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

Front Cover: Red Mountain project (IDM Mining Ltd.).
Photo by Jeff Kyba.

Back Cover: Drilling at Kemess East (AuRico Metals Inc.).
Photo by Paul Jago.

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www.em.gov.bc.ca/geology

Victoria
British Columbia
Canada
January 2017
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 2017-2).

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. In 2016, exploration expenditures, drilling estimates and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey, which replaces the annual Ministry of Energy and Mines mineral exploration expenditures 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.

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.em.gov.bc.ca/geology.

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

Gordon Clarke
Director, Mineral Development Office
British Columbia Geological Survey
January, 2017
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Exploration and Mining in British Columbia, 2016: 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 and silver, and more than 30 industrial minerals including gypsum, magnesite, limestone, and dimension stone. Numerous quarries produce sand and gravel or crushed aggregate.

Despite continued difficulties securing venture capital, mine development projects and numerous mineral exploration projects remained active in 2016 (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, a web-based mineral tenure system, and investment incentives such as the British Columbia Mining Exploration Tax Credit and the British Columbia Mining Flow-Through Share Tax Credit.

This summary uses information from the British Columbia Coal Industry Overview (British Columbia Geological Survey Information Circular 2017-2) 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 and Mines forecasts total value of mine production for 2016 at $7.15 billion (Fig. 3), including coal, copper, industrial minerals, aggregate, gold, molybdenum and silver. This is an increase of $1.25 billion over the 2015 preliminary NRCAN production value of $5.90 billion (Fig. 4). For 2016, coal was the highest value mine product from British Columbia, comprising about 46% of the total output, followed by copper (about 31%).

In 2016, eight metal mines operated during at least part of the year (Table 2). One metal mine went on care and maintenance during 2016. Coal was produced at five large open pit operations in the southeastern part of the province, one open pit operation in the northeastern part of the province and one underground mine on Vancouver Island (Table 3). The underground coal operation went on care and maintenance early in 2016. The open-pit operation in the northeast is a former mine that restarted in the fall. 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 an estimated $3.02 billion of all mine production in 2016, representing about 42% of all mine production in the province (Table 2). Eight metal mines were in production at the start of 2016. This number dropped to seven as the Huckleberry mine went on care and maintenance in August.

In the Northwest Region, Imperial Metals Corporation’s Red Chris copper-gold mine reached its first year of full production. In the North Central Region, the Mt. Milligan open-pit copper-gold mine was in its third year of production and completed its ramp-up phase at the start of the year. Mill throughput averaged about 52,800 tonnes per day over the first three quarters of the year.

An important development in the North Central Region was the purchase of Thompson Creek Metals Company Inc. by Centerra Gold Inc. The purchase price, which included a nearly US$900 million debt, allowed creditors to be paid and helped ensure continued production at the Mt. Milligan mine.

In the South Central Region, Copper Mountain Mining Corporation reported in December that production was slightly ahead of planned for the year. Teck Resources Ltd’s Highland Valley mine achieved throughputs exceeding its rated capacity of 130,000 tonnes per day. In September, Taseko Mines Limited...
Fig. 1. Mines, mine development, selected proposed mines, and selected exploration projects in British Columbia, 2016. Terranes from the BC digital geology map (Cui et al., 2015).
Table 1. Regional Geologists contact information.

<table>
<thead>
<tr>
<th>Region</th>
<th>Community</th>
<th>Regional Geologist</th>
<th>Phone</th>
<th>email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest</td>
<td>Smithers</td>
<td>vacant</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Northeast and North Central</td>
<td>Prince George</td>
<td>Paul Jago</td>
<td>250-565-4316</td>
<td><a href="mailto:Paul.Jago@gov.bc.ca">Paul.Jago@gov.bc.ca</a></td>
</tr>
<tr>
<td>South Central</td>
<td>Kamloops</td>
<td>Jim Britton</td>
<td>250-371-3903</td>
<td><a href="mailto:Jim.Britton@gov.bc.ca">Jim.Britton@gov.bc.ca</a></td>
</tr>
<tr>
<td>Southeast</td>
<td>Cranbrook</td>
<td>Fiona Katay</td>
<td>250-417-6010</td>
<td><a href="mailto:Fiona.Katay@gov.bc.ca">Fiona.Katay@gov.bc.ca</a></td>
</tr>
<tr>
<td>Southwest</td>
<td>Vancouver</td>
<td>Bruce Northcote</td>
<td>604-660-2713</td>
<td><a href="mailto:Bruce.Northcote@gov.bc.ca">Bruce.Northcote@gov.bc.ca</a></td>
</tr>
<tr>
<td>Mineral Development Office</td>
<td>Vancouver</td>
<td>Gordon Clarke</td>
<td>604-660-2094</td>
<td><a href="mailto:Gordon.Clarke@gov.bc.ca">Gordon.Clarke@gov.bc.ca</a></td>
</tr>
</tbody>
</table>

Fig. 2. Geographic regions and Regional Geologist offices.

Fig. 3. Estimated value of British Columbia mineral production for 2016.

Fig. 4. Value of British Columbia mineral production by year 1996-2016 (p=NRCAN preliminary estimate, f=NRCAN and MEM forecast).

Polley operation completed its first full year of production after being shut down after a tailings dam breach in 2014.

3.2. Coal mines

Seven operating coal mines (Table 3) accounted for a forecast $3.32 billion of production for 2016, representing about 46% of all mineral production in the province. Coal was produced at five large open pit operations of Teck Coal Limited in southeastern British Columbia, the Brule open pit operation of Conuma Coal Resources Limited in northeastern British Columbia, and the Quinsam underground operation of Hillsborough Resources Ltd. on Vancouver Island. The Quinsam operation went on care and maintenance in early 2016. The Brule operation is a former mine that restarted operations in the fall of 2016.

In the second half of 2016, coal prices rebounded significantly. Teck received $92 USD/tonne as a quarterly benchmark price in Q3 of 2016, negotiated in late June. Since the middle of the year prices on the spot market rose sharply and exceeded $200 USD/tonne by mid-September. The Q4 quarterly benchmark price was negotiated at around $200-$205 USD/tonne. This has reopened a molybdenum circuit at their Gibraltar mine, which was shut down in 2015. New Gold Inc. continued to advance their New Afton mine, and their new mill, which was installed in 2015, produced throughputs ranging between 15,250 and 15,900 tonnes per day. Imperial Metals Corporation’s Mount Polley operation completed its first full year of production after being shut down after a tailings dam breach in 2014.
### Table 2. Operating metal mines, 2016, forecast mine production, reserves, and resources.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huckleberry</td>
<td>Northwest</td>
<td>Huckleberry Mines Ltd.</td>
<td>copper, gold, silver, molybdenum; Porphyry Cu-Mo-Au; 093E 037</td>
<td>9,270 t (20.4 Milbs) Cu,</td>
<td>Approx., 37 Mt at 0.3% Cu</td>
<td></td>
<td>Mining ceased Jan 6. Stockpiles provided mill feed until Aug. 31. Now on care and maintenance.</td>
</tr>
<tr>
<td>Red Chris</td>
<td>Northwest</td>
<td>Red Chris Development Company Ltd.</td>
<td>copper, gold, silver; Porphyry Cu-Au; 104H 005</td>
<td>31,277 t (68.95 Milbs) Cu, 1,319 kg (42,426 oz) Au</td>
<td>294 Mt at 0.36% Cu and 0.27% Au</td>
<td>1,027 Mt at 0.35% Cu, 0.35 g/t Au, 1.14 g/t Ag.</td>
<td>Depletion of near-surface high-grade at the East zone reduced head grade; increased clay minerals from near surface Main zone reduced recoveries.</td>
</tr>
<tr>
<td>Mt. Milligan</td>
<td>North Central</td>
<td>Centerra Gold Inc. (Centerra B.C. Holdings Inc.)</td>
<td>copper, gold; Alkalic porphyry Cu-Au; 093N 194, 093N 191</td>
<td>27 Kt (60 Milbs) Cu; 6.22 t (200,000 oz) Au</td>
<td>506.4 Mt at 0.196% Cu and 0.349 g/t Au; containing 991.1 Kt (2,185 Milbs) Cu and 177 t (5.69 Moz) Au</td>
<td>118.5 Mt at 0.16% Cu and 0.320 g/t Au (additional to reserves).</td>
<td></td>
</tr>
<tr>
<td>Copper Mountain</td>
<td>South Central</td>
<td>Copper Mountain / Mitsubishi Materials</td>
<td>copper, gold; alkalic porphyry; 092HSE 001</td>
<td>82.8 Milb Cu; 29,200 oz Au; 294,400 oz Ag</td>
<td>Proven and Probable as of 2014-12-31; 0.18% Cu cut-off; 146 Mt grading 0.35% Cu, 1.47 g/t Au, 0.12 g/t Ag (containing 1.1 Blb of Cu; 6.9 Moz Ag; 560,000 oz Au)</td>
<td>Measured and Indicated resources (as of 2014-12-31; 0.18% Cu cut-off); 265 Mt grading 0.33% Cu, 1.33 g/t Ag, 0.40 g/t Au (containing 1.9 Blb Cu; 11.35 Moz Ag; 930,000 oz Au).</td>
<td>Drilling carried out at Pit 2 to convert inferred resources into Measured/Indicated.</td>
</tr>
<tr>
<td>Gibraltar</td>
<td>South Central</td>
<td>Taseko Mines Ltd.</td>
<td>copper, molybdenum; calc-alkalic porphyry; 093B 012</td>
<td>123 Milb Cu; 740,000 lb Mo.</td>
<td>Proven and Probable as of 2014-12-31; 0.15% Cu cut-off; 749 Mt grading 0.26% Cu and 0.008% Mo. (Recoverable metal: 3.3 Blb Cu)</td>
<td>Measured and Indicated resources (as of 2014-12-31; 0.15% Cu cut-off); 1,092 Mt grading 0.25% Cu and 0.008% Mo.</td>
<td>Gibraltar’s molybdenum circuit resumed operation in September 2016.</td>
</tr>
<tr>
<td>Highland Valley Copper</td>
<td>South Central</td>
<td>Teck Highland Valley Copper Partnership</td>
<td>copper, molybdenum; calc-alkalic porphyry; 092ISW 012</td>
<td>129,100 t Cu; 4.2 Milb Mo.</td>
<td>Proven and Probable as of 2015-12-31; cut-off not stated; 577.2 Mt grading 0.29% Cu; 0.007% Mo. (Recoverable metal: 1,450,000 t Cu; 30,000 t Mo.)</td>
<td>Resources (as of 2015-12-31; cut-off not stated); Measured: 412.1 Mt grading 0.34% Cu; 0.008% Mo; Indicated: 709.2 Mt grading 0.23% Cu; 0.010% Mo.</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Continued.

<table>
<thead>
<tr>
<th>Mount Polley</th>
<th>South Central</th>
<th>Imperial Metals Corporation</th>
<th>copper; gold; silver; alkaline porphyry; 093A 008</th>
<th>27.1 Mlb Cu; 46,900 oz Au; 105,200 oz Ag</th>
<th>Proven and Probable (as of 2016-01-01; variable mill head values for cut-off): 73.6 Mt grading 0.274% Cu, 0.293 g/t Au, 0.562 g/t Ag</th>
<th>Measured and Indicated resources (as of 2016-01-01; variable mill head values for cut-off): 247 Mt grading 0.266% Cu, 0.262 g/t Au, 0.667 g/t Ag</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Afton</td>
<td>South Central</td>
<td>New Gold Inc.</td>
<td>copper; gold; alkaline porphyry; 092INE 023</td>
<td>405,000 oz Au; 1.8 Moz Ag; 95 Mlb Cu.</td>
<td>Proven and Probable (as of 2014-12-31; cut-off NSR US$21/t or US$24/t depending on block): 42 Mt grading 0.56 g/t Au, 2.3 g/t Ag, 0.84% Cu; (containing 760,000 oz Au, 3.1 Moz Ag, 781 Mlb Cu)</td>
<td>Measured and Indicated resources (as of 2014-01-01; cut-off 0.40% CuEq): 73 Mt grading 0.75 g/t Au, 2.2 g/t Ag, 0.87% Cu; (containing 1.75 Moz Au, 5.2 Moz Ag, 1.4 Blb Cu).</td>
</tr>
</tbody>
</table>

contributed to increased production by Teck and the restart of the Brule operation by Conuma.

3.3. Industrial minerals, aggregates, and jade

About 30 industrial mineral mines and over 1000 aggregate operations are active in British Columbia. Selected operations are listed in Table 4. With estimated production figures for industrial minerals of $457 million (6% of total mineral production) and for aggregates of $348 million (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, with demand close to a few hundred tonnes per year.

The Northwest Region was the most active for jade producers. In the Northeast Region, Fireside Minerals Ltd. mines veins of massive white barite. Mined barite is crushed and bagged on site and trucked to Fort St. John, BC and Alberta for use in aggregate production, 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. Heemskirk Canada Limited continued redeveloping their Moberly Silica operation to produce frac sand. Plant engineering is progressing, and plant commissioning is expected by early 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 projects’ 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. Both 2016 mine development projects are in the Northwest Region (Table 5).

Pretium Resources Inc.’s Brucejack high-grade gold project continues with full-scale construction underway and a mine startup planned for 2017. JDS Silver’s Silvertip silver-zinc-lead project has entered the commissioning stage and full-scale production is planned for 2017.

5. Selected proposed mine projects

Projects at the proposed mine (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 6) 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 current Mines Act and Environmental Management Act permits in good standing and is allowed to excavate up to 75,000 t per year. In early 2013, the project submitted applications to amend their existing Mines Act and Environmental Management Act 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.

The Galore Creek copper-gold-silver project is owned by the
Table 3. Operating coal mines, 2016, forecast mine production, and reserves.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable; Reported Dec 31, 2015)</th>
<th>Resource (Measured and Indicated; Reported Dec 31, 2015)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brule</td>
<td>Northeast</td>
<td>Conuma Coal Resources Limited</td>
<td>PCI; Bituminous coal; 093P 007</td>
<td>250,000 t</td>
<td>16.3 Mt saleable; Proven</td>
<td>n/a</td>
<td>Restart activities began in Sept. 2016. Operating under contract with Walter Energy Holdings, Inc. until ownership transition is complete.</td>
</tr>
<tr>
<td>Coal Mountain</td>
<td>Southeast</td>
<td>Teck Coal Ltd. (100%)</td>
<td>PCI, TC; Bituminous coal</td>
<td>2.3 Mt</td>
<td>Proven + Probable: 4.5 Mt PCI</td>
<td>CMO: Measured + Indicated: 78.4 Mt; Inferred: 4.7 Mt</td>
<td>Mineable resource at CMO is nearing depletion and expected mine shut down in late 2017; Coal Mountain Phase II (CMO2/Marten Wheeler) would use facilities from CMO, but currently remains on hold.</td>
</tr>
<tr>
<td>Elkview</td>
<td>Southeast</td>
<td>Teck Coal Ltd. (95%); Nippon Steel &amp; Sumimoto Metal Corp. (2.5%); POSCO (2.5%)</td>
<td>HCC; Bituminous coal</td>
<td>7.0 Mt</td>
<td>Proven + Probable: 273.2Mt HCC</td>
<td>Measured + Indicated: 580.1 Mt HCC; Inferred: 224.6 Mt HCC</td>
<td>Baldy Ridge Extension (BRE) received an Environmental Assessment Certificate in September, 2016; pre-stripping at BRE; exploration drilling in active pits; development progressing in new approved mining areas.</td>
</tr>
<tr>
<td>Fording River</td>
<td>Southeast</td>
<td>Teck Coal Ltd. (100%)</td>
<td>HCC, TC; Bituminous coal</td>
<td>8.2 Mt</td>
<td>Proven + Probable: 434.9 Mt HCC + 5.0 Mt TC</td>
<td>Measured + Indicated: 1322.8 Mt HCC + 13.4 Mt TC; Inferred: 787.2 Mt HCC + 7.5 Mt TC</td>
<td>EA approval of Swift expansion (2015); permit amendments to align mine design with improved efficiencies; exploration drilling in active pits; construction of Fording River water treatment plant began.</td>
</tr>
<tr>
<td>Greenhills</td>
<td>Southeast</td>
<td>Teck Coal Ltd. (80%); POSSCAN (20%)</td>
<td>HCC, PCI, TC; Bituminous coal</td>
<td>5.2 Mt</td>
<td>Proven + Probable: 201.3Mt HCC + 5.0 Mt PCI + 2.7 Mt TC</td>
<td>Measured + Indicated: 304.5 Mt HCC + 7.9 Mt PCI + 1.1 Mt TC; Inferred: 148.5 Mt HCC + 4.3 Mt PCI + 0.3 Mt TC</td>
<td>Cougar Pit Expansion (CPX) is preparing for pre-application of EA; environmental baseline.</td>
</tr>
<tr>
<td>Line Creek</td>
<td>Southeast</td>
<td>Teck Coal Ltd. (100%)</td>
<td>HCC, TC; Bituminous coal</td>
<td>3.3 Mt</td>
<td>Proven + Probable: 66.6 Mt HCC + 11.1Mt TC</td>
<td>Measured + Indicated: 756.1 Mt HCC + 19.3 Mt TC; Inferred: 414.45 Mt HCC + 3.1 Mt TC</td>
<td>Burnt Ridge Extension (BRX) in pre-application of EA (2014); pre-stripping at Line Creek Phase II (2013 EA approval); Commissioning of West Line Creek water treatment facility in February, 2016.</td>
</tr>
<tr>
<td>Quinsam</td>
<td>Southwest</td>
<td>Hillsborough Resources Ltd.</td>
<td>TC; A04: Bituminous coal; 092F 319</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>On Care and Maintenance. Production suspended Jan. 2016. Reserves and resources are unpublished.</td>
</tr>
</tbody>
</table>

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

Galore Creek Partnership, in which a wholly owned subsidiary of Novagold Resources Inc. and Teck Resources Ltd. are equal partners. In 2016, work was limited to baseline monitoring and targeted engineering studies. Alloycorp Mining Inc.’s past producing Kitsault molybdenum-silver mine is fully permitted, but requires project financing. Financing is dependent upon an increase in the market price for molybdenum.

Seabridge Gold Inc. continued work on their KSM copper-gold porphyry deposit. Seabridge received federal and provincial approval of the project Environmental Assessment (EA) in 2014 and is actively seeking partnership to advance into construction. In 2016, Seabridge delivered two comprehensive technical reports: 1) a Preliminary Feasibility Study (PFS) based on updated Mineral Reserves; and 2) a Preliminary Economic Assessment (PEA) that incorporated Inferred Mineral Resources into a conceptual project design. The PEA envisions a milling rate of 170,000 tpd for the initial 20 years followed by 130,000 tpd for 15 years, reduced to 77,000 tpd for 12 years and finally reduced to 28,000 tpd for 3 years. Total mine life would be 51 years.
Table 4. Selected industrial mineral mines and quarries, 2016, forecast mine production, reserves, and resources.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning Daylight</td>
<td>Northwest</td>
<td>Stone Ridge Quarries Ltd.</td>
<td>Columnar Basalt; dimension stone</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Basalt quarry, bulk sampling.</td>
</tr>
<tr>
<td>Cassiar Jade</td>
<td>Northwest</td>
<td>Dynasty Jade Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104P 005</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Trenching, quarrying, placer production.</td>
</tr>
<tr>
<td>Dean Kutcho</td>
<td>Northwest</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones;</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, quarrying, up to 200 tonnes.</td>
</tr>
<tr>
<td>Jade Valley</td>
<td>Northwest</td>
<td>United Oriental Mining Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104I 048</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, quarrying, placer production.</td>
</tr>
<tr>
<td>Kistumkalum</td>
<td>Northwest</td>
<td>Kalum Quarry Ltd. Partnership</td>
<td>Industrial rock; crushed rock</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, blasting, crushing, production for CN railway bed.</td>
</tr>
<tr>
<td>Kutcho Creek Jade</td>
<td>Northwest</td>
<td>Continental Jade Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104I 078</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Mining, trenching, auger drilling.</td>
</tr>
<tr>
<td>Letain</td>
<td>Northwest</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones; 104I 079</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, mining up to 200 t.</td>
</tr>
<tr>
<td>Provencer</td>
<td>Northwest</td>
<td>Glenpark Enterprises Ltd.</td>
<td>Jade; Gems and semi-precious stones;</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Mining, trenching, auger drilling.</td>
</tr>
<tr>
<td>Wolverine</td>
<td>Northwest</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones;</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, &lt; 2,000 tonnes of material mined.</td>
</tr>
<tr>
<td>Fireside</td>
<td>Northeast</td>
<td>Fireside Minerals Ltd.</td>
<td>Barite; Vein barite; 094M 003, 094M 019</td>
<td>10,000 t</td>
<td>475,000 t (non NI 43-101 compliant)</td>
<td>n/a</td>
<td>Mined from the Moose Pit. Overburden stripping revealed two 96% to 99.4% barite veins with a combined true thickness of 6.5 m.</td>
</tr>
<tr>
<td>Ogden Mountain</td>
<td>North Central</td>
<td>Green Mountain Jade Inc.</td>
<td>Nephrite jade; Jade; 093N 156, 093N 157, 093N 165</td>
<td>35 t</td>
<td>n/a</td>
<td>n/a</td>
<td>Exploration and placer mining of alluvial jade boulders, excavation of in situ jade.</td>
</tr>
<tr>
<td>Ashcroft</td>
<td>South Central</td>
<td>IG Machine and Fibers Ltd. (IKO Industries Ltd.)</td>
<td>Basalt (roofing granules); 092INW 104</td>
<td>350,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Bromley Creek (Zeotech)</td>
<td>South Central</td>
<td>Canadian Mining Company Inc.</td>
<td>Zeolite; 092HSE 243</td>
<td>n/a</td>
<td>M+1 (as of 2013-06-30); 550,000 t</td>
<td></td>
<td>Combined production from Bud and Red Lake quarries.</td>
</tr>
<tr>
<td>Bud</td>
<td>South Central</td>
<td>Absorbent Products Ltd.</td>
<td>Bentonite; 092HSE 162</td>
<td>30,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Decor</td>
<td>South Central</td>
<td>Pacific Bentonite Ltd.</td>
<td>Alumina, landscape rock; 092INW 084</td>
<td>100,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td>Production likely to be affected by shut down of Lafarge’s Kamloops Cement Plant.</td>
</tr>
</tbody>
</table>
Table 4. Continued.

<table>
<thead>
<tr>
<th>Location</th>
<th>Region</th>
<th>Company Name</th>
<th>Material Type</th>
<th>Proven Reserves</th>
<th>Probable Reserves</th>
<th>Measured and Indicated Reserves</th>
<th>Project Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falkland South Central Lafarge Canada Inc.</td>
<td>Gypsum; 082LNW 001</td>
<td>6,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td>Production likely to be affected by shut down of Lafarge’s Kamloops Cement Plant.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harper Ranch South Central Lafarge Canada Inc.</td>
<td>Limestone; 092INE 001</td>
<td>220,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td>On care and maintenance as of November 2016.</td>
<td></td>
</tr>
<tr>
<td>Kettle Valley quarries South Central Kelowna Sand and Gravel Ltd / Kettle Valley Stone Ltd.</td>
<td>Ashlar, flagstone, thin veneer; 082ENW 109; 111; 112</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klinker South Central Opal Resources Canada Inc.</td>
<td>Opal; 082LSW 125</td>
<td>Intermittent operation</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lady King Basalt South Central Spectral Gold Corp.</td>
<td>Basalt columns; n/a</td>
<td>Intermittent operation</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mount Polley Magnetite South Central Craigmont Industries Ltd.</td>
<td>Magnetite (recovered from tailings); 093A 008</td>
<td>3,000 tons.</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td>Plant operated part time in 2016 due to weak demand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pavilion South Central Graymont Western Canada Inc.</td>
<td>Limestone; 092INW 081</td>
<td>20,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td>On care and maintenance as of June 2016.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Lake South Central Absorbent Products Ltd.</td>
<td>Diatomaceous earth; 092INE 081</td>
<td>30,000 tons</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td>Combined production from Bud and Red Lake quarries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mount Brussilof Southeast Baymag Inc.</td>
<td>Magnesite; hydrothermal sparry magnesite; 082JNW001</td>
<td>220,000 t annually; 50 Mt proven</td>
<td></td>
<td></td>
<td>MgO and MgOH; sediment-hosted sparry magnesite.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moberly Silica Southeast Heemskirk Canada Ltd.</td>
<td>Silica; industrial use silica, frac sand; 082JNW001</td>
<td>20 to 140 mesh frac sand (dry); Proven 8.9 Mt of 64% frac sand + Probable 4.6 Mt of 64% frac sand; OR Silica for industrial (dry); 12.8 Mt Proven + 0.7 Mt Probable</td>
<td>20 to 140 mesh frac sand (dry); 32.4 Mt at 64% frac sand Measured and Indicated + 11.7 Mt silica as frac sand residues; OR Silica for industrial (dry); 43.2 Mt Measured +266M capital cost for plant construction and upgrades to existing facility (for frac sand operation); 300,000 tonnes per year capacity. Construction started on frac sand processing plant in 2014, commissioning expected in 2017.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horse Creek Silica Southeast HITest Sand Inc.</td>
<td>Silica; industrial use, aggregate; 082N 043</td>
<td>Estimated: 3 Mt at 99.5% Silica (1987)</td>
<td></td>
<td></td>
<td>Variety of aggregate and industrial use products.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elkhorn Southeast CertainTeed Gypsum Canada Inc.</td>
<td>Gypsum; evaporitic bedded gypsum; 082JSW021</td>
<td>400,000 t annually</td>
<td></td>
<td></td>
<td>4 years of mine life remaining; the company will replace production by developing the Kootenay West mine (in EIA).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4J Southeast Georgia-Pacific Canada Limited</td>
<td>Gypsum; evaporitic bedded gypsum; 082JSW009</td>
<td>n/a; Processing stockpiled ore</td>
<td>20 Mt</td>
<td></td>
<td>Processing stockpiles; updating mine expansion plans.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Crystal Southeast Eagle Graphite Corp.</td>
<td>Graphite; metamorphic hosted flake graphite; 082FNW260, 082FNW283</td>
<td>n/a; Quarry on Care and Maintenance; company focused on process optimization and exploration</td>
<td>Regolith: Measured + Indicated: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: Measured + Indicated: 4.765 Mt at 1.21% fixed carbon</td>
<td></td>
<td>Process optimization at plant; produced sample of 99.995% pure spheroidized graphite from flake graphite; product suitable for Li-Ion battery specifications; research and development.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winner; Friday Quarry Southeast Roxal Inc.</td>
<td>Gabbro/basalt; crushed rock for mineral wool; 082SE265</td>
<td>Quarrying to supply feed stock for mineral wool plant</td>
<td></td>
<td></td>
<td>Crushing, screening, stockpiling, environmental.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4. Continued.

<table>
<thead>
<tr>
<th>Project</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand Forks Slag</td>
<td>Southeast</td>
<td>Granby River Mining Company Inc.</td>
<td>Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264</td>
<td>n/a</td>
<td>n/a</td>
<td>Quarrying for abrasives and roofing granules</td>
<td>Crushing, screening; environmental.</td>
</tr>
<tr>
<td>Apple Bay (PEM 100)</td>
<td>Southwest</td>
<td>Electra Stone Ltd.</td>
<td>Silica + alumina; R12: Volcanic glass-perlite; 092L 150</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Continuation of 2015 drilling to assess resources.</td>
</tr>
<tr>
<td>Benson Lake</td>
<td>Southwest</td>
<td>Benson Lake Carbonates ULC</td>
<td>High brightness carbonate; R09: Limestone; 092L 295</td>
<td>19,000 t</td>
<td>n/a</td>
<td>n/a</td>
<td>New owner 2016. Possible exploration to come.</td>
</tr>
<tr>
<td>Blubber Bay</td>
<td>Southwest</td>
<td>Ash Grove Cement Company</td>
<td>Limestone, dolostone; R09: Limestone; 092F 479</td>
<td>43,240 t +</td>
<td>n/a</td>
<td>100+ years</td>
<td>Dolostone is shipped to Ash Grove in Oregon.</td>
</tr>
<tr>
<td>Garibaldi Pumice</td>
<td>Southwest</td>
<td>Garibaldi Pumice Ltd.</td>
<td>Pumice; R11: volcanic ash; 092JW 039</td>
<td>16,000 m³</td>
<td>n/a</td>
<td>11,396,000 m³ pumice 4,990,000 m³ pumicite (fines)</td>
<td>2014 resource estimate.</td>
</tr>
<tr>
<td>Imperial Limestone</td>
<td>Southwest</td>
<td>Imperial Limestone Co. Ltd.</td>
<td>Limestone; R09: Limestone; 092F 394</td>
<td>250,000 t high grade CaCO₃; 317,500 t lower grade limestone</td>
<td>n/a</td>
<td>50+ years</td>
<td>Production to December 2016.</td>
</tr>
<tr>
<td>K2</td>
<td>Southwest</td>
<td>K2 Stone Quarries Inc.</td>
<td>Dimension stone, flagstone; R08: flagstone; 092C 159</td>
<td>20,400 t</td>
<td>n/a</td>
<td>n/a</td>
<td>Material extracted from quarry is cut to size.</td>
</tr>
<tr>
<td>Mount Meager Pumice</td>
<td>Southwest</td>
<td>Great Pacific Pumice Inc.</td>
<td>Pumice; R11: volcanic ash; 092JW 039</td>
<td>1850 t</td>
<td>n/a</td>
<td>n/a</td>
<td>Shipped 5964 t.</td>
</tr>
<tr>
<td>Sumas Shale</td>
<td>Southwest</td>
<td>Sumas Shale Ltd. (Clayburn Industries Ltd., Lafarge Canada Inc.)</td>
<td>Shale, clay, sandstone; B05: Residual kaolin; 092GSE024</td>
<td>500,000 t</td>
<td>n/a</td>
<td>50+ years</td>
<td>Product for cement production.</td>
</tr>
<tr>
<td>Texada Quarry</td>
<td>Southwest</td>
<td>Texada Quarrying Ltd. (Lafarge Canada Inc.)</td>
<td>Limestone, aggregate; R09: Limestone; 092F 395</td>
<td>n/a</td>
<td>n/a</td>
<td>100+ years</td>
<td>Mostly limestone for cement production.</td>
</tr>
</tbody>
</table>

### Table 5. Mine development projects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucejack</td>
<td>Northwest</td>
<td>Pretium Resources Inc.</td>
<td>Au, Ag; Au-quartz veins; quartz stockwork breccia; epithermal; 104B 193</td>
<td>16.5 Mt at 14.1 g/t Au, 57.7 g/t Ag</td>
<td>15.3 Mt at 17.6 g/t Au, 14.3 g/t Ag</td>
<td>40,000 m underground infill drill program, underground mine development: 1,573 m of lateral workings and 239 m of raise workings.</td>
<td>Mine construction underway; aiming for commercial production by 2017.</td>
</tr>
<tr>
<td>Silvertip</td>
<td>Northwest</td>
<td>JDS Silver</td>
<td>Ag, Pb, Zn, Au; Polymetallic manto; 104O 038</td>
<td>n/a</td>
<td>2.455 Mt at 315 g/t Ag, 5.88% Pb, 6.28% Zn, 0.413 g/t Au</td>
<td>Road reconditioning, pre-construction earthworks, mill and process plant acquisition.</td>
<td>In the commissioning stage. Production to be announced in 2017.</td>
</tr>
</tbody>
</table>
Table 6. Selected proposed mine projects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Region</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dome Mountain</td>
<td>Northwest</td>
<td>Gavin Mines Inc. (subsidiary of Metal Mountain Resources Inc.)</td>
<td>Au, Ag; Vein breccia and stockwork; 093L 022</td>
<td>135,131 t at 11.2 g/t Au</td>
<td>144,144 t at 17.7 g/t Au</td>
<td>Diamond drilling, mine rehabilitation.</td>
<td>Tracked ore to Nicola custom mill in Merritt.</td>
</tr>
<tr>
<td>Galore Creek</td>
<td>Northwest</td>
<td>Galore Creek Mining Corp.</td>
<td>Au, Cu; Alkalic porphyry; 104G 090</td>
<td>528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag</td>
<td>814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.2 g/t Ag</td>
<td>Baseline monitoring. Reduced environmental baseline monitoring.</td>
<td></td>
</tr>
<tr>
<td>Kitsault</td>
<td>Northwest</td>
<td>Alloycorp Mining Inc.</td>
<td>Mo, Ag, Pb; Porphyry Mo (low F type); 103P 120</td>
<td>228.2 Mt at 0.083% Mo, 5.0 g/t Ag</td>
<td>321.8 Mt at 0.071% Mo, 4.8 g/t Ag</td>
<td>Baseline monitoring, removed mine camp.</td>
<td>Waiting for improved Mo price.</td>
</tr>
<tr>
<td>KSM</td>
<td>Northwest</td>
<td>Seabridge Gold Inc.</td>
<td>Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 191</td>
<td>2,198 Mt at 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag, 42.6 g/t Mo</td>
<td>M: 2,902.5 Mt at 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag, 44 g/t Mo; Inf: 2,719.2 Mt at 0.35 g/t Au + 0.32% Cu + 2.0 g/t Ag + 20 g/t Mo</td>
<td>Preliminary Feasibility Study, Underground Preliminary Economic Assessment, Deep Kerr exploration portal permitted, exploration drilling at Lower Deep Kerr (7110.4 m) and Iron Cap (1038.4 m).</td>
<td>Significant advantages detailed in PEA by integrating more underground mining.</td>
</tr>
<tr>
<td>Morrison</td>
<td>Northwest</td>
<td>Pacific Booker Minerals Inc.</td>
<td>Cu, Mo; Calc-alkalic porphyry; 093M 007</td>
<td>224.2 Mt at 0.53% Cu, 0.163 g/t Au, 40 g/t Mo</td>
<td>265.9 Mt at 0.35% Cu, 0.17 g/t Au, 50 g/t Mo</td>
<td>Baseline monitoring, EA permitting ongoing.</td>
<td>Entered EA in 2010.</td>
</tr>
<tr>
<td>Red Mountain</td>
<td>Northwest</td>
<td>IDM Mining Ltd.</td>
<td>Au, Ag; Porphyry related gold; 103P 086</td>
<td>n/a</td>
<td>1.641 Mt at 8.36 g/t Au, 26 g/t Ag</td>
<td>PEA, resource update, underground rehabilitation, infill resource drilling, metallurgical, geotechnical, environmental baseline, EA submission preparation.</td>
<td>Preparing EA application submission.</td>
</tr>
<tr>
<td>Schaft Creek</td>
<td>Northwest</td>
<td>Teck Resources Limited</td>
<td>Cu, Au; Calc-alkalic porphyry; 104G 015</td>
<td>940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag</td>
<td>1,228.5 Mt at 0.26% Cu, 0.017% Mo, 0.19 g/t Au, 1.69 g/t Ag</td>
<td>Baseline monitoring, in-house engineering, evaluating and reinterpreting, relogged core (43,000 m) for possible resource update.</td>
<td></td>
</tr>
<tr>
<td>Tulsequah Chief</td>
<td>Northwest</td>
<td>Chieftain Metals Inc</td>
<td>Au, Ag, Cu, Zn, Pb; Noranda / Kuroko massive sulphide; 104K 002</td>
<td>4,435 Mt at 2.85 g/t Au, 104 g/t Ag, 1.46% Cu, 1.29% Pb, 6.94% Zn</td>
<td>6,575 Mt at 2.82 g/t Au, 104.76 g/t Ag, 1.34% Cu, 1.33% Pb, 6.71% Zn</td>
<td>Corporate, company entered receivership.</td>
<td>Seeking buyer for project.</td>
</tr>
<tr>
<td>Location</td>
<td>Region</td>
<td>Company Name</td>
<td>Metal(s) or Commodity</td>
<td>Deposit Type</td>
<td>Resource Category</td>
<td>Additional Details</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>--------------------------------------------</td>
<td>-------------------------------------------</td>
<td>----------------------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Murray River</td>
<td>Northeast</td>
<td>HD Mining Int’l Ltd.</td>
<td>HCC; Bituminous coal; 0931 010</td>
<td>261.6 Mt mineable; proven</td>
<td>314.2 Mt in situ</td>
<td>Mines Act permit and federal EA (under review), drilling, hydrogeological, geotechnical hand trenching, 2D seismic survey, engineering and environmental studies. Proposed underground longwall mining operation with average annual production of 4.8 Mt of saleable coal over a 25 year mine life.</td>
<td></td>
</tr>
<tr>
<td>Sukunka</td>
<td>Northeast</td>
<td>Glencore plc</td>
<td>HCC; Bituminous coal; 093P 012, 093P 014</td>
<td>n/a</td>
<td>145 Mt in situ</td>
<td>EA (under review), engineering and environmental studies. Proposed open-pit mine with initial annual production of 1.5 - 2.5 Mt of saleable coal over a 20+ year mine life.</td>
<td></td>
</tr>
<tr>
<td>Wapiti East</td>
<td>Northeast</td>
<td>Fertoz Int'l Inc.</td>
<td>P2O5; Sedimentary phosphate deposits; 093I 039, 093I 022, 093I 008</td>
<td>n/a</td>
<td>0.81 Mt at 22.3% P2O5, Indicated</td>
<td>Mines Act permit application, bulk sample (17,500 t permitted), trenching, 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.</td>
<td></td>
</tr>
<tr>
<td>Aley</td>
<td>North Central</td>
<td>Taseko Mines Limited (Aley Corporation)</td>
<td>Nb; Carbonatite-hosted deposit; 094B 027</td>
<td>83.8 Mt at 0.50% Nb2O5; containing 293 Kt* Nb*calculated by author</td>
<td>285.8 Mt at 0.37% Nb2O5; containing 739.2 Kt* Nb*calculated by author</td>
<td>EA (pre-app), geochemical characterization studies, environmental baseline monitoring. Proposed open-pit mine with 10,000 t/d ore processing rate and average annual production of 9,000 t niobium over a 24 year mine life.</td>
<td></td>
</tr>
<tr>
<td>Blackwater</td>
<td>North Central</td>
<td>New Gold Inc.</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037</td>
<td>344.4 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 254 t (8.17 Moz) Au, 1,890 t (60.8 Moz) Ag</td>
<td>55.49 Mt at 0.72 g/t Au, 4.4 g/t Ag; containing 40.2 t (1.29 Moz) Au, 243 t (7.82 Moz) Ag; additional to reserves</td>
<td>EA (under review), engineering and environmental studies. Proposed open-pit mine with 60,000 t/d 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.</td>
<td></td>
</tr>
<tr>
<td>Giscome</td>
<td>North Central</td>
<td>Graymont Western Canada Inc.</td>
<td>CaCO3; Limestone; 093J 041, 093J 025</td>
<td>n/a</td>
<td>&gt;100 Mt of limestone (&gt;95% calcium carbonate, &lt;5% magnesium carbonate) in situ; Indicated</td>
<td>EA (under review), hand auguring, baseline studies. Proposed 600,000 t/y limestone quarry to feed a vertical lime kiln producing 198,000 t of lime annually over a 50+ year mine life.</td>
<td></td>
</tr>
<tr>
<td>Kemess Underground (KUG)</td>
<td>North Central</td>
<td>AuRico Metals Inc.</td>
<td>Cu, Au, Ag; Porphyry Cu=Mo=Au; 094E 021</td>
<td>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; Probable</td>
<td>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; Indicated</td>
<td>Feasibility study update, EA (under review), engineering and environmental studies. Proposed underground panel cave mine with 24,600 t/d 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.</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Province</td>
<td>Company Name</td>
<td>Minerals/Characteristics</td>
<td>Reserves (P+P; NSR cut-off US$7.10/t):</td>
<td>Resources (M+I; NSR cut-off US$7.10/t):</td>
<td>Environmental Monitoring Status</td>
<td>Project Status</td>
</tr>
<tr>
<td>----------------</td>
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</tr>
<tr>
<td>Ajax</td>
<td>South Central</td>
<td>KGHM Ajax Mining Inc.</td>
<td>Cu, Au; Alkalic porphyry 092INE 012, 013</td>
<td>426 Mt grading 0.29% Cu; 0.19 g/t Au; 0.39 g/t Ag (containing 2.7 Bt Cu; 2.6 Moz Au; 5.3 Moz Ag)</td>
<td>368 Mt grading 0.26% Cu; 0.18 g/t Au; 0.35 g/t Ag (containing 2.7 Bt Cu; 2.6 Moz Au; 5.3 Moz Ag)</td>
<td>Environmental monitoring; Public and First Nations engagement. Compiling comments received during public review periods, and drafting responses.</td>
<td>Project at application review stage. Company temporarily suspended review to respond to comments received.</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>South Central</td>
<td>Teck Resources Ltd.</td>
<td>Cu, Mo; Calc-alkaline porphyry 092ISE 001</td>
<td>n/a</td>
<td>n/a</td>
<td>Formal review under a Minister’s permit process started in September; engineering studies.</td>
<td>Project at application review stage. Resource informally stated as 100 Mt, but without grades.</td>
</tr>
<tr>
<td>Bonanza Ledge</td>
<td>South Central</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>Au; Pyrite replacement; 093H 140</td>
<td>Resource (as of 2015-03-31; cut-off 1.7 g/t Au): Measured: 170,000 t grading 8.74 g/t Au (containing 48,000 oz Au); Indicated: 240,000 t grading 6.86 g/t Au (containing 54,000 oz Au); M+I: 420,000 t grading 7.63 g/t Au (containing 102,000 oz Au)</td>
<td>n/a</td>
<td>Formal review under a Minister’s permit process started in December; engineering studies.</td>
<td>Project at application review stage.</td>
</tr>
<tr>
<td>Harper Creek</td>
<td>South Central</td>
<td>Yellowhead Mining Inc.</td>
<td>Cu, Au, Ag; Stratiform, volcanic-hosted 092M 008, 009</td>
<td>n/a</td>
<td>n/a</td>
<td>Project on hold.</td>
<td>Project at application review stage. Company suspended review in October 2015 for economic reasons.</td>
</tr>
<tr>
<td>New Prosperity</td>
<td>South Central</td>
<td>Taseko Mines Ltd.</td>
<td>Cu, Au; Calc-alkaline porphyry 092O 041</td>
<td>Reserves (P+P; cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag</td>
<td>Resources (M+I; cut-off 0.14% Cu): 1,010 Mt grading 0.24% Cu; 0.41 g/t Au</td>
<td>Preparations for site investigation of proposed mine facilities. Company is seeking judicial review of federal EA decision. Results pending.</td>
<td>Project at post-decision stage. Granted provincial certificate but denied federal approval.</td>
</tr>
<tr>
<td>Ruddock Creek</td>
<td>South Central</td>
<td>Ruddock Creek Mining Corporation</td>
<td>Pb, Zn, Ag; Monashee-type sediment-hosted massive sulphide 082M 082</td>
<td>n/a</td>
<td>Resources (M+I; cut-off 4.0% Pb+Zn): 6.2 Mt grading 6.50% Zn, 1.33% Pb</td>
<td>Environmental monitoring; permitting work.</td>
<td>Project at pre-application stage.</td>
</tr>
<tr>
<td>Spanish Mountain</td>
<td>South Central</td>
<td>Spanish Mountain Gold Ltd.</td>
<td>Au, Ag; Sediment-hosted gold 093A 043</td>
<td>n/a</td>
<td>Resources (M+I; cut-off 0.20 g/t Au): 237.8 Mt grading 0.46 g/t Au; 0.69 g/t Ag; containing 3.5 Moz Au; 5.28 Moz Ag</td>
<td>Environmental monitoring. Technical studies to evaluate different scenarios for mining.</td>
<td>Project at pre-application stage.</td>
</tr>
</tbody>
</table>
Table 6. Continued.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Location</th>
<th>Company Name</th>
<th>Resource Type</th>
<th>Exploration Activities</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bingay Creek</td>
<td>Southeast</td>
<td>Centremount Coal Ltd.</td>
<td>Coal (HCC); open pit and underground; 082JSE011</td>
<td>42.43 Mt Measured + 52.9 Mt Indicated (2012) ; Drilling; environmental baseline studies; engineering and geotechnical evaluation for mine design; permitting.</td>
<td>Pre-application of EA (2012), on hold; 20-year proposed mine life.</td>
</tr>
<tr>
<td>Coal Mountain Phase II (Marten Wheeler)</td>
<td>Southeast</td>
<td>Teck Coal Limited.</td>
<td>Coal (PCI and TC); open-pit and underground; 082GNE006</td>
<td>Measured + Indicated: 173.9 Mt HCC + 6.5 Mt PCI; Inferred: 7.9 Mt HCC + 0.9 Mt PCI (2015)</td>
<td>On hold. Pre-application of EA (2014); Potential of 76.5 Mt; proposed 34-year mine life at 2.25 Mt/yr production. EA withdrawn in late 2015; project on hold.</td>
</tr>
<tr>
<td>Crown Mountain</td>
<td>Southeast</td>
<td>NWP Coal Canada Ltd. (Jameson Resources Ltd.)</td>
<td>Coal (HCC and PCI); open-pit; 082GNE018</td>
<td>HCC: 42.60 Mt Proven + 4.91 Mt Probable; PCI: 7.13 Mt Proven + 1.19 Mt Probable (2014)</td>
<td>HCC + PCI: 68.9 Mt Measured + 6.0 Mt Indicated (2014)</td>
</tr>
<tr>
<td>Driftwood Magnesite</td>
<td>Southeast</td>
<td>MGX Minerals Inc.</td>
<td>Magnesite; hydrothermal sparry magnesite; quarry; 082KNE 068</td>
<td>Measured + Indicated: 8.028 Mt grading 43.3% MgO (2016; using cutoff grade of 42.5% MgO)</td>
<td>Driftwood Magnesite; 20 year mine lease acquired; drilling; 100t bulk sample; metallurgical test work; acquisition of a pilot test mill; resource estimate. 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 100m of surface; working on Preliminary Economic Assessment; drilling to extend the zone.</td>
</tr>
<tr>
<td>Michel Creek (Loop Ridge)</td>
<td>Southeast</td>
<td>CanAus Coal Ltd.</td>
<td>Coal (HCC and PCI); open-pit and underground; 082GSE050</td>
<td>HCC: 44.6 Mt Measured + 42.5 Mt Indicated; open-pit and underground (2015)</td>
<td>Drilling; trenching; environmental and baseline work; mine design; coal quality; permitting. Pre-application of EA (2015); Coal quality testing; updated geological model; drilling has identified 20 coal seams with cumulative thickness of 70m (14% of a 504 m section in the Mist Mountain Fm); PEA model indicates potential production of 3.4 Mt/y (~2.1 Mt/y saleable).</td>
</tr>
<tr>
<td>Driftwood Magnesite</td>
<td>Southeast</td>
<td>MGX Minerals Inc.</td>
<td>Magnesite; hydrothermal sparry magnesite; quarry; 082KNE 068</td>
<td>Measured + Indicated: 8.028 Mt grading 43.3% MgO (2016; using cutoff grade of 42.5% MgO)</td>
<td>Driftwood Magnesite; 20 year mine lease acquired; drilling; 100t bulk sample; metallurgical test work; acquisition of a pilot test mill; resource estimate. 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 100m of surface; working on Preliminary Economic Assessment; drilling to extend the zone.</td>
</tr>
<tr>
<td>Kootenay West</td>
<td>Southeast</td>
<td>CertainTeed Gypsum Canada Inc.</td>
<td>Gypsum; evaporitic bedded gypsum; quarry; 082JSW005, 082JSW020</td>
<td>North and South Quarries: Total 18.7 Mt (at average quality of 83-85%)</td>
<td>Environmental baseline work; mine design. Pre-application of EA (2014); proposed 400,000 t/yr operation with a 42-year mine life. Would produce a blended product to market specifications.</td>
</tr>
</tbody>
</table>
Table 6. Continued.

<table>
<thead>
<tr>
<th>BURNCO Aggregate</th>
<th>Southwest</th>
<th>BURNCO Rock Products Ltd.</th>
<th>Aggregate; n/a</th>
<th>Approx. 20 Mt</th>
<th>Permitting.</th>
<th>Environmental Assessment Review. Resource not represented as NI 43-101 compliant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sechelt Carbonate</td>
<td>Southwest</td>
<td>Ballinteer Management Inc.</td>
<td>Limestone, dolostone, aggregate; n/a</td>
<td>Carbonate Rock: 76.1 Mt Gabbro: &gt;700 Mt</td>
<td>Baseline monitoring, archaeological studies.</td>
<td>Environmental Assessment pre-application. Resource not represented as NI 43-101 compliant.</td>
</tr>
</tbody>
</table>

Exploration activities focussed at the Deep Kerr and Lower Iron cap zones. Proven plus Probable reserves were updated in July 2016 and now total 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 completed in May (inclusive of reserves) total 2.903 Bt grading 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag and 44 g/t Mo. Additional Inferred resources total 2.719 Bt grading 0.35 g/t Au, 0.32% Cu, 2 g/t Ag and 29 g/t Mo.

Pacific Booker Minerals Inc.’s Morrison copper-gold-molybdenum-silver porphyry project has Measured and Indicated resources 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. After the Mount Polly tailings breach in 2014, the Morrison EA review was suspended and 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 2016, IDM Mining Ltd. continued to move forward with their Red Mountain gold project. In the spring an updated NI 43-101 resource was released. Measured plus Indicated resources increased 16% to 1.64 Mt grading 8.36 g/t Au and 26 g/t Ag. Inferred resources increased by 33% to 0.55 Mt grading 6.1 g/t Au and 9 g/t Ag. Resource grade cut-off is 3 g/t Au.

In early 2016, IDM received their Section 11 Order for the project from the British Columbia Environmental Assessment Office. The order sets out the scope, requirements, processes, and methods of the provincial Environmental Assessment, as well as the public and Aboriginal consultation procedures. In July, IDM announced the results of an updated Preliminary Economic Assessment (‘PEA’) authored by JDS Energy and Mining Ltd. The PEA outlines the anticipated low capital and operating costs, robust economic potential and near-term production profile of the Red Mountain underground gold project. Exploration, including diamond drilling, continued throughout 2016, and in 2017 the permitting process will continue. An updated resource and a feasibility study are planned.

At the Schaft Creek copper-molybdenum-gold-silver porphyry project, Teck Resources Ltd. (75%) and Copper Fox Metals Inc. (25%) re-logged 43,000 m of legacy core; the results might contribute to an update of the project’s mineral resource estimate. The project has been in the pre-application phase of Environmental Assessment since 2006. In 2016, the collection of baseline environmental data continued.

The Tulsequah Chief zinc-copper-gold project of Chieftain Metals Corp. has an Environmental Assessment certificate in place and Chieftain was actively seeking financing for the proposed mine. In 2016, Chieftain Metals Corp. and its wholly owned subsidiary Chieftain Metals Inc., (collectively Chieftain), were served with a receivership application by West Face Capital Inc., as agent for West Face Long Term Opportunities Global Master L.P., seeking the appointment of Grant Thornton Limited as receiver of all of the assets, undertakings and properties of Chieftain.

5.2. Northeast Region

5.2.1. Proposed coal mines

In 2016, HD Mining continued work on their Murray River project. A bulk sampling program was completed and engineering and environmental studies continued in support of a Mines Act permit application. At their Sukunka project, Glencore plc (75% interest) and JX Nippon Oil & Energy Corporation (25% interest), continued with engineering and environmental studies in support of a substituted Environmental Assessment application, which is under review. An open-pit mining operation is proposed with initial production of 1.5-2.5 Mt of saleable metallurgical coal per year, and a mine life of at least 20 years. Addition of a room-and-pillar underground mining component in a future mine plan would increase production to 6 Mt per year. Workforce requirements are estimated at about 250 jobs during construction, and 543 direct employees during operations (Jago, this volume).

5.2.2. Proposed industrial mineral mines

At the Wapiti East phosphate project, Fertoz International Inc. continued trenching to collect a permitted 17,500 t bulk sample. Refinement of the project design and a scoping study continued, as did compiling of information requirements for a Mines Act permit application.
5.3. North Central Region

5.3.1. Proposed metal mines

Taseko Mines Limited and subsidiary Aley Corporation Limited continued collecting environmental baseline data and geochemically characterizing ore, waste, and tailings for the Aley niobium project. This work is to support a substituted Environmental Assessment which remained in pre-application status throughout the year. Metallurgical test work continued with the aim of improving efficiency to help reduce projected costs. Capital expenditure, cumulative for the first three quarters, was $600,000.

At New Gold Inc.’s Blackwater gold and silver project, engineering and environmental studies continued in support of their Environmental Assessment which is under review. The project is proposed as an open-pit mining operation, with a 60,000 tonnes per day processing plant and a mine life of 17 years.

AuRico Metals Inc. continued to advance its proposed Kemeness Underground (KUG) copper-gold-silver block cave mine project. In March, AuRico announced the results of an updated feasibility study for the proposed underground panel cave mine with a single extraction level. An average production rate of nearly 25,000 tonnes per day would generate 4.01 t (129,000 ounces) gold and 23 Kt (52 million pounds) copper annually over the first five years. Total production during a 12-year mine life would be 43 t (1.4 million ounces) gold and 260 Kt (573 million pounds) copper and 140 t (4.5 million ounces) of silver (Jago this volume). The project entered the review stage of a Substituted (federally and provincially harmonized) Environmental Assessment in May and a certification decision is anticipated in early 2017.

5.3.2. Proposed industrial mineral mines

At their Giscome limestone property, Graymont Western Canada Inc. continues with the environmental review process. The Environmental Assessment application review process for the proposed quarry and lime plant was suspended in March to allow for consideration of proposed changes to the project. In July the process recommenced with the original project design. The initial phase of operations would comprise a 600 Kt per year limestone quarry and conveyor system that would feed a vertical lime kiln producing 600 tonnes of lime daily and 198 Kt 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. In 2016, formal Environmental Review of the project continued. 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.

Teck Resources Ltd. submitted plans to reopen the past-producing Bethlehem mine, which is two kilometres east of its Highland Valley Copper operations. In the past few years, Teck has defined 100 million tonnes of new ore at Bethlehem. If approved, the mine would produce additional feed its 140,000 tonne per day mill. A Mine Development Review Committee commenced formal review of the Bethlehem Phase 1 proposal in September. Engineering and feasibility studies continue.

The Bonanza Ledge mine saw limited production as an open-pit mine between March 2014 and June 2015. In December 2016, Barkerville Gold Mines Ltd. applied for a permit to mine the remaining resource by underground methods. The company hopes production can resume in 2017. The plan is to mine at a rate of ~500 tonnes per day (~150,000 tonnes per year) using a long-hole method with cemented rock fill.

The Harper Creek copper-gold-silver project is owned by Yellowhead Mining Inc. In 2015, the company suspended work on the project due to a lack of funds. The project remained on hold in 2016 while the company sought financing 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 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 the fall, Taseko submitted plans for a detailed site investigation of proposed mine infrastructure. If approved, work will start in 2017.

Ruddock Creek Mining Corporation (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.

Spanish Mountain Gold Ltd. continued baseline environmental studies at its Spanish Mountain gold project as the company prepares for formal environmental review. In 2016, the company commissioned engineering studies to evaluate if higher grade zones could support an alternative mine model with a 20,000 tonne per day mill and a 20-year mine life (in contrast to a previous estimate of 40,000 tonne per day and a 14 year mine life for the entire resource). As of April 2014, Measured and Indicated resources (using a cut-off grade of 2 g/t Au) are 237.8 Mt grading 0.46 g/t Au and 0.69 g/t Ag.

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 property. Work in 2016 consisted of drilling and environmental baseline studies. The project is in the pre-application stage of Environmental Assessment. If the proposed mine goes into production it would produce 2 Mt of coal annually, and have a mine life of 20 years, with a total
resource of about 39 Mt.

In 2015, Teck Coal Ltd. 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 2017.

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. In 2016, a preliminary prefeasibility study was updated with improved economics related to coal pricing, OPEX and CAPEX costs. Coal quality test work indicates that approximately 84% of the coal is hard coking coal, with the remainder as pulverized coal injection (PCI) coal.

The Michel Creek project of CanAus Coal Ltd., a wholly owned subsidiary of CoalMont Pty Ltd., is in the pre-application stage of Environmental Assessment. Drilling in 2016 focused on the Loop Ridge and Michel Head areas, with samples collected for coal quality testing. The project will use new techniques for treating selenium in the construction and operational phases of the project to comply with environmental targets identified in the Elk Valley Water Quality Plan. 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 the pre-feasibility engineering and design phases for the project.

5.5.3. Proposed industrial mineral mines

The Driftwood Magnesite property is owned by MGX Minerals Inc. In 2016 a NI 43-101 compliant resource estimate was released with updated results from their 2014 and 2015 drill programs. The company is working on a preliminary economic assessment. Additional drilling was carried out in the fall of 2016. 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 (MgCO3), and a silica by-product using reverse floatation techniques. The magnesite was shipped offsite for further processing to produce magnesium oxide (MgO) and magnesium metal (Mg). The company received a 20-year mine lease for quarry operations and are evaluating mine and process design options. They are also conducting environmental baseline work for their quarry application.

CertainTeed Gypsum Canada Inc. continued to advance the proposed Kootenay West project, which entered the pre-application stages of Environmental Assessment in 2014. The mine will have an average production rate of 400,000 t per year, over a 42-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. In 2016, the company focused on environmental work and mine design, with two pits (North and South). The projected start-up date for the mine is in 2018.

5.6. Southwest Region

5.6.1. Proposed industrial mineral mines

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 bargeing 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.

Ballinteer Management Inc. now holds the property comprising the Sechelt Carbonate project. They filed engineering, archeological, and baseline environmental studies for assessment in 2016. After a period of quiescence, Ballinteer indicates 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 limestone, dolostone, and gabbroic rock for potential use as aggregate.

6. Exploration expenditures

In 2016, exploration expenditures, drilling estimates, and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey, which replaces the annual Ministry of Energy and Mines mineral exploration expenditures 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. The new survey does not capture exploration expenditures for aggregates, which had previously been done for the Southwest region only. Previous surveys also assigned expenditures to a predominant category for a program, for example, grassroots. The new survey allowed respondents to partition expenditures as a percentage, for example grassroots 60%, advanced 40%. For details see Ernst & Young LLP, 2017, British Columbia Mineral and Coal Exploration Survey 2016 Report, which can be downloaded from (http://www.ey.com/ca/en/industries/mining---metals/bc-mineral-and-coal-exploration-survey).

Total metal, industrial mineral and coal exploration expenditures are estimated at $205 million for 2016, down $67 million from the 2015 survey total of $272 million. Of this, $38.5 million was contributed by coal projects and $166.5 million by metal and industrial mineral projects (Fig. 5). Exploration expenditures by region for 2016 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). Although not directly comparable due to the new collection methods, it is worth noting that in the 2015 survey, grassroots and early-stage exploration represented 14.7% of the total exploration expenditures, whereas the 2016 survey estimates the value at 27.5%.

The total reported metres drilled for the province was 290,702 (see Fig. 14 for regional breakdown).
Fig. 5. Total exploration expenditures, metals plus other expenditures, and coal expenditures by year.

Fig. 6. Exploration expenditures by region (Ernst and Young LLP and MEM survey).

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.

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

Fig. 12. Southeast Region exploration expenditures by exploration category.
7. Exploration land tenure

Acquisition of new mineral claims in 2016 was up slightly compared to 2015 (Fig. 15). The total for 2016 was 1,167,303 hectares vs. 930,981 hectares for the previous year. New coal licenses issued in 2016 totalled 105,991 hectares, up from the 2015 total of 70,806 hectares (Fig. 16).

8. Selected exploration project highlights

Although exploration expenditures were lower in 2016, 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. Survey data suggest that grassroots and early stage projects may have increased. Below, selected exploration projects are grouped by project type and region (Table 7). A more comprehensive list of selected exploration projects active in 2016 are described in the individual regional sections of this volume.

8.1. Precious metal projects

8.1.1. Northwest Region

In the first half of 2016, an increase in the price of gold increased interest in gold exploration in the Northwest Region. Outside of the Brucejack proposed mine area, evaluation of the surrounding 1,200 km² of mineral claims by Pretium Resources Inc. continued (Brucejack Regional). Work in the last two years included airborne geophysical surveys and regional sampling. In 2016, the regional program focussed on an area about 20 km southeast of the mine project. New work included additional airborne magnetic, radiometric and hyperspectral surveys. Ground work included magneto-telluric geophysical surveys, property-scale mapping, prospecting, and diamond drilling.

The Clone gold property is owned by Makena Resources Inc. 50%, Silver Grail Resources Ltd. 25% and Teuton Resources Corp. 25%. In 2016, seven diamond drill holes with lengths reported to range between 38 and 137 m were completed. Reported assay results for the first hole included 6.43 metres grading 17.83 g/t Au.

The Iskut project is owned by Seabridge Gold Inc. The project was obtained through the acquisition of SnipGold Corp. by Seabridge in June of 2016. Seabridge carried out an exploration program consisting of 3,368 m of diamond drilling in thirteen holes, a magnetotelluric (MT) survey, hyperspectral imagery acquisition, prospecting, geological mapping, and legacy data compilation, including core re-logging. Results are anticipated to be applied to a much larger 2017 exploration program.

