enclosed between Intermontane and Insular terranes during Middle Jurassic to Middle Cretaceous regional sinistral faulting (Bustin et al., 2013; Monger and Brown, in press). Gambier Group equivalent overlap deposits and parts of the Nooksack-Harrison terrane are prospective for VMS mineralization. The Coquihalla Serpentine belt, along the Hozameen fault between the Bridge River terrane to the west and the Methow terrane to the east, hosts several gold prospects and five past producers including the Carolin mine, which operated between 1981 and 1984.

Tectonic uplift, erosion, and glaciation produced sand and gravel deposits important to the construction and transportation industries of the Lower Mainland. Most are products of the most recent retreat of the Cordilleran Ice Sheet in the Pleistocene (e.g., Howes, 1983; Clague and Ward, 2011). For further details about the geology of the Southwest Region see Northcote (2017).

3. Mines

The Southwest Region has one metal mine, one coal mine and numerous industrial minerals and aggregate operations (Fig. 1; Tables 1-3). Of eight large-scale industrial minerals operations in the region, two entered care and maintenance in 2016 and remained so in 2017. Aggregate operations in the region number in the hundreds and only the most prominent (e.g., those producing at least one million tpy) are reported here.

3.1. Metal mines

3.1.1. Myra Falls Operations (Nyrstar N.V.)

Myra Falls Operations is an underground polymetallic mine that exploits a cluster of volcanogenic massive sulphide lenses. Nyrstar suspended mining activities at the beginning of the

Table 1. Metal mines, Southwest Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Myra Falls	Nyrstar Myra Falls Ltd. (parent co. Nyrstar N.V.)	Zn, Cu, Pb, Au, Ag; Noranda/Kuroko massive sulphide; 092F 072, 092F 330, 092F 071, 092F 073	na	P+Pr: 4.96 Mt 6.75% Zn, 0.72% Pb, 0.89% Cu, 71.01 g/t Ag, 1.71 g/t Au	M+I: 7.68 Mt 6.46% Zn, 0.69% Pb, 0.98% Cu, 68.99 g/t Ag, 1.74 g/t Au Inf: 1.03 Mt 8.80% Zn, 1.03% Pb, 0.85% Cu, 135.37 g/t Ag, 2.68 g/t Au	Resuming operations 2017-2018. Resources inclusive of reserves.

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

Table 2. Coal mines, Southwest Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Quinsam	Quinsam Coal Corporation (ERP Compliant Fuels LLC)	TC; Bituminous coal; 092F 319	Approx. 50,000 t clean coal	na	na	Resources and reserves are unpublished. Resumed operations Sept 2017.

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

second quarter in 2015. A \$100 million infrastructure upgrade is in progress with the goal of producing zinc by the second half of 2018 and ramping up to an annual rate of 30 kt/y of concentrate by the end of the year. The restart project includes: upgrading the H-W shaft and headframe; upgrading the paste plant; diamond drilling to increase resources and reserves; purchasing a new underground fleet; refitting and repairing the concentrator; constructing a new camp; and moving the power house. Infrastructure for hydroelectric power was upgraded.

Nyrstar now views its North American mines, including Myra Falls, to be a core part of the company's portfolio and do not appear to be actively seeking a buyer. Whereas current reserves and resources (Table 1) may be adequate for approximately 10 years at recent rates of mining, the company anticipates a longer operating life, pointing to exploration potential. A multi-year on-site exploration campaign, which was suspended in 2015, has resumed. Untested target areas remain in this camp, which so far consists of at least 7 significant deposits comprising at least 50 different sulphide lenses.

The deposits are hosted by the Sicker Group, a Middle Devonian volcano-sedimentary island-arc assemblage that forms basement to Wrangellia beneath much of Vancouver Island (Fig. 1). Ore bodies are in two horizons of the Myra Formation and are generally considered to have formed as Kuroko type, bimodal felsic volcanogenic massive sulphides.

3.2. Coal mines

3.2.1. Quinsam (ERP Compliant Fuels LLC.)

Underground coal mining on Vancouver Island dates back to 1849. The **Quinsam** thermal coal mine near Campbell River (Fig. 1) began operation in 1986 but went on care and maintenance in 2016. In 2017 the Vitol Group sold the mine. ERP Compliant Fuels LLC, is affiliated with Conuma Coal Resources Ltd., the company that resumed operations at Wolverine and Brule in northeastern British Columbia. Mining resumed in early fall and the wash plant was in operation shortly afterward. By late fall approximately 50 workers were on site. Production for 2017 was approximately 50,000 t of clean coal.

Table 3. Selected industrial mineral mines and quarries, Southwest Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Apple Bay (PEM 100)	Linceo Media Group Inc.	Silica+alumina; R12:Volcanic glass-perlite; 092L 150	na	na	na	Care and maintenance 2017.
Benson Lake	Benson Lake Carbonates ULC	High brightness carbonate; R09:Limestone; 092L 295	na	na	na	Care and maintenance 2017.
Blubber Bay	Ash Grove Cement Company	Limestone, dolostone; R09:Limestone; 092F 479	24,500 t	na	100+ years	Care and maintenance, continues to ship dolomite on contract.
Garibaldi Pumice	Garibaldi Pumice Ltd.	Pumice; R11:Volcanic ash; 092JW 039	15,000 m ³	na	11,396,000 m ³ pumice 4,990,000 m ³ pumicite (fines)	2014 resource. Additional exploration 2015. Future work proposed and permitted.
Imperial Limestone	Imperial Limestone Co. Ltd.	Limestone; R09:Limestone; 092F 394	263,000 t	na	50+ years	Production number is their high quality product. Resource estimated at roughly 200 Mt.
K2	K2 Stone Quarries Inc.	Dimension stone, flagstone; R08:Flagstone; 092C 159	19,662 t	na	na	Number represents material extracted.
Mount Meager Pumice	Great Pacific Pumice Inc.	Pumice; R11:Volcanic ash; 092JW 039	2100 t	na	na	Sales about 1600 t.
Sumas Shale	Sumas Shale Ltd. (Lafarge Canada Inc., Clayburn Industrial Group)	Shale, clay, sandstone; B05:Residual kaolin; 092GSE024	Approx. 500,000 t	na	50+ years	Approximately 55% shale, 45% sandstone for cement production.
Texada Quarry	Texada Quarrying Ltd. (Lafarge Canada Inc.)	Limestone, aggregate; R09:Limestone; 092F 395	na	na	100+ years	Mostly produces limestone for cement manufacture. High brightness carbonate and aggregates also produced.

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

Currently the only underground coal mine in the province, the **Quinsam** mine produces from coal seams in the upper part of the Comox Formation, the basal unit of the Nanaimo Group (Late Cretaceous). The mine is capable of producing more than half a million tonnes a year. ERP Compliant Fuels is a private company that does not release reserve and resource

figures. The mine has a significant potential resource. Product is blended to meet customers' specifications. Most recently, the mine supplied local cement plants. The mine can also serve international markets using a freighter loading facility on Texada Island.

3.3. Selected industrial minerals and aggregates mines

Large quarries on the coast (Table 3) serve the Lower Mainland, Vancouver Island, and U.S. Pacific northwest markets by barge. Those with access to freighter loadout facilities can also supply eastern Pacific international markets, and Hawaii. Aggregates are an important part of the mining industry on the south coast, generating more jobs in the region than metal and coal mining. The area hosts some of the largest aggregate pits and quarries in Canada. Most quarries serve local markets, although a few of the largest also export. General sales and production trends follow those of the construction industry. Lafarge North America, Lehigh Hanson Materials Ltd. and a local company Mainland Sand and Gravel Ltd. are the three largest participants in the Coast area, although hundreds of pits and quarries produce in the region.

One of the largest aggregate-only mines is the **Sechelt Mine**, operated by Lehigh Hanson. The company no longer makes production figures public, but volumes have been in the 5 million tonne range in recent years. It is permitted for up to 7.5 Mt per year. A loading facility capable of accommodating Panamax class freighters handles most of the shipments. In addition to the **Texada Quarry**, Lafarge North America operates two of the largest aggregate quarries in the region (**Earle Creek** and **Pitt River**) each of which typically produces more than 1 Mt per year. Production and employment estimates for 2016 reported by Lafarge for their four largest aggregate operation serving the Lower Mainland include: 1.0 Mt and 23 people at **Earle Creek**, 1.1 Mt and 21 people at **Pitt River Quarry**; 1.0 Mt and 17 people at **Central Aggregate**; and 0.9 Mt and 10 people at **Ward Road**. Remediation work continues at Lafarge's **Pipeline Road** site. In total 4 Mt were produced and 77 people employed at these operations alone.

Near the **Pipeline Road** site are large operations by Jack Cewe Ltd and Allard Contractors Ltd. Together they produce in excess of one million tonnes per year most years. Cewe also operates a large quarry on Jervis Inlet at Treat Creek. They do not release yearly production figures.

Polaris Materials Corporation operates the **Orca** quarry near Port McNeill, which produces sand and gravel mainly for export (Fig. 2). Polaris Materials anticipates full-year 2017 sales of



Fig. 2. A scraper at the Orca quarry.

3.2 to 3.4 tons (about 3 t). In November 2017, shareholders of Polaris Materials Corporation, approved an offer from U.S. Concrete Inc. to purchase Polaris. An arrangement agreement with Vulcan Materials Company was cancelled. Polaris has meanwhile applied to the BC Environmental Assessment Office for an amendment to its Orca project certificate to allow for aggregate production at a site approximately 4 km from current operations. The new site was previously known as the Black Bear project. This site would supply up to 250,000 tpy of a crushed basalt product.

The **Cox Station** quarry, on the north side of Sumas Mountain, is operated by Mainland Sand and Gravels Ltd. More than 95% of the crushed quartz diorite product goes to the Lower Mainland market via barge on the Fraser River. The quarry also has two CN Rail spur lines, which allow shipment by rail. Production and shipments have recently been 2-3 Mt per year. The quarry employs 45-50 people.

Small operations produce building stone on Vancouver Island. Van Isle Slate Ltd. offers a line of hand-cut slate products quarried from rocks of the Leech River complex. The quarry had minor production in 2016 and the owner expected to produce again in 2017. Island Stone Landscape Supply is another established producer and supplier of flagstone, as is San Juan Quarries. Matrix Marble and Stone Inc. continues to quarry marble on Vancouver Island and fabricate a line of products including countertops, sinks, and tiles. They quarry Tlupana Blue Grey and Vancouver Island White marble near Hisnit Inlet.

Landscaping stone and dimension stone is quarried in the Squamish-Whistler corridor. The largest operator is Northwest Landscape and Stone Supply, with the Spumoni quarry and their Cabin Group property, which now has a Mines Act quarry permit. Others active in the area include Bedrock Granite Sales Ltd., Citadel Stone Ltd., and Alpine Natural Stone Ltd.

Haddington Island and Hardy Island have been two regular suppliers of dimension stone on the coast. The Haddington Island product (typically referred to as Haddington Island andesite) is a durable, resistant dacitic volcanic rock (70.5% silica), part of the Alert Bay volcanic belt (Neogene). Adera Natural Stone Supply Ltd. supplied Haddington Island stone for a new porte cochere at the Fairmont Empress Hotel, but there was no new quarrying in 2017. The quarry supplies stone as needed and may operate in 2018. Most of the product is used in restoration work on historic buildings, but it has also been used in modern monuments and buildings.

Hardy Island Granite Quarries Ltd. produces from a uniform grey Coast Plutonic complex granodiorite unit. Like Haddington Island, it is an historic quarry that mainly serves the local market. By the end of 2017, it will have produced about 3800 t. Hardy Island has opened another quarry on Valdes Island that supplies sandstone from the Nanaimo Group, another rock type that can be found on many older buildings in Vancouver and Victoria. Response to test marketing appears to be positive and production in 2016 was about 1500 t. They

shipped from stockpiles in 2017 and plan to quarry again in 2018.

3.3.1. Texada (Texada Quarrying Ltd.)

The largest limestone quarry on the coast is the **Texada Quarry** operation near Gillies Bay. Texada Quarrying Ltd. is a subsidiary of Lafarge Canada Inc. The quarry also produces aggregate, mainly from quartz monzonite to gabbro dikes and sills, which would otherwise be waste rock. The site also hosts a white carbonate quarry, one of only a few sources on the coast. The quarry, which has operated for more than 60 years, has extensive reserves and, at current rates, is capable of producing for more than 100 years.

3.3.2. Imperial Limestone (Imperial Limestone Co. Ltd.)

In recent years, the **Imperial Limestone** quarry near Van Anda on Texada Island (Fig. 1) has produced approximately 250,000 to 270,000 tpy of high-purity product. In 2017 they expect to produce about 290,000 tons (263,000 t), most of which will be shipped to their parent company in Seattle. They also mine and stockpile a larger quantity of lower quality limestone. Quarrying at the Imperial site dates back to the 1930s, and the current owners have operated it since the early 1950s. They anticipate reserves will last for more than 50 years.

3.3.3. Blubber Bay Quarry (Ash Grove Cement Company)

The **Blubber Bay** limestone quarry on Texada Island has remained mostly on care and maintenance since 2010, after more than 100 years of operation. It reopens for sufficiently large contracts. It can still supply limestone aggregate and continues to supply dolomite. It barged about 24,500 t of dolomite to Ash Grove's Rivergate Limestone Plant in Oregon in 2017. It has a contract for 150,000 t and plans 75,000 tpy during the next two years.

3.3.4. PEM 100 (Linceo Media Group LLC)

On northern Vancouver Island, the new operator of the **PEM 100** or **Apple Bay** quarry, Linceo Media Group LLC, left the site on care and maintenance, but with environmental monitoring ongoing. When operating, the quarry ships silica and alumina products from silicified and clay-altered rhyolitic flows and volcanoclastic rocks. Ash Grove Cement Company and previous quarry operator Electra Stone Ltd. conducted mine site exploration programs to better define its resources and to identify higher-silica (>97% SiO₂) material in 2015-2016. The new operator is proposing exploration and a higher production rate, pending discussions with the lease holder.

3.3.5. Benson Lake (Benson Lake Carbonates ULC.)

At the **Benson Lake** white carbonate deposit on northern Vancouver Island, new owner Benson Lake Carbonates ULC reported 2016 production totalling approximately 19,000 t. In 2017, the quarry was on care and maintenance. The new owner expects to suspend production for 1-2 years but may conduct

some on-site exploration. The high-brightness product is used mainly as white filler.