Ascot Resources limited carried out over 69,000 m of diamond drilling on their Premier project with numerous holes returning high-grade gold and silver values. Highlight intersections include 125.50 g/t Au over a core length of 1.50 metres within a broader interval grading 13.71 g/t Au over
Table 7. Selected exploration projects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Region</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bow</td>
<td>Northwest</td>
<td>Decade Resources Ltd.</td>
<td></td>
<td>Au, Ag, Co in quartz veins</td>
<td>Chip and grab sampling, diamond drilling.</td>
<td>Highlight drilling results included 6.09 m of 17.17 g/t Au, 47.27 g/t Ag and 0.165% Co and 5.80 m of 21.18 g/t Au, 48.81 g/t Ag and 0.227% Co.</td>
<td></td>
</tr>
<tr>
<td>Brucejack Regional</td>
<td>Northwest</td>
<td>Pretium Resources Inc.</td>
<td>103P 251</td>
<td>Au, Ag, Zn, Cu; Precious metal veins, VMS</td>
<td>Diamond drilling, geological mapping, rock sampling (4,500), hyperspectral imagery, geochronology, geophysics (Magnetotelluric, magnetics, radiometrics).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clone</td>
<td>Northwest</td>
<td>Makena Resources Inc.</td>
<td>103P 251</td>
<td>Au, Ag, Cu, Co; Au; precious metal veins</td>
<td>Diamond drilling (7 holes), rock sampling.</td>
<td>Reported assay results for the first hole included 6.43 metres grading 17.83 g/t Au from 46.33 to 52.76 metres downhole.</td>
<td></td>
</tr>
<tr>
<td>Dolly Varden</td>
<td>Northwest</td>
<td>Dolly Varden Silver Corporation</td>
<td>103P 188</td>
<td>Ag, Zn; Noranda / Kuroko massive sulphide,</td>
<td>I: 3.073 Mt at 321.6 g/t Ag; In: 898,500 t at 373.3 g/t Ag</td>
<td>Diamond drilling (~2,311.6 m, 13 holes), mapping, prospecting, soil sampling.</td>
<td>Drilling highlights included 19.4 m grading 485 g/t Ag.</td>
</tr>
<tr>
<td>GJ</td>
<td>Northwest</td>
<td>Skeena Resources Limited</td>
<td>104G 034</td>
<td>Cu, Au; calc-alkalic - porphyry</td>
<td>M+I: 133.670 Mt at 0.32% Cu + 0.36 g/t Au; Inf: 53.69 Mt at 0.26% Cu + 0.330 g/t Au</td>
<td>Diamond drilling (2,872 m, 8 holes), prospecting, legacy data compilation, camp rebuild.</td>
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</tr>
<tr>
<td>Iskut</td>
<td>Northwest</td>
<td>Seabridge Gold Inc.</td>
<td>104B 107</td>
<td>Au, Ag; intrusion related, calc-alkalic porphyry</td>
<td>24 kt at 11.3 g/t Au, 22 g/t Ag, 0.23% Cu (Johnny Mtn)</td>
<td>Diamond drilling (3,368 m in 13 holes), MT geophysics, hyperspectral imagery, geological mapping, prospecting, legacy data compilation, reclamation.</td>
<td></td>
</tr>
<tr>
<td>Kirkham</td>
<td>Northwest</td>
<td>Metallis Resources Inc.</td>
<td>104B 079</td>
<td>Au, Cu; calc-alkalic porphyry and Au; Ag; intrusion related</td>
<td>VTEM/magnetic/radiometric survey carried out.</td>
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<tr>
<td>Company</td>
<td>Region</td>
<td>Exploration subdued</td>
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<tr>
<td>KSP</td>
<td>Northwest</td>
<td>Colorado Resources Ltd.</td>
<td>104B 111 and 104B13</td>
<td>Au, Cu; calc-alkaline porphyry and Au, Ag; intrusion related</td>
<td>Diamond drilling (6 holes (2 at Tami, 4 at Khyber)) geological mapping, prospecting, rock sampling, and ground magnetics. Drilling highlight results at Inel included one meter grading 138.5 g/t Au and broader intercepts including 25.7 m averaging 9.24 g/t Au.</td>
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<tr>
<td>Ootsa</td>
<td>Northwest</td>
<td>Goldreach Resources Ltd.</td>
<td>093E 105</td>
<td>Cu, Au; calc-alkaline porphyry</td>
<td>Prospecting, soil sampling, geology, (Troitsa target area). PEA release March 2016. Sampling at Troitsa returned up to 4.78% Cu and 96.9 g/t Ag.</td>
<td></td>
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<tr>
<td>Premier</td>
<td>Northwest</td>
<td>Ascot Resources Ltd.</td>
<td>104B 044</td>
<td>Au, Ag; Au in quartz veins</td>
<td>Diamond drilling (69,123 m in 279 holes). Highlight intersections include 125.50 g/t Au over a core length of 1.50 meters within a broader interval grading 13.71 g/t Au over 14.80 meters.</td>
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</tr>
<tr>
<td>Pyramid</td>
<td>Northwest</td>
<td>OK2 Minerals Ltd.</td>
<td>Cu, Au; calc-alkaline porphyry</td>
<td>RC drilling (2000 m, 5 holes), geological mapping, prospecting, soil sampling, ground geophysics (IP), corporate. Grab samples graded up to 82.96 g/t Au (zone 37), 0.15% Cu and 0.18 g/t Au (Chili zone).</td>
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<tr>
<td>Scottie</td>
<td>Northwest</td>
<td>Rotation Minerals Ltd. 80%, Red Eye Resources Ltd. 20%</td>
<td>104B 034</td>
<td>Au, Ag; Au in quartz veins</td>
<td>Diamond drilling, prospecting. Drilling highlights included 1.13 m of 31.54 g/t Au.</td>
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<tr>
<td>Snip</td>
<td>Northwest</td>
<td>Skeena Resources Limited</td>
<td>104B 250</td>
<td>Au, Ag; Au in quartz veins</td>
<td>Diamond drilling (7,180 m in 28 holes), ground magnetics, corporate. Drilling highlight results included 33.07 g/t Au over 2.4 m for the Lamp Zone, 16.24 g/t Au over 13.5 m for the 200 Footwall Zone and 16.01 g/t Au over 4.7 m at the Twin West structural corridor.</td>
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<tr>
<td>Spectrum</td>
<td>Northwest</td>
<td>Skeena Resources Limited</td>
<td>104G 036</td>
<td>Au, Cu; Au in quartz veins, high k calc-alkaline porphyry</td>
<td>Ind: 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)</td>
<td>Diamond drilling (6,826 m, 24 holes), mapping, prospecting, soil sampling, ground magnetics, maiden resource established.</td>
<td></td>
</tr>
<tr>
<td>Surprise Lake</td>
<td>Northwest</td>
<td>Decoors Mining Corp.</td>
<td>104N 032</td>
<td>Au; Au in quartz veins</td>
<td>Trenching, sampling. Five 1 m trench samples of new bedrock gold discovery returned assays of 0.01, 6.89, 42.1, 3.05 and 0.15 g/t Au.</td>
<td></td>
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<tr>
<td>Location</td>
<td>Company</td>
<td>Metals/Mineralogy</td>
<td>Resource Size</td>
<td>Drilling Highlights</td>
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<tr>
<td>Thorn Northwest</td>
<td>Brixton Metals Corporation</td>
<td>Ag, Au; Subvolcanic</td>
<td>Inf: 7.4 Mt at 35.54 g/t Ag + 0.51 g/t Au + 0.13% Cu + 0.03% Pb + 0.59% Zn</td>
<td>Diamond drilling included 10 m of 3.61 g/t Au within 52 m of 0.94 g/t Au at the Outlaw zone and 1 m of 4.42 g/t Au within 3 m of 1.72 g/t Au at the Abelour zone.</td>
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<tr>
<td>Treaty Creek</td>
<td>Tudor Gold Corp.</td>
<td>Au, Ag; Epithermal high sulphidation</td>
<td>Diamond drilling (~3,765 m, 8 holes)</td>
<td>Drilling highlights included 54 m grading 1.12 g/t Au over 630 m.</td>
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<tr>
<td>Whiting Creek</td>
<td>Huckleberry Mines Limited</td>
<td>Cu, Mo; calc-alkaline porphyry</td>
<td>19.6 Mt at 8.17% Zn, 1.58% Pb, 13.6 g/t Ag, containing 1.6 Mt (3,540 Mlbs) Zn, 311 Kt (685 Mlbs) Pb, 267 t (8.6 Moz) Ag; Indicated</td>
<td>Diamond drilling.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Akie North Central</td>
<td>Canada Zinc Metals Corp.</td>
<td>Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>NI 43-101 technical report, resource estimate update, environmental baseline monitoring.</td>
<td>Highlights included 222.5 m of 0.91% Cu and 0.02% Mo</td>
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<tr>
<td>Cirque North Central</td>
<td>Teck Resources Limited (Cirque Operating Corp.)</td>
<td>Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>historic non NI 43-101 compliant: 28.38 Mt at 7.85% Zn, 2.17% Pb, 46.8 g/t Ag (North Cirque), indicated and inferred (Teck Corporation, 1995)</td>
<td>NI 43-101 technical report, resource estimate update, environmental baseline monitoring.</td>
<td></td>
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</tr>
<tr>
<td>Kemess East North Central</td>
<td>AuRico Metals Inc.</td>
<td>Cu, Au, Ag; Porphyry Cu:Mo:Au;</td>
<td>39.27 Mt at 0.40% Cu, 0.50 g/t Au, 1.99 g/t Ag, 0.008% Mo containing 157,650 t (347.55 Mlbs) Cu, 19.6 t (630 Koz) Au, and 78.1 t (2.53 Moz) Ag, 3.20 Kr (7.05 Mlbs) Mo, Indicated</td>
<td>Resource estimate update, core drilling (13 holes, 13,544 m; infill, expansion), metallurgical testwork.</td>
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</tr>
<tr>
<td>Kwanika North Central</td>
<td>Serengeti Resources Inc. (95%) Daewoo Minerals Canada Corp. (5%)</td>
<td>Cu, Au, Ag; Porphyry Cu:Mo:Au;</td>
<td>Central Zone pit: 101.5 Mt at 0.31% Cu, 0.32 g/t Au, 0.06 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; Indicated</td>
<td>Core drilling (2,446 m), ground geophysics (IP), resource estimate update, preliminary economic assessment update.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panorama North</td>
<td>North Central</td>
<td>Atrium Coal Panorama Inc.</td>
<td>104A 085, 104A 089</td>
<td>Coal; Anthracite</td>
<td>n/a</td>
<td>core drilling (1,180 m).</td>
<td>2016 drilling highlights: 6.85 m total coal (1.90 m thickest seam) to 326 m depth (DHPN-16-01); 9.87 m total coal (2.05 m thickest seam) to 260 m; (DHPN-16-02); 10.75 m total coal (2.30 m thickest seam) to 325 m; (DHPN-16-03); 11.80 m total coal (1.70 m thickest seam) to 269 m (DHPN-16-04).</td>
</tr>
<tr>
<td>Pie, Cirque East, Yuen (Pie Option properties)</td>
<td>North Central</td>
<td>Copper North Mining Corp.</td>
<td>094F 023; 094F 008; 094F 013</td>
<td>Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>n/a</td>
<td>core drilling (Pie; 1080 m), ground geophysics (gravity), geochemical sampling (rock, soil), mapping, prospection.</td>
<td>2016 drilling highlights: 1.87 m total coal (2.05 m thickest seam) to 260 m; (DHPN-16-02); 10.75 m total coal (2.30 m thickest seam) to 325 m; (DHPN-16-03); 11.80 m total coal (1.70 m thickest seam) to 269 m (DHPN-16-04).</td>
</tr>
<tr>
<td>Thor</td>
<td>North Central</td>
<td>Copper North Mining Corp.</td>
<td>094D 126</td>
<td>Cu, Au; Ag; Porphyry Cu+Mo+Au</td>
<td>n/a</td>
<td>core drilling, prospection.</td>
<td>2016 drilling highlights: 107.60 m at 0.14% Cu, 0.045 g/t Au (Thor East).</td>
</tr>
<tr>
<td>Cariboo Gold (Barkerville Mountain; Cow Mountain; Island Mountain)</td>
<td>South Central</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>093H 019</td>
<td>Au; Vein; replacement</td>
<td>Cow Mountain block (as of 2015-03-31; cut off 0.5 g/t Au): Indicated: 35.8 Mt grading 2.4 g/t Au (containing 2.8 Moz Au); Inferred: 27.5 Mt grading 2.3 g/t Au (containing 2.0 Moz Au)</td>
<td>Drilling to define resources at BC vein; Cow Mountain; Island Mountain; geochemical and geophysical surveys; explored regional targets.</td>
<td>Improved resource definition; discovery of new ore zones near mines; discovery of “Cariboo break” structural feature.</td>
</tr>
<tr>
<td>Fox (Ridley Creek; BN; BK; South Grid)</td>
<td>South Central</td>
<td>Happy Creek Minerals Ltd.</td>
<td>093A 259</td>
<td>W, Mo, Ag; Skarn</td>
<td>Ridley Creek zone (as of 2016-03-15; cut-off 0.1% WO3): Indicated: 505,000 tonnes grading 0.66% WO3; Inferred: 280,000 tonnes grading 0.456% WO3.</td>
<td>Drilling to delineate target areas and demonstrate continuity of mineralization; trenching; sampling.</td>
<td>Published first resource estimate for Ridley Creek zone. Improved geological models for BN and BK zones.</td>
</tr>
<tr>
<td>Gibraltar North</td>
<td>South Central</td>
<td>Taseko Mines Ltd.</td>
<td>093B 011</td>
<td>Cu, Mo; Porphyry</td>
<td>n/a</td>
<td>Drilling.</td>
<td>Intersected high grade Cu-Mo porphyry outside mining area.</td>
</tr>
<tr>
<td>Ike</td>
<td>South Central</td>
<td>Amarc Resources Ltd.</td>
<td>092O 025</td>
<td>Cu, Mo; Ag; Porphyry</td>
<td>n/a</td>
<td>Drilling; Geophysical surveys.</td>
<td>Extended mineralized zone.</td>
</tr>
<tr>
<td>Prospect Valley</td>
<td>South Central</td>
<td>Westhaven Ventures Inc.</td>
<td>092ISW 107; 111; 112</td>
<td>Au, Ag; Vein</td>
<td>North and South Discovery zones (as of 2012-01-11; cut-off 0.30 g/t Au): Indicated: 10.1 Mt grading 0.5 g/t Au, containing 166,000 troy oz Au.</td>
<td>Drilling; prospecting.</td>
<td>Extended mineralized zone; improved geological model. Drilling highlights included 95.8m of 0.70g/t Au, including 15m of 2.23g/t Au.</td>
</tr>
<tr>
<td>Thule (including Titan Queen; Embayment; Eric) (South Central)</td>
<td>South Central</td>
<td>Nicola Mining Inc.</td>
<td>092ISE 034; 035; 036</td>
<td>Cu, Au; Ag; Skarn; porphyry</td>
<td>n/a</td>
<td>Drilling.</td>
<td>Improved geological model.</td>
</tr>
</tbody>
</table>
Table 7. Continued.

<table>
<thead>
<tr>
<th>Company</th>
<th>Area</th>
<th>Host Society</th>
<th>Property Code</th>
<th>Deposit Type</th>
<th>++Location++</th>
<th>Exploration Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>May Mac</td>
<td>Southeast</td>
<td>Golden Dawn Minerals Inc.</td>
<td>082ESE 045, 116</td>
<td>Au-Ag-Pb-Zn+/+Cu; Cu-Au-Ag skarns, polymetallic veins, epithermal Au-veins</td>
<td>37,200 t grading 3.4 g/t Au, 342.8 g/t Ag, 2% Pb, 2% Zn</td>
<td>Drilling (17 DDH: 1,770 m); mapping; rock sampling.</td>
</tr>
<tr>
<td>Thor</td>
<td>Southeast</td>
<td>Taranis Resources Inc.</td>
<td>082KNW 030, 031, 060, 061</td>
<td>Ag-Pb-Zn+/+Au; polymetallic veins and breccia, stratiform volcanogenic massive sulphide</td>
<td>Indicated: 640,000 t grading 0.88 g/t Au, 187 g/t Ag, 0.14% Cu, 2.51% Pb, and 3.51% Zn; Inferred: 424,000 t grading 0.98% Au, 176 g/t Ag, 0.14% Cu, 2.26% Pb, and 3.2% Zn</td>
<td>Drilling; data compilation and updating geological modeling; acquisition of a test mill, and moved on site; environmental baseline studies.</td>
</tr>
<tr>
<td>Jersey- Emerald</td>
<td>Southeast</td>
<td>Margaux Resources Inc.</td>
<td>082FSW 010, 009</td>
<td>Pb-Zn-Ag+/+W, Au, Mo, Bi; stratiform replacement, skarn</td>
<td>Emerald-Dodger Tungsten: Measured and Indicated: 3.071 Mt grading 0.34% WO3; 0.028 Mt grading 0.1% Mo; Inferred 5.48 Mt grading 0.27% WO3, 0.481 Mt grading 0.1% Mo (2006 - 2015)</td>
<td>Dewatering underground workings at Emerald; channel sampling in the underground; drilling (800m); surface sampling; LiDAR surveys; data compilation and 3D geological modeling.</td>
</tr>
<tr>
<td>Whitewater</td>
<td>Southeast</td>
<td>Braveheart Resources Inc.</td>
<td>082FSW 222, 171</td>
<td>Au-Ag-Pb-Zn+/+Mo; polymetallic veins, Au-veins</td>
<td>Results on their bulk sample; Drilling (1500 m).</td>
<td>Bulk sample (354 kg) assayed 15.5 g/t Au; Drill core assays included 2.48 m of 3.29 g/t Au and 17.7 g/t Ag and 5.1 m of 2.13 g/t Au and 5.2 g/t Ag.</td>
</tr>
</tbody>
</table>
Northisle reported a new 7 square kilometre gold-in-soil anomaly associated with a new target areas. In particular, the soil survey delineated a geochemical and geophysical programs outlined significant surveying, and 1,645 m of diamond drilling in nine holes. The property. Work included the collection of 2,337 soil samples, 247 rock samples, 15.5 km of ground IP surveying, LiDAR mapping, and 247 rock samples, 15.5 km of ground IP surveying, LiDAR surveying, and 1,645 m of diamond drilling in nine holes. The geochemical and geophysical programs outlined significant new target areas. In particular, the soil survey delineated a new 7 square kilometre gold-in-soil anomaly associated with a near surface IP chargeability high anomaly at the Chivas zone. Drilling highlights included 10 m of 3.61 g/t Au within 52 m of 0.94 g/t Au at the Outlaw zone and 1 m of 4.42 g/t Au within 3 m of 1.72 g/t Au at the Abelour zone.

In 2016, Tudor Gold Corp. worked on the Treaty Creek project. Ownership is divided between Tudor Gold Corp. (60%), Teuton Resources Corp. (20%) and American Creek Resources Ltd. (20%). Work included a magnetotelluric survey that covered favorable areas identified by previous drilling and geophysical programs. The geophysical surveying was followed up with a 3,765 m eight-hole drill program. Highlights included 54 m grading 1.12 g/t Au within a broader zone of 0.53 g/t Au over 630 m.

### 8.1.2. South Central Region

Barkerville Gold Mines Ltd. advanced its Cariboo Gold project by: drilling the BC vein to define high-grade, mineable zones; drilling at Cow Mountain (site of former Cariboo Gold Quartz mine) to define a bulk-mineable resource; drilling at Island Mountain (site of former Mosquito Creek and Aurum mines) to define a bulk-mineable resource; planning an underground mine beneath the Bonanza Ledge open pit; and testing early-stage exploration targets across an expanded block of claims and a newly-identified, 60-kilometre structural trend called the ‘Cariboo Break’. This is by far the biggest exploration project in the region. Approximately 70,750 m were drilled in 2016, using four drill rigs. Drilling highlights included 14.59 g/t Au over 10 m and 10.02 g/t Au over 22.20 m, including 13.01 g/t Au over 11.50 m at Cariboo. Newly discovered zones at Island Mountain returned 52.62 g/t Au over 3.25 m and 16.08 g/t Au over 7.10 m.

In February 2016, Westhaven Ventures Inc. increased its interest in the Prospect Valley project from 70% to 100%, taking over the property from Berkwood Resources Ltd. In 2016, Westhaven carried out a program of re-logging old core, prospecting, soil sampling, mapping, geophysical surveys, and drilling (8 holes; ~1,500 m). The focus was on the Discovery trend and offsets to it. Prospecting led to the discovery of new targets, such as the Ridge and Southeast Extension.
zones, which have gold-bearing quartz stockworks. Drilling targeted the Early Fault Zone, on the southern side of the South Discovery zone, and the Southeastern Extension zone, seeking higher grade mineralization that can occur deeper in epithermal systems. Drilling highlights included 95.8 m of 0.70 g/t Au, including 15 m of 2.23 g/t Au.

8.2. Porphyry (Cu-Au, Cu-Mo, Mo) projects

8.2.1. Northwest Region

Metallis Resources Inc. carried out a VTEM/magnetic/radiometric airborne survey on their Kirkham project. The survey was carried out on parts of their property not covered by the same survey methods in 2013. Results will be integrated and interpreted to design a 2017 exploration program, which includes drilling.

The KSP property is under option to Colorado Resources Ltd. from Seabridge Gold Inc. In 2016 Colorado’s exploration program included rock and soil sampling, geological mapping, induced polarization and magnetic ground surveys, an airborne VTEM survey, and 8,862 m of diamond drilling in 59 holes. Drilling (53 holes) focussed around the former Inel underground workings. Drilling highlight results include one metre grading 138.5 g/t Au and broader intersections including 25.7 m grading 9.24 g/t Au.

The Ootsa copper-gold-molybdenum-silver project is owned by Gold Reach Resources Ltd. Gold Reach released an updated resource estimate and Preliminary Economic Assessment (PEA) for the Ootsa project in March 2016. The PEA envisioned a toll-milling scenario whereby material would be milled and processed on a fee-basis at the Huckleberry mine facility. No agreements are in place to conduct toll-milling of Ootsa mill-feed at the Huckleberry facilities. The PEA presents initial details of a conventional pit and shovel mining operation at the East and West, Ox and Seel deposits. Ground work on the Ootsa project in 2016 included evaluating the Troitsa Peak prospect area, about 8 km south of the Seel deposit. An alteration system of strong argillic replacement and silicified breccia zones of approximately 250 m by 1,700 m has been identified. Forty-seven rock outcrop and float samples were collected and returned anomalous gold-silver grades up to 1.4 g/t Au and 197 g/t Ag. A sample described as high grade returned values of 4.78% Cu and 96.9 g/t Ag. Follow up work is planned for 2017.

The Pyramid gold-copper project is owned by OK2 Minerals Ltd. A 2016 work program included geological mapping, rock sampling, prospecting, and reconnaissance reverse circulation (RC) drilling. Two new zones of gold mineralization were discovered (Zone 3 and the Chili zone). Grab samples from zone 37 returned assays up to 82.96 g/t Au. The Chili zone is a 15 km² alteration assemblage from which rock samples graded up to 0.15% Cu and 0.18 g/t Au. The RC drilling was carried out on the known West zone and results will be used to prioritize areas for follow-up diamond drilling in 2017.

The Spectrum-GJ gold-copper project(s) of Skeena Resources Limited contain two separate mineral resources (Spectrum and GJ) that will be combined in a NI 43-101 Preliminary Economic Assessment, expected to be released in April, 2017. In 2016, Skeena drilled 2.872 m in 8 holes at the GJ Donnelly deposit, and 6,279 m were drilled in 22 holes at the Spectrum Central Zone. The drilling was carried out to collect samples for metallurgical test work and to better define the resource in planned mining areas. Highlights included 180 m grading 0.55 g/t Au and 0.15% Cu, including 73 m grading 0.97 g/t Au and 0.26% Cu at Spectrum. Results for the GJ Donnelly deposit are pending.

Huckleberry Mines Ltd. carried out a small exploration program on the Whiting Creek prospect, about 8 kilometres from the Huckleberry mine processing plant. Three diamond-drill holes tested the edges of the Creek zone, one of three known zones of mineralization at Whiting Creek. All three holes intersected copper mineralization with WC16-01 intersecting 70.1 m of 0.39% Cu and 0.02% Mo (from surface), WC-16-02 intersecting 222.5 m of 0.31% Cu and 0.02% Mo (from near surface), and WC16-03 intersecting 152.4 m of 0.25% Cu and 0.02% Mo (starting at a depth of about 185.0 m). The drilling shows that the Creek zone is open to the west, and has potential to have higher grades, as the intercept in WC16-01 included a 36.6 m intersection of 0.57% Cu.

8.2.2. North Central Region

The Kemess East copper-gold property of AuRico Metals Inc. is 1 kilometre east of AuRico’s KUG deposit. In 2016, a 13-hole (18,544 m) drilling program was carried out. Drilling targeted the existing resource and high-grade core for infill and step-out expansion, and also refinement of the geological model through better delineation of key faults. Except for one abandoned hole, all drilling intersected mineralization, including a 628 m interval grading 0.53 g/t Au, 0.41% Cu, 2.07 g/t Ag, and 0.005% Mo. Metallurgical test work on drill core is planned.

The Kwanika property is owned by Serengeti Resources Inc. (95% interest) and Daewoo Minerals Canada Corp. (5%). In 2016, Serengeti Resources completed a deep-penetrating ground IP survey line that confirmed a modeled strong IP chargeability anomaly from a previous survey. A three-hole deep-drilling program followed to test the lateral continuity of the supergene enrichment in the known Central Zone high-grade core, and to test for extensions along its down-dip edge to the north and to greater depth into the chargeability anomaly. Results included a 438-m long mineralized intersection in the Central Zone grading 0.71% copper, 0.83 g/t gold, and 2.0 g/t silver, and a 58 m intersection grading 0.26% Cu and 0.29 g/t Au at the bottom of a hole that tested the down-dip northwest edge of the Central Zone. As well, anomalous copper-gold mineralization in strongly altered andesite was encountered over a 246 m intersection. This potentially represents a downthrown structural block 500 m to the north of the Central Zone above the deep chargeability anomaly. In November, an updated resource estimate was released for the Central Zone (Indicated and Inferred, pit constrained and underground components at
0.13% and 0.27% CuEq cut-offs) and South Zone (Inferred, pit constrained). It includes a high-grade domain in the Central Zone of 57.7 Mt grading 0.48% Cu, 0.55 g/t Au, and 1.43 g/t Ag at a 0.40% CuEq cut-off. The 2016 drilling was incorporated into the resource estimate. The release of a revised Preliminary Economic Assessment is planned for 2017.

In 2016, work was carried out on the Thor property of Copper North Mining Corp. (under option from Electrum Resources Corp.). Work included diamond drill testing of two target areas on the western flank of the north-south trending McConnell Range and adjacent valley. The Thor East target in the uplands is defined by potassic alteration and mineralization in outcrop coincident with local aeromagnetic highs. Drilling highlight results included 107.60 m of 0.14% Cu and 0.045 g/t Au at the Thor East target.

8.2.3. South Central Region

In August 2016, Taseko Mines Limited announced acquiring more than 2,400 acres of mineral claims, adjacent to existing claims but outside current mining areas for the Gibraltar mine. The Gibraltar North claims are 2 kilometres northwest of the Extension zone (part of Gibraltar mine’s current resources). Decades ago, exploration found geophysical anomalies characteristic of porphyry mineralization. Drilling in 1992 intersected 0.4-0.9% copper over 80-100 m. In September 2016, Taseko released results from a single hole drilled in 2015 that confirmed previous results. The hole intersected ~150 m of ~0.4% copper, within which was an interval of 73 m of 0.68% copper. In the Fall Taseko commenced a six-hole, 4,500 m drill program. Results are pending. The company’s exploration target is a possible high-grade core to known porphyry mineralization.

Amarc Resources Ltd. continued drilling their Ike property. The program was financed through an option agreement with Centerra Gold Inc. The principal target is copper-molybdenum-silver porphyry mineralization in an extensive alteration zone on the eastern side of the Coast Plutonic Complex. The 2016 drilling program (3 holes; 1,900 m) helped define the southern part of the deposit and included a step-out hole some 800 metres to the west. All holes encountered mineralization. The two southern holes intersected long intervals with copper-molybdenum-silver values that are comparable to other BC porphyry deposits. The step-out hole intersected lower grade copper and molybdenum over its ~480 m length. As defined by drilling to date, the main zone at Ike covers an area of 1200 m east-west, 1000 m north-south, and extends to depths of more than 500 m. It remains open to expansion laterally and to depth. Drill intersections in the main zone range up to ~600 m grading ~0.3% Cu, ~0.03% Mo and ~2 g/t Ag. Other work in 2016 included 77 km of induced polarization on four nearby targets, talus sampling, and regional geological mapping. The company plans extensive drilling in 2017 to delineate known mineralization and to test early stage targets on nearby claims.

Nicola Mining Inc. carried out a diamond drilling program (1,084 m in five holes) on their Thule copper property, which surrounds the main pit of the past-producing Craigmont mine. Highlight results included 1.11% Cu over 85.92 m. The company also plans to evaluate Craigmont’s low-grade 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% Cu.

8.2.6. South Coast Region

The North Island project of Northisle Copper and Gold Inc. consists of two separate deposits (Hushamu and Red Dog) that are approximately 7.5 kilometres apart. 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 205,600,000 t 0.18% Cu, 0.26 g/t Au, 0.008% Mo and 0.38 ppm Re. In 2016, Northisle carried out a drilling program at Red Dog which, at a 0.20% Cu cut off, has an updated resource estimate of 23.6 Mt at 0.32% Cu, 0.46 g/t Au and 0.007% Mo in the Indicated category and 848,000 t at 0.23% Cu, 0.33 g/t Au and 0.003% Mo Inferred. An ongoing preliminary economic assessment includes both Red Dog and Hushamu deposits.

8.3. Polymetallic base and precious metal projects

8.3.1. Northwest Region

Decade Resources Ltd. has an option agreement by which they can earn an 80% interest in the Bow project. In 2016, Decade carried out chip sampling and diamond drilling. Highlight drilling results included 6.09 m of 17.17 g/t Au, 47.27 g/t Ag and 0.165% Co and 5.80 m of 21.18 g/t Au, 48.81 g/t Ag and 0.227% Co.

The Dolly Varden silver project is owned by Dolly Varden Silver Corporation. In 2016, Dolly Varden carried out surface mapping and sampling and completed 2,311 m of diamond drilling in 13 holes. Diamond drilling was carried out on the Torbit deposit and in the Ace-Galena area. Drilling at Torbit intersected multiple mineralized zones including 2.0 m of 2,488.5 g/t Ag within a broader intersection of 19.4 m grading 485 g/t Ag. Drilling at Ace-Galena extended known mineralized horizons 300 m along strike and results included 3.25 m of 405.77 g/t Ag, 0.12% Pb and 0.16% Zn within a broader intercept of 66.46 m of 59.97 g/t Ag, 0.12% Pb and 0.10% Zn.

8.3.2. North Central Region

The Akie property of Canada Zinc Metals Corp. and subsidiary Ecstall Mining Corp. (100% owned) includes the Cardiac Creek baritic zinc-lead-silver SEDEX deposit. In 2016, a NI 43-101 technical report was released with an updated resource estimate for the Cardiac Creek deposit that incorporates infill and step-out drilling carried out since 2012. This drilling focused on the central, high-grade part of the deposit and refinement of the deposit model. The resource, a continuous zone at a 5% zinc cut-off grade, increased by 55% in the Indicated category from the previous 2012 estimate with little change in average grade; it now stands at 19.6 Mt grading
8.17% Zn, 1.58% Pb, and 13.6 g/t Ag. The additional Inferred resource, now 29% of the total, is 8.1 Mt grading 6.81% Zn, 1.16% Pb, and 11.2 g/t Ag. Environmental baseline monitoring and review of plans for permitted underground exploration via a ramp decline to about 500 m below surface continued.

The Cirque property is owned by the Cirque Operating Corporation, which is a joint venture partnership between Teck Resources Limited (50% interest) and Korea Zinc Company, Ltd. (50% interest). The property includes the South Cirque, North Cirque, and Cardiac Creek deposits. In 2016, developing and refining drill targets continued as part of a multi-year exploration program that has integrated airborne gravity gradiometry (AGG) and Versatile Time Domain Electromagnetic (VTEM) geophysics, targeted ground gravity geophysics, soil and rock geochemical sampling, geologic mapping, and prospecting. Drilling in 2016 focused on the R-Creek target about 1 kilometre northwest of North Cirque deposit. As well, property-wide baseline environmental monitoring continued.

The Pie Option properties (Pie, Cirque East and Yuen) are under option from Canada Zinc Metals Corp. by the Cirque Operating Corporation. In 2016, five high-priority target areas on Pie and Yuen were selected for focused exploration, and a target about one kilometre west and down-dip of historic drilling and trenching in the Pie Main area was drilled. Baseline environmental monitoring for the Pie, Cirque East and Yuen properties continued.

8.3.2. Southeast Region

Taranis Resources Inc. continued drilling at the Thor property, which is composed of several targets and showings, including the True Fissure, Great Northern, Broadview, and Blue Bell past-producing mines. Their 2016 program included 2,100 m of drilling on several targets, and further sampling and mapping.

Braveheart Resources Inc. continued exploration work at their Whitewater property. Early in the year they released the results for a bulk sample taken in 2015. The 354 kg sample assayed 15.5 g/t Au. They also carried out a 10-hole 582.5 m diamond drilling program. Highlight results included 2.48 m of 3.29 g/t Au and 17.7 g/t Ag and 5.1 m of 2.13 g/t Au and 5.2 g/t Ag. In October it was announced that an additional 500 m follow-up drilling program was being carried out.

8.4. Skarn projects

8.4.1. South Central

At the Fox tungsten skarn property, Happy Creek Minerals Ltd. continued to define the extent, grade, and continuity of tungsten mineralization. In March 2016, the company released its first NI 43-101 compliant resource estimate for the Ridley Creek deposit and in June updated this report with metallurgical data from a 450 tonne sample. Resources stand at 505,000 t WO3 (Indicated) and 280,000 t WO3 (Inferred) with a 0.1% WO3 cut-off.

Exploration in 2016 focused on four targets (BK; Ridley Creek; BN; South Grid) with a program of geological mapping, trenching, and drilling (28 holes; ~2,330 m). Three of seven holes drilled at BK, near hand-dug trenches, returned values of ~0.7% WO3 over 2 to 6 m intersections. Ten holes drilled at the Ridley Creek zone were designed to expand the existing resource. One hole on the northern edge of the deposit returned ~8.5 m grading ~1.1% WO3. At the BN zone, one hole returned ~4 m of ~5% WO3, which compared favourably with previous drill results. The company believes these tungsten values may represent a higher grade zone (currently 100 by 150 m) within a larger, lower grade deposit some 1,000 by 1,500 m in extent. The company plans more work to define trenching and drilling locations.

8.4.2. Southeast Region

Golden Dawn Minerals Inc. began drilling at their May Mac gold-silver-lead-zinc project in 2015, and continued their drill program in 2016. Drilling tested down dip and step-out extensions of the main mineralized vein, and intersected similar zones with iron, lead, and zinc sulphides. Drilling highlights included 4.4 m grading 218.6 g/t Ag, 2.49 g/t Au, 1.5% Pb, 2.9% Zn; 2.1 m grading 185.9 g/t Ag, 3.50 g/t Au, 1.5% Pb, 1.8% Zn and the discovery of a new silver zone returning 2.3 m grading 152.0 g/t Ag, 0.36 g/t Au, 1.9% Pb and 1.9% Zn. Bulk sampling and further underground drilling is planned for 2017. They also entered into an agreement with Huakan International Mining Inc. to acquire the idle Lexington mill (200 tpd gravity-flotation processing facility) and the former Lexington and adjacent Golden Crown underground Cu-Au mines.

Margaux Resources Ltd. continued work on their Jersey-Emerald project. The project area contains the historic Jersey and Emerald mines. In 2016, Margaux collected samples from a historic drift at Emerald that was discovered during a 2014 drilling program. Channel sampling results included 3.0 m grading 14.15% Zn, 9.30 Pb, 4.18 g/t Ag; 3.0 m grading 11.6% Zn, 23.21% Pb, 2.99 g/t Ag; 3.0 m 14.85% Zn, 10.55% Pb, 2.32 g/t Ag; 3.8 m grading 11.45% Zn, 20.45% Pb, 3.22 g/t Ag; 0.9 m grading 11.35% Zn, 13.60% Pb, 4.40 g/t Ag and 2.7 m grading 14.65% Zn, 0.91% Pb, 0.49 g/t Ag. They also conducted surface sampling, completed a LiDAR survey over the property, worked on dewatering historic underground workings, and compiling historic data. In the fall they announced a planned 800 m drilling program.

A 2015 resource estimate for the Emerald is 3.07 Mt grading 0.34% WO3 (measured and Indicated) with 5.48 Mt grading 0.273% WO3 (Inferred) using a 0.15% WO3 cut-off grade. The 2010 Jersey resource estimate included 1.9 Mt grading 4.1% Zn and 1.96% Pb (Indicated), and 4.98 Mt grading 3.37% Zn and 1.95% Pb (Inferred), using cutoff grades of 3.5%.

8.5. Coal Projects

8.5.1. North Central Region

In August, Atrum Coal NL entered into a joint exploration agreement with Japan Oil, Gas and Metals National Corporation (JOGMEC) for the Panorama North property. JOGMEC can
earn a 35% interest by investing $5 million over three years. Review of historic exploration results was followed by a four-hole drilling program in October. Multiple coal seams, including near-surface seams, were intersected; the thickest seam ranges from 1.70-2.30 m. Down-hole geophysical logging was also completed. Anthracite coal has metallurgical and specialty market industrial mineral applications.

9. Publicly 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 Association for 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 and Mines. 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. Projects in 2016 focused on deposit studies, exploration methods development, and regional synthesis and map compilation. Projects in the Nicola arc (Quesnel terrane) focused on mapping and establishing a stratigraphic and geochronologic framework to better understand the prolific porphyry deposits in the region. In northwest British Columbia, mapping in Stikine terrane, also with an exceptional porphyry mineral endowment, was in collaboration with the Geological Survey of Canada (GSC) through the second iteration of Geo-mapping for Energy and Mineral program (GEM 2). In association with the GSC fifth iteration of the Targeted Geoscience Initiative (TGI-5), BCGS is assessing the genetic relationship of ‘orogenic’ gold deposits along the Llewellyn fault system in northwest BC and continuing specialty metal studies in southwest BC. In recent years the BCGS has expanded and developed new mineral exploration methods. An important theme in 2016 studies was using indicator minerals as an exploration tool. 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 all which can be accessed through MapPlace. Since 1995, MapPlace, has provided open geoscience data and custom map-making tools to help assess the mineral potential of British Columbia, assist exploration, and guide investment decisions. The next generation of MapPlace, (MapPlace 2), was released in November 2016 at the BCGS Open House in Victoria. Relative to the original version, MapPlace 2 can be used on either a Mac or a PC, requires no plug-ins and works in most web browsers, has a simpler, more intuitive interface that is easy to use, accesses third-party base maps and imagery from sources such as Google, Bing Maps and OpenStreetMap, and displays province-level data at exceptional speeds. In contrast to other Canadian web map services, MapPlace 2 goes beyond simply displaying information. Databases are continuously updated and talk to each other, enabling users to conduct queries and generate custom results by connecting to current data from
many sources. MapPlace 2 is designed for anyone who wants to reduce the costs of accessing and analyzing geoscience data in British Columbia, including the mineral industry, resource planners, public safety agencies, communities, First Nations groups, government, research organizations, and the general public.

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 collaborative effort 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 is industry-focused, with 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 many of the large 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

Although exploration expenditures were down compared to 2015, 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.

Eight metal mines were in production at the start of 2016. This number dropped to seven as the Huckleberry mine went on care and maintenance in August. The Red Chris mine declared its first year of financial production, and metal mine development projects continued with the Brucejack and Silvertip projects. The Quinsam underground coal mine went on care and maintenance in early 2016. In the Northeast Region mining restarted at the Brule coal mine.
Exploration and mining in the North Central and Northeast regions, British Columbia

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1. Introduction

The North Central (Omineca) Region has subdued to mountainous physiography and varied geology reflecting a history of volcanic arc and oceanic terrane accretion onto the western margin of ancestral North America followed by episodes of mountain-building, post-accretionary volcanism and sedimentation, regional transient faulting, and glaciation. The Omineca Mountains cover much of north-central British Columbia, west and northwest of the town of Mackenzie (Figs. 1, 2). Rocks of the region are prospective for metals including copper, molybdenum, gold, silver, zinc, lead, nickel, niobium, rare-earth elements, for anthracite coal, and for other industrial, construction and ornamental minerals including silica, limestone, aggregate, and nephrite jade. The main ore deposit types explored for in 2016 (Figs. 1, 3) included epithermal gold-silver, porphyry copper-gold, and stratiform zinc-lead-silver. The Mt. Milligan open-pit copper-gold mine is the only operating mine in the region. It is in its third year of production and completed its ramp-up phase at the start of the year. The open-pit Endako molybdenum mine remained on care and maintenance status into a second year. Small-scale mining continued for nephrite jade north-northwest of Fort St. James. Along the tributaries of several rivers in the region, placer gold and sand and gravel operations were carried out. As of December, the number of notice-of-work applications for 2016 was over 30 for mineral (down about 25% from more than 40 in 2015); over 30 for sand-and-gravel (down about 25% from over 40 in 2015); and 70 for placer (up about 40% from close to 50 in 2015). About 1.40 million hectares or 8.86% of the region were under mineral claim; about 259,750 hectares under coal licence (117,350 ha) and coal licence applications (142,400 ha), or 1.64% of the region; and about 61,880 hectares under placer claim (59,420 ha) or placer lease (2460 ha) or 0.40% of the region.

In 2016, exploration expenditures, drilling estimates, and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey, which replaces the annual Ministry of Energy and Mines mineral exploration expenditures 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 North Central Region, exploration expenditures were estimated at 29.0 million dollars and exploration drilling was estimated at approximately 34,500 m (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017 in press).

In 2016, ramp-up activities were completed at the Mt. Milligan mine (Ceniterra Gold Inc.), environmental assessments continued for Kness Underground (AuRico Metals Inc.), Aley (Taseko Mines Limited), Blackwater (New Gold Inc.), and Giscome (Graymont Western Canada Inc.), NI 43-101 compliant technical reports with updated resource estimates were provided for Kness Underground and Kness East (AuRico Metals Inc.), and Lawyers (PPM Phoenix Precious Metals Corp.), and Atrum Coal Groundhog Inc. was permitted to obtain an underground bulk coal sample and use an existing railbed subgrade for access.

Drilling was undertaken for porphyry copper-gold at Kness East (AuRico Metals Inc.), Kwanika (Serengeti Resources Inc.), Later (ML Gold Corp., Pacific Empire Minerals Corp.), North Grid-Mt. Milligan (Ceniterra Gold Inc.), Q7a (Vale Exploration Canada Inc.), and Thor (Copper North Mining Corp.); for sediment-hosted zinc-lead-silver at Cirque and Pie (Teck Resources Limited); for anthracitic coal at Panorama North (Atrum Coal Panorama Inc.); and for amber-bearing coal at Bowron River.

The Northeast Region is underlain by continental platform and slope and foreland thin-skinned thrust and fold belt of the Northern Rocky Mountains. Bituminous coal, phosphate rock, and barite are the main exploration focus, although copper-silver quartz vein and stratiform zinc-lead deposit types are also prospective in areas. Aggregate is an important mineral product in the region, regularly used in the energy sector as roadwork and well-site construction material, and more recently as material for the $8.8 billion Site C Clean Energy Project (BC Hydro) project, which began construction in summer 2015 and is scheduled for completion in 2024. Metallurgical coal has been proportionately the largest of British Columbia’s mined export commodities in recent years in terms of mineral production value, ranging from about 40-60%. Roughly 15% of the province’s coal production was derived from the Peace River coalfield (Fig. 1) before challenging market conditions forced coal mines to...
Fig. 1. Mines and selected exploration projects, North Central and Northeast regions, 2016. Terranes from the BC digital geology map (Cui et al., 2015).
**Sedimentary and carbonate rocks**

- **Quaternary**
  - Quaternary cover or age unknown

- **Oligocene-Pliocene**
  - Coarse clastic rocks

- **Upper Cretaceous - Eocene**
  - Undivided sedimentary rocks

- **Middle Jurassic - Middle Cretaceous**
  - Undivided sedimentary rocks

- **Triassic - Lower Jurassic**
  - Undivided sedimentary rocks

- **Upper Proterozoic - Silurian**
  - Limestone, dolomite, marble, calcareous sedimentary rocks

- **Triassic - Lower Jurassic**
  - Undivided sedimentary rocks

- **Permian - Jurassic**
  - Limestone, marble, calcareous sedimentary rocks

**Volcanic rocks**

- **Miocene - Holocene**
  - Basaltic volcanic rocks

- **Cretaceous - Oligocene**
  - Mafic to felsic volcanic and volcaniclastic rocks

- **Jurassic**
  - Mafic to felsic volcanic and volcaniclastic rocks

- **Triassic**
  - Mafic to intermediate volcanic and volcaniclastic rocks

- **Upper Proterozoic - Permian**
  - Mafic to felsic volcanic and volcaniclastic rocks

**Plutonic rocks**

- **Cretaceous - Eocene**
  - Diorite to granite, monzodiorite to syenite

- **Jurassic**
  - Diorite to granite, monzodiorite to syenite

- **Triassic**
  - Diorite to granite, monzodiorite to syenite

- **Permian - Triassic**
  - Ultramafic intrusive rocks

- **Devonian - Permian**
  - Gabbro to diorite, monzonite to syenite

**Metamorphic rocks**

- **Cretaceous - Eocene**
  - Paragneiss, orthogneiss, migmatite

- **Upper Paleozoic - Jurassic**
  - Orthogneiss, paragneiss, greenschist, blueschist, lower amphibolite, serpentinite, greenstone

- **Proterozoic - Lower Paleozoic**
  - Paragneiss, orthogneiss, metasediments, greenschist, greenstone

**Faults**

- Thrust or reverse fault
- Normal fault
- Strike-slip fault, other

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Fig. 2. Bedrock geology of the North Central and Northeast regions with selected geographic domains and features. Map data were sourced in March 2015 from Cui et al. (2015). Fault abbreviations: ET = Eureka thrust fault, KF = Kechika fault, MM = Manson-McLeod fault system, NRMT = Northern Rocky Mountain trench, PF = Pinchi fault, PT = Pundata thrust, SF = Swannell thrust fault, TIF = Takla-Ingenika-Finlay fault system.
Fig. 3. Generalized stratigraphy, North Central and Northeast regions. Selected intrusive rocks: a) Brooks diorite complex and Stern Creek plutonic suite (Endako batholith), b) Endako batholith and Laidman batholith; c) Capoose batholith and Blackwater pluton; d) Chu pluton; e) Black Lake plutonic suite; f) Spike Peak intrusive suite; g) granodiorite plutons (unnamed suite); h) Hogem plutonic suite (Triassic-Jurassic); i) Hogem plutonic suite (Cretaceous) and Germansen Batholith; j) St. Marie plutonic suite; k) Bayonne plutonic suite; l) Wolverine Range plutonic suite; m) Aley carbonatite complex. Unit ages from Diakow et al. (1993, 1997), Ferri et al. (1994), Garnett (1978), Nelson and Bellocfontaine (1996), MacIntyre (1998), Schiarizza and MacIntyre (1998), Staples (2009), Stott (1984), Wetherup and Struik (1996), Villeneuve et al. (2001), and the BC digital geology map (Cui et al., 2015). VMC is Vanderhoof metamorphic complex. Mineral and coal deposit ages are from Evenchick and Thorkelson (2005), Logan and Mihalyuk, (2014), McLeish (2013), Nelson and Bellocfontaine (1996), New Gold Inc. (2015), and Pell (1994). Geologic timescale from International Commission on Stratigraphy (Cohen et al., 2013).
idle operations in 2013 and 2014. The low-ash, low-sulphur bituminous coal mined in the northeast is internationally recognized for producing high-quality coke, a key ingredient in steel making. In 2016, three of the idled coal mines entered a sale and investment solicitation process, attracting a number of potential bidders. In August, international spot prices for premium hard coking coal began making strong gains just as an asset purchase agreement was signed between Walter Energy Canada Holdings, Inc. and Conuma Coal Resources Limited. In September the sale was finalized and, by the end of the month, restart activities had begun at the Brule mine. There was negligible exploration activity for coal in the region in 2016.

The region has one active industrial mineral mine (Fireside) in the Liard Plain area (Fig. 2), which produces barite. Numerous aggregate quarries and sand-and-gravel pits are distributed along river valleys in the central and eastern part of the region.

As of December, the total number of notice-of-work applications for 2016 included six for coal (down 40% from 10 in 2015); and over 70 for sand-and-gravel (up about 40% from close to 50% in 2015). About 533,990 hectares, or 3.0% of the region, were under coal lease (28,730 ha), coal licence (397,030 ha), and coal licence applications (108,230 ha); and about 44,730 hectares, or 0.26% of the region, under mineral claim. For the Northeast Region, exploration expenditures were estimated at $9.0 million and exploration drilling was estimated at approximately 2,900 m (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017 in press).

In 2016, restart activities commenced at the Brule mine (Conuma Coal Resources Limited); the underground bulk coal sample program at Murray River (HD Mining International Ltd.) was completed; engineering and environmental studies continued at Murray River supporting a Mines Act permit application, and at Sukunka (Glencore plc), supporting an environmental assessment; and a NI 43-101 compliant technical report with updated resource estimate was reported for Wapiti River (Canadian Dehua International Mines Group Inc.)

Ridley Terminals Inc., the main port servicing the Peace River coalfield, reported continued reduction in throughput for the first half of 2016. Rail unloading volumes decreased year-on-year by 44.83% (Q1) and 13.91% (Q2), and ship-loading volumes by 45.83% (Q1) and 15.07% (Q2).

2. Geological overview

Metallogeny in British Columbia is 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 North Central-Northeast combined region is underlain by: 1) ancestral North America (Laurentia), including cratonic basement rocks and Mesoproterozoic to Early Mesozoic siliciclastic and carbonate successions deposited on its western flank; 2) the Intermontane belt, including the Slide Mountain terrane (back-arc basin) the Quesnel and Stikine volcanic arc terranes, which formed outboard of ancestral North America starting in the Late Paleozoic and then accreted by the Middle Jurassic, and Late Paleozoic-Early Mesozoic oceanic rocks of the Cache Creek terrane; 3) post-accretionary rocks; and 4) younger cover rocks (Figs. 1-3).

Two main episodes of mountain building occurred (Monger, 2008), forming the Columbia-Omineca-Cassiar mountains (Middle Jurassic-Early Cretaceous) and the Northern Rocky Mountains (Late Cretaceous-Paleogene). The first produced a continuous belt of polydeformed metamorphic rocks in the collision zone between the Intermontane terranes and the continent margin (Fig. 2), and the second is characterized by thin-skinned style deformation of Paleozoic cover rocks (e.g., Wright et al., 1994).

2.1. Ancestral North America

In the North Central and Northeast regions, Laurentian basement is unconformably overlain by Mesoproterozoic to Early Mesozoic continental shelf and deep-water marine siliciclastic and carbonate successions of the Western Canada Sedimentary Basin. These were deposited as a westward-thickening prism on the western cratonic margin of ancestral North America during protracted rifting and breakup of the supercontinent Rodinia (Fig. 3, Thompson, 1989; Nelson et al., 2013). Passive margin sedimentation ended in the Jurassic with orogenic activity related to terrane accretion. The oldest Mesoproterozoic rocks include dolomitic sedimentary units of the Muskwa basin (Muskwia assemblage, Figs. 2, 3), which host northeast-striking Churchill-type Cu-Ag quartz-ankerite veins spatially related to diabase dikes (MINFILE 094K 003) including those at the Key prospect.

In the Rocky Mountains north of Prince George, rocks of the Windermere Supergroup (Neoproterozoic) are represented by siliciclastic sedimentary units of the Misinchinka Group and their metamorphic equivalents (Ferri et al., 1994); south of Prince George are similar rocks of the Miette Group. The Gog Group (Lower Cambrian) unconformably overlies the Windermere Supergroup and consists predominantly of shield-derived sandstone, pebble conglomerate, quartzite and limestone.

In the Rocky Mountains north of Mackenzie, Early to Middle Paleozoic marine sedimentation is represented mainly by phylitic siltstone, shale, and carbonate units of the Kechika Group (Cambrian-Ordovician), Road River Group (Middle Ordovician-Middle Devonian) and Earn Group (Devonian-Mississippian). The highest peak in the Canadian Rockies, Mt. Robson (Fig. 2) exposes a succession of Middle-Upper Cambrian carbonate rocks correlative to the Kechika Group. East of Prince George, Nonda Formation (Silurian; Fig. 3) greenstone, limestone and quartzite, including that at the Longworth silica prospect, are found in a westernmost range of the Rocky Mountains (McGregor range). Farther east, in the Hart ranges and west of the Peace River coalfield (see section 2.3.5.), Middle Triassic phosphorite-bearing siltstones
of the Sulphur Mountain Formation (Spray River Group; Fig. 3), host of the Wapiti East phosphate prospect, represent off-self sedimentation in open marine conditions with upwelling currents (Butrenchuk, 1996). Portions of this belt of Proterozoic to Lower Mesozoic rocks are prospective for copper-silver quartz veins, sediment-hosted zinc-lead, Carlin-type gold deposits, carbonatite-hosted specialty metals, barite, silica (including frac sand), and phosphate.

The Kechika trough is the southeastern extension of the Selwyn basin of the Yukon and Northwest Territories, which hosts prolific sedimentary exhalatite (SEDEX) zinc-lead deposits of Cambrian, Silurian and Late Devonian age (Magnall et al., 2014). The trough is in the Northern Rocky Mountain fold and thrust belt (Muska ranges), bounded to the west by the Northern Rocky Mountain trench and to the east by the Macdonald platform (Fig. 2). Siliceous and carbonaceous shale of the Upper Devonian Gunsteel Formation (Earn Group) hosts stratiform baritic zinc-lead-silver deposits including those at Akie and Cirque. The host shales are preserved in a series of Cretaceous to Paleogene northwest-trending imbricate thrust sheets and asymmetric synclinal keels (MacIntyre, 1998). A series of northwest-trending elongate asymmetric graben systems, with more localized restricted sub-basins, would have formed during Paleozoic extension and marine transgression; basin bounding normal faults may have been reactivated during Cretaceous shortening (Henry and Theissen, 2014).

The Aley carbonatite complex (Late Devonian-Early Mississippian) also lies in the Muska ranges and it is hosted by Cambrian to Ordovician carbonate and siliciclastic rocks, including shelf carbonates of the Skoki Formation (Ordovician; Fig. 3). The complex is near the transition between shelf deposits of the MacDonald platform and deep-water deposits of the Kechika trough (Mäder, 1986; McLeish, 2011). Regionally, it lies within a belt of alkaline igneous rocks and carbonatites that follows the Rocky Mountain trench in BC (Pell, 1994; Millonig and Groat, 2013).

About 60 km east of the Kechika trough, a north-south trending regionally extensive belt in the Muska ranges hosts Mississippian Valley-type deposit prospects and showings in thrust-faulted and folded platformal dolomitic carbonate rocks, including the Muncho-McConnell Formation (Silurian-Devonian), and Stone and Dunedin formations (Lower to Middle Devonian; Fig. 3). Prospects, including Coral, are regarded as being coeval with Late Devonian SEDEX deposits farther west in the Kechika trough and are similarly associated with Devonian-Mississippian subduction in back-arc and intra-arc settings (Nelson et al., 2002).

The most outboard continental components of ancestral North America are the Cassiar platform and Kootenay parautochthonous terrane. Both originated as basement highs during Neoproterozoic to Cambrian fragmentation of Laurentia (Nelson et al., 2013). The Cassiar platform lies west of the Tintina-Northern Rocky Mountain trench fault; restoration of ca. 490 km of Cretaceous-Eocene dextral motion (Gabrielse et al., 2006) places it outboard of the southern Kechika trough. The oldest rocks are Paleoproterozoic to Mesoproterozoic, and include amphibolite facies metamorphic rocks and crystalline limestone along the Northern Rocky Mountain trench near Kwadacha (Cassiar platform; Fig. 1); and orthogneiss of the Malton Gneiss complex, which is the northernmost expression of the Monashee Mountains near Valemount (Kootenay terrane; see Katay, this volume). The Cassiar platform is underlain by rocks similar to the Windermere Supergroup and Lower Paleozoic carbonate and siliciclastic units that correlate with those of the MacDonald platform of ancestral North America. North of Mackenzie, these include rocks of the Ingenika Group (Neoproterozoic) and Kechika Group, whereas southeast of Prince George are the Kaza (Neoproterozoic), Cariboo (Neoproterozoic-Cambrian) and Gog Group (Ferri et al., 1994). West of the Cassiar platform, Laurentian basement is inferred to underlie allochthonous rocks at depth as far west as beneath the Cache Creek terrane (Nelson et al., 2013).

Triassic limestone sequences near Giscome are assigned to the North American margin and are interpreted as tectonic windows through overthrust Slide Mountain Group Mississippian-Permian basaltic volcanic units (Struik et al., 1990). South of Prince George, metasedimentary rocks of the Snowshoe Group (Neoproterozoic-Paleozoic) represent the northern extent of the Kootenay terrane. Cassiar platform rocks are locally prospective for argentiferous polymetallic veins, carbonatite-hosted specialty metals, limestone, and silica (including frac sand), whereas placer gold is the main focus of fluvial deposits that overly Kootenay terrane rocks.

2.2. Intermontane belt

In the North Central Region, the Intermontane belt (Fig. 1 inset) comprises a group of allochthonous terranes of the peri-Laurentian realm (Nelson et al., 2013) including volcanic arc terranes (Quesnel and Stikine), and structurally intervening oceanic terranes (Slide Mountain and Cache Creek).

2.2.1. Slide Mountain terrane

In Devonian-Mississippian time, eastward subduction of oceanic crust beneath ancestral North America led to back-arc extension and opening of the Slide Mountain ocean (Ferri et al., 1994). Its crust is preserved as imbricated allochthons structurally overlying the deformed continental margin. East and southeast of Prince George, the Antler Formation of the Slide Mountain Group (Mississippian-Permian; Fig. 3) includes pillowd basalt, basalt breccia, gabbro, diorite, argillite and chert. Northwest of Mackenzie, the Nina Creek Group (Mississippian-Permian) has marine sedimentary units, including chert and argillite, as well as basalt and gabbro. The terrane is bounded by strands of the Manson-McLeod fault system and the west-dipping Pundata thrust (Fig. 2).

2.2.2. Quesnel terrane

Volcanic island-arc rocks that originated outboard of ancestral North America in the Late Triassic to Early Jurassic (Nelson et al., 2013; Logan and Mihalynuk, 2014) extend along
strike for more than 600 km in the North Central Region. The Quesnel arc (Mesozoic) developed in two phases above an Upper Paleozoic volcanic-sedimentary subterrane assemblage (Ferri et al., 1994; Nelson and Bellefontaine, 1996). The Takla Group (Fig. 3) phase comprises a lower unit of deep-water basin sedimentary rocks, including the Slate Creek succession (Middle to Upper Triassic), which underlies placer mining activities in the Manson Creek area (Fig. 1) and is prospective for gold-bearing quartz veins. This is overlain by Upper Triassic mafic and intermediate island-arc volcanic successions that represent several discrete volcanic centres. Facies variability is reflected in local names. In the Nation Lakes area, fine-grained volcanioclastic rocks of the Inzana Lake succession, which host rock of the Fran prospect, interfinger with overlying volcanic rocks of the Witch Lake succession, partial host of the Mt. Milligan deposit. Farther north, equivalent successions are the Willy George and Plughat Mountain facies, the latter considered host of the Cat, Vega and Granite Basin prospects.

In some areas, these rocks are paraconformably overlain by partially subaerial intermediate volcanic rocks, including the Chuchi Lake and Twin Creek successions (Early Jurassic; Fig. 3), which were emplaced on a more mature arc. The Chuchi Lake succession hosts the Later and Q7a prospects. Suites within both volcanic phases are considered to have mildly alkaline, or shoshonitic, geochemistry (Barrie, 1993). Coeval with the Takla Group and Early Jurassic successions, the regional 180-km long north-northwest trending Hogem intrusive complex (Figs. 2, 3) and its peripheral offshoots locally host, or are spatially related to, porphyry copper-gold±silver±molybdenum deposits and prospects including Mt. Milligan, Kwanika, Cathedral, and Cat.

Petrogenesis of the Hogem intrusive suite was from more mafic to more felsic central phases, and from more weakly alkaline to sub-alcaline compositions from the Late Triassic to Early Cretaceous, with the exception of an Early Jurassic strongly alkaline phase that includes the Chuchi syenite and Duckling Creek syenite complex, known for being copper-gold prospective (Garnett, 1978; Bath et al., 2014; Devine et al., 2014). At its southern end, the intrusive complex bends towards the east-southeast, suggesting influence of a deep basement structure (Nelson and Bellefontaine, 1996), and the exploration projects Later, Chuchi, Q7a, SYL, Milligan West, North Grid, and the Mt. Milligan mine lie along this prospective trend.

Structurally, open upright northwest-trending kilometre-scale folds of probable Late Triassic to Early Jurassic age predominate, but basal slaty units exhibit tight folding (Nelson et al., 1990; Ferri et al., 1994). The Quenel Terrane is bounded on its eastern side by northwest-trending thrust and strike-slip faults that include the Swannell fault, Manson-McLeod fault system, and Eureka thrust. It is bounded on its western side by the Pinchi and Ingenika strike-slip faults (Fig. 2).

2.2.3. Stikine terrane

The Stikine terrane shares ancestry with the Quesnel terrane (Logan and Mihalynuk, 2014). Both are thought to have been part of a larger arc complex lying offshore of ancestral North America in the Late Permian to Early Jurassic. Accretion of the joint terranes and closure of the intervening ocean basin is thought to have resulted from westward subduction of oceanic crust beneath an anticlockwise rotating Stikinia and eastward subduction beneath Quesnellia (Diakow et al., 1993; Mihalynuk et al., 1994; Nelson et al., 2013). The Stikine terrane underlies much of the Northwest Region and the westernmost part of the North Central Region, including the Toogoggone River (northwest) and Nechako Plateau (southwest) areas (Fig. 2).

In the Toogoggone River area (Fig. 3), bimodal volcanic and sedimentary rocks of the Asitka Group (Lower Permian) are unconformably overlain by mafic to intermediate volcanic rocks of the Takla Group (Late Triassic; also referred to as Stuhini Group). Hazelton Group subaerial intermediate to felsic volcanic rocks (Toogoggone Formation; Lower Jurassic) unconformably overlie the Takla Group. Coeval with Hazelton Group, quartz monzonite to granodioritic rocks of the Black Lake intrusive suite (Figs. 2, 3) form a roughly 60-km long, north-northwest trending pluton that locally hosts porphyry-style mineralization. Intrusive rocks follow the margins of an elongate structural depression that was filled by Hazelton Group ash-flow tuffs particularly in the central part of the area (Diakow et al., 1993). A horst-and-graben fault system includes northwest trending normal faults, northeast-trending cross faults, and shallow to moderately tilted monoclinal blocks. Porphyry copper-gold-silver-molybdenum deposits such as Kemess Underground and Kemess East are in the southern portion of the area, whereas epithermal gold-silver deposits of mainly low-sulfidation type, such as Lawyers, and lesser high-sulfidation type, are in the central and northern parts. The terrane-bounding Finlay-Ingenika fault system defines the eastern extent of the Toogoggone River area (Fig. 1), juxtaposing Quesnel terrane, Cassiar platform and post-accretionary rocks to the east.

In the Nechako Plateau area (Fig. 3), Hazelton Group island-arc rocks (Early to Middle Jurassic) include marine sedimentary and bimodal volcanic rocks of the Entiako Formation, and overlying mafic volcanic and volcanogenic sedimentary rocks of the Naglico Formation (Angen et al., 2015; Diakow et al., 1997), both of which underlie the Nechako Gold prospect area. Southwest-vergent recumbent folded and thrust-faulted Hazelton Group rocks (Entiako Formation) are exposed near the Blackwater project access road.

2.2.4. Cache Creek terrane

The Cache Creek terrane is a thrust-stacked oceanic fore-arc assemblage that formed outboard of the combined Stikine-Quesnel arc terranes. It contains blueschist belts, remnants of oceanic primitive arcs, and structural blocks of ocean island crust with exotic fossils of Tethyan (Asian) affinity (Schirazza and MacIntyre, 1998; Nelson et al., 2013). From the Trembleur Lake area northward to the Takla Landing-Tsaya Lake area (Fig. 3), the terrane consists of the Sitika assemblage (Permian-
Early Jurassic) and the Cache Creek complex (Pennsylvanian-Jurassic). In the Sitlika assemblage, a lower unit of bimodal metavolcanic rock is overlain to the east by a siliciclastic unit. These rocks are considered to be part of a primitive oceanic arc complex known as the Sitlika-Kutcho-Venables arc (Logan and Mikalynuk, 2014). The Cache Creek complex includes an ophiolite sequence of: variably serpentinized peridotite (Trembleur ultramafic unit), host rock of the Decar nickel-iron alloy deposit (MINFILE 093K 039); the gabbro-diorite-diabase Rubyrock intrusive complex; and an overlying unit of massive-to-pillowed basalts and mafic dikes and sills (North Arm succession). The ophiolite sequence is in thrust contact with a pelagic phyllite-chert unit. Farther to the east a massive limestone unit lies underneath Fort St. James (Fig. 1).

Nephrite jade lenses are found in high-pressure, low-temperature metamorphic rocks of the Cache Creek complex and mining activity continues locally at the Ogden Mountain and Pishon Green Jade projects. Predominantly west-directed structural imbrication and obduction of oceanic rocks onto Stikinia occurred during Early-Middle Jurassic terrane accretion. The Cache Creek terrane is bounded to the west by the Takla fault and to the east by the Pinchi fault.

2.3. Post-accretionary rocks (Middle Jurassic to Recent)

Post-accretionary successions followed forming the final accretion of terranes of the Intermontane belt to the margin of ancestral North American in the Middle Jurassic. They include plutonic rocks, volcanic and sedimentary cover rocks, and unconsolidated sediments including glacigenic deposits, alluvium, and colluvium.

2.3.1. Bowser Basin, Sustut Group, and Skeena Group

The North Central Region includes the eastern part of the Bowser basin (Fig. 2), which is more extensive in the Northwest Region. West of the Toodoggone River area, sedimentary rocks of the Bowser Lake Group (Middle Jurassic-Lower Cretaceous; Fig. 3) formed in a foreland basin west of the uplifted Cache Creek terrane and Omineca mountains (Evenchick et al., 2007) and recorded the amalgamation of Stikinia and Cache Creek terrane and Omineca mountains (Evenchick et al., 2007) formed in a foreland basin west of the uplifted Cache Creek and Stikine terranes. The Endako subsuite (Late Jurassic) of the Francois Lake plutonic suite hosts the Endako low-fluorine porphyry molybdenum deposit (Pond, 2013; Devine et al., 2015). The Brooks diorite complex (Fig. 3) is a composite pluton 25-km long that is partially high-grade metamorphosed and features northwest-striking steeply dipping foliation (Angen et al., 2016). The Trout and 2 X Fred epithermal vein prospects lie at its southwest and northeast margins.

2.3.2. Endako batholith, Laidman batholith, Brooks diorite complex

In the Nechako Plateau area (Diakow et al., 1997; Angen et al., 2015), the Hazelton Group is unconformably overlain by deep-water sedimentary rocks (Ashman Formation), and mafic volcanic rocks with coarse- to fine-grained sedimentary units (Nechako Formation) of the Bowser Lake Group (Fig. 3). Coarse siliciclastic sedimentary units of the Skeena Group (Lower-Middle Cretaceous; Fig. 3) are exposed locally, but are more widespread in the Northwest Region (Alldrick and Lin, 2007). These Skeena Group rocks are similar to the Sustut Group rocks found in the Toodoggone River area.

2.3.3. Cretaceous and Eocene magmatism

In the Quesnel terrane, Cretaceous granite plutonic rocks are widespread (Figs. 2, 3). Intrusive rocks include: the Early Cretaceous phase of the Hogem intrusive complex; the Wolverine Range plutonic suite in the Wolverine metamorphic complex; and two-mica granodiorite-granite of the Germansen and Naver (Bayonne plutonic suite) batholiths near the Manson Creek and Hixon placer mining areas.

In the Nechako Plateau area (Fig. 3), regional transpression and the development of a continental arc to the west by the Late Cretaceous led to an episode of granodiorite intrusion (Diakow et al., 1997; Nelson et al., 2013; Angen et al., 2015), which included the Capoose batholith and Blackwater pluton, and the Quanchus plutonic suite (Eocene). The Blackwater intermediate sulphidation epithermal gold-silver deposit
were deposited in deltaic and lagoonal settings along the Western Canada Sedimentary Basin (Fig. 3; Cunningham and Cretaceous) of the Bullhead and Fort St. John groups of the and are hosted in the Gething and Gates formations (Lower continuity are predominantly medium-volatile bituminous rank area (Figs. 1, 4). Coal seams of economic thickness and inner foothills, from the Alberta border to the Pink Mountain extends roughly 400 km along the Northern Rocky Mountain region and cross faults are important controls on epithermal vein-type showings developed during Late Cretaceous to Eocene uplift and extension, such as at the Trout and 2 X Fred prospects. The Nechako uplift, an inferred northeast-trending horst with obscured bounding faults (Diakow et al., 1997), provides a window exposing Hazelton Group rocks beneath Miocene and younger cover.

2.3.4. Regional post-accretionary faults

Regional dextral strike-slip faults offset older terrane boundaries as a component of overall transpression from the Middle Cretaceous to Paleogene, and then as a component of transtension in the Paleogene (Nelson et al., 2013; Fig. 3). In the Quesnel terrane, anastomosing fault strands, second-order strike-slip faults, fault splays, and releasing bends resulted in variably tilted structural blocks and triangular-shaped basins filled with Upper Cretaceous to Neogene sedimentary and minor volcanic rocks, and local coal beds (Nelson and Bellefontaine, 1996). The moderate tilt and faults in the Mt. Milligan deposit may in part be related to motion along a strand of the Manson-McLeod fault system, which truncates the deposit on the east, separating uplifted basement (Nelson et al., 1990) from an Early Tertiary sedimentary basin. The Wolverine metamorphic complex (Fig. 3), a core complex related to extensional and strike-slip tectonics, comprises schistose to gneissic amphibolite-grade Neoproterozoic basement rocks that were rapidly exhumed in the Paleogene (Ferri et al., 1994; Staples, 2009).

2.3.5. Peace River coalfield

In northeastern British Columbia, the Peace River coalfield extends roughly 400 km along the Northern Rocky Mountain inner foothills, from the Alberta border to the Pink Mountain area (Figs. 1, 4). Coal seams of economic thickness and continuity are predominantly medium-volatile bituminous rank and are hosted in the Gething and Gates formations (Lower Cretaceous) of the Bullhead and Fort St. John groups of the Western Canada Sedimentary Basin (Fig. 3; Cunningham and Sprecher, 1992, Smith et al., 1994). Coal-bearing cyclothem were deposited in deltaic and lagoon settings along the western edge of the foreland basin during a major transgression of the inland sea (Stott, 1984; Thompson, 1989; Grieve et al., 1995). These synorogenic rocks, comprising siliciclastic units and coal seams, were shortened during the Laramide Orogeny (Late Cretaceous-Paleogene), lying east of a tectonically thickened eastwardly prograding wedge. Thrusts, northeast-v, vertly plunging asymmetric folds, box-folds, and triangle zones formed by back-thrusts generally trend northwest-southeast. Commonly, tight anticlines adjacent to thrust faults are bordered by broad synclines. Product coals from both the Gething and Gates formations are generally low in ash and sulphur (Grieve et al., 1995). The middle Gething Formation seams are those of interest at the Brule mine. In 2012, the Government of British Columbia estimated 4,900 Mt of potentially mineable resources in the Peace River coalfield.

East and north of the coalfield, Cretaceous marine and non-marine fine siliciclastic rocks of the Western Canada Sedimentary Basin comprise much of the shallow bedrock.

2.4. Neogene to Quaternary cover rocks

Tertiary fluvial deposits formed in large braided and meandering river systems (Levson and Giles, 1993) such as the ancient Peace River, which flowed north (Turner et al., 2010). Floodbasals of the Chilcotin Group (Miocene and younger) outcrop locally in paleotopographic lows (Mihalynuk, 2007) and remnant olivine basalt volcanic centres and necks form local topographic highs (Resnick et al., 1999). Quaternary glacial till, glaciofluvial, and glaciolacustrine deposits are extensive in the southern part of the North Central Region where outcrop is sparse (Quesnel Trough, Nechako Plateau) and in the northwestern part of the Northeast Region (Rabbit Plateau, Liard Plain; Fig. 2) and are more topographically confined in the Omineca and Northern Rocky mountains. More recent alluvial and colluvial deposits are along rivers and streams and organic deposits in poorly drained depressions (Blais-Stevens and Clague, 2007).

3. Mines and quarries

The combined North Central-Northeast region has two metal mines, five coal mines, and one industrial mineral mine for nephrite jade (Fig. 1). Of these, one metal mine and all five coal mines have gone on care and maintenance status in the last three years due to challenging market conditions. One coal mine began restart activities towards a planned return to full scale operation by year end. Small-scale, privately owned dimension stone quarries near Valemount were inactive in 2016.

3.1. Metal mines

In 2016, there was one operating open-pit mine (Table 1), the Mt. Milligan mine of Centerra Gold Inc., and one open-pit mine that was on care and maintenance status, the Endako mine of Centerra Gold Inc. (75% interest) and Sojitz Moly Resources, Inc. (25% interest). Both are in the North Central Region.
Fig. 4. Coal mines and exploration projects, northeastern British Columbia, 2016. From British Columbia Geological Survey (2017).
Table 1. Metal mines, North Central Region.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mt. Milligan</td>
<td>Centerra Gold Inc. (Centerra B.C. Holdings Inc., Thompson Creek Metals Company Inc.)</td>
<td>Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194, 093N 191</td>
<td>27 Kt (60 Mlbs) Cu; 6.22 t (200,000 oz) Au</td>
<td>506.4 Mt at 0.196% Cu and 0.349 g/t Au; containing 991.1 Kt (2,185 Mlbs) Cu and 177 t (5.69 Moz) Au</td>
<td>118.5 Mt at 0.16% Cu and 0.320 g/t Au (additional to reserves)</td>
<td>Ramp-up completed by January. Permanent secondary crusher was constructed and commissioned in October. Annual capex estimated at $72 million ±10%. Closing of an Arrangement Agreement with Centerra Gold Inc. for the US$1.03 billion acquisition of Thompson Creek Metals Company Inc. was finalized in late October. Mine life about 22 years. Over 350 employees.</td>
</tr>
<tr>
<td>Endako</td>
<td>As above</td>
<td>Mo; Porphyry Mo (Low F-type); 093K 006</td>
<td>N/A</td>
<td>N/A</td>
<td>33.4 Mt at 0.049% Mo</td>
<td>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).</td>
</tr>
</tbody>
</table>

3.1.1. Mt. Milligan (Centerra Gold Inc.)

The Mt. Milligan deposit (Fig. 1; Table 1; Centerra Gold Inc.) is a silica-saturated alkaline copper-gold porphyry deposit in central Quesnellia (Lang et al., 1995; Logan, 2013; Logan and Mihalyuk, 2014). It is a moderately dipping, roughly tabular body (ca. 2.5 x 1.5 km) extending to a depth of 400 m (Clifford and Berthelesen, 2015). It is hosted in mafic-intermediate volcanic and pyroclastic rocks of the Takla Group (Witch Lake succession) and by Early Jurassic monzonite porphyry stocks that are coeval with volcanic rocks of the Chuchi Lake succession (Fig. 3; Mortensen et al., 1995; Nelson and Bellefontaine, 1996). The roughly 400 m diameter magnetite-breccia (MBX) stock in the current open-pit area features a sheet intrusion (Rainbow dike) up to 50 m wide that protrudes from its footwall. Copper-gold mineralization with accessory silver occurs as sulphide disseminations, fracture fills, and lesser veinlets in monzonite stocks, their brecciated margins, and in hornfelsed and altered volcanic rocks. A core zone of magnetite-rich potassic alteration and auriferous chalcopyrite-pyrite mineralization (MBX sub-zone) transitions southeastward to a sericite-carbonate (phylic) altered, potentially down-dropped peripheral zone of gold-predominant mineralization (66 sub-zone) suggestive of an alkaline lithocap structural root (Holliday and Cooke, 2007, Jago et al., 2014). An oxidized zone with weak supergene enrichment affects the uppermost benches of the pit to about 20 m depth, extending to about 70 m depth along faults, mainly on the northern margin of the MBX stock.

Commissioned in October 2013, the Mt. Milligan mine saw its third full-year of operations in 2016 (Fig. 5). By January, the ramp-up process of the mine and mill facility to its design capacity of 60,000 tonnes-per-day was complete. Mill throughput then averaged about 52,800 tonnes-per-day over the first three quarters of the year. Phase 3 mining of the MBX pit continued with some modification such that mining in the gold-rich 66 zone began earlier than previously scheduled, and Phase 4 was to start by year end. Mining in the 66 zone on the hanging-wall side of the southeast dipping Rainbow Fault has confirmed a modelled repetition in zoned alteration and mineralization sequence (Jago et al., 2014). Construction of a permanent secondary crusher began in the first quarter and commissioning started in mid-October. This addition is expected to increase average mill throughput to 62,500 tonnes-per-day or higher (Fig. 6). Efforts to optimize mine and mill operations and increase recoveries continued, including blast fragmentation and movement monitoring and ongoing geometallurgical modelling. Copper-gold concentrate production in the first half of the year totaled 72,000 dry tonnes, and seven shipments were completed. Production guidance for...
the year was estimated at close to 65 million pounds of copper and over 240 thousand ounces of gold. Capital expenditure for the year was estimated at $72 million ±10% including $5 million for operations, $20 million for the tailings dam, and $47 million for the secondary crusher. Remaining mine life is about 22 years. More than 350 employees are working at the mine. The closing of an Arrangement Agreement for the US$1.03 billion acquisition of Thompson Creek Metals Company Inc. was finalized in late October and common shares were transferred to Centerra B.C. Holdings Inc., a wholly-owned subsidiary of Centerra Gold.

3.1.2. Endako (Centerra Gold Inc.)

In 2016, the Endako mine became an asset of Centerra Gold Inc. through the acquisition of Thompson Creek Metals Company Inc. The current ownership status is Centerra Gold Inc. (operator and 75% owner) and Sojitz Moly Resources, Inc. (25% owner). Mining of the 5200 x 900 m, and 320 m deep, northwest-trending low-fluorine porphyry molybdenum Endako deposit (Fig. 1; Table 1) ceased in July 2015 and the mine is currently on care and maintenance.

The former ore body is hosted in Endako phase quartz monzonite (Late Jurassic; Figs. 2, 3). Mineralization consists of early thin vein stockworks associated with K-feldspar alteration and later subparallel or en-echelon ribbon-textured quartz-molybdenite-pyrite veins associated with sericite alteration (Pond, 2013; Devine et al., 2015). Open pits extend across four structural blocks separated by southwest trending faults that appear to be offset as a series of Tertiary listric normal faults (Lowe et al., 2001).

3.2. Coal mines

Metallurgical coal mining operations (Table 2) in the Peace River coalfield of the Northeast Region were suspended and placed on care and maintenance in 2013 and 2014. At the end of 2015, Walter Energy Canada Holdings, Inc. obtained creditor protection under the Companies’ Creditors Arrangement Act. In January of 2016 it began a sale and investment solicitation process for its idled Perry Creek (Wolverine), Brule, and Willow Creek mines and exploration projects. In September, an asset purchase agreement was finalized with Conuma Coal Resources Limited, a stand-alone Canadian company that is a related by common ownership to ERP Compliant Fuels, LLC. Restart activities for the Brule mine began immediately and return to full operations was expected by December with a 170 person workforce. The Perry Creek (Wolverine) operation is being considered for restart in 2017, contingent on market conditions and meeting permit requirements. A restart would employ about 180 people. Of the three idled mines, Willow Creek was the highest cost producer. Further study is required before restart, but its processing plant and rail loadout are shared with the Brule mine, together forming the Brazion Group operations. Conuma Coal is operating under contract with Walter Energy until ownership transition is complete.

Elsewhere, the Trend-Roman mine of Peace River Coal Inc. (wholly owned by Anglo American plc), and Quintette (Babcock) mine of Teck Coal Limited remained on care and maintenance status. The Trend, Quintette and Perry Creek mines produced mainly hard coking coal (HCC), whereas the Brule mine produces pulverized coal injection (PCI) coal, a high-rank thermal coal used to sustain blast furnace temperatures in steelmaking. The Willow Creek mine produced both HCC (one third of production) and PCI coal (two thirds of production).

3.2.1. Brule and Willow Creek (Conuma Coal Resources Limited)

Conuma Coal’s Brule mine (Figs. 1, 4; Table 2) produces PCI coal from three seams in the lower part of the Gething Formation, with an average cumulative thickness of about 12 m. The mine lies in a northwest-trending anticline-syncline pair in a larger structural block bound by northeast-verging thrust faults. Run-of-mine coal is crushed and then trucked 60 km on a connector road to the processing plant and rail load-out facility at the Willow Creek mine (Figs. 1, 4) where only one of the mined seams requires beneficiation; the others are direct-shipped. In recent years, targeted annual production was about 2 Mt of saleable coal. Both mines form part of Walter Energy’s Brazion Group of properties. The Willow Creek mine was placed on care and maintenance in April 2013. Restart activities for the Brule mine began around mid-September. By October, 40,000 tonnes of run-of-mine coal had been hauled (Fig. 7), and by November the first loadtrain of coal had been shipped. Work on a bioreactor for selenium treatment had continued during the summer. The mine was last in full production in June 2014, before suspending operations, processing final inventory, and entering care and maintenance mode. Expansion plans initiated in 2014 were to culminate in a merging of the North and South Brule pits over a mine life of about eight years. Mining activity is now focused on the north wall of the South Brule pit and working northward. Conuma may introduce new mining techniques to operations including cast blasting and highwall mining.
Table 2. Coal mines, Northeast Region.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willow Creek</td>
<td>Conuma Coal Resources Limited</td>
<td>HCC, PCI; Bituminous coal; 093O 008</td>
<td>N/A</td>
<td>16.6 Mt saleable</td>
<td>N/A</td>
<td>Placed on care and maintenance in 2013. Property under contract with Walter Energy Holdings, Inc. until ownership transition is complete.</td>
</tr>
<tr>
<td>Brule</td>
<td>Conuma Coal Resources Limited</td>
<td>PCI; Bituminous coal; 093P 007</td>
<td>250,000 t</td>
<td>16.3 Mt saleable; Proven</td>
<td>N/A</td>
<td>Restart activities began in Sept. 2016. Operating under contract with Walter Energy Holdings, Inc. until ownership transition is complete.</td>
</tr>
<tr>
<td>Perry Creek</td>
<td>Conuma Coal Resources Limited</td>
<td>HCC; Bituminous coal; 093P 025</td>
<td>N/A</td>
<td>8.8 Mt saleable; Proven</td>
<td>N/A</td>
<td>Placed on care and maintenance in 2014. Property under contract with Walter Energy Holdings, Inc. until ownership transition is complete. Potential 2017 restart.</td>
</tr>
<tr>
<td>Trend</td>
<td>Anglo American plc (Peace River Coal Inc.)</td>
<td>HCC; Bituminous coal; 093I 030</td>
<td>N/A</td>
<td>8.3 Mt saleable</td>
<td>26.5 Mt mineable in situ (additional to reserves)</td>
<td>Placed on care and maintenance in 2014, 50,000 t mined inventory shipped in January 2015.</td>
</tr>
<tr>
<td>Roman Mountain</td>
<td>Anglo American plc (Peace River Coal Inc.)</td>
<td>HCC; Bituminous coal; 093I 043</td>
<td>N/A</td>
<td>25.8 Mt saleable</td>
<td>4.3 Mt mineable in situ (additional to reserves)</td>
<td>Placed on care and maintenance in 2014.</td>
</tr>
<tr>
<td>Quintette</td>
<td>Teck Coal Limited</td>
<td>HCC, TC; Bituminous coal; 093I 011</td>
<td>N/A</td>
<td>39.1 Mt saleable</td>
<td>120.3 Mt mineable in situ (additional to reserves)</td>
<td>Placed on care and maintenance in 2014.</td>
</tr>
</tbody>
</table>

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal; ULV = ultra low volatile.

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal; ULV = ultra low volatile.

3.2.2. Perry Creek (Wolverine) (Conuma Coal Resources Limited)

At Conuma Coal’s Perry Creek mine (Wolverine Project; Figs. 1, 4; Table 2) medium-volatile bituminous HCC has been mined from seams in the Gates Formation in the Perry Creek syncline. The median cumulative thickness of the mineable seams is about 15 m. Before idling production in April 2014, mining was forecast to continue for approximately another four years and then switch over to the EB expansion project (MINFILE 093P 015) with no overlap in operations; EB has an estimated mine life of ten years. Targeted annual production had been about 1.9 Mt of saleable coal. Conuma Coal is considering restart of the mine in 2017 with a 180-person workforce, contingent on market conditions and meeting permit requirements.

3.2.3. Trend (Peace River Coal Inc.)

At Anglo American-Peace River Coal’s Trend mine, HCC of medium-volatile bituminous rank had been mined until the mine was placed on care and maintenance in December 2014. Coal seams occur in the Gates Formation along the steeply dipping northeast limb of the Waterfall anticline, which forms an anticline-syncline pair with the closely folded Murray syncline to the southwest on Roman Mountain. The cumulative thickness of Gates Formation seams is about 18 m, whereas seams in the Gething Formation, which can be blended with Gates Formation coals, have a cumulative thickness of 7.5 m. The Roman Mountain expansion project, about 1.5 km from
the former Trend operations in the Murray syncline, was fully permitted by March 2014. Related construction activities had been underway before the project went on care and maintenance with the Trend mine. If the expansion goes into operation as planned, the combined operations would be known as Trend-Roman (Figs. 1, 4; Table 2). The expansion, reported to have a capital cost of about $200 million in 2013, would comprise 5 km of linear open-cuts in three phases to capture the middle Gates coal seams, and satellite pits for the upper Gething coal seams (Peace River Coal Inc., 2007). The combined operation (Figs. 1, 4; Table 2) would have a saleable coal production rate of 2.5 Mt per year and extend the mine life for 16 years. The mine remained on care and maintenance in 2016.

3.2.4. Quintette (Babcock) (Teck Coal Limited)

If brought back into operation, the Quintette (Babcock) mine (Figs. 1, 4) of Teck Coal Limited would reopen the Windy (Big and Little Windy) and Window pits on the northern side of Mt. Babcock. Mt. Babcock is a box anticline with a coal sequence similar to that at the Trend-Roman mine. The historic Quintette mine operated from 1982 to 2000 with development in 1998 of the open-cuts on Mt. Babcock. For the next phase of mining, fully permitted in 2014, production would average 3.5 Mt of saleable coal per year over a 12 year mine life. In mid-2014 the project was placed on care and maintenance and a restart deferred until market conditions improve. Capital expenditure for the mine re-opening was estimated at $858 million in late 2012, of which about $130 million was spent in 2013.

3.3. Industrial mineral mines and quarries

In 2016, one industrial mineral mine operated in the Northeast Region, the Fireside barite mine of Fireside Minerals Ltd., and one in the North Central Region, the Ogden Mountain nephrite jade mine of Green Mountain Jade Inc. (Table 3).

3.3.1. Fireside (Fireside Minerals Ltd.)

At Fireside (Fig. 1; Table 3) in the Liard Plain (Fig. 2), Fireside Minerals Ltd. mines veins of massive white barite hosted in Kechika Group sedimentary rocks. The north- and northeast-trending, steeply dipping veins are spatially related to probable Early-Middle Paleozoic gabbro dikes (S. Allan, personal communication, November 2016; Wojdak, 2008). In late summer of 2016, the first 10,000 tonnes of barite were mined from the Moose Pit (Fig. 8). Exploration drilling completed in 2014 indicates the vein system continues north of previous workings and remains open to the northeast. A recently stripped area revealed two, steeply dipping barite veins with a combined true thickness of 6.5 m. Vein composition ranges from 96.0 - 99.4% barite with variable silica, iron, zinc and lead impurities. Exploration efforts continue at the nearby Moose Southwest pit and the Beaver prospect. Mined barite is crushed and bagged on site and trucked to Fort St. John, BC and Alberta for use in the drilling industry as a weighting additive in drilling fluids.

3.3.2. Ogden Mountain (Green Mountain Jade Inc.)

Jade is a 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 in a subduction-related orogenic belt. The Ogden Mountain property (Fig. 1) of Green Mountain Jade Inc., a partner of the Jade West Group, is underlain by metamorphosed, thrust-faulted, and well-foliated ultramafic rocks, including serpentinite mélange and schist, of the Cache Creek complex. These rocks are locally intercalated with massive white calc-silicate rock, historically called rodeingite, considered to be a metasomatic replacement of mafic intrusive rocks (Simandl et al., 2000, Zharikov, 2007). Near the rodeingite, altered ultramafic rock appears to grade from serpentinite to nephrite to soapstone (talc schist), with some variations. The nephrite forms lenses that pinch and swell along the regional fabric. In 2016, Green Mountain Jade resumed exploration and placer mining of alluvial nephrite boulders, and excavation of nephrite from bedrock.

4. Placer operations

Placer gold exploration and mining is a significant traditional and ongoing activity in the North Central Region, occurring along numerous creeks and several rivers but centred around the Manson Creek and Hixon communities. Approximately 70 notice-of-work applications for placer gold were submitted to the Ministry of Energy and Mines regional office in 2016. From north to south these were mainly in three general areas: 1) Manson Creek, in the Quesnel terrane between the Pinchi and Manson fault zones and generally following arc transverse structure on the north side of the Germansen batholith; 2) Fort St. James to Mackenzie, in the Quesnel terrane near the McLeod Lake fault zone or other structures; and 3) Hixon, near the faulted contact (Eureka thrust) of the Quesnel terrane with...
Table 3. Industrial mineral mines and quarries, North Central and Northeast regions.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fireside</td>
<td>Fireside Minerals Ltd.</td>
<td>Barite; Vein barite; 094M 003, 094M 019</td>
<td>10,000 t</td>
<td>475,000 t (non NI 43-101 compliant)</td>
<td>N/A</td>
<td>Mined from the Moose Pit. Overburden stripping revealed two 96% to 99.4% barite veins with a combined true thickness of 6.5 m.</td>
</tr>
<tr>
<td>Ogden Mountain</td>
<td>Green Mountain Jade Inc.</td>
<td>Nephrite jade; Jade; 093N 156, 093N 157, 093N 165</td>
<td>35 t</td>
<td>N/A</td>
<td>N/A</td>
<td>Exploration and placer mining of alluvial jade boulders, excavation of in situ jade.</td>
</tr>
</tbody>
</table>

the Kootenay terrane, and near the Naver pluton (Bayonne plutonic suite).

Placer mining is generally conducted on abandoned benches and abandoned channels above the current level of streams. Medium-scale operations use power machinery such as hydraulic excavators and backhoes to excavate pay gravel, which is then either trucked or directly dumped into a wash plant for processing. Wash plants generally comprise a grizzly, trommel or screening plant, sluice box and jigs to concentrate gold (Fig. 9).

Placer gold exploration in the region targets Tertiary, and pre-Late Wisconsinan paleochannel and paleofan deposits (Eyles and Kocsis, 1989; Levson and Giles, 1993). Older (Tertiary) gravels are pebble-cobble gravels that were deposited during non-glacial intervals and rest on older bedrock. These gravels incorporated lode gold from locally weathered bedrock and were then overlain by Wisconsin glacial drift. The glacial deposits were subsequently downcut by post-glacial watercourses. Paleochannel systems can have little relation to modern drainage patterns and can be controlled by major long-lived faults. Subglacial deposits are found on the leeside of bedrock highs, in the basal portion of lodgement tills, in boulder pavements, and narrow gravel-filled notches. Postglacial deposits that formed by reworking of subglacial and older gravels are typically lower grade.

5. Mine development

A mine development project has financing in place and construction is underway with a targeted production start-up date. The project proponent must have all required government approvals and permits for constructing and operating a mine. There was no mine development in the North Central and Northeast regions in 2016. The last mine development project in the North Central Region was Mt. Milligan (see section 3.1.1.), which officially opened as a mine in October 2013.

The last planned mine development projects in the Northeast Region were the Roman Mountain expansion and the Quintette (Babcock) planned restart. Construction activities for the Roman Mountain expansion were halted when the Trend mine (see section 3.2.) was placed on care and maintenance at the end of 2014. The Quintette (Babcock) mine (see section 3.2.) was in a combined development and early production stage when it went into care and maintenance in mid-2014.

6. Proposed mines or quarries

The proposed mine, or mine evaluation, stage (Table 4) is concerned with the environmental, social, engineering, and financial evaluation of an exploration project that is moving beyond an advanced stage. It includes, at minimum, the submission of 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, or the direct submission of a Mines Act permit application for smaller scale, commonly seasonally active, projects not meeting the threshold criteria for review by the EAO. It also includes projects that have received an environmental assessment certificate but are in the final Mines Act permit application review process before potentially going into development and commercial production.

In 2016, the combined North Central-Northeast region had five projects, including Aley (Taseko Mines Limited),

![Fig. 9. Gold with heavy minerals from a sluice box capture mat at a Manson Creek placer mine.](image-url)
Table 4. Selected proposed mines, North Central and Northeast regions.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwater (North Central region)</td>
<td>New Gold Inc.</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037</td>
<td>344.4 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 254 t (8.17 Moz) Au, 1,890 t (60.8 Moz) Ag</td>
<td>55.49 Mt at 0.72 g/t Au, 4.4 g/t Ag; containing 40.2 t (1.29 Moz) Au, 243 t (7.82 Moz) Ag; additional to reserves</td>
<td>*EA (under review), engineering and environmental studies</td>
<td>Proposed open-pit mine with 60,000 t/d 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.</td>
</tr>
<tr>
<td>Kemess Underground (KUG) (North Central region)</td>
<td>AuRico Metals Inc.</td>
<td>Cu, Au, Ag; Porphyry Cu±Mo±Au; 094E 021</td>
<td>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; Probable</td>
<td>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; Indicated</td>
<td>Feasibility study update, EA (under review), engineering and environmental studies</td>
<td>Proposed underground panel cave mine with 24,600 t/d 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.</td>
</tr>
<tr>
<td>Aley (North Central region)</td>
<td>Taseko Mines Limited (Aley Corporation)</td>
<td>Nb; Carbonatite-hosted deposit; 094B 027</td>
<td>83.8 Mt at 0.50% Nb2O5; containing 293 Kt* Nb *calculated by author</td>
<td>285.8 Mt at 0.37% Nb2O5; containing 739.2 Kt* Nb (including reserves) *calculated by author</td>
<td>EA (pre-app), geochemical characterization studies, environmental baseline monitoring</td>
<td>Proposed open-pit mine with 10,000 t/d ore processing rate and average annual production of 9,000 t niobium over a 24 year mine life.</td>
</tr>
<tr>
<td>Murray River (Northeast region)</td>
<td>HD Mining Int’l Ltd.</td>
<td>HCC; Bituminous coal; 093I 010</td>
<td>261.6 Mt mineable; proven</td>
<td>314.2 Mt in situ</td>
<td>Mines Act permit and federal EA (under review), drilling (hydro-geological, geotechnical) hand trenching, 2D seismic survey, engineering and environmental studies</td>
<td>Proposed underground longwall mining operation with average annual production of 4.8 Mt of saleable coal over a 25 year mine life.</td>
</tr>
<tr>
<td>Sukunka (Northeast region)</td>
<td>Glencore plc</td>
<td>HCC; Bituminous coal; 093P 012, 093P 014</td>
<td>N/A</td>
<td>145 Mt in situ</td>
<td>EA (under review), engineering and environmental studies</td>
<td>Proposed open-pit mine with initial annual production of 1.5 - 2.5 Mt of saleable coal over a 20+ year mine life.</td>
</tr>
<tr>
<td>Giscome (North Central region)</td>
<td>Graymont Western Canada Inc.</td>
<td>CaCO3; Limestone; 093J 041, 093J 025</td>
<td>N/A</td>
<td>&gt;100 Mt of limestone (&gt;95% calcium carbonate, ≤5% magnesium carbonate) in situ; Indicated</td>
<td>EA (under review), hand auguring, baseline studies</td>
<td>Proposed 600,000 t/y limestone quarry to feed a vertical lime kiln producing 198,000 t of lime annually over a 50+ year mine life.</td>
</tr>
<tr>
<td>Wapiti East (Northeast region)</td>
<td>Fertoz Int’l Inc.</td>
<td>P2O5; Sedimentary phosphate deposits; 093I 039, 093I 022, 093I 008</td>
<td>N/A</td>
<td>0.81 Mt at 22.3% P2O5; Indicated</td>
<td>Mines Act permit application, bulk sample (17,500 t permitted), temporary road (2.2 km)</td>
<td>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.</td>
</tr>
</tbody>
</table>

*EA = Environmental Assessment
at various stages and activity in the pre-application phase of environmental assessment. One project below the EAO threshold criteria, Wapiti East (Fertoz International Inc.), continued work on information requirements for a Mines Act permit application before a final submission. Four projects, Blackwater (New Gold Inc.), Giscome (Graymont Western Canada Inc.), Kemess Underground (AuRico Metals Inc.) and Sukunka (Glencore plc), have submitted applications and were under review. One project, Murray River (HD Mining International Ltd.) received an environmental assessment certificate in October 2015 and was under review for a final Mines Act permit.

6.1. Proposed metal mines

Work continued on three proposed metal mines in 2016; the Blackwater (New Gold Inc.), Kemess Underground (AuRico Metals Inc.) and Aley (Taseko Mines Limited) projects. All three projects are in the North Central Region. Blackwater is in the Nechako Plateau area, Kemess Underground in the Tooodogone River area, and Aley in the Muskwa ranges of the Northern Rocky Mountains.

6.1.1. Blackwater (New Gold Inc.)

The Blackwater deposit (Figs. 1, 3; Table 4; New Gold Inc.) is interpreted as an intermediate sulphidation epithermal gold-silver system hosted by Kasalka Group volcanic rocks (Late Cretaceous; Christie et al., 2014; Looby, 2015). The volcanic section includes andesite flows, latitic lapilli tuffs and volcanic breccias, flow-banded and tuffaceous ryodacites, heterolithic breccia containing altered fragments of other units, and silicified hydrothermal breccias. The volcanic sequence unconformably overlies Bowser Lake Group sedimentary rocks at depth. Alteration and mineralization associated with the deposit define a continuous 1300 x 950 m west-striking, shallowly north-northwest plunging feature that is bounded by east-northeast trending normal faults. A fragmental zone with an average vertical extent of 350 m tapers downward to 600 m vertical extent in a low-grade core. It contains pervasive muscovite-illite±silica, smectite, biotite, and chlorite alteration accompanied by disseminated, replacement and veinlet-hosted pyrite-sphalerite-marcasite-pyrrhotite±chalcopyrite, galena, and arsenopyrite. Native gold and electrum that occur as micron-scale grains (ranging from about 30 μm up to 200 μm) are spatially associated with sulphide and silicification. The timing of main stage mineralization is interpreted to be earliest Paleogene (Looby, 2015). Steep, north-plunging higher-grade ore shoots are thought to be influenced by subvertical fault intersections. Highest gold grades returned in drilling (up to 47.49 g/t Au over 15 m) are along the margins of silicified breccia bodies. Local Mn-rich spessartine garnet, an important indicator mineral, occurs with pyrrhotite-bearing potassic alteration in the western part of the deposit, and may be related to a separate Late Cretaceous barren hydrothermal system. Illite and rare buddingtonite alteration suggests a late volatile phase common to shallow hydrothermal systems (Krohn et al., 1993).

New Gold continued engineering and environmental studies to support provincial and federal environmental assessments that were under review, and to advance further permitting requirements; capital expenditure was US$7 million to the end of September.

A 2014 feasibility study describes an open-pit mining operation with a 60,000 tonnes-per-day processing plant and a 17-year mine life. Life-of-mine average annual production would be 12.8 t (413,000 ounces) of gold and 54.1 t (1.74 million ounces) of silver. Total metal production would be 217 t (7.0 million ounces) of gold and 920 t (29.6 million ounces) of silver. The mine, with total development capital costs estimated at $1.576 billion, would create an average 1,200 jobs during construction and a permanent workforce of over 500 employees. The 180 day provincial EA review process was suspended twice during the year for development and review of suggested project design changes. A certification decision is anticipated by mid-2017. Exploration of significant porphyry copper-molybdenum-silver and epithermal gold-silver targets within several kilometres to the south and west of the proposed mine area was temporarily suspended by New Gold due to challenging market conditions and allocation of financial resources to other projects.

6.1.2. Kemess Underground (KUG) (AuRico Metals Inc.)

The Kemess Underground proposed mine (Fig. 1; Table 4; AuRico Metals Inc.) would extract part of a porphyry copper-gold-silver deposit (Fig. 3) that is centered on the tabular Kemess North pluton (earliest Jurassic). The quartz diorite pluton, assigned to the Black Lake intrusive suite, follows a south-dipping reverse fault. The fault separates Takla Group basaltic-andesites from a barren wedge of Tooodogone Formation (Hazelton Group) fragmental dacite to the north, and cuts off the pluton and mineralization at depth probably due to reactivation (Chervier et al., 2016). An 80 m thick sulphate leach zone (probable Jurassic) of clay-rich broken rock overlies the deposit. Subjacent phyllic alteration with pyrite-anhydrite/gypsum veining is predominant and widespread in the Takla Group volcanic rocks; at depth, quartz-zonitic±biotite potassic alteration becomes prevalent. Auriferous chalcopyrite-pyrite+molybdenite mineralization occurs as disseminations, fracture fills and with quartz±magnetite veins in the pluton, and less so in hanging wall volcanic rocks. Stockwork vein density intensifies in the potassically altered high-grade northeast corner of the deposit. The deposit is truncated on the east by a northwest-trending normal fault with east side down displacement; about 400 m to the west, grade weakens and pluton morphology changes from tabular to wide dikes hosted in Takla Group volcanic units.

In March, AuRico announced the results of an updated feasibility study (Chervier et al., 2016) for the proposed underground panel cave mine with a single extraction level. An average production rate of nearly 25,000 tonnes-per-day would generate 4.01 t (129,000 ounces) gold and 23 Kt (52 million pounds) copper annually over the first five years. Total
A two-phase open-pit mine with a 10,000 tonnes-per-day processing plant and ferroniobium convertor is planned. The near surface nature of mineralization is reflected in a low waste-to-ore strip ratio of 0.5 to 1. Average annual production over the 24 year mine life would be about 9,000 tonnes of niobium in the form of ferroniobium (annual production of about 14,000 t FeNb). Pre-production capital cost is estimated at $870 million. A workforce of about 700 people would be employed during construction and up to 350 at full operation (Aley Corporation, 2014). Niobium is used in the production of high-strength low-alloy steel.

6.2. Proposed coal mines

Work continued on two proposed coal mines in 2016, the Murray River (HD Mining International Ltd.) and Sukunka (Glencore plc) projects. Both projects are in the Peace River coalfield of the Northeast Region.

6.2.1. Murray River (HD Mining International Ltd.)

The 35 km-long, 160 km² northwest trending licensed area for the Murray River project (Figs. 1, 4; Table 4) of HD Mining International Ltd. is underlain by Lower to Upper Cretaceous successions of the Fort St. John Group that lie above the Gates Formation. The main geologic structure is modelled as a gently northeast-dipping homoclinal with asymmetric subsidiary folds, and reverse faults that bring coal beds in the middle part of the Gates Formation to shallower depths (Norwest Corporation, 2010; ERM Rescan, 2014). The Project Description identifies 5-6 underground workable Gates Formation seams with average thickness of 1.6-6.2 m.

In December 2015, HD Mining International Ltd. completed their underground bulk sample program. Following completion, equipment was pulled from the 1,357 m decline (to about 400 m depth) and the decline was sealed with a bulkhead and allowed to flood. Geotechnical drilling and head trenching, hydrogeological drilling, a 2D seismic survey, and engineering and environmental studies continued in support of a Mines Act permit application. Both the application and federal environmental assessment were under review; a provincial environmental assessment certificate was received in October 2015. The bulk sample was being tested for mining, coal quality and marketability. Contingent on the results, the proposed underground longwall mining operation would produce 4.8 Mt of saleable coal per year over a 25-year mine life. The three year construction phase would require a workforce of about 270 people on average but peak at about 450. The operations phase would provide approximately 780 direct employment opportunities (ERM Rescan, 2014). The company is working with Northern Lights College on curriculum development and a training program for underground longwall mining.
6.2. Sukunka (Glencore plc and JX Nippon Oil & Energy Corporation)

The Sukunka project (Figs. 1, 4; Table 4) of Glencore plc (75% interest) and JX Nippon Oil & Energy Corporation (25% interest) lies in a broad monocline that generally dips gently to the southwest. Southwest dipping thrust faults cut across the property and have brought coal seams in the hanging wall closer to surface. Three coal seams ranging from 1-6 m thick in the upper part of the Gething Formation are on the property and include the mineable Skeeter and Chamberlain seams. Additional seams in the lower part of the Gething Formation (BP Coal Limited, 1977) are also being targeted and are included in the current measured and indicated resource estimate (Table 4).

Glencore reported ongoing progress in open cut and underground mining studies, and engineering and environmental studies continued in support of a substituted environmental assessment application which was under review. An open-pit mining operation is proposed with initial production of 1.5-2.5 Mt of saleable metallurgical coal per year, and a mine life of at least 20 years (Stantec, 2013). Addition of a room-and-pillar underground mining component in a future mine plan would increase production to 6 Mt per year. Workforce requirements are estimated at about 250 jobs during construction, and 543 direct employees during operations.

6.3. Proposed industrial mineral mines

Work was carried out on two proposed industrial mineral mines in 2016, the Giscome lime plant and quarry project (Graymont Western Canada Inc.) and the Wapiti East phosphate rock project (Fertoz International Inc.). The Giscome project, in the North Central Region, was under review by the Environmental Assessment Office whereas the Wapiti East project, in the Northeast Region, is below the EAO threshold for review and its Mine’s Act application is being assessed through the Ministry of Energy and Mines regional office.

6.3.1. Giscome (Graymont Western Canada Inc.)

The Giscome property (Fig. 1; Table 4) of Graymont Western Canada Inc., a subsidiary of Graymont Limited, is underlain by fossiliferous limestone (Triassic) of the Cassiar platform, and basaltic volcanic rocks of the Slide Mountain Group (Antler Formation; Struijk et al., 1990). High-quality limestone grades of about 98% CaCO3 have been described in the area (Dahrouge and Kluczny, 2007). The environmental assessment application review process for the proposed quarry and lime plant was suspended in March to allow for consideration of proposed changes to the project. In July the process recommenced with the original project design. Auger drilling for borrow material was completed and environmental baseline monitoring continued. The initial phase of operations would include a 600 Kt per year limestone quarry and conveyor system that would feed a vertical lime kiln producing 600 tonnes of lime daily and 198 Kt annually (Pottinger Gaherty Environmental Consultants Ltd., 2013). The mine life is estimated at 50 years minimum and would create 40-60 jobs during construction and about 15 permanent jobs during operations. Lime products have environmental and industrial applications.

6.3.2. Wapiti East (Fertoz International Inc.)

At the Wapiti East project (Figs. 1, 3; Table 4) of Fertoz International Inc., pelletal and nodular phosphate-bearing units are interbedded with siltstones in folded and thrusted rocks of the Whistler member (Spray River Group; Butrenchuk, 1996). The main ore mineral is microcrystalline francolite, a carbonate-rich variety of fluorapatite. In 2016, construction of a linkage road for improved longer term access was followed by continued trenching of a permitted 17,500 tonne bulk sample. Refinement of the project design and a scoping study continued, as did compiling of information requirements for a Mines Act permit application. A seasonal (May-October) shallow open-pit mine is proposed with excavation along strike of a moderate- to steeply dipping phosphorite unit. Production would be up to 75,000 tonnes-per-year of phosphate rock and mine life is expected to exceed 20 years. The at surface resource averages one metre width and 30 m depth over a strike length of 12.5 km in four zones, but is thought to extend an additional 26.5 km in strike length beyond the indicated and inferred estimate. Organic certification for the low-leaching direct application fertilizer product was obtained in April through continued farm trials and laboratory testing.

7. Exploration activities and highlights (North Central Region)

Exploration projects can be categorized by exploration stages. The grassroots stage represents initial reconnaissance of a property and involves activities such as airborne geophysical surveys, geochemical sampling, mapping, and prospecting. Early-stage exploration consists of focused work on a target and typically includes ground geophysical surveys, trenching, drilling, and continued grassroots stage work. As well, First Nation consultation should begin by at least early-stage exploration and continue throughout the remaining stages. Advanced-stage exploration includes resource delineation, preliminary economic assessments and prefeasibility studies. Activity at the advanced stage typically includes infill drilling, bulk sampling, and baseline environmental data collection. These activities continue into the mine evaluation (proposed mine) stage. At this stage, detailed and professionally managed environmental, social, engineering and financial evaluation activities are undertaken. As well, permit applications are submitted to regulators proposing that the project become a producing mine.

Compared to 2015, which saw 35 active exploration projects in the North Central Region, 48 were tracked in 2016 (Tables 4, 5), reflecting an increase in grassroots to early-stage exploration. Of the 48 projects, four (8%) were at the mine evaluation stage, six (13%) were at the advanced stage, 25 (52%) were at the early stage, and 13 (27%) were at the...
grassroots stage. Project types included precious metal (10 properties, 21%); porphyry (Cu-Au, Cu-Mo, Mo) projects (23 properties, 48%); polymetallic base and precious metals (seven properties, 15%); specialty metals (one property, 2%); industrial minerals including jade and amber (five properties, 10%); and coal (two properties, 4%).

7.1. Precious metal projects
In 2016, 10 precious metals projects were tracked in the North Central Region. With the exception of the mine evaluation stage Blackwater project (section 6.1.1.) all were at the early exploration stage (four projects) or grassroots stage (five projects). These included epithermal gold-silver deposit prospects (seven projects) and other vein-type deposit prospects (two projects). Seven of the properties are in the Nechako Plateau area of the Stikine terrane.

7.1.1. Lawyers (PPM Phoenix Precious Metals Corp.)
The Lawyers property (Fig. 1; Table 5) of private company PPM Phoenix Precious Metals Corp. (100% owned) is accessed by the Omineca Resource Access Road past the Kemess property, through the inactive Baker mine site, and about 7 km farther north by an exploration road. It is underlain by andesitic volcanic units of the Hazelton Group (Toodoggone Formation). North-northwest trending graben-bounding faults cross the property over a 3 km wide area and are the primary controlling structures for four sub-parallel moderate-steeply dipping zones of low-sulphidation epithermal mineralization. A high-sulphidation prospect lies less than 2 km farther west (Silver Pond North; MINFILE 094E 069). The property contains the former Amethyst Gold Breccia (AGB), Cliff Creek and Phoenix mines which were operated by Cheni Mines Ltd. from 1989 to 1992. They produced over 5.32 t (171,000 ounces) of gold and 109 t (3.5 million ounces) of silver, mainly from the AGB deposit, now reclaimed (Lane et al., 2016). The north sub-zone of the Cliff Creek deposit, 2 km to the west of AGB was only partially mined. Underground development to >200 m vertical depth remains intact but is flooded. The Cliff Creek deposit has a strike length of about 1,600 m and variable width <58 m (Lane, 2011). It is divided into three sub-zones (north, mid, and south) with best mineralization considered to be in the north and south sub-zones. The adjacent Duke’s Ridge deposit has a 1,480 m strike length and its northern end intersects the Cliff Creek structural trend at a shallow angle. Veins are characterized by multiple stages of crackle-to-chaotic breccia with sulphide mineralized clasts, grey quartz-chalcedony veining and stockwork zones with fine grey sulphide; and late milky quartz-amethyst-calcite fill (Fig. 10). Mineralization comprises finely disseminated pyrite with accessory sphalerite, galena, chalcopyrite, bornite, native gold, native silver, electrum and acanthite. Alteration consists of silicification ±aldularia, intergrown sericite-clay with chlorite, relic biotite, and selective-pervasive hematization.

In 2016, a NI 43-101 technical report (Lane et al., 2016) was completed, including an updated resource estimate (Table 5) consisting of a 550 Kt inferred resource at Cliff Creek North containing 2.5 t (80,000 ounces) of gold and 115 t (3.7 million ounces) of silver; and a 58 Kt inferred resource at Duke’s Ridge containing 250 kg (8,000 ounces) of gold and 8.1 t (260,000 ounces) of silver. The estimate incorporates results of a 2015 drilling program and historic data. Drilling results indicate the two sub-zones have minimum strike lengths of 225 m (Cliff Creek North) and 380 m (central Duke’s Ridge). The newly discovered P2 semi-massive sulphide vein in the Cliff Creek North hanging-wall returned a high-grade drill intersection of 2.40 m including 293.40 g/t Au and 7,622 g/t Ag over 0.70 m. A 51.00 m intersection in the deeper part of the sub-zone graded 1.71 g/t Au and 41.5 g/t Ag and represents a bulkmineable target. Drilling in the central part of Duke’s Ridge returned low to moderate gold-silver grades near surface. The property, including the neighboring Silver Pond group of high-sulphidation epithermal prospects, was included in a 2016 Geoscience BC project (see section 9.1.) that aims to develop an exploration framework for porphyry-to-epithermal transitions in the area.

7.1.2. Two Times Fred (Kootenay Silver Inc., Theia Resources Ltd.) and Copley (Kootenay Silver Inc.)
The Two Times Fred (2 X Fred) property (Fig. 1; Table 5) of Kootenay Silver Inc., is under option to Theia Resources Ltd. It is 24 km southwest of Vanderhoof and accessed by logging roads. The property is underlain by Endako Formation basalt with local felsic volcanic and conglomeratic units on the north side of the fault-bound Brooks diorite complex (Fig. 3). At least six major subvertical north- to northeast-trending shallow-level low-sulphidation epithermal vein systems have been identified on the property. They occur over a 3.0 x 1.4 km area, with strike lengths of individual veins up to 500 m and true widths up to 30 m. The gold-silver bearing quartz veins are centred on a coincident airborne electromagnetic and magnetic high anomaly and feature multiple crosscutting
Table 5. Selected exploration projects, North Central Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Ts</td>
<td>Independence Gold Corp.</td>
<td>093F 055, 093F 068</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)</td>
<td>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; Inferred</td>
<td>geochemical sampling (MMI soil), prospecting</td>
<td>Following up of Au-As-Zn anomalies generated by a 2015 Geoscience BC spruce top biogeochemical survey.</td>
</tr>
<tr>
<td>Akie</td>
<td>Canada Zinc Metals Corp.</td>
<td>094F 031</td>
<td>Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>19.6 Mt at 8.17% Zn, 1.58% Pb, 13.6 g/t Ag; containing 1.6 Mt (3,540 Mlbs) Zn, 311 Kt (685 Mlbs) Pb, 267 t (8.6 Moz) Ag; Indicated</td>
<td>NI 43-101 technical report, resource estimate update, environmental baseline monitoring</td>
<td>Reviewing plans for permitted underground exploration.</td>
</tr>
<tr>
<td>Big Bear</td>
<td>Parlane Resource Corp.</td>
<td>093F 075</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)</td>
<td>N/A</td>
<td>geochemical sampling (rock, soil), prospecting</td>
<td>Rock samples up to 1.7 g/t Au, 39 g/t Ag, 1.7% Zn, 2.1% Pb (Old Crow); 10.1 g/t Au, 13.8 g/t Ag, 0.5% Zn (the Cub).</td>
</tr>
<tr>
<td>Bowron River</td>
<td>First Amber Mines Inc.</td>
<td>093H 005, 093H 130</td>
<td>Amber; Bituminous coal</td>
<td>historic non NI 43-101 compliant 40 Mt coal reserves (Norco Resources Ltd., March 1981)</td>
<td>drilling (core, percussion RAB)</td>
<td></td>
</tr>
<tr>
<td>BT</td>
<td>Porpoise Bay Minerals Ltd.</td>
<td>093G 002, 093G 032</td>
<td>Cu, Co; Cu±Ag quartz veins</td>
<td>N/A</td>
<td>geochemical sampling (channel sampling)</td>
<td>Sampling over 24 m returned over 1% Cu values.</td>
</tr>
<tr>
<td>Captain</td>
<td>Orestone Mining Corp.</td>
<td>093J 026, 093J 180</td>
<td>Cu, Au; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>ground geophysics (IP/resistivity, magnetics; 8 line-km)</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>Cat Syndicate</td>
<td>094C 069</td>
<td>Cu, Au, Ag; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>geochemical sampling (rock), hand trenching, prospecting</td>
<td></td>
</tr>
<tr>
<td>Cathedral</td>
<td>Thane Minerals Inc.</td>
<td>094C 018, 094C 048, 094C 072, 094C 109, 094C 176</td>
<td>Cu, Au; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>aerial photography, airborne geophysics (magnetic, radiometric; 974 line-km, 2015), LiDAR survey, geochemical sampling (soil, silt, rock), ground geophysics (magnetics, 2016)</td>
<td>Pinnacle showing sampling highlights: 6.96% Cu, 0.26 g/t Au, 12.4 g/t Ag (2015, massive sulfide); 3.60 g/t Au (F1 fault, 2013); 7.78 g/t Au, 12.3 g/t Ag and 2.54% Cu (F2 fault, 2013); 4.37 g/t Au and 10,000+ ppm As (F6 fault, 2013).</td>
</tr>
<tr>
<td>Chuchi</td>
<td>Kiska Metals Corporation</td>
<td>093N 159</td>
<td>Cu, Au; Alkalic porphyry Cu-Au</td>
<td>historic non NI 43-101 compliant: 50 Mt at 0.21-4.0% Cu, 0.21-0.44 g/t Au; inferred (Digger Resources Inc., 1991)</td>
<td>core relogging (4,000 m), geochemical sampling (historic core, 350 samples)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5. Continued.

<table>
<thead>
<tr>
<th>Company</th>
<th>Code</th>
<th>Zinc, Lead, Silver; Sedimentary exhalative Zn-Pb-Ag</th>
<th>Resource Estimate</th>
<th>Exploration Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cirque Teck Resources Limited (Cirque Operating Corp.)</td>
<td>094F 008  Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>historic non NI 43-101 compliant: 28.38 Mt at 7.85% Zn, 2.17% Pb, 46.8 g/t Ag (North Cirque); indicated and inferred (Teck Corporation, 1995)</td>
<td>core drilling (495 m), processing and interpretation of airborne and ground gravity datasets, mapping, prospecting</td>
<td>2013 drilling highlights (released in 2015): 10.5 m at 1.26% Zn, 0.22% Pb, 3.36 g/t Ag (gap area, CRQ-13-001); 63 m at 1.61% Zn, 0.30% Pb, 3.94 g/t Ag, including 12 m at 3.22% Zn, 0.65% Pb, and 8.23 g/t Ag (South Cirque, CRQ-13-003).</td>
</tr>
<tr>
<td>Copley Kootenay Silver Inc.</td>
<td>093F 070, 093F 071</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)</td>
<td>N/A</td>
<td>geochemical sampling (rock), geologic mapping, prospecting</td>
</tr>
<tr>
<td>Coral Minfocus Exploration Corp.</td>
<td>094B 008, 094B 021</td>
<td>Zn, Pb; Mississippi Valley-type Pb-Zn</td>
<td>N/A</td>
<td>core drilling, geochemical sampling (rock), prospecting</td>
</tr>
<tr>
<td>Franklin MGX Minerals Inc.</td>
<td>093K 108</td>
<td>Cu, Au; Alkaline porphyry Cu-Au</td>
<td>N/A</td>
<td>geochemical sampling (soil, rock), prospecting</td>
</tr>
<tr>
<td>Granite Basin Canasil Resources Inc.</td>
<td>094C 009</td>
<td>Cu, Au, Ag; Porphyry Cu±Mo±Au</td>
<td>N/A</td>
<td>geochemical sampling (rock), prospecting</td>
</tr>
<tr>
<td>Groundhog North Atrum Coal Groundhog Inc.</td>
<td>104A 086, 104A 078</td>
<td>Coal; Anthracite</td>
<td>349 Mt in situ (Western Domain; Measured and Indicated), 260 Mt in situ (Eastern Domain; Indicated)</td>
<td>Prefeasibility study update, preparatory work for underground bulk sample, washability tests, engineering and environmental studies</td>
</tr>
<tr>
<td>Hixon Gitennes Exploration Inc.</td>
<td>093G 068, 093G 070</td>
<td>Au; Au-quartz veins</td>
<td>N/A</td>
<td>geochemical sampling (soil, till), ground geophysics (EM, Mag), mapping, prospecting</td>
</tr>
<tr>
<td>Jewel Serengeti Resources Inc.</td>
<td>093N 240</td>
<td>Cu, Au, Ag; Alkaline porphyry Cu-Au</td>
<td>N/A</td>
<td>ground geophysics (EM, IP)</td>
</tr>
<tr>
<td>Kemess East AuRico Metals Inc.</td>
<td>094E 315</td>
<td>Cu, Au, Ag; Porphyry Cu±Mo±Au;</td>
<td>39.27 Mt at 0.40% Cu, 0.50 g/t Au, 1.99 g/t Ag, 0.08% Mo containing 157,650 t (347.55 Mtbs) Cu, 19.6 t (630 Koz) Au, and 78.1 t (2.51 Moz) Ag, 3.20 Kt (7.05 Mtbs) Mo, Indicated</td>
<td>resource estimate update, core drilling (13 holes, 13,544 m; infill, expansion), metallurgical testwork</td>
</tr>
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<td></td>
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<td>2016 drilling highlights: 628 m at 0.53 g/t Au, 0.41% Cu (KH-16-13); 549 m at 0.55 g/t Au, 0.41% Cu (KH-16-12); 504 m at 0.52 g/t Au, 0.36% Cu (KH-16-9); 372 m at 0.59 g/t Au, 0.40% Cu (KH-16-11); 344 m at 0.51 g/t Au, 0.43% Cu (KH-16-07).</td>
</tr>
</tbody>
</table>
Table 5. Continued.

<table>
<thead>
<tr>
<th>Company</th>
<th>Project Location</th>
<th>ORE Type</th>
<th>Carrying Company</th>
<th>Exploration Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kwanika</strong></td>
<td></td>
<td></td>
<td>Serengeti Resources Inc. (95%) Daewoo Minerals Canada Corp. (5%)</td>
<td>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; Indicated core drilling (2,446 m), ground geophysics (IP), resource estimate update, preliminary economic assessment update. 2016 Central Zone drilling highlights: 438 m at 0.71% Cu, 0.83 g/t Au, 2.0 g/t Ag including 233.6 m at 1.18% Cu, 1.30 g/t Au, 3.2 g/t Ag (K-16-177); 58 m at 0.26% Cu, 0.29 g/t Au, 1.2 g/t Ag (K-16-179).</td>
</tr>
<tr>
<td><strong>Kwanika East-Smoke</strong></td>
<td></td>
<td></td>
<td>Serengeti Resources Inc. (95%) Daewoo Minerals Canada Corp. (5%)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Later</strong></td>
<td></td>
<td></td>
<td>ML Gold Corp., Pacific Empire Minerals Corp.</td>
<td>Core drilling (1,107 m) 2015-16 drilling highlights: 94 m at 0.34 g/t Au (DD15 ELB001); 28 m at 0.25 g/t Au (DD15 ELB004); 41.3 m at 0.42 g/t Au, including 3.0 m at 2.88 g/t Au (DD16 ELB007); 103.6 m at 0.14 g/t Au (DD16 ELB005).</td>
</tr>
<tr>
<td><strong>Lawyers</strong></td>
<td></td>
<td></td>
<td>PPM Phoenix Precious Metals Corp.</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation) 550 Kt at 4.51 g/t Au, 209.15 g/t Ag (Cliff Creek North zone); 58 Kt at 4.30 g/t Au, 139.13 g/t Ag (Duke's Ridge zone); both at 4.0 g/t Au AuEq cut-off, inferred, see main text for contained metal; NI 43-101 technical report released, updated resource estimate 2015 drilling highlights (data released 2016): 8.63 m at 9.64 g/t Au and 307.0 g/t Ag (Cliff Creek North); 2.40 m at 87.84 g/t Au, 2.407 g/t Ag, including 0.70 m at 293.40 g/t Au, 7.622 g/t Ag (P2 vein); 51.99 m at 1.71 g/t Au, 41.5 g/t Ag (Cliff Creek North); 4.00 m at 8.54 g/t Au and 171.8 g/t Ag (Duke's Ridge).</td>
</tr>
<tr>
<td><strong>Lil</strong></td>
<td></td>
<td></td>
<td>Canasil Resources Inc.</td>
<td>Geochemical sampling (rock), prospecting</td>
</tr>
<tr>
<td><strong>Longworth</strong></td>
<td></td>
<td></td>
<td>MGX Minerals Inc.</td>
<td>Geochemical sampling (rock), metallurgical testing 99.34% SiO2 average value of 10 rock chip samples (Snow zone).</td>
</tr>
<tr>
<td><strong>Milligan West</strong></td>
<td></td>
<td></td>
<td>Serengeti Resources Inc. (50%) Fjordland Exploration Inc. (50%)</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Nechako Gold</strong></td>
<td></td>
<td></td>
<td>Tower Resources Ltd.</td>
<td>Sampling (rock, till), prospecting</td>
</tr>
</tbody>
</table>

Table 5. Continued.

<table>
<thead>
<tr>
<th>North Grid</th>
<th>Centerra Gold Inc. (Centerra B.C. Holdings Inc.)</th>
<th>093N 123</th>
<th>Cu, Au; Alkalic porphyry Cu-Au</th>
<th>N/A</th>
<th>core drilling (2,000 m; Mitzi and Snell targets)</th>
<th>Agreement with Centerra Gold Inc. for the US$1.03 billion acquisition of Thompson Creek Metals Company Inc. was finalized in late October.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGK (Nova Block)</td>
<td>Cat Syndicate</td>
<td>O94C 177, O94C 138, O94C 174</td>
<td>Cu, Au, Ag; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>geochemical sampling (rock), prospecting</td>
<td>2016 drilling highlights: 6.85 m total coal (1.90 m thickest seam) to 326 m depth (DHPN-16-01); 9.87 m total coal (2.05 m thickest seam) to 260 m; (DHPN-16-02); 10.75 m total coal (2.30 m thickest seam) to 325 m; (DHPN-16-03); 11.80 m total coal (1.70 m thickest seam) to 269 m (DHPN-16-04).</td>
</tr>
<tr>
<td>Panorama North</td>
<td>Atrum Coal Panorama Inc.</td>
<td>104A 085, 104A 089</td>
<td>Coal; Anthracite</td>
<td>N/A</td>
<td>core drilling (1,180 m)</td>
<td>2016 drilling highlights: 6.85 m total coal (1.90 m thickest seam) to 326 m depth (DHPN-16-01); 9.87 m total coal (2.05 m thickest seam) to 260 m; (DHPN-16-02); 10.75 m total coal (2.30 m thickest seam) to 325 m; (DHPN-16-03); 11.80 m total coal (1.70 m thickest seam) to 269 m (DHPN-16-04).</td>
</tr>
<tr>
<td>Pie, Cirque East, Yuen (Pie Option properties)</td>
<td>Teck Resources Limited</td>
<td>094F 023; 094F 008; 094F 013</td>
<td>Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag</td>
<td>N/A</td>
<td>core drilling (Pie; 1080 m), ground geophysics (gravity), geochemical sampling (rock, soil), mapping, prospecting</td>
<td>Pillar East zone: 0.6 m at 2.80 g/t Au, 6.5 g/t Ag (P1 hand drill sample); up to 6.57 g/t Au and 69.7 g/t Ag (12 rock samples, 2016); Copper Cliff zone: 1.27% Cu, 33.8 g/t Ag (talus sample, 2015); 0.05-1.04% Cu, 2.8-23.9 g/t Ag (11 rock samples, 2016).</td>
</tr>
<tr>
<td>Pil (Pillar East)</td>
<td>Finlay Minerals Ltd.</td>
<td>094E 213 094E 215 094E 216 094E 217</td>
<td>Cu, Au, Ag; Porphyry Cu±Mo±Au; Au-Ag-Cu (low sulphidation)</td>
<td>N/A</td>
<td>geochemical sampling (soil, stream, rock), prospecting</td>
<td>2016 drilling highlights: 6.85 m total coal (1.90 m thickest seam) to 326 m depth (DHPN-16-01); 9.87 m total coal (2.05 m thickest seam) to 260 m; (DHPN-16-02); 10.75 m total coal (2.30 m thickest seam) to 325 m; (DHPN-16-03); 11.80 m total coal (1.70 m thickest seam) to 269 m (DHPN-16-04).</td>
</tr>
<tr>
<td>Pishon Green Jade</td>
<td>Private individual</td>
<td>093K 005</td>
<td>Nephrite jade; jade;</td>
<td>N/A</td>
<td>surface bulk sample (1000 t)</td>
<td>largest nephrite exposure is known as the jade cliff.</td>
</tr>
<tr>
<td>Q7a</td>
<td>Vale Exploration Canada Inc.</td>
<td>093N 206</td>
<td>Cu, Au; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>historic core relogging, prospecting (2015), core drilling (1101 m; 2016)</td>
<td>Historic core resampling returned anomalous copper and gold values.</td>
</tr>
<tr>
<td>Red Lion</td>
<td>Garibaldi Resources Corp.</td>
<td>094D 165 094D 167 094D 169</td>
<td>Cu, Au; Porphyry Cu±Mo±Au</td>
<td>N/A</td>
<td>geochemical sampling (soil, rock), prospecting</td>
<td>2016 drilling highlights: 107.60 m at 0.14% Cu, 0.045 g/t Au (Thor East).</td>
</tr>
<tr>
<td>SYL</td>
<td>Serengeti Resources Inc.</td>
<td>093N 163</td>
<td>Cu, Au; Alkalic porphyry Cu-Au</td>
<td>N/A</td>
<td>ground geophysics (IP)</td>
<td>Soil sampling delineated a 900 x 100 m northeast trending Au-As-Sb geochemical anomaly.</td>
</tr>
<tr>
<td>Thor</td>
<td>Copper North Mining Corp.</td>
<td>094D 126</td>
<td>Cu, Au, Ag; Porphyry Cu±Mo±Au</td>
<td>N/A</td>
<td>core drilling, prospecting</td>
<td>2016 drilling highlights: 107.60 m at 0.14% Cu, 0.045 g/t Au (Thor East).</td>
</tr>
<tr>
<td>Trout</td>
<td>Venerable Ventures Ltd.</td>
<td>093F 044</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)</td>
<td>N/A</td>
<td>geochemical sampling (soil; late 2015)</td>
<td>Soil sampling delineated a 900 x 100 m northeast trending Au-As-Sb geochemical anomaly.</td>
</tr>
</tbody>
</table>
vein stages, crustiform banding, comb textures, lattice bladed quartz, internal deformation textures, mosaic and chaotic breccia, and fine grained pyrite mineralization (Fig. 11). Wall rock fragments are clay-chlorite-hematite altered. In 2016, results were released from a 2015 drilling program that tested two of the vein systems to 100 m depth (see Table 5 for assay highlights). Consistent grade and vein textures suggest a higher-grade boiling horizon could lie deeper or along-strike. Follow-up grassroots mapping and geochemical sampling focused on recently discovered gold-silver bearing flat-lying vein system and sinter targets in the northern part of the property. Grab samples taken 750 m north of the 2015 drilling area returned high values including 12.7 g/t Au, 4.4 g/t Au and 11.4 g/t Au from sub-cropping veins.

Grassroots mapping and geochemical sampling was also conducted on nearby Copley property of Kootenay Silver Inc. (100% owned). The property is about 35 km south of Fraser Lake and is accessible by a logging road. Three northeast-trending topographic domes are underlain by silicified and clay-hematite altered Ootsa Lake Formation rhyolite (Thompson, 2010). Previous exploration suggested a large 6 x 2 km near-surface low-sulphidation epithermal gold system featuring banded chalcedonic quartz veins, stockwork veining and breccias, and disseminated and vein-hosted pyrite.