3.3.6. Sumas Shale (Sumas Shale Ltd.)

The **Sumas Shale** quarry of Sumas Shale Ltd., operated by contractor Fraser Pacific Enterprises Inc., delivers sandstone and shale product to the Lafarge and Lehigh cement plants in Richmond, and Ash Grove in Seattle. Sumas Shale Ltd is 50% owned by Lafarge Canada Inc. and 50% by Clayburn Industrial Group. Production and shipments have been approximately 500,000 tpy in recent years and a similar quantity is anticipated for 2017, with sales projected at 550,000 t. In future they plan to mine an average 475,000 tpy of approximately 55% shale and 45% sandstone. Because Clayburn's brick and refractory products plant in Abbotsford closed, fireclay is no longer produced separately.

3.3.7. Bute Inlet (Ironwood Clay Company Inc.)

Ironwood Clay Company Inc. mines glacial marine clay on the central Coast. Until 2015, production had been from the **DeCosmos Lagoon** south of Bella Bella (Fig. 1). They have a new site at the head of **Bute Inlet**, which is likely to supply future raw material. They collected approximately 595 t there in 2017. Ironwood produces cosmetic products using the clay at its Richmond plant, a business that has continued for 29 years. Other individuals and companies supply the growing cosmetic clay market at smaller scales from locations on the central Coast and Vancouver Island. Glacial Bay Organic Clay Inc. is extracting material by hand, also near the head of Bute Inlet. Generally, Mines Act permits are not required where material is collected by hand, and therefore some glacial marine clay operations are unreported.

3.3.8. Garibaldi Pumice and Mount Meager Pumice (Garibaldi Pumice Ltd., Great Pacific Pumice Inc.)

In the Mount Meager area, Garibaldi Pumice Ltd. produced 15,000 m³ of pumice from the **Garibaldi Pumice** quarry in 2017 (similar to 2015 and 2016) and reported strong sales. Exploration on the property consisted of 12 test pits to further delineate the existing resource (Table 3).

Neighbouring Great Pacific Pumice Inc. produced about 2100 t in 2017 at their **Mount Meager** quarry, and sold about 1600 t. They have stockpiles in Squamish from which they can ship year-round.

3.3.9. K2 (K2 Stone Quarries Inc.)

K2 Stone is a natural stone product supplier with a quarry near Port Renfrew on Vancouver Island (**K2**). They extracted 19,662 t in 2017. The rock is trucked to Nanaimo for processing into masonry and landscaping products.

4. Placer gold

Historic placer camps include the Lower Fraser River, Leech River, and China Creek. Although short lived, a gold rush in the

Fraser Canyon, beginning in 1858 at Hills Bar, led lead miners farther up the Fraser River into the Chilcotin and Cariboo. In 1864, reports of gold in the Leech River on southern Vancouver Island led to another brief gold rush. Both camps are worked by placer miners to the present day. There was one permit amendment on the Leech River in 2017 and a permit issued on the Lillooet River. Many placer miners operate with multi-year permits.

5. Mine development

Mine development projects are those for which a decision to produce has been made, key government approvals are in place, and on-site construction has begun. The Southwest Region has no such projects.

6. Selected proposed mines

Proposed mines are feasibility-stage projects for which proponents have begun the environmental certification process (in the case of large projects) or have submitted applications for Mines Act permits (in the case of projects below British Columbia Environmental Assessment Act thresholds). The Southwest Region has four such projects (Table 4); several small-scale and inactive larger projects are not covered in this report.

6.1. Proposed metal mines

The Southwest Region had no proposed major metal mine projects active in 2017.

6.2. Proposed coal mines

In 2016, the BC Environmental Assessment Office terminated environmental assessment of the Raven Underground Coal

mine project of Compliance Coal Corporation, and the region now has no active proposed coal mine projects.

6.3. Selected proposed industrial minerals mines

Proposed mines include the **BURNCO Aggregate** Project and the **Sechelt Carbonate** project, which has been inactive apart from a request by the owner to remain in the provincial environmental assessment process. The **Black Bear** aggregate project near Port McNeill is subject of an application to amend the Orca permit. Callache Stone Quarries Inc. has applied for a quarry permit for its **Tahsis** marble project.

6.3.1. BURNCO Aggregate (BURNCO Rock Products Ltd.)

The **BURNCO Aggregate** Project in the McNab Creek Valley (Fig. 1) submitted its application for environmental assessment with both provincial and federal agencies in 2016. The BC Environmental Assessment Office issued a draft Summary Assessment Report in October 2017 and a public comment period on the report followed. The proposed sand and gravel mine would ramp up to a 1.6 Mt per year operation, initially barging product to BURNCO Rock Products Ltd.'s ready-mix concrete plants in South Burnaby and Port Kells. BURNCO submitted revisions to the project in 2014, changing production rate, relocating some facilities and specifying a mine life of 16 years. Design modifications continued into the review phase to mitigate identified effects.

6.3.2. Sechelt Carbonate (Ballinteer Management Inc.)

Ballinteer Management Inc. now holds the property comprising the **Sechelt Carbonate** project. They filed engineering, archeological, and baseline environmental studies for assessment in 2016; no activity was reported for 2017.

Table 4. Selected proposed mines or quarries, Southwest Region.

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Black Bear	Polaris Materials Corporation	Aggregate; R15; n/a	na	na	Orca environmental certificate amendment for an adjacent quarry applied for.
BURNCO Aggregate	BURNCO Rock Products Ltd.	Aggregate; B12:Sand and Gravel; n/a	na	Approx. 20 Mt	Late in environmental assessment review.
Sechelt Carbonate	Ballinteer Management Inc.	Limestone, dolostone, aggregate; R09:Limestone; R10:Dolomite; R15:Crushed rock; 093GNW031	na	Carbonate Rock: 76.1 Mt Gabbro: >700 Mt	Environmental assessment pre-application.
Tahsis	Callache Stone Quarries Inc.	Marble; R09; 092E 020	na	na	Quarry permit and lease application for commercial production.

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

After a period of quiescence, Ballinteer indicated an interest in advancing the project, which entered the pre-application phase of environmental assessment in 2005 under different ownership. The property contains resources of both calcite- and dolomite-bearing carbonate rock and gabbroic rock for potential use as aggregate.

6.3.3. Black Bear (Polaris Materials Corporation)

As noted above, Polaris Materials Corporation is including **Black Bear** near its **Orca** sand and gravel quarry in an environmental certificate amendment for Orca. If the project proceeds, it will be a source of up to 250,000 tpy of crushed basalt.

6.3.4. Tahsis (Callache Stone Quarries Inc.)

Callache Stone Quarries Inc. is applying for a quarry permit and lease near Tahsis (**Tahsis** quarry) and intend to enter commercial production. Meanwhile they continue with surface preparation, bulk sampling, testing, and marketing.

7. Selected exploration activities and highlights

Exploration projects are categorized as grassroots, early-stage, advanced or mine evaluation, depending upon the nature of recent work. Work directed at discovering new resources away from ore bodies in an existing mine plan can be considered mine-lease or on-site exploration. The Southwest Region had few large exploration programs in 2017 (Table 5).

7.1. Selected precious metal projects

Precious metal prospects are found in a variety of settings in the region. There was one major exploration project in 2017, in addition to several smaller projects.

7.1.1. Goldstar (DSM Syndicate)

Grab samples taken during reconnaissance prospecting south of Bella Coola returned high-grade gold values from sulphide bearing quartz veins. Out of 16 samples, 6 had values of interest and 4 samples returned more than 10 g/t Au with Ag, Cu and Pb values. This area has no record of previous exploration. Goliath Resources Ltd. holds 10% of DSM Syndicate and Juggernaut Exploration Ltd. 20%.

7.1.2. Eliza (Caisey Harlinton)

At the **Eliza** gold prospect, owned by Caisey Harlinton, a hand-held drilling program, started in 2016, is testing gold-bearing veins near historical workings. Additional drilling is permitted. In 1940, 12.7 tonnes of ore yielded 435 grams of Au with Ag and Cu by products. The area was also explored in the 1980s.

7.1.3. Surespan Gold (640895 B.C. Ltd.)

A numbered company doing business as Surespan Gold, drilled approximately 6000 m in the Privateer area near Zeballos. The project is privately funded and results have not been made public. The company expects to return to

exploration in 2018. The area is underlain mainly by Jurassic basaltic to rhyolitic volcanic rocks of the Bonanza Group, and Eocene intrusive rocks. Between 1934 and 1975, the Zeballos camp (Figs. 3, 4) produced approximately 300,000 oz Au from

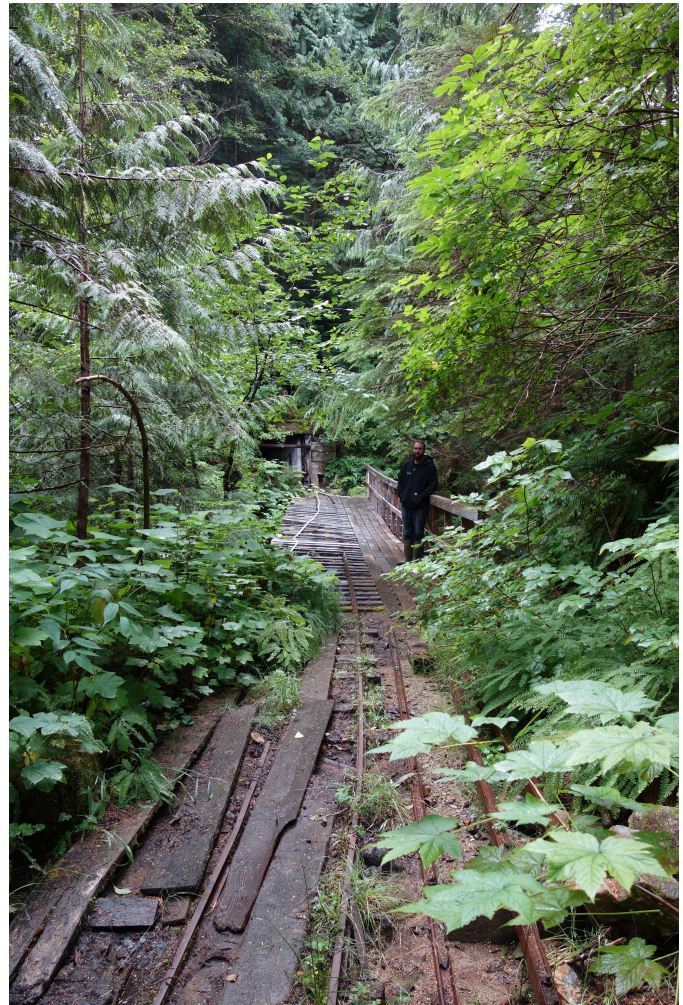


Fig. 3. Surespan project, in front of the portal of the historic Privateer mine.



Fig. 4. The Zeballos River valley looking south west. The historic mining camp spanned the river, with most mines southeast of the river (left of frame).

Table 5. Selected exploration projects, Southwest Region.

Project	Operator (partner)	Commodity; Deposit type MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Ashlu	Ashlu Mines Inc.	Au, Ag, Cu; Polymetallic veins; 092GNW013	na	Multi-year geology, geochemistry and geophysics continued. Property surrounds the Ashlu past producing mine.
Dancer Group	AMA Gold Exploration Ltd.	Au, Ag; Au-quartz veins; 092GNW008, 092GNW012	na	Permitting, archaeology, metallurgy.
Eliza	Caisey Harlington	Au, Ag, Cu; Cu±Ag quartz veins; 092E 043	na	Portable diamond drilling.
Fandora	Imperial Metals Corporation	Au, Ag; Cu±Ag quartz veins; 092F 040 092F 041 092F 205	Historical: 180,000 t 10.3 g/t Au	Mapping, soil and rock geochemistry.
Giant Copper	Imperial Metals Corporation	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au; 092HSW001 092HSW002 092HSW027 092HSW161	Invermay zone I: 17,532,570 tons 0.226% Cu, 0.011 oz/t Au, 0.310 oz/t Ag AM Breccia zone Historical: 29,523,030 tons 0.653% Cu, 0.11 oz/t Au, 0.360 oz/t Ag, 0.007% Mo	Access, soil and rock geochemistry.
Goldstar	DSM Syndicate	Au, Ag, Zn, Cu	na	Prospecting, sampling. Discovery of gold mineralization.
Jasper	Nitinat Minerals Corporation	Cu, Zn, Au, Ag; Noranda/Kuroko massive sulphide; 092C 080 092C 037 092C 081 092C 088	na	Geophysical interpretation.
Jordan River	New Sunro Copper Ltd.	Cu, Au, Ag; Tholeiitic intrusion-hosted; 092C 073	Historical: 1.4 Mt 1.4% Cu	Permitting.
Ladner Gold	New Carolin Gold Corp.	Au, Ag; Au- quartz veins; 092HWN003 092HWN007 092HWN018 092HSW034	Carolyn Inf: 12,352,124 t 1.53 g/t Au McMaster Inf: 3,575,000 t 0.69 g/t Au Tailings I: 445,378 t 1.83 g/t Au Inf: 93,304 t 1.85 g/t Au	Underground rehabilitation and preparation for drilling.

Table 5. Continued.

Myra Falls	Nyrstar N.V.	Zn, Cu, Pb, Au, Ag; Noranda/Kuroko massive sulphide; 092F 330 092F 071 092F 072 092F 073	See Table 1	On-lease exploration drilling began late in 2017.
North Island	Northisle Copper and Gold Inc.	Cu, Au, Mo; Porphyry Cu±Mo± Au; 092L 240 092L 200	Red Dog I: 23.6 Mt 0.32% Cu, 0.46 g/t Au Hushamu I: 304 Mt 0.21% Cu, 0.29 g/t Au, 0.01% Mo Inf: 205.6 Mt 0.18% Cu, 0.26 g/t Au, 0.008% Mo	Diamond drilling (1800 m in 6 holes), preliminary economic assessment.
OK	Lorraine Copper Corp.	Cu, Mo; Porphyry Cu±Mo± Au; 092K 008 092K 057 092K 168	Inf: 86,800,000t 0.31% Cu, 0.014% Mo	Induced polarization survey started.
Port Renfrew Block	Pacific Iron Ore Corporation	Clay; Surficial; na	na	Investigation of extensive glacial lacustrine clay deposits.
Prosper	New Sunro Copper Ltd.	Au, Ag, Cu; Cu±Ag quartz veins; 092F 053	Historical: 8150 t 32 g/t Au	Permitting, litho-geochemistry.
Tahsis	Callache Stone Quarries Inc.	Marble; 092E 020	na	Permitting, surface preparation, bulk sampling.
Skull Lake	BC Marble Products Ltd.	Marble; 092F 414	na	Bulk sample.
Surespan Gold	640895 B.C. Ltd.	Au, Ag; Au-quartz veins; 092L 008	Privateer Historical: 122,475 t 17 g/t Au	Privateer mine area. Approximately 6000 m diamond drilling.
Turnour Island	New Sunro Copper Ltd.	Cu, Au; na; na	na	Recent discovery of copper-bearing quartz stockwork veining.
Valentine Mountain	Great Thunder Gold Corp.	Au, Ag; Au-quartz veins; 092B 108 092B 183 092B 185	I: 54,763 t 16.3 g/t Au Inf: 20,700 t 22.6 g/t Au	2013 resource estimate includes Discovery B,C, E and Discovery West C vein. 2017 field work was soil and stream moss mat geochemistry.