7.1.3. Trout (Venerable Ventures Ltd.)

The Trout property (Fig. 1; Table 5), of Venerable Ventures Ltd. (100% owned) is 70 km southwest of Vanderhoof and accessible by logging and spur roads. It is underlain by mafic-intermediate volcanic units of the Hazelton Group and Nechako Plateau Group (Endako Formation), and Chilcotin Group basalt. The property is at the southwest side of the Brooks diorite complex about 31 km southwest of the 2 X Fred project, which is on the northeast side of the complex. The low-sulphidation epithermal Discovery zone has estimated dimensions of 150 x 100 m, and 100 m depth, and is hosted in polymictic conglomerate and andesitic to trachytic volcanic breccia units mapped as Kasalka Group within an interpreted graben at its southeast margin (Cuttle, 2014; Ostensoe, 2011). Steeply dipping banded chalcedonic quartz veins and silicified breccia host fine-grained pyrite, argentite and native gold and appear to be controlled by southwest- and southeast- trending structures. Soil sampling into late 2015 delineated a 900 x 100 m northeast-trending Au-As-Sb geochemical anomaly 3.5 km southwest of the Discovery zone along the northwest-dipping interpreted graben boundary. The geochemical anomaly is coincident with an airborne resistivity high and magnetic low.

7.1.4. Big Bear (Parlane Resource Corp.)

The Big Bear property (Fig. 1; Table 5) of Parlane Resource Corp. (claims held in the name Little Bear Gold Corp.) is 95

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Table 5. Continued.

<table>
<thead>
<tr>
<th>Property</th>
<th>Company/Operator</th>
<th>Claim Name/Woodland</th>
<th>Location</th>
<th>Stage</th>
<th>Target Type</th>
<th>Assay Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Times Fred (2 X Fred)</td>
<td>Theia Resources Ltd., Kootenay Silver Inc.</td>
<td>093F 036</td>
<td>Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)</td>
<td>N/A</td>
<td>geochemical sampling (rock), geologic mapping, prospecting</td>
<td>2015 drilling highlights: 7.6 m at 1.69 g/t Au, 29.36 g/t Ag, including 1.9 m at 3.20 g/t Au, 46.48 g/t Ag (Saki vein system); 67 m at 0.37 g/t Au and 7.22 g/t Ag (Saki vein); 24.4 m at 0.29 g/t Au, 7.70 g/t Ag (Gold Hill vein system).</td>
</tr>
<tr>
<td>UDS</td>
<td>Serengeti Resources Inc.</td>
<td>094E 070</td>
<td>Cu, Au, Ag; Porphyry Cu-Mo-Au</td>
<td>N/A</td>
<td>ground geophysics (IP), prospecting</td>
<td>900 x 1500 m southward plunging strong IP chargeability anomaly identified at the South Valley target.</td>
</tr>
<tr>
<td>Vega</td>
<td>Canasil Resources Inc.</td>
<td>094C 021</td>
<td>Cu, Au; Alkaline porphyry Cu-Au</td>
<td>N/A</td>
<td>geochemical sampling (rock), prospecting</td>
<td></td>
</tr>
</tbody>
</table>

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Fig. 11. Crustiform-colloform banded chalcedonic quartz vein with comb texture and lattice bladed quartz in vugs at 2 X Fred.
km southwest of Vanderhoof and is accessible by logging roads. It is underlain by volcanic units of the Hazelton Group, Bowser Lake Group, and Nechako Plateau Group (Ootsa Lake Formation) and dioritic intrusive plugs (probable Late Cretaceous; Diakow, 1997).

North-northeast and northeast-striking assumed high-angle faults (Diakow and Levson, 1997) intersect in the southwest part of the property in the Black Bear target area where drilling in 2012 returned mineralized intervals in two holes, including 330.7 m of 0.26 g/t Au, 2.67 g/t Ag and 0.21% Zn (BB12-4; Webster, 2013) hosted in intermediate-felsic lapilli and crystal tuff units. In 2016, follow-up soil sampling was completed to determine additional drill locations. In addition, a 12,968 hectare claim block contiguous to the property on the north was acquired. Follow-up prospecting and sampling confirmed vein-hosted gold-silver-zinc mineralization at the Old Crow and Cub showings (Fig. 12; Table 5) in volcaniclastic units. An additional showing of mineralized boulders in a narrow forest road was discovered 2 km east of the Cub and named the Sugar Bear. The bedrock source of the boulders was located and sampled for similar style vein-hosted mineralization. The claim block also hosts the recently discovered Liesegang redbed copper type showing (Angen et al., 2016) underlain by Hazelton Group (Entiako Formation) basalt with hematitic Liesegang rings and epidote veins. Parlane completed mapping and prospecting in the area and the showing was resampled.

7.1.5. Nechako Gold (Tower Resources Ltd.)

The Nechako Gold property (Fig. 1; Table 5), under option to Tower Resources Ltd. from a private vendor, is 78 km southwest of Vanderhoof and is accessible by logging roads. It is underlain by volcanic and volcaniclastic units of the Hazelton and Kasalka groups, sedimentary units of the Hazelton and Bowser Lake groups, a composite dioritic intrusive (Late Cretaceous), and granodiorite rocks of the Ch pluton (Eocene). The Ch pluton is spatially related to the Chu low fluorine-type porphyry molybdenum developed prospect (MINFILE 093F 001). The property and two other claim areas to the northwest were staked to cover the interpreted source of down-ice till geochemical anomalies and geophysical signatures suggestive of Blackwater-type mineralization. Grassroots prospecting and geochemical sampling was followed by a property-scale till sampling survey conducted by Overburden Drilling Management (ODM).

7.1.6. 3Ts (Independence Gold Corp.)

The 3Ts property (Fig. 1; Table 5) of Independence Gold Corp. (100% owned) is about 126 km southwest of Vanderhoof and is accessible by logging and exploration roads. It is underlain by Hazelton Group rhyolite tuffs and flows (Entiako Formation) and mafic-intermediate volcanic units (Naglico Formation), Bowser Lake Group coarse siliciclastic units, and quartz monzonite intrusive units assigned to the Capoose batholith. Rhyolitic units host a low-sulfidation epithermal vein system that has more than a dozen subvertical, north-striking mineralized veins up to 900-m long and 20-m wide that appear to have formed by open space fillings along faults (Armitage, 2014). The veins have quartz-calcite-chalcedony, sericite, adularia, amethyst gangue, and feature crustiform banding and comb textures. Vein breccia fragments and silicified wall rock fragments indicate multiple pulses of vein formation during faulting. Mineralization includes pyrite and Cu-Ag sulfosalts(?) disseminations and sooty hairline veinlets, with accessory chalcopyrite, sphalerite, and galena. A generally 80 m thick Late Cretaceous (73.8 Ma, U-Pb zircon; Friedman et al., 2001) microdiorite sill crosscuts the veins. However, an Early Miocene (21.2 Ma Re-Os; D. Pawliuk, personal communication, November 2014) hydrothermal quartz breccia vein above the sill implies a protracted mineralizing history. The western side of the property is covered by glacial till. In 2016, an MMI and B-horizon soil geochemical sampling program was conducted following the release of the 2015 Geoscience BC spruce top biogeochemical survey results that show gold, arsenic, and zinc anomalies in the up-ice (west) direction from the known vein system. Soil sampling included an orientation survey and some regional sampling with the aim of developing targets in new areas. Prospecting continued in the area of known veins.

Fig. 12. Auriferous vuggy quartz-pyrite vein with comb texture in Hazelton Group volcaniclastic unit at the Cub showing.
7.1.7. Lil (Canasil Resources Inc.)

The Lil property (Fig. 1; Table 5) of Canasil Resources Inc. (100% owned) is 200 km northwest of Mackenzie and is accessible by logging roads to within 3 km of the main showings. It is underlain by sedimentary rocks of the Ingenika Group (and metamorphosed equivalents) that host narrow argentiferous quartz veins and breccia with tetrahedrite, argentite and pyrrargyrite (ruby silver) mineralization and Ordovician to Lower Devonian carbonate rocks that host disseminated and irregular replacement lead-zinc-silver mineralization (Lame, 2015b). A north-trending granitic dike cuts across the central part of the property. In 2016, grassroots prospecting and geochemical sampling continued.

7.1.8. Hixon (Gitennes Exploration Inc.)

The Hixon project (Fig. 1; Table 5) of Gitennes Exploration Inc. (100% owned) is 61 km south of Prince George near the Hixon placer mining community and is accessible by logging roads. It is underlain by a northwest-trending sequence of Snowshoe Group metasedimentary rocks, Takla Group basaltic volcanic and fine-grained volcaniclastic rocks, including the black phyllyite unit correlative with the Slate Creek succession near the Manson Creek (Ferri et al., 1994), ultramafic intrusive rocks of the Polaris Ultramafic suite, and granite of the Naver pluton (Bayonne intrusive suite). The Eureka thrust zone (southwest dipping) crosses the area. In 2016, a grassroots program of ground magnetic and electromagnetic surveys, soil sampling, geological mapping, and prospecting for bedrock hosted vein-type gold mineralization was completed.

7.2. Porphyry projects

There were 23 porphyry projects tracked in 2016 in the North Central Region. One project, Kemess Underground (section 6.1.2.), was at the mine evaluation stage. Two projects were at the advanced exploration stage (Kemess East and Kwanika). The remainder were either at the early exploration stage (13 projects), or the grassroots stage (seven projects). Six of the properties are within the eastern margin of the Stikine terrane; five of these in the Toodoggone River area, and one in the Nechako Plateau area (Endako batholith). Most properties (17 projects) are in the Quesnel terrane.

7.2.1. Kemess East (AuRico Metals Inc.)

The Kemess East property (Fig. 1; Table 5) of AuRico Metals Inc. (100% owned) is one kilometre east of AuRico’s KUG deposit (see section 6.1.2.) and is accessible by exploration roads, or by helicopter from the Kemess South property, 6.5 km to the south. The Kemess East deposit appears to be similar in size and style to KUG, with gold-to-copper ratios ranging from 1:1 to 2:1 and good continuity of grade throughout. Mineralization, at 900-1600 m below surface, is hosted primarily in the dioritic Kemess East pluton (earliest Jurassic) and, to a lesser degree, in Takla Group basaltic-andesite. A high-grade core has been identified over a 300 x 300 m zone. A similar lower-grade diorite intrusive unit at greater depth suggests a series of flat-lying to gently south dipping sills (Chevrier et al., 2016). Auriferous chalcopryte is mostly disseminated but also occurs in quartz veins in the pluton. The highest copper-gold grades are associated with secondary biotite and silica in a potassic alteration zone (Fig. 13). Phyllic alteration is less intense than at KUG, and late calcite-zeolite alteration is spatially associated with a granodiorite pluton south of the deposit. A structurally offset prospect between KUG and Kemess East, the Kemess Offset Zone (KOZ), is downthrown east of KUG. The Kemess East zone is downthrown again east of KOZ before stepping up to shallower levels in a continuing series of horst-and-graben style fault blocks. A southwest-dipping strike-slip fault (Kemess East Offset) truncates the system on the east. The Kemess East deposit may represent the deeper portion of a single dissected mineralized system that includes KOZ and KUG; it remains open in three directions, as does the high-grade core zone.

An updated resource estimate for the project was released with the KUG feasibility study (Chevrier et al., 2016) and features a 19.2 Mt potassically altered high-grade core zone grading 0.47% Cu and 0.72 g/t Au within a 39.2 Mt indicated resource (Table 5). The estimate incorporates drilling from 2015 and, similar to the KUG resource estimate, used updated lithology, structure, and alteration models to define grade estimation domains and parameters. Exploration continued in 2016 in a US$4.9 million 13-hole (18,544 m) drilling program (Fig. 14). Drilling targeted the existing resource and high-grade core for infill and step-out expansion, and also refinement of the geological model through better delineation of key faults. Except for one abandoned hole, all drilling intersected mineralization, including a 628 m interval grading 0.53 g/t Au, 0.41 % Cu, 2.07 g/t Ag, and 0.005 % Mo (KH-16-13; Table 5). Metallurgical testwork on drill core was planned.

Fig. 13. Kemess East chalcopyrite-pyrite mineralization with magnetite-quartz-biotite-chlorite alteration in brecciated Black Lake monzodiorite unit (KH-15-23).
7.2.2. Pil (Finlay Minerals Ltd.)

The Pil property (Fig. 1; Table 5) of Finlay Minerals Ltd. (100% owned) is about 35 km north of the Kemess South property and is accessible by the Omineca Resource Access Road and secondary resource roads. The property is underlain by Hazelton Group volcanic rocks including fragmental andesitic to dacitic units of the Toadogone Formation. A monzonitic body of the Black Lake intrusive suite crosses the claim block alongside a north-northwest trending fault. In 2015 and 2016, grassroots exploration focused on two target areas in the Pillar East zone, an epithermal gold-silver target and a porphyry copper target. Geophysically, the Pillar East zone features a 2 km diameter aeromagnetic high ring anomaly with a central magnetic low. In 2015, a rusty outcrop was sampled using a portable drill. Drill results included 2.80 g/t Au over 0.6 m (drill sample P1) and 12.7 g/t Ag over 0.6 m (drill sample P4). Angular talus fragments collected at the epithermal gold-silver target returned up to 8.30 g/t Au and 39.7 g/t Ag.

In 2016, follow-up soil sampling was undertaken to confirm and refine previously identified gold-in-soil anomalies. Quartz veining and breccia were located in outcrop. Composite rock samples were collected, twelve of which returned assays ranging from anomalous up to 6.57 g/t Au and 69.7 g/t Ag. Some also returned significant zinc and lead values. A steeply dipping, north-northeast trending controlling structure has been identified and is about 800 m in length and open along strike.

In 2015, prospecting in the area targeted for porphyry copper mineralization discovered chalcopyrite mineralized phyllic altered lapilli tuff on a talus slope south of the epithermal gold-silver target area. Assays ranged between 0.99-1.67% Cu and up to 33.8 g/t Ag in four composite rock samples. In the 2016 follow-up program, a 40 x 30 m area of disseminated and veinlet-hosted chalcopyrite mineralization was discovered in potassically altered monzonite porphyry bedrock upslope of the talus. Eleven rock samples collected in this area assayed between 0.05-1.04% Cu and 2.8-23.9 g/t Ag.

Fig. 14. Two drills on the upper flat of East Squared Cirque valley at Kemess East. A third drill rig is out of view down-slope. View is looking northwest.

7.2.3. UDS (Serengeti Resources Inc.)

The UDS property (Fig. 1; Table 5) of Serengeti Resources Inc. (100% owned) is about 8 km northeast of the Kemess South property and is accessible by helicopter. The property is underlain by Asitka Group limestone, Stuhini Group volcanic and sedimentary rocks, Hazelton Group (Toodogone Formation) fragmental dacitic volcanics, and granodiorite of the Black Lake intrusive suite. Recent work outlined the August 30 and South Valley target areas. The August 30 target area (1500 x 800 m) features copper mineralized outcrops and phyllic alteration associated with felsic dikes that occupy a faulted lithological contact. The South Valley target area (1.5 x 3 km) features a strong copper-zinc-gold soil anomaly. The Kemess East deposit lies about 4 km to the west. In 2016, a follow-up deep-penetrating induced polarization survey in four widely spaced lines delineated a 900 x 1500 m southward plunging strong chargeability anomaly at the South Valley target area that is coincident with the soil geochemical anomaly and remains open to the north.

7.2.4. Thor (Copper North Mining Corp.)

The Thor property (Fig. 1; Table 5) of Copper North Mining Corp. (under option from Electrum Resources Corp.) is about 15 km south of the Kemess South property and is accessible by the Omineca Resource Access Road and spur roads to base camp, and then by helicopter. The property overlies a strand of the terrane-bounding Ingenika fault (Fig. 1) and the north-northwest trending Moose Valley Fault which separates Sustut Group sedimentary rocks on the west from Asitka Group limestone, Takla Group basaltic volcanic rocks, and granodiorite intrusive rocks (Early Jurassic) on the east. Copper sulphide mineralized veins and fractures are associated with silicified and oxidized shear zones. In 2016, drilling tested two target areas on the western flank of the north-south trending McConnell Range and adjacent valley. The Thor East target in the uplands is defined by potassic alteration and mineralization in outcrop coincident with local aeromagnetic high anomalies. Drilling results (Table 5) included more than 107 m of copper-gold mineralization in fractured granodiorite near a contact with Takla volcanics, and a transition to phyllic alteration at depth.

The Thor West target is along the till covered lower slopes in the valley. The target is defined by a large (4 x 2 km) ground IP chargeability anomaly and a coincident broad aeromagnetic high that suggests a large intrusive complex underlies the glacial overburden (McCIntock, 2015).

7.2.5. Red Lion (Garibaldi Resources Corp.)

The Red Lion property (Fig. 1; Table 5) of Garibaldi Resources Corp. (under option from a private vendor) is about 235 km northwest of Mackenzie and is accessible by the Omineca Resource Access Road. Similar to the contiguous Kliyul developed prospect (MINFILE 094D 023) it is underlain by the Takla Group. A lower unit of volcanic sandstone on the west side of the property transitions to an upper unit of basaltic...
volcanic breccia on the east side (Schiarizza, 2003; Voordouw, 2012). Intrusive rocks include a north- to northwest-trending ultramafic-mafic suite that includes diorite (Late Triassic), a quartz dioritic-monzonitic suite (early Middle Jurassic), and a northwest-trending granodioritic suite (Early Cretaceous). The northern end of the Hogem intrusive complex (Early Jurassic suite) is about 16 km to the south. A north-trending dextral strike-slip fault crosses the property. Historic showings include quartz vein hosted and disseminated chalcopyrite-pyrite mineralization associated with shear zones and diorite contact zones. In 2016, grassroots geochemical sampling was conducted near the access road, following up the 2015 geophysical surveys.

7.2.6. Granite Basin and Vega (Canasil Resources Inc.)

The Granite Basin property (Fig. 1; Table 5) of Canasil Resources Inc. (100% owned) is about 215 km northwest of Mackenzie and is accessible by resource roads and spur roads. The property is underlain by Takla Group volcanic and fine siliciclastic rocks, diorite sills, and late feldspar porphyry dikes and sills (Lane, 2015a). Gold-silver mineralization is hosted in west- to northwest-trending, carbonate-sericite-pyrite-jarosite altered shear zones that cut across all rock types. About 50 km southeast, the southeast corner of the Vega property (Fig. 1; Table 5) of Canasil Resources Inc. (100% owned) is accessible by logging roads. The property is underlain predominantly by Takla Group volcanic, volcaniclastic and sedimentary rocks, dioritic intrusive rocks (Late Triassic-Early Jurassic), and quartz monzonitic intrusive rocks (Early Jurassic) of the Hogem intrusive complex. Copper-gold mineralization is hosted in quartz-carbonate healed fracture/shear zones, in massive sulfide lenses with magnetite, or is disseminated (Lane, 2016c). In 2016, a grassroots geochemical sampling and prospecting was completed on both properties.

7.2.7. Cathedral (Thane Minerals Inc.)

The Cathedral property (Fig. 1; Table 5) of private company Thane Minerals Inc. (100% owned) is a large claim block (over 28,700 ha) located about 170 km northwest of Mackenzie. The southern and eastern edges of the property can be accessed by logging roads. The property is predominantly underlain by dioritic to quartz monzonitic rocks of the Hogem intrusive complex (Early Jurassic), but in the northeast is underlain by Takla Group volcanic rocks and fine-grained siliciclastic rocks. At least eight target areas are on the property, with the Cathedral area (Pinnacle showing; southern part of the property) and Lake area (northern part of the property) being the main focus in recent years (Naas, 2014; 2016). The Pinnacle showing is a 60 m wide outcrop of a north-northwest trending copper-gold mineralized fault zone (Table 5) with anomalous arsenic values associated with significant gold grades. The Cathedral area also hosts lenses of massive sulfide mineralization with magnetite and specularite. Alteration is mainly potassic. Chalcopyrite and pyrite is disseminated, in fractures, and in quartz±calcite veins. Mineralization in the Lake area is more disseminated and, visually, most abundant in diorite. Magnetite is pervasive to semi-massive. Aerial photography covering the entire property was flown in 2015 and an airborne magnetic and radiometric survey was completed. In 2016, a LiDAR survey was flown over the Cathedral area, geochemical sampling was conducted on several targets, and some ground magnetometer test surveying was completed. Reconnaissance work was conducted on newly acquired tenure that covers the C JL showing (MINFILE 094C 176), a magnetite breccia zone with copper grades up to 9% (C. Naas, personal communication, November 2016).

7.2.8. Cat and OGK (Cat Syndicate)

The Cat property (Fig. 1; Table 5) of the private Cat Syndicate group of prospectors, (100% owned) is about 164 km northwest of Mackenzie and is accessible by logging roads. The property is underlain by Takla Group mafic-intermediate volcanic, pyroclastic and fine-grained siliciclastic rocks up to about 4 km east of the north-northwest trending eastern margin of the Hogem intrusive complex (Early Jurassic suite; Fig. 2). Small monzonite and syenite intrusions in the volcanic rocks form an apparent ring-dike complex associated with a 700 x 400 m variably-altered and mineralized area (Macdonald, 2013). Structurally hosted, steeply dipping, north- and northwest-trending auriferous magnetite veins with accessory chalcopyrite, pyrite, quartz and calcite (Fig. 15) range up to 0.6 m wide. Chalcopyrite also forms disseminations and veinlets in magnetite-chlorite-epidote altered volcanic host rocks. Monzonitic intrusive rocks are sericite-carbonate altered. Three main target areas are on the property. The deposit-type may be transitional between shear-hosted vein and alkalic porphyry system. In 2016, a grassroots program included geochemical sampling, prospecting, and hand trenching across a north-south striking oxidized vein hosted in monzodiorite. The OGK property (100% owned) is about 14 km to the west of the Cat property. The east and central portions of the OGK property are accessible by logging roads; access to other parts of the
property is by helicopter. The property consists of four separate claim blocks underlain by the Hogem intrusive complex (Early Jurassic suite), with the northern part underlain mainly by granodiorite and the southern part by the Duckling Creek syenite complex. In 2016, grassroots geochemical sampling continued in the Nova zone (northwest block) which features northwest-trending magnetic highs and sulphide mineralized quartz veins that have returned several high gold assays (Price and Mclaughlin, 2012).

7.2.9. Kwanika and Kwanika East-Smoke (Serengeti Resources Inc.)

The Kwanika property (Figs. 1, 3; Table 5) of Serengeti Resources Inc. (95% interest) and Daewoo Minerals Canada Corp. (5%) is about 140 km northwest of Fort St. James and is accessible by logging roads. It comprises two porphyry deposits, the Central Zone (Cu-Au-Ag) and the South Zone (Cu-Mo-Au-Ag), which are separated by about 1 km. Both deposits are associated with potassically altered dioritic to monzonitic rocks of the Hogem intrusive complex (Late Triassic to Early Jurassic). The 1250 × 600 m Central Zone features two moderate to steeply west-dipping intrusive bodies and several minor intrusive units hosted in Takla Group andesites. Both intrusive and volcanic rocks are mineralized, but copper-gold grades are higher in the intrusive units, particularly monzonite (Rennie, 2011). The Pinchi fault (north-northwest trending) and associated half-graben shaped conglomeritic basin (Cretaceous) truncates the Central Zone on the west. Mineralization occurs as chalcopyrite-pyrite-quartz-anhydrite, magnetite, bornite veins, vein stockwork and disseminations with potassic and reported albitic alteration. Phyllic alteration (sericite±pyrite, chlorite, hematite, carbonate) variably overprints the potassic alteration. A supergene enrichment zone follows the sedimentary basin unconformity; both native copper and secondary copper sulphides are observed with grades commonly above 1% CuEq (Fig. 16). In the South Zone, mineralization in strongly altered quartz monzonitic rocks lies within a 2900 × 500 m north-northwest trending fault-bounded corridor about 750 m east of the Pinchi Fault. The property hosts several additional exploration targets as the system remains open to the north and at depth. A series of sedimentary basins extending more than 25 km to the south of the deposit area may host additional supergene enrichment zones.

In 2016, Serengeti Resources completed a deep-penetrating ground IP survey line that confirmed a modeled strong IP chargeability anomaly from a previous survey. The modeled anomaly extends up to 1000 m north of the Central Zone at depth below previous drilling. A three-hole deep drilling program followed to test the lateral continuity of the supergene enrichment in the Central Zone high-grade core, and to test for extensions along its down-dip edge to the north and to greater depth into the chargeability anomaly. Results included a 438 m long mineralized intersection in the Central Zone grading 0.71% copper, 0.83 g/t gold, and 2.0 g/t silver, and a 58 m intersection grading 0.26% Cu and 0.29 g/t Au at the bottom of a hole that tested the down-dip northwest edge of the Central Zone. As well, anomalous copper-gold mineralization in strongly altered andesite was encountered over a 245 m intersection. This potentially represents a downthrown structural block 500 m to the north of the Central Zone above the deep chargeability anomaly.

In November, an updated resource estimate was released (Table 5) for the Central Zone (indicated and inferred, pit constrained and underground components at 0.13% and 0.27% CuEq cut-offs) and South Zone (inferred, pit constrained). It includes a high-grade domain in the Central Zone of 57.7 Mt grading 0.48% Cu, 0.55 g/t Au, and 1.43 g/t Ag at a 0.40% CuEq cut-off. The 2016 drilling was incorporated into the resource estimate. The release of a revised Preliminary Economic Assessment is planned for 2017.

Roughly 7 km to the northeast, the Kwanika East-Smoke property (Figs. 1; Table 5) of Serengeti Resources Inc. (95%) and Daewoo Minerals Canada Corp. (5%) is also accessible by logging roads. It is underlain by several phases of the Hogem intrusive complex including gabbro to diorite (Late Triassic- Early Jurassic), quartz monzonite (Early Jurassic), and granite (Early Cretaceous). The eastern side of the property is underlain by intermediate volcanic rocks of the Takla Group and Twin Creek succession. The property follows an east-northeast trending topographic lineament that crosses the Central Zone at Kwanika and intersects the eastern contact of the Hogem intrusive complex at a high angle (Clarke, 2014b). Serengeti completed a 14 line-km induced polarization survey over several aeromagnetic anomalies, and identified two target areas for follow-up. Geochemical sampling on the property was also carried out. Exploration work on the Kwanika area properties was funded by Daewoo Minerals Canada Corp. as part of a binding agreement finalized in April.

7.2.10. Jewel, SYL, Milligan West (Serengeti Resources Inc.)

Serengeti Resources Inc. holds tenure on a regional suite of properties in the Quesnell terrane (Quesnel Trough properties; 100% owned except for Milligan West) and several of these...
had grassroots to early-stage exploration programs in 2016. The Jewel property (Fig. 1; Table 5) is about 135 km north-northwest of Fort St. James and is accessible by helicopter from base camp. It is underlain by fine-grained siliciclastic rocks of the Takla Group at the western margin of the Germansen batholith (Fig. 3). A ground-based induced polarization and electromagnetic survey was completed to follow up the 2015 aeromagnetic survey that identified a 2 km-long ringed cluster of magnetic anomalies. The SYL property (Fig. 1; Table 5) is 90 km north of Fort St. James and is accessible by logging road. It is underlain by till-covered Takla Group volcanioclastic rocks along an interpreted east-west trending flexure in the Quesnel terrane (Clarke, 2014c) extending eastward from the southern end of the Hogem intrusive complex (Fig. 2). The Milligan West joint venture property (Fig. 1; Table 5) of Serengeti Resources (50% interest) and Fjordland Exploration Inc. (50% interest) is 17 km to the south of SYL and is accessible by a combination of logging road (southern half of property) and trails (northern half). It is underlain by till-covered Takla Group volcanioclastic and fine-grained siliciclastic rocks, Chuchi Lake succession pyroclastic rocks, and sedimentary rocks of a Paleogene half-graben. It similarly lies along the interpreted east-west trending flexure and includes a coincident airborne and ground-based geophysical target with copper-gold anomalous glacial till in the down-ice direction (Clarke, 2014a). The eastern side of the claim block is about 4 km west of the Mt. Milligan mine. In 2016, grassroots exploration and ground-based induced polarization surveys were completed at both SYL and Milligan West.

7.2.11. Later (ML Gold Corp., Pacific Empire Minerals Corp.)

The Later property (Figs. 1, 3; Table 5) of private company Pacific Empire Minerals Corp., under option to ML Gold Corp., is about 100 km north of Fort St. James and is accessible by logging roads. The property covers the northeast margin of the southern tail of the Hogem intrusive complex (Early Jurassic) where it is in fault contact with gently south-dipping intermediate volcanic units of the Chuchi Lake succession, and where a structural bend or break in the regional fabric intersects an interpreted northeast-trending transverse linear feature. Drilling in 2015 and 2016 tested a coincident geophysical anomaly consisting of a large (3 x 2 km) IP chargeability anomaly on the west side of the Elbow target area and a 2 km scale IP resistivity anomaly on the east side. These anomalies overlap a central magnetic high (Peters and Ritchie, 2015). The 2015 drilling, about 800 m to the west of the 2016 drilling area intersected 94 m grading 0.34 g/t gold with elevated copper values in a zone of phyllic (sericite-pyrite-calcite) altered Chuchi Lake succession volcanic units. Drilling in 2016 expanded the area of elevated gold mineralization to more than 1600 m within the chargeability anomaly, which is still open to the north and west (Table 5). The area is blanketed by glacial till.

7.2.12. Chuchi (Kiska Metals Corporation)

The Chuchi property (Figs. 1, 3; Table 5) of Kiska Metals Corporation (100% owned) is about 18 km east of the Later property and is accessible by logging and exploration roads. The claim block is centered on the northeast margin of the Hogem intrusive complex (Early Jurassic suite) at its southeastern end and continues eastward where it is underlain by a cluster of porphyritic monzonite stocks, dikes, and sills (Early Jurassic) that cut Chuchi Lake succession volcanic and sedimentary rocks. A central target (BP zone) of copper-gold mineralization over a >1.5 x 1.5 km area remains open in three directions and at depth (Chadwick, 2014). A 4 x 3 km zoned alteration footprint transitions inwards from propylitic to calc-potassic alteration (actinolite-magnetite±K-feldspar) and biotite hornfels (Nelson and Bellefontaine, 1996), and is coincident with an inwardly zoned high-to-moderate ground-based IP chargeability anomaly. Historic drilling in the northeast part of the BP Zone intersected mineralization from top to bottom consisting of disseminations, clots, and veins of chalcopyrite-pyrite+bornite. An aeromagnetic high and coincident copper and gold soil geochemical anomalies continue eastward across a north-south trending fault-bound valley that bisects the property. In 2016, a 4000 m core relogging and resampling program was conducted in two east-west cross sections similarly oriented to the 2015 induced polarization geophysical survey across the BP zone. One northeast-southwest long section was also completed. The 2015 survey defined chargeability anomalies coincident with the central magnetic high feature and zones of known mineralization. These chargeability anomalies extend beyond the magnetic feature and known mineralization both laterally and at depth, and to the east across the fault valley.

7.2.13. Q7a (Vale Exploration Canada Inc.)

The Q7a property (Fig. 1; Table 5) of Vale Exploration Canada Inc. (100% owned) is about 84 km north of Fort St. James and is accessible by logging roads. It is underlain by gently south-dipping Chuchi Lake succession volcanic and volcanioclastic rocks with dioritic to monzonitic intrusive units (probable Early Jurassic suite), and sedimentary rocks of a Paleogene half-graben (Hicks, 2015). A blanket of glacial till covers the property. In 2016, a three-hole drilling program tested a geophysical target across a strike length of 800 m. The target comprises an airborne magnetic high coincident with a ground IP chargeability anomaly on its eastern side.

In 2015, four unrecorded historic drill holes were found on the property and two of the drill sites were located. The holes were relogged and resampled, returning anomalous copper and gold values (Hicks, 2015). Mineralization with potassic and variable sericite-calcite alteration includes fine disseminated chalcopyrite and pyrite±chalcopyrite, quartz, magnetite, biotite, albite veins.

The North Grid property (Fig. 1; Table 5) of Centerra Gold Inc. (100% owned) is about 5 km northwest of the Mt. Milligan mine and is accessible by exploration roads from the mine. It is underlain by moderately east-dipping Takla Group mafic-intermediate volcaniclastic units less than 2 km south of the predominantly monzonitic Mount Milligan pluton (Early Jurassic), which lies on trend with the southern tail of the Hogem intrusive complex (Nelson and Bellefontaine, 1996), and less than 2 km west of an interpreted southeast-trending buried extension of the pluton towards the Mt. Milligan deposit area (Clifford and Berthelsen, 2015). A biotite-magnetite rich unit has previously been interpreted as an amphibolitic schist related to basement uplift (MINFILE 093N 204). In 2016, a multi-year drill program continued. Two drill holes tested an airborne magnetic high anomaly with a coincident ground IP chargeability anomaly on its western side (Mitzi target), and one hole tested a similar coincident geophysical anomaly about 2 km to the west (Snell target). At the Mitzi target, drilling intercepted an interval of pyrite-mineralized silicified and sericite altered chaotic breccia that is visually similar to units in the gold-enriched 66 Zone at the Mt. Milligan mine.

7.2.15. Fran (MGX Minerals Inc., Manto Gold Corp.)

The Fran property (Fig. 1; Table 5) of Manto Resources Ltd., optioned by Manto Gold Corp, a wholly-owned subsidiary of MGX Minerals Inc., is about 60 km north of Fort St. James and is accessible by logging roads. It is underlain mainly by Takla Group sedimentary (Inzana Lake succession) rocks, and also volcaniclastic rocks (Witch Lake succession), dioritic intrusive rocks (Late Triassic-Early Jurassic), and a granite stock (Cretaceous-Tertiary). The main target area on the property, the 1.5 km long Bullion Alley zone (MacIntyre, 2013), comprises northwest-trending en-echelon shear zones hosting auriferous quartz-sulphide veins, veinlet stockwork, and replacement mineralization. These are spatially related to a series of steeply north-dipping porphyritic monzodiorite dikes in contact with hornfelsed volcanic siltstones. The zone is open to the southeast.

In 2016, grassroots geochemical soil and rock sampling (Table 5) focused on the Fran East zone, west of the Bullion Alley zone. Soils were analyzed by soil gas hydrocarbon (SGH) analysis, a weak extractive procedure proprietary to Activation Laboratories Ltd. used to locate mineralization through cover. Results identified a 1000 x 400 m zone of anomalous copper and gold SGH signatures coincident with a large aeromagnetic anomaly and generated new drill targets.

7.2.16. Captain (Orestone Mining Corp.)

The Captain property (Fig. 1; Table 5) of Orestone Mining Corp. is about 50 km north-northeast of the Fort St. James and is accessible by logging and spur roads. It is underlain by Takla Group sedimentary (Inzana Lake succession) and volcanic rocks (Witch Lake succession), dioritic intrusive rocks (Late Triassic-Early Jurassic), paragneiss metamorphic rocks of the western margin of the Wolverine metamorphic complex, Chilcotin Group basaltic volcanic rocks, and is largely blanketed by glacial till generally 20-60 m thick. The property hosts a large northwest-trending central airborne magnetic high interpreted to be a buried dioritic pluton flanked by two greater than 1 x 3 km target areas, the East Magnetic target and West Magnetic target, which host clusters of smaller ground-based magnetic highs with moderate-strong peripheral IP chargeability anomalies including those of the 1 x 1.5 km Admiral target (East Magnetic target area). Copper-gold mineralization is associated with a series of potentially north-south striking subvertical monzonite porphyry dikes and consists of sulphide disseminations, blebs and veinlets with magnetite-rich potassic (K-feldspar-biotite-actinolite) and phyllic (sericite-pyrite-carbonate-chlorite) alteration. In 2016, ground-based induced polarization and magnetic surveys were completed to better define the Admiral target prior to further drilling; the last drilling program was in 2013 (Zawada, 2014).

7.2.17. Orbit (private individual, prospector)

The Orbit property (Fig. 1; Table 5) is about 11 km north-northwest of Fraser Lake and is accessible by highway and logging roads. It is predominantly underlain by dioritic intrusive rocks of the Stern Creek plutonic suite (Late Triassic), and by basaltic-andesite of the Endako Formation on its eastern side. Outcrops on the northern part of the property have quartz and epidote veining, and a sheared quartz vein with chalcopyrite mineralization was recently discovered (Rempel, 2012). In 2016, auger drilling was conducted to sample basal till and top of bedrock from 35 pre-disturbed sites.

7.3. Polymetallic base and precious metal projects

In 2016, seven polymetallic base and precious metal projects were tracked in the North Central Region. Two projects were at the advanced exploration stage (Akie and Cirque). The other projects were at the early exploration stage (five projects). Six of the properties are in the Muskwa ranges of the Northern Rocky Mountains, in the western margin of ancestral North America.

7.3.1. Akie (Canada Zinc Metals Corp.)

The Akie property (Figs. 1, 3; Table 5) of Canada Zinc Metals Corp. and subsidiary Ectall Mining Corp. (100% owned) is about 250 km north of Mackenzie and is accessible by logging and exploration roads. Fixed-wing aircraft can use the gravel airstrip at Tsay Keh Dene and Kwadacha. The property is underlain by fine-grained siliciclastic and limestone units of the Kechika Group, Road River Group, and Earn Group. The property includes the Cardiac Creek baritic zinc-lead silver SEDEX deposit, which is hosted in Gunsteel Formation shale (Earn Group). It is a steeply southwest-dipping tabular mineralized body that averages about 20 m thickness (<35 m thickness) and extends for an approximate strike length of 1,950 m, of which 1,300 m is considered potentially economic to a depth of about 800 m below surface (Sim, 2012; Sim,
From bottom to top, mineralization generally defines a stratiform sequence of: 1) bedded to massive barite and minor quartz-carbonate veining; 2) mottled sphalerite-galena-pyrite banding with deformed beds and upwardly decreasing barite-calcite; 3) grey sphalerite bands with thickly banded pyrite and minor galena and barite; 4) thickly banded fine-grained laminar pyrite with few bands of grey sphalerite; and 5) fine-grained laminar pyrite and nodular barite. The mineralized zone is commonly interbedded with siliceous Gunsteel Formation shale, can have weakly mineralized pyritic massive sulfide in a footwall zone, and is underlain by marine turbidites of the Paul River Formation (Lower Devonian) that include interbedded black shale and limestone debris flows (MacIntyre, 1998).

In 2016, a NI 43-101 technical report was released with an updated resource estimate for the Cardiac Creek deposit that incorporates infill and step-out drilling carried out since 2012. This drilling focused on the central, high-grade part of the deposit and refinement of the deposit model. The resource, a continuous zone at a 5% zinc cut-off grade, increased by 55% in the indicated category from the previous 2012 estimate with little change in average grade (Table 5); it now stands at 19.6 Mt grading 8.17% zinc, 1.58% lead, and 13.6 g/t silver. The additional inferred resource, now 29% of the total, is 8.1 Mt grading 6.81% zinc, 1.16% lead, and 11.2 g/t silver. Environmental baseline monitoring and review of plans for permitted underground exploration via a ramp decline to about 500 m below surface continued.

### 7.3.2. Cirque, Pie, Cirque East, Yuen (Teck Resources Limited; Korea Zinc Company, Ltd.)

The Cirque property (Figs. 1, 3; Table 5) of Cirque Operating Corporation, a joint venture partnership between Teck Resources Limited (50% interest) and Korea Zinc Company, Ltd. (50% interest) is about 20 km northwest of Akie and is also accessible by logging and exploration roads, or by helicopter. It is underlain by similar geology as the Akie property but with different proportions of interfingered sedimentary facies, particularly of the Earn Group. Three major northwest-trending regional thrust panels cut across the property. They are referred to as the Western, Cirque, and Akie panels (Henry and Theissen, 2014). The Cirque panel hosts the South Cirque and North Cirque deposits and the Akie panel hosts the Akie property Cardiac Creek deposit.

The South Cirque deposit is a partially delineated apparent tabular mineralized body that does not outcrop. The better-defined North Cirque deposit does outcrop and is a 1000 x 300 m and <60 m thick, moderately southwest dipping, south plunging lensoid baritic zinc-lead-silver SEDEX deposit with a maximum depth of about 400 m below surface. Zinc-lead-silver mineralization at the Cirque deposits may have a replacement-style component instead of being strictly exhalative, similar to the Red Dog deposit in Alaska where mineralization formed by submarine replacement of a sea-floor barite deposit (Leach et al., 2010). In 2016, the development and refinement of drill targets continued as part of a multi-year exploration program that has integrated airborne gravity gradiometry (AGG) and Versatile Time Domain Electromagnetic (VTEM) geophysics, targeted ground gravity geophysics, soil and rock geochemical sampling, geologic mapping and prospecting. Drilling in 2016 focused on the R-Creek target about a kilometre northwest of North Cirque (Fig. 17). As well, property wide baseline environmental monitoring continued.

A similar integrated exploration strategy is being used on the nearby Pie, Cirque East and Yuen properties (Pie Option properties) optioned from Canada Zinc Metals Corp. In 2016, five high priority target areas on Pie and Yuen were selected for focused exploration, and a target about one kilometre west and down-dip of historic drilling and trenching in the Pie Main area was drilled (Fig. 18). Mineralized showings Pie Main and Pie Breccia (Pie property) and target areas with soil geochemical anomalies at Noel Creek (Yuen property) and Cirque East are hosted in the Akie panel. The West Pie showings (Pie property) and a target area with coincident AGG and soil geochemical...
anomalies at China Ridge (Yuen property) are in the Cirque panel. Baseline environmental monitoring for the Pie, Cirque East and Yuen properties continued.

7.3.3. Coral (Minfocus Exploration Corp.)

The Coral property (Fig. 1; Table 5) of Minfocus Exploration Corp. (100% owned) is about 92 km north of Mackenzie and is accessible by helicopter only. It is underlain by dolomitic carbonate rocks (Upper Silurian-Lower Devonian) in an east-dipping limb of a fold in the hanging wall of a thrust fault (Thompson, 1986), and hosts a Mississippi Valley-type deposit prospect. Zinc-lead mineralization lies in a northwest-trending irregular stratabound zone of dolomite breccia that is cut by coarse dolomite veinlets, and a later stage of yellow sphalerite (Fig. 19). Several target areas are on the property, including mineralized outcrop, soil geochemical anomalies (including a 600 x 300 m zinc soil anomaly) and stream-sediment anomalies.

In 2016, drilling equipment was barged from near Hudson’s Hope (Fig. 1) on the Peace Arm of Williston Reservoir and a nine-hole drilling program, oriented north-south over about 500 m, tested two target areas. New mineralization was also discovered in outcrop less than 100 m from a recently resampled historic trench (deGraff et al., 2015) and the outcrop was sampled over a strike length of seven metres (Table 5).

![Fig. 19. Sawn sample of dolostone breccia with red sphalerite and wispy galena veinlets at bottom left. Photo courtesy of Minfocus Exploration Corp.](image)

7.3.4. BT (Porpoise Bay Minerals Ltd.)

The BT (Bobtail) property of private company Porpoise Bay Minerals Ltd. (100% owned) is accessible by logging roads (Fig. 1; Table 5). It is underlain by serpentinized ultramafic rocks and basaltic volcanic rocks of the Cache Creek complex, and a granite stock (Eocene). Following up the 2015 trenching program, channel sampling of serpentinite bedrock over about 24 m returned high copper values in assay (over 1% Cu; R. Seel, personal communication, November 2016) with anomalous cobalt.

7.4. Coal projects

Two coal projects were tracked in the North Central Region in 2016. One project was at the advanced exploration stage (Groundhog North), and the other was at the early exploration stage (Panorama North). Both projects are in the Groundhog coalfield in the Bowser Basin and Skeena fold and thrust belt.

7.4.1. Groundhog North and Panorama North (Atrum Coal NL)

The Groundhog-Klappan coalfield, in the northcentral part of Bowser Basin, extends across the North Central - Northwest regional boundary. The Groundhog North (Figs. 1, 3; Table 5) anthracite coal property of Atrum Coal Groundhog Inc. (100% owned) is accessible by fixed-wing aircraft or helicopter. It lies in a broad, northwest-southeast trending open-folded synclinorium (British Columbia Geological Survey, 2016). The main coal bearing sequence is the Groundhog-Gunanoot assemblage (Evenchick and Thorkelson, 2005), locally known as the Groundhog unit (Upper Jurassic-Lower Cretaceous; Bowser Lake Group), a 600 m-thick alternating marine and non-marine deltaic sequence with 46 modelled coal seams (Atrum Coal, 2014). Primary and secondary targeted seams are gently folded with average thicknesses of about 2 m and 3 m, and average depths of about 72 m and 265 m. In 2016, a revised prefeasibility study was completed for the Groundhog North Mining Complex involving a small-scale underground starter mine and a staged development approach. The Phase 1 mine could produce up to 880,000 tonnes-per-year of saleable ultra-high-grade anthracite coal (including 43% inferred resources) over 28 years. Mining would require establishing access to road, rail, and port infrastructure. Fully ramped-up production at a later stage would be 1.6 Mt annually.

Improved washability test results with yields averaging above 80% were received for coal from the eastern part of the property, potentially reducing project costs. In May, permit approval was received for the underground and surface extraction of an up to 100,000 tonne bulk coal sample and special use of an existing railbed subgrade for ground-based access and haulage of the bulk sample to a nearby railway connection point to the southeast. The railbed was built in the 1970s by British Columbia Rail. Engineering design work and site preparation planning followed. The advanced stage project has yet to enter the environmental assessment process but environmental baseline work is continuing. In August Atrum Coal entered into a joint exploration agreement with Japan Oil, Gas and Metals National Corporation (JOGMEC) for the Panorama North property, 15 km southwest of Groundhog North, whereby JOGMEC can earn a 35% interest by investing $5 million over three years. Review of historic exploration results was followed by a four-hole drilling program in October. Multiple coal seams, including near-surface seams, were intersected;
the thickest seam ranges from 1.70-2.30 m (Table 5). Downhole geophysical logging was also completed. Anthracite coal has metallurgical and specialty market industrial mineral applications.

7.5. Industrial mineral projects

In 2016, five industrial mineral projects were tracked in the North Central Region. Ornamental minerals such as nephrite jade are included in this category. One project, Giscome (section 6.3.1.) was at the mine evaluation stage. One project, Pishon Green Jade, was at an advanced exploration stage. The others were at an early exploration stage (two projects) or grassroots stage (one project). Nephrite jade projects are in the Cache Creek terrane; silica and limestone projects are in rocks of ancestral North America.

7.5.1. Longworth (MGX Minerals Inc.)

The Longworth property (Fig. 1; Table 5) of MGX Minerals Inc. (100% owned) is about 82 km east of Prince George. The property is in a westernmost range of the Northern Rocky Mountains, adjacent the Northern Rocky Mountain trench, and is accessible by logging roads and trail. It is underlain by greenstone, carbonate and quartzite units of the Nonda Formation (Silurian; Fig. 3) in a northwest-trending, steeply east-dipping synformal structure (Quartermain, 1986). Four high purity silica target areas 100-300 m wide and up to 400 m thick are in ridges of white quartzite that is intermittently exposed for six kilometres. The quartzite is massive and homogenous with minor impurities including muscovite, limonite and calcite. In 2016, a grassroots geochemical sampling program was completed and metallurgical testing was planned (Fig. 20). In the Snow zone, quartzite samples averaged 99.34% SiO₂, ranging up to 99.9% SiO₂. A high-silica product derived from quartzite could have use as feed material in the production of silicon metal, which has a variety of industrial uses including in construction materials, electronics and healthcare products.

7.5.2. Bowron River (First Amber Mines Inc.)

The Bowron River property (Fig. 1; Table 5) of First Amber Mines Inc. is about 56 km east of Prince George and is accessible by logging roads. It is underlain by Slide Mountain Group (Antler Formation) basaltic volcanic rocks and a northwest-trending, 15-km long, roughly 2-km wide, sedimentary basin (Upper Eocene) that follows a meandering section of the Bowron River and hosts the Bowron River coalfield. Basin strata dip moderately to the northeast. Three major coal seams of high volatile B rank with cumulative thickness of about 9 m have been historically identified in the lower 85 m of the more than 700 m thick section. The coals have been described as having an average amber content of 4% based on a visual estimate from the upper seam, but data for the lower seam of about 1% average amber content may be more accurate (Kerr, Dawson & Associates Ltd., 1978). Elongate and flattened blebs of amber resin are hosted in coal lenses, bands and seams, and in shaley partings (Rees, 1982). In 2016, a percussion and core drilling program was completed near two historic adits with the aim of collecting samples for test marketing of the amber.

7.5.3. Pishon Green Jade (private individual)

The privately owned Pishon Green Jade property (Fig. 1; Table 5), is about 96 km northwest of Fort St. James in the Cache Creek terrane and accessed by logging and exploration roads. Northeast-trending, variably dipping lenses of green nephrite jade are hosted in Cache Creek complex metasedimentary rocks near a thrust faulted contact with serpentinitized ultramafic rocks of the Trembleur ultramafic unit (McIntyre and McIntyre, 1995). A large granodiorite pluton (Early Cretaceous) lies about 2.5 km to the west. The largest nephrite exposure is known as the jade cliff. A similar zoned alteration sequence as at the Ogden Mountain property is documented with the transition of pure talc to foliated talc-tremolite-chlorite to hard grey tremolite to nephrite. In 2016, a private individual began a surface bulk sample program (Fig. 21).

8. Exploration activities and highlights (Northeast Region)

Six active exploration projects were tracked in the Northeast Region in 2016, up from three in 2015 (Tables 4, 6). Of these six, three were at the mine evaluation stage, two were at the advanced stage, and one was at the grassroots stage. Four properties were for coal, one for industrial minerals, and one for polymetallic base and precious metals.
8.1. Polymetallic base and precious metal projects
The single polymetallic base and precious metal project is a Cu±Ag quartz vein (Churchill-type vein copper) project at a grassroots exploration stage.

8.1.1. Key (Botco Mining and Exploration)
The Key property (Fig. 1; Table 6) of Botco Mining and Exploration (100% owned) is about 163 km west of Fort Nelson in the Muskwa ranges of the Northern Rocky Mountains, in a north-northwest trending anticlinorium. Access is generally by helicopter; an historic exploration road heading south from Highway 97 is ATV accessible. The property is underlain by southwest-dipping fine-grained sedimentary units of the Muskwa assemblage (Aida Formation; Mesoproterozoic; Figs. 2, 3) that are asymmetrically folded with northeast vergence and southeast plunge. These units are cut by subvertical diabase dikes up to 100 m wide that generally strike northeast. A northeast-trending 2.5-km wide belt features northeast-trending subvertical fracture zones and structurally controlled quartz-carbonate veins with massive, semi-massive and disseminated chalcopyrite mineralization. Wallrock margins are altered by silicification, graphite and iron-carbonate. At least five mineralized veins are on the property, with average widths ranging from about 0.5 to 2.5 m (Harrington, 2012). The Eagle vein system, at 1.2 m average width, has been traced over 1,220 m strike length and explored underground to a vertical depth of 460 m. Five kilometres to the south-southeast, the historic Churchill Copper (Magnum) mine milled 498 Kt (549,000 tons) of ore grading 3.00% Cu from 1970 - 1974. In 2016, a grassroots program of geochemical sampling and prospecting was completed.

8.2. Coal projects
All four projects tracked in the Northeast Region in 2016 are in the Peace River coalfield. Two, Murray River (section 6.2.1.) and Sukunka (section 6.2.2.), were at the mine evaluation stage, two, Wapiti River and Huguenot, are at an advanced exploration stage.

8.2.1. Wapiti River (Canadian Dehua International Mines Group Inc.)
The Wapiti River property (Fig. 1; Table 6) of Canadian Dehua International Mines Group Inc. (100% ownership) is about 45 km southeast of Tumbler Ridge and is accessible by highway and logging roads. On its western side, the claim block

Table 6. Selected exploration projects, Northeast Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key</td>
<td>Botco Mining and Exploration</td>
<td>094K 012</td>
<td>Cu, Ag, Co, Pb; Cu±Ag quartz veins</td>
<td>historic non NI 43-101 compliant: 1.248 Mt (1,375,700 tons) at 3.38% Cu; semi-proven and probable reserves (Chapman, Wood &amp; Griswold, 1971)</td>
<td>geochemical sampling (rock), prospecting</td>
<td></td>
</tr>
<tr>
<td>Wapiti River</td>
<td>Canadian Dehua Int'l Mines Group Inc.</td>
<td>093I 041</td>
<td>Coal; Bituminous coal</td>
<td>562.6 Mt in situ (Measured and Indicated), 196 Mt (Inferred), No.1 Mine</td>
<td>feasibility study update, resource estimate update</td>
<td>Results of 2015 feasibility study update made public in early 2016.</td>
</tr>
<tr>
<td>Huguenot</td>
<td>Colonial Coal Int'l Corporation</td>
<td>093I 036, 093I 014</td>
<td>Coal; Bituminous coal</td>
<td>277.7 Mt in situ (Measured and Indicated), 119.2 Mt in situ (Inferred)</td>
<td>baseline environmental studies, reports</td>
<td></td>
</tr>
</tbody>
</table>
is underlain by fine- to coarse-grained siliciclastic units in the upper parts of the Fort St. John Group (Lower Cretaceous; Fig. 3) and on its eastern side by Upper Cretaceous units. Seismic interpretations (2D) and drilling log information have resulted in 63 modelled coal seams (main and sub-seam) in the Gates and Gething formations in a syncline-anticline pair cut by east and west-dipping reverse faults. In 2016, results of an updated NI 43-101 technical report completed in 2015 by Norwest Corporation for the No.1 Mine were made public (Canadian Dehua International Mines Group Inc., 2016). A medium volatile bituminous coking coal resource of 562.6 Mt in the measured and indicated categories includes 14 main mineable seams with average cumulative thickness of 29.5 m, extending to 900 m depth. A three-level underground longwall mining operation with coal production capacity of 10 Mt per year over nearly 47 years is envisioned. Infrastructure requirements would include powerline and railway extensions from Tumbler Ridge. The advanced-stage project has yet to initiate an environmental assessment.

8.2.2. Huguenot (Colonial Coal International Corp.)

The Huguenot property (Fig. 1; Table 5) of Colonial Coal International Corp. (100% owned) is about 82 km southeast of Tumbler Ridge. It lies in a northwest-trending band of tight to open folds and northeast-vergent thrust faults on the northeast limb of a broad anticlinorium. The average cumulative thickness of Gates Formation coal seams in three separate blocks is about 15 to 19 m. A NI 43-101 compliant preliminary economic assessment study (Evenson, 2013) describes a combined surface and underground longwall mining operation that would produce between 1.4 Mt-5.9 Mt/y, averaging 3.0 Mt/y of saleable coal over 31 years. Total production over the life of mine would be 89 Mt of saleable coal. In 2016, baseline environmental studies and further data compilation were completed.

9. Geological research

Geological research in the North Central Region in 2016 was carried out mainly by Geoscience BC in the Nechako Plateau and Toodoggone River areas of the Stikine terrane, and also focused on the north central Quesnel terrane. The British Columbia Geological Survey completed a study that included a mineral deposit (inactive project) in the ancestral North American margin. In the Northeast Region, Geoscience BC supported studies in the Western Canada Sedimentary Basin.

9.1. Geoscience BC

Geoscience BC continued moving the TREK (Targeting Resources through Exploration and Knowledge) program (Clifford and Hart, 2014) through its final stages and deliverables. The program started in 2013 with the aim of integrating geophysical, geological and geochemical data in the northern Interior Plateau, including the Nechako Plateau area, to develop an improved understanding of underlying geology which is largely obscured by Chilcotin Group basalt flows and glacial drift. The study area includes mineral discoveries made during regional mapping by Diakow et al., (1997). Geologic mapping studies focused on correlating geophysical signatures to lithology and structure and identifying new showings and styles of mineralization (Angen et al., 2016), and characterizing Late Cretaceous volcanic suites (Kim et al., 2016). Results of a helicopter-supported biogeochemical survey that collected spruce-top twig and needles were released in April (Jackaman and Sacco, 2016). Coverage is mainly south of the North Central Region but overlaps onto its southwestern margin.

Geoscience BC supported a Mineral Deposit Research Unit (MDRU) project to develop an updated exploration framework for porphyry to epithermal transitions in the Toodoggone River area. The project was conducted by MDRU research associates in 2016 and focused on characterizing several mineralized systems through mineralogical descriptions and geochemical sampling, used to estimate depths of emplacement and exhumation levels as they relate to deposit-type prospectivity.

Geoscience BC also supported a mineral prospectivity mapping study (Granek and Haber, 2016) using advanced spatial-data analysis techniques on the QUEST project dataset that covers much of the Quesnel terrane in the North Central Region, and some sedimentary geology studies related to the energy sector in the Northeast Region that focused on Quaternary geology (Hayes et al., 2016) and the Montney Formation siltstone (Lower Triassic; Geglick et al., 2016; Prenoslo et al., 2016) which correlates with lower stratigraphic units of the Spray River Group (Sulphur Mountain Formation; Fig. 3).

9.2. British Columbia Geological Survey

The British Columbia Geological Survey did not carry out ground based work in the North Central or Northeast regions in 2016. The Wicheeda (MINFILE 093J 014) carbonatite-related rare earth element deposit, near the margin of ancestral North America in the North Central Region, was included in a fluorite geochemistry study that examined the use of fluorite as an indicator mineral in discriminating different deposit types (Mao et al., 2016).

10. Summary

Challenges associated with low commodities prices and market volatility continued to affect the North Central and Northeast regions in 2016 and four of five operational or fully permitted coal mines, and one metal mine, remained on care and maintenance. One coal mine began restart activities immediately following a rebound in metallurgical coal price that began in August. Although difficulties in raising capital through equity financing in the junior market also continued, more grassroots to early stage exploration activity was tracked in 2016 perhaps indicating the initial stage of an improving cycle for mineral exploration and investment. Underexplored parts of the two regions continue to generate interest for a variety of mineral deposit types including porphyry, epithermal, and stratiform or vein-hosted polymetallic types, and also for
coal and industrial minerals. Placer gold mining continues to be a robust activity in the North Central Region.

Main highlights for 2016 included: the reaching of production capacity and the construction and commissioning of a permanent secondary crusher at the Mt. Milligan mine (Centerra Gold Inc.); the restart of the Brule mine (Comuna Coal Resources Limited) after being on care and maintenance since mid-2014; the advancement of a final Mines Act permit application review process for development of an underground coal mine at Murray River (HD Mining International Ltd.); the advancement of several environmental assessments in the review stage including Blackwater (New Gold Inc.), Kemess Underground (AuRico Metals Inc.), Giscome (Graymont Western Canada Inc.), and Sukunka (Glencore plc) and the continued delineation of an ore body through drilling at the advanced exploration Kemess East project (AuRico Metals Inc.).

Exploration drilling programs expanded areas of known mineralization at Lawyers (PPM Precious Metals Corp; published results from 2015 drilling), Kwanika (Serengeti Resources Inc.), Late (ML Gold Corp., Pacific Empire Minerals Corp.) and Coral (Minfocus Exploration Corp.) and potentially at Cirque (Teck Resources Limited). Drilling programs also confirmed metal mineralization at Thor (Copper North Mining Corp.), and potentially at North Grid (Centerra Gold Inc.), Q7a (Vale Exploration Canada Inc.), and Pie (Teck Resources Limited, Canada Zinc Metals Corp.), and for coal at Panorama North (Atrum Coal Panorama Inc.) and Bowron River (First Amber Mines Inc.).

New discoveries continue to be made at the grassroots-exploration level such as a northern extension of the epithermal vein system at 2 X Fred (Kootenay Silver Inc., Theia Resources Ltd.) and newly documented mineralized showings on the expanded Big Bear property (Parlane Resources Corp.), at Coral (Minfocus Exploration Corp.), and on the Pil property (Finlay Minerals Ltd.). New high-priority drill targets were defined through geophysics and/or geochemistry at Captain (Orestone Mining Corp.), Cathedral (Thane Minerals Inc.), Chuchi (Kootenay Silver Inc.), Fran (MGX Minerals Inc.), Kwanika East-Smoke and UDS (Serengeti Resources Inc.), and on the Pie, Cirque East and Yuen properties (Teck Resources Limited, Canada Zinc Metals Corp.).

Acknowledgments
The information in this report was derived from news releases, quarterly reports, management discussion and analysis reports, company websites, technical reports, assessment reports, COALFILE reports, MINFILE reports, Geological Survey of British Columbia publications, Geological Survey of Canada publications, the British Columbia digital geology map, site visits and discussions with industry professionals and personnel.

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Exploration and mining in the Southeast Region, British Columbia

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1. Introduction

The Southeast (Kootenay-Boundary) 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 over 8 Mt of zinc, 8.5 Mt of lead, and 298 Moz of silver throughout its life. The Trail smelter (Teck Resources Ltd.) is still in operation, and expected volumes for 2016 are 13,000 tonnes of refined lead, and up to 25 million ounces of silver. Exploration for both base metals and precious metals continues to be an exploration focus for the region.

As a pilot project, the Ministry of Energy and Mines partnered with the Association for Mineral Exploration and Ernst & Young LLP to develop a comprehensive online survey to collect expenditure data. For the Southeast Region, exploration expenditures are estimated at $37.4 million and exploration drilling is estimated at approximately 31,000 m (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017 in press).

Highlights for 2016 include

• the West Line Creek water treatment facility (Teck Coal Limited) was commissioned in February 2016
• conditional approval of the Elkview mine Baldy Ridge extension (BRE) (Teck Coal Limited) in September, 2016
• the Line Creek Burnt Ridge extension (BRX) (Teck Coal Limited) entered the pre-application stage of Environmental Assessment
• active programs at the Crown Mountain (NWP Coal Canada Ltd.) and Michel Creek/Loop Ridge (CanAus Coal Limited) coal projects, which are both in the pre-application stage of Environmental Assessment
• the Greenhills Cougar Pit extension (CPX) (Teck Coal Limited) working towards the pre-application stage of Environmental Assessment
• advancement of the Kootenay West gypsum mine (CertainTeed Gypsum Canada Inc.)
• the Driftwood Magnesite project (MGX Minerals Inc.) was granted a 20-year lease for quarry development
• plant construction at Moberly Silica (Heemskirk Canada Limited) to redesign operations for silica frac sand production
• the pending sale of the Lexington mine and mill to Golden Dawn Minerals Inc.

2. Geological overview

The Canadian Cordillera has long been of interest to the exploration industry for the mineral resources it contains. The diverse assemblage of rocks, varied structural elements, and diversity of metallogenic styles are evidence that the western margin of North America has undergone a complex history of plate tectonic processes and terrane accretion, spanning over 1.8 billion years (Nelson et al., 2013). The Cordillera is now a tectonic collage of terranes, with a complex history of deformation, intrusion, metamorphism, and mineralization.

The Southeast Region (Fig. 1) 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 fundamentally transformed from a set of loosely connected arc and pericratonic terranes, to a progressively thickening and complexly structured accretionary wedge. Intrusive events superimposed on the region (Proterozoic, Devonian, Jurassic, Cretaceous, and Cenozoic) represent periods of enhanced
Fig. 1. Mines and selected exploration projects, Kootenay-Boundary Region, 2016. Terranes from the BC digital geology map (Cui et al., 2015).
tectonic activity, and deep tectonic structures along terrane boundaries and in Archean basement rocks show evidence of episodic reactivation through time.

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). The Omineca belt and the Rocky Mountain foreland belt are separated by the southern Rocky Mountain Trench, which formed during Tertiary transtensional collapse (Monger et al., 1982; Nelson et al., 2013). The Rocky Mountain Trench fault is a normal fault its eastern edge in southeastern BC, with approximately 5 km of west-side down displacement.

2.1. Omineca belt
2.1.1. Laurentian basement (ancestral North America) and metamorphic core complexes

Laurentian basement rocks form the core of the North American continent, and extend beneath the Cordillera west of the southern Rocky Mountain Trench. The basement is an assemblage of microcontinents and magmatic arcs that formed through progressive accretion from the Archean to Mesoproterozoic. A structural grain was imparted on the surface by the successive orogenic events during its formation, and is seen on the regional aeromagnetic map of western Canada (Fig. 3). Northeast-trending basement structures later influenced both Cordilleran tectonism and metallogeny (e.g., Ross et al., 1991; McMehan, 2012; Nelson et al., 2013). For example, the Moyie-Dibble Creek (MDC) (Fig. 3) fault has been interpreted by Price (1981) and McMehan (2012) as the surface expression of the Vulcan Tectonic zone (Figs. 2, 3). Abrupt changes in thickness and facies in Proterozoic to Mesoproterozoic. A structural grain was imparted on the surface by the successive orogenic events during its formation, and is seen on the regional aeromagnetic map of western Canada (Fig. 3). Northeast-trending basement structures later influenced both Cordilleran tectonism and metallogeny (e.g., Ross et al., 1991; McMehan, 2012; Nelson et al., 2013). For example, the Moyie-Dibble Creek (MDC) (Fig. 3) fault has been interpreted by Price (1981) and McMehan (2012) as the surface expression of the Vulcan Tectonic zone (Figs. 2, 3). Abrupt changes in thickness and facies in Proterozoic to Early Proterozoic strata across these northeast-trending structures suggest periodic reactivation. In the West Kootenays, the southwestward shift in trend at the south end of the Kootenay Arc, and significant stratigraphic thickness and facies differences in strata of northeastern Washington also suggests a deep structural influence of the basement Vulcan Low.

Although generally deeply buried, crystalline basement rocks are locally exposed in structural culminations such as the Shuswap-Monashee complex (Figs. 3-4). Located west of the east-dipping Columbia River fault (Fig. 2), the complex is bounded by early Tertiary normal faults, and was emplaced during Tertiary extension (Monger, 1999). Paleoproterozoic granitic and granodiorite gneisses are unconformably overlain by a Neoproterozoic to Paleozioc platformal paragneiss assemblage of calc-silicate gneiss, pelitic gneiss, psammitic gneiss, quartzite and marble. The Valhalla metamorphic complex (Fig. 2) forms a structural dome at the eastern exposed edge of the Shuswap metamorphic complex. Rock types include amphibolite-facies pelitic schist, marble, calc-silicate gneiss, psammitic gneiss, quartzite and metaconglomerate, amphibolite gneiss, and ultramafic schists, and mid-Cretaceous to Eocene igneous rocks. These paragneiss assemblages host stratabound lead-zinc deposits, including Ruddock Creek, Jordan River, and Big Ledge (Fyles, 1970; Höy, 1982b), and flake graphite deposits (Black Crystal; Fig. 1).

2.1.2. Proterozoic rift successions and the Purcell anticlinorium

Following the Hudsonian orogeny (2.0-1.8 Ga), but before the breakup of ancestral North America (780-570 Ma), sedimentary successions accumulated in the Canadian Cordillera (Nelson et al., 2013). In the Southeast Region, the Belt-Purcell basin (1.47-1.4 Ga) was a north-northwest trending intracratonic rift system that extended into what are now northern Idaho and Montana. The 10-12 km thick rift-fill succession of the Belt-Purcell is a shallowing upwards sequence of rusty-weathering deep-water turbidites (Aldridge Formation; Fig. 4), shallow-water platform and fan-delta deposits at the margins of the rift and surrounding shelf, and shallow-water carbonates, mud flat, lagoonal, and alluvial deposits of the rift-cover succession (Fig. 5). Synsedimentary faulting during graben extension and sporadic tholeiitic to alkaline magmatism (1468 ±2 Ma) characterize the lower Belt-Purcell stratigraphic successions (i.e., Moyie sills; Lydor, 2010 and 2007).

Intracratonic rift systems that have been infilled by marine sedimentary rocks, such as in the Belt-Purcell, have long been recognized as the most favorable environment for the formation of seafloor hydrothermal Zn-Pb-(Cu) sulphide, or SEDEX deposits. These are prime exploration targets because of their large tonnage and grades (Paradis and Goodfellow, 2012; Paradis, 2015). The Sullivan deposit (MINFILE 082FNE052) was discovered near Kimberley in 1892. The mine operated from 1909 to 2001 and produced over 8 Mt of zinc, 8.5 Mt of lead, and 298 Moz of silver. Gold, tin, copper, cadmium, and small amounts of antimony, bismuth, and indium were also produced. SEDEX Pb-Zn-Ag mineralization similar to that of the historic Sullivan mine (Fig. 6) continues to be an exploration focus for the region. The contact between the lower and middle Aldridge members hosts the Sullivan ore body (Fig. 6) and likely marks one period of active graben extension. Indicators of exhalative-style mineralization are distributed throughout the Belt-Purcell basin, including disseminated sphalerite and galena, tourmalinite-sericite-chlorite alteration, sections of fragmental sediments, anomalous Pb-Zn-Ag-Sn-Cu, and indicator element geochemistry. In addition to stratabound base metals, extensional tectonics also led to the development of vent and feeder pipe complexes and base metal vein deposits. Pb-Zn-Ag mineralization with characteristic tourmaline alteration is commonly localized at the intersections of north-northwest trending and northeast-trending faults, including the St. Mary, Kimberley, and Moyie-Dibble Creek faults (Höy et al., 2000; McMehan, 2012; Price, 1981), and these fault intersections have been the focus of recent exploration. The upper part of
Fig. 2. Geology and physiographic belts of the Kootenay-Boundary region. Physiographic belts after Nelson et al. (2013). Bedrock units are after Cui et al. (2013) and Wheeler et al. (1991), and generalized to highlight temporal and lithological differences in the region for this report. Vulcan tectonic zone is after McMechan (2012).
Fig. 3. Residual total field aeromagnetic map of western Canada, showing Precambrian basement domains of the western Laurentian craton with respect to the Cordilleran orogen (eastern limit of Cordilleran deformation indicated by white line). Precambrian basement domains are after Hoffman (1988), Ross et al. (1991), Villeneuve et al. (1993), Ross (2002), Hope and Eaton (2002), and Aspler et al. (2003). Aeromagnetic image is derived from a 2010 compilation in the Canadian aeromagnetic database (http://gdr.agg.nrcan.gc.ca/geodap). Precambrian domain boundaries are delineated by dotted lines; major basement structures are shown by short dashed lines. Some major structures extend beneath the Cordillera, including the Moyie-Dibble Creek fault (MDC) and related structures in the south (after McMechan, 2012), and the Liard and Fort Norman lines in the north (after Cecile et al., 1997). Stars show location of Precambrian basement exposures in the Omineca belt: MC = Monashee complex (1.86-2.10 Ga; Crowley, 1999); MG = Malton complex and Gold Creek gneiss (ca. 1.87-2.09 Ga; McDonough and Parrish, 1991; Murphy et al., 1991); PRC = Priest River complex (ca. 2.65 Ga; Doughty et al., 1998); SR = Sifton Ranges (ca. 1.85 Ga; Evenchick et al., 1984). Initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio isopleths for Mesozoic granitic rocks of the Cordillera (dashed blue lines) are after Armstrong (1988). Dashed brown line indicates inferred extent of North American crust beneath the Cordilleran orogen from geophysical, geochemical, and geological. Other abbreviations: CBL = Cape Bathurst line, FN = Fort Nelson high, GFTZ = Great Falls tectonic zone, GSLSZ = Great Slave Lake shear zone, HRF = Hay River fault, KD = Ksituan domain, KL = Kiskatinaw low (1.90-1.98 Ga), LD = Lacombe domain, RDZ = Red Deer zone, SRMT = Southern Rocky Mountain trench, TL = Thorsby low (1.91-2.38 Ga). From Nelson et al. (2013).
the Purcell Supergroup contains carbonate-hosted, stratiform replacement-style sulphide mineralization in dolomites of the Mount Nelson Formation (Figs. 4, 6), and associated structurally related polymetallic Ag-Pb-Zn veins.

The Purcell anticlinorium (Fig. 2) is now a shallowly northward plunging upright fold system that was formed during two early phases of deformation and metamorphism. The first phase was the East Kootenay orogeny (1350-1300 Ma; McMechan and Price, 1982), which marked the end of sedimentation in the Belt-Purcell rift basin, and involved folding, regional metamorphism, and granitic intrusion (i.e., Hellroaring Creek stock). By the end of the Mesoproterozoic (ca. 1.0 Ga), the Precambrian supercontinent, Rodinia, was assembled. Further block faulting and low-grade metamorphism of the anticlinorium occurred during the Goat River orogeny (900-800 Ma), which produced higher grade, sillimanite-bearing rocks in the core of the anticlinorium (de Kemp et al., 2015).
The Purcell Supergroup is unconformably overlain by the Windermere Supergroup (Fig. 4) at the northern end of the north-plunging anticlinorium, which is associated in part with rifting of Rodinia. Up to 2-3 km of strata were eroded from the uplifted Belt-Purcell succession and shed northward (Aitken, 1969; Simony and Aitken, 1990). Beginning in the Neoproterozoic, rifting of the Rodanian supercontinent occurred over an extended interval of time, in at least two main episodes (Colpron et al., 2002). The earlier phase (ca. 723-716 Ma) in southern BC resulted in the deposition of the Toby and Horsethief Creek Groups (Fig. 4). Thermal subsidence during the second phase (570-540 Ma) resulted in deposition of the Hamill-Gog Group unconformably over the Horsethief Creek Group (Nelson et al., 2013). Sedimentary rocks of the Hamill-Gog Group are predominantly sandstones deposited on a continental margin at a time marked by a worldwide transgression (Vail et al., 1977). Deposition of the Windermere Supergroup may also have been locally affected by small- and large-scale structures, including the ‘Windermere High’, which was a northwest-trending offshore high that developed south of 53°N (Hein and McMechan, 2012), and the Vulcan Tectonic zone (Fig. 2). Thick sections of Hamill Group rocks are along Highway 3 near the Salmo-Creston pass but are absent to the south, suggesting that sediments were shed northward off a structural high. Facies changes in the overlying Paleozone platformal carbonates south of the Canadian-USA border are also evidence that a high persisted into the Paleozoic. Though the Windermere Supergroup marks a major rifting episode, it hosts only limited syngenetic and replacement (Irish, Mississippi Valley-type, and manto) and polymetallic vein mineralization, mainly along north-trending faults.

Deformation and uplift of the Purcell anticlinorium and rift successions continued during the Columbian-Laramide orogeny (220-70 Ma), when imbricated thrusts carried up to 15 km of Belt-Purcell and Paleozoic margin sedimentary rocks eastward over a basement ramp (Fig. 7; Cook and Van der Velden, 1995). The anticlinorium is transected by steep north-northwest longitudinal faults and northeast-trending transverse faults, that were likely reactivated repeatedly over time from Proterozoic Belt-Purcell Supergroup and Windermere Supergroup sedimentation (Höy, 1982a) through the Paleozone and Mesozoic, and into the Tertiary. These transverse structures and basement structures related to the Vulcan Tectonic Zone (Figs. 2, 3) may also have influenced Mesozoic shear and vein gold, a trend that runs east-west through the historic gold rush district (Stobie, 1993). This backarc extension caused the opening of the Slide Mountain ocean in Pennsylvania to Early Permian time (285-300 Ma). The rocks of the Kootenay terrane (Fig. 1) represent the inactive remnants of the arc that remained on the continental side (Piecyk et al., 2006; Nelson et al., 2006). The rocks consist of variably metamorphosed Neoproterozoic and Paleozoic strata, including the Badshot limestone (Lower Cambrian), and siliciclastic, carbonate, and volcanic rocks of the Ladner Group (mid Cambrian-Mississippian; Fig. 4) (Logan and Colpron, 2006; Nelson et al., 2013). In the southern portion of the arc, correlative sequences are the Reno, Laib, Nelway and Active formations (Fig. 4; Fyles, 1967). Early Paleozoic volcanism (Eagle Bay assemblage), late Devonian granitic intrusions (Ice River complex), and late Cretaceous granitic intrusions are characteristic of the Kootenay terrane (Price, 2012).

By early to middle Permian, east-dipping subduction that was
established beneath the western Laurentian margin was replaced by westward subduction, and the Slide Mountain ocean, which may have been up to 3,000 km wide, by the mid-Permian, closed by the Triassic. Remnant slivers of the Slide Mountain terrane, including: metamorphosed oceanic assemblages of inter-bedded MORB basalts; cherts, quartz sandstones and conglomerates; and serpentinites (Late Paleozoic; Milford and Kaslo Groups; Fig. 4), were accreted and imbricated between the rocks of Quesnellia and ancestral North America.

Deposits in the Kootenay arc include stratiform, laminated, to massive sulphides, replacement-style Irish-type, Besshi-type, Cu-Zn-rich VMS, boron-enriched exhalites (Nelson et al., 2013), and Mesozoic precious-metal and skarn mineralization. Some Pb-Zn deposits are Ordovician to Devonian, which is consistent with an epigenetic Mississippi Valley-type rather than a syngenetic origin (Simandl and Paradis, 2009). The Badshot Formation, a thick Cambrian carbonate unit, and its southern equivalent, the Reeves member (Laib Formation; Fig. 4), host stratiform, laminated to massive sulphides, and replacement-style mineralization. The Laib Formation also hosts skarn mineralization in the Truman member. Overlying the Badshot limestone, the Lardeau Group (Middle Cambrian to Permian) comprises >3.5 km of graphitic phyllites, immature siliciclastic rocks, and mafic volcanic rocks, that are coeval
with the shallow-water shelf deposits to the east (Logan and Colpron, 2006; Nelson et al., 2013). Within the Lardeau Group, rift-basin, MORB, and OIB rocks host Besshi-type, Cu-Zn-rich VMS deposits, and boron-enriched exhalative horizons in the upper Index and Jowett formations, and structurally hosted polymetallic breccias and veins. Latest Devonian to Early Mississippian (ca. 360-340 Ma) carbonatites and associated alkalic intrusions, as well as hydrothermal MVT mineralization in the western Rockies and Omineca belt are also related to backarc extension, and include the Ice River and Fir showings in the Southeast Region (Nelson et al., 2013).

### 2.1.4. Quesnel terrane and Okanagan subterrane

Arc magmatism in the peri-Laurentian realm is recorded in the rocks of the Quesnellia terrane (Figs. 1, 2, 4), where mafic to felsic arc-related volcanic rocks and carbonate rocks are juxtaposed with Paleozoic strata. Volcanic island arcs, back-arc marginal basins, and their associated successions that once formed and lay outboard of the continent were accreted to the western margin during the Columbian-Laramide orogeny (220-70 Ma). The rocks consist of upper Devonian to Permain cherts, clastics, and basalts (Harper Ranch, Mount Roberts, and Attwood groups; Fig. 4); coeval volcanioclastic rocks, petrites, and carbonates (Brooklyn Group); and Upper Triassic to Lower Jurassic volcanic arc rocks (Nicola Group). Synorogenic siliciclastics (Triassic; Slocan Group) disconformably overlap the Slide Mountain and Quesnellia terranes, and were likely derived from uplift during accretion.

In the southern portions of the region, Devonian and older units of Quesnellia differ significantly from coeval units to the north, and have been referred to as the Okanagan sub-terrane (Monger et al., 1991). They form a roughly east-west trending belt, and constitute basement to Late Devonian and younger sequences (Colpron and Nelson, 2009). Fragmentary evidence suggests these rocks may be an accreted remnant from the Arctic realm (Massey et al., 2013; Nelson et al., 2013). The Trail gneiss complex (paragneiss and orthogneiss), Knob Hill complex (chert, greenstone, and ultramafic ophiolitic rocks), and Anarchist Group (argillite-phyllite, chert, carbonate, and greenstones) rocks may represent a primitive arc to back-arc assemblage, with MORB, island arc tholeiites, and associated facies (Figs. 2, 4; Colpron and Nelson, 2009).

Mineralization occurs as Ag-Pb-Zn±Au, Cu polymetallic vein; shear-hosted, stockwork and breccia deposits; replacement-type base metals; Cu-Au-Ag and base metal skarns; porphyry Cu-Mo; alkalic porphyry Cu-Au-Ag; Au-Ag epithermal vein; Zn-Pb bearing mesothermal quartz veins; and precious and base metal massive sulphides.

### 2.1.5. Post accretionary plutons – Mesozoic to Tertiary magmatism

Metallogenic episodes in the Late Jurassic-Early Cretaceous, mid-Cretaceous, Late Cretaceous, and Paleocene-Eocene and Late Eocene can be related to changing convergence rates, subduction geometries, and convective heat transfer (Figs. 2, 4; Nelson et al., 2013). Shearing and deformation created pathways for pluton emplacement, and mineralization. Renewed eastward subduction and terrane accretion led to Late Triassic to Cretaceous magmatic intrusions, while in the Eocene, the tectonic framework was one of dextral transtension accompanied by extensional collapse. The metallogenic importance of this is found in the suite of epigenetic deposits with increasing influence of continental sources of metals (e.g., Mo, W), and increased precious metal enrichment (Nelson et al., 2013). Exhumation of the Shuswap-Monashee, Valhalla, and Kettle River metamorphic complexes (Fig. 1) is also related to the Eocene extension (Reesor, 1965; Vanderhaeghe et al., 2003; Evenchick et al., 2007).

The Middle Jurassic intrusive suite comprises syn- to late-tectonic plutons that were emplaced during the collapse of the outer margin and accretion of Quesnellia (Monger et al., 1982). The intrusions are predominantly granite and granodiorite, but have local diorite, monzonite and syenite phases (Armstrong, 1988). Ag-Pb-Zn vein, polymetallic Ag-Pb-Zn±Au, breccia, shear-hosted, Cu-Au skarn, and replacement deposits are thought to be genetically related to the Kuskanax and Nelson intrusions (Middle to Late Jurassic; Fig. 4).

Cretaceous intrusions of the Bayonne magmatic belt (Figs. 2, 4) were emplaced inboard of the main magmatic arc in continental margin rocks. They are generally intermediate to felsic alkaline to calc-alkaline, including: peraluminous, subalkaline hornblende-biotite granodiorites, highly fractionated two-mica granites, aplites, and pegmatites (Logan and Mihalynuk, 2014). Mineralization related to the suite includes Mo-Au±W-quartz veins; W-Cu-Au skarns; Au-Bi-Cu-Pb fault-veins; and Pb-Zn-Au±As-Sb±W quartz-carbonate veins (Logan, 2002), with a low concentration of base metals and sulphides. At the southern end of the Bayonne magmatic belt, and along northeast-trending faults related to the Vulcan tectonic zone (Fig. 2), are magmatic-hydrothermal mineral deposits (Fyles and Hewlett, 1959).

Intrusions emplaced during regional Tertiary extension include the Coryell suite of alkaline plutons (with local extrusive equivalents) and stocks of granite and augite-biotite syenite and monzonite (Figs. 2, 4). Tertiary biotite, feldspar, hornblende and augite lamprophyre dikes are commonly emplaced along fractures, faults, or prominent foliation planes (L. Caron, pers. comm, 2014). Some Tertiary faults expose Proterozoic crystalline basement (Kettle River and Valhalla metamorphic core complexes; Fig. 2) in their footwalls. Major deposit types include porphyry Cu-Mo±Au and Mo, intrusion-related gold, Ag-Pb-Zn, tungsten skarn, and structurally controlled epithermal and orogenic Au veins.

### 2.2. Rocky Mountain foreland belt

Following the breakup of Rodinia, passive margin successions were deposited on the western flank of ancestral North America (Figs. 2, 4). Though the Paleozoic is represented mainly by a passive margin setting, rapid changes in stratigraphy and structural style within the succession indicate that basement
Structures continued to be active. Structural elements that existed during the Paleozoic include: the Cathedral escarpment, the Kicking Horse Rim, and the White River trough, and were influenced by basement structures including the Vulcan low, and the Red Deer tectonic zone (McMechan, 2012; Fig. 7). A cluster of deep-sourced alkaline, ultrabasic, diatreme breccia pipes and dikes are evidence of extension during the Upper Ordovician to Middle Devonian (Mott, 1989). Hydrothermal alteration of Cambrian carbonate rocks created hydrothermal magnesite and Mississippi Valley-type (MVT) deposits (Paradis et al., 2011). Carbonatite-related rare earth element (REE) mineralization is also related to these deep structures, and most commonly found at the intersection of basin-parallel and transverse structures (McMechan, 2012). The restricted marine basins of the Devonian also contain mineable evaporitic deposits, including gypsum (Burnais Formation), and the well-sorted Ordovician quartz sandstones (Mount Wilson Formation; Fig. 4) which is mined for silica.

In the Mesozoic, terrane accretion along the western margin forced the Mesoproterozoic to Paleozoic continent margin successions to be uplifted, and displaced northeastward, into the Rocky Mountains (Price et al., 1972). The Rocky Mountain fold and thrust belt (Fig. 2) is a classical thin-skinned belt, with eastward-vergent, piggyback thrusts that detached along a basement-cover decollement (Fig. 8; Price and Fermor, 1985). These thrust sheets host relatively easily mined industrial minerals such as gypsum, magnesite, silica, and phosphate.

Thrust loading on the western margin of the continent during the Mesozoic also led to foreland basin subsidence. Sediments were cannibalized from the emerging highs in the west, and shed eastward into the basin (Cant and Stockmal, 1989). The Fernie Formation and Kootenay Group (Fig. 4) consist of a coarsening-upwards sequence of deep-water basin to coastal plain sandstones, shales, and coals that were deposited adjacent to the uprising Canadian Cordillera in the Jurassic to Early Cretaceous. They represent the first of a series of coarsening-upwards clastic wedges that were deposited in the foreland basin (Stott, 1984; Poulton, 1988). As thrusting continued, the accretory wedge propagated eastward, and the coal seams of the Kootenay Group were also thrust upwards into the mountains. This faulting thickened and repeated the Mist Mountain sequence throughout the Elk Valley. The coal seams are now exposed along strike for about 175 km in the Rocky Mountain Front Ranges in north-south trending synclines, near horizontal to steep westerly dipping thrust faults, and a few high-angle normal faults. Some of the thickened sections permit open-pit mining.

Mineable coal seams make up 8-12% of the total thickness.

---

Fig. 8. Palinspastic restoration of the Rocky Mountain fold and thrust belt, southeastern British Columbia. Modified from Price and Fermor (1985).
of the Mist Mountain Formation (Kootenay Group; Fig. 9), and are typically medium-volatile bituminous in rank, generally with high volatile-A bituminous coals near the top of the section, and low-volatile bituminous coals near the base. The coal is mainly metallurgical, hard coking coal (Grieve, 1993).

The East Kootenay coalfields comprise three structurally separated fields, including the Elk Valley, Crowsnest, and Flathead (Fig. 10). The Elk Valley coalfield is in the Alexander Creek and Greenhills synclines. The Crowsnest coalfield coincides with the Fernie basin, a broad north-trending synclinorium, and the Flathead coalfield consists of four relatively small, isolated exposures of Kootenay Group rocks in the extreme southeast corner of the region. Provincial legislation prohibits subsurface resource exploration and development in the Flathead River watershed (Fig. 10), and the Flathead coalfield and portions of the Crowsnest coalfield are excluded from coal mining activity.

![Fig 9. Coal seams of the Mist Mountain Formation, displayed in the pit wall at the Fording River mine. Photo courtesy of Teck Coal Ltd.](image)

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, tufa, flagstone, railroad ballast, rip rap, smelter slag and aggregate (Fig. 1).

3.1. Metal mines

In 2016, no metal mines operated in the Southeast Region.

3.2. Coal mines

Southeastern British Columbia has a history of coal mining that dates back to the 1800s, with reports of coal discovered in the Elk Valley around 1845. Today, mining operations, coal production, and environmental assessment for expansion plans continue at four of the five mines in the Elk Valley operated by Teck Coal Limited (Table 1; Figs. 1, 10). The main product is metallurgical coal (85%), with some thermal and pulverized coal injection (PCI) coal (15% combined). The region accounts for over 70% of Canada’s annual coal exports.

Over the past few years, the coal mines in the southeast have been reducing costs and optimizing operations in response to lower prices on the coal market. The average price of metallurgical coal in 2015 was $93USD/tonne, down from $115USD/tonne in 2014. Teck Coal Limited (Teck) implemented rotating shutdowns at the mines in the third quarter of 2015 in order to align production and inventory with the weaker commodity prices. In early 2016, prices had dropped further to around $80USD/tonne but have rebounded throughout the year. Teck received $92USD/tonne as a quarterly benchmark price in Q3 of 2016, negotiated in late June. Since the middle of the year prices on the spot market rose sharply and exceeded $200USD/tonne by mid-September. The Q4 quarterly benchmark price was negotiated at around $200-$205USD/tonne, and Teck ramped up production volumes in response. Record production was reported in Q3 and expected annual production volumes for 2016 are expected to be around 26 Mt. The recent price spike is due to a number of factors on the supply side, including: global production curtailments since 2014 resulting from the lower coal prices, reduced mine operation days in the Chinese domestic coal sector, and supply disruptions in China and Australia (Teck, 2016a).

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 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 decision making with respect to all water quality and mining in the Elk Valley. It includes water diversion and treatment, and establishes water quality targets for selenium, nitrate, sulphate, cadmium, and calcite. The plan was developed with scientific advice from a Technical Advisory Committee chaired by the British Columbia Ministry of Environment, and included representatives from Teck, the Ktunaxa Nation, the US Environmental Protection Agency, the State of Montana, Environment Canada and other agencies.

The selenium management plan will cost a projected $600 million over five years, and $40 million to operate annually. In 2015, Teck spent approximately $43 million on mitigative measures and construction of treatment facilities, and 2016 spending is estimated at $31 million. The West Line Creek water treatment facility (Line Creek mine; Fig. 10), the first of six facilities planned for the Elk Valley completed commissioning in February 2016. Construction has begun at the second water treatment facility at Fording River (Fig. 10; Teck, 2016b).

In May 2016, the Ktunaxa Nation Council and Teck also formally signed a comprehensive Impact Management and Benefits Agreement (IMBA) regarding the five mines in the Elk Valley. The IMBA sets out commitments for both parties that will support environmental and cultural stewardship.
Fig. 10. Map of the Kootenay Group and East Kootenay Coalfields, including the major coal mines and projects in southeastern British Columbia near Sparwood, BC.
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Fording River</td>
<td>Teck Coal Limited (100%)</td>
<td>HCC, TC</td>
<td>8.2 Mt</td>
<td>Proven + Probable: 434.9 Mt HCC + 5.0 Mt TC</td>
<td>Measured + Indicated: 1322.8 Mt HCC + 13.4 Mt TC</td>
<td>EA approval of Swift expansion (2015); permit amendments to align mine design with improved efficiencies; exploration drilling in active pits; construction of Fording River water treatment plant begun</td>
</tr>
<tr>
<td>Greenhills</td>
<td>Teck Coal Limited (80%); POSCAN (20%)</td>
<td>HCC, PCI, TC</td>
<td>5.2 Mt</td>
<td>Proven + Probable: 201.3 Mt HCC + 5.0 Mt PCI + 2.7 Mt TC</td>
<td>Measured + Indicated: 304.5 Mt HCC + 7.9 Mt PCI + 1.1 Mt TC; Inferred 148.5 Mt HCC + 4.3 Mt PCI + 0.3 Mt TC</td>
<td>Cougar Pit Expansion (CPX) is preparing for pre-application of EA; environmental baseline</td>
</tr>
<tr>
<td>Line Creek</td>
<td>Teck Coal Limited (100%)</td>
<td>HCC, TC</td>
<td>3.3 Mt</td>
<td>Proven + Probable: 66.6 Mt HCC + 11.1 Mt TC</td>
<td>Measured + Indicated: 756.1 Mt HCC + 19.3 Mt TC</td>
<td>Burnt Ridge Extension (BRX) in pre-application of EA (2014); pre-stripping at Line Creek Phase II (2013 EA approval); Commissioning of West Line Creek water treatment facility in February, 2016</td>
</tr>
<tr>
<td>Elkview</td>
<td>Teck Coal Limited (95%); Nippon Steel &amp; Sumimoto Metal Corp. (2.5%), POSCO (2.5%)</td>
<td>HCC</td>
<td>7.0 Mt</td>
<td>Proven + Probable: 273.2 Mt HCC</td>
<td>Measured + Indicated: 580.1 Mt HCC; Inferred: 224.6 Mt HCC</td>
<td>Baldy Ridge Extension (BRE) received an Environmental Assessment Certificate in September, 2016; pre-stripping at BRE; exploration drilling in active pits; development progressing in new approved mining areas</td>
</tr>
<tr>
<td>Coal Mountain</td>
<td>Teck Coal Limited (100%)</td>
<td>PCI, TC</td>
<td>2.3 Mt</td>
<td>Proven + Probable: 4.5 Mt PCI</td>
<td>CMO: Measured + Indicated: 78.4 Mt; Inferred: 4.7 Mt</td>
<td>Mineable resource at CMO is nearing depletion and expected mine shut down in late 2017; Coal Mountain Phase II (CMO2/Marten Wheeler) would utilize facilities from CMO, but currently remains on hold</td>
</tr>
</tbody>
</table>

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal
within the Elk Valley. It sets out decision-making, dispute resolution and significant collaboration processes, and provides clarity on topics including: consultation and engagement, the environment and land stewardship, and employment and business opportunities for Ktunaxa citizens.

3.2.1. Fording River (Teck Coal Limited)

Fording River (Figs. 9, 10) consists of approximately 23,000 hectares of coal lands, and produces primarily metallurgical coal, and a small amount of thermal coal, from their Eagle Mountain, Turnbull, and Henretta pits. In 2016, exploration drilling was conducted mainly in active pits. Mine models indicate that relatively thick, low-dipping seams extend into Turnbull Mountain, with potential for highwall pushback for both South Henretta and Turnbull pits. The current annual production capacities of the mine and preparation plant are approximately 8.5 million and 9.5 million tonnes of clean coal, respectively. Mineable coal reserves east of the current Henretta pit also exist on the eastern limb of the Alexander Creek syncline down section from the current footwall limit. Proven and Probable reserves are projected to support a further 52 years from their Eagle Mountain, Greenhills Ridge, Turnbull, Henretta, and Castle Mountain areas.

In September 2015, the Swift expansion received conditional environmental assessment approval, and in 2016, the company received permit amendments for modifications of the initial phases of mine design in response to the recent lower commodity prices. Initial construction costs are approximately $88.5 million dollars and operating costs will be around $16.9 billion over the life of the project. The open-pit project will use the existing Fording mine facilities and is expected to produce 175 Mt of clean coal over 25 years. To meet specifications outlined in the Elk Valley Watershed Management Plan, the construction of a selenium water treatment facility on site is underway. Located west of the Fording River mine in the northern part of the Greenhills Range, the project will mine multiple coal seams on both limbs of the Greenhills syncline, and include both previously mined and unmined zones (Fig. 11). The project is along strike and directly north of the Greenhills Cougar North project; eventually the two will merge and collectively become the Swift.

3.2.2. Greenhills (Teck Coal Limited)

Greenhills produces mainly metallurgical coal with a small amount of thermal coal, and consists of approximately 11,800 hectares of coal lands. In 2016, the mine set new record second quarter and first-half production from the Cougar pit area. The mine is on the west limb of the Greenhills syncline (Fig. 10). 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 (on a 100% basis) is 5.2 million tonnes of clean coal. Proven and Probable reserves are projected to support another 39 years of mining at the current rate.

The Cougar Pit Extension (CPX) project (Fig. 10) is the proposed expansion area for Greenhills Operations, and lies immediately north of the existing operations, with similar coal characteristics. At full development, the CPX project will merge with the Fording River Swift expansion. In 2016, Teck conducted further baseline work and mine-planning to prepare for the pre-application phase of Environmental Assessment.

3.2.3. Line Creek (Teck Coal Limited)

Line Creek produces mainly metallurgical coal and small amounts of thermal coal from the Burnt Ridge South, North Line Creek, and Horseshoe pits (Figs. 10, 12). The mine consists of approximately 8,200 hectares of coal lands. Coal seams are predominantly medium-volatile bituminous in rank, with some high-volatile-A bituminous coals near the top of the section. In 2016, record production levels were achieved at the mine by the second quarter. The current annual production capacity of the mine and preparation plant is approximately 3.5 million tonnes of clean coal. In 2016, exploration drilling was mainly focused in active pits. Expansion plans are well underway with the Line Creek Phase II, which received conditional Environmental Assessment approval in 2013. As part of the conditional approval, the West Line Creek water treatment facility was commissioned in February, 2016. This expansion will extend operations at Line Creek northward, and encompass the Mount Michael and Burnt Ridge North areas, adding approximately 59 Mt of clean coal to the mine. Proven and probable reserves at Line Creek are now projected to support mining at planned production rates for a further 23 years.

In June, 2014, the Burnt Ridge Extension (BRX) project entered the pre-application stage of Environmental Assessment (Fig. 10). The project will connect the current Phase I operating area at Line Creek to the Phase II area by pushing back the highwall of the Burnt Ridge South pit to the north. It will add 8.3 Mt of clean coal reserves to the mine.
3.2.4. Elkview (Teck Coal Limited)

The Elkview mine (Fig. 10) 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 hectares of coal lands. The current annual production capacity of the mine and preparation plant (on a 100% basis) is approximately 7.0 million tonnes of clean coal. 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 mine received approval for their expansion at Baldy Ridge BR2 in 2012 and also for the Natal PH2 in 2013, and they have been also progressing towards development of these, along with environmental baseline work to satisfy permit conditions. The Baldy Ridge Extension (BRE) received an Environmental Assessment Certificate in September 2016, and the company began pre-stripping. 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 a point later in the mine life. The BRE expansion is expected to be brought on stream by 2018 to maintain production at Elkview at around 6.8 Mt per year.

3.2.5. Coal Mountain (Teck Coal Limited)

Coal Mountain (Figs. 10, 13) produces mainly PCI (metallurgical) and thermal coal from seams at 37-Pit and 6-Pit. The mine site consists of approximately 3,000 hectares of coal lands. The current annual production capacities of the mine and preparation plant are approximately 2.7 million and 3.5 million tonnes of clean coal, respectively. The Coal Mountain Phase II (Marten Wheeler) project (Fig. 10), was designed to replace production after depletion of the resource at Coal Mountain. In November 2015, however, Teck Coal Limited removed the proposal from the pre-application process as a result of lower commodity pricing and placed the project on hold. The Coal Mountain mine will remain active at current rates of production until the expected to shut-down in late 2017. The company is evaluating opportunities for optimizing and expanding production at their other existing metallurgical coal mines in order to replace around 2.25 Mt of lost production after the shut-down.

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 the upturned strata are easily mined. A variety of smaller mines and quarries exist throughout the region, and graphite is also mined from rocks of the metamorphic core complexes (Fig. 1; 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. 14). 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 (Figs. 4, 14) that were deposited on the edge of the Cathedral escarpment, at the continental shelf edge. The deposit is a result of magnesium hydrothermal alteration, with characteristics similar to Mississippi Valley-type mineralization. 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 220 kt.

3.3.2. Moberly Silica (Heemskirk Canada Limited)

Silica is produced by Heemskirk Canada Limited at the Moberly Silica operation. The deposit is in regionally extensive
Table 2. Selected industrial mineral mines and quarries, Southeast Region, 2016.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2015 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Brussilof</td>
<td>Baymag Inc.</td>
<td>Magnesite; hydrothermal sparhy magnesite; 082JNW001</td>
<td>220,000 t annually</td>
<td>50 Mt Proven</td>
<td>-</td>
<td>MgO, and MgOH; sediment-hosted sparry magnesite</td>
</tr>
<tr>
<td>Moberly Silica</td>
<td>Heemskirk Canada Ltd.</td>
<td>Silica; industrial use silica, frac sand; 082N 001</td>
<td>-</td>
<td>-</td>
<td>20 to 140 mesh frac sand (dry): Proven 8.9 Mt of 64% frac sand + Probable 4.6 Mt of 64% frac sand; OR Silica for industrial (dry): 12.8 Mt Proven + 0.7 Mt Probable</td>
<td>$26M capital cost for plant construction and upgrades to existing facility (for frac sand operation); 300,000 tonne per year capacity; Construction started on frac sand processing plant in 2014, commissioning expected 2017</td>
</tr>
<tr>
<td>Horse Creek Silica</td>
<td>HiTest Sand Inc.</td>
<td>Silica; industrial use, aggregate; 082N 043</td>
<td>-</td>
<td>-</td>
<td>Estimated: 3 Mt at 99.5% Silica (1987)</td>
<td>Variety of aggregate and industrial use products</td>
</tr>
<tr>
<td>Elkhorn</td>
<td>CertainTeed Gypsum Canada Inc.</td>
<td>Gypsum; evaporitic bedded gypsum; 082JSW021</td>
<td>400,000 t annually</td>
<td>-</td>
<td>-</td>
<td>Variety of aggregate and industrial use products</td>
</tr>
<tr>
<td>4J</td>
<td>Georgia-Pacific Canada Limited</td>
<td>Gypsum; evaporitic bedded gypsum; 082JSW009</td>
<td>N/A; Processing stockpiled ore</td>
<td>-</td>
<td>20 Mt</td>
<td>Processing stockpiles; updating mine expansion plans</td>
</tr>
<tr>
<td>Black Crystal</td>
<td>Eagle Graphite Corp.</td>
<td>Graphite; metamorphic hosted flake graphite; 082FNW260, 082FNW283</td>
<td>N/A; Quarry on Care and Maintenance; company focused on process exploration</td>
<td>Regolith: Measured + Indicated: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: Indicated: 4.765 Mt at 1.21% fixed carbon</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Winner; Friday Quarry</td>
<td>Roxul Inc.</td>
<td>Gabbro/basalt; crushed rock for mineral wool; 082ESE265</td>
<td>Quarring to supply feed stock for mineral wool plant</td>
<td>-</td>
<td>-</td>
<td>Crushing, screening, stockpiling; environmental</td>
</tr>
<tr>
<td>Grand Forks Slag</td>
<td>Granby River Mining Company Inc.</td>
<td>Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264</td>
<td>Quarrying for abrasives and roofing granules</td>
<td>-</td>
<td>-</td>
<td>Crushing, screening; environmental</td>
</tr>
</tbody>
</table>
orthoquartzites of the Mount Wilson Formation (Middle to Upper Ordovician; Fig. 15). The formation occurs over a 300 km length along the western portions of the Rocky Mountain fold and thrust belt. 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 frac sand for the western Canadian oil and gas industry, and outlined a mine plan for a 400,000 t per year operation with a 35-year mine life. In 2014, the company began redeveloping the current silica operations, redesigning and upgrading the haul roads, and constructing a new processing plant. Plant engineering is progressing, and plant commissioning is expected by early 2017.

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 (Figs. 4, 15), 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 from a thinly bedded evaporite unit in the Burnais Formation (Middle Devonian; Figs. 4, 16) that was deposited in a restricted, shallow-marine embayment. Gypsum-bearing strata are structurally disturbed, occurring as steeply dipping and contorted sections ranging in thickness from 30 to 180 m (Butrenchuk, 1991). CertainTeed Gypsum Canada Inc. operates the Elkhorn mine, which is expected to continue production for another 4 years.

3.3.5. 4J (Georgia-Pacific Canada Limited)

Georgia-Pacific Canada Limited operates the 4J gypsum mine and rail load-out facility southeast of Canal Flats. The deposit is within Burnais Formation evaporites (middle Devonian; Figs. 4, 16). The company has been re-evaluating their mine design for the next stages of pit expansion as they wait for commodity prices to improve. In 2016, they produced mainly fines from stockpiled material for use in the agricultural industry.

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 Valhallla complex (Fig. 2) in the Valhallla dome, a structural culmination 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 calc-silicates 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 2016, the open-pit quarry was on care and maintenance, and efforts were focused on improving processing techniques at the plant, and enhancing purity and quality of the product. Process optimization enabled production of a sample of 99.995% pure spheronized graphite from fine flake graphite. Further electrochemical testing demonstrated that these particles met the specifications for lithium-ion batteries. The company also conducted a pilot project for pre-concentration of feed material without the need for flotation, on a variety of size fractions, which would allow for pre-processing of material at the quarry site and reduce transportation costs.

3.3.7. Winner and Friday quarries (Roxul Inc.)
Roxul Inc. seasonally operates two small quarries near Grand Forks. Gabbro is quarried from the Winner quarry, and basalt is quarried from the nearby Friday Quarry (North Fork). The material is trucked to the Roxul Inc. manufacturing plant in Grand Forks, where it is blended with other mineral material necessary to make mineral wool insulation, construction board, blankets, and pipe covering.

3.3.8. Grand Forks Slag (Granby River Mining Company Inc.)
North of Grand Forks, the Granby River Mining Company Inc. operates the Grand Forks Slag quarry, which produces abrasives and roofing granules from the smelter slag that was generated from the Granby Consolidated Mining and Smelting copper smelter. The smelter operated between 1900 and 1918, and generated slag from smelting copper-gold ore from the historic Phoenix mine, located west of Grand Forks.

4. Placer operations
Placer mining has occurred in southeastern British Columbia since the gold rush began in 1864. Currently there are still several placer streams in the region, though activities were not tracked in detail in 2016.

5. Mine development
A mine development project has financing in place and construction is underway with a targeted production start-up date. The project proponent must have all required government approvals and permits for constructing and operating a mine.

With the exception of the coal mine expansion projects that are currently in construction phases and discussed above, no new mine development projects were under construction in the Southeast Region in 2016.

6. Proposed mines and quarries
The proposed mine (or mine evaluation) stage, is concerned with the environmental, social, engineering and financial evaluation of a proposed mine. It includes application for an Environmental Assessment certificate and/or a Section 10 permit which states that a project is reviewable by the Environmental Assessment Office; or the submission of a Mines Act permit application for smaller scale projects not meeting the threshold criteria for review by the B.C. Environmental Assessment Office.

In the Southeast Region, there are currently four proposed coal mines, several proposed industrial mineral mines and quarries of various scales, and one proposed metal mines. The coal projects are Michel Creek/Loop Ridge (CanAus Coal Ltd.), Crown Mountain (NWP Coal Canada Ltd.), Coal Mountain Phase II (on hold; Teck Coal Limited), and Bingay Creek (Centermount Coal Ltd.). Two of the industrial mineral projects include the Kootenay West mine and the Driftwood Magnesite project (Fig. 1; Table 3).

6.1. Proposed metal mines
In 2016, there were no metal mine proposals yet with reviewable Environmental Assessment applications. However, several projects are working through stages with Mine Development Review Committees to ensure information requirements are being met.

6.2. Proposed coal mines
6.2.1. Michel Creek/Loop Ridge (CanAus Coal Ltd.)
In October 2015, CanAus Coal Ltd., 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, Tent Mountain, and Michel Head (Figs. 10, 17). The application has a current focus only on Loop Ridge, and a proposed production rate of 3.5 Mt/year (2.1 Mt/year clean coal), over a 10-year mine life. Future potential mine expansion to their other areas (Tent Mountain and Michel Head) could extend the project by an additional 10 years. The company began environmental baseline work for the project in 2013, and is hoping to begin construction in 2017. Drilling in 2016 focused on the Loop Ridge and Michel Head areas, with samples collected for coal quality testing. The project will use new techniques for the treatment of selenium in the construction and operational phases of the project to comply with environmental targets identified in the Elk Valley Water Quality Plan. Drill results have identified twenty coal seams from 5 to 20 m thick west of the Erickson normal fault. Structure and spacing of the seams gives the project a low strip ratio of ~6:1, and testwork indicates coal quality is hard coking coal. The company
Table 3. Selected proposed mines, Southeast Region, 2016.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michel Creek (Loop Ridge)</td>
<td>CanAus Coal Ltd.</td>
<td>Coal (HCC and PCI); open-pit and underground; 082GSE050</td>
<td>-</td>
<td>HCC: 44.6 Mt Measured + 42.5 Mt Indicated; open-pit and underground (2015)</td>
<td>Drilling; trenching; environmental and baseline work; mine design; coal quality; permitting</td>
<td>Pre-application of EA (2015); Coal quality testing; updated geological model; drilling has identified 20 coal seams with cumulative thickness of 70m (14% of a 504 m section in the Mist Mountain Fm); PEA model indicates potential production of 3.4Mt/y (~2.1 Mt/y saleable)</td>
</tr>
<tr>
<td>Crown Mountain</td>
<td>NWP Coal Canada Ltd. (Jameson Resources Ltd.)</td>
<td>Coal (HCC and PCI); open-pit; 082GNE018</td>
<td>HCC: 42.60 Mt Proven + 4.91 Mt Probable; PCI: 7.13 Mt Proven + 1.19 Mt Probable (2014)</td>
<td>HCC + PCI: 68.9 Mt Measured + 6.0 Mt Indicated (2014)</td>
<td>Prefeasibility studies; environmental and baseline work; mine design; permitting</td>
<td>Pre-application of EA (2014); 16-year mine life; 1.7 Mt/yr; review of pre-feasibility study identified upside in lower capital costs for contract mining and additional resources in Southern Extension</td>
</tr>
<tr>
<td>Coal Mountain Phase II (Marten Wheeler)</td>
<td>Teck Coal Limited</td>
<td>Coal (PCI and TC); open-pit and underground; 082GNE006</td>
<td>Measured + Indicated: 173.9 Mt HCC + 6.5 Mt PCI; Inferred: 7.9 Mt HCC + 0.9 Mt PCI (2015)</td>
<td>-</td>
<td>On hold</td>
<td>Pre-application of EA (2014); Potential of 76.5 Mt; 34-year mine life; 2.25 Mt/yr; EA withdrawn in late 2015; project on hold</td>
</tr>
<tr>
<td>Bingay Creek</td>
<td>Centermount Coal Ltd.</td>
<td>Coal (HCC); open pit and underground; 082JSE011</td>
<td>42.43 Mt Measured + 52.9 Mt Indicated (2012)</td>
<td>-</td>
<td>Drilling; environmental baseline studies; engineering and geotechnical evaluation for mine design; permitting</td>
<td>Pre-application of EA (2012), on hold; 39 Mt; 20-year mine life; 2 Mt/yr</td>
</tr>
<tr>
<td>Driftwood Magnesite</td>
<td>MGX Minerals Inc.</td>
<td>Magnesite; hydrothermal sparpy magnesite; quarry; 082KNE 068</td>
<td>-</td>
<td>Measured + Indicated: 8.028 Mt grading 43.3% MgO (2016; using cutoff grade of 42.5% MgO)</td>
<td>20 year mine lease acquired; drilling; 100 t bulk sample; metallurgical test work; acquisition of a pilot test mill; resource estimate</td>
<td>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 100m of surface; working on Preliminary Economic Assessment; drilling to extend the zone</td>
</tr>
</tbody>
</table>

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 the pre-feasibility engineering and design phases for the project.

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 tonnes. 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 the company 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 Ltd.) is along strike with Line Creek, and is considered an erosional outlier of the Mist Mountain Formation (Fig. 10). The property contains seven major 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. 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 categories), with upside potential in a Southern Extension, and a preliminary prefeasibility study (PFS). In 2016, the PFS was updated with improved economics related to coal pricing, OPEX and CAPEX costs. Coal quality test work indicates that approximately 84% of the coal is hard coking coal, with remainder as 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. 10). The seams range in rank from medium- to high-volatile bituminous coal. The project entered pre-application stages of environmental assessment in September, 2014. In 2015, the project was withdrawn from environmental assessment and put on hold as a result of Teck Coal Limited implementing cost-saving measures. The project was proposed to replace production and use infrastructure from the Coal Mountain mine, which is scheduled to be shut down in 2017. It has potential to produce 76.5 Mt of clean coal over an estimated 34-year mine life, at a production rate of approximately 2.25 Mt per year. The project remains on hold.

6.2.4. Bingay Creek (Centermount Coal Ltd.)
Centermount Coal Ltd.’s Bingay Main is a proposal for an open-pit and underground coal mine on the Bingay Creek property (Fig. 10). It entered pre-application of environmental assessment in early 2013. Work in 2016 consisted of drilling and environmental baseline studies. The mine would produce 2 Mt of coal annually, and have a mine life of approximately 20 years, with a total resource of approximately 39 Mt of clean coal. At Bingay Creek, the coal-bearing Mist Mountain Formation is preserved in a tight, asymmetric syncline in the immediate footwall of the west-dipping Bourgeau thrust fault. The coal at Bingay Creek 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, which entered the pre-application stages of Environmental Assessment in 2014. The quarry will target gypsum from a deformed hydrated evaporite layer 20-25 m thick, with beds of 75-95% gypsum in the Burnais Formation (Figs. 4, 16). The mine will have an average production rate of 400,000 t per year, over a 42-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. In 2016, the company focused on environmental work and mine design, with two pits (North and South). The projected start-up date for the mine is in 2018.

6.3.2. Driftwood Magnesite (MGX Minerals Inc.)
At the Driftwood Magnesite property, cliff-forming, upturned beds of sparry magnesite (Fig. 18) are interlayered with dolostones and dolomitic limestones of the Mount Nelson Formation (Proterozoic; Fig. 4). The coarse-grained textures in the magnesite zone suggest that hydrothermal alteration and recrystallization of magnesite occurred during regional metamorphism (Kikauka, 2000). The deposit varies from 100 to 300 m in thickness and has been traced along strike for 2,000 m, to a depth of approximately 110 m. In recent years, the company has been drilling and resampling 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 are working on a preliminary economic assessment. Further step-out drilling was conducted in the fall, with nine holes drilled on the East zone, and seven holes on the West zone in order 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 filation system. The mill was used to process the bulk sample material to a high-purity magnesite (MgCO₃), and a silica by-product using reverse flotation techniques. The magnesite was shipped offsite to undergo further processing to produce magnesium oxide (MgO) as well as magnesium metal (Mg). The company received a 20-year mine lease for quarry operations and are evaluating mine and process design options. They are also conducting environmental baseline work for their quarry application.

Magnesium (Mg) 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) is also a widely used industrial mineral with end uses in fire-retardant wallboard, fertilizer, animal feed, environmental water treatment, and a refractory material in the steel industry.

7. Selected exploration activities and highlights

Exploration projects can be categorized by exploration stages. The grassroots stage represents initial reconnaissance of a property and involves such activities as airborne geophysical surveys, geochemical sampling, mapping, and prospecting. Early-stage exploration consists of focused work on a target and typically includes ground geophysical surveys, trenching, drilling, and continued grassroots stage work. As well, First Nations consultation should begin at least by early-stage exploration and continue throughout the remaining stages. Advanced-stage exploration includes resource delineation, preliminary economic assessments and prefeasibility studies. Activity at the advanced stage typically includes infill drilling, bulk sampling and baseline environmental data collection. These activities continue into the mine-evaluation stage. At the mine-evaluation stage, detailed environmental, social, engineering and financial evaluation activities are carried out. As well, permit applications are submitted and it is proposed that the project become a mine.

Exploration continued in the Southeast Region in 2016 (Fig. 1; Table 4) for a variety of targets, including base and precious metals, industrial minerals, and coal.

7.1. Precious metal projects

Exploration for precious metals along fault and vein structures, and coincident with Mesozoic intrusions, is ongoing in the East Kootenays along the Kimberley Gold trend, which is interpreted as being associated with the Vulcan low (McMechan, 2012; Seabrook, 2015; Höy, 1982a). In the West Kootenays and Boundary regions, precious metal exploration dates back to the 1880s, and is also ongoing in vein (epithermal and mesothermal), associated with intrusives, and in skarn systems. Precious metals are explored for throughout the region, and are not limited to the projects discussed in this report.

7.1.1. Dewdney Trail (PJX Resources Inc.)

PJX Resources Inc. identified a new target area at their Dewdney Trail property in 2016. 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. Scanning electron microscope probe 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 Mesoproterozoic units (Fort Steele, Aldridge, Creston and Kitchener formations, Fig. 4). Stratabound between less permeable argillaceous units, a 75 to 100 m thick succession of immature quartz-wacke sandstone (Spirit quartzite) in the Upper Aldridge Formation is pervasively altered (sericite-quartz-pyrite-iron oxide-iron carbonate), veinined, and fractured along the 7 kilometre length of an anticline fold axis. The fold axis is intruded by Cretaceous and possibly Tertiary felsic to mafic rocks. Fractures are typically filled with multi-episodic veins containing hematite/limonite, quartz, pyrite, ±copper oxides and magnetite. Locally, mineralization occurs near the contact of argillite and quartzite in brecciated quartzite, in syenite dikes and in fault gouge zones. 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, and 3) skarn and stockwork Cu-Au prospects at the Dew Drop showing. Past exploration efforts on the showing 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 metre wide, altered syenite dike, which returned 1,953 g/t Au, while other rock samples have yielded up to 18 g/t Au.

7.1.2. Zinger (PJX Resources Inc.)

In 2016, PJX Resources Inc. continued exploration on their Zinger property, which hosts numerous showings along an 8 km strike length. The property is adjacent to the Perry Creek fault, and hosts gold mineralization in multiple structures, veins, and shear zones. Host rocks are the Proterozoic Purcell Supergroup (Fig. 4), predominantly metasedimentary quartzites, argillites, and siltstones of the Creston Formation, argillites of the Kitchener Formation, and gabbro sills and dikes. Veins occur as quartz stockworks, veins, and stringers with iron carbonate, sericite, and minor sulphides. Sulphide
### Table 4. Selected exploration projects, Southeast Region, 2016.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dewdney Trail</td>
<td>PJX Resources Inc.</td>
<td>082GNW 094</td>
<td>Au; Au-veins</td>
<td>-</td>
<td>Heavy mineral stream sampling; mapping; sampling</td>
<td>Very angular gold grains, new target separate from previously identified gold mineralization on property</td>
</tr>
<tr>
<td>Zinger</td>
<td>PJX Resources Inc.</td>
<td>082FSE 122, 065</td>
<td>Ag-Pb-Zn+/-Au; polymetallic veins</td>
<td>-</td>
<td>Soil geochemistry</td>
<td>Soil anomaly approximately 100 m x 300 m, with Au ranging from 100 ppb to 4,941 ppb</td>
</tr>
<tr>
<td>Greenwood Gold</td>
<td>KG Exploration (Canada) Inc.</td>
<td>082ESW 022, 210, 034, 221</td>
<td>Au-Cu-Pb-Zn-Ag+/-Mo; Cu-Au-Ag skarn, polymetallic vein, Au-vein, porphyry</td>
<td>-</td>
<td>Mapping; sampling; remodelling airborne, ground EM and Magnetic data; geological evaluation</td>
<td>Option agreement with Grizzly Discoveries Inc. to gain 75% interest in 27,346 ha; rock samples yielded 29.8 g/t Au near Au-Ag-Bi-Sb-Hg-Mo-Te geochemical anomalies in soil samples, and 9.27 g/t Au with elevated Ag, Cu, Hg, Sb and Te; anomalous precious metals and epithermal indicators in stream sediment samples</td>
</tr>
<tr>
<td>May Mac</td>
<td>Golden Dawn Minerals Inc.</td>
<td>082ESE 045, 116</td>
<td>Au-Ag-Pb-Zn+/Cu; Cu-Au-Ag skarn, polymetallic veins, epithermal Au-veins</td>
<td>37,200 t grading 3.4 g/t Au, 342.8 g/t Ag, 2% Pb, 2% Zn (1981; non-compliant)</td>
<td>Drilling (17 DDH: 1,770 m); mapping; rock sampling</td>
<td>Drill intersections include: 4.4 m grading 218.6 g/t Ag, 2.49 g/t Au, 1.5% Pb, 2.9 % Zn; 2.1 m grading 185.9 g/t Ag, 3.50 g/t Au, 1.5% Pb, 1.8 % Zn; discovery of a new silver zone with 2.3 m grading 152.0 g/t Ag, 0.36 g/t Au, 1.9% Pb, 1.9 % Zn</td>
</tr>
<tr>
<td>LH</td>
<td>Magnum Goldcorp Inc.</td>
<td>082FNW 212</td>
<td>Cu-Ag-Au; subvolcanic, skarn, Au-veins</td>
<td>-</td>
<td>SP, magnetometer and EM surveys</td>
<td>Gold mineralization appears to be associated with pyrrhotite +/- arsenopyrite, providing conductive targets; identification of drill targets</td>
</tr>
<tr>
<td>Vine</td>
<td>PJX Resources Inc.</td>
<td>082GSW 050, 049, 035</td>
<td>Pb-Zn-Ag+/-Au; polymetallic vein, SEDEX</td>
<td>1.3 Mt grading 2.2 g/t Au, 3.12% Pb, 36.3 g/t Ag, 3.12% Zn (1990; non-compliant)</td>
<td>Drilling; geophysical and geological modeling</td>
<td>Drilling on UTEM anomaly; encountered fragmentals, bedded pyrrhotite-sphalerite, and indicators of distal-style mineralization in sedex system</td>
</tr>
<tr>
<td>Monroe</td>
<td>Highway 50 Gold Corp.</td>
<td>082GSW 069, 035, 041</td>
<td>Pb-Zn-Ag+/-Au, Cu; SEDEX</td>
<td>-</td>
<td>Drilling (2 DDH; 1354 m); mapping</td>
<td>Drilling on UTEM anomaly; encountered fragmentals, bedded pyrrhotite-sphalerite, and indicators of distal-style mineralization in sedex system</td>
</tr>
<tr>
<td>Irishman-Panda</td>
<td>Teck Resources Limited</td>
<td>082FSE 110</td>
<td>Pb-Zn-Ag+/-Cu; SEDEX, polymetallic veins</td>
<td>-</td>
<td>Mapping, soil geochem; sampling; re-logging historic core</td>
<td>Initial stages of exploration on the property identified fragmental units, alteration assemblages, and indicators of sedex-style mineralization</td>
</tr>
<tr>
<td>Sully Kootenay Zinc Corp.</td>
<td>-</td>
<td>Pb-Zn-Ag+/Au; Gravity anomaly, sediment-hosted</td>
<td>-</td>
<td>Drilling; mapping; magnetic surveys; geophysical modeling</td>
<td>Mass models suggest two gravity anomalies may be stratiform sulphide mineralization; complex faulting on property</td>
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<tr>
<td>Boulder Gold</td>
<td>Classic Financial Corp. 082GNW 02, 036, 051</td>
<td>Ag-Pb-Zn+/Au; polymetallic veins</td>
<td>-</td>
<td>Drilling (2 DDH); mapping; data compilation</td>
<td>Drilling on structure; encountered favorable mineralization</td>
<td></td>
</tr>
<tr>
<td>Gallowai Bul River</td>
<td>Purcell Basin Minerals Inc. 082GNW 002</td>
<td>Cu-Ag-Au+/Pb-Zn; Cu-Ag veins; underground</td>
<td>90,720 t at 1.3% Cu, 0.31 g/t Au, 21.77 g/t Ag (1984; non-compliant)</td>
<td>Permitting; environmental baseline; mine plan and mine design; ARD/ML</td>
<td>Proposed restart of Bul River Mine that is currently on care and maintenance</td>
<td></td>
</tr>
<tr>
<td>Cummins River</td>
<td>MMG Canada Exploration Inc. 083D 001, 002, 015</td>
<td>Pb-Zn-Ag+/Cu; sediment-hosted</td>
<td>Indicated: 5 Mt grading 7 g/t Ag, 0.6% Pb, 2.3% Zn (1987; non-compliant)</td>
<td>Drilling; soil and rock geochemistry; mapping</td>
<td>Stratiform sulphides; soil survey followed up on conductive and magnetic anomalies from VTEM; Zn-Pb-Mn anomaly in soil survey</td>
<td></td>
</tr>
<tr>
<td>Goldstream</td>
<td>Barkerville Gold Mines Ltd. 082M 141</td>
<td>Cu-Ag-Au-Zn; Besshi type massive sulphides</td>
<td>-</td>
<td>Airborne VTEM geophysics</td>
<td>A number of conductive targets were identified over an area of 142 km²</td>
<td></td>
</tr>
<tr>
<td>Thor</td>
<td>Taranis Resources Inc. 082KNW 030, 031, 060, 061</td>
<td>Ag-Pb-Zn+/Au; polymetallic veins and breccia; stratiform volcanogenic massive sulphide</td>
<td>Indicated: 640,000 t grading 0.88 g/t Au, 187 g/t Ag, 0.14% Cu, 2.51% Pb, and 3.51% Zn; Inferred: 424,000 t grading 0.98% Au, 176 g/t Ag, 0.14% Cu, 2.26% Pb, and 3.2% Zn (2013: potential open pit and underground)</td>
<td>Drilling; data compilation and updating geological modeling; acquisition of a test mill, and moved on site; environmental baseline studies</td>
<td>9.15 m grading 143.9 g/t Ag, 1.05 g/t Au, 0.09% Cu, 1.83% Pb, 3.78% Zn; 9.05 m grading 97.7 g/t Ag, 0.74 g/t Au, 0.16% Cu, 3.32% Pb, 5.83% Zn; 7.22 m grading 156.1 g/t Ag, 0.88 g/t Au, 0.09% Cu, 4.1% Pb, 2.39% Zn; 2.5 m grading 400.8 g/t Ag, 0.55 g/t Au, 0.13% Cu, 2.38% Pb, 3.19% Zn</td>
<td></td>
</tr>
<tr>
<td>Teddy Glacier /Spider Mine</td>
<td>Jazz Resources Inc. 082KNW 069</td>
<td>Ag-Pb-Zn+/Au; polymetallic veins</td>
<td>Inferred: 44,000 t grading 4.46 g/t Au, 7.94% Pb, 6.74% Zn (2007; non-compliant)</td>
<td>Metallurgical test work (flotation); ML/ARD; bulk sample permitting; environmental baseline studies</td>
<td>Pb flotation concentrate with 62% Pb, 83% Au and 92% Ag; Zn flotation concentrate with 48.7% Zn; Permitting pilot mill and tailings pond at Spider Mine</td>
<td></td>
</tr>
<tr>
<td>Slocan Silver (Silvana)</td>
<td>Klondike Silver Corp 082FNW 050, 013, 082KSW 006</td>
<td>Ag-Pb-Zn+/Au; polymetallic veins; underground</td>
<td>-</td>
<td>Geological mapping and modeling; facility upgrades; environmental monitoring</td>
<td>Mill on care and maintenance; work focused on identifying exploration targets</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Continued.

<table>
<thead>
<tr>
<th>Company/Location</th>
<th>Resource Owner</th>
<th>Project Code</th>
<th>Metals</th>
<th>Exploration Methods</th>
<th>Economic Feasibility Studies</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jersey-Emerald</td>
<td>Margaux Resources Inc.</td>
<td>082FSW 010, 009</td>
<td>Pb-Zn-Ag+/W, Au, Mo, Bi; stratiform replacement, skarn</td>
<td>Emerald-Dodger Tungsten: Measured and Indicated: 3.07 Mt grading 0.34% WO₃, 0.028 Mt grading 0.1% Mo; Inferred 5.48 Mt grading 0.27% WO₃, 0.481 Mt grading 0.1% Mo(2006 - 2015)</td>
<td>Dewatering underground workings at Emerald; channel sampling in the underground; drilling (800m); surface sampling; LiDAR surveys; data compilation and 3D geological modeling</td>
<td>Jersey: Indicated: 1.9 Mt @ 4.1% Zn, 1.96% Pb; Inferred: 4.98 Mt @ 3.37% Zn, 1.95% Pb (2010)</td>
</tr>
<tr>
<td>Swift Katie</td>
<td>Valterra Resource Corp.</td>
<td>082FSW 290</td>
<td>Cu-Au+/-Pb-Zn-Ag-Mo</td>
<td>Measured and Indicated: At a 3.5 g/t Au cut-off: 758,199 t grading 6.67 g/t Au, 0.85% Cu, 12.54 g/t Ag; Using a 2.5 g/t Au cut-off: 1,337,457 t grading 5.05 g/t Au, 0.74% Cu, 10.72 g/t Ag (2012)</td>
<td>Preliminary Economic Assessment; geological modeling; mine design; MAX facility upgrades; environmental baseline studies</td>
<td>Plan to process ore from the Willa using the MAX mill and tailings facility; estimated mine life of approximately 4.1 years at 500 t/day</td>
</tr>
<tr>
<td>Willa</td>
<td>MX Gold Corp.</td>
<td>082FNW 070, 071</td>
<td>Ag-Pb-Zn +/- Au-Cu-Mo; subvolcanic breccia, polymetallic veins, porphyry Mo, Au-skarn</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Referendum/Whitewater</td>
<td>Braveheart Resources Inc.</td>
<td>082FSW 222, 171</td>
<td>Au-Ag-Pb-Zn +/- Mo; polymetallic veins, Au veins</td>
<td>Results on their bulk sample; Drilling (1500 m)</td>
<td>-</td>
<td>Bulk sample (354 kg) assayed 15.5 g/t Au; Drill core assays including: 1.25 m grading 7.8 g/t Au, 17.8 g/t Ag; 1.0 m grading 6.9 g/t Au, 7.6 g/t Ag; 2.48 m grading 3.29 g/t Au, 17.7 g/t Ag</td>
</tr>
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<td>Referendum/Whitewater</td>
<td>Braveheart Resources Inc.</td>
<td>082FSW 222, 171</td>
<td>Au-Ag-Pb-Zn +/- Mo; polymetallic veins, Au veins</td>
<td>Results on their bulk sample; Drilling (1500 m)</td>
<td>-</td>
<td>Bulk sample (354 kg) assayed 15.5 g/t Au; Drill core assays including: 1.25 m grading 7.8 g/t Au, 17.8 g/t Ag; 1.0 m grading 6.9 g/t Au, 7.6 g/t Ag; 2.48 m grading 3.29 g/t Au, 17.7 g/t Ag</td>
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<td>Results on their bulk sample; Drilling (1500 m)</td>
<td>-</td>
<td>Bulk sample (354 kg) assayed 15.5 g/t Au; Drill core assays including: 1.25 m grading 7.8 g/t Au, 17.8 g/t Ag; 1.0 m grading 6.9 g/t Au, 7.6 g/t Ag; 2.48 m grading 3.29 g/t Au, 17.7 g/t Ag</td>
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<td>Referendum/Whitewater</td>
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<td>Au-Ag-Pb-Zn +/- Mo; polymetallic veins, Au veins</td>
<td>Results on their bulk sample; Drilling (1500 m)</td>
<td>-</td>
<td>Bulk sample (354 kg) assayed 15.5 g/t Au; Drill core assays including: 1.25 m grading 7.8 g/t Au, 17.8 g/t Ag; 1.0 m grading 6.9 g/t Au, 7.6 g/t Ag; 2.48 m grading 3.29 g/t Au, 17.7 g/t Ag</td>
</tr>
<tr>
<td>Marten Phosphate</td>
<td>Fertoz Ltd.</td>
<td>082GNE 027</td>
<td>Phosphate; upwelling</td>
<td>Processing of stockpiled material (2015); extraction of an additional 2,000 tonne bulk sample</td>
<td>-</td>
<td>XRF of stockpiles: 24 – 27% P₂O₅, rock phosphate product was certified for use as an organic agriculture product in compliance with the requirements of the Canadian Organic Standards (COS) and the USDA National Organic Program; additional claims staked</td>
</tr>
<tr>
<td>Coal Creek</td>
<td>Crows Nest Pass Coal Mining Ltd.</td>
<td>082GSE035</td>
<td>Coal (HCC and PCI); underground</td>
<td>HCC + PCI: 616 Mt in the upper 3 near-surface seams (2014)</td>
<td>Prefeasibility studies; geological modeling; resource evaluation; baseline studies</td>
<td>Potential for an underground mine; review of the historical mine workings of Coal Creek colliery (operated from 1897 to 1958)</td>
</tr>
</tbody>
</table>
mineralization is mainly pyrite (weathered to limonite near the surface), galena and chalcopyrite. Historic drilling intersected near-surface gold mineralization including 2.92 g/t Au over 2 m, within a broader interval of 0.50 g/t Au over 22.38 m. Soil sampling in 2016 identified an anomaly approximately 100 m wide and over 300 m long with gold in soil values ranging from 100 ppb to 4,941 ppb (or 4.941 g/t), and the company plans follow-up work including both trenching and drilling.