M = Measured; I = Indicated; Inf = Inferred

veins, mostly at the Privateer and Spud Valley mines. The last significant exploration was in the early 2000s.

7.1.4. Fandora (Imperial Metals Corporation)

Imperial reported mapping, soil, and rock geochemistry in the vicinity of the historic **Fandora** mine. This follows geochemical sampling in 2016. Discovered in the 1930s, Fandora produced 972 t between 1960 and 1964, yielding 45,660 g Au. It has an historical resource of 180,000 t at 10.3 g/t Au.

7.1.5. Prosper (New Sunro Copper Ltd.)

New Sunro plans to re-activate a prospect explored by Bralorne Mines Ltd. in the 1940s. The historical program produced 90 t yielding 6687 g Au with Ag and Cu. In addition to geochemical sampling, New Sunro filed a Notice of Work for drilling. Rock samples confirm gold in quartz veins (the highest 124.53 g/t Au, 115 g/t Ag). Lead isotope analysis suggested that sulphides are Eocene.

7.1.6. Valentine Mountain (Great Thunder Gold Corp.)

Great Thunder Gold Corp. reported soil sampling and sampling of moss mats in streams at its **Valentine Mountain** Property on southern Vancouver Island. The moss mat sampling was over an area of 2000 by 500 m on the northern flank of Valentine Mountain. The soil samples were from Discovery West zone, 600 m west of the Discovery zone. The property was last drilled in 2012 and resource estimates were prepared in 2013.

7.1.7. Dancer Group (AMA Gold Exploration Ltd.)

AMA Gold's 2017 work included metallurgy and an archaeological impact study. Drilling, trenching, and bulk sampling was permitted late in the year. They have an agreement with Nicola Mining Inc. to process the bulk sample.

7.1.8. Ashlu (Ashlu Mines Inc.)

Ashlu Mines Inc. is a private company that has assembled a land position near the former Ashlu Mine near Squamish (**Ashlu property**). In 2017, they reported continuing geology and geochemistry at the property. A multi-year geological, geophysical (VLF-EM), and geochemical (rock, soil, and silt sampling) program that began in 2009 and continued annually since 2011, has relocated showings near the former mine. The Ashlu Mine, not part of this project, is a past producer that exploited a narrow (<1 to 4.6 m) gold-bearing quartz vein along a strike length of 90 m and extending 85 m down dip. In 1981 reserves were just less than 90,000 t of 8.57 g/t Au and 12.31 g/t Ag. The principal target of the surrounding project is mineralization similar to the Ashlu Mine. The property is largely underlain by the Clodburst pluton (Jurassic).

7.1.9. Ladner Gold (New Carolin Gold Corp.)

New Carolin Gold Corp. completed its acquisition of the **Ladner Gold** project in 2016 and now holds 100% of the property, including the former Carolin Mine site (subject to percentage of net smelter returns royalty). Following a surface program in 2016, 2017 work included preparing for underground drilling with a survey of workings, upgrades, and re-timbering. Before the recent surface drilling, the company had resource estimates at the past-producing Carolin mine (Fig. 5) for an open pit operation of Inferred at 0.5 g/t cutoff of 12,352,124 t grading 1.53 g/t Au and for an underground operation of Inferred at 2.0 g/t cutoff of 2,588,376 t grading 3.34 g/t Au.

The McMaster zone has an Inferred resource of 3,575,000 t grading 0.69 g/t Au at a 0.5 g/t Au cut off. The Carolin Mine tailings estimate has 445,378 t at 1.83 g/t Au in the Indicated category and 93,304 t grading 1.85 g/t in the Inferred category. Late in 2016, New Carolin began a second underground phase of their program which continued in 2017, including underground rehabilitation, channel sampling and geological mapping.

New Carolin has surrounding tenures covering much of the Coquihalla gold belt, a north-northwest trending series of gold



Fig. 5. View of the Carolin mine area from the tailings pond. The main resource is in the logged area.

occurrences between Sowaqua and Siwash Creeks, which has generally not been well explored by modern methods. Veins of economic interest are found in sedimentary and mafic volcanic rocks northeast of the East Hozameen fault and Coquihalla serpentine belt.

7.2. Selected porphyry (Cu-Au, Cu-Mo, Mo) projects

The region's most advanced porphyry project, the North Island Project, is focused on Jurassic mineralization. In addition, southwestern British Columbia has several advanced Eocene to Miocene porphyry copper targets. Two of these, OK and Giant Copper, saw modest levels of exploration in 2017.

7.2.1. North Island Project, Red Dog and Hushamu (Northisle Copper and Gold Inc.)

Between 1971 and 1994, the Island Copper mine produced 345 Mt with average head grades of 0.41% Cu, 0.017% Mo, and 0.19 g/t Au. Several porphyry copper and epithermal gold targets extend along a 40 km west-north-west trend from Island Copper. **Hushamu**, a copper-molybdenum-gold porphyry prospect, is the most advanced, with Indicated 304 Mt of 0.21% Cu, 0.29 g/t Au, 0.010% Mo, and 0.56 ppm Re and Inferred 205.6 Mt of 0.18% Cu, 0.26 g/t Au, 0.008 % Mo and 0.38 ppm Re. In 2015, Northisle Copper and Gold Inc. acquired an option on the **Red Dog** property, approximately 7.5 km west-north-west of the Hushamu deposit. In 2016, they drilled to verify a historical resource estimate. At a 0.20% Cu cut off, the updated Red Dog estimate has 23.6 Mt at 0.32% Cu, 0.46 g/t Au and 0.007% Mo Indicated and 848,000 t at 0.23% Cu, 0.33 g/t Au and 0.003% Mo Inferred. The Red Dog and Hushamu resources together were subject of a 2017 preliminary economic assessment, which modelled a 75,000 tpd open-pit operation with a 22-year life. The base case had an after tax net present value of \$550.5 million applying a discount rate of 8%. The internal rate of return is estimated at 14.3%. Initial capital costs were estimated at \$1.34 billion. The project would benefit from existing infrastructure in the area (Fig. 6).

Drilling in 2017 (1800 m in 6 holes) included testing a



Fig. 6. Cape Scott wind farm looking north from North Island porphyry project.

southeastern extension of the Hushamu deposit, testing an area in the Hushamu deposit previously considered occupied by late or post-mineral breccia and barren, and testing for deep mineralization at Red Dog. Mineralization at Hushamu does appear to be open to the southeast and north and the infill drilling encountered mineralization above cut off. The hole at Red Dog was lost before reaching target depth but did encounter porphyry style alteration and increasing mineralization at depth.

Mineralization also remains open on Northisle's tenures to the west. A separate mineralized zone, 400 m east of the Red Dog zone, has been reported. Since it was detected as a geochemical anomaly in 1962, Red Dog has seen more than 9000 m of reported drilling. Hushamu, Hep, Red Dog and a 2005 discovery, NW Expo, form a roughly 10 km west-northwest trending series of porphyry occurrences. The former Island Copper mine is approximately 30 km east-southeast.

7.2.2. OK (Lorraine Copper Corp.)

Lorraine Copper Corp. acquired 100% of the **OK** copper-molybdenum prospect north of Powell River in 2016. Late in 2017, they began an induced polarization survey. Known mineral occurrences extend along a roughly 5 km north-northwest trend. The northernmost, North Lake Zone, has an Inferred resource of 86.8 million tonnes grading 0.31% Cu and 0.014% Mo. The mineralization is open with untested step-out geophysical and geochemical drill targets.

7.2.3. Turnour Island (New Sunro Copper Ltd.)

New Sunro reports copper mineralization in stockwork quartz veins in intrusive rocks on Tournour Island. Results of prospecting and rock, stream sediment, and moss-mat sampling were filed for assessment. The showing was discovered during recent logging operations. An initial grab sample returned 1.38% Cu, 8.0 g/t Ag, 0.599 g/t Au. A follow up sample was similar, grading 0.876% Cu, 4.8 g/t Ag, 0.469 g/t Au. There is no record of previous mineral exploration on Turnour Island, although several volcanic redbed-type showings are documented on nearby islands and neighbouring Harbledown Island hosts a limestone prospect.

7.2.4. Giant Copper (Imperial Metals Corporation)

Imperial reported work on access and soil sampling and lithogeochemistry. This follows sampling in 2016, which delineated a 250 x 400 m gold in soil anomaly. There is a 2006 resource estimate on the Invermay zone of 17,532,570 tons at 0.226% Cu, 0.011 oz/t Au and 0.310 oz/t Ag Indicated. Giant Copper also has historical resources for the AM breccia zone. The open pit estimate is 29.5 Mtons at 0.653% Cu, 0.11 oz/t Au, 0.360 oz/t Ag, and 0.007% Mo. The historical underground estimates are 2.6 Mtons at 1.223% Cu, 0.017 oz/t Au, 0.626 oz/t Ag, and 0.005% Mo; and 1,234,500 t at 1.155% Cu, 0.013 oz/t Au, 0.682 oz/t Ag, and 0.024% Mo historical inferred (non-compliant).

7.3. Selected polymetallic base and precious metal projects

With the notable exception of a program at Myra Falls, volcanogenic massive sulphide deposits in the southwest saw limited exploration in 2017.

7.3.1. Jasper (Nitinat Minerals Corporation)

Nitinat filed 2017 geophysical work for assessment. Results, which include an inversion of electromagnetic data, remain confidential.

7.4. Selected mafic and ultramafic associated projects

Mafic- and ultramafic-associated deposits are known in the Metchosin complex on southern Vancouver Island and in assemblages in the Harrison Lake-Hope area (e.g., Giant Mascot intrusion), which hosted British Columbia's only significant nickel producer.

7.4.1. Jordan River (New Sunro Copper Ltd.)

New Sunro Copper Ltd., a private company, reported no new technical work, but obtained a permit to drill their Jordan River project, site of the Sunro past producer. Recent work included underground remediation, mapping, historical data compilation, and airborne geophysics. The first phase of drilling, now permitted, would be from surface. Classed as a magmatic deposit, sulphide mineralization is reported mainly in shear zones, fractures, shatter zones in Metchosin complex basalt, close to gabbroic sills. Some mineralized samples

from the site were anomalous in nickel, cobalt, and palladium but copper, gold and silver are the commodities found in economic concentrations to date. Two orebodies were mined intermittently from 1962 to 1974. Between 1962 and 1978 the mine produced 13,754 t Cu, 203,101 g Au and 2,262,651 g Ag from 1.3 Mt of ore. Exploration has been modest and limited to surface surveys since mining ceased in 1974. The last reported historical resource estimate was in 1973. At that time 1,030,465 t grading 1.47% Cu were in proven and 423,782 t grading 1.33% Cu in probable categories.

7.5. Selected industrial minerals and aggregates projects

Exploration for industrial minerals and aggregates is commonly carried out by individuals and private companies and typically goes un-reported. Of the more than 600 quarry and sand and gravel operations with active permits not all are currently producing or conducting investigative work.

7.5.1. Port Renfrew Block (Pacific Iron Ore Corporation)

The company filed work for assessment (prospecting, geology, and geochemistry) in 2017. The Loss Creek area has deposits of glacial lacustrine clay that are being investigated to determine their commercial potential.

7.5.2. Skull Lake (BC Marble Products Ltd.)

BC Marble Products continued their bulk sample at their marble prospect near Skull Lake in 2017. Limestone was quarried nearby at Pipestem Inlet in the Early 20th century.

8. Geological research

The digital geology map of British Columbia (Cui et al., 2017) has been updated to include mapping in northern Vancouver Island by Nixon et al. (2011). Heberlein et al. (2017a, b) reported an investigation of halogens and other volatile compounds as indicators of mineralization. The study areas include the Lara polymetallic VMS prospect and the Mount Washington epithermal Au-Cu-Ag prospect, both on Vancouver Island.

Jackaman (2017) presented results of an RGS sample reanalysis project that includes NTS map sheet 092N. Geoscience BC (2017) released maps, reports and other data relating to Mount Meager geothermal energy potential (Project 2017-006).

9. Summary

In 2017, the most positive news in the region was both Myra Falls and the Quinsam mine being reactivated. Both have traditionally carried out exploration programs and, in the case of Myra Falls, this work has already begun. The North Island porphyry project released its first public preliminary economic assessment study. What started as a fairly modest drill program in the Zeballos camp expanded over the course of the year and could continue into 2018. Two significant industrial minerals quarries on Northern Vancouver Island remained on care and maintenance.

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Exploration and mining in the Northwest Region, British Columbia



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1. Introduction

The Northwest Region includes about 263,000 km² of British Columbia, approximately 25% of the province (Fig. 1). The region has two operating mines, one mine on temporary shutdown and seven proposed mine projects. More than 60 exploration projects were active in 2017, with activities predominantly focussed on precious metal and porphyry style copper-gold mineralization.

In 2017, exploration expenditures, drilling estimates and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey. The survey is a joint initiative between the Province of British Columbia Ministry of Energy and Mines, the Association for Mineral Exploration, and Ernst & Young LLP. For the Northwest Region, exploration expenditures were estimated at \$99.1 million and exploration drilling was estimated at approximately 274,100 m (Clarke et al., 2018; Ernst & Young LLP, in press).

The Northwest Region saw several significant events in 2017. In July commercial production was declared at the new Brucejack mine. The new grassroots high-grade gold Saddle South discovery and the Saddle North copper-gold-silver porphyry discovery were made by GT Gold Corp. Highlight results for Saddle South included 51.53 g/t Au over 6.95 m and 5.10 g/t Au over 23.66 m. Highlight results for Saddle North included 210.3 m of 0.14 g/t Au, 0.28 g/t Ag and 0.16% Cu. At their E&L nickel project Garibaldi Resources Corp. reported high grade intersections including 8.3% Ni and 4.2% Cu over 16.75 m.