7.1.3. Greenwood Gold (KG Exploration (Canada) Inc.)

KG Exploration (Canada) Inc. (a wholly owned subsidiary of Kinross Gold Corporation) continued working on the Greenwood Gold project. Exploration targets include epithermal and skarn related precious metal mineralization in Tertiary and pre-Tertiary rocks found in the northern extensions of the Republic and Toroda grabens. The property consists of approximately 27,346 hectares of land optioned from Grizzly Discoveries Inc. in 2015. Kinross can earn a 75% interest by incurring US$3 million over a 5-year period. The company focused on three key areas including Tertiary rocks in the northern portion of the Toroda Graben, pre-Tertiary rocks just northwest of Midway (the “Midway Window”), and pre-Tertiary rocks surrounding the historic Phoenix-Golden Crown-Lexington district (Attwood). Initial results identified previously unrecognized epithermal quartz veining and precious metal mineralization in the Attwood-Overlander area that are hosted in pre-Tertiary limestone and siltstone. Rock grab samples from exposed epithermal veins, from 0.75 to 2 m wide returned up to 29.8 g/t gold. A number of nearby geochemical anomalies with elevated Au-Ag-Bi-Sb-Hg-Mo-Te were outlined. Pre-Tertiary rocks of the “Midway Window” 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. Rock samples from bands of sulphide mineralization within altered limestone yielded up to 9.27 g/t Au, with elevated Ag, Cu, Hg, Sb and Te. At March Creek, Bruce Creek, and Kerr Creek, stream-sediment samples were anomalous for precious metals and indicator minerals of a potential epithermal system. The company also remodelled airborne and ground electromagnetic and magnetic data, and conducted extensive mapping and sampling to further define drill targets for 2017.

The area is underlain by rocks of the Paleozoic Knob Hill and Anarchist groups, Brooklyn Formation (Triassic), and Penticton Group (Eocene; Fig. 4). Intrusions of Jurassic, Cretaceous, and Eocene age occur throughout the area. Mineralization occurs as: Cu-Au-Ag skarn, Au-Ag epithermal, Ag-Pb-Zn±Au shear-hosted, stockworks and breccias and Cu-Au-Ag alkalic porphyry targets. The geology and mineralization are similar to Kinross Gold Corporation’s Kettle River-Buckhorn mine and mill (1,800 tonne-per-day capacity), which is south of the project area, across the border in Washington State, USA.

7.1.4. May Mac (Golden Dawn Minerals Inc.)

Golden Dawn Minerals Inc. has been evaluating several historic mineralized areas on their Boundary Falls project, including the Deadwood, Wild Rose, Amigo, and May Mac. The company began drilling at the May Mac in 2015, and continued their drill program in 2016. Drilling tested downdip and step-out extensions of the main mineralized vein, and intersected similar zones with iron, lead, and zinc sulphides. Bulk sampling and further underground drilling is planned for 2017. They also entered into an agreement with Huakan International Mining Inc. to acquire the idle Lexington mill (200 ton-per-day gravity-flotation processing facility; Fig. 19) and the former Lexington and adjacent Golden Crown underground Cu-Au mines.

The area is underlain by rocks of the Paleozoic Knob Hill and Anarchist groups, Brooklyn Formation (Triassic), and Penticton Group (Eocene; Fig. 4), and intrusions of Jurassic, Cretaceous,

Table 4. Continued.

| Elko American Coal Limited 082GSE029 Coal (HCC, PCI) | Measured: 19.2 Mt + Indicated: 57 Mt + Inferred: 181.3 Mt (JORC 2015) | Mine design and CAPEX study | Mapping of 5 coal seams over the property; 3 seams have hard coking coal quality, 2 seams have PCI coal |

Fig. 19. 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.
and Eocene age occur throughout the area. Mineralization occurs as: Cu-Au-Ag skarn, Au-Ag epithermal, Ag-Pb-Zn±Au shear-hosted, stockworks and breccias and Cu-Au-Ag alkalic porphyry targets.

7.1.5. LH (Magnum Goldcorp Inc.)

In 2016, Magnum Goldcorp Inc. continued work on their LH property. Ground geophysical surveys including self-potential (SP), magnetometer and EM surveys were carried out. The company hopes to follow up with a drilling program in 2017 on anomalies that were identified by the surveys, and to extend mineralized zones from their 2015 drilling and sampling.

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, within granodiorites of the Nelson batholith (Fig. 4). Gold occurs within a structural zone up to 13.7 m wide that contains mesothermal quartz lenses and veins averaging 30 to 60 cm in thickness, and in silicified breccias and stockworks in hornfelsed volcanic rocks. Both styles of mineralization are associated with elevated sulphides, including pyrite, pyrrhotite, arsenopyrite, and chalcopyrite. Gossan zones appear on surface near an old adit.

7.2. Polymetallic base and precious metal projects

Base metals are explored for throughout the region in the Omineca belt, and are found in SEDEX, MVT, VMS, manto and replacement deposits, and along structures in vein and fault systems. Only a few of the active projects in the region are discussed below.

7.2.1. Vine (PJX Resources Inc.)

PJX Resources Inc. continued drilling in 2016 at the Vine property, and updated their geological-geophysical model. Gravity geophysical surveys identified two target areas (East and West) that are interpreted to have potential for massive sulphide mineralization (Pb-Zn-Ag±Au) in the Aldridge Formation (Fig. 6). Recent drilling on these targets identified disseminated and replacement style sphalerite (zinc) along fractures and associated with carbonate-rich beds. The Western 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. Geophysical models of West target correspond to the depth of these intersections. The 2016 drill program is ongoing, and results are pending.

The property lies immediately north of the Moyie fault, a northeasterly-trending structure in the Vulcanic tectonic zone (Fig. 2), and a small north-trending graben. The property is underlain by middle Aldridge Formation argillites and quartzites. Historic trenching and drilling at the Vine Vein revealed vein-related and disseminated sulphides (pyrite, sphalerite, and galena) along a strike length of over 1000 m, and to a depth of over 700 m.

7.2.2. Monroe (Highway 50 Gold Corp.)

Highway 50 Gold Corp. drilled at the Monroe property, targeting sulphide mineralization in the Aldridge Formation (Fig. 6). Drilling intersected abundant carbonate beds and pyrrhotite-biotite-chlorite-albite±chalcopyrite veins over a 150 m interval, with sericite and chlorite alteration above the Lower-Middle Aldridge contact. One hole also intersected a fragmental unit with pyrrhotite, and the second hole intersected a thin unit of bedded pyrrhotite- sphalerite. The drill program followed up on geochemical soil anomalies, geophysics and drilling that was conducted in 2015.

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.

7.2.3. Irishman/Panda and DD (Teck Resources Ltd.)

Teck Resources conducted mapping and sampling at the Irishman/Panda in 2016, and re-logged historic drill core from the property. The company staked claims in the area in 2015 and has also optioned in on some of the other surrounding claims for SEDEX-style mineralization. Teck has the option to acquire 75% of the nearby DD property from PJX Resources Inc. by incurring $4M in exploration expenses by 2021, and a further $4M in expenses by 2026. The area is underlain by the Middle Aldridge (Fig. 6) siliciclastic rocks, with extensive stratabound and discordant fragmental units and widespread albite-tourmaline-chlorite-sericite alteration. The company plans to continue exploration in 2017.

7.2.4. Sully (Kootenay Zinc Corp.)

Kootenay Zinc Corp. expanded the ground magnetic survey on the Sully property and began drilling late in the year. Two subsurface gravity anomalies in the Purcell Supergroup (Fig. 4) have been identified on geophysical modeling. Mass models of the anomalies are consistent with contrasting specific gravities of sulphide mineralization, relative to the country rocks on the property. Previous mapping, drill-hole correlations, and interpretations suggest the anomalies may represent fault repetition of an upturned and rotated stratabound horizon in the Aldridge Formation. Previous drilling intersected traces of Pb-Zn-Cu sulphide mineralization and sericite alteration, and indicate that the property is underlain by complex fault structures.

7.2.5. Boulder Gold (Classic Financial Corp.)

Classic Financial Corp. drilled at their Boulder Gold property this year on targets that were identified by mapping and prospecting in 2015. A number of visible gold-bearing veins and structures have been identified on the property. Drilling encountered the down-dip extension of surface structures and zones of alteration, including the Boulder fault zone. Mineralization at the property is best developed in quartz-iron carbonate-pyrite-sericite veins in north-northeast trending shears and breccias, and in the hinge zones of folds en echelon.
with the Boulder Creek fault zone.

The Boulder Creek area is underlain by siliciclastic, carbonate, and volcanic rocks of the Mesoproterozoic Purcell Supergroup, and Lower Cambrian quartzites, slates, and carbonate rocks. Gabbro-diorite Moyie sills intrude the area, as well as Cretaceous felsic (syenite/monzonite) intrusions and lamprophyre dikes.

7.2.6. Gallowai Bul River (Purcell Basin Minerals Inc.)

Purcell Basin Minerals Inc. is working to restart the Gallowai Bul River mine, which has been on care and maintenance since 2009. The property is hosted in fault-bounded blocks of the Aldridge Formation (Fig. 6). Cu-Ag mineralization is in a network of east-west trending, near-vertical, sulphide-bearing quartz-carbonate veins, in sheared and brecciated host rocks. The main vein structure and stringer zones range from a few cm to 30 m wide. Mineralization occurs as pyrite, pyrrhotite, and chalcopyrite, with minor galena, sphalerite, arsenopyrite, cobalite, and traces of tetrahedrite and native gold. The historic Dalton mine operated between 1971 and 1974, and produced 7,260 t of Cu, 6,354 kg of Ag, and 126 kg of Au from 471,900 t milled (BC MINFILE) from open pits. The property has existing infrastructure, including a 750 t per day conventional mill, assay and metallurgical laboratories, tailings impoundment, waste dumps, and two open pits. The company has been completing environmental baseline work and updating mine plans, and is working towards fulfilling requirements for permit application.

7.2.7. Cummins River (MMG Canada Exploration Inc.)

MMG Canada Exploration Inc. continued work at the Cummins River property this year. The company drilled on low-moderate conductive, NW orientated targets that are coincident with magnetic anomalies and structures, as a follow up to their work in 2015. Targets, including a zinc-lead-manganese anomaly near the Bend North Road MINFILE showing, were identified on airborne VTEM, and soil sampling surveys.

The area is underlain by a thick sequence of amphibolite-grade lower to middle Cambrian quartzites, carbonates and pelites of the Miette, Gog, and Chancellor groups (Fig. 4) on the western limb of the Porcupine Creek anticlinorium. At the Cummins River Canyon, pyrite, pyrrhotite, sphalerite and galena are hosted in the Kinbasket limestones and Tsar Creek Formation metapelites (Chancellor Group) as intensely deformed, stratiform massive sulphides, siliceous sulphides, and mineralized manganiferous dolostone, 5 to 10 m thick (Reddy et al., 1986).

7.2.8. Goldstream (Barkerville Gold Mines Ltd.)

Barkerville Gold Mines Ltd. conducted 686 km of airborne geophysical (VTEM) surveys at the Goldstream property covering an area of 142 km². A number of moderate to high conductive targets were identified. Conductive targets coincide with magnetic anomalies, and are interpreted as sub-vertical tabular bodies, with depths to the top of the anomalies ranging from about 50-80 metres.

The property was acquired from International Bethlehem Mining Corp. in 2012 and contains the Goldstream mine and 1,000 tonne-per-day mill. Between 1983 and 1996, the mine produced 2,224,387 tonnes yielding 26,228,450 grams of silver, 42,363 grams of gold, 78,269,389 kilograms of copper and 7,988,112 kilograms of zinc (BC MINFILE). The deposit is classified as a stratiform Besshi-type Cu-Zn-Pb-Ag volcanogenic massive sulphide deposit. Mineralization consists of a thin sheet (1 to 3 metres thick) of pyrrhotite, chalcopyrite and sphalerite in serticite quartzite and calcareous and chloritic phyllite, extending along a strike length of 400 metres.

The area is underlain by Lower Cambrian and younger metasedimentary and metavolcanic rocks of the Lardeau Group (Index Formation; Fig. 4). Massive greenstone units, chloritic phyllite, ultramafic pods and dark calcareous to pelitic schists host the Goldstream deposit.

7.2.9. Thor (Taranis Resources Inc.)

Taranis Resources continued drilling at the Thor property, which is composed of several targets and showings, including the True Fissure, Great Northern, Broadview, and Blue Bell past-producing mines (Figs. 20, 21). Their 2016 program included 2,100 m of drilling on several targets, and further sampling and mapping. 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). The resource highlights both open-pit (62% of the property) and underground mining projects. Additional work since 2006 has identified other targets, which appear as VLF conductors and gossan features. In 2015, the company surveyed and sampled stockpiles at the Broadview, Great Northern, and True Fissure past-producers, and are updating the resource model on the property with the results. It is believed that historically, the galena ore was hand-picked while the chalcopyrite and sphalerite were left in the dumps. This year’s drilling encountered stacked zones of mineralization beneath the Great Northern, and as step-out mineralization in previously undrilled areas. The company also acquired a portable test mill this year and have placed it on site. They plan to use it to process a 1,000 kg bulk sample. The company has updated their 3D model of the deposit to identify peripheral targets, and plans to update the resource after next year’s drilling.

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. 4). The geology on the property is highly deformed, but it is interpreted that primary stratiform sulphide mineralization (Ag-Pb-Zn-Au-Cu) may be of volcanogenic massive sulphide origin, and predates folding and faulting. 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
pyroclastic tuffaceous sediments. Drilling has encountered foliated quartz-feldspar porphyry on the property, which is believed to pre-date structures and possibly be related to the mineralizing event. High-grade gold is also found in late quartz veins that flank sulphide deposits.

7.2.10. Teddy Glacier/Spider Mine (Jazz Resources Inc.)

The Teddy Glacier property has been intermittently explored since the 1920s. In 2016, the company continued mapping and sampling, and conducted environmental baseline studies and mill upgrades. Jazz Resources Inc. plans to collect a bulk sample and process it at the Spider Mine mill, and have been working to obtain permits for this facility.

The property is underlain by tightly folded and sheared limestones, carbonaceous phyllites, and grits of the Index and Jowett formations (Lardeau Group; Fig. 4). Mineralization occurs as a series of irregular Ag-Pb-Zn±Au polymetallic veins at the Big Showing, East Vein, Dunbar Vein, and West Vein. The Vimy Ridge stratabound zone exists as massive galena-pyrite-chalcopyrite in a silicified limestone at a schist-limestone contact (Shearer, 2007).

7.2.11. Slocan Silver (Klondike Silver Corp.)

Klondike Silver Corp’s Slocan Silver project consists of 25,000 hectares with several past producers from silver-rich veins in a historic Ag-Pb-Zn mining area. The area is underlain by sheared and brecciated argillites and slates of the Slocan Group (Triassic) that are cut by Nelson granodiorite and quartz monzonite dikes (Middle Jurassic; Fig. 4). Shear-hosted polymetallic veins contain Ag-Pb-Zn mineralization. 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 (BC MINFILE). The company’s mill at Sandon is a 100 tonne-per-day concentrator
that operated at an average rate of 40 t per day (Fig. 22). In 2016, the mine and mill remained on care and maintenance, and the company focused on exploration work to identify new exploration targets and sources of mill feed for a re-start of the mill. Environmental work and engineering upgrades to the tailings facility and underground structures are ongoing.

![Fig. 22. The Sandon mill, currently on care and maintenance. The mill has a capacity of 100 tonnes-per-day, and is owned and operated by Klondike Silver Corp.](image)

7.2.12. Jersey-Emerald (Margaux Resources Ltd.)
Margaux Resources Ltd. continued work at Jersey-Emerald. Early in the year, the company focused on an historic drift (ca. 1905) that they discovered during their 2014 East Emerald tungsten drill program, and which is along strike with the Pb-Zn Jersey mine. In 2016, Margaux collected samples from this drift, and found it to be 12.8 metres long with continuous galena-rich mineralization along its length. After the initial underground sampling, the company conducted surface sampling and sampled several gossan zones and veins. They also 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 5,300 drill collars, logs, and assay data). They began expanding their 3D modelling of the property, and drilled late in the year with a focus on higher grade gold-bismuth targets and lead-zinc targets. The 2015 resource estimate for the Emerald is 3.071 Mt grading 0.34% WO₃ (Measured and Indicated) with 5.48 Mt grading 0.273% WO₃ (Inferred) using a 0.15% WO₃ cut-off grade. The 2010 Jersey resource estimate included 1.9 Mt grading 4.1% Zn and 1.96% Pb (Indicated), and 4.98 Mt grading 3.37% Zn and 1.95% Pb (Inferred), using cutoff grades of 3.5%.

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 (Fig. 4). Coarse-grained marble to garnet-pyroxene skarn occurs in the Truman and Reeves members at contacts with small Cretaceous biotite granite stocks, Jurassic Nelson intrusions, 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 (Fig. 23); 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. The surrounding historic Dodger, Invicible, and Feeny mines also display tungsten mineralization.

![Fig. 23. Skarn mineralization in the Truman Member (Cambrian) at the Jersey-Emerald.](image)

7.2.13. Willa (MX Gold Corp.)
MX Gold Corp. continued work on the Willa property and are in the permitting stages and conducting environmental baseline studies for planned underground and bulk sampling. They have also been rehabilitating a historic portal and underground workings and upgrading the road. In addition to their work at the Willa, they have also begun repairs, maintenance, and modifications to the MAX mill and tailings facility, which they plan to use to process their bulk sample from the Willa. The MAX mine is 135 km to the west, near Trout Lake, and has been on care and maintenance since 2011.

The Willa deposit is in a roof pendant of the Nelson batholith, containing mafic volcanic rocks of the Rossland Group, intruded by felsic dikes (Fig. 4). Surrounding Slocan Group metasedimentary rocks contain silver-lead-zinc mineralization. Lamprophyre dikes and faults post-date and crosscut the metavolcanic rocks and intrusions. Mineralization (Pb-Zn-Ag-
Au±Mo) is in structurally controlled silica-rich breccias, pipes and stockwork veins, with local massive- to disseminated, replacement zones. The main copper-gold mineralization is hosted in a sub-volcanic breccia pipe at the centre of a hypabyssal complex of quartz and feldspar porphyritic intrusions, and has an alkalic porphyry signature. Chalcopyrite, pyrite, and magnetite mineralization comprise three zones in, and peripheral to, the breccia pipe (Ash, 2014).

7.2.14. Whitewater (Braveheart Resources Inc.)
Braveheart Resources Inc. continued exploration work at the Whitewater property. They began drilling in October 2016 with plans for additional drilling late in the year to test the extension and continuity of mineralization in quartz veins on the property. Results were also released early in the year from their 2015 bulk sampling program (354 kg).

The area is underlain by Middle to Late Jurassic Nelson intrusions in contact with andesite tuffs, balsaltic tuffs, lapilli tuffs of the Lower Jurassic Elise Formation (Fig. 4). Mineralized quartz veins hosted by hornblende granodioritic rocks (Jurassic) and found in northeastering trending shear zones, contain galena, sphalerite, pyrite, chalcopyrite, and molybdenite mineralization. At Whitewater, banded veins are 0.5 to 2 m thick, and at the Referendum, visible gold is in shear-hosted banded quartz veins that are up to 2 m wide and 400 m long.

7.2.15. Swift Katie (Valterra Resource Corporation)
Valterra Resource Corp. began drilling on their Swift Katie project late in the year, following up on drilling that was done in 2014 by Riverside Resources. One of the holes is offsetting a 2014 hole that initially assayed 3.5 m grading 13.3 g/t gold, 201 g/t silver and 0.33% copper. In 2016, drilling continued late in the year and results are pending.

The property is underlain by volcanic and synvolcanic intrusive rocks of the Elise Formation, Jurassic to Cretaceous (Nelson) intrusions, Eocene intrusive rocks (Coryell), and Tertiary felsic to maﬁc and lamprophyric dikes (Fig. 4). The property contains alkalic porphyry Cu-Au mineralization, with pyrite, chalcopyrite, bornite, pyrrhotite, sphalerite, tetrahedrite and chalcocite, and polymetallic (Pb-Zn-Ag±Au,Cu) shear-hosted quartz-calcite veins. In addition to a Cu-Au porphyry target, gold mineralization at the Swift also appears to be associated with pyrite-pyrrhotite-chalcopyrite veins at the contact between andesite and a diorite intrusion, and elevated copper and lead. The package at the Swift may reﬂect a transitional environment from a porphyry to an epithermal system. Drilling on the Katie has identiﬁed zones of copper-gold mineralization along a 1,800 m strike length, with numerous untested soil anomalies, representing an alkali porphyry target.

7.3. 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. Only one project of several in the region is described below.

7.3.1. Marten Phosphate (Fertoz Limited)
Fertoz Limited was active at their Marten Phosphate project, targeting phosphoritic beds of oolitic sandstone at the base of the Fernie Formation (Jurassic), immediately above the Spray River Group (Triassic; Fig. 4). Handheld XRF analysis of the phosphoritic beds indicates 24-27% P2O5, and the beds have been mapped for over 1,200 m. Fertoz is permitted for a 10,000 t bulk sample and in 2016, the company crushed and pulverized approximately 1,720 tonnes of previously stockpiled rock phosphate for direct application spreading as rock phosphate fertilizer. They extracted a further 2,000 tonnes this year, and staked additional claims to expand their land position. The company also received approval for use of their rock phosphate to process organic agriculture products in compliance with the requirements of the Canadian Organic Standards (COS) and the USDA National Organic Program.

7.4. Coal projects
Coal exploration is ongoing in the Elk Valley, Crowsnest, and Flathead coalfields (Fig. 10), though with coal prices being depressed over the past few years, exploration on new projects has slowed. Two projects are discussed within this report.

7.4.1. Coal Creek (CrowsNest Pass Coal Mining Ltd.)
CrowsNest Pass Coal Mining Ltd. continued geological modeling, engineering review, resource, and pre-feasibility work at their Coal Creek property (Fig. 10). Although fieldwork remained on hold in 2016, environmental baseline studies, including water quality surveys are ongoing.

The company has been testing the downdip extensions of the uppermost coal seams at the historical underground Coal Creek and Elk River collieries, the former of which closed in 1958. 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)
In 2016, Pacific American Coal Limited conducted mine design and CAPEX studies on their Elko coal project property (Fig. 10), and updated their geological model. In 2015, they mapped and sampled, located old adits, and compiled historical drill, geological and sample data on the property. They have outlined locations for future drilling.

The project is in the Crowsnest coalfield, targeting Mist Mountain coal seams in the McEvoy syncline. Five seams outcrop on the property, with thicknesses of 2.57 to 5.0 metres, 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 + 19.2 Mt measured, and has plans for drilling in 2016.

8. Geological research

Geological research is being carried out in the region by the British Columbia Geological Survey, Geoscience BC, the Geological Survey of Canada, the National Institute of Advanced Industrial Science and Technology (AIST) at the Geological Survey of Japan, and by various students at the MSc and PhD levels.

8.1. Geoscience BC

Geoscience BC funds a variety of projects in the region. Over the past few years, several projects have also been funded as part of the SEEK (Stimulating Exploration in the East Kootenays) program, which is largely focused on gold and base metals mineral potential in the Belt-Purcell Basin (Purcell Anticlinorium; Fig. 2). One recent paper studies the links between fragmental rocks and mud volcanoes to massive sulphide Ag-Pb-Zn deposits in the Purcell Basin (Kennedy and Höy, 2016). Funding also supports the Fort Steele Drill Core Library Project, which is managed by the East Kootenay Chamber of Mines. The project aims to develop a secure repository to preserve some of the East Kootenay drill core, including core from the Sullivan mine and some of the other recent drilling in the area. In the Boundary area, geological mapping is being conducted in NTS 083E/07 (Höy et al., 2016).

8.2. British Columbia Geological Survey and Geological Survey of Canada

The British Columbia Geological Survey has entered into a partnership agreement with National Institute of Advanced Industrial Science and Technology (AIST) at the Geological Survey of Japan, with technical support from the Geological Survey of Canada to study the rare earth element potential in the Purcell Anticlinorium. Preliminary reconnaissance work was conducted in 2016 on the project, with further work planned for next year.

9. Summary

In 2016, 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 down and markets began the year at lower levels. However, prices and investment funding picked up later in Q3, and several late drill programs occurred throughout the region. Several drill programs are also planned for 2017.

Acknowledgments

Parts of this report are the result of a compilation and update of earlier reports and project files by previous Regional Geologists, British Columbia Geological Survey geologists, BC MINFILE data, technical and assessment reports, and company news releases. Sincere thanks also go out to industry exploration and mining staff who provided updated information. The generous cooperation of industry staff make it possible for the Regional Geologists to effectively monitor activities, trends, and results, and make the information available to the public. All errors and omissions in this report are the responsibility of the author.

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Exploration and mining in the South Central Region, British Columbia

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1. Introduction

South Central region (formerly Thompson-Okanagan-Cariboo) was established as an administrative area in 2010 after the province reorganized its natural resource agencies. In 2016 the Ministry of Energy and Mines resumed the use of an older name for the region, while retaining its newer boundaries. For over 150 years the region has been a locus of mining. It is now home to five of BC's largest metal mines, several industrial mineral mines, and many small placer operations, gravel pits and rock quarries. Mineral products include: copper, molybdenum; gold; silver; limestone; zeolite; diatomaceous earth; high-alumina shale; precious opal; dimension stone; and aggregate. The region's diverse geology, natural endowment, infrastructure (road, rail, power), and skilled workers sustain the search for new deposits. In 2016, two limestone quarries (Pavilion and Harper Ranch) and related processing operations were placed on care and maintenance due to weak demand. All metal mines reported relentless efforts to reduce costs in the face of low metal prices. Gibraltar mine restarted its molybdenum circuit (closed since 2015). Other major metal mines recorded improvements in mining or milling, but small metal mines remained on care and maintenance.

Two projects (Bethlehem; Bonanza Ledge) entered formal environmental review under the Minister’s permit process. The Ajax project, its review well underway, saw steady progress but with a much smaller staff. The Prosperity project (which has received provincial but not federal environmental approval) submitted plans for a detailed site investigation.

Exploration focused on defining or expanding porphyry and porphyry-related deposits (copper-gold; copper-molybdenum), gold deposits of various types, and stratiform base-metal deposits, but also included some industrial minerals (limestone; basalt). This year’s pace of exploration closely matched last year’s, hinting that the steady decline since late 2011 has slowed. Many projects were inactive because operators were unable to raise venture capital or unwilling to spend it in the region.

As a pilot project, the Ministry of Energy and Mines partnered with the Association for Mineral Exploration and Ernst & Young LLP to develop a comprehensive online survey of exploration data to replace surveys previously conducted by Ministry geologists. For the South Central region, exploration expenditures are estimated to be $43.5 million; exploration drilling is estimated at 103,000 metres (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017 in press). The geological overview section was written by Paul Schiarizza of the British Columbia Geological Survey (and first published in Britton, 2015). It is reproduced here with only minor changes.

2. Geological overview by Paul Schiarizza, BCGS

The tectonic and metallogenic evolution of the Canadian Cordillera are intimately linked (Fig. 1, e.g., Nelson et al., 2013; Colpron and Nelson, 2011). The South Central region straddles three of British Columbia’s five morphostratigraphic 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, shown on Figure 1, include Jurassic-Cretaceous siliciclastic and local volcanic rocks, Eocene volcanic rocks, Neogene and Quaternary basalt, and Middle Jurassic to Eocene granitic intrusions.

2.1. Cratonic and pericratonic terranes

The Monashee complex, partly represented by a narrow belt along the eastern edge of the region, comprises Paleoproterozoic orthogneiss, interpreted as part of the North American craton, overlain by a Neoproterozoic to Paleozoic cover sequence that includes quartzite, pelitic schist, calc-silicate schist and marble (Armstrong et al., 1991). Basement gneisses, including the Malton gneiss, are also exposed to the north, near Blue River, where they are associated with Neoproterozoic sedimentary sequences (Windermere Supergroup) that were deposited following initial rifting that formed the western margin of ancestral North America (McDonough and Parrish, 1991; Murphy et al., 1991). Extending northward from there, Cariboo terrane comprises Neoproterozoic to mid-Paleozoic siliciclastic and carbonate rocks, represented by the Kaza, Cariboo and Black Stuart groups, which are interpreted as distal facies of the North American platform (Struik, 1988a).
Kootenay terrane comprises Neoproterozoic to mid-Paleozoic rocks that are interpreted as deep-water basin facies equivalents deposited west of the North American platform. Lower Cambrian and older rocks are similar to North American strata to the east, but the overlying lower Paleozoic succession is characterized by units of coarse siliciclastic and mafic volcanic rocks that may reflect intermittent extensional deformation (Colpron and Price, 1995). This belt also includes Devon-Mississippian calc-alkaline to alkaline volcanic rocks and associated granitoid intrusions, found mainly in the Eagle Bay assemblage east and southeast of Clearwater (Schiarizza and Preto, 1987), which reflect the initiation of east-dipping subduction beneath the North American plate margin. These rocks host polymetallic volcanicogenic massive sulphide occurrences, as well as the Harper Creek bulk tonnage copper deposit.

2.2. Arc and oceanic terranes

Slide Mountain terrane comprises the easternmost tract of oceanic rocks in the Canadian Cordillera. It includes the Fennell Formation, near Clearwater; the Antler Formation, near Wells; and, in the intervening area, a narrow, discontinuous belt of rocks referred to as the Crooked amphibolite. The Fennell and Antler formations comprise thrust-imbricated sequences of mainly basalt, chert, diabase, and gabbro, ranging from early Mississippian to mid-Permian (Schiarizza and Preto, 1987; Struik and Orchard, 1985). 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 (or Quesnellia) is a Late Triassic to Early Jurassic magmatic arc complex that formed along or near the western North American continental margin (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 that include the Old Tom, Independence, and Shoemaker formations (Tempelman-Kluit, 1989). The Mesozoic rocks are represented mainly by Middle to Upper Triassic volcanic and sedimentary rocks of the Nicola Group, together with abundant 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 dark grey siltstone and slate intercalated with quartzite and limestone (Bloodgood, 1990; Schiarizza et al., 2013; Mihalynuk et al., 2015). The volcanic rocks are mainly augite-phryic 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 (Ashcroft formation, Windy Mountain successions, Dragon Mountain successions) that overlie western parts of the Nicola Group unconformably or disconformably (Travers, 1978; Logan and Moynihan, 2009; Schiarizza et al., 2013).

Quesnel terrane is an important metallogenic province, particularly for porphyry deposits containing copper, gold and molybdenum (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, including the Bromley, Pennask, Wild Horse, Thuya and Takomkane batholiths (Fig. 2).

Cache Creek terrane, comprising Carboniferous to Early Jurassic chert, argillite, basalt, limestone, sandstone, gabbro and serpentinitized 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 includes Late Triassic blueschists farther north (Ghent et al., 1996), and is interpreted, at least in part, as an accretion-subduction complex that was 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. The older arc system includes bimodal volcanic rocks and associated intrusions of the Wineglass assemblage, southwest of Williams Lake, and late Permian intrusive rocks within the Mount Lynton complex (Friedman and van der Heyden, 1992; Schiarizza, 2013). The younger arc system includes Upper Triassic volcanic and sedimentary rocks of the Cadwallader Group and Tyaughton Formation, Late Triassic intrusions in the western part of the terrane and in the Mount Lynton complex, and Lower to Middle Jurassic siliciclastic and local volcanic rocks of the Ladner Group (Schiarizza, 2013, and references therein).

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). Dated cherts and limestones range from Mississippian to late Middle Jurassic, and blueschist-facies metamorphic rocks yielded Middle to Late Triassic Argon-Argon ages (Cordey and Schiarizza, 1993;
Fig. 2. Generalized geology of southern Quesnellia and Cu±Mo±Au deposits. Mesozoic arc plutons align along the length of southern Quesnellia to define three, north-trending, temporally distinct belts that get younger to the east: 1) Late Triassic; 2) Late Triassic-Early Jurassic; and 3) Early Jurassic. Discrete porphyry copper mineralizing events are directly linked to each of these magmatic episodes. From Logan (2013).
Schiarizza et al., 1997). The Bridge River complex is thought to be the product of accretion and subduction processes, possibly related to Mesozoic arc volcanics of the adjacent Cadwallader terrane. Chert-bearing sequences are locally overlain by siliciclastic rocks of the Cayoosh assemblage (Jurassic-Cretaceous; Journeay and Mahoney, 1994), which forms the youngest component of the terrane.

Stikine terrane (or Stikinia) 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). Upper Triassic volcanic and sedimentary rocks assigned to the Mount Moore and Mosely formations, in the eastern Coast belt west of Chilko Lake, are also considered part of the Stikine terrane (Rusmore and Woodsworth, 1991).

2.3. Late Jurassic and younger rocks

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, but are shown only in the southwest, where they form part of the Coast plutonic complex (Fig. 1).

3. Mines and quarries

The region produces copper, molybdenum, gold and silver from five, large, metal mines and a variety of industrial minerals (limestone, bentonite, zeolite, diatomaceous earth, high-alumina shale, precious opal, and dimension stone) from about ten quarries. Almost 1,000 placer mines and gravel pits have active permits, but perhaps only a tenth of that number actually produce.

3.1. Metal mines

South Central region hosts roughly half of the province’s metal mines (Fig. 1; Table 1). These include the province’s two largest copper-molybdenum producers (Gibraltar mine, near Williams Lake, owned by Taseko Mines Limited, and Highland Valley Copper mine, near Logan Lake, operated by Teck Highland Valley Copper Partnership) and three major copper-gold mines (Imperial Metals Corporation’s Mount Polley mine, near Likely; New Gold Inc.’s New Afton mine, near Kamloops; and Copper Mountain Mining Corporation’s Copper Mountain mine). The region hosts three precious metal mines. All have less than 300 tonnes-per-day mill capacity; all are on care and maintenance. These include: Bonanza Ledge, near Wells, owned by Barkerville Gold Mines Ltd.; Bralorne, near Gold Bridge, owned by Avino Silver & Gold Mines Ltd.; and Treasure Mountain, near Merritt, owned by Nicola Mining Inc.

3.1.1. Copper Mountain (Copper Mountain Mining Corporation and Mitsubishi Materials Corporation)

The Copper Mountain copper-gold mine, near Princeton (Fig. 2), has been producing since August 2011 (see Holbek and Joyes, 2013). It is operated by a partnership of Copper Mountain Mining Corporation (75%) and Mitsubishi Materials Corporation (25%). The rate of mining has met or exceeded guidance figures, but until a new secondary crusher was installed in mid-2014, milling operations struggled to achieve the targeted 35,000 tonnes-per-day. Quarterly mine production since 2015 has consistently exceeded targets. Milling exceeded the company’s benchmark of 40,000 tonnes-per-day for the last two months of the year. Copper Mountain drew ore from Pit 2, Saddle, Virginia and the newly developed Oriole areas. The Virginia and Oriole pits are, respectively, northeast and southeast of the mine’s three main pits. A multi-year exploration program seeks to upgrade resources, test ore depths and find mineralization outside the current mine plan. In 2016, the company drilled 5,000 metres to convert resources to reserves. Holbek et al. (2015) described the deposit as a structurally complex, alaskite porphyry copper-gold system wherein most of the copper-gold mineralization occurs in Nicola Group (Triassic) volcanic rocks while subordinate amounts occur in coeval intrusive rocks. Mineralization shows strong vertical continuity.

3.1.2. Gibraltar (Taseko Mines Limited and Cariboo Copper Corp.)

The Gibraltar copper-molybdenum mine (Fig. 2) is operated by Taseko Mines Limited and Cariboo Copper Corp. Production began in 1972. In 2013, the mine completed its first full year of operation after extensive modernization. Part of the modernization plan was building a separate molybdenum circuit, which operated until 2015 when it was shut down due to low metal prices. However, in September 2016 Taseko reopened the molybdenum circuit producing some 185,000 lbs of molybdenum in that month alone. Since 2013, the mine has generally met guidance of 85,000 short tons per day from its combined mills. Proven and probable reserves (as of 2014-12-31; 0.15% Cu cut-off) stand at 749 million short tons grading 0.26% Cu and 0.008% Mo, with 3.3 billion pounds of copper recoverable (Jones, 2015). Ore comes from five pits...
### Table 1. Metal mines, South Central Region, 2016 (listed alphabetically).

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven and Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonanza Ledge (open pit on care and maintenance since June 2015)</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>gold; pyrite replacement; 093H 140</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Resource (as of 2015-03-31; cut-off 1.7 g/t Au): Measured: 170,000 t grading 8.74 g/t Au (containing 48,000 oz Au); Indicated: 240,000 t grading 6.86 g/t Au (containing 54,000 oz Au); M+I: 420,000 t grading 7.63 g/t Au (containing 102,000 oz Au)</td>
</tr>
<tr>
<td>Bralorne (on care and maintenance)</td>
<td>Avino Silver and Gold Mines Ltd.</td>
<td>gold; vein; 093JNE 001</td>
<td>Nil</td>
<td>Reserve data not available.</td>
<td>Measured and Indicated resources (as of 2016-10-20; cut-off not stated): 273,123 tons grading 0.33 oz/t Au (containing 91,528 oz Au)</td>
<td>2016 work improved tailings storage facility, mill and mine infrastructure; prepared for long-hole mining; updated resource estimate.</td>
</tr>
<tr>
<td>Copper Mountain</td>
<td>Copper Mountain / Mitsubishi Materials</td>
<td>copper, gold, silver; alkalic porphyry; 092HSE 001</td>
<td>*83 Mlb Cu; 30,800 oz Au; 291,900 oz Ag</td>
<td>Proven and Probable reserves as of 2014-12-31; 0.18% Cu cut-off): 146 Mt grading 0.35% Cu, 1.47 g/t Ag, 0.12 g/t Au (containing 1.1 Blb of Cu; 6.9 Moz Ag; 560,000 oz Au)</td>
<td>Measured and Indicated resources (as of 2014-12-31; 0.18% Cu cut-off): 265 Mt grading 0.33% Cu, 1.33 g/t Ag, 0.40 g/t Au (containing 1.9 Blb Cu; 11.35 Moz Ag; 930,000 oz Au)</td>
<td>Drilled at Pit 2 to convert Inferred resources into Measured/Indicated. *Annual production taken from Copper Mountain news release (2017-01-11).</td>
</tr>
<tr>
<td>Gibraltar</td>
<td>Taseko Mines Ltd.</td>
<td>copper, molybdenum; calc-alkalic porphyry; 093B 012</td>
<td>*133 Mlb Cu; 900,000 lb Mo.</td>
<td>Proven and Probable reserves (as of 2014-12-31; 0.15% Cu cut-off): 749 Mt grading 0.26% Cu and 0.008% Mo. (Recoverable metal: 3.3 Blb Cu)</td>
<td>Measured and Indicated resources (as of 2014-12-31; 0.15% Cu cut-off): 1,092 Mt grading 0.25% Cu and 0.008% Mo</td>
<td>Gibraltar’s molybdenum circuit resumed operation in September 2016. *Annual production taken from Taseko news release (2017-01-09).</td>
</tr>
</tbody>
</table>

*Annual production taken from Copper Mountain news release (2017-01-11).
Table 1. Continued.

<table>
<thead>
<tr>
<th>Deposit</th>
<th>Operator</th>
<th>Minerals</th>
<th>Proven and Probable Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highland Valley Copper</td>
<td>Teck Highland Valley Copper Partnership</td>
<td>copper, molybdenum; calc-alkalic porphyry; 092ISW 012</td>
<td>Proven and Probable reserves (as of 2015-12-31; cut-off not stated): 129,100 t Cu; 4.2 Mlb Mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resources (as of 2015-12-31; cut-off not stated): 577.2 Mt grading 0.29% Cu; 0.007% Mo.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Recoverable metal: 1,450,000 t Cu; 30,000 t Mo.)</td>
<td></td>
</tr>
<tr>
<td>Mount Polley</td>
<td>Imperial Metals Corporation</td>
<td>copper; gold; silver; alkaline porphyry; 093A 008</td>
<td>Proven and Probable reserves (as of 2016-01-01; variable mill head values for cut-off): 27.1 Mlb Cu; 46,900 oz Au; 105,200 oz Ag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resources (as of 2016-01-01; variable mill head values for cut-off): 73.6 Mt grading 0.274% Cu, 0.293 g/t Au, 0.562 g/t Ag</td>
<td></td>
</tr>
<tr>
<td>New Afton</td>
<td>New Gold Inc.</td>
<td>copper, gold; alkaline porphyry; 092INE 023</td>
<td>Proven and Probable reserves (as of 2014-12-31; cut-off NSR US$21/t or US$24/t depending on block): 405,000 oz Au; 1.8 Moz Ag; 95 Mlb Cu.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resources (as of 2014-12-31; cut-off 0.40% CuEq): 73 Mt grading 0.75 g/t Au, 2.2 g/t Ag, 0.87% Cu; (containing 1.75 Moz Ag, 5.2 Moz Ag, 1.4 Blb Cu)</td>
<td></td>
</tr>
<tr>
<td>QR (mine on care and maintenance; mill operates)</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>gold; skarn; 093A 121</td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resources (as of 2014-01-01; cut-off 0.40% CuEq): 73 Mt grading 0.75 g/t Au, 2.2 g/t Ag, 0.87% Cu; (containing 1.75 Moz Ag, 5.2 Moz Ag, 1.4 Blb Cu)</td>
<td></td>
</tr>
<tr>
<td>Treasure Mountain (on care and maintenance)</td>
<td>Nicola Mining Inc.</td>
<td>silver, lead, zinc; vein; 092HSW 016</td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resources (as of 2014-01-01; cut-off 0.40% CuEq): 73 Mt grading 0.75 g/t Au, 2.2 g/t Ag, 0.87% Cu; (containing 1.75 Moz Ag, 5.2 Moz Ag, 1.4 Blb Cu)</td>
<td></td>
</tr>
</tbody>
</table>

- Deposit depleted or mill awaiting ore from other sources.
(Connector; Gibraltar; Granite; Extension; and Pollyanna), but not all operate at all times. The deposit occurs 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). Exploration at the Gibraltar North project, outside the main mining area, is described below.

3.1.3. Highland Valley Copper (Teck Resources Limited)

The Highland Valley Copper copper-molybdenum mine (Fig. 2), operated by Teck Highland Valley Copper Partnership, is the largest base metal mine in Canada. For many years the mine was a partnership between Teck (97.5%) and Highmont Mining Company Ltd. (2.5%). In the third quarter of 2016, Teck acquired a 100% stake in the mine. Ore comes from three pits (Valley; Lornex; Highmont). In 2016, production shifted from the Valley pit to the Lornex pit which has softer rock but lower grades. The softer rock allowed mill throughput consistently to exceed the rated capacity of 130,000 tonnes-per-day.

Following ground geophysical survey and drilling programs that started in 2012, Teck Highland Valley Copper Partnership 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. All mineralization at Highland Valley occurs 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)

Mount Polley copper-gold-silver mine (Fig. 2) of Imperial Metals Corporation completed its first year of full operations two years after a breach in its tailings dam caused a year of lost production. The company continues to remedy damage caused by the August 2014 breach, focusing on restoring fish habitat in Hazeltine Creek. Early in 2016, the company released an updated resource estimate based on five zones (Springer, Cariboo, WX, Boundary open pit, Boundary underground, see Brown et al., 2016, and Table 1). In 2016, ore came from the Cariboo open pit and Boundary underground zone. Late in the year, the company initiated a 5,000 m underground drilling program to test two zones (Martel and Green) from the access ramp to the Boundary zone. The Martel zone lies beneath the Wight pit. The Green zone has been tested by widely spaced drilling in 2004. 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. 2) is a block cave operation owned by New Gold Inc. that opened in mid-2012 (Hall and May, 2013). In mid-2015 the company installed a new 14,000 tonne-per-day mill. For 2016, mill throughput has ranged between 15,250 and 15,900 tonnes-per-day, without loss of recovery. The deposit forms a high-grade keel beneath the past-producing Afton open pit mine, an alkalic porphyry in the Iron Mask batholith (Triassic). Exploration continued to expand resources in the C zone, a down-plunge extension of the area now being mined (Rennie et al., 2015), and test other targets along the eastern edge of New Gold’s claims.

3.1.6. Bonanza Ledge (Barkerville Gold Mines Ltd.)

The Bonanza Ledge mine, near Wells, is owned and operated by Barkerville Gold Mines Ltd. It began as an open pit, truck and shovel operation with a mine life of four years. Test mining took place between March 2014 and June 2015 when it was halted due to problems with grade control and the cost of trucking ore to the company’s mill at QR mine 110 km away. Previously published reserves (as of August 2009, Proven: 130,724 tonnes grading 10.227 g/t Au; Probable: 166,808 tonnes grading 8.114 g/t Au) were reclassified as resources because test mining had been unprofitable (Snowden, 2015). Bonanza Ledge is a pyrite replacement deposit consisting of native gold in quartz veins within pyrite-bearing, carbonaceous and chloritic phyllite of the Snowshoe Group (Proterozoic-Paleozoic).

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. In 2016 Avino continued to improve their mill and tailings facility and further develop a strategic operating plan for future production. The mine plan proposes a long-hole mining method, which is considered safer and requires less labour. The company thinks the new plan will support production at a rate of 300 short tons per day. In October the company released a new technical report with increased tonnage and grade estimates in all categories (Kirkm and Yee, 2016). Ore occurs in gold-bearing mesothermal quartz veins between three former mines (Bralorne, King and Pioneer). The veins occupy an imbricated contact zone between Bridge River (oceanic) and Cadwallader (arc) assemblages, subsequently intruded by Cretaceous to Tertiary plutons and cut by major faults (e.g., the Fraser-Yalakom array).

3.1.8. Treasure Mountain (Nicola Mining Inc.)

Treasure Mountain mine, 40 kilometres west of Princeton, owned by Nicola Mining Inc. (formerly Huldra Silver Inc.), has been on care and maintenance since 2015. The Treasure Mountain deposit is a stacked series of high-grade silver-lead-zinc veins in Cretaceous sedimentary rocks of the Pasayten Group in the Methow terrane (Fig. 1). A resource estimate (Indicated but not compliant with NI 43-101) prepared in 2009 was 33,000 tonnes grading 828 g/t Ag, 4.16% Pb, and 3.8% Zn, at a 311 g/t Ag cut-off (Ostensoe et al., 2009). Other targets near the mine have returned high-grade grab samples but have not been drilled.

3.1.9. Merritt mill (Nicola Mining Inc.)

Nicola Mining Inc. (formerly Huldra Silver Inc.) reopened
its 200 tonne-per-day Merritt mill and tailings facility at the former Craigmont mine site. The mill has processed ore from Treasure Mountain mine and the Elk gold deposit (owned by Gold Mountain Mining Company). In 2016, the mill processed gold-silver ore from the Dome Mountain mine near Smithers under a contract with Metal Mountain Resources Inc. The company hopes the mill and tailings facility will support smaller gold and silver mining operations in the Pacific Northwest.

3.1.10. QR mill (Barkerville Gold Mines Ltd.)

The QR mine of Barkerville Gold Mines Ltd. has operated sporadically in recent years due to depleting ore and is now essentially closed. QR’s mill has been on care and maintenance awaiting ore from Bonanza Ledge mine 110 km away.

3.2. Coal mine (Basin Mine Limited Partnership)

Basin coal mine (Fig. 1; Table 2) continued on care and maintenance in 2016. The mine is now owned by Basin Mine Limited Partnership after its previous owner, Coalmont Energy Corporation, was assigned into bankruptcy in mid-2015. Basin mine produced thermal coal between June and October 2013 at an initial rate of 250,000 tonnes-per-year of thermal coal. Production halted due to a spill of mine water and has not restarted because of poor coal prices. Basin mine, 18 kilometres west of Princeton, has a 250 tonne per hour Parnaby wash plant, which eliminates the need for a tailings pond. Cleaned coal moved by truck and barge to Texada Island for shipment to local and overseas markets. Coal seams occur in Eocene rocks that form a half graben. The Main seam is about 32 metres thick and has four coal units separated by thin layers of siltstone, tuff or ironstone. Twenty-seven metres below the Main seam is the Lower seam (7 metres thick), which remains an exploration target.

3.3. Industrial mineral mines

More than ten industrial mineral quarries and processing plants operate in the region (Fig. 1; Table 3). These operations employ more than 250 people.

3.3.1. Ashcroft (IG Machine and Fiber Ltd.)

Five kilometres east of Ashcroft, IG Machine and Fiber Ltd., a subsidiary of IKO Industries Ltd., operates the Ashcroft basalt quarry and roofing granule plant.

3.3.2. Decor (Pacific Bentonite Ltd.)

The Decor pit of Pacific Bentonite Ltd., 20 kilometres west of Cache Creek, has supplied alumina-rich burnt shale to the Lafarge cement plant in Kamloops. This operation will likely go on care and maintenance as a consequence of the Lafarge shutdown. The Decor property also hosts a large bentonite deposit, which is being investigated for municipal engineering and tile manufacturing applications.

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

After operating intermittently for many years supplying cement to meet demand in 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 uses gypsum and anhydrite mined at the Falkland quarry and alumina-silica silt obtained from a loess deposit on site.

3.3.4. 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 processes this material to produce flagstone, ashlar, facing stone and landscape rock. In 2010, Spectral Gold Corp. began developing the Lady King Basalt deposit, near Vernon, selling basalt columns as landscape rock.

3.3.5. Klinker (Opal Resources Canada Inc.)

Opal Resources Canada Inc. produces gem quality fire opal

Table 2. Coal mine, South Central Region, 2016.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven and Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin</td>
<td>Basin Mine Limited Partnership</td>
<td>TC; 092HSE 157</td>
<td>On care and maintenance since 2013</td>
<td>Not available</td>
<td>Not available</td>
<td>-</td>
</tr>
</tbody>
</table>

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal; ULV = ultra low volatile
Table 3. Industrial mineral mines, South Central Region, 2016 (listed alphabetically).

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven and Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashcroft</td>
<td>IG Machine and Fibers Ltd. (IKO Industries Ltd.)</td>
<td>Basalt (roofing granules); 092INW 104</td>
<td>350,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>-</td>
</tr>
<tr>
<td>Bromley Creek (Zeotech)</td>
<td>Canadian Mining Company Inc.</td>
<td>Zeolite; 092HSE 243</td>
<td>On care and maintenance since 2015</td>
<td>Not available</td>
<td>M+I (as of 2013-06-30): 550,000 t</td>
<td>-</td>
</tr>
<tr>
<td>Bud</td>
<td>Absorbent Products Ltd.</td>
<td>Bentonite; 092HSE 162</td>
<td>30,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>Production is combined amount from Bud and Red Lake quarries.</td>
</tr>
<tr>
<td>Decor</td>
<td>Pacific Bentonite Ltd.</td>
<td>Alumina, landscape rock; 092INW 084</td>
<td>100,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>Production likely to be affected by shut down of Lafarge’s Kamloops Cement Plant.</td>
</tr>
<tr>
<td>Falkland</td>
<td>Lafarge Canada Inc.</td>
<td>Gypsum; 082LNW 001</td>
<td>6,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>Production likely to be affected by shut down of Lafarge’s Kamloops Cement Plant.</td>
</tr>
<tr>
<td>Harper Ranch</td>
<td>Lafarge Canada Inc.</td>
<td>Limestone; 092INE 001</td>
<td>220,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>On care and maintenance as of November 2016.</td>
</tr>
<tr>
<td>Kettle Valley quarries</td>
<td>Kelowna Sand and Gravel Ltd / Kettle Valley Stone Ltd.</td>
<td>Ashlar, flagstone, thin veneer; 082ENW 109; 111; 112</td>
<td>Not available</td>
<td>Not available</td>
<td>Not available</td>
<td>-</td>
</tr>
<tr>
<td>Klinker</td>
<td>Opal Resources Canada Inc.</td>
<td>Opal; 082LSW 125</td>
<td>Intermittent operation</td>
<td>Not available</td>
<td>Not available</td>
<td>-</td>
</tr>
<tr>
<td>Lady King Basalt</td>
<td>Spectral Gold Corp.</td>
<td>Basalt columns; N/A</td>
<td>Intermittent operation</td>
<td>Not available</td>
<td>Not available</td>
<td>-</td>
</tr>
<tr>
<td>Mount Polley Magnetite</td>
<td>Craigmont Industries Ltd.</td>
<td>Magnetite (recovered from tailings); 093A 008</td>
<td>3,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>Plant operated part time in 2016 due to weak demand.</td>
</tr>
</tbody>
</table>
Table 3. Continued.

<table>
<thead>
<tr>
<th>Pavilion</th>
<th>Graymont Western Canada Inc.</th>
<th>Limestone; 092INW 081</th>
<th>20,000 t</th>
<th>Not available</th>
<th>Not available</th>
<th>On care and maintenance as of June 2016.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Lake</td>
<td>Absorbent Products Ltd.</td>
<td>Diatomaceous earth; 092INE 081</td>
<td>30,000 t</td>
<td>Not available</td>
<td>Not available</td>
<td>Production is combined amount from Bud and Red Lake quarries.</td>
</tr>
</tbody>
</table>

from the Klinker property, 25 kilometres northwest of Vernon. In 2016, the company closed its retail store, north of Vernon, but continued to market jewelry through a distributor in Whistler and the Internet. Opal forms fracture and vesicle-fillings in andesitic to basaltic lahars and breccias in the Kamloops Group (Eocene).

3.3.6. McAbee and Walhachin (Canadian National Railway Company, Canadian Pacific Railway Limited)

Both of Canada’s transcontinental railways have ballast quarries between Kamloops and Cache Creek. At the McAbee quarry, on the north side of the Thompson River, CN Rail extracts ballast from a phase of the Guichon Creek batholith (Late Triassic). CP Rail mines Nicola Group (Triassic) basalt at its Walhachin quarry on the south side of the Thompson River. Ballast extracted from these quarries is used as far east as Manitoba.

3.3.7. Mount Polley (Craigmont Industries Ltd.)

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

3.3.8. Pavilion (Graymont Western Canada Inc.)

Earlier in the year, Graymont Western Canada Inc.’s Pavilion limestone quarry and lime plant was placed on care and maintenance. The operation is a few kilometres west of Decor, and 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.

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

At their plant in Kamloops, Absorbent Products Ltd. manufactures cat litter, barn deodorizer, industrial absorbents, and carriers for agricultural products prepared from diatomaceous earth from the Red Lake quarry, 45 kilometres northwest of Kamloops, and bentonite from the Bud quarry 7 kilometres south of Princeton.

3.3.10. Zeotech/Bromley Creek (Canadian Mining Company Inc.)

In 2014, Canadian Mining Company Inc. concluded its option agreement with Heemskirk Canada Ltd and regained control of the Zeotech/Bromley Creek zeolite quarry, 6 kilometres east of Princeton. Zeolite from the quarry has agricultural and absorbent applications.

3.4. Placer mines, aggregate pits and rock quarries

A recent tally of ‘active’ placers, pits and quarries that have valid Mines Act permits, shows there are 652 placer surface mines; 1 placer underground mine (Wingdam); 291 sand and gravel pits; and 45 quarries in the region (A. Hart, pers. comm., October 2016). ‘Active’ is an administrative classification that does not imply production and includes mines undergoing reclamation and closure. Most of these operations are small, intermittent or seasonal, and lack production data.

4. Mine development

‘Mine development projects’ are those for which there is a positive production decision, key government approvals and on-site construction has begun. No projects meet these criteria.

5. 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 coordinated 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 and Mines. The MDRC review is informally called the Minister’s permit process.

Seven projects are in this category: Ajax, Bethlehem, Bonanza Ledge, Harper Creek, Prosperity, Ruddock Creek, and Spanish Mountain (Fig. 1; Table 4).

5.1. Ajax (KGHM Ajax Mining Inc.)

Formal review of the Ajax copper-gold porphyry project, owned by KGHM Ajax Mining Inc., continued under the auspices of the BC Environmental Assessment Office and
### Table 4. Proposed mines, South Central Region, 2016 (listed alphabetically).

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven and Probable)</th>
<th>Resources (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajax</td>
<td>KGHM Ajax Mining Inc.</td>
<td>Cu, Au; Alkalic porphyry</td>
<td>Reserves (P+P; NSR cut-off US$7.10/t): 426 Mt grading 0.29% Cu; 0.19 g/t Au; 0.39 g/t Ag (containing 2.7 Bt Cu; 2.6 Moz Au; 5.3 Moz Ag)</td>
<td>Resources (M+I; USR cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag</td>
<td>Environmental monitoring; Public and First Nations engagement. Compiling comments received during public review periods, and drafting responses.</td>
<td>Project at application review stage. Company temporarily suspended review to respond to comments received.</td>
</tr>
<tr>
<td>Bethlehem</td>
<td>Teck Resources Ltd.</td>
<td>Cu, Mo; Calc-alkaline porphyry</td>
<td>n/a</td>
<td>Resources (cut-off 1.7 g/t Au): Measured: 170,000 t grading 8.74 g/t Au (containing 48,000 oz Au); Indicated: 240,000 t grading 6.86 g/t Au (containing 54,000 oz Au); M+I: 420,000 t grading 7.63 g/t Au (containing 102,000 oz Au)</td>
<td>Formal review under a Minister’s permit process started in September; engineering studies</td>
<td>Project at application review stage. Resource informally stated as 100 Mt, but without grades</td>
</tr>
<tr>
<td>Bonanza Ledge (underground)</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>Au; Pyrite replacement;</td>
<td>Reserves (P+P; cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag</td>
<td>Resources (M+I; cut-off 0.14% Cu): 1,010 Mt grading 0.24% Cu; 0.41 g/t Au</td>
<td>Formal review under a Minister’s permit process started in December; engineering studies</td>
<td>Project at application review stage.</td>
</tr>
<tr>
<td>Harper Creek</td>
<td>Yellowhead Mining Inc.</td>
<td>Cu, Au, Ag; Stratiform, volcanic-hosted</td>
<td>Reserves (P+P; cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag</td>
<td>Resources (M+I; cut-off 0.14% Cu): 1,010 Mt grading 0.24% Cu; 0.41 g/t Au</td>
<td>Project on hold.</td>
<td>Project at application review stage. Company suspended review in October 2015 for economic reasons.</td>
</tr>
<tr>
<td>New Prosperity</td>
<td>Taseko Mines Ltd.</td>
<td>Cu, Au; Calc-alkaline porphyry;</td>
<td>Reserves (P+P; NSR cut-off $5.50/t): 831 Mt grading 0.23% Cu and 0.41 g/t Au; containing (recoverable) 3.6 Bt Cu; 7.7 Moz Au</td>
<td>Resources (M+I; cut-off 0.14% Cu): 1,010 Mt grading 0.24% Cu; 0.41 g/t Au</td>
<td>Preparations for site investigation of proposed mine facilities. Company is seeking judicial review of federal EA decision. Results pending.</td>
<td>Project at post-decision stage. Granted provincial certificate but denied federal approval.</td>
</tr>
</tbody>
</table>
Table 4. Continued.

<table>
<thead>
<tr>
<th>Ruddock Creek</th>
<th>Ruddock Creek Mining Corporation</th>
<th>Pb, Zn, Ag; Monashee-type sediment-hosted massive sulphide; 082M 082</th>
<th>Resources (M+I; cut-off 4.0% Pb+Zn); 6.2 Mt grading 6.50% Zn, 1.33% Pb</th>
<th>Environmental monitoring; permitting work.</th>
<th>Project at pre-application stage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish Mountain</td>
<td>Spanish Mountain Gold Ltd.</td>
<td>Au, Ag; Sediment-hosted gold; 093A 043</td>
<td>Resources (M+I; cut-off 0.20 g/t Au); 237.8 Mt grading 0.46 g/t Au; 0.69 g/t Ag; containing 3.5 Moz Au; 5.28 Moz Ag</td>
<td>Environmental monitoring. Technical studies to evaluate different scenarios for mining.</td>
<td>Project at pre-application stage.</td>
</tr>
</tbody>
</table>

the Canadian Environmental Assessment Agency. In 2016, KGHM reduced project staff from around 60 to 10 to meet parent company priorities. Because Ajax is on the outskirts of Kamloops, the company has funded independent reviews of its application by the City and local First Nations. A revised feasibility study released at the start of 2016 modelled Ajax as a 65,000 tonne-per-day open pit mine with a projected 18-year life. The company is an 80:20 joint venture between KGHM Polska Miedź S.A. (KGHM SA) and Abacus Mining and Exploration Corporation. Mineralization occurs in the Iron Mask batholith, a Triassic, multi-phase, alkaline intrusive complex (Fig. 2).

5.2. Bethlehem (Teck Resources Limited)

Teck Resources Limited submitted plans to reopen the past-producing Bethlehem mine, 2 kilometres east of its Highland Valley Copper operations. Over the past few years, Teck has defined 100 million tonnes of new ore at Bethlehem. If approved, the mine would feed its 140,000 tonne-per-day mill. A Mine Development Review Committee commenced formal review of the Bethlehem Phase 1 proposal in September. Engineering and feasibility studies continue.

5.3. Bonanza Ledge (Barkerville Gold Mines Ltd.)

As noted above, Bonanza Ledge saw limited production as an open pit mine between March 2014 and June 2015. In December 2016, Barkerville Gold Mines Ltd. applied for a permit to mine the remaining resource by underground methods. The company hopes production can resume in 2017. The plan is to mine at a rate of ~500 tonnes-per-day (~150,000 tonnes-per-year) using a long-hole method with cemented rock fill. Initial mine life is estimated at 2 years with $7 million in capital costs. If successful, this mine will generate income for the company as it advances work on other deposits (e.g., Cow Mountain and Island Mountain: see exploration section below).

5.4. Harper Creek (Yellowhead Mining Inc.)

The Harper Creek copper-gold-silver project, 90 km north of Kamloops, 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 to provincial and federal authorities was accepted in January 2015. In October 2015, the company suspended further work on the project (including baseline environmental studies) due to a lack of funds. The project remained on hold in 2016 while the company sought financing to complete the review. Proven and Probable mineral reserves stand at 716 million tonnes grading 0.26% Cu; 0.029 g/t Au and 1.2 g/t Ag (Merit Consultants, 2014). The feasibility study proposes a 70,000 tonne-per-day operation with a mine life of 28 years. Initial capital costs would exceed $1 billion.

5.5. Prosperity (Taseko Mines Limited)

The Prosperity (also known as New Prosperity or Fish Lake) project of Taseko Mines Limited, 125 km southwest of Williams Lake, is described as a gold-copper porphyry with Proven and Probable reserves of 830 million tonnes 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. BC granted Taseko a project certificate in November 2013 and has extended its expiry date by five years. In the Fall, Taseko submitted plans for a detailed site investigation of proposed mine infrastructure. If approved, work will start in 2017.

5.6. Ruddock Creek (Imperial Metals Corporation, Mitsui Mining and Smelting Co Ltd., Itochu Corporation)

At the Ruddock Creek massive sulphide prospect, 75 kilometres northeast of Clearwater (Fig. 1), Imperial Metals Corporation collected environmental baseline data in preparation for future permitting requirements. The project is owned by Imperial Metals Corporation (50%) and joint venture partners Mitsui Mining and Smelting Co Ltd. (30%) and Itochu Corporation (20%). The operator and manager of the joint venture is the Ruddock Creek Mining Corporation. 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 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.

5.7. Spanish Mountain (Spanish Mountain Gold Ltd.)

Late in 2014, Spanish Mountain Gold Ltd. suspended exploratory work on its Spanish Mountain sediment-hosted gold deposit, 70 kilometres northeast of Williams Lake, until economic conditions improve. Baseline environmental studies continue as the company prepares for formal environmental review. In 2016, the company commissioned engineering studies to evaluate if higher grade zones could support an alternative mine model with a 20,000 tonne-per-day mill and a 20-year mine life (in contrast to a previous scenario of 40,000 tonnes-per-day and a 14-year mine life for the entire resource). The company also commissioned work to assess whether a simplified metallurgical process might achieve planned recoveries at lower capital and operating costs. As of April 2014, Measured and Indicated resources (using a cut-off grade of 0.2 g/t Au) are 237.8 million tonnes grading 0.46 g/t Au and 0.69 g/t Ag (Giroux and Koffyberg, 2014).

6. Exploration highlights

Exploration in 2016 focused on defining or expanding porphyry and porphyry-related deposits (copper-gold and copper-molybdenum), skarn deposits (tungsten; copper), gold deposits of various types and stratiform base-metal deposits. Industrial minerals (basalt; gypsum; jade; limestone; manganese; zeolite) were also sought. Herein, projects are grouped by deposit type and listed alphabetically (Fig.1; Table 5).

6.1. Precious metal projects

South Central region has many mineral deposits in which precious metals are the principal target. Among them are mesothermal veins, transitional veins, epithermal veins, hot spring systems, replacement deposits, skarns, sediment-hosted deposits, and intrusion-related breccias. In 2016, exploration focused on mesothermal and epithermal veins, skarns and replacement deposits.

6.1.1. Cariboo Gold (Barkerville Gold Mines Ltd.)

Barkerville Gold Mines Ltd. advanced its Cariboo Gold project by: drilling the BC vein to define high-grade, mineable zones; drilling at Cow Mountain (site of former Cariboo Gold Quartz mine) to define a bulk-mineable resource; drilling at Island Mountain (site of former Mosquito Creek and Aurum mines) to define a bulk-mineable resource; planning an underground mine beneath the Bonanza Ledge open pit; and testing early-stage exploration targets across an expanded block of claims and a newly identified, 60-kilometre structural trend called the ‘Cariboo Break’. This is by far the biggest exploration project in the region. Approximately 70,750 metres were drilled in 2016, using four drill rigs.

Refinancing and restructuring in 2013-2014 brought new management and technical staff to Barkerville Gold Mines Ltd. and revived its Cariboo Gold project (Stokes, 2015). The project lies 85 kilometres east of Quesnel and covers ~211,900 hectares of claims, including three historic groups of Crown grants (Cariboo Group, Island Mountain Group, and Mosquito Creek Group). Past production has come from gold-bearing pyrite replacement deposits and gold-sulphide-quartz veins. Host rocks are folded and metamorphosed siliciclastic sedimentary and subordinate volcanic rocks of the Snowshoe Group (Neoproterozoic-Lower Paleozoic).

Highlights from work in 2016 are as follows.

• Completion of Phase 1 drilling on the BC vein followed by Phase 2 (infill drilling) to define economically prospective and mineable portions. The BC vein has a strike length of 1,400 metres and has been drilled to a depth of 400 metres below surface.

• KL zone evaluation. In the course of drilling the BC vein, the company discovered new zones of mineralization in both its hangingwall and footwall. Of particular interest is the KL zone, 500 metres east of the Bonanza Ledge pit, which consists of quartz-sulphide veins that parallel the BC vein. Tracing this zone 850 metres to the southeast was delayed until the company could acquire a block of claims owned by Williams Creek Gold Ltd.

• Completion of Phase 1 drilling (242 holes; 32,290 metres) at Cow Mountain to increase confidence in mine data and to upgrade resource categories. Cow Mountain is the site of the past-producing Cariboo Gold Quartz mine. This work discovered a new, undrilled zone of ore-grade mineralization between the Sanders and Rainbow zones within the old mine.

• Initiation of Phase 1 drilling (27,131 metres by year end) at Island Mountain, site of the past-producing Mosquito Creek and Aurum (Island Mountain) mines. Previously, mining had focused on pyrite replacement deposits because of their higher grades. Phase 1 drilling deliberately tested the tenor and continuity of vein mineralization.

• Discovery of two new gold zones (Shaft and 4300) in an undeveloped area between Mosquito Creek and Aurum mines. Both zones have intense silica alteration and an increase in vein density.

• Discovery of the ‘Cariboo break’ and identification of over 130 exploration targets as part of an assessment of regional resource potential. The Cariboo break is a feature some 60 kilometres long that has a marked spatial association between gold-in-soil anomalies and high-resolution magnetic and electromagnetic signatures. It is interpreted as a shear zone that channeled gold mineralization. The Cariboo break and associated targets will be the focus of regional exploration in the years ahead.

6.1.2. Bonaparte (Westkam Gold Corp.)

At the Bonaparte gold property, 50 kilometres northwest
Table 5. Selected exploration projects, South Central Region, 2016 (listed alphabetically).

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspen Grove (Ketchan Lake)</td>
<td>Kaizen Discovery Inc.</td>
<td>092HNE 115</td>
<td>Cu, Au; Porphyry</td>
<td>n/a</td>
<td>Drilling</td>
<td>Improved geological model</td>
</tr>
<tr>
<td>Bonaparte</td>
<td>WestKam Gold Corp.</td>
<td>092P 050</td>
<td>Au, Cu; Vein; porphyry</td>
<td>n/a</td>
<td>Underground bulk sampling</td>
<td>Advanced decline but stopped short of target Crow/Grey Jay zone. Plan to resume in 2017.</td>
</tr>
<tr>
<td>Bralorne</td>
<td>Avino Silver &amp; Gold Mines Ltd.</td>
<td>092JNE 001</td>
<td>Au; Vein</td>
<td>n/a</td>
<td>Resource estimate; Engineering studies</td>
<td>Assessed viability of long-hole mining.</td>
</tr>
<tr>
<td>Brett</td>
<td>Ximen Mining Corp.</td>
<td>082L 04E</td>
<td>Au, Ag; Vein</td>
<td>n/a</td>
<td>Drilling to test main zone and parallel structures</td>
<td>Improved geological model.</td>
</tr>
<tr>
<td>Cariboo Gold (Barkerville Mountain; Cow Mountain; Island Mountain)</td>
<td>Barkerville Gold Mines Ltd.</td>
<td>093H 019</td>
<td>Au; Vein; replacement</td>
<td>Cow Mountain block (as of 2015-03-31; cut off 0.5 g/t Au): Indicated: 35.8 Mt grading 2.4 g/t Au (containing 2.8 Moz Au); Inferred: 27.5 Mt grading 2.3 g/t Au (containing 2.0 Moz Au)</td>
<td>Drilling to define resources at BC vein; Cow Mountain; Island Mountain; geochronological and geophysical surveys; explored regional targets</td>
<td>Improved resource definition; discovery of new ore zones near mines; discovery of “Cariboo break” structural feature.</td>
</tr>
<tr>
<td>Copper King</td>
<td>Copper King Exploration Ltd.</td>
<td>092INE 024</td>
<td>Cu, Au; Porphyry</td>
<td>n/a</td>
<td>Geophysics; drilling</td>
<td>Improved geological model.</td>
</tr>
<tr>
<td>Fox (Ridley Creek; BN; BK; South Grid)</td>
<td>Happy Creek Minerals Ltd.</td>
<td>093A 259</td>
<td>W, Mo; Ag; Skarn</td>
<td>Ridley Creek zone (as of 2016-03-15; cut-off 0.1% WO3): Indicated: 505,000 tonnes grading 0.468% WO3; Inferred: 280,000 tonnes grading 0.456% WO3.</td>
<td>Drilling to delineate target areas and demonstrate continuity of mineralization; trenching; sampling</td>
<td>Published first resource estimate for Ridley Creek zone. Improved geological models for BN and BK zones.</td>
</tr>
<tr>
<td>Gibraltar North</td>
<td>Taseko Mines Ltd.</td>
<td>093B 011</td>
<td>Cu, Mo; Porphyry</td>
<td>n/a</td>
<td>Drilling</td>
<td>Intersected high grade Cu-Mo porphyry outside mining area.</td>
</tr>
<tr>
<td>Ike</td>
<td>Amarc Resources Ltd.</td>
<td>092O 025</td>
<td>Cu, Mo; Ag; Porphyry</td>
<td>n/a</td>
<td>Drilling; Geophysical surveys</td>
<td>Extended mineralized zone.</td>
</tr>
</tbody>
</table>
Table 5. Continued.

<table>
<thead>
<tr>
<th>Location</th>
<th>Company/Proponent</th>
<th>Project Code</th>
<th>Minerals/Sediment</th>
<th>Style</th>
<th>RC/Exploration Method</th>
<th>Result/Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lac la Hache (Aurizon South)</td>
<td>Engold Mines Inc.</td>
<td>092P 002</td>
<td>Cu, Au, Ag; Breccia</td>
<td>n/a</td>
<td>Drilling; prospecting</td>
<td>Extended structure along strike and down dip.</td>
</tr>
<tr>
<td>Lucky Mike</td>
<td>Plate Resources Inc.</td>
<td>092ISE 027</td>
<td>W, Cu, Mo; Skarn; porphyry</td>
<td>n/a</td>
<td>Drilling</td>
<td>Extended mineralized zone; improved geological model.</td>
</tr>
<tr>
<td>Prospect Valley</td>
<td>Westhaven Ventures Inc.</td>
<td>092ISW 107; 111; 112</td>
<td>Au, Ag; Vein</td>
<td>North and South Discovery zones (as of 2012-01-11; cut-off 0.30 g/t Au); Inferred: 10.1 Mt grading 0.5 g/t Au, containing 166,000 troy oz Au.</td>
<td>Drilling; prospecting</td>
<td>Extended mineralized zone; improved geological model.</td>
</tr>
<tr>
<td>Rabbit North</td>
<td>Tower Resources Ltd.</td>
<td>092INE 071</td>
<td>Cu, Au; Porphyry</td>
<td>n/a</td>
<td>Drilling; mapping; prospecting</td>
<td>Extended mineralized zone; improved geological model.</td>
</tr>
<tr>
<td>Redhill</td>
<td>Troymet Exploration Corp.</td>
<td>092INW 042</td>
<td>Pb, Zn, Au; Volcanogenic massive sulphide</td>
<td>n/a</td>
<td>Drilling; mapping; geochemical and geophysical surveys</td>
<td>Discovered new massive sulphide layer.</td>
</tr>
<tr>
<td>Shovelnose</td>
<td>Westhaven Ventures Inc.</td>
<td>092HNE 308; 309</td>
<td>Au; Vein; breccia</td>
<td>n/a</td>
<td>Drilling</td>
<td>Mineralized zone extended</td>
</tr>
<tr>
<td>Thule (including Titan Queen; Embayment; Eric)</td>
<td>Nicola Mining Inc.</td>
<td>092ISE 034; 035; 036</td>
<td>Cu, Au, Ag; Skarn; porphyry</td>
<td>n/a</td>
<td>Drilling</td>
<td>Improved geological model.</td>
</tr>
<tr>
<td>TL</td>
<td>Pacific Ridge Exploration Ltd.</td>
<td>082LNE 047</td>
<td>Pb, Zn; Sedimentary exhalative</td>
<td>n/a</td>
<td>Drilling</td>
<td>Improved geological model.</td>
</tr>
<tr>
<td>Woodjam (including Woodjam North; Woodjam South; Megaton)</td>
<td>Consolidated Woodjam Copper Corp.</td>
<td>093A 078; 251</td>
<td>Cu, Au; Porphyry</td>
<td>Southeast zone: Inferred: 227.5 Mt at 0.31% Cu, containing 1.5 billion lbs copper.</td>
<td>IP</td>
<td>Improved geological model.</td>
</tr>
</tbody>
</table>

of Kamloops, West Kam Gold Corp. started underground bulk sampling on the Grey Jay/Crow vein system. The company has a permit to extract 10,000 tonnes of ore. To reach the target zone, the company has had to extend an existing 120 metre decline as well as install safety bays and ground support (Fig. 3). En route to the target zone, the decline intersected the Eaglet/Chickadee system of narrow veins, which have yielded historic values of up to ~14 grams per tonne gold. The target Grey Jay/Crow vein system is the down-dip extension of gold mineralization exposed in surface trenches. Previous bulk samples (totaling ~4,000 tonnes) taken from these trenches have grades up to ~25 grams per tonne gold.

6.1.3. Brett (Ximen Mining Corp.)

In November 2016, Ximen Mining Corp. completed drilling (16 holes; ~2,360 metres) at the past-producing Brett epithermal gold deposit, west of Vernon. The company hopes to delineate high-grade ore shoots and subparallel mineralized structures.
related to the Main zone. Precious metal mineralization occurs as native gold, electrum and argentite associated with multiphase silica veins, stockworks and breccias in Kamloops Group (Eocene) volcanic and volcaniclastic rocks. Ximen also started grassroots exploration for silver at the Treasure Mountain North project adjacent to the Treasure Mountain silver-lead-zinc mine south of Merritt.

6.1.4. Elk (Gold Mountain Mining Corporation)

In April 2015, Gold Mountain Mining Corporation released results from open-pit bulk sampling at the Elk project in 2014. The ~6,600 tonne sample averaged 16.7 g/t Au and showed that previous resource estimates were low: more gold was recovered from the bulk sample than expected. Work on this project stalled in 2015 but may resume in the future. Gold mineralization at Elk occurs in pyritic quartz veins in a Mesozoic granite that may be a phase of the Osprey Lake batholith (Jurassic).

6.1.5. Prospect Valley (Westhaven Ventures Inc.)

In February 2016, Westhaven Ventures Inc. increased its interest in the Prospect Valley project from 70% to 100%, taking over the property from Berkwood Resources Ltd. who had explored it for several years. Berkwood had identified the North and South Discovery zones and other prospective zones. Taken together, the North and South Discovery zones have a resource of ~10 million tonnes grading 0.5 g/t Au (Inferred; using 0.3 g/t Au cut off; Awmack and Giroux, 2012). The deposit is described as a low-grade, low-sulphidation, epithermal gold system, with potential for higher grade zones, within volcanic and volcaniclastic rocks of the Spences Bridge Group (mid-Cretaceous).

In 2016, Westhaven carried out a program of re-logging old core, prospecting, soil sampling, mapping, geophysical surveys, and drilling (8 holes; ~1,500 m). The focus was on the Discovery trend and offsets to it. Prospecting led to the discovery of new targets, such as the Ridge and Southeast Extension zones, which have gold-bearing quartz stockworks.

Drilling targeted the Early Fault Zone, on the southern side of the South Discovery zone, and the Southeastern Extension zone, seeking higher grade mineralization that can occur deeper in epithermal systems.

6.1.6. Shovelnose (Westhaven Ventures Inc.)

Westhaven Ventures Inc. drilled the Shovelnose property, 30 kilometres south of Merritt and southeast of Prospect Valley. Shovelnose (like Prospect Valley) is a described as a low-sulphidation, epithermal gold system within the Spences Bridge Gold belt. An initial round of drilling (5 holes; ~1,150 metres) started in May to test the Mik, Tower and Alpine zones. The Mik and Tower zones have been drilled previously, but the Alpine zone was discovered in 2015 by an induced polarization survey. One hole in the Alpine zone intersected 0.27 g/t Au over ~120 metres, starting at bedrock. Higher grades (up to ~17 g/t Au) over narrow widths (0.5 metres) were also found (Fig. 4). Follow-up drilling in November (4 holes; 725 metres) attempted to extend favourable results from the Alpine zone. Analyses are pending. Drilling in 2016 has expanded the Tower and Alpine zones which remain open in all directions.

Fig. 4. Shovelnose gold project. Westhaven Ventures Inc. explored low-sulphidation epithermal gold systems south of Merritt. This sample had ~16 grams per tonne gold and ~30 grams per tonne silver (Image courtesy of Westhaven Ventures Inc.).
6.2. Porphyry (Cu-Au, Cu-Mo, Mo)

In the past few years, the southern end of the Quesnel terrane, between Aspen Grove and Princeton, has seen renewed exploration interest (see also Mihalynuk and Logan, 2013a, b and Mihalynuk et al., 2014, 2015) for results of recent British Columbia Geological Survey mapping, and Logan and Mihalynuk, 2014 for a review of Cordilleran porphyry deposits). From north to south, some of the larger properties (and their operators or owners) include: Big Kidd (Jiulian Resources Inc); Aspen Grove (60% Kaizen Discovery Inc. / 40% Itochu Corp); Man-Prime (Sunrise Resources Ltd.); Dillard (formerly Fjordland Exploration Inc./Sumac Mines Ltd); Allison Lake; Hit/Aspen Grove South (Colorado Resources Ltd.); Axe (formerly Copper Mountain Mining Corp./Weststar Resources Corp.); Castle (Blue River Resources Ltd.); Miner Mountain (Sego Resources Inc.); Copper Mountain mine (Copper Mountain Mining Corp.); and Princeton (Anglo Canadian Mining Corp.). A poor economy has idled most of these projects.

Between Merritt and Kamloops, porphyry projects such as the Thule (Nicola Mining Inc.), Lucky Mike (Plate Resources Inc.), Rabbit North (Tower Resources Ltd.) and Copper King (Copper King Exploration Ltd.) saw exploratory drilling.

Farther north, the Quesnel terrane in southern and central Cariboo saw renewed activity at Wilcox (Freeport-McMoRan of Canada Ltd.), Iron Lake (Eastfield Resources Ltd.), Woodjam (Consolidated Woodjam Copper Corp.) and Gibraltar North (Taseko Mines Limited).

The eastern flank of the Coast plutonic complex (Ike project; Amarc Resources Ltd.) has attracted the interest of explorationists and the national media.

6.2.1. Copper King (Copper King Exploration Ltd.)

Private company Copper King Exploration Ltd. followed up previous mapping and geophysical surveys at its Copper King project with a program of shallow drilling (5 holes; ~350 m). Drilling on Crown-granted mineral claims tested near-surface mineralization near an adit and glory hole that, from ~1900-1950, had supported intermittent, artisanal mining. Mineralization occurs as disseminations and veins (Fig. 5) in the Cherry Creek phase of Iron Mask batholith (Late Triassic). The project abuts the TransCanada highway, 20 kilometres west of Kamloops.

6.2.2. Aspen Grove-Ketchan Lake (Kaizen Discovery Inc.)

Kaizen Discovery Inc. acquired the Aspen Grove copper-gold project in 2013 and commenced drilling in 2014. The project is a 60:40 joint venture between Kaizen and ITOCHU Corporation. Claims at Aspen Grove include a number of known mineral occurrences (e.g., Zig-Nor, Thalia; Boss-Thor; Par; Ketchan Lake; Coke). The current drilling has focused on Par and Ketchan Lake. Three seasons of drilling at Ketchan Lake have confirmed the size of the porphyry intrusive. Mineralization spans a zone approximately 500 metres wide and 1,800 metres long. Drilling in 2016 (8 holes; ~4,000 m) focused on expanding known zones of mineralization and testing undrilled areas within the Ketchan Stock. All holes intersected potassic or calc-potassic alteration and all but one returned intervals of copper and gold mineralization. One hole intersected 62 metres grading 0.46% copper and 0.10 g/t gold, including 28 metres grading 0.90% copper and 0.17 g/t gold. Understanding controls on mineralization (in particular grade and distribution) remains a focus of further work.

6.2.3. Rabbit North (Tower Resources Ltd.)

Tower Resources Ltd. followed up 2013 results with prospecting and drilling at the Rabbit North project, 25 kilometres southwest of Kamloops. The drill program (11 holes; 3,400 m) tested four distinct copper-gold targets: Western Magnetite; Central Monzonite South; Chrysocolla East; and Dominic. All are associated with the Durand stock (late Triassic), a composite pluton with an older rim of diorite and a younger core of monzonite. The best intersection reported to date cut 200 metres of 0.3% Cu and 0.15 g/t Au from a hole in the Western Magnetite zone.

6.2.4. Woodjam (Consolidated Woodjam Copper Corp.)

Consolidated Woodjam Copper Corp. returned to the Woodjam area, 45 kilometres northeast of Williams Lake, following a $20 million campaign by Gold Fields Horsefly Exploration Corporation between 2009 and 2013. Work in 2016 consisted of induced polarization surveys over the Woodjam North, Woodjam South, Megaton (Southeast)
areas intended to fill in or extend known anomalies or zones of mineralization in support of future drilling. The Woodjam project covers a large area (~60,000 hectares) with numerous zones of copper-gold mineralization, some with published resources. Mineralization occurs along the western edge of the Takomkan batholith (Early Jurassic) and adjacent volcanic and sedimentary rocks of the Nicola Group (Triassic).

6.2.5. Gibraltar North (Taseko Mines Limited)

In August 2016, Taseko Mines Limited announced acquiring more than 2,400 acres of mineral claims, adjacent to existing claims but outside current mining areas. The Gibraltar North claims are 2 kilometres northwest of the Extension zone (part of Gibraltar mine’s current resources). Decades ago, exploration found geophysical anomalies characteristic of porphyry mineralization. Drilling in 1992 intersected 0.4-0.9% copper over 80-100 metres. In September 2016, Taseko released results from a single hole drilled in 2015 that confirmed previous results. The hole intersected ~150 m of ~0.4% copper, within which was an interval of 73 metres of 0.68% copper. In the fall Taseko commenced a six-hole, 4,500 metre drill program. Results are pending. The company’s exploration target is a possible high-grade core to known porphyry mineralization.

6.2.6. Ike (Amarc Resources Ltd.)

Amarc Resources Ltd. continued drilling the Ike property in the South Chilcotin Mountains, 110 kilometres northwest of Lillooet, with financial assistance from Thompson Creek Metals Company Inc. The principal target is copper-molybdenum-silver porphyry mineralization in an extensive alteration zone on the eastern side of the Coast Plutonic Complex. The project includes the Tasco (or Chilcotin Belle) mineral occurrence. The 2016 drilling program (3 holes; 1,900 metres) helped define the southern part of the deposit and included a step-out hole some 800 metres to the west. All holes encountered mineralization. The two southern holes intersected long intervals with copper-molybdenum-silver values that are comparable to other BC porphyry deposits. The step-out hole intersected lower grade copper and molybdenum over its ~480 metre length. As defined by drilling to date, the main zone at Ike covers an area of 1200 metres east-west, 1000 metres north-south and extends to depths of more than 500 metres. It remains open to expansion laterally and to depth. Drill intersections in the main zone range up to ~600 metres grading ~0.3% Cu, ~0.03% Mo and ~2 g/t Ag. Mineralization occurs as replacements and veins in granitic rocks that show evidence of repeated pulses of magmatism. Other work in 2016 included 77 kilometres of induced polarization on four nearby targets, talus sampling, and regional geological mapping. The company plans extensive drilling in 2017, to delineate known mineralization and to test early stage targets on nearby Rowbottom, Mad Major and Buzzer claims.

6.2.7. Lucky Mike (Plate Resources Inc.)

Plate Resources Inc. has an option agreement with Nexgeo Inc. and Korea Resources Corporation to advance the Lucky Mike project at Swakum Mountain, 25 kilometres north of Merritt. The Swakum Mountain area has a variety of deposit types, including veins, skarns, and porphyries. In the course of drilling a tungsten-copper(-silver) skarn target in 2014, the company discovered molybdenum mineralization extending over tens of metres of core. Drilling in 2015 further explored both the skarn and molybdenum targets. In 2016, the drill program (5 holes; ~3800 m) focused on the molybdenum discovery. The molybdenum target is a 25 hectare area with high magnetic and high chargeability values. Molybdenum mineralization occurs in small veins and fracture fillings. The company’s current geological model is a broad molybdenum (-copper) porphyry core zone with subordinate, distal copper-tungsten skarn zones in altered calcareous horizons.

6.2.8. Maggie (Constanitia Resources Ltd.)

In May 2016 Constanitia Resources Ltd. placed its Maggie project, 15 kilometres north of Cache Creek, on care and maintenance, closing the community office, and suspended further exploration for the rest of 2016 and 2017. In November the company solicited bids for multi-year leases on farm lands that overlies the deposit.

Two phases of drilling (in early 2014 and late 2015) have confirmed historic grade and continuity of mineralization and tested possible extensions. Maggie is described as a typical, calc-alkaline porphyry deposit in which copper and molybdenum occur in stockwork veins and as disseminations. The intrusion is a multi-phase, quartz monzonite porphyry with a U-Pb zircon age of ~66 Ma (J. Lang, pers. comm., October 2015). Host rocks are part of the Carboniferous to Permian Cache Creek assemblage, consisting of deformed sedimentary and volcanic sequences of low metamorphic grade that are intruded by pyroxenite dikes and sills.

6.2.9. Generative exploration

Work on the Ike project has revived interest in nearby properties such as the Mike (also called Bridge River; Griswold; Russnor) owned by Cresval Capital Corporation, and the Lorn operated by Jet Gold Corporation. Farther north, near Tatla Lake, Tchaikazan Resources Inc.’s Bluff project (Fig. 6) occurs on the eastern flank of the Coast plutonic complex, in a geological setting broadly similar to Ike.

There have been relatively few grassroots or generative exploration efforts in the region. Private company Tech-X Resources Inc. conducted induced polarization surveys at Lawless Creek, 50 kilometres south of Merritt. In the southern Cariboo, Freeport-McMoRan of Canada Ltd. explored the Wilcox property, 30 kilometres northeast of 100 Mile House. Eastfield Resources Ltd. announced the discovery of a new gold target on the Iron Lake property, 45 kilometres northeast of 100 Mile House.

6.3. Polymetallic base and precious metal projects

The polymetallic category includes stratiform base metal
deposits of diverse origins (e.g., mantos, sedimentary exhalative deposits; and volcanogenic massive sulphide deposits). South Central region has a history of successful exploration, development and mining of polymetallic deposits. However, in the past few years, only a few projects (e.g., TL; Redhill) have targeted this deposit type.

6.3.1. TL (Pacific Ridge Exploration Ltd.)

Pacific Ridge Exploration Ltd. optioned the TL Zinc project, east of Mabel Lake, 60 kilometres northeast of Vernon. Late in the year the company started a drilling program (planned 6 holes; 1,800 m) to test coincident anomalies defined by 2012 EM and 2016 gravity surveys. The target at TL is a sedimentary-exhalative (Monashee or Broken Hill type) massive sulphide deposit.

6.3.2. Redhill (Troymet Exploration Corp.)

Late in 2015, Troymet Exploration Corp. acquired the Redhill property, 15 kilometres south of Cache Creek, and began exploring VMS copper-zinc and gold targets. Historical work had identified three zones (Alpha; Alpha South; Beta) with coincident soil geochemical and geophysical anomalies and sulphide mineralization. In September 2016, Troymet commenced a drilling program (5 holes; ~1000 m) on the Alpha zone. Drilling encountered a new, near-surface layer of massive sulphides grading ~0.7% Cu and 6.5 g/t Ag over 6.5 metres. The same hole intersected a 2 metre layer of sulphides grading 0.6% Cu and 1.5% Zn some 200 metres below the upper layer (Fig. 7). Geophysical work (electromagnetic; induced polarization) on the Beta zone refined targets that the company intends to drill next year.

6.4. Skarn projects (tungsten; copper; gold)

The South Central region has a history of successful exploration, development and mining of skarn deposits. In the past few years, however, only a few projects (e.g., Fox; Thule; Lac La Hache) have targeted this deposit type.

6.4.1. Fox (Happy Creek Minerals Ltd.)

At the Fox tungsten skarn property, 115 kilometres east of Williams Lake, Happy Creek Minerals Ltd. continued to define the extent, grade, and continuity of scheelite mineralization. Skarn mineralization occurs in flat-lying sedimentary rocks of the Snowshoe Group (Neooproterozoic to Lower Paleozoic) that have been intruded by the Deception stock, a mid-Cretaceous (106 Ma) pluton that ranges from quartz monzonite to muscovite-biotite granite.

Work on this project since 2011 has identified seven, near-surface mineralized zones within a tungsten skarn system that extends over an area measuring 3 kilometres by 10 kilometres. From north to south the zones are: North; BK; Ridley Creek (or ‘RC’); BN; 708; Nightcrawler-Discovery (or ‘NC’); and South Grid.

In March 2016, the company released its first NI 43-101 compliant resource estimate for the Ridley Creek zone (Gruenwald and Desautels, 2016) and in June updated this report with metallurgical data from a 450 tonne sample (Gruenwald et al., 2016). Resources stand at 505,000 tonnes WO3 (Indicated) and 280,000 tonnes WO3 (Inferred) with a 0.1% WO3 cut-off. Ridley Creek deposit currently measures 350 metres by 175 metres, is from 5 to 25 metres thick, and comes within 25 metres of the surface.

Exploration in 2016 focused on four targets (BK; Ridley Creek; BN; South Grid) with a program of geological mapping, trenching and drilling (28 holes; ~2,330 metres). Three of seven holes drilled at BK, near hand-dug trenches, returned values of ~0.7% WO3 over 2 to 6 metre intersections. Prospecting attempted to correlate mineralized strata at the BK and Ridley Creek zones, which are about 1 kilometre apart. Ten holes drilled at the Ridley Creek zone were designed to expand the existing resource. One hole on the northern edge of the deposit returned ~8.5 metres grading ~1.1% WO3. At the BN zone, one hole returned ~4 metres of ~5% WO3, which compared favourably with previous drill results. The company believes these tungsten values may represent a higher grade zone (currently 100 by 150 metres) within a larger, lower grade
deposit some 1,000 by 1,500 metres in extent. At the South Grid, the company discovered a new zone of scheelite-bearing calc-silicate float, sub-outcrop and outcrop, poorly exposed over a 500 by 1,250 metre area. The company plans more work to site future trenches and drill holes.

6.4.2. Lac La Hache (Engold Mines Ltd.)

Engold Mines Ltd. (formerly GWR Resources Inc.) focused on the Aurizon-South copper-gold-silver hydrothermal breccia structure on its Lac La Hache property. The company hopes to demonstrate that the shape, tonnage, and grade of this zone will support mining by bulk-tonnage methods. The 2016 drill program (12 holes; 3,850 metres) extended the structure to 400 metres along strike and to a depth of 700 metres. The steeply dipping zone remains open. A narrow, near-surface quartz vein with visible gold was intersected in one hole. This is the first occurrence of free gold reported on the property. The company plans to resume drilling early in 2017, with a view to establishing a resource estimate as soon as possible, followed by a preliminary economic assessment.

6.4.3. Thule (Nicola Mining Inc.)

Nicola Mining Inc. explored the Thule copper property that surrounds the main pit of past-producing Craigmont mine, west of Merritt. One hole drilled on the Embayment Zone skarn intersected ~86 m of ~1.1% copper. Other skarn and porphyry targets (e.g., Titan Queen; Eric; WP; Marb) on Thule are also being pursued. The company plans to evaluate Craigmont’s low-grade stockpiles as potential feed for Teck’s mill at Highland Valley Copper since the former mine’s cut-off grade was as high as 1.2% copper.

6.5. Industrial mineral exploration

Basalt

Two companies received permits to collect bulk samples of basalt. Kelowna Sand and Gravel Ltd. commenced a multi-year, 10,000 tonne bulk sample at its Phoenix property between Kelowna and Beaverdell. Roadway Construction has a one-year permit for 1,000 tonnes from its Roadway quarry southeast of Vernon. Both basalt occurrences appear to be from the Chilcotin Group (Miocene) and will be used for decorative purposes.

Graphite

Lithium Corporation evaluated results from 2015 trenching (Fig. 8) on their BC Sugar graphite project. The current focus is the Weather Station zone but the property comprises a large block of claims between Mabel Lake and Sugar Lake, east of Vernon. The company hopes to find exploitable concentrations of flake graphite. Crystalline graphite occurs in gneiss and marble of the Shuswap metamorphic complex (Neoproterozoic).

Gypsum

Homegold Resources Ltd. has a permit to sample 500 tonnes of gyspite at its Snapper project, 15 kilometres west of Merritt.

This small project has had to address a number of concerns raised by local First Nations.

Jade

Whistler Jade Inc. continued to test and market products from jade-bearing rocks extracted at their Birkenhead (Hell Creek) prospect near Lillooet. Products include garden ornaments, decorative stone, and translucent tiles.

Manganese

Vendome Resources Corp. prospected for manganese on the MN claims near Clinton and reported finding grab samples with up to 28% manganese. The company plans further work.

Marble

Prospector N. Mughal evaluated the marketability of crushed marble at his Clifton project 60 kilometres north of Lumby. Previous efforts to mine and market marble as dimension stone have been unsuccessful.

Zeolite

ZMM Canada Minerals Corp. returned to its Back Valley project and reported finding grab samples with up to 25% zeolite.
zeolite quarry, near Cache Creek, to assess if further extraction of clinoptilolite is feasible. The company also prospected for zeolites in Tertiary rocks between Cache Creek and Vernon.

7. Geological research

The BC Geological Survey supported bedrock mapping southeast of Kamloops, between Stump Lake and the Salmon River. Paul Schiarizza extended the regional stratigraphic framework that he had initially developed in the Cariboo area farther north (Schiarizza, 2016, 2017).

Travis Ferbey and colleagues released surficial geological maps in the Moffat Creek, Woodjam Creek, and Guichon Creek (Highland Valley) areas that covered important porphyry camps (Ferbey et al., 2016a, b; Plouffe and Ferbey, 2016). Alexei Rukhlov and colleagues released data on apatite as a porphyry indicator mineral (Rukhlov et al., 2016).

8. Outlook for 2017

Foreseeable economic conditions seem to offer few incentives for exploration. Financing grassroots or early stage projects continues to be difficult. Producing mines will continue to reduce operating costs, and may reduce production or staff, or go on care and maintenance as a result of weak commodity prices.

Ajax, Bethlehem and Bonanza Ledge will be the only projects to proceed with formal environmental reviews, unless Harper Creek secures alternative financing. Most of the exploration projects active in 2016 that generated positive results are likely to continue. If economic conditions improve, grassroots exploration should pick up in the Gold Bridge area (near the Ike project), the Eagle Bay assemblage near Barriere, and the Quesnel terrane, in particular between Merritt and Princeton and between 100 Mile House and Quesnel.

Acknowledgments

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Exploration and mining in the Southwest Region, British Columbia

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1. Introduction

This report covers the Southwest Region (Fig. 1), conterminous with the South Coast and West Coast natural resource regions. The area has one major polymetallic metal mine, Myra Falls, one coal mine, Quinsam, and numerous industrial minerals and aggregate operations. Industrial minerals and aggregate operations serving the construction industry have generally continued in steady production. However, both Myra Falls and Quinsam are on care and maintenance. Nyrstar N.V. is in discussions with potential purchasers of Myra Falls Operations. Vitol Group has also been in discussions on the sale of the Quinsam mine. Both companies have curtailed mine site exploration programs and, in the case of Quinsam, regional exploration programs.

Despite the lack of mine site programs there were some positive signs in regional exploration. A few companies were able to do equity financings and planned, or in some cases proceeded with, drill programs. About 25 active exploration projects were tracked; most were small in scale. One significant proposed mine project has progressed to the BC Environmental Assessment review stage: BURNCO Rock Products Ltd.’s large aggregate project, BURNCO Aggregate, on Howe Sound.

As a pilot project, the Ministry of Energy and Mines partnered with the Association for Mineral Exploration and Ernst & Young LLP to develop a comprehensive online survey to replace the surveys conducted previously by the Regional Geologists. For the Southwest Region, exploration expenditures are estimated at $2.0 million and exploration drilling at about 3,800 m (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017, in press). The new survey excluded aggregate exploration expenditures and is therefore not directly comparable to estimates of previous years for the Southwest Region. However it is clear that expenditures for 2016 are objectively low and do not reflect a level of exploration likely to sustain metal or coal mining should the trend continue. Suspension of exploration at Myra Falls and Quinsam contributed to the unusually low total.

2. Geological overview

Metallgeny 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 Southwest Region includes parts of the Insular and Intermontane tectonic provinces; most of the area is underlain by rocks of the Wrangell terrane and the post-accretionary Coast Plutonic Complex (Fig. 1). Wrangellia is part of the Insular tectonic province, a Paleozoic-Mesozoic allochthonous assemblage that docked with Intermontane terranes in the Early-Middle Jurassic as Panthalassic oceanic crust subducted beneath them (e.g., Nelson et al., 2013). The Intermontane tectonic province is represented by a group of small terranes in the southern Coast Mountains. Subsequent to terrane accretion, a late Jurassic-Cretaceous-Eocene continent-margin arc was established in the area of the present Coast Mountains. Its roots are represented by the Coast Plutonic Complex. During the Early to mid-Cretaceous, southeast-directed oblique convergence brought the Insular terrane and western Coast Plutonic Complex southward with respect to the Intermontane terranes, trapping segments of oceanic crust and arc rocks that became the terranes of the southeastern Coast Mountains, and transecting and duplicating part of the Middle-Late Jurassic arc (Monger et al., 1994; Bustin et al., 2013; Monger and Brown, in press). From the Cretaceous onward, accretion continued outboard of Wrangellia. Cenozoic ridge subduction converted much of the North America-Pacific plate margin to a transform fault (Queen Charlotte fault). Today, the small oceanic Juan de Fuca plate slides eastward beneath the previously accreted terranes of the Outboard tectonic province on Vancouver Island (Pacific Rim, Crescent, and Wrangell, Fig. 1) along the Cascadia subduction zone (e.g., Hyndman, 1995). The principal deposit types in the Southwest Region are tied to Cordilleran terranes (Fig. 2).

2.1. Insular Superterrane

The Insular Superterrane is represented mainly by Wrangellia in the Southwest Region.

2.1.1. Wrangellia

Wrangellia is a long-lived (Devonian to Jurassic) island arc...
Fig. 2. Time-space diagram showing relations between terranes, basins, plutonic rocks (circles), and some significant mineralizing events on in southwestern British Columbia. 1) Sicker Group volcanogenic massive sulphide; 2) orogenic gold veins in Sicker Group 3) Harrison Formation volcanogenic massive sulphide 4) Island plutonic suite porphyry Cu-Mo, Fe, Cu skarn 5) orogenic Au vein (Coquihalla serpentinite belt) 6) Gambier Group volcanogenic massive sulphide 7) tholeiitic intrusion hosted Cu-Ni (Cretaceous) 8) Nanaimo Group coal 9) Orogenic Au veins 10) tholeiitic intrusion hosted Cu-Ni (Eocene?) 11) Porphyry Cu, Mo, Epithermal Au (Eocene to Miocene).
2.2. Outboard tectonic province

On Vancouver Island, the western and southern margins of Wrangellia are structurally juxtaposed with the Pacific Rim terrane, which consists of possible mélangé deposits (Pandora Peak unit, Rusmore and Cowan, 1985; Pacific Rim complex, Brandon, 1989) and the Leech River complex, an assemblage of greeenschist- 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 complex has been an active placer gold camp since 1864. Gold-bearing quartz veins have been the subject of recent exploration near the Leech River Fault, along the southern margin of the terrane (Fig. 1).

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 constituting the 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 (MINFILE 092C 073).

2.3. Intermontane terranes of the Southeastern Coast Belt

The Southwest Region boundary transects small parts of the Quesnel terrane and a larger area of Stikinia. However, much is covered by parkland and is unavailable for mineral development or is otherwise inaccessible. Exceptions include the Redbird, a molybdenum prospect west of Tweedsmuir Provincial park and east of the Kitlope Heritage Conservancy (MINFILE 093E 026).

The southeastern Coast Belt, north of the international border, is underlain by the Nooksack-Harrison and Chilliwack terranes (equivalent to Stikinia; Monger and Straik, 2006), and the Bridge River, Cadwallader and Methow terranes, which are 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). Historically, these terranes have not been shown to host large deposits, which may explain why the area has not been intensively explored despite its accessibility and proximity to infrastructure. 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 (MINFILE 092HNW007), which operated between 1981 and 1984.

2.4. Post-accretionary intrusions and overlap strata

Post accretionary intrusions include the Coast Plutonic Complex (Jurassic-Cretaceous) and many smaller Eocene-to-Miocene bodies, some of which have associated porphyry and epithermal mineralization. Upper Cretaceous sedimentary rocks on Vancouver Island host historically important coal deposits, and unconsolidated Quaternary sediments are an important source of construction material.

2.4.1. Coast Plutonic Complex

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 derived from the deep crust of the sutured Intermontane and Insular terranes. For the most part, uplift and erosion appear to have removed the levels at which epithermal and porphyry style mineralization form, however there are 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 (MINFILE 092GNW003), a Kuroko-type polymetallic volcanogenic massive sulphide deposit that produced 517,000 t of copper along with zinc, silver, gold, lead and cadmium between 1905 and 1974.

The Late Cretaceous Giant Mascot ultramafic-mafic intrusive suite (Manor et al., 2014) hosts the province’s only past producing nickel mine, Giant Mascot Nickel (MINFILE 092HSW004, 092HSW093, 092HSW125), which operated between 1958 and 1974.

2.4.2. Nanaimo Group

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 and were recently mined near Campbell River.

2.5. Cenozoic magmatism and volcanism

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. Southwestern British Columbia was an active part of this semi-continuous belt (Madsen et al., 2006). Mineral deposits related to Cenozoic magmatism have not been particularly productive, but neither are they well explored. Between 1964 and 1967, Mount Washington Copper (Eocene; MINFILE 092F 117) produced 3,548 tonnes of copper, 131 kg gold and 7,235 kg silver. Catface Copper (Eocene; MINFILE 092F 120) has a significant undeveloped resource. Other targets of presumed Cenozoic age include Giant Copper (MINFILE 092HSW001) and Okeover (MINFILE 092K 008). Harmony
2.6. Post-accretionary faulting

Fraser-Straight Creek is a north-south fault system with at least 100 km right lateral offset in the Eocene. It truncates the Pasayten and Hozameen faults and could be responsible for reactivation of these older structures. Significant prospects along the Coquihalla Gold Belt (MINFILE 092HNW007 and others) and Giant Copper camp (MINFILE 092HSW001 and others) lie on, and immediately east of, the Hozameen fault system. The Late Eocene Chilliwack batholith is not offset by the Fraser-Straight Creek fault (Monger and Brown, in press).

The Harrison Lake fault separates highly deformed and higher metamorphic grade schistose rocks, including Bridge River terrane to the northeast, from rocks of the Harrison-Nooksack terrane to the southwest. Post accretionary activity along the fault includes a series of Tertiary diorite intrusions and gold vein occurrences such as Harrison Gold (MINFILE 092HSW092), Doctor’s Point (MINFILE 092HNW071), and Providence (MINFILE 092HNW030).

Vancouver Island is extensively faulted. Among the fault systems are northwest-southeast Eocene thrust faults and folds that bring prospective Sicker Group basement to surface. On northern Vancouver Island, a well-mineralized belt lies north of the westerly trending Holberg fault.

The Queen Charlotte fault is a dextral transform linking the Aleutian and present day Cascadian subduction zones. Eocene magmatism on Vancouver Island (Catface and Mount Washington intrusive suites) may have been products of paleo-Cascade magmatism. A transtensional environment on Haida Gwaii presumably influenced Miocene epithermal mineralization, the most significant example of which is Harmony.

On Northern Vancouver Island, Late Miocene magmatism occurs north of the present Nootka fault, a transform between Juan de Fuca and Explorer plates.

2.7. Quaternary sediments

As a tectonically active region, southwestern British Columbia has undergone a high degree of uplift and high rates of erosion. Glaciation has influenced the nature of erosion and deposition. The Fraser Glaciation 25,000-12,000 years ago was the last major advance. Most sand and gravel deposits are products of its final, Pleistocene retreat, a period of high-energy erosion and deposition as compared to the Holocene (Clague, 1981; Clague and Luternauer, 1983; Howes, 1983).

Sediments derived from quartz diorite and granodiorite of the Coast Mountains, or volcanic, sedimentary and metasedimentary rocks of Cascades provenance, in clean glaciofluvial deposits, can produce strong, chemically inert, construction material suitable for a variety of applications.

Peat bogs were once exploited for horticultural use in the Fraser delta. Mining of peat on the Fraser Delta ceased in the 1980s due to depletion of the resource.

3. Mines

This section covers significant metal and coal mines that operated in the past year, and selected industrial minerals and aggregate operations. See also Tables 1-3.

3.1. Metal mines

**Myra Falls Operations** is an underground polymetallic mine, owned and operated by Nyrstar N.V., which exploits a cluster of volcanogenic massive sulphide lenses. Nyrstar suspended mining activities at **Myra Falls Operations** at the beginning of the second quarter 2015. Although the workforce was reduced at that time, work proceeded on restoring and upgrading power facilities and other infrastructure. Mine development planning focussed on the western orebodies with exploration and definition drilling directed at those targets. Generally, exploration was successful, producing high-grade intersections and identifying untested targets.

Late in 2015, Nyrstar halted investment at the mine. The company has not announced specific plans for Myra Falls, but says it has been in discussion with potential buyers. If this does not lead to a sale, there could be exploration at the site to augment reserves in 2017.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Producti on (based on Q1- Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Myra Falls Operations</strong></td>
<td>Nyrstar N.V</td>
<td>Zn, Cu, Pb, Au, Ag; G06; Noranda/Kuroko Massive Sulphide Cu-Pb-Zn; 092F 330, 092F 073</td>
<td>N/A</td>
<td>4.66 Mt</td>
<td>7.49 Mt</td>
<td>Resources are inclusive of reserves. Effective date Dec. 31, 2015. Production suspended April 2015. Reserves decreased compared to 2014, total resources increased with exploration.</td>
</tr>
</tbody>
</table>

**Table 1. Metal mines, Southwest Region.**
Table 2. Coal mines, Southwest Region.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinsam</td>
<td>Hillsborough Resources Ltd.</td>
<td>TC; A04: Bituminous coal; 092F 319</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>On Care and Maintenance. Production suspended Jan. 2016. Reserves and resources are unpublished.</td>
</tr>
</tbody>
</table>

HCC = hard coking coal; PCI = pulverized coal injection; TC = thermal coal; ULV = ultra low volatile

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

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Forecast 2016 Production (based on Q1-Q3)</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Bay (PEM 100)</td>
<td>Electra Stone Ltd.</td>
<td>Silica+alumina; R12:Volcanic glass-perlite; 092L 150</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Continuation of 2015 drilling program to assess resources.</td>
</tr>
<tr>
<td>Benson Lake</td>
<td>Benson Lake Carbonates ULC</td>
<td>High brightness carbonate; R09:Limestone; 092L 295</td>
<td>19,000 t</td>
<td>N/A</td>
<td></td>
<td>New owner 2016. Possible exploration to come.</td>
</tr>
<tr>
<td>Blubber Bay</td>
<td>Ash Grove Cement Company</td>
<td>Limestone, dolostone; R09:Limestone; 092F 479</td>
<td>43,240 t +</td>
<td>N/A</td>
<td>100+ years</td>
<td>Dolostone is shipped to Ash Grove in Oregon.</td>
</tr>
<tr>
<td>Garibaldi Pumice</td>
<td>Garibaldi Pumice Ltd.</td>
<td>Pumice; R11:volcanic ash; 092JW 039</td>
<td>16,000 m³</td>
<td>N/A</td>
<td>11,396,000 m³ pumice 4,990,000 m³ pumicite (fines)</td>
<td>2014 resource estimate.</td>
</tr>
<tr>
<td>Imperial Limestone</td>
<td>Imperial Limestone Co. Ltd.</td>
<td>Limestone; R09:Limestone; 092F 394</td>
<td>250,000 t high grade CaCO₃, 315,500 t lower grade limestone</td>
<td>N/A</td>
<td>50+ years</td>
<td>Production to December 2016.</td>
</tr>
<tr>
<td>K2</td>
<td>K2 Stone Quarries Inc.</td>
<td>Dimension stone, flagstone; R08:flagstone; 092C 159</td>
<td>20,400 t</td>
<td>N/A</td>
<td>N/A</td>
<td>Material extracted from quarry is cut to size.</td>
</tr>
<tr>
<td>Mount Meager Pumice</td>
<td>Great Pacific Pumice Inc.</td>
<td>Pumice; R11:volcanic ash; 092JW 039</td>
<td>1850 t</td>
<td>N/A</td>
<td>N/A</td>
<td>Shipped 5964 t.</td>
</tr>
<tr>
<td>Sumas Shale</td>
<td>Sumas Shale Ltd. (Clayburn Industries Ltd., Lafarge Canada Inc.)</td>
<td>Shale, clay, sandstone; B05:Residual kaolin; 092GSE024</td>
<td>500,000 t</td>
<td>N/A</td>
<td>50+ years</td>
<td>Product for cement production.</td>
</tr>
<tr>
<td>Texada Quarry</td>
<td>Texada Quarrying Ltd. (Lafarge Canada Inc.)</td>
<td>Limestone, aggregate; R09:Limestone; 092F 395</td>
<td>N/A</td>
<td>N/A</td>
<td>100+ years</td>
<td>Mostly limestone for cement production.</td>
</tr>
</tbody>
</table>
Mining began at the Myra Falls site in 1966 and the operation mined its 30 millionth tonne of ore in 2013. Suspensions occurred previously; notably a 16 month suspension in 1993-1994. Since 2006, replacement of reserves and resources occurred at a rate approximately equal to that at which they were mined. In 2014 and 2015, there were after-mining increases to resources (Table 1). The mine employed approximately 350 during production.

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

Underground coal mining on Vancouver Island dates back to 1849. The Quinsam thermal coal mine near Campbell River (Fig. 1) began operation in 1986, and suspended mining activity early in 2016, switching to care and maintenance. There have been some discussions with potential buyers, but no sale announced. The site is operated by Quinsam Coal Corporation, a subsidiary of Hillsborough Resources Ltd., which is currently part of the Vitol Group of companies. It is currently the only underground coal mine in the province. The Quinsam mine produced 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 over half a million tonnes a year. Hillsborough is a private company that does not release reserve and resource figures. The mine has a significant potential resource, however sulphur content varies. 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. Industrial minerals and aggregates

Large quarries on the coast serve the Lower Mainland, Vancouver Island, and U.S. Pacific Northwest markets by barge. Those with access to freighter loadout facilities can also supply Pacific international markets and Hawaii. The largest industrial minerals producers in the region are listed in Table 3 (exclusive of aggregate-only quarries) and are discussed in the following sections.

Other smaller producers of slate quarry rocks of the Leech River complex, Vancouver Island Slate has been offering a line of hand cut products. That quarry had minor production in 2016 and the owner expects to produce again in 2017. Island Stone Landscape Supply is another established producer and supplier of flagstone from the area, 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, tiles, and building products. 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 Sputoni 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 (MINFILE 092F 425, 092L 146) 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). Haddington Island Stoneworks Ltd. did not quarry in 2016 but expects to supply stone for projects in the Lower Mainland in 2017 or 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 has resumed production in the past 10-15 years, mainly serving the local market. It mined and shipped approximately 2500 t in 2016, a significant increase over 2015. Hardy Island has opened another quarry on Valdes Island that supplies sandstone (Nanaimo Group), another rock type found on many older buildings in Vancouver and Victoria. Response to test marketing appears to be positive; production in 2016 was about 1500 t.

Aggregates are an important part of the mining industry on the south coast, generating more jobs 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 quarries, 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 Minerals Corporation operates the Orca quarry near Port McNeill, which produces sand and gravel mainly for export. Polaris Minerals Corporation reported sales of approximately 2.1 Mt in the first three quarters of 2016 and expects 2.7-2.9 Mt for the year Polaris reports some initial exploration off site near the quarry for limestone and igneous rock for possible use as crushed products.

One of the largest operations in the area is the Cox Station quarry. It is on the north side of Sumas Mountain, and 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 to 50 people.

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. A production estimate is not available for 2016. Most of its 2015 production (3.9 Mt) supplied local cement plants. 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 has been in operation for over 60 years and employs 69 people. The quarry 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.)

The Imperial Limestone quarry near Van Anda on Texada Island (Fig. 1) has produced approximately 250,000 to 270,000 t annually and produced approximately 250,000 t of their high-grade carbonate product as of the end of November 2016. In addition they mined 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 more than 50 years.

3.3.3. Blubber Bay (Ash Grove Cement Company)

Ash Grove Cement Company’s 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 dolostone to lower Mainland and northwest US markets intermittently. It barged dolostone to Ash Grove’s Rivergate Limestone Quarry in Oregon in 2016, about 43,240 t as of the end of November, with another shipment planned for December or January.

3.3.4. PEM 100 (Apple Bay) (Electra Stone Ltd.)

On northern Vancouver Island, Electra Stone Ltd. continued to mine silica and alumina products from silicified and clay-altered rhyolitic flows and volcaniclastic rocks at the PEM 100 or Apple Bay quarry through the first quarter of 2016, but suspended operations thereafter. The site remains on care and maintenance, with ongoing environmental monitoring and a water treatment system upgrade in October 2016. When operating, the quarry ships raw product by barge to Ash Grove Cement Company in Seattle. Ash Grove and Electra conducted mine site exploration programs to better define its resources and to identify higher-silica (>97% SiO₂) material in 2015-2016. The quarry is permitted for up to 249,000 tonnes per year.

3.3.5. Benson Lake (Benson Lake Carbonates ULC)

At the Benson Lake white carbonate deposit, also on northern Vancouver Island, new owner Benson Lake Carbonates ULC reported 2016 production totalling approximately 19,000 t. The high-brightness product is used mainly as white filler. The new owner expects to suspend production for 1-2 years and conduct some on-site exploration.

3.3.6. Sumas Shale (Clayburn Industrial Group Ltd.)

The Sumas Shale quarry on Sumas Mountain is owned by Clayburn Industrial Group Ltd. and operated by contractor Fraser Pacific Enterprises Inc. It delivers sandstone and shale product to the Lafarge and Lehigh cement plants in Richmond and Ash Grove in Seattle, a joint venture with Lafarge North America (Sumas Shale Ltd.). Production and shipments will be approximately 500,000 t in 2016, up slightly from 2015. 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 400 t there in 2015 and expect to return to this site or one of their other sites in 2017-2018. Ironwood produces cosmetic products using the clay at its Richmond plant, a business that has continued for 28 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. They reported increasing sales in 2015, particularly to Asia. 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 16,000 m³ of pumice from the Garibaldi Pumice quarry in 2016, similar to 2015. Production included 11,000 m³ of material for lightweight fill and 5000 m³ of fines. Garibaldi Pumice Ltd. did some exploration in 2015 (test pits and LIDAR) and drone photogrammetry in 2016.
Neighbouring Great Pacific Pumice Inc. produced about 2000 t in 2016 at their Mount Meager quarry, and shipped close to 6000 t. They have stockpiles in Squamish from which they can ship year-round.

### 3.3.9. K2 (K2 Stone)

K2 Stone is a natural stone product supplier with quarries near Port Renfrew on Vancouver Island. In 2014, K2 Stone mined and shipped over 17,000 t from Port Renfrew with a five person crew. They quarried 22,000 t in 2015 and about 20,400 t in 2016. The rock is trucked to Nanaimo for processing into masonry and landscaping products.

### 3.4. Placer gold

Historic placer camps include the Lower Fraser River, Leech River and China Creek. A gold rush in the Fraser Canyon, which began in 1858 at Hills Bar, was relatively short lived, but did ultimately 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 new Notice of Work on the Leech River in 2016 and another on the Lower Fraser among about five for the region altogether. In 2015, there were two new NOWs in the Leech River camp and two on the Lower Fraser. Many placer miners operate with multi-year permits. Currently 17 permits are active.

### 4. Mine development

Mine development projects are those for which there is a positive production decision, key government approvals and on-site construction has begun. There are no major mine development projects in the Southwest Region.

### 5. 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 (Table 4). Several small-scale and inactive larger projects are not covered in this report.

#### 5.1. Proposed metal mines

No proposed major metal mines in the Southwest Region are considered to be active projects in 2016.

#### 5.2. Proposed coal mines

No proposed coal mines in the Southwest Region are considered to be active projects. In 2016, the BC Environmental Assessment Office terminated environmental assessment of the Raven Underground Coal Mine project of Compliance Coal Corporation.

#### 5.3. Proposed industrial minerals mines

Proposed mines include the BURNCO Aggregate Project and the Sechelt Carbonate project.

##### 5.3.1. 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. The Ministry of Energy and Mines new Major Mines Permitting Office will process the Mines Act application. 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 revisions to the project in

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>BURNCO Aggregate</td>
<td>BURNCO Rock Products Ltd.</td>
<td>Aggregate; B12: Sand and Gravel; N/A</td>
<td>N/A</td>
<td>Approx. 20 Mt</td>
<td>Permitting</td>
<td>Environmental Assessment Review. Resource not represented as NI 43-101 compliant.</td>
</tr>
<tr>
<td>Sechelt Carbonate</td>
<td>Ballinteer Management Inc.</td>
<td>Limestone, dolostone, aggregate; R09: Limestone; R10: dolomite; R15: Crushed rock; 093GNW031</td>
<td>N/A</td>
<td>Carbonate Rock: 76.1 Mt Gabbro: &gt;700 Mt</td>
<td>Baseline monitoring, archaeological studies</td>
<td>Environmental Assessment pre-application. Resource not represented as NI 43-101 compliant.</td>
</tr>
</tbody>
</table>
2014, changing production rate, relocating some facilities and specifying a mine life of 16 years.

5.3.2. 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. After a period of quiescence, Ballinteer indicates 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 limestone and dolostone as well as gabbroic rock for potential use as aggregate.

6. 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 2016 (Table 5). These and some smaller programs are described briefly.

6.1. Precious metal projects

Precious metal prospects are found in a variety of settings in the region. There was one major exploration project in 2016, in addition to several smaller projects.

6.1.1. Valentine Mountain (Great Thunder Gold Corp.)

Great Thunder Gold Corp. reported gold assays from selected rock samples (162.8 g/t, 2.3 g/t, 37.9 g/t, 13.6 g/t Au) at its Valentine Mountain Property on southern Vancouver Island. There was further hand trenching late in the year. The property was last drilled in 2012 and resource estimates were prepared in 2013.

6.1.2. Eliza (Casey Harlington)

At the Eliza gold prospect, owned by Caisey Harlington, a hand held drilling program tested gold-bearing veins near historical workings. In 1940, 12.7 tonnes of ore yielded 435 grams of gold with silver and copper by products. The area was also explored in the 1980s.

6.1.3. 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 2016, they reported continuing geophysics and geochemistry at the property (MINFILE 092GNW045, 47, 55, 62; MINFILE 092GNW013). A multi-year rock, soil, and silt sampling program has relocated showings near the former mine. The Ashlu Mine is a past producer that exploited a narrow (<1 to 4.6 metres) gold-bearing quartz vein over a strike length of 90 metres and extending 85 metres 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 property is mainly underlain by the Cloudburst pluton (Jurassic).

6.1.4. Harrison Gold (Bear Mountain Gold Mines Ltd.)

Bear Mountain Gold Mines Ltd. proposes a bulk sample at the Harrison Gold, or Abo property. The company is seeking a permit for underground development and a bulk sample. Abo has a 1989 (non-compliant) resource in two zones of 1.8 Mt in a “probable resource” category and 613,600 t in a “possible resource” category, with average grades of 2.79 g/t Au. Previous operators took bulk samples in 1972, 1979, and 1985.

6.1.5. Ladner Gold (New Carolin Gold Corp.)

New Carolin Gold Corp. completed its acquisition of the Ladner Gold project (Fig. 3) and now holds 100% of the property, including the former Carolin Mine site (subject to percentage of net smelter returns royalty). Work in 2016 included drilling focused on the Idaho zone (Figs. 3 and 4) and a broader program of mapping and sampling on the property. Before the recent drilling, the company had existing resource estimates intended to represent open pit and
Table 5. Selected Exploration projects, Southwest Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Bay</td>
<td>Electra Stone Ltd</td>
<td>092L 150</td>
<td>Silica, high alumina clay; R12: volcanic glass</td>
<td>N/A</td>
<td>Drilling (rotary air blast)</td>
<td>Seeking high-silica material.</td>
</tr>
<tr>
<td>Ashlu</td>
<td>Ashlu Mines Inc</td>
<td>092GNW013</td>
<td>Au, Ag, Cu; I05: polymetallic Veins</td>
<td>N/A</td>
<td>Geochemistry, geophysics</td>
<td>Ongoing program for past 6 years.</td>
</tr>
<tr>
<td>Black Bear</td>
<td>Polaris Metals Corp.</td>
<td>none</td>
<td>Aggregate; R15: Crushed rock</td>
<td>Measured and Indicated: 70 Mt Inferred: 330 Mt</td>
<td>Drilling, (core), surface sampling, testing</td>
<td>Material is basalt for use as crushed aggregate. Located near Orca Quarry.</td>
</tr>
<tr>
<td>Bugaboo- Reko</td>
<td>Vancouver Island</td>
<td>092C 022</td>
<td>Iron, copper; K03: Fe skarn</td>
<td>Inferred: 14 M 60% Magnetite</td>
<td>Reporting of 2015 work (geology, geochemistry)</td>
<td>Ownership change.</td>
</tr>
<tr>
<td>Eliza</td>
<td>Casey Harlington</td>
<td>092E 043</td>
<td>Au, Ag, Cu; I06 Cu+-Ag quartz veins</td>
<td>N/A</td>
<td>Packsack drilling</td>
<td></td>
</tr>
<tr>
<td>Harrison Gold</td>
<td>Bear Mountain Gold Mines Ltd.</td>
<td>092HSW092</td>
<td>Au; Ag; I01: Au quartz veins</td>
<td>Historical (see MINFILE)</td>
<td>Permitting</td>
<td>Consultation, planned bulk sample.</td>
</tr>
<tr>
<td>Krof</td>
<td>Mystic Capital Corp.</td>
<td>092HNW070</td>
<td>Cu, Zn, Ag, Au; G04: Besshi massive sulphide Cu-Zn</td>
<td>N/A</td>
<td>Reporting of 2015 work (geology, geochemistry)</td>
<td></td>
</tr>
<tr>
<td>Ladner Gold</td>
<td>New Carolin Gold Corp.</td>
<td>092HNW007, 092HNW003, 092HNW018, 092HSW034</td>
<td>Au, Ag; I01: quartz veins</td>
<td>Inferred 2.6 Mt 3.23 g/t Au (Carolin Mine)</td>
<td>Drilling (~3000 m, 12 holes) Idaho Zone, surface and underground mapping and sampling.</td>
<td>Stated resource before current drill program. There are separate estimates for McMaster Zone and tailings.</td>
</tr>
<tr>
<td>Lekcin</td>
<td>Blady, Carlson, Chapman, Paul</td>
<td>092HSW168</td>
<td>Ni, Cu, Co, Pd; M02 : Tholeiitic intrusion-hosted Ni-Cu</td>
<td>N/A</td>
<td>Reporting of 2015 work (geology, geochemistry)</td>
<td></td>
</tr>
<tr>
<td>North Island Copper and Gold Inc.</td>
<td>092L 240, 092L 200, 092L 078</td>
<td>092L 240, 092L 200, 092L 078</td>
<td>Cu, Au, Mo, Re; L04: Porphyry Cu±Mo±Au</td>
<td>Hushamu: Indicated 304 Mt 0.29 g/t Au 0.21% Cu 0.01% Mo Inferred 205.6 Mt 0.26 g/t Au, 0.18% Cu, 0.008% Mo Red Dog: Indicated 23.6 Mt 0.32% Cu, 0.46 g/t Au, 0.007% Mo Inferred 848,000 t 0.23% Cu, 0.33 g/t Au, 0.005% Mo</td>
<td>Drilling to update historical resource at Red Dog. Ongoing preliminary economic assessment.</td>
<td>Hushamu and Red Dog are separate deposits now included in the same project.</td>
</tr>
<tr>
<td>OK</td>
<td>Lorraine Copper Corp.</td>
<td>092K 008, 092K 057, 092K 168</td>
<td>Cu, Mo; L04: Porphyry Cu±Mo±Au</td>
<td>Inferred 86.8 Mt 0.31% Cu, 0.014% MoS₂</td>
<td>Soil geochemistry</td>
<td>Drilling planned pending permitting. Surface work for assessment.</td>
</tr>
</tbody>
</table>
underground scenarios at the past-producing Carolin Mine:
- Inferred resource at 0.5 g/t cutoff of 12,352,000 t grading 1.53 g/t Au;
- Inferred resource at 2.0 g/t cutoff of 2,589,000 t grading 3.34 g/t Au.

The McMaster zone has an inferred resource of 3,375,000 t grading 0.69 g/t. The Carolin Mine tailings estimate remained unchanged from 2011, with 403,700 t at 1.83 g/t Au in the Indicated category and 84,400 t grading 1.85 g/t in the Inferred category.

Late in the fall, New Carolin began a second phase of their 2016 program, including underground channel sampling and geological mapping.

New Carolin has surrounding tenures covering much of the Coquihalla gold belt, a north-northwest trending series of gold occurrences between Sowaqua and Siwash Creeks that is generally not 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 serpentinite belt.