Seabridge Gold Inc. continued to report wide zones of significant grade for the Iron Cap deposit, which is part of their KSM project. Results included 858 m of 0.86 g/t Au and 0.51% Cu including 113 m of 2.98 g/t Au and 1.56% Cu. IDM Mining Ltd., continued to advance their Red Mountain project, with step-out drilling, a feasibility study, and a project application and an environmental impact statement, which were submitted to regulators and stakeholders. Ascot Resources Ltd. carried out a 379 hole, 118,800 m diamond drilling program at their Premier/Dilworth project. Numerous high-grade intersections were reported; including 36.31 g/t Au over 16.15 m. Plans for

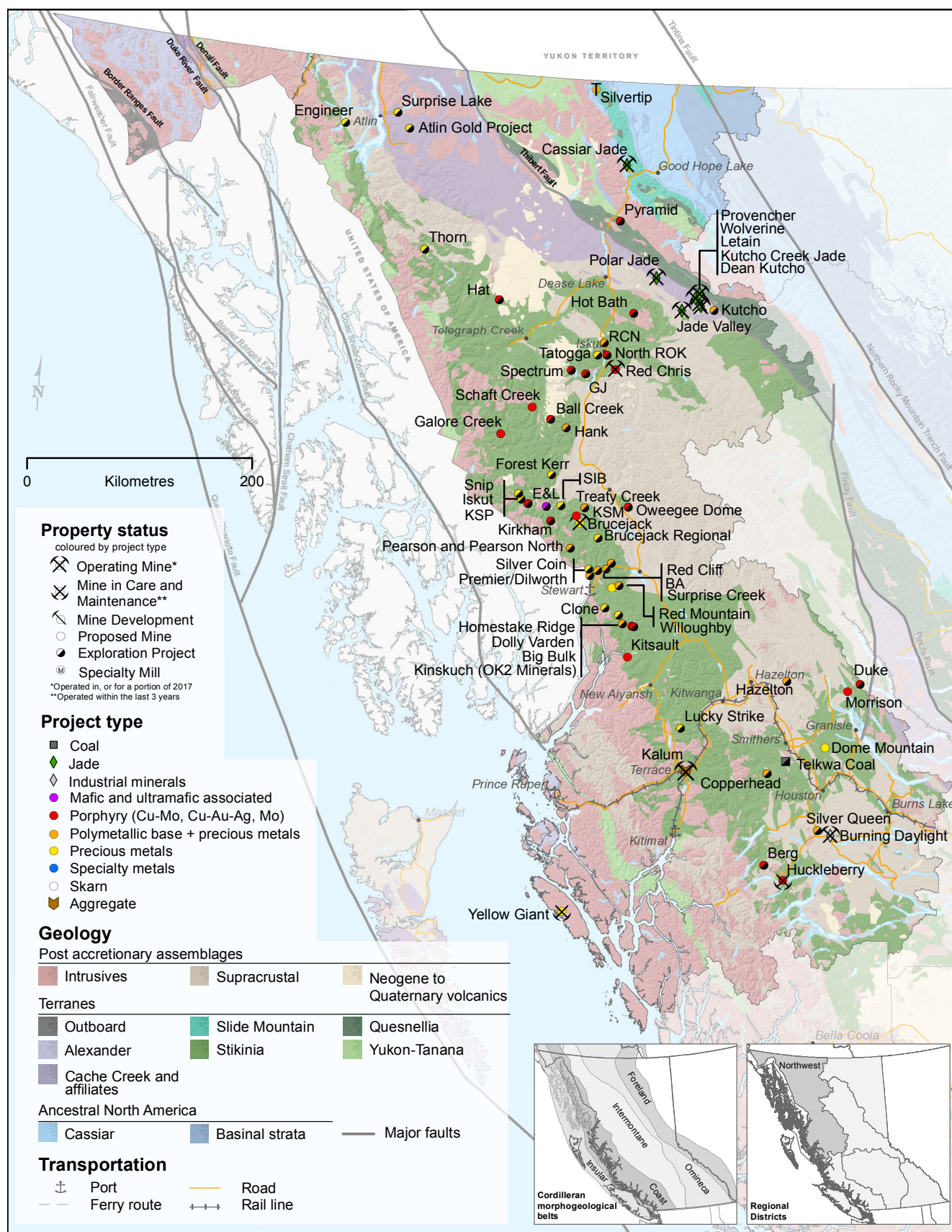
2018 include continued drilling and a new NI 43-101 resource calculation.

In October, the Silvertip mine was purchased from JDS Silver Inc. by Coeur Mining Inc. for about \$250 million. Coeur plans to invest US\$25-\$35 million in surface infrastructure, accelerated underground development and drilling, and mill optimization over a six-month period. It plans to resume production early in 2018.

2. Geological overview

Metallogeny in British Columbia is intimately linked to the tectonic evolution of the Canadian Cordillera, first as an accretionary orogen consisting of allochthonous terranes that were welded to, and deformed with, the western margin of ancestral North America primarily during the Jurassic and then as the site of post-accretionary tectonism and magmatism (e.g., Nelson et al., 2013). The region includes all of the physiographic belts of the Canadian Cordillera (Fig. 1), and transects the Cordilleran orogen (Fig. 1). From east to west it is underlain by: 1) autochthonous and parautochthonous carbonate and siliciclastic strata deposited on the flank of ancestral North America (Laurentia); 2) the Intermontane terranes, including the Slide Mountain terrane (back-arc basin); the Yukon-Tanana terrane (a rifted Devonian pericratonic arc); the Quesnel and Stikine volcanic arc terranes (formed outboard of ancestral North America starting in the Late Paleozoic and accreted in the Middle Jurassic); and the Cache Creek oceanic terrane, which intervenes between Quesnellia and Stikinia; 3) the Alexander terrane; 4) post-accretionary rocks; and 5) younger cover rocks (Fig. 1).

All of the allochthonous terranes initially accreted to each other and to western North America in the Jurassic. Since then, the mosaic has been intruded by post accretion plutonic suites and covered, in part, by Jurassic and younger syn- and post-accretionary siliciclastic deposits. For details about the geology, metallogeny, and tectonics of the Northwest Region see Nelson et al. (2013).



3. Mines and quarries

During 2017, three metal mines (**Red Chris, Brucejack and Silvertip**) operated in the region (Fig. 1; Table 1). Eight industrial mineral mines were tracked, including six jade operations (Fig. 1; Table 2). Placer mining has been active in the Northwest Region for well over a century. Operations are mainly in the Atlin area and to, a lesser degree in the Cassiar area. Numerous small aggregate operations supply mainly local needs throughout the region and are not discussed in this report.

3.1. Metal mines

Three metal mines produced in the Northwest Region during 2017 (Table 1). The **Red Chris** mine operated throughout the year, the **Brucejack** mine announced official production in July and the **Silvertip** mine operated until April.

3.1.1. Red Chris (Red Chris Development Company Ltd.)

The **Red Chris** copper-gold mine is accessed by a controlled mine road from highway 37. The project is owned by Red Chris Development Company Ltd., a subsidiary of Imperial Metals

Corporation. Production up to the end of the 3rd quarter of 2017 totalled 51.40 Mlbs Cu and 20,396 oz Au from 7.88 Mt of ore grading 0.38% Cu and 0.20 g/t Au. Metal recoveries averaged 78.13% for Cu and 39.47% for gold. Target production for the year was forecast between 76-80 Mlbs Cu and 33,000-37,000 oz Au.

The Red Chris copper-gold deposit is hosted in a 204 Ma diorite-monzonite that intrudes Late Triassic rocks of the Stuhini Group. The 6.5 x 1.5 km porphyry consists of four main intrusive phases. The second phase (P2) contains most of the copper and gold, and measures greater than 2 km x 650 m in plan and extends to a depth of more than 1.5 km. The syn-mineral P2 intrusive phase is high-potassic, calc-alkalic in composition and contains abundant 'A' type quartz-chalcopyrite-magnetite +/- bornite veins (Rees et al., 2015).

Measured plus Indicated resources total 1034.7 Mt with an average grade of 0.35% Cu, 0.35 g/t Au and 1.14 g/t Ag. Additional Inferred resources total 787.1 Mt grading 0.29% Cu, 0.32 g/t Au and 1.04 g/t Ag. Resource figures are for combined open pit and planned underground operations and do not take into account any mining since start-up.

Table 1. Metal mines, Northwest Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Huckleberry	Huckleberry Mines Ltd.	Cu, Au, Ag, Mo; Porphyry Cu-Mo-Au; 093E 037	na	Approx., 37 Mt at 0.3% Cu	na	Placed on care and maintenance in 2016.
Red Chris	Red Chris Development Company Ltd.	Cu, Au, Ag; Porphyry Cu-Au; 104H 005	68.5 Mlbs Cu and 27,000 oz Au	na	M+I: 1.035 Bt at 0.35% Cu, 0.35 g/t Au and 1.14 g/t Ag	First year of full production achieved in 2016. Resource figures are for combined open pit and planned underground operations and do not take into account any mining since start-up.
Brucejack	Pretium Resources Inc.	Au, Ag; Au-quartz veins, Quartz stockwork breccia; Epithermal; 104B 193	na	P+Pr: combined VOK zone and West zone 18.5 Mt at 14.6 g/t Au, 53.5 g/t Ag.	M+I: VOK zone 16.4 Mt at 17.2 g/t Au and 15.0 g/t Ag M+I: West zone 4.9 Mt at 5.85 g/t Au and 267 g/t Ag	Mine declared official production in July.
Silvertip	JDS Silver Inc./Coeur Mining Inc.	Ag, Pb, Zn, Au; Polymetallic manto; 104O 038	na	na	2.35 Mt at 352 g/t Ag, 6.73% Pb, 9.41% Zn	Operations suspended in April. Purchased by Coeur Mining Inc. in October for approximately \$250 million.

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

Table 2. Selected industrial mineral mines and quarries, Northwest Region.

Mine	Operator (partner)	Commodity; deposit type; MINFILE	Forecast 2017 Production (based on Q1-Q3)	Reserves	Resource	Comments
Burning Daylight	Stone Ridge Quarries Ltd.	Columnar Basalt; dimension stone	unknown	na	na	Basalt quarrying.
Cassiar Jade	Dynasty Jade Ltd.	Nephrite Jade; Gems and semi-precious stones; 104P 005	unknown	na	na	Trenching, quarrying, placer production.
Jade Valley	United Oriental Mining Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 048	unknown	na	na	Trenching, quarrying, placer production.
Kalum	Kalum Quarry Ltd. Partnership	Industrial rock; crushed rock	unknown	na	na	Drilling, blasting, crushing, production for CN railway bed.
Kutcho Creek Jade	Continental Jade Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 078	unknown	na	na	Mining, trenching.
Letain	Cassiar Jade Contracting Inc.	Nephrite Jade; Gems and semi-precious stones; 104I 079	unknown	na	na	Mining, trenching.
Provencher	Glenpark Enterprises Ltd.	Nephrite Jade; Gems and semi-precious stones; 104I 092	unknown	na	na	Mining, trenching.
Wolverine	Cassiar Jade Contracting Inc.	Nephrite Jade; Gems and semi-precious stones	unknown	na	na	Mining, trenching.

3.1.2. Brucejack (Pretium Resources Inc.)

The **Brucejack** underground gold-silver mine project is about 65 km north-northwest of Stewart. Access is via year-round, all-weather road. An all season airstrip is on the road access, approximately 20 km southeast of the planned mine site. Pretium completed a feasibility study in 2014 and started construction in September 2015.

In July of 2107, commercial production was announced. For the third quarter ended September 30th the process plant averaged 2840 tpd and mill feed averaged 10.5 g/t Au. The mill feed grade is expected to increase as processing switches from low-grade stockpiles and development muck to stope ore. In December, Pretium submitted an application to increase production to 3,800 tpd.

Free gold and electrum is recovered (Fig. 2) to produce gold-silver doré, which is flown off site from their all season airstrip. Sulphide concentrate will be trucked offsite to be refined at a receiving smelter.

Total mineral reserves and resources for the project are based on the Valley of the Kings (VOK) and West zones. In 2016,



Fig. 2. Gold pour, Brucejack mine. Photo courtesy of Pretium Resources Inc.

Pretium reported Measured plus Indicated resources for the VOK zone at 16.4 Mt grading 17.2 g/t Au and 15.0 g/t Ag. Additional Inferred resources total 4.6 Mt grading 21.0 g/t Au and 26.9 g/t Ag. For the West zone, Measured plus Indicated

were reported at 4.9 Mt grading 5.85 g/t Au and 267 g/t Ag. Additional Inferred resources total 4.0 Mt grading 6.44 g/t Au and 82 g/t Ag. Proven plus Probable reserves for the VOK zone was reported as 15.6 Mt grading 16.1 g/t Au and 11.7 g/t Ag. Proven plus Probable reserves for the West zone was reported as 2.9 Mt grading 6.9 g/t Au and 279 g/t Ag. Combined reserves are reported as 18.5 Mt grading 14.6 g/t Au and 53.5 g/t Ag.

Regional exploration efforts continue to follow up new targets outside of the mining lease in their surrounding 1200 km² of mineral claims and are discussed below.

3.1.3. Silvertip (JDS Silver Inc. and Coeur Mining Inc.)

The **Silvertip** silver-zinc-lead mine shut down in spring 2017 due to permitting issues, having started production in the fourth quarter of 2016. In October, the mine was purchased from JDS Silver Inc. by Coeur Mining Inc. for about \$250 million. Coeur plans to invest US\$25-\$35 million in surface infrastructure, accelerated underground development and drilling, and mill optimization over a six-month period. It plans to resume production early in 2018.

The Silvertip deposit is in the Cassiar terrane. The ore body consists of five zones; the Silver Creek, the 28, the 65, the Discovery and the Discovery North zones. The zones consist of massive sulphide bodies in limestones of the McDame Group and are unconformably overlain by Devonian-Mississippian rift-related, siliciclastic rocks of the Earn Group. Current resource estimates are 2.35 Mt at 352 g/t Ag, 6.73% Pb and 9.41% Zn.

3.2. Industrial mineral mines and quarries

Eight industrial mineral mines were tracked including six jade producers and two industrial rock quarries (Table 2).

3.2.1. Nephrite jade

Jade is the commercial term for jadeite and nephrite. In British Columbia jade occurs as nephrite. Nephrite is composed of interlocking fibrous amphibole minerals derived from an ultramafic protolith that has undergone dynamothermal metamorphism and metasomatism. The two significant areas of nephrite jade extraction in the Northwest Region are east of Dease Lake in the Turnagain River area and north of Dease Lake in the Cassiar area. Production varies between operations and ranges from 200 to 2000 tpy.

3.2.2. Industrial rock quarries

The **Burning Daylight** basalt stone quarry is owned by Stone Ridge Quarries Limited. Access to the project is via a forest service road. Stone Ridge mines basalt for landscape and building stone markets.

The **Kalum Quarry** is 3 km west of Terrace at the confluence of the Kitsumkalum and Skeena Rivers on the traditional territory of the Kitsumkalum First Nation. The quarry is owned and operated by the Kalum Quarry Ltd. Partnership, a subsidiary of the Kitsumkalum First Nation. The quarry has road access and a 3 km rail line connecting it to the CN mainline.

Rock is drilled, blasted, and crushed on site to meet specific contact requirements. Various aggregate size fraction products are produced for industrial and residential purposes. Typical products include large diameter rip-rap, railway ballast, asphalt crush, and finer materials for concrete. An estimated 22 million cubic meters of material remains available for development. Basalt and andesite of the Hazelton Group are quarried.

3.2.3. Placer operations

Placer mining operations have been active in the Northwest Region for well over a century. Because of the large number of mines and difficulty in obtaining information, these operations are not tracked.

4. Mine development

The mine development stage is achieved when a project acquires the required permits and has started mine construction. Essential permits include provincial and federal environmental assessment certificates, a Mines Act permit from the Ministry of Energy, Mines and Petroleum Resources, and an Environmental Management Act permit from the Ministry of Environment. Brucejack was the only mine development project in the region until it declared commercial production.

5. Proposed mines or quarries

Proposed mines are feasibility-stage projects for which proponents have begun or completed the environmental certification process (for large projects), or have submitted or received approvals for Mines Act permits (for projects below British Columbia Environmental Assessment Act thresholds).

5.1. Selected proposed metal mines

The Northwest Region has several proposed metal mines, seven of which have been active within the past three years and/or hold permits to allow construction if financing becomes available (Fig. 1; Table 3).

5.1.1. KSM (Seabridge Gold Inc.)

Owned by Seabridge Gold Inc., the **KSM** project occupies the adjoining mineral claims west of the Brucejack mine. Access to KSM is via helicopter. The project consists of four porphyry gold-copper deposits: Kerr, Sulphurets, Mitchell, and Iron Cap. The deposits represent what may be the largest undeveloped copper-gold camp in the world (by reserves). Proven plus Probable reserves are reported as 2.198 Bt grading 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag and 42.6 g/t Mo. An updated Measured plus Indicated resource estimate (inclusive of reserves) completed in May totals 2.903 Bt grading 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag and 46.6 ppm Mo. Seabridge received federal and provincial approval of the project environmental assessment in 2014 and is actively seeking partnership to advance into construction.

In 2017, Seabridge completed 10,383 m of drilling in 11 holes at the Iron Cap deposit. All 11 holes returned wide zones of significant grade. Highlights include 858 m of 0.86 g/t Au

Table 3. Selected proposed mines, Northwest Region.

Project	Operator (partner)	Commodity; deposit type; MINFILE	Reserves	Resource	Comments
Dome Mountain	Dome Mountain Resources of Canada Inc.	Au, Ag; Vein breccia and stockwork; 093L 022	na	M+I: 144,144 t grading 17.7 g/t Au	Announced plans to negotiate processing ore at Nicola Mining Inc.'s custom mill.
Galore Creek	Galore Creek Mining Corp.	Au, Cu; Alkalic porphyry; 104G 090	P+Pr: 528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag	M+I: 814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.2 g/t Ag	Baseline monitoring.
Kitsault	Alloycorp Mining Inc.	Mo, Ag, Pb; Porphyry Mo (low F type); 103P 120	P+Pr: 228.2 Mt at 0.083% Mo, 5.0 g/t Ag	M+I: 321.8 Mt at 0.071% Mo, 4.8 g/t Ag	Baseline monitoring.
KSM	Seabridge Gold Inc.	Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 191	P+Pr: 2.198 Bt at 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag, 0.00426% Mo	M+I: 2.902 Bt at 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag, 0.0044% Mo	Updated resource estimate in May. 10,383 m of drilling in 11 holes at Iron Cap deposit. Highlights include 858 m of 0.86 g/t Au and 0.51% Cu including 113 m of 2.98 g/t Au and 1.56% Cu.
Morrison	Pacific Booker Minerals Inc.	Cu, Mo; Calc-alkalic porphyry; 093M 007	na	M+I: 208.3 Mt at 0.39% Cu, 0.19 g/t Au, 0.005% Mo (at a 0.30% CuEq cut-off)	Baseline monitoring, EA ongoing. Resource information from 2009 NI 43-101 technical report.
Red Mountain	IDM Mining Ltd.	Au, Ag; Porphyry related gold; 103P 086	na	M+I: 2.075 Mt at 8.75 g/t Au, 25.00 g/t Ag	Positive feasibility study completed. Resource updated. Drilling in 2017 expanded mineralization to north, south and down dip. EA application submitted. Construction start planned for 2018.
Schaft Creek	Teck Resources Limited	Cu, Au; Calc-alkalic porphyry; 104G 015	P+P: 940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag	1.229 Bt at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag	Resource re-modelling in progress. Environmental baseline data collection, permitting.

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

and 0.51% Cu including 113 m of 2.98 g/t Au and 1.56% Cu. Seabridge reported that Iron Cap is approaching parity in size with other deposits in the project, but with zones of considerably higher metal values. The early development of Iron Cap is considered as a high priority for further study due to its grade, location and size. Results may result in a revision

of the project's mine plan and enhance KSM's projected economics.

The KSM deposits are related to the Mitchell intrusions of the Texas Creek plutonic suite (Early Jurassic; ~194 Ma; Margolis, 1993). Diorite, monzonite and quartz-syenite stocks and dikes intrude along the Sulphurets fault (pre-Early Jurassic) into the

surrounding sedimentary and volcanic rocks of the Stuhini and Hazelton groups. Mineralization is disseminated and in stockwork veins and consists of fine-grained chalcopyrite, bornite, molybdenite, and pyrite.

5.1.2. Dome Mountain (Gavin Mines Inc.)

The **Dome Mountain** past-producing gold mine is accessed by forest service roads from highway 16. Gavin Mines Inc., a subsidiary of Metal Mountain Resources Inc. owns 54%. Grace Mining Inc. owns 30%, Dome Mountain Resources of Canada Inc. owns 14% and two private shareholders own 2%. The project has current Mines Act and Environmental Management Act permits in good standing and is allowed to excavate up to 75,000 tpy. In early 2013, the project submitted applications to amend their existing Mines Act and Environmental Management Act permits that would allow for onsite milling and tailings storage. Due to delays, including regulatory changes due to the 2014 Mount Polley tailings breach, the permit amendments remain outstanding. In 2016 stockpiled material was processed at Nicola Mining Inc.'s custom mill facility near the town of Merritt. In February of 2017 the company reported that a longer term profit share agreement with Nicola was being negotiated.

5.1.3. Red Mountain (IDM Mining Ltd.)

The **Red Mountain** gold project is 18 km east-northeast of Stewart; access to the site is by helicopter. IDM Mining Ltd. acquired 100% ownership of the 17,125 ha property from Seabridge Gold Inc. in May. Current Proven plus Probable reserves are 1.953 Mt at 7.53 g/t Au and 21.86 g/t Ag. IDM is targeting production for the first quarter of 2020.

IDM, continued to advance the project in 2017, with step-out drilling, a feasibility study, and a project application and an environmental impact statement, which were submitted to regulators and stakeholders. A total of 29,312 m of drilling was completed consisting of 104 underground, eight surface, and three geotechnical core holes. Drilling highlights include 25.0 m grading 13.7 g/t Au and 30.9 g/t Ag and their highest grade intersection to date: 1400 g/t Au and 437 g/t Ag over 0.5 m, in an interval of 149.24 g/t Au and 59.88 g/t Ag over 4.88 m.

The project contains five known underground gold zones; Marc, AV, JW, 141 and 132. Mineralized zones consist of crudely tabular, northwesterly trending and moderately to steeply southwesterly dipping gold and silver-bearing iron sulphide stockworks. Mineralized widths vary from less than 2 m to 40 m and average 16 m. The stockwork zones consist of pyrite microveins, coarse-grained pyrite veins, irregular coarse-grained pyrite masses and breccia matrix pyrite hosted predominately in a pale, strongly sericite-altered porphyry. Vein widths vary from 0.1 cm to 80 cm but widths of 1 to 3 cm are most common. The veins are variably spaced and average 2 to 10 per m. The veins are very commonly heavily fractured or brecciated with infillings of fibrous quartz and calcite. The pyrite veins typically carry gold grades ranging

from ~3 g/t to greater than 100 g/t. Gold occurs as grains of native gold, electrum, petzite, and a variety of gold tellurides and sulphosalts. Pyrite is the predominant sulphide although pyrrhotite is locally important. The stockwork zones also occur to a lesser extent in rafts of sedimentary and volcanoclastic rocks.

5.1.4. Galore Creek (Galore Creek Mining Corporation)

The **Galore Creek** gold-copper project is operated by the Galore Creek Mining Corporation (GCMC). Ownership of GCMC is equally split between NovaGold Resources Inc. and Teck Resources Limited. Development of the Galore Creek project is currently on hold.

The project consists of thirteen known zones of gold-copper mineralization with Proven plus Probable reserves reported as 528 Mt at 0.59% Cu, 0.32 g/t Au and 65.02 g/t Ag.

5.1.5. Schaft Creek (Teck Resources Limited (75%) and Copper Fox Metals Inc. (25%))

The **Schaft Creek** copper-gold-silver molybdenum project is owned by Teck Resources Limited (75%) and Copper Fox Metals Inc. (25%). Access to the project is via helicopter or fixed wing aircraft to a gravel airstrip. The project has been in the pre-application phase of environmental assessment since 2006. In 2017, work included updated resource modelling, collection of environmental baseline data and ongoing First Nations consultation.

The Schaft Creek project consists of three deposits: the Main (Liard) zone, The Paramount zone and the West Breccia zone. The deposit hosts a Measured and Indicated resource of 1228.6 Mt grading 0.26% Cu, 0.017% Mo, 0.19 g/t Au and 1.69 g/t Ag and a 597.2 Mt Inferred resource grading 0.22% Cu, 0.016% Mo, 0.17 g/t Au and 1.65 g/t Ag.

5.1.6. Kitsault (Alloycorp Mining Inc.)

The **Kitsault** project is owned by Alloycorp Mining Inc., a privately owned company. The road accessible project produced molybdenum between 1967 and 1972 and again between 1981 and 1982. The project is currently on hold but has environmental assessment approval from both the provincial and federal governments. Pre-production costs are estimated to be \$1.2 billion. The proposed operation would have a 45,500 tpd throughput which will recover both molybdenum and silver. Measured plus Indicated resources are 321.8 Mt at 0.071% Mo, 4.8 g/t Ag.

The Kitsault deposit is hosted in the Lime Creek intrusive complex (Eocene) which intrudes Jurassic argillite and greywackes of the Bowser Lake Group. Molybdenite is hosted in aplite dikes and quartz-molybdenite stockworks.

5.1.7. Morrison (Pacific Booker Minerals Inc.)

Access to the **Morrison** copper-gold-molybdenum-silver project is by road and barge. Measured and Indicated resources are reported as 265.9 Mt at 0.35% Cu, 0.17 g/t Au and 0.005%

Mo (at a 0.20% Eq copper cutoff). Proposed is an open pit operation with a 30,000 t per day mill, equating to a 21-year mine life.

Pacific Booker submitted an EA application in 2010, which was denied in 2012. In late 2013, a supreme court ruled procedural fairness was not adhered to in the 2012 rejection and required the EAO to accept a remitted application for reconsideration. After the Mount Polly tailings breach, the review was suspended, but then resumed in June 2015. In July 2015, a letter from the British Columbia Minister of Environment and Minister of Energy and Mines stated that concerns still remained regarding the project design. The project continues to undergo further review. In 2017, Pacific Booker carried out environmental studies.

6. Selected exploration activities and highlights

Exploration-stage projects are defined as the initial stages of evaluation for economic minerals. This includes grassroots activities such as prospecting, rock and soil sampling, regional mapping and airborne geophysical surveys.

Early-stage activities include more focussed sample grids, geophysical surveys, prospect-scale geological mapping, drill target generation and testing that set the stage for future mine evaluation. Collecting baseline environmental data is also common at this stage. Selected exploration projects active during 2017 are summarized in Table 4 and shown on Fig. 1.

6.1. Selected precious metal projects

Precious metal projects in the Northwest Region were generally concentrated in the Stewart area and in the Lower Iskut River area. Multiple drilling programs continued to test new targets and extend known mineralization.

6.1.1. Atlin Gold Project (Brixton Metals Corporation)

In 2017, Brixton collected 200 rock samples, 120 soil samples and flew 4571 line km of airborne magnetic survey at a line spacing of 200 m at the **Atlin Gold** project. All the rock samples were vuggy, quartz vein-iron oxide fragments from historic trenching. One sample returned Au values greater than 100 g/t (293 g/t), six greater than 10 g/t, and eight greater than 1 g/t.

6.1.2. Brucejack regional (Pretium Resources Inc.)

Outside of the **Brucejack** mine area, evaluation of the surrounding 1250 km² of mineral claims continued. Work in previous years included airborne geophysical surveys, regional sampling, mapping, prospecting, ground geophysics and diamond drilling. To date three distinct areas, the American Creek, Koopa and Boulder zones have been identified with potential to host epithermal mineralization. In 2017, new work included prospecting, mapping and ground geophysics. Data analysis will define targets for drilling in spring 2018.

6.1.3. Clone (Sunvest Minerals Corp.)

Sunvest collected grab and channel samples and resampled

historic drill core at the **Clone** gold property. Channel sample results included 101 g/t Au over 7.5 m including 1.5 m of 245 g/t Au. Grab samples taken near the edge of retreating glaciers assayed 101 g/t and 93.7 g/t Au.

6.1.4. Engineer (Blind Creek Resources Ltd.)

The **Engineer** project includes the historic Engineer mine. In April, Blind Creek acquired the project from Pan Andean Minerals Ltd. (formerly BCGold Corp.). In August, Blind Creek carried out geological mapping, sampling, and soil geochemical surveys to follow up on previous results immediately south of the mine site and on the Wann River claims, five km to the south. In October, the company received an amended Mines Act Permit from the Ministry of Energy, Mines and Petroleum Resources authorizing exploration, underground mining, and on-site milling activities. Future plans include resource and mine development at the Engineer mine.