6.2. Porphyry (Cu-Au, Cu-Mo, Mo) projects

The region’s most advanced porphyry project, the North Island Project, is focused on Jurassic mineralization. Several advanced Eocene to Miocene porphyry copper targets are in southwestern B.C. Two of these, OK and Rogers Creek, saw modest levels of exploration in 2016.

6.2.1. North Island Project, Red Dog and Hushamu (Northisie 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-northwest trend from Island Copper. Hushamu (MINFILE 092L 240), 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. An ongoing preliminary economic assessment includes both Red Dog and Hushamu.

Northisie Copper and Gold Inc. acquired an option on the Red Dog property, approximately 7.5 km west-northwest of the Hushamu deposit in 2015. In 2016, they drilled (Figs. 5 and 6) to verify a 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 in the indicated category and 848,000 t grading 0.23% Cu, 0.33 g/t Au and 0.003% Mo inferred. Mineralization remains open on Northisie’s tenures to the west. An apparently separate mineralized zone, 400 m east of the Red Dog zone, is cut by post-mineral dikes. Since it was detected as a geochemical anomaly in 1962, Red Dog has seen approximately 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.
6.2.2. OK (Lorraine Copper Corp.)

Lorraine Copper Corp. acquired 100% of the OK copper-molybdenum prospect north of Powell River. As they seek a new permit for drilling, 2016 work included a geochemical survey. The 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.

6.2.3. Rogers Creek (Carube Copper Corp.)

Carube Copper Corp. reports surface geochemistry, geophysics and geological work at its Rogers Creek porphyry copper project north of Harrison Lake in 2016. In 2015, an IP survey identified a largely untested chargeability anomaly that may represent a new target, as previous drilling intersected anomalous Cu-Mo-Ag mineralization at the edge of the anomaly.

6.3. Polymetallic base and precious metal projects

Volcanogenic massive sulphide deposits in the southwest saw very limited exploration in 2016. Particulary prospective is the Sicker Group on Vancouver Island, which hosts the Myra Falls deposits and others past producers in the Mount Sicker area.

6.3.1. Seneca (NSS Resources Inc.)

In 2014, NSS Resources Inc. acquired tenures surrounding the Seneca (MINFILE 092HSW013) and Vent (MINFILE 092HSW139) VMS occurrences, last active in 2007. The new land package, the Seneca property includes the Fleetwood zone (MINFILE 092HSW165). NSS filed geochemical and prospecting work for assessment in 2016. The Vent and Seneca prospects themselves are now held by Turnagain Resources Inc. The deposits are hosted in volcanic rocks of the Nooksack-Harrison terrane.

6.3.2. Krof (Mystic Capital Corp.)

Early in 2016, Mystic Capital Corp. reported a geochemical survey at the Krof project (work occurred late in 2015). Krof is a Besshi-type VMS prospect in Bridge River equivalent rocks. Work in recent years has focused on investigating geophysical and geochemical targets along a north-northwest trend including known mineralization. Krof was drilled by Minnova Inc. in the 1980s and there was a small drill program by Nomad Ventures Inc. in 2010. Mike Blady, Chris Paul, John Chapman and Gerry Carlson are owners of the property.

6.4. Iron, copper and gold skarn projects

Skarn occurrences are numerous in the Wrangell terrane, commonly in Vancouver Group rocks where intruded by the Island Plutonic suite. Very little exploration occurred on these targets in 2016, with the exception of prospecting.

6.4.1. Bugaboo-Reko (Vancouver Island Iron Ore Corporation)

Canadian Dehua International Mines Group Inc. has transferred most of its southern Vancouver Island properties (including Bugaboo-Reko) to a new Company, Vancouver Island Iron Ore Corporation. They report no new work but Canadian Dehua filed its 2015 work for assessment.

6.5. Mafic and ultramafic associated projects

Mafic and ultramafic associated deposits are known in the Metchosin Complex on southern Vancouver Island and in mafic-ultramafic assemblages in the Harrison Lake – Hope Area (e.g., Giant Mascot intrusion), which hosted British Columbia’s only significant nickel producer. There was little exploration in 2016.

6.5.1. Sunro (New Sunro Copper Ltd.)

New Sunro Copper Ltd., a private company, reported no new technical work, but filed physical work on the New Sunro property, including the Sunro past producer. This was part of an ongoing project to stop water flowing from underground workings. Exploration drilling from surface is proposed, but not anticipated in 2016.

Classed as a magmatic deposit (BC deposit model M02 or USGS mafic and ultramafic dike-sill complex related), sulphide
mineralization is reported mainly in shear zones, fractures, and shatter zones in Metchosin basalt, close to gabbroic sills. Some mineralized samples from the site were anomalous in nickel, cobalt, and palladium, among other elements, 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. There are exploration targets in addition to historical ore zones.

6.6.4. Apple Bay (Electra Stone Ltd.)
Electra Stone Ltd. continued a drilling and mapping program to define resources at its Apple Bay quarry project that began in 2015.

6.6.3. Black Bear (Polaris Materials Corporation)
As noted above, Polaris Materials Corporation conducted exploration at Black Bear near its Orca sand and gravel quarry for sources of crushed aggregate, and is testing bulk samples.

6.6.2. Tahsis (Callache Stone Quarries Inc.)
Callache Stone Quarries Inc. sampled a marble prospect near Tahsis (Tahsis quarry) and explored the area for additional high-quality material.

6.6.1. T&S Mine (Cataract Enterprises Ltd.)
Cataract Enterprises Ltd. is extracting a bulk sample from the T&S Mine marble project near Skull Lake on the west coast of Vancouver Island. They truck the product to a plant in Chemainus, currently under construction.

7. Geological research
No new large-scale publicly funded economic geology focused research projects known are in the region in 2016, although some recent British Columbia Geological Survey projects have ongoing components and some student thesis research is ongoing.

7.1. British Columbia Geological Survey
Compilation of Wrangellia terrane bedrock geology on northern Vancouver Island is an ongoing project of the British Columbia Geological Survey. Publications so far include Nixon and Orr (2007), and a series of 1:50,000 geology maps (e.g., Nixon et al., 2011).

In the Nooksack-Harrison terrane, Rukhlov and Ferbey (2015a, b) published findings of a study using the Seneca VMS prospect as a field area to test using lead isotopes in till for mineral exploration. The relatively low-cost high-resolution ICP-MS method they describe is similar to techniques applied to Paleozoic and older targets. This study demonstrates effectiveness with a Jurassic target.

Nixon et al. (2015) and Manor et al. (2014, 2015, 2016) continued to publish results of recent work at the Giant Mascot Ni-Cu-PGE deposit. This work results from collaboration between the British Columbia Geological Survey, the Geological Survey of Canada, and the University of British Columbia in a study of Ni-Cu-PGE mineralization in convergent-margin or supra-subduction-zone tectonic settings. Among the findings is a precise 93 Ma crystallization age for the ultramafic suite that hosts the past-producing deposit, identifying it as the youngest known magmatic Ni-Cu-PGE sulphide deposit.

7.2. Graduate student research.
There are ongoing university-based research projects in the Southwest Region. For example, PhD candidate Brian McNulty is studying the genesis of the Myra Falls deposits with the Centre of Excellence in Ore Deposits (CODES) group at the University of Tasmania.

8. Summary
Although demand for construction materials continues to support industrial minerals and aggregates production and development, coal and metals exploration and production have been curtailed severely over the past three years. There were two major exploration drill programs for metals in the southwest and one reported for aggregate. On and off-lease projects at Myra Falls and Quinsam were suspended.

Acknowledgments
I thank those in industry who generously provided information and access to their properties.

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Exploration and mining in the Northwest Region, British Columbia

Mineral Development Office


1. Introduction

The Northwest Region (Skeena) covers approximately 263,213 square kilometres of British Columbia, approximately 25% of the province (Fig. 1). The region has one operating mine, two mine development projects and eight proposed mine projects. Over eighty exploration projects were active in 2016 and activities were predominantly focussed on precious metal and porphyry style copper-gold mineralization.

In 2016, exploration expenditures, drilling estimates and other metrics for British Columbia were captured in the British Columbia Mineral and Coal Exploration Survey, which replaces the annual Ministry of Energy and Mines mineral exploration expenditures 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 83.9 million dollars and exploration drilling was estimated at approximately 115,000 m (Clarke et al., this volume; Ernst & Young LLP (E&Y), 2017 in press).

Significant events in the Northwest Region in 2016 include:

- continued construction of the Brucejack high-grade underground gold mine by Pretium Resources Inc.
- the discovery of coarse gold in bedrock at the Otter Creek placer operation, part of the Surprise Lake prospect in the Atlin placer camp
- the release by Seabridge Gold Inc. of an updated Pre-Feasibility Study and a Preliminary Economic Assessment for the KSM gold-copper porphyry project
- issuing of permits to Seabridge Gold Inc. for a proposed exploration adit at Deep Kerr and a key water license for the KSM project
- ongoing construction by JDS Silver (near production) at the proposed Silvertip silver mine
- Tudor Gold Corp. reporting project drilling results of 630 m grading 0.53 g/t Au for their Treaty Creek project
- Seabridge Gold Inc. acquiring the Iskut gold project from Snip Gold Corp.
- IDM Mining Ltd. completing an updated Preliminary Economic Assessment for the Red Mountain gold project
- the Huckleberry copper-gold-molybdenum mine goes on care and maintenance status in August
- Skeena Resources Limited releases resource estimates for the Spectrum and GJ gold-copper projects
- Ascot Resources Ltd. drills 69,123 m in 279 holes at the Premier gold-silver project.

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 transects all of the physiographic belts of the Canadian Cordillera (Fig. 1).

The Northwest Region spans a transect of the Cordilleran orogen (Fig. 1). From east to west it is underlain by: 1) autochthonous and paraautochthonous carbonate and siliciclastic strata of ancestral North America (Laurentia); 2) terranes of the Intermontane tectonic province including the Slide Mountain terrane (back-arc basin); the Yukon-Tanana terrane (rifted Devonian pericratonic arc), the Quesnel and Stikine volcanic arcs (formed outboard of ancestral North America starting in the Late Paleozoic and accreted in the Middle Jurassic), and the late Paleozoic-early Mesozoic accretionary complex of the Cache Creek oceanic terrane, which intervenes between Quesnellia and Stikinia; 3) the Alexander terrane, part of the Insular tectonic province; 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.

2.1. Ancestral North America

Carbonate platformal rocks of the Laurentian realm are limited to the northeastern corner of the Northwest Region and mark the ancient margin of North America. Platform and deep-water sedimentary rocks host favorable environments for stratiform barite and set the stage for later polymetallic manto
Fig. 1. Mines, proposed mines and selected exploration projects, Northwest Region, 2016. Terranes from the BC digital geology map (Cui et al., 2015).
development. Sedimentary exhalative prospects also occur and are better developed to the east in the Kechika basin in the North Central Region (see Jago, this volume).

2.2. Intermontane tectonic province

In the Northwest Region the Intermontane tectonic province comprises a group of allochthonous terranes including Slide Mountain, Yukon-Tanana, Quesnel, Stikine, and Cache Creek.

2.2.1. Slide Mountain terrane

The Slide Mountain terrane is exposed in the Sylvester allochthon, a klippe that structurally overlies the Cassiar platform near Cassiar. It contains imbricated marginal ocean basin lithosphere, including ultramafic upper mantle, gabbro, basalt and pelagic sedimentary strata. Extensively serpentinitized ultramafic rocks host nephrite jade. Placer gold of the Cassiar camp was derived from orogenic gold-quartz veins such as at past-producing Cusac and Taurus deposits.

2.2.2. Yukon-Tanana terrane

The Yukon-Tanana terrane records a Devonian-Mississippian volcanic arc on a pericratonic rifted block. The terrane hosts volcanogenic massive sulphides such as the Scotia prospect in the Ecstall belt near Prince Rupert.

2.2.3. Quesnel terrane

The Quesnel terrane records a multi-phase late Paleozoic-early Mesozoic volcanic arc that is extensively exposed in north central and southern British Columbia. Its northern extension in the Northwest Region contains stratigraphic equivalents of the Takla Group, intruded by the Eagle granodiorite, which is considered a faulted extension of the northern Hogem batholith (Gabrielse, 1998). Two porphyry copper-gold-molybdenum prospects, the Eaglehead deposit and the grassroots Pyramid prospect are in Quesnellia and the Northwest Region.

2.2.4. Stikine terrane

The Stikine terrane generally trends northwest extending for 1,500 km along the length of the province. It ranges from less than 100 to more than 300 km wide. It is the largest terrane in the Northwest Region and the most metallogenically significant. It hosts the Red Chris mine, and most of the economic mineral potential is in the form of porphyry and associated copper-gold-silver-molybdenum deposits such as KSM and Brucejack. The Philippine microplate with opposite-facing arcs is considered a faulted extension of the northern Hogem batholith.

The Stikine terrane records a volcanic arc built during three episodes between the late Paleozoic and early Mesozoic. Each episode is represented by an unconformity-bound volcanic-sedimentary sequence and coeval intrusive suite: 1) Devonian to Permian Stikine assemblage and Asitka Group and Forrest Kerr and More Creek plutons, (Logan et al., 2000; Gunning et al., 2006); 2) Middle to Upper Triassic Stuhini and Takla groups and accompanying intrusions such as the Hotailuh and Hickman batholiths (Souther, 1977; Monger, 1977; Dostal et al., 1999); and 3) Lower to Middle Jurassic Hazelton Group and related high-level intrusions such as the Texas Creek suite (Barresi et al., 2015). Much of the porphyry related metal endowment is in sub-volcanic intrusive complexes related to the Stuhini and Hazelton groups. The contact between the Hazelton and Stuhini groups may represent an important regional targeting feature for porphyry and related deposits. More importantly, fault systems that are near or crosscut the Stuhini-Hazelton boundary and are inferred to have early origins, such as the Sulphurets Fault, have been shown to influence emplacement of mineralized intrusions as at KSM and KSP properties (Kyba and Nelson 2015, Nelson and Kyba, 2014). The Eskay rift is also inferred to be influenced by a pre-existing basement structure, the Unuk River shear zone. The Middle Jurassic rift trends over 300 km at a high angle to the arc front and contains prolific past-producing mines including Eskay Creek, Granduc and Anyox.

2.2.5. Cache Creek terrane

The Cache Creek terrane records an oceanic fore-arc that formed outboard of the combined Stikine-Quesnel arc terranes, and now lies structurally between them. It contains blueschist belts, remnants of oceanic primitive arc crust and ultramafic upper mantle and structural blocks of ocean island crust with exotic fossils of Tethyan (Asian) affinity (Nelson et al., 2013). Serpentinitized ultramafic bodies host nephrite jade now mined as placer boulders in till and alluvium. Placer gold deposits are associated with the Cache Creek terrane and its bounding faults, notably the Thibert fault. Bedrock sources of the gold are not well known.

2.3. Insular tectonic province

2.3.1. Alexander terrane

The Alexander terrane underlies most of north coastal British Columbia. It comprises Neoproterozoic and Cambro-Ordovician primitive arc sequences (Gehrels et al., 1983) that probably accreted to pericratonic crust in the Devonian (Nelson et al., 2013). In coastal British Columbia, small VMS-style occurrences are associated with Ordovician rhyolites. Farther north in southeastern Alaska and far northwest British Columbia, the Alexander terrane hosts Neoproterozoic (Niblack) and Triassic (Greens Creek, Windy Craggy) volcanogenic deposits. The Alexander terrane accreted to the western margin of the Intermontane terranes during the Middle Jurassic (van der Heyden, 1992; McClelland and Mattinson, 2000; Saleebey, 2000; Gehrels, 2001).

2.4. Post-accretionary overlap strata and intrusions

2.4.1. Bowser basin and Skeena clastic overlap sequences

Middle-late Mesozoic Bowser Lake Group and Skeena Group rocks formed in syn- to post-accretionary basins and cover much of the north-central part of the Stikine terrane. The Bowser Lake Group sedimentary sequence spans the former basin between the Stikine arch and Skeena arch and contains significant anthracite coal deposits in the Groundhog-Klappan
Coalfield. The Bowser Lake Group consists of nine different sedimentary assemblages; of which, five are known to be coal bearing. Three of these are deltaic facies containing high rank anthracite coal such as at the Groundhog project (see Jago, this volume). The coal-bearing sequences are interbedded with mudstone, siltstone and sandstone and are about 1,100 metres thick. Thirty-three coal horizons, up to 12 metres thick, have been identified.

2.4.2. Coast Plutonic Complex

The Coast Plutonic Complex underlies the Coast Mountains of western British Columbia and extends into the islands and lowlands to the west. It is a vast batholith, with component plutons ranging from Late Jurassic in the west, through to mainly Cretaceous in its center, to Eocene outliers in the east. It overlaps the suture between the Intermontane and Insular terranes; it developed as the roots of the subsequent arc that formed as Pacific Ocean plates subducted under the new western margin of North America. Economic mineralization is generally limited to polymetallic vein deposits. However, porphyry-style mineralization has been identified at the Ike project in the South Central Region (see Britton, this volume).

2.4.3. Bulkley and Babine porphyries and Ootsa Lake Group

Late Mesozoic to Cenozoic intrusive rocks formed in an intracontinental setting, after the outboard arc and related terranes accreted to the western margin of North America. These deposits are interpreted to have formed in continental back arc settings and individual deposits are hosted by a variety of older country rocks. In the Northwest Region, deposits are generally hosted in the Hazelton Group and show a spectrum of metal associations such as copper-molybdenum at Huckleberry, Morrison and Berg; copper-gold at past-producing Bell and Granisle mines; and molybdenum at Kitsault. Coeval and younger volcanic rock such as the Ootsa Lake Group host polymetallic precious metal veins like the past-producing Captain mine. Similar aged intrusions are mapped throughout the Skeena Arch and as far north as the eastern margin of the Cassiar batholith. There, a 72 Ma intrusion is interpreted to be related to polymetallic manto development at the Silvertip deposit, which is in Cambrian-Devonian carbonate rocks of the Cassiar platform.

2.4.4. Post-accretionary faults

Braided sets of post-accretionary, northwest-trending, strike-slip faults, transect the mosaic of terranes and set the overall structural grain of the Cordillera in the Northwest Region. Faults record mainly dextral displacement from mid-Cretaceous to Eocene with a cumulative offset up to 800 km (Gabrielse et al., 2006).

2.5. Younger rocks

Younger cover rocks consist of volcanic rocks of the Mt. Edziza complex (Pleistocene). Some of the oldest quarries of obsidian mined by First Nations peoples are hosted in the Mt. Edziza volcanic rocks. (MINFILE 104G 101).

3. Mines and quarries

During 2016, two metal mines operated (Huckleberry and Red Chris). Huckleberry ceased active mining in January and went on care and maintenance in August. Seven industrial mineral mine operations produced jade. Metal mines are summarized in Table 1 and industrial mineral mines and selected quarries are summarized in Table 2. Numerous aggregate operations supply mainly local needs throughout the region and are not discussed in this report.

3.1. Metal mines

There were two producing metal mines in the Northwest Region during 2016 (Table 1). The Huckleberry mine ceased active mining in January and produced concentrate from low grade stockpiles until going on care and maintenance in August. The Red Chris mine achieved its first full year of commercial production in 2016.

3.1.1. Huckleberry (Huckleberry Mines Ltd.)

The Huckleberry copper-gold-molybdenum mine is approximately 85 km southwest of the town of Houston and is accessed by forest service roads. The mine is owned and operated by Huckleberry Mines Ltd. (HML). Imperial Metals Corporation owns 50% of HML with the remaining 50% owned by the Japan Group consisting of Mitsubishi Materials Corporation, Dowa Mining Co. Ltd. and Furukawa Co. Ltd. Production until shut-down in August 2016 totalled 9,270 t (20.4 Mlbs) Cu from 5.1 Mt of ore with an average grade of 0.23% Cu and an 87.5% recovery. Gold and silver production values were not available. Mill throughput averaged 18,785 tpd. Active mining ceased in January and milled material was sourced from stockpiles until August.

The mine is now in care and maintenance and is prepared to resume operations if copper prices increase. The Huckleberry mine consisted of two deposits, the Main and East zones. Both are hosted in or peripheral to Late Cretaceous (~82 Ma) granodiorite stocks of the Bulkley Plutonic suite that intrude Lower Jurassic Hazleton Group volcanic tuffs (MacIntyre et al., 1994). Copper mineralization occurs as disseminated, fracture-fill and vein concordant chalcopryite at the margins of the stocks and in hornfelsed selvages around them.

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

The Red Chris copper-gold mine is 16 km southeast of the community of Iskut and 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. Red Chris declared its first full year of commercial production in 2016.

Production to the end of the 3rd quarter of 2016 totalled 31.2 t (68.95 Mlbs) Cu and 1.319 kg (42,426 oz) Au from approximately 7.35 Mt of ore grading approximately 0.55%
**Table 1. Metal mines, Northwest Region.**

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>2016 Q1-Q3 Production</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huckleberry</td>
<td>Huckleberry Mines Ltd.</td>
<td>Copper, gold, silver, molybdenum; Porphyry Cu-Mo-Au; 093E 037</td>
<td>9,270 t (20.4 Mtbs) Cu,</td>
<td>Approx., 37 Mt at 0.3% Cu</td>
<td>1,027 Mt at 0.35% Cu and 0.35 g/t Au, 1.14 g/t Ag</td>
<td>Mining ceased Jan 6. Stockpiles provided mill feed until Aug. 31. Now on care and maintenance.</td>
</tr>
<tr>
<td>Red Chris</td>
<td>Red Chris Development Company Ltd.</td>
<td>Copper, gold, silver; Porphyry Cu-Au; 104H 005</td>
<td>31,277 t (68.95 Mtbs) Cu, 1,319 kg (42,426 oz) Au</td>
<td>294 Mt at 0.36% Cu and 0.27% Au</td>
<td>1,027 Mt at 0.35% Cu, 0.35 g/t Au, 1.14 g/t Ag</td>
<td>First year of full production achieved.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Mine</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>2016 Q1-Q3 production</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning Daylight</td>
<td>Stone Ridge Quarries Ltd.</td>
<td>Columnar Basalt; dimension stone</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Basalt quarrying, bulk sampling.</td>
</tr>
<tr>
<td>Cassiar Jade</td>
<td>Dynasty Jade Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104P 005</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Trenching, quarrying, placer production.</td>
</tr>
<tr>
<td>Dean Kutcho</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, quarrying, up to 200 tonnes.</td>
</tr>
<tr>
<td>Jade Valley</td>
<td>United Oriental Mining Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104I 048</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, quarrying, placer production.</td>
</tr>
<tr>
<td>Kistumkalum</td>
<td>Kalum Quarry Ltd. Partnership</td>
<td>Industrial rock; crushed rock</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, blasting, crushing, production for CN railway bed.</td>
</tr>
<tr>
<td>Kutcho Creek Jade</td>
<td>Continental Jade Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104I 078</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Mining, trenching, auger drilling.</td>
</tr>
<tr>
<td>Letaín</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones; 104I 079</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, mining up to 200 t.</td>
</tr>
<tr>
<td>Provencher</td>
<td>Glenpark Enterprises Ltd.</td>
<td>Jade; Gems and semi-precious stones; 104I 092</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Mining, trenching, auger drilling.</td>
</tr>
<tr>
<td>Wolverine</td>
<td>Cassiar Jade Contracting Inc.</td>
<td>Jade; Gems and semi-precious stones</td>
<td>unknown</td>
<td>n/a</td>
<td>n/a</td>
<td>Drilling, trenching, &lt;2,000 tonnes of material mined.</td>
</tr>
</tbody>
</table>
Cu and approximately 0.35 g/t Au. Metal recoveries averaged 77.6% for Cu and 51.1% for gold. Target production for the year was forecast between 38,500-40,800 t (85-90 Mlbs) Cu and 1,400-1,500 kg (45-50,000 oz) Au.

Ore is mined from two zones referred to as the East and the Main zones. Ore excavated from near-surface portions of the Main zone contained higher clay concentrations and lower copper grades, which resulted in lower metal recoveries. Tests indicated longer flotation time is required to increase rougher circuit recoveries to designed specifications. As a result, an additional rougher cell was to be installed by the end of 2016.

The Red Chris copper-gold deposit is hosted in a 204 Ma diorite-monzonite that intrudes Late Triassic Stuhini Group rocks. 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 more than 2 km x 650 m in plan and extends to a depth 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).

Proven reserves total 301.5 Mt with an average grade of 0.36% Cu and 0.27 g/t Au. Mine life is expected to be 28 years at a 30,000 tonne-per-day milling rate. Measured plus Indicated resources total 1,034.7 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. Investigations are under way to expand the open pit design and incorporate underground block cave mining methods to access resources not included in the current mine plan.

3.2. Industrial mineral mines and quarries

Seven industrial mineral mines produced jade, and two industrial rock quarries are documented in this report (Table 2). Numerous aggregate operations supply mainly local needs throughout the region and are not discussed further.

3.2.1. Nephrite jade

Jade is a 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 in a subduction-related orogenic belt. There are two significant areas of nephrite jade extraction in the Northwest Region: 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 200-2,000 t per year. Producers are listed in Table 2 and their locations are illustrated in Figure 1.

3.2.2. Industrial rock quarries

The Burning Daylight columnar basalt dimension stone quarry is approximately 30 km south of Houston and owned by Stone Ridge Quarries Limited. Access to the project is via a forest service road. Stone Ridge mined an unverified amount under a bulk sample permit for landscape and building stone markets.

The Kitsumkalum 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. There is road access and a 3 km rail line connecting the property to the CN mainline. Rock is drilled, blasted and crushed on site to meet specific contract 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 metres of material remains available for development. Quarryed rock consists of dark green-grey basalt and andesite of the Hazelton Group.

3.2.3. Placer operations

Placer mining operations have been active in the Northwest Region for well over a century. At least 12 significant placer operations operated during 2016. Operations are mainly in the Atlin area and to a lesser degree in the Cassiar area. In 2016, coarse visible gold was discovered in bedrock at the Otter Creek placer operation (Mihalynuk et al., 2017).

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 Mines and an Environmental Management Act permit from the Ministry of Environment. The two mine development projects in the Northwest region in 2016 include the Brucejack and Silvertip metal mine projects (Table 3).

4.1. Brucejack (Pretium Resources Inc.)

The Brucejack underground gold-silver mine project is approximately 65 km north-northwest of the municipality of Stewart and is owned by Pretium Resources Inc. Road access is via combined all weather dirt road and glacier road. An all season airstrip is located 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. Since then, full-scale construction efforts (Fig. 2) have focussed on erecting the mill building, underground development, a permanent 330 person mine camp, and connecting a 57 km power line. Construction timelines are on schedule and budget, with a startup scheduled for 2017. Brucejack will be a 2,700 tonne-per-day underground mining operation with a forecasted 18-year mine life and will produce an estimated 7.27 million ounces of gold.

Free gold and electrum will be recovered to produce gold-silver doré, which will be flown off site from their all season airstrip. Sulphide concentrate will be trucked offsite to be refined at a receiving smelter.
Table 3. Mine development projects, Northwest Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity; deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resource (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucejack</td>
<td>Pretium Resources Inc.</td>
<td>Au, Ag; Au-quartz veins; Quartz stockwork breccia; Epithermal; 104B 193</td>
<td>16.5 Mt at 14.1 g/t Au, 57.7 g/t Ag</td>
<td>16.4 Mt at 17.2 g/t Au, 15 g/t Ag</td>
<td>Mine, mill and infrastructure construction, underground development, regional exploration.</td>
<td>Construction on schedule, aiming for commercial production in 2017.</td>
</tr>
<tr>
<td>Silvertip</td>
<td>JDS Silver</td>
<td>Ag, Pb, Zn, Au; Polymetallic manto; 104O 038</td>
<td>n/a</td>
<td>2.35 Mt at 352 g/t Ag, 6.73% Pb, 9.41% Zn</td>
<td>Mine, mill and infrastructure construction near completion, near mine condemnation drilling.</td>
<td>Commissioning underway.</td>
</tr>
</tbody>
</table>

Fig. 2. Brucejack project site, August 2016.

Total mineral reserves and resources for the project are based on the Valley of the Kings (VOK) and West zones. A 63,444 m, 354 hole underground infill drill program for the VOK zone that began in late 2015 was completed in May 2016.

Highlight results included 49 intersections grading over 1,000 g/t Au. The drill program increased Measured resources for the VOK by 58%. Measured plus Indicated resources for the VOK zone now total 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. Proven plus Probable reserves for the VOK and the West zone remain unchanged from the 2014 feasibility study at 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 1,200 km² of mineral claims and are discussed in section 6.1.1.

4.2. Silvertip (JDS Silver)

The Silvertip silver-zinc-lead project is approximately 90 km west-southwest of Watson Lake. The project is owned by a private company, JDS Silver. Access to the site is via a 26 km all weather mine road, which spurs south from the Alaska Highway near the community of Rancheria.

The project received the required permits to operate in June 2015 and mine construction started in March of 2016. Commissioning is underway with commercial production planned for the near future. The mill is designed to process up to 1,000 t per day. Parallel flotation circuits will produce a lead-silver concentrate and a separate zinc concentrate, which will be transported offsite to a receiving smelter. Due to the remote location, Silvertip will not be connected to grid power. Five natural gas fired turbines and a backup diesel generator will supply electrical needs.

The Silvertip deposit is hosted in Neoproterozoic to Middle Devonian back-arc basin carbonate and siliciclastic rocks of the Cassiar terrane faulted onto the western margin of North America. 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 in the upper part of the McDame Group and are unconformably overlain by Devonian-Mississippian rift-related, siliciclastic
rock of the Earn Group. The sulphide bodies are in paleokarst features, and along fault surfaces and fold hinges. The Silver Creek zone is the largest and consists of massive pyrite, sphalerite, galena and chalcopyrite. Current resource estimates are 2.35 Mt at 352 g/t Ag, 6.73% Pb and 9.41% Zn.

5. Proposed mines or quarries

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

5.1. Proposed metal mines

Several proposed metal mines are in the Northwest Region. Table 4 lists eight proposed mines that have been active in the past three years or hold permits to allow construction if financing becomes available.

5.1.1. KSM (Seabridge Gold Inc.)

The KSM project is owned by Seabridge Gold Inc. and is approximately 65 km north of Stewart and occupies the adjoining mineral claims west of the Brucejack mine development project. Access to KSM is via helicopter.

The project consists of four, gold-copper porphyry deposits: Kerr, Sulphurets, Mitchell and Iron Cap. (Fig. 3). All deposits are related to the Early Jurassic (~194 Ma; Margolis, 1993) Texas Creek intrusions and contain possibly the largest undeveloped copper-gold camp in the world (by reserves). Proven plus Probable reserves were updated in July 2016 and now total 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 completed in May (inclusive of reserves) total 2.903 Bt grading 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag and 44 g/t Mo. Additional Inferred resources total 2.719 Bt grading 0.35 g/t Au, 0.32% Cu, 2 g/t Ag and 29 g/t Mo. Seabridge received federal and provincial approval of the project environmental assessment (EA) in 2014 and is actively seeking partnership to advance into construction.

During 2016, Seabridge delivered two comprehensive technical reports: 1) a Preliminary Feasibility Study (PFS) based on updated Mineral Reserves and 2), a Preliminary Economic Assessment (PEA) which incorporated Inferred mineral resources into a conceptual project design. Additional exploration activities focussed at the Deep Kerr and Lower Iron cap zones.

Updates include commitments established in the EA, particularly around water management and improved environmental protection. Project design updates include replacing the tunnel conveyor with a rail system and improved mine sequencing as well as updating current metal values and exchange rates.

The 2016 PFS details a proposed 53-year mine life of a combined open pit and underground block cave operation. During the first 33 years, most material would be mined from the open pits and then transition to underground mining over two years. Milling rates for the initial 35 years would be

!!! Fig. 3. KSM project, longitudinal cross section looking west. Diagram courtesy of Seabridge Gold Inc. !!!
Table 4. Selected proposed mines, Northwest Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>Commodity: deposit type; MINFILE</th>
<th>Reserves (Proven + Probable)</th>
<th>Resources (Measured and Indicated)</th>
<th>Work Program</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dome Mountain</td>
<td>Dome Mountain Resources of Canada Inc.</td>
<td>Au, Ag; Vein breccia and stockwork; 093L 022</td>
<td>135,131 t at 11.2 g/t Au</td>
<td>144,144 t at 17.7 g/t Au</td>
<td>Diamond drilling, mine rehabilitation.</td>
<td>Trucked ore to Nicola custom mill in Merritt.</td>
</tr>
<tr>
<td>Galore Creek</td>
<td>Galore Creek Mining Corp.</td>
<td>Au, Cu; Alkalic porphyry; 104G 090</td>
<td>528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag</td>
<td>814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.2 g/t Ag</td>
<td>Baseline monitoring.</td>
<td>Reduced environmental baseline monitoring.</td>
</tr>
<tr>
<td>Kitsault</td>
<td>Alloycorp Mining Inc.</td>
<td>Mo, Ag, Pb; Porphyry Mo (low F type); 103P 120</td>
<td>228.2 Mt at 0.083% Mo, 5.0 g/t Ag</td>
<td>321.8 Mt at 0.071% Mo, 4.8 g/t Ag</td>
<td>Baseline monitoring, removed mine camp.</td>
<td>Waiting for improved Mo price.</td>
</tr>
<tr>
<td>KSM</td>
<td>Seabridge Gold Inc.</td>
<td>Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 191</td>
<td>2.198 Mt at 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag, 42.6 g/t Mo</td>
<td>M+I: 2,902.5 Mt at 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag, 44 g/t Mo; Inf: 2,719.2 Mt at 0.35 g/t Au + 0.32% Cu + 2.0 g/t Ag + 20 g/t Mo</td>
<td>Preliminary feasibility Study, Underground Preliminary Economic Assessment, Deep Kerr exploration portal permitted, exploration drilling at Lower Deep Kerr (7110.4 m) and Iron Cap (1038.4 m).</td>
<td>Significant advantages detailed in PEA with integrating more underground mining.</td>
</tr>
<tr>
<td>Morrison</td>
<td>Pacific Booker Minerals Inc.</td>
<td>Cu, Mo; Calc-alkalic porphyry; 093M 007</td>
<td>224.2 Mt at 0.33% Cu, 0.163 g/t Au, 40 g/t Mo</td>
<td>265.9 Mt at 0.35% Cu, 0.17 g/t Au, 50 g/t Mo</td>
<td>Baseline monitoring, EA permitting saga.</td>
<td>Entered EA in 2010.</td>
</tr>
<tr>
<td>Red Mountain</td>
<td>IDM Mining Ltd.</td>
<td>Au, Ag; Porphyry related gold; 103P 086</td>
<td>n/a</td>
<td>1.641 Mt at 8.36 g/t Au, 26 g/t Ag</td>
<td>Preliminary Economic Assessment, resource update, underground rehab, infill resource drilling, metallurgical, geotechnical, environmental baseline, EA package submission prep</td>
<td>Preparing EA application submission.</td>
</tr>
<tr>
<td>Schaft Creek</td>
<td>Teck Resources Limited</td>
<td>Cu, Au; Calc-alkalic porphyry; 104G 015</td>
<td>940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag</td>
<td>1,228.5 Mt at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag</td>
<td>Baseline monitoring, in-house engineering, evaluating re-interpreted, re-logged core (43,000 m) for possible resource update</td>
<td></td>
</tr>
<tr>
<td>Tulsequah Chief</td>
<td>Chieftain Metals Inc.</td>
<td>Au, Ag, Cu, Zn, Pb; Noranda / Kuroko massive sulphide; 104K 002</td>
<td>4.435 Mt at 2.85 g/t Au, 104 g/t Ag, 1.46% Cu, 1.29% Pb, 6.94% Zn</td>
<td>6.575 Mt at 2.82 g/t Au, 104.76 g/t Ag, 1.34% Cu, 1.33% Pb, 6.71% Zn</td>
<td>Corporate.</td>
<td>Company entered receivership and is seeking a buyer for project.</td>
</tr>
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</table>
130,000 tpd and then reduced to 95,000 tpd for approximately 10 years once transitioned to underground operations and lastly reduced to approximately 60,000 tpd for the final years of processing stockpiles. Ore would be processed through grinding and flotation circuits to produce a clean concentrate averaging 25% copper with high gold and silver content. Separate circuits would produce Mo concentrate and gold-silver doré. Products would be trucked to the port of Stewart and shipped overseas for smelting.

The PEA was prepared by Amec Foster Wheeler and conceptualised expanded underground block cave mining methods across the project. Most significant, the PEA included the 2.7 Bt of Inferred resources at the Deep Kerr and Lower Iron Cap zones in addition to the 2.9 Bt of Measured and Indicated resources from the other deposits. In this scenario, approximately 78% of all the mined material would be recovered by underground block cave mining methods while 22% would be excavated from open pits. This change would reduce the amount of waste rock by 81% (approximately 2.4 Bt) and substantially reduce the footprint of the project compared to the operation detailed in the PFS. The PEA envisions a milling rate of 170,000 tpd for the initial 20 years followed by 130,000 tpd for 15 years, reduced to 77,000 tpd for 12 years and finally reduced to 28,000 tpd for 3 years. Total metal production would increase by 77% over a 51 year mine life.

In addition to pre-development studies, exploration at Lower Iron Cap and Deep Kerr continued to expand the deeper limits of mineralization. At Iron Cap, a single 1,038.4 m drill hole, IC-16-62, intersected the targeted extension of the lower zone with more than 555 m grading 0.83 g/t Au and 0.24% Cu from 353.5 m depth. In the same hole, an unanticipated shallower zone of gold-copper mineralization was intersected: 60.7 m grading 1.2 g/t Au and 0.95% Cu from 201 m depth. Mineralization consists of dense quartz veins in a porphyritic intrusive rock, (Fig. 4) similar to mineralization at the Mitchell deposit and other high-grade core zones on the KSM property.

Exploration drilling at Deep Kerr totalled 8,514.8 m. Results indicate that copper-gold mineralization extends down dip of the known resources on the east and west limbs of the deposit. Results will be integrated into underground block-cave mining scenarios as resource confidence improves. Mineralization defined for the Kerr deposit now extends nearly 2 km along strike, and over 1.5 km in vertical extent. Future definition drilling is proposed to upgrade resources to reserves. It would be conducted from a recently permitted 2.1 km exploration adit (Fig. 3) designed to cross-cut the deposit at approximately the 250 m elevation level. The adit would also provide valuable geotechnical information to integrate into block cave design and mine development.

The KSM deposits are associated with the Early Jurassic Mitchell intrusions of the Texas Creek plutonic suite. Diorite, monzonite and quartz-syenite stocks and dikes intrude along the pre-Early Jurassic Sulphurets fault into the surrounding sedimentary and volcanic rocks of the Stuhini and Hazelton groups. Mineralization is disseminated and stockwork vein-concordant, fine-grained chalcopyrite, bornite, molybdenite and pyrite.

5.1.2. Dome Mountain (Gavin Mines Inc.)

The Dome Mountain past-producing gold mine is approximately 38 km east of Smithers and 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 various 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. The mine is positioned to resume underground excavations by the end of the year and aims to truck ore to the Nicola mill in the near future.

Activities on the property in 2016 included diamond drilling, underground geological mapping, and preparation to resume
mining. A diamond drill program completed over the 2015-2016 winter totalled 6,954 m in 35 holes. The drilling increased an in-house resource estimate that suggests the mine life could be extended past its current 5 year plan. Current resource estimates (Measured plus Indicated) are 144,144 t at 17.7 g/t Au.

The Dome Mountain deposit consists of two principal zones of gold-silver mineralized structures named the Boulder and the Argillite veins. Both occur in folded fragmental rocks and in variably altered, amygdaloidal basaltic andesite. The Boulder vein varies from 0.7 m to 4.5 m wide and has sub-parallel hanging wall and footwall veins. Known strike length is approximately 700 m and may extend westward. The Argillite Vein varies from 0.7-4.75 m wide and has a known strike length of about 200 m.

The mineralized vein systems are primarily composed of quartz with lesser calcite and ankerite. They are typically only gold bearing when sulphide minerals are present. Quartz occurs as both an opaque, massive variety and a clear variety that is associated with higher gold grades. Sulphide minerals include pyrite, sphalerite, chalcopyrite, galena, tetrahedrite, and arsenopyrite. Visible gold is rare. Native gold and electrum occur as micro-scale fracture fills in pyrite and along grain boundaries.

5.1.3. Red Mountain (IDM Mining Ltd.)

The Red Mountain gold project is about 18 km east-northeast of Stewart. IDM Mining Ltd. can acquire 100% ownership of the 17,125 hectare property under an option agreement from Seabridge Gold Inc. Access to the site is by helicopter. 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 (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 about 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 often 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 volcaniclastic rocks.

In April, an updated NI 43-101 resource was released. Measured plus Indicated resources increased 16% to 1.64 Mt grading 8.36 g/t Au and 26 g/t Ag. Inferred resources increased by 33% to 0.55 Mt grading 6.1 g/t Au and 9 g/t Ag. Resource grade cut-off is 3 g/t Au.

In early 2016, IDM received their Section 11 Order for the project from the British Columbia Environmental Assessment Office. The order sets out the scope, requirements, processes, and methods of the provincial environmental assessment, as well as the public and Aboriginal consultation procedures.

In July, IDM announced the results of an updated Preliminary Economic Assessment (“PEA”) authored by JDS Energy and Mining Ltd. The PEA outlines the anticipated low capital and operating costs, robust economic potential and near-term production profile of the Red Mountain underground gold project.

Exploration in 2016 included underground and surface drilling to expand the existing resource and surface drilling to test the Lost Valley prospect, which is about 4 kilometres southwest of the defined resource. Underground drilling was carried out from dewatered and rehabilitated underground development that had been carried out in the 1990s. Underground drilling highlights included 15.52 g/t Au and 44.82 g/t Ag over 15 m true width, 20.29 g/t Au and 68.74 g/t Ag over 8.0 m true width, 18.70 g/t Au and 66.85 g/t Ag over 6.80 m true width and the discovery of a new zone (NK zone) 70 m outside the current resource estimate that returned 6.00 m grading 7.43 g/t Au and 12.51 g/t Ag. At the Lost Valley prospect, drilling returned 1.0 m of 3.0 g/t Au and 23.80 g/t Ag and 1.2 m averaging 4.63 g/t Au and 90.90 g/t Ag.

In 2017, IDM will continue to move forward with the permitting process and an updated resource and a feasibility study are planned.

5.1.4. Tulsequah Chief (Chieftain Metals Corp.)

The Tulsequah Chief zinc-copper-gold project of Chieftain Metals Corp., is 100 km south of Atlin. In 2015, it was announced that the project’s environmental assessment certificate was to remain in effect for the life of the project, and that Chieftain was actively seeking financing for the proposed mine. In 2016, Chieftain Metals Corp. and its wholly owned subsidiary Chieftain Metals Inc., (collectively Chieftain), were served with a receivership application by West Face Capital Inc., as agent for West Face Long Term Opportunities Global Master L.P., seeking the appointment of Grant Thornton Limited as receiver of all of the assets, undertakings and properties of Chieftain.

The deposit consists of several stacked massive sulphide lenses in rhyolite flows and fragmental rocks that overlie a thick sequence of basalt. Mineralization consists of massive pyrite, chalcopyrite, semi-massive sphalerite and galena and minor amounts of tetrahedrite-tennantite and rare native gold.

5.1.5. Galore Creek (Galore Creek Mining Corporation)

The Galore Creek gold-copper project is about 150 km northwest of Stewart and operated by 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. Limited in-house engineering and optimization studies
focussed on tunnel-related infrastructure and mine sequencing. Onsite activities were reduced to baseline data acquisition and maintenance of the camps and equipment.

The Galore Creek project consists of thirteen known zones of gold-copper mineralization. The largest are the Central, Bountiful and Southwest zones which contain most of the 528 Mt of Proven plus Probable reserves defined in a 2011 Feasibility study.

6.1.1. Brucejack Regional (Pretium Resources Inc.)

Outside of the Brucejack proposed mine area, evaluation of the surrounding 1,200 km² of mineral claims continued. Work in the previous two years included airborne geophysical surveys and regional sampling. In 2016, the regional program was focussed approximately 20 km southeast of the mine project. New work included additional airborne magnetic, radiometric and hyperspectral surveys. Ground work included magneto-telluric geophysical surveys, property scale mapping, prospecting and diamond drilling.

6.1.2. Clone (Makena Resources Inc. (50%), Silver Grail Resources Ltd. (25%) and Teuton Resources Corp. (25%))

The Clone copper-gold-silver molybdenum project is about 80 km southwest of Iskut and 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 2016, the collection of baseline environmental data continued. As well, 43,000 m of legacy core was relogged and the results might contribute to an update of the project’s mineral resource estimate.

The Schaft Creek project consists of three deposits: the Main (Liard) zone, the Paramount zone and the West Breccia zone. The deposits host a Measured and Indicated resource of 1,228.6 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.

5.1.7. Kitsault (Alloypcorp Mining Inc.)

The Kitsault project is located approximately 140 km northeast of Prince Rupert and is owned by Alloypcorp Mining Inc., a privately owned company. The road accessible project was a past producer of molybdenum between 1967 and 1972 and again between 1981 and 1982.

The project is fully permitted for construction and requires project financing to start construction. 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 Eocene Lime Creek intrusive complex that cuts Jurassic argillite and greywackes of the Bowser Lake Group. Molybdenite is hosted in apilite dikes and quartz-molybdenite stockwork.

5.1.8. Morrison (Pacific Booker Minerals Inc.)

The Morrison copper-gold-molybdenum-silver project is 65 km northeast of Smithers and 35 km northeast of Granisle and is owned by Pacific Booker Minerals Inc. Access to the site 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 tpd mill, equating to a 21-year mine life.

Pacific Booker submitted an EA application in 2010 and 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 Morrison EA review was suspended and 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.

6. 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 will set the stage for future mine evaluation. The initiation of baseline environmental data collection is also recommended at this stage. Selected exploration projects active during 2016 are summarized in Table 5.

6.1. 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. Del Norte and Big Gold (Teuton Resources Corp.)

Teuton Resources Corp. intersected copper-gold mineralization in a six-hole drill program and completed a magnetotelluric geophysical survey at their Del Norte project. As well, an eight-hole drill program was completed at their
Table 5. Selected exploration projects, Northwest Region.

<table>
<thead>
<tr>
<th>Project</th>
<th>Operator</th>
<th>MINFILE</th>
<th>Commodity; Deposit type</th>
<th>Resource (NI 43-101 compliant unless indicated otherwise)</th>
<th>Work Program 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adanac</td>
<td>Global Drilling Solutions Inc.</td>
<td>104N 052</td>
<td>Mo, W, Cu; Porphyry (Low F-type)</td>
<td>M+I: 212.907 Mt at 0.063% Mo</td>
<td>Diamond drilling (3,188 m, 14 holes) compilation of legacy data.</td>
</tr>
<tr>
<td>Kinsch</td>
<td>OK2 Minerals Ltd.</td>
<td>103P 014</td>
<td>Au, Cu; Subvolcanic</td>
<td></td>
<td>Geological mapping, rock sampling, channel sampling, petrography, corporate.</td>
</tr>
<tr>
<td>Big Gold</td>
<td>Teuton Resources Corp.</td>
<td></td>
<td>Au, Ag; porphyry related</td>
<td></td>
<td>Diamond drilling.</td>
</tr>
<tr>
<td>Bow</td>
<td>Decade Resources Ltd.</td>
<td></td>
<td>Au, Ag, Co in quartz veins</td>
<td>Chip and grab sampling, diamond drilling. Highlight drilling results included 6.09 m of 17.17 g/t Au, 47.27 g/t Ag and 0.165% Co and 5.80 m of 21.18 g/t Au, 48.81 g/t Ag and 0.227% Co.</td>
<td></td>
</tr>
<tr>
<td>Brucejack Regional</td>
<td>Pretium Resources Inc.</td>
<td></td>
<td>Au, Ag, Zn, Cu; Precious metal veins, VMS</td>
<td>Diamond drilling, geological mapping, rock sampling (4,500), hyperspectral imagery, geochronology, geophysics (Magnetotelluric, magnetics, radiometrics).</td>
<td></td>
</tr>
<tr>
<td>Clone</td>
<td>Makena Resources Inc.</td>
<td>103P 251</td>
<td>Au, Ag, Cu, Co; Au; precious metal veins</td>
<td>Diamond drilling (7 holes), rock sampling. Reported assay results for the first hole included 6.43 metres grading 17.83 g/t Au from 46.33 to 52.76 metres downhole.</td>
<td></td>
</tr>
<tr>
<td>Del Norte</td>
<td>Teuton Resources Corp.</td>
<td>104A 176</td>
<td>Cu, Au; calc-alkaline porphyry</td>
<td>Diamond drilling (6 holes) MT geophysical survey, legacy data compilation.</td>
<td></td>
</tr>
<tr>
<td>Dolly Varden</td>
<td>Dolly Varden Silver Corporation</td>
<td>103P 188</td>
<td>Ag, Zn; Noranda / Kuroko massive sulphide</td>
<td>Diamond drilling (~2,311.6m, 13 holes), mapping, prospecting, soil sampling. Drilling highlights included 19.4 m grading 485 g/t Ag.</td>
<td></td>
</tr>
<tr>
<td>E.L.</td>
<td>Garibaldi Resources Corp.</td>
<td>104B 006</td>
<td>Ni, Cu, Pt, Ag; Tholeitic intrusion</td>
<td>Geological mapping, prospecting, rock sampling, hand trenching, legacy data compilation.</td>
<td></td>
</tr>
<tr>
<td>Eaglehead</td>
<td>Carmax Mining Corp.</td>
<td>104I 008</td>
<td>Cu, Mo; calc-alkaline porphyry</td>
<td>Re-logging and sampling, petro physical characterization, geophysical modelling.</td>
<td></td>
</tr>
<tr>
<td>Electrum</td>
<td>American Creek Resources Ltd.</td>
<td>104B 033</td>
<td>Au, Ag; in quartz veins</td>
<td>Diamond drilling (1,406 m, 19 holes), trenching, u/g rehab, rock sampling, geological mapping.</td>
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</tr>
<tr>
<td>Fireweed</td>
<td>Shamrock Enterprises Inc.</td>
<td>93M 151</td>
<td>Ag, Pb, Zn, Cu; Sedimentary exhalative</td>
<td>Diamond drilling (700 m program announced in late 2016).</td>
<td></td>
</tr>
<tr>
<td>Four J's</td>
<td>Rotation Minerals Ltd.</td>
<td>104B 128</td>
<td>Zn, Pb, Ag, Au; polymetallic veins</td>
<td>Diamond drilling (2 holes).</td>
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<tr>
<td>GJ</td>
<td>Skeena Resources Limited</td>
<td>104G 034</td>
<td>Cu, Au; calc-alkalic - porphyry M+I: 133,670 Mt at 0.32% Cu + 0.36 g/t Au; Inf: 53.69 Mt at 0.26% Cu + 0.330 g/t Au</td>
<td>Diamond drilling (2,872 m, 8 holes), prospecting, legacy data compilation, camp rebuild.</td>
<td></td>
</tr>
<tr>
<td>Hat</td>
<td>Doubleview Capital Corp.</td>
<td>104J 015</td>
<td>Au, Cu; calc-alkalic porphyry</td>
<td>Diamond drilling (~2,000 m) geology, geochemistry, pack sack drilling, camp upgrades.</td>
<td></td>
</tr>
<tr>
<td>Iskut</td>
<td>Seabridge Gold Inc.</td>
<td>104B 107</td>
<td>Au, Ag, Cu; intrusion related, calc-alkalic porphyry</td>
<td>diamond drilling (3,368 m in 13 holes), MT geophysics, hyperspectral imagery, geological mapping, prospecting, legacy data compilation, reclamation.</td>
<td></td>
</tr>
<tr>
<td>Kirkham</td>
<td>Metallis Resources Inc.</td>
<td>104B 079</td>
<td>Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related</td>
<td>VTEM/magnetic/radiometric survey carried out.</td>
<td></td>
</tr>
<tr>
<td>KSP</td>
<td>Colorado Resources Ltd.</td>
<td>104B 111 and 104B 013</td>
<td>Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related</td>
<td>Diamond drilling (6 holes (2 at Tami, 4 at Khyber)) geological mapping, prospecting, rock sampling, ground magnetics. Diamond drilling (8,861.8 m, 59 holes) sampling (990 soils, 511 rock), geological mapping (50 km2), Geophysics (IP, 10 line km; ground mag, 47 line km VTEM, 126 line km) at Inel occurrence.</td>
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<tr>
<td>Ootsa</td>
<td>Goldreach Resources Ltd.</td>
<td>093E 105</td>
<td>Cu, Au; calc-alkalic porphyry M+I: 224.189 Mt at 0.22% Cu, 0.15 g/t Au, 0.021% Mo, 2.8 g/t Ag; Inf: 5.212 Mt at 0.18% Cu, 0.09 g/t Au, 0.019 % Mo, 2.6 g/t Ag (at $8.50 / NSR cut-off)</td>
<td>Prospecting, soil sampling, geology, (Troitsa target area) PEA release March 2016. Sampling at Troitsa returned up to 4.78% Cu and 96.9 g/t Ag.</td>
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</tr>
<tr>
<td>Oweegee Dome</td>
<td>Millrock Resources Inc.</td>
<td>104A 165</td>
<td>Cu, Au, Mo, Zn; calc-alkalic porphyry</td>
<td>Regional reconnaissance, legacy data compilation, airborne geophysical survey (ZTEM), corporate.</td>
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<tr>
<td>Premier</td>
<td>Ascot Resources Ltd.</td>
<td>104B 044</td>
<td>Au, Ag; Au in quartz veins</td>
<td>Diamond drilling (69,123 m in 279 holes). Highlight intersections include 125.50 g/t Au over a core length of 1.50 meters within a broader interval grading 13.71 g/t Au over 14.80 metres.</td>
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<tr>
<td><strong>Pyramid</strong></td>
<td>OK2 Minerals Ltd.</td>
<td>Cu, Au; calc-alkaline porphyry</td>
<td>RC drilling (2000 m, 5 holes), geological mapping, prospecting, soil sampling, ground geophysics (IP), corporate. Grab samples graded up to 82.96 g/t Au (zone 37), 0.15% Cu and 0.18 g/t Au. (Chili zone).</td>
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<tr>
<td><strong>Red Cliff</strong></td>
<td>Decade Resources Ltd.</td>
<td>104A 037 Cu, Au, Ag, Zn; polymetallic veins</td>
<td>Geochemical surveys, rock sampling and diamond drilling.</td>
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<tr>
<td><strong>Scottie</strong></td>
<td>Rotation Minerals Ltd. 80%, Red Eye Resources Ltd. 20%</td>
<td>104B 034 Au, Ag; Au in quartz veins</td>
<td>Diamond drilling, prospecting Drilling highlights included 1.13 m of 31.54 g/t Au.</td>
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<tr>
<td><strong>Snip</strong></td>
<td>Skeena Resources Limited</td>
<td>104B 250 Au, Ag; Au in quartz veins</td>
<td>Diamond drilling (7,180 m in 28 holes), ground magnetics, corporate. Drilling highlight results included 33.07 g/t Au over 2.4 m for the Lamp Zone, 16.24 g/t Au over 13.5 m for the 200 Footwall Zone and 16.01 g/t Au over 4.7 m at the Twin West structural corridor.</td>
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<tr>
<td><strong>Spectrum</strong></td>
<td>Skeena Resources Limited</td>
<td>104G 036 Au, Cu; Au in quartz veins, high k calc-alkaline porphyry</td>
<td>Ind: 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) Diamond drilling (6,826 m, 24 holes), mapping, prospecting, soil sampling, ground magnetics, maiden Resource established.</td>
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<tr>
<td><strong>Surprise Lake</strong></td>
<td>Decoors Mining Corp.</td>
<td>104N 032 Au; Au in quartz veins</td>
<td>Trenching, sampling. Five 1 m trench samples of new bedrock gold discovery returned assays of 0.01, 6.89, 42.1, 3.05 and 0.15 g/t Au.</td>
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<tr>
<td><strong>Telkwa Coal</strong></td>
<td>Telkwa Coal Ltd.</td>
<td>093L 156 bituminous coal</td>
<td>M: 89.113 Mt I: 42.037 Mt Inf: 33.412 Mt Corporate, updated feasibility; scoping study on multi-phased mine plan.</td>
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<tr>
<td><strong>Thorn</strong></td>
<td>Brixton Metals Corporation</td>
<td>104K 031 Ag, Au; Subvolcanic</td>
<td>Inf: 7.4 Mt at 35.54 g/t Ag + 0.51 g/t Au + 0.13% Cu + 0.032% Pb + 0.59% Zn Diamond drilling (1,645 m total; (1,190 m in 5 holes at Outlaw, ; 455 m in 4 holes at Aberlour)), mapping, prospecting, soil sampling, ground geophysics 20 line km IP, Lidar mapping, increased mineral claims to 99,560 ha. Drilling highlights included 10 m of 3.61 g/t Au within 52 m of 0.94 g/t Au at the Outlaw zone and 1 m of 4.42 g/t Au within 3 m of 1.72 g/t Au at the Abelour zone.</td>
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Table 5. Continued.

<table>
<thead>
<tr>
<th>Treaty Creek</th>
<th>Tudor Gold Corp.</th>
<th>104B 078</th>
<th>Au, Ag; Epithermal high sulphidation</th>
<th>Diamond drilling (~3,765 m, 8 holes), prospecting, magnetotelluric geophysical survey, corporate. Drilling highlights included 54 m grading 1.12 g/t Au within a broader zone of 0.53 g/t Au over 630 m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiting Creek</td>
<td>Huckleberry Mines Limited</td>
<td>093E 112</td>
<td>Cu, Mo; calc-alkalic porphyry</td>
<td>Diamond drilling. Highlights included 222.5 m of 0.31% Cu and 0.02% Mo.</td>
</tr>
<tr>
<td>Yellow Jacket</td>
<td>African Queen Mines Ltd.</td>
<td>104N 043</td>
<td>Au; Au in quartz veins</td>
<td>Diamond drilling (~2,000 m, 4 holes), corporate, baseline monitoring. Drilling highlights included 37.1 g/t Au over 1.08 m.</td>
</tr>
</tbody>
</table>

Big Gold project. Although sampling identified anomalous levels of gold, silver and zinc, no economic intersections were reported for Big Gold.

6.1.4. Electrum (Tudor Gold Corp. (60%) and American Creek Resources Ltd. (40%))

The Electrum gold project is about 160 km north-northwest of Stewart. Tudor completed 1,406 m of drilling in 19 drill holes and a four tonne bulk sample at the past-producing Electrum gold project. Tudor owns 60% of the project and American Creek owns 40%.

6.1.5. Four J’s (Rotation Minerals Ltd.)

Rotation Minerals Ltd. drilled two holes at the Four J’s property, which is about 47 km northwest of Stewart. Quartz-breccia zones carrying sphalerite and bournonite were intersected in both holes. Rotation has the option to acquire 50% of the property from Teuton Resources Corp.

6.1.6. Iskut

The 294 km² Iskut project is about 110 km north of Stewart and is owned by Seabridge Gold Inc. The project was obtained through the acquisition of SnipGold Corp. by Seabridge in June of 2016.

Seabridge carried out an exploration program consisting of 3,368 m of diamond drilling in thirteen holes, a magnetotelluric geophysical survey, hyperspectral imagery acquisition, prospecting, geological mapping, and legacy data compilation including core re-logging. Results are anticipated to be applied to a much larger 2017 exploration program.

6.1.7. KSP (Colorado Resources Ltd.)

The 305 km² KSP property is about 95 km northwest of Stewart and is under option to Colorado Resources Ltd. from Seabridge Gold Inc.

In 2016, Colorado’s exploration program included sampling (990 soil, 511 rock), geological mapping (50 km²), ground geophysics (IP, 10 line km; ground mag, 47 line km) an airborne VTEM survey (126 line km) and 8,862 m of diamond drilling in 59 holes. Drilling (53 holes) focussed around the former Inel underground workings. Drilling highlight results include one metre grading 138.5 g/t Au and broader intersections including 25.7 m averaging 9.24 g/t Au.

6.1.8. Oweegee Dome (Millrock Resources Inc.)

The Oweegee Dome project is a district-scale land package 90 km northeast of Stewart. Millrock Resources Inc. has a 100% ownership interest. The property covers the same stratigraphy as the KSM and Brucejack deposits. In the fall of 2016, Millrock initiated a ZTEM airborne geophysical survey. Results of the survey will be integrated with previous surveys and be used to develop drill targets for testing in 2017.

6.1.9. Premier (Ascot Resources Ltd.)

The Premier project is about 13 km north of Stewart. In 2009, Ascot signed an option agreement with Boliden Ltd. to acquire a 100% interest in the >100 km² property that includes the historic 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. Under the terms of a 2015 amending agreement, Ascot can acquire 100% of the project by making a payment of $4.775 million on or before June 30, 2017.

Numerous drill holes returned high-grade gold and silver values. Highlight intersections include 125.50 g/t Au over a core length of 1.50 metres within a broader interval grading 13.71 g/t Au over 14.80 metres.

6.1.10. Scottie (80% Rotation Minerals Ltd. and 20% Red Eye Resources Ltd.)

The Scottie gold property (80% Rotation Minerals Ltd. and 20% Red Eye Resources Ltd.) is located 50 km north of Stewart and is accessible by gravel road. The project site is the former Scottie Gold mine, which operated from 1981 to 1985.
6.1.11. Snip (Skeena Resources Limited)

The Snip past-producing gold mine is about 110 km north of Stewart and is being explored by Skeena Resources Limited under an option agreement with Barrick Gold Corporation. The Snip mine operated from 1991 to 1999 and produced over 1.1 million ounces of Au.

Skeena has met the expenditure requirement to acquire 100% ownership from Barrick Gold and it is anticipated that in 2017 regulatory approvals will be received, allowing the complete transfer of the property to Skeena. In 2016, the company completed 7,180 m of diamond drilling in 28 holes. Drill results identified or confirmed three significant high-grade zones all of which are outside of historic mine working areas. Highlight results included 33.07 g/t Au over 2.4 m for the Lamp Zone, 16.24 g/t Au over 13.5 m for the 200 Footwall Zone and 16.01 g/t Au over 4.7 m at the Twin West structural corridor. Under the terms of the option agreement, 2016 drilling was only allowed within 25 m of historic workings. When the property transfer is complete Skeena plans to carry out a 2017 drill program from underground historic workings.

6.1.12. Surprise Lake (Gray Rock Resources Ltd.)

The Surprise Lake project is 8 kilometres east of Atlin and owned by DeCoors Mining Corp. who has signed a binding letter of intent to transfer ownership to Gray Rock Resources Ltd. Access to the project is via gravel road from Atlin.

In 2016, coarse visible gold was discovered in the bottom of a placer mining operation on Otter Creek (Fig. 5). This is the first documented occurrence of bedrock gold in the Atlin gold placer camp (Mihalynuk et al., 2017). The gold occurs in quartz-feldspar veins with up to 2% pyrite in a dark to medium grey phyllite that is graphitic in part.

Gray Rock Resources Ltd. reported the results of a sampling program initiated by the bedrock gold discovery. Five one-metre long samples were collected from rock sawn channels cut into mineralized rock composed of fine-grained, black, phyllite with local centimetre-scale quartz veins parallel to the foliation. The samples returned assays of 0.01, 6.89, 42.1, 3.05 and 0.15 g/t Au. As well, 20 grab samples were taken and highlights include 20.8 and 4.11 g/t Au.

6.1.13. Thorn (Brixton Metals Corporation)

The 996 km² Thorn property is about 120 km southeast of Atlin and is owned by Brixton Metals Corporation. Access to the project is via helicopter or fixed wing aircraft from Atlin or Dease Lake.

Brixton carried out an exploration program that included the collection of 2,337 soil samples and 247 rock samples, 15.5 km of ground IP surveying, LiDAR surveying and 1,645 m of diamond drilling in nine holes. The geochemical and geophysical programs outlined significant new target areas. In particular, the soil survey delineated a new 7 km² gold-in-soil anomaly associated with a near surface IP chargeability high anomaly at the Chivas zone. Drilling highlights included 10 m of 3.61 g/t Au within 52 m of 0.94 g/t Au at the Outlaw zone and 1 m of 4.42 g/t Au within 3 m of 1.72 g/t Au at the Abelour zone.

6.1.14. Treaty Creek (Tudor Gold Corp. (60%), Teuton Resources Corp. (20%) and American Creek Resources Ltd. (20%))

The 179 km² Treaty Creek project is 75 km north of Stewart and immediately north-northwest of the KSM and Brucejack projects. Ownership is divided between Tudor Gold Corp. (60%), Teuton Resources Corp. (20%) and American Creek Resources Ltd. (20%). Access to the project is by helicopter.

In 2016, Tudor completed a magnetotelluric survey that covered favorable