6.1.5. Forest Kerr (Aben Resources Ltd.)

In 2017, Aben carried out a nine hole, 2445 m diamond drilling program at the **Forest Kerr** project (Fig. 3). Highlight results from the newly discovery Boundary North zone included 1.2 g/t Au, 1.8 g/t Ag and 0.21% Cu over 122 m that includes 10.9 g/t Au, 14.6 g/t Ag and 1.5% Cu over 12 m with a high grade core of 21.5 g/t Au, 28.5 g/t Ag and 3.1% Cu over 6 m.



Fig. 3. Drill setup, Forest Kerr project. Photo courtesy of Aben Resources Ltd.

6.1.6. Homestake Ridge (Auryn Resources Inc.)

At the **Homestake Ridge** project Auryn carried out a 37 hole, 14,850 m diamond drilling program in 2017. Drill result highlights include 30 m of 2.00 g/t Au (including 4 m of 6.03 g/t Au and 2 m of 11.80 g/t Au), 10 m of 4.12 g/t Au (including 2 m of 18.01 g/t Au), 18 m of 1.29 g/t Au (including 4 m of 4.18 g/t Au), 8 m of 2.67 g/t Au (including 2 m of 7.4 g/t), and 14 m of 1.23 g/t Au.

6.1.7. Iskut (Seabridge Gold Inc.)

In 2017, Seabridge carried out a ten hole, 4459 m diamond drilling program on the Quartz Rise target at the **Iskut** project. Drilling found evidence of a gold-bearing intermediate sulfidation epithermal system beneath the Quartz Rise lithocap. Results included 1.5 m grading 8.26 g/t Au and 1.5 m grading

Table 4. Selected Exploration projects, Northwest Region.

Project	Operator (partner)	Commodity; Deposit type MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Atlin Gold Project	Brixton Metals Corporation	Au; precious metal veins	na	Rock and soil sampling. Gold values for rock samples returned up to 293 g/t Au. One sample returned Au values greater than 100 g/t, six greater than 10 g/t, and eight greater than 1 g/t.
BA	Mountain Boy Minerals Ltd.	Ag, base metals	na	Rock sampling, interpretation of VTEM and magnetic airborne survey data.
Ball Creek	Evrin Resources Corp.	Cu-Au- Ag±Mo; porphyry, Au- Ag epithermal veins	na	Definitive agreement with a wholly owned subsidiary of Antofagasta Plc by which Antofagasta can earn up to a 70% interest in the Ball Creek property by spending up to an aggregate of US\$31 million or delivering a prefeasibility study.
Berg	Centerra Gold Inc.	Cu, Mo, Ag; porphyry 093E 046	I+Inf: 557,000 t at 0.3% Cu, 0.037% Mo, 3.12 g/t Ag	Mapping, sampling, historic core re-logging.
Big Bulk	Dolly Varden Silver Corporation	Cu, Au; porphyry 103P 016	na	Carried out an airborne ZTEM geophysical survey over the property.
Brucejack Regional	Pretium Resources Inc.	Au, Ag; epithermal vein	na	Evaluation of approximately 800 km ² of mineral claims. To date three distinct areas, the American Creek, Koopa and Boulder zones have been identified with potential to host epithermal mineralization. In 2017, new work included prospecting, mapping and ground geophysics. Data analysis will define targets for drilling in spring 2018.
Clone	Sunvest Minerals Corp.	Au, Ag, Cu, Co; Au; precious metal veins; 103P 251	na	Rock grab and channel sampling.
Copperhead	Goliath Resources Limited	Cu, Ag, Au	na	Geophysics, prospecting, channel sampling, and mapping to define drill targets.
Dolly Varden	Dolly Varden Silver Corporation	Ag, Zn; Noranda/ Kuroko massive sulphide; 103P 188	I: 3.073 Mt at 321.6 g/t Ag Inf: 898,500 t at 373.3 g/t Ag	12,000 m diamond drilling program. New discoveries include the Central zone returning 16.10 m (13.19 m true thickness) grading 269.0 g/t Ag, 0.30% Pb, and 0.21% Zn and an eastern fault offset of the Torbit deposit (Torbit East), returning assays including 13.00 m (9.96 m true thickness) grading 244.8 g/t Ag, 0.14% Pb, and 0.09% Zn.
Duke	Amarc Resources Ltd.	Cu, Mo, Au; porphyry Cu- Au; 093M 009, 121, 163	Historic non NI 43-101 compliant I: 41 Mt at 0.25% Cu, 0.01% Mo	Property straddles the Northwest and North Central regions. Drilling was in the North Central Region. 2 holes, total 1045.5 m, with several intersections over 1.1 g/t Au.

Table 4. Continued.

E&L	Garibaldi Resources Corp.	Ni, Cu, Pt, Ag; Tholeiitic intrusion; 104B 006	na	Diamond drilling program intersected a sequence of mafic and ultramafic rocks and highlight results included 8.3% Ni and 4.2% Cu over 16.75 m.
Engineer	Blind Creek Resources	Au, Ag; Epithermal Veins; 104M 014	Inf: 41,000 t at 19.0 g/t	Geological mapping, sampling and soil geochemical surveys.
Forest Kerr	Aben Resources Ltd.	Au, Ag, Cu; Precious metal veins	na	Diamond drilling, nine holes, 2445 m. Highlight results from the newly discovery Boundary North zone included 1.2 g/t Au, 1.8 g/t Ag and 0.21% Cu over 122 m that includes 10.9 g/t Au, 14.6 g/t Ag and 1.5% Cu over 12 m with a high grade core of 21.5 g/t Au, 28.5 g/t Ag and 3.1% Cu over 6 m.
GJ	Skeena Resources Limited	Cu, Au; calc-alkalic porphyry; 104G 034	M+I: 133.67 Mt at 0.32% Cu, 0.36 g/t Au; Inf: 53.69 Mt at 0.26% Cu, 0.330 g/t Au	One of two deposits that form the Spectrum-GJ project. Updated mineral resource estimate and a preliminary economic assessment.
Hank	Golden Ridge Resources Ltd.	Au, Ag; Epithermal veins, Cu, Au porphyry	na	Announced a 9000 m diamond drilling program. Final meterage not reported but results included 4.13 m of 19.74 g/t Au, 193.9 g/t Ag, 0.77% Pb, 1.97% Zn and 60.27 m of 2.14 g/t Au, 6.9 g/t Ag, 0.11% Pb, 0.45% Zn.
Hat	Doubleview Capital Corp.	Au, Cu; calc-alkalic porphyry; 104J 015	na	Soil and rock sampling. Results define anomalies that extend over an area of 550 x 850 m at the Hoey gold area and 1400 x 700 m at the West Gossan area. Also at the Hoey gold area, some rock samples reported results as high as 8.11 g/t Au, 7% Cu and 0.5% Co. The West Gossan soil anomaly returned one sample of 55.2 g/t Au with 0.2% Cu.
Hazelton	Jaxon Mining Inc.	Ag, Au, Zn; VMS with epithermal veins	na	A 12 hole, 2281 m diamond drilling program on the Max target. Drilling focused on induced polarization survey geophysical targets interpreted to be associated with sulphide mineralization. Assay results are pending.
Homestake Ridge	Auryn Resources Inc.	Au, Ag, Cu; epithermal veins	I: 0.624 Mt at 6.25 g/t Au, 47.9 g/t Ag, 0.18% Cu Inf: 7.245 Mt at 4.00 g/t Au, 90.9 g/t Ag, 0.11% Cu. (Resources at a 2.0 g/t AuEq cut-off)	Produced a new mineral resource estimate. A 37 hole, 14,850 m diamond drilling program. Drill result highlights include 30 m of 2.00 g/t Au (including 4 m of 6.03 g/t Au and 2 m of 11.80 g/t Au), 10 m of 4.12 g/t Au (including 2 m of 18.01 g/t Au), 18 m of 1.29 g/t Au (including 4 m of 4.18 g/t Au), 8 m of 2.67 g/t Au (including 2 m of 7.4 g/t), and 14 m of 1.23 g/t Au.

Table 4. Continued.

Hot Bath	Gray Rock Resources Ltd.	Cu, Au; porphyry	na	Four hole diamond drilling program. Drilling intersected porphyritic textured, hornblende-monzonite intrusive rocks with potassium feldspar, hematite, magnetite and kaolinite group alteration.
Iskut	Seabridge Gold Inc.	Au, Ag, Cu; intrusion related, calc-alkalic porphyry; 104B 107	na	Ten hole, 4459 m diamond drilling program on the Quartz Rise target. Drilling found evidence of a gold bearing intermediate sulphidation epithermal system beneath the Quartz Rise lithocap. Results included 1.5 m grading 8.26 g/t Au and 1.5 m grading 74.1 g/t Au. Sampling of a cliff face north of the Quartz Rise target returned high grades ranging from 1.49 to 125.3 g/t Au.
Kinskuch (OK2 Minerals)	OK2 Minerals Ltd.	Cu, Au; Alkalic porphyry; 103P 016	na	Airborne ZTEM survey over the property, rock grab samples collected. Sampling returned promising results over a 2.25 km trend with 42 rock samples returning an average of 0.57% Cu and 0.35 g/t Au. Sampling also defined a new zone of porphyry mineralization with assays grading from background values up to 7.2% Cu, 4.2 g/t Au and 21.6 g/t Ag.
Kirkham	Metallis Resources Inc.	Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related; 104B 079	na	A three hole, 1048 m diamond drilling program at the Cliff porphyry target intersected zones of potassic alteration featuring abundant chalcopyrite. Drill results identified a broad zone of Cu-Au mineralization and high grade Au mineralized zones. Assay highlights for Cu-Au mineralization included 146 m of 0.34 g/t Au and 0.22% Cu, including 68 m at 0.52 g/t Au and 0.3% Cu. Assay results for the high grade Au zone included 2 m of 15 g/t Au, 2 m of 2.66 g/t Au and 2 m of 3.36 g/t Au.
KSP	Colorado Resources Ltd.	Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related; 104B 111 and 104B 013	na	A 24 hole, 11,824 m diamond drilling tested multiple target areas within the Inel-Khyber zone and additionally tested the Tami zone with 11 drill holes. Highlight results for the Tami zone include 13.6 m of 2.37 g/t Au, 0.16% Cu, 58.7 m of 1.05 g/t Au, 0.19% Cu and 40 m of 1.74 g/t Au, 0.24% Cu. Highlight results for the Inel zone include 4470 g/t Au over 0.5 m and 0.43 g/t Au and 0.11% copper over 195.4 m.
Kutcho	Kutcho Copper Corp.	Cu, Pb, Zn; VMS; 104I 060	M+I: at 16.853 Mt of 1.89% Cu, 2.87% Zn, 0.36 g/t Au and 32.8 g/t Ag (at a 1.0% Cu cut-off)	Kutcho (formerly Desert Star Resources Ltd.) signed an agreement to acquire 100% interest in the project from Capstone Mining Corp. for \$28.8 million. Announced a positive prefeasibility study with updated resource figures.

Table 4. Continued.

Lucky Strike	Goliath Resources Ltd.	Au, Ag, Pb, Zn, Cu; polymetallic veins; 103I 030	na	69 channel samples, 336 rock grab samples and 734 soil samples collected. Detailed geological mapping and flew a 563 line high-resolution SKYTEM [™] airborne geophysical survey over the entire property. Assay results are pending.
North ROK	Colorado Resources Ltd.	Cu, Au; Porphyry; 104H 035	Inf: 142.3 Mt 0.22% Cu, 0.26 g/t Au (at a 0.20% CuEq % cut-off)	Rock and soil sampling and a six hole, 2529 m diamond drilling program. Rock and soil sampling results highlighted multiple Cu soil anomalies and Cu and Au in rock samples along a nine km favorable trend. Drill results are pending.
Oweegee Dome	Sojourn Exploration Inc.	Cu, Au, Mo, Zn; calc-alkalic porphyry; 104A 165	na	Multi element stream sampling (464 samples) and soil sampling (324 samples) program. A number of anomalies were defined in the vicinity of high potential geophysical targets. Follow up prospecting and sampling is planned for 2018 to establish drill targets.
Pearson and Pearson North	Teuton Resources Corp.	Cu, Ag, Au; polymetallic veins	na	Prospecting and sampling. Float below malachite stained cliff faces averaged 1.63% Cu and >15% Fe. Samples for other locations on the property ran trace to 7.06% Cu, 0.2 to 321 g/t Ag and 0.05 to 68.69 g/t Au. A high resolution airborne geophysical survey over the property is planned for 2018.
Premier/Dilworth	Ascot Resources Ltd.	Au, Ag; Au in quartz veins; 104B 044	na	A 379 hole, 118,800 m diamond drilling program. Drilling discovered a new high-grade subzone (Ben) of the Northern Lights zone in the Premier mine area. Numerous high-grade intersections were reported, including 36.31 g/t Au over 16.15 m.
Pyramid	OK2 Minerals Ltd.	Cu, Au; calc-alkalic porphyry	na	Eleven RC drill holes and three diamond drill holes totalling 1366 m carried out on the West zone and Central zone targets. No significant intercepts were reported for the Central zone but results for the West zone included 482 m of 0.16 g/t Au, 0.12 g/t Ag and 0.02% Cu. This interval included 19 m of 0.57 g/t Au, 0.34 g/t Ag, 0.02% Cu, 75 m of 0.32 g/t Au, 0.17 g/t Ag, 0.01% Cu and 24 m of 0.71 g/t Au, 0.21 g/t Ag, 0.02 % Cu.
RCN	Serengeti Resources Inc.	Cu, Au	na	Aeromagnetic survey over the property highlights several targets, including two linear magnetic anomalies, one of which is coincident with a quartz-sericite-pyrite zone and copper-gold mineralization identified by Serengeti in 2014.

Table 4. Continued.

Red Cliff	Decade Resources Ltd. (65%), (Mountain Boy Minerals Ltd. (35%))	Cu, Au, Ag, Zn; polymetallic veins; 104A 037	na	Chip sampling results of 19.9 g/t over 4 m for the Waterpump zone and 390 g/t Au over 5 m for the Lower Montrose zone. Reported drilling results for the Montrose zone include 14.93 g/t Au over 8.38 m and 9.5 g/t Au over 10.98 m.
SIB	SSR Mining Inc.	Au, Ag	na	A 12 hole, 9336 m diamond drilling program. Results have not been announced.
Silver Coin	Jayden Resources (Canada Inc.) (80%), (Mountain Boy Minerals Ltd. (20%))	Ag, Zn, Pb, Cu; Intrusion related Au pyrrhotite veins, Subaqueous hot spring Ag, Au, Polymetallic veins; 104B 095	na	A 14 hole, 2225 m diamond drilling program. Assay results included 8.63 g/t Au over 7.7 m, 6.5 g/t Au over 1.5 m and 8.25 g/t Au over 1.0 m.
Silver Queen	New Nadina Explorations Ltd.	Ag, Cu, Au, Zn, Pb; Polymetallic veins; 093L 002	na	A 3 hole, 2158 m diamond drill program. Results included 0.4 m of 120 g/t Ag, 1.29 g/t Au, 1.4 % Cu and 3 m of 120 g/t Ag, 0.24 g/t Au and 0.5% Cu.
Snip	Skeena Resources Limited	Au, Ag; Mineralized quartz veins; 104B 250	na	A 72 hole, 9000 m underground diamond drill program. Highlight results included 341.00 g/t Au over 1.50 m, 67.68 g/t Au over 2.03 m and 10.76 g/t Au over 4.30 m including 14.80 g/t Au over 1.49 m and 9.47 g/t Au over 1.50 m.
Spectrum	Skeena Resources Limited	Au, Cu; mineralized quartz veins, high k calc-alkalic porphyry 104G 036	I: 8.59 Mt at 1.04 g/t Au, 6.58 g/t Ag, 0.11% Cu Inf: 22.63 Mt at 1.03 g/t Au, 3.85 g/t Ag, 0.11% Cu (0.50 g/t eAu cut-off)	One of two deposits that form the Spectrum-GJ project. Updated mineral resource estimate and a preliminary economic assessment.
Surprise Creek	Mountain Boy Minerals Ltd.	Au, Ag; polymetallic veins	na	Rock sampling and interpretation of airborne VTEM and magnetic data. Samples results of up to 3 g/t Au with associated Ag up to 324 g/t reported.
Surprise Lake	Gray Rock Resources Ltd.	Au; mineralized quartz veins; 104N 032	na	Program including geochemical surveys, ground geophysical surveys, channel sampling and detailed geological mapping was announced. Results have not been published.

Table 4. Continued.

Tatogga	GT Gold Corp.	Au, Ag, Cu; polymetallic veins, porphyry	na	Two new grassroots exploration discoveries; the high grade Saddle South gold discovery and the Saddle North copper-gold-silver porphyry discovery. Saddle South results include 51.53 g/t Au over 6.95 m and 5.10 g/t Au over 23.66 m. Saddle North results include 210.3 m of 0.14 g/t Au, 0.28 g/t Ag and 0.16% Cu including 0.22 g/t Au, 0.36 g/t Ag and 0.24% Cu over the last 33.73 m of the hole. The Saddle North discovery also included epithermal veins that assayed 13.55 g/t Au over 2.58 m including 61.10 g/t Au and 30.90 g/t Ag over 0.61 m. In 2018, drilling programs will continue on all the current target discoveries.
Telkwa Coal	Telkwa Coal Limited	bituminous coal; 093L 156	M: 89.113 Mt I: 42.037 Mt Inf: 33.412 Mt	In 2017, a favourable pre-feasibility study was released and plans for a feasibility study and permit applications were announced. Telkwa Coal Limited is a wholly owned subsidiary of Allegiance Coal Limited.
Thorn	Brixton Metals Corporation	Ag, Au; Subvolcanic; 104K 031	Inf: 7.4 Mt at 35.54 g/t Ag, 0.51 g/t Au, 0.13% Cu, 0.032% Pb, 0.59% Zn	A 10 hole, 2455 m diamond drill program at the Chivas zone. Highlight results included 21.00 m of 0.46 g/t Au, 39.74 g/t Ag and 18.00 m of 0.99 g/t Au, 19.46 g/t Ag, 0.66% Zn, 0.19% Pb including 6.45 m of 2.63 g/t Au, 45.15 g/t Ag, 1.5% Zn, 0.18% Cu, 0.42% Pb.
Treaty Creek	Tudor Gold Corp. (80%), (Teuton Resources Corp. (20%), American Creek Resources Ltd. (20%))	Au, Ag; Epithermal high sulphidation; 104B 078	na	A 27 hole, 13,722 m diamond drill program. The target was the Copper Belle zone and highlight results from five holes included 115.1 m of 1.31 g/t Au, 4.4 g/t Ag, 0.022% Cu including 39 m of 2.38 g/t Au, 8.3 g/t Ag, 0.026% Cu. Assays for the remaining 22 holes are pending.
Willoughby	Sojourn Exploration Inc. (Millrock Resources Inc.)	Au, Ag, Zn, Pb; polymetallic veins; 103P 006	na	Sojourn has an option to earn 100% of the property from Millrock. Prospecting locates new zones of bedrock mineralization. One m chip samples returned values of: 3.88 g/t Au and 2.42 g/t Ag, 1.93 g/t Au and 4.81 g/t Ag, 2.76 g/t Au and 92.1 g/t Ag; 1.87 g/t Au and 2.13 g/t Ag, and 0.56 g/t Au and 1.24 g/t Ag.

M = Measured; I = Indicated; Inf = Inferred

74.1 g/t Au. Sampling of a cliff face north of the Quartz Rise target returned high grades ranging from 1.49 to 125.3 g/t Au.

6.1.8. Lucky Strike (Goliath Resources Ltd.)

At the **Lucky Strike** in 2017, Goliath staked additional ground, took 69 channel samples, collected 336 rock grab samples and 734 soil samples, carried out detailed geological mapping, and flew a 563 line high-resolution SKYTEM™ airborne geophysical survey over the entire property.

6.1.9. SIB (SSR Mining Inc.)

At the **SIB** property, SSR carried out a 12 hole, 9336 m diamond drilling program. The property is under option from Eskay Mining Corp. SSR has the option to earn a 51% undivided interest in the property by spending an aggregate of \$11.7-million in exploration expenditures over three years, with an option to earn a further 9% undivided interest by either delivering a preliminary economic assessment or completing an aggregate of 23,000 m of diamond drilling.

6.1.10. Silver Coin (Jayden Resources (Canada Inc.) 80%, Mountain Boy Minerals Ltd. 20%)

The **Silver Coin** project is operated by Sprott Mining Inc., a private company. In 2017, a 14 hole, 2225 m diamond drilling program was carried out. Drilling intersected altered andesite with a quartz-sericite-chlorite altered breccia zone exhibiting quartz stringers with visible gold grains, 5-6% sphalerite, up to 1% galena and 7-8% pyrite mineralization. Assay results for this altered andesite included 8.63 g/t Au over 7.7 m including several higher-grade intervals up to 37.1 g/t Au. Additional zones of siliceous breccia returned 6.5 g/t Au over 1.5 m and 8.25 g/t Au over 1.0 m. Assays are still pending for four holes. These results are from a new zone 550 m to the northeast of the main Silver Coin deposit. At a 0.3 g/t Au cut-off grade, the estimated Measured and Indicated resource at Silver Coin already consists of 24.13 Mt grading 1.08 g/t Au.

6.1.11. Snip (Skeena Resources Limited)

In July 2017, Skeena acquired 100% interest in the **Snip** past-producing gold mine from Barrick Gold Corporation. The Snip mine operated from 1991 to 1999 and produced over 1.1 million ounces of Au. Exploration in 2017 included a 72 hole, 9000 m underground diamond drill program. Highlight results included 341.00 g/t Au over 1.50 m, 67.68 g/t Au over 2.03 m and 10.76 g/t Au over 4.30 m including 14.80 g/t Au over 1.49 m and 9.47 g/t Au over 1.50 m. Skeena reported that drilling verified historical data. For 2018, they plan to expand upon the known mineralized zones and to prioritize previously overlooked areas.

6.1.12. Surprise Lake (Gray Rock Resources Ltd.)

In June, a program the **Surprise Lake** project, including geochemical surveys, ground geophysical surveys, channel sampling and detailed geological mapping was announced. The program was designed to follow-up on coarse gold found in 2016 on the Otter Creek property.

6.1.13. Tatogga (GT Gold Corp.)

The **Tatogga** project is approximately 14 km west of the Red Chris copper-gold mine, less than 1 km west of Iskut, and close to a paved road (Highway 37). The project has two new grassroots discoveries: the high-grade Saddle South gold discovery (Fig. 4) and the Saddle North porphyry copper-gold-silver discovery. The initial discovery was Saddle South, which was drilled to follow up on anomalous soil sample results. The 2017 work program included 28 reverse circulation drill holes (1527 m) on Saddle South, 32 line km of IP surveying, 165 line km of helicopter-borne magnetic surveying, 86 diamond drill holes (15,998 m) on Saddle South and six diamond drill holes (1713 m) on Saddle North. The Saddle South discovery won the prestigious Mines and Money "Exploration Discovery Award".

Drilling on Saddle South returned a high density of high-grade intersections. Highlight results include 51.53 g/t Au over 6.95 m and 5.10 g/t Au over 23.66 m. Drilling on Saddle North

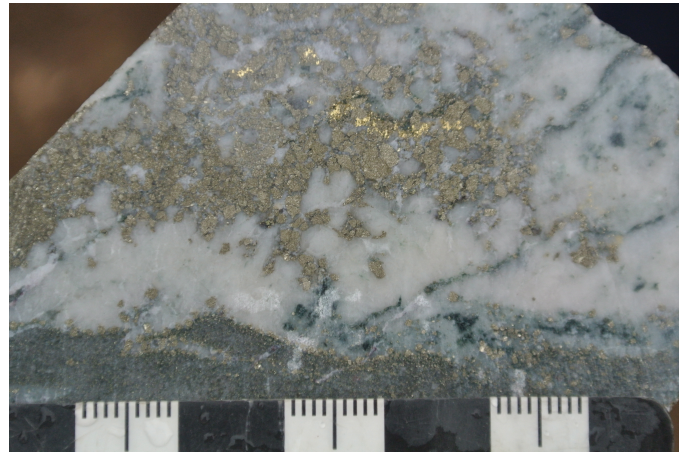


Fig. 4. Visible gold in Tatogga project Saddle South drill core. Photo courtesy of GT Gold Corp.

was designed to test a large-scale, high-intensity, coincident IP-magnetic anomaly. Drilling results included a new porphyry discovery and the intersection of high-grade epithermal veins (on the western end of the Saddle North trend). The porphyry mineralization discovery hole returned 210.3 m of 0.14 g/t Au, 0.28 g/t Ag and 0.16% Cu. Grades improved downhole and the hole ended in mineralization. The last sample interval of 33.73 m returned 0.22 g/t Au, 0.36 g/t Ag and 0.24% Cu. Highlight intersections for the epithermal vein discovery included 13.55 g/t Au over 2.58 m including 61.10 g/t Au and 30.90 g/t Ag over 0.61 m. In 2018, drilling programs will continue on all the current target discoveries.

6.1.14. Thorn (Brixton Metals Corporation)

At the **Thorn** project in 2017, Brixton carried out a 10 hole, 2455 m diamond drill program, which was the first drilling on the Chivas zone. The holes tested a gold-in-soil geochemical anomaly and an IP geophysical anomaly. Highlight results included 21.00 m of 0.46 g/t Au, 39.74 g/t Ag and 18.00 m of 0.99 g/t Au, 19.46 g/t Ag, 0.66% Zn, 0.19% Pb including 6.45 m of 2.63 g/t Au, 45.15 g/t Ag, 1.5% Zn, 0.18% Cu, 0.42% Pb.

6.2. Selected porphyry (Cu-Au, Cu-Mo, Mo) projects

The Northwest Region is highly prospective for porphyry deposits related to island arc assemblages accreted to North America and with post accretionary intrusive suites.

6.2.1. Ball Creek (Evrin Resources Corp.)

The **Ball Creek** project is approximately 80 km southwest of Iskut and 60 km southwest of the Red Chris mine. In 2017, Evrim signed a definitive agreement with a wholly owned subsidiary of Antofagasta Plc by which Antofagasta can earn up to a 70% interest in the Ball Creek property by spending up to an aggregate of US\$31 million or delivering a prefeasibility study. Exploration plans were to include work on four known porphyry systems and regional exploration elsewhere on the project.

6.2.2. Berg (Centerra Gold Inc.)

The **Berg** project is approximately 90 km southwest of Houston and 20 km northwest of the Huckleberry mine. In 2017, Centerra carried out mapping, sampling, and logging of historic drill core.

6.2.3. Big Bulk (Dolly Varden Silver Corporation)

In 2017, Dolly Varden carried out an airborne ZTEM geophysical survey at the **Big Bulk** project.

6.2.4. Duke (Amarc Resources Ltd.)

The **Duke** property straddles the Northwest and North Central regions. The property includes a copper+/-molybdenum porphyry deposit that was the subject of an historic (NI 43-101 non-compliant) inferred resource estimated at 40.8 million tons at 0.25% Cu and 0.01% Mo. The property was explored intermittently by IP and magnetic surveys, and by shallow drilling, between 1965 and 2010, and was acquired by Amarc in 2016. The early IP work had suggested that the mineralized system might be offset by faults, leaving significant prospective areas unexamined. In late autumn 2017, the company diamond drilled two holes (1045.5 m) and reported several intersections with more than 1.1 g/t Au.

6.2.5. Spectrum-GJ (Skeena Resources Limited)

The **Spectrum-GJ** gold-copper project is approximately 30 km west of the **Red Chris** mine. In 2017, Skeena Limited filed a mineral resource update and a preliminary economic assessment for the project. The project consists of two deposits, separated by about 14 km, one porphyry copper-gold deposit (Donnelly, at GJ), the other porphyry gold-copper deposit (Spectrum).

6.2.6. Hat (Doubleview Capital Corp.)

The **Hat** gold-copper project contains the Lisle gold-copper alkali porphyry zone. In 2017, Doubleview collected soil and rock samples. Results defined anomalies that extend over an area of 550 by 850 m at the Hoey gold area and 1400 by 700 m at the West Gossan area. Also at the Hoey gold area, some rock samples reported results as high as 8.11 g/t Au, 7% Cu and 0.5% Co. The West Gossan soil anomaly returned one sample of 55.2 g/t Au with 0.2% Cu.

6.2.7. Hot Bath (Gray Rock Resources Ltd.)

In 2017, Gray Rock diamond drilled four holes (totalling 1000 m) at the **Hot Bath** project. The holes tested induced polarization geophysical targets and/or gold geochemical anomalies. Drilling intersected porphyritic, hornblende-monzonite intrusive rocks with potassium feldspar, hematite, magnetite and kaolinite group alteration.

6.2.8. Kinskuch (OK2 Minerals Ltd.)

In 2017, OK2 flew an airborne ZTEM survey and collected rock grab samples at the **Kinskuch** property. New sampling of 42 rock specimens along a 2.25 km trend in an area considered

to represent a relatively deep structural level returned an average of 0.57% Cu and 0.35 g/t Au. These rock samples come from areas with limited or no historic sampling and some are from areas of recent glacial retreat. Sampling also defined a new zone of porphyry mineralization with assays grading from background values up to 7.2% Cu, 4.2 g/t Au and 21.6 g/t Ag. The new area is approximately 750 m south of the main trend of mineralization.

6.2.9. Kirkham (Metallis Resources Inc.)

In 2017, Metallis announced that a three hole, 1048 m diamond drilling program at the Cliff porphyry target on the **Kirkham** property intersected zones of potassic alteration featuring abundant chalcopyrite. Drill results identified a broad zone of Cu-Au mineralization and high-grade Au mineralized zones. Assay highlights for Cu-Au mineralization included 146 m of 0.34 g/t Au and 0.22% Cu, including 68 m at 0.52 g/t Au and 0.3% Cu. Assay results for the high grade Au zone included 2 m of 15 g/t Au, 2 m of 2.66 g/t Au and 2 m of 3.36 g/t Au.

Mapping and sampling also identified several gabbroic units considered contiguous with the rocks that host nickel-copper sulphides at Garibaldi Resources Corp.'s **E&L** project.

6.2.10. KSP (Colorado Resources Ltd.)

In 2017, Colorado diamond drilled a total of 11,824 m in 24 holes at the **KSP** property. Drilling tested the Inel-Khyber and Tami zones. Highlight results for the Tami zone include 13.6 m of 2.37 g/t Au, 0.16% Cu, 58.7 m of 1.05 g/t Au, 0.19% Cu and 40 m of 1.74 g/t Au, 0.24% Cu. Highlight results for the Inel zone include 4470 g/t gold over 0.5 m and 0.43 g/t gold and 0.11% copper over 195.4 m.

6.2.11. North ROK (Colorado Resources Ltd.)

The **North ROK** property is 15 km northwest of the Red Chris mine. The property contains the North ROK deposit with a mineral resource of 142.3 Mt of 0.22% Cu and 0.26 g/t Au (at a 0.20% CuEq% cut-off). In 2017, Colorado carried out rock and soil sampling and diamond drilled a total of 2529 m in six holes. The rock and soil sampling results highlighted multiple Cu soil anomalies and Cu and Au in rock samples along a 9 km trend.

6.2.12. Oweegee Dome (Sojourn Exploration Inc.)

The **Oweegee Dome** project is under option by Sojourn from Millrock Resources Inc. In 2017, Sojourn carried out multi element stream sampling (464 samples) and soil sampling (324 samples) to follow up on airborne geophysical surveying carried out by Millrock in 2016.

A number of anomalies were defined near geophysical targets. Follow up prospecting and sampling is planned for 2018 to establish drill targets.

6.2.13. Pyramid (OK2 Minerals Ltd.)

The 2017 exploration program at the **Pyramid** gold-copper

project consisted of 11 RC drill holes and three diamond drill holes totalling 1366 m at the West zone and Central zone. No significant intercepts were reported for the Central zone but results for the West zone included 482 m of 0.16 g/t Au, 0.12 g/t Ag and 0.02% Cu. This interval included 19 m of 0.57 g/t Au, 0.34 g/t Ag, 0.02% Cu, 75 m of 0.32 g/t Au, 0.17 g/t Ag, 0.01% Cu and 24 m of 0.71 g/t Au, 0.21 g/t Ag, 0.02% Cu.

6.3. Selected polymetallic base and precious metal projects

The Northwest Region hosts many significant base and precious metal deposits. A number of precious metal enriched polymetallic prospects were explored in 2017.

6.3.1. BA (Mountain Boy Minerals Ltd.)

In 2017, Mountain Boy acquired 100% of the **BA** project, carried out rock sampling and started an interpretation of an airborne survey VTEM and magnetic data.

6.3.2. Copperhead (Goliath Resources Limited)

In 2017, Goliath staked additional ground at the **Copperhead** property, collected 42 rock grab samples and completed a 47 line-km high-resolution SKYTEM[™] airborne geophysical survey. Planned work in 2018 includes geophysics, prospecting, channel sampling, and mapping to define drill targets.

6.3.3. Dolly Varden (Dolly Varden Silver Corporation)

In 2017 Dolly Varden Silver Corporation announced plans for 12,000 m of diamond drilling at the **Dolly Varden** silver project. The project consists of the Torbrit, Dolly Varden, Wolf, and North Star deposits. Drilling between the Torbrit and Wolf deposits resulted in a new discovery (Central zone), with results that included 16.10 m (13.19 m true thickness) grading 269.0 g/t Ag, 0.30% Pb, and 0.21% Zn. Follow-up drilling confirmed this discovery, returning results of 7.15 m (6.72 m true thickness) grading 1180.7 g/t Ag, 1.83% Pb and 0.26% Zn. Drilling also discovered an eastern fault offset of the Torbrit deposit (Torbrit East), with assays including 13.00 m (9.96 m true thickness) grading 244.8 g/t Ag, 0.14% Pb, 0.09% Zn. Within this interval was 5.00 m (3.83 m true thickness) grading 481.9 g/t Ag, 0.21% Pb, 0.12% Zn.

6.3.4. Hank (Golden Ridge Resources Ltd.)

In 2017, Golden Ridge announced plans for 9000 m of diamond drilling at the **Hank** project. Results reported to date include 4.13 m of 19.74 g/t Au, 193.9 g/t Ag, 0.77% Pb, 1.97% Zn and 60.27 m of 2.14 g/t Au, 6.9 g/t Ag, 0.11% Pb, 0.45% Zn.

6.3.5. Hazelton (Jaxon Mining Inc.)

In 2017, Jaxon diamond drilled a total of 2281 m in 12 holes on the Max target of the **Hazelton** project. Drilling focused on induced polarization survey geophysical targets interpreted to be associated with sulphide mineralization.

6.3.6. Kutcho (Kutcho Copper Corp.)

In June of 2017, Kutcho (formerly Desert Star Resources

Ltd.) announced signing an agreement to acquire 100% interest in the **Kutcho** project from Capstone Mining Corp. for \$28.8 million. In July, they announced a prefeasibility study with updated resource figures. At a 1.0% copper cut off, combined Measured and Indicated resources are estimated at 16.853 Mt of 1.89% copper, 2.87% zinc, 0.36 g/t gold and 32.8 g/t silver. Kutcho plans to advance the project to a completed feasibility study and permitted for construction within 2.5 years.

6.3.7. Pearson and Pearson North (Teuton Resources Corp.)

The **Pearson** and **Pearson North** properties are about 20 km southwest of Seabridge Gold's KSM project. In 2017 Teuton carried out prospecting and sampling. Samples collected from float at the base of malachite stained cliff faces averaged 1.63% Cu and >15% Fe. Additional samples, mostly from either quartz veins or diorite, ranged from trace to 8.57% Cu, trace to 0.07% Co, trace to 16.7% Zn, trace to 29.2% Pb, trace to 451 g/t Ag, and trace to 12.7 g/t Au.

A zone with multiple occurrences of malachite and azurite was sampled on the Pearson North property. Many vein samples were taken from carbonate-altered areas mostly, in the malachite-rich zone, and ran trace to 7.06% Cu, 0.2 to 321 g/t Ag and 0.05 to 68.69 g/t Au.

A high-resolution airborne geophysical survey is planned for 2018.

6.3.8. Premier/Dilworth (Ascot Resources Ltd.)

In 2017, Ascot carried out a 379 hole, 118,800 m diamond drilling program at the **Premier/Dilworth** project, which includes the past-producing Premier gold mine. Until operations were suspended in 1996, the Premier mine produced 2 million ounces of Au and 42.8 million ounces of silver. Target areas include Big Missouri, Northern Lights, and Premier. The drilling discovered a new high-grade subzone (Ben) of the Northern Lights zone in the Premier mine area. Numerous high-grade intersections were reported; including 36.31 g/t Au over 16.15 m. Plans for 2018 include continued drilling and a new NI 43-101 resource calculation.

6.3.9. RCN (Serengeti Resources Inc.)

In 2017, Serengeti completed an aeromagnetic survey at the **RCN** project. The survey highlighted several targets, including two linear magnetic anomalies, one of which is coincident with a quartz-sericite-pyrite zone and copper-gold mineralization identified by Serengeti in 2014.

6.3.10. Red Cliff (Decade Resources Ltd., (65%), Mountain Boy Minerals Ltd., (35%))

Decade Resources reported rock sampling results of 19.9 g/t over 4 m for the Waterpump zone at the **Red Cliff** gold-copper project. Drill core from the Waterpump zone is described as having sphalerite-galena-chalcopryrite veining in the wall of a strong breccia that contains quartz, pyrite and minor chalcopryrite over 15-20 m true width. Visible gold has been observed in sphalerite-galena-chalcopryrite veinlets and in

quartz-pyrite veinlets. Drill result highlights for the Montrose zone include 14.93 g/t Au over 8.38 m and 9.5 g/t Au over 10.98 m.

6.3.11. Silver Queen (New Nadina Explorations Ltd.)

In 2017, New Nadina diamond drilled a total of 2158.5 m in three holes at their **Silver Queen** project. Results included 0.4 m of 120 g/t Ag, 1.29 g/t Au, 1.41% Cu and 3 m of 120 g/t Ag, 0.24 g/t Au and 0.5% Cu.

6.3.12. Surprise Creek (Mountain Boy Minerals Ltd.)

In 2017, Mountain Boy acquired 100% of the **Surprise Creek** project, carried out rock sampling, and started interpreting airborne VTEM and magnetic data. Rock sampling discovered a new zone of gold-silver mineralization associated with a quartz stockwork containing tetrahedrite, pyrite, arsenopyrite and chalcopyrite. Assays of up to 3 g/t Au with associated Ag up to 324 g/t were reported.

6.3.13. Treaty Creek (Tudor Gold Corp. 80%, Teuton Resources Corp. 20%, American Creek Resources Ltd. 20%)

The **Treaty Creek** project is adjacent to Seabridge's KSM project and Pretium's Brucejack mine. In 2017, Tudor carried out a 27 hole, 13,722 m diamond drill program. The target was the Copper Belle zone and highlight results from five holes included 115.1 m of 1.31 g/t Au, 4.4 g/t Ag, 0.022% Cu including 39 m of 2.38 g/t Au, 8.3 g/t Ag, 0.026% Cu.

6.4. Mafic and ultramafic hosted projects

Although not numerous, the Northwest Region has several advanced ultramafic-hosted metallic prospects, including intrusion-hosted and serpentinite-hosted nickel occurrences.

6.4.1. E&L (Garibaldi Resources Corp.)

Diamond drilling at the **E&L** property in 2017 intersected a sequence of mafic and ultramafic rocks. Highlight results included 8.3% Ni and 4.2% Cu over 16.75 m.

6.5. Coal projects

The Northwest Region contains the Tuya, Telkwa coalfields and a portion of the Groundhog-Klappan coalfield which are prospective for anthracite coal deposits.

6.5.1. Telkwa (Telkwa Coal Limited)

Telkwa Coal Limited is a wholly owned subsidiary of Allegiance Coal Limited. A technical report for the **Telkwa** coal project filed in February of 2015 confirmed a global estimate of 165 Mt of semi-soft coking coal including 131 Mt of Measured plus Indicated resources and 33.4 Mt of Inferred resources. In 2017 a favourable pre-feasibility study was released and plans for a feasibility study and permit applications were announced.

7. Geological research

In 2017, geological research in the Northwest Region was

carried out by the British Columbia Geological Survey (BCGS) and by the BCGS in partnership with the Geological Survey of Canada (GSC), Mineral Deposit Research Unit (MDRU) and Geoscience BC (GBC). Partnership projects between the BCGS and the GSC included the Cordilleran Project (Porphyry Transitions) (GEM 2) and Gold Systems Llewellyn (TGI-5). The SeArch mapping project is a partnership between the GSBC, MDRU and GBC. Nelson et al. (2018) reviewed key aspects of Hazelton Group in the Iskut River region, host to many significant porphyry, precious-metal vein and volcanogenic massive sulphide deposits, and introduced a new regionally consistent stratigraphic framework. Continued mapping and geochronologic studies on the northeastern margin of Stikinia east of Dease Lake by van Straaten, and Bichlmaier (2018) focussed on the Horn Mountain Formation (late Early to Middle Jurassic), a predominantly volcanic unit in the upper part of the Hazelton Group that regionally hosts advanced argillic alteration zones with potential for porphyry-style systems at depth. As part of the Gold Systems Llewellyn (TGI-5) project, Ootes et al. (2018) demonstrated that different styles of gold mineralization along the Llewellyn fault (British Columbia) and Tally-Ho shear zone (Yukon) developed during temporally distinct tectonic events. Although early ductile and late brittle deformations along the regional structure share the same space, they developed at least ca. 20 Ma apart and are not part of a structural continuum. A series of aeromagnetic maps for the Llewellyn area were released by Boulanger and Kiss (2017a, b). As part of the GEM2 porphyry transitions project, Mihalynuk et al. (2018) summarized new mapping, geochronologic, and geochemical data from the Turtle Lake area, which includes the boundary between the Cache Creek and Stikine terranes. Rowins et al. (2018) used digital datasets provided by Gold Reach Resources Ltd. to build a 3D GOCAD model for the Ootsa Lake porphyry Cu-Mo-Au property, southeast of the past-producing Huckleberry mine, and estimate the thickness of drift covering bedrock.

Geoscience BC continued with the SeArch Project, releasing the Phase II airborne magnetic and radiometric survey, collected near the communities of Smithers, Houston, Burns Lake, Fraser Lake and Vanderhoof. The survey was flown at a line spacing of 250 m, and the total survey coverage is 117,000 line-km.

8. Summary

The Northwest Region is highly prospective for mineral deposit discovery. The region has a number of advanced and proposed mine projects. The region also has numerous active exploration projects, primarily for precious and base metals. In 2017, exploration activity increased for the first time since 2012. Exciting new results were announced for established projects and a number of new discoveries were also made.

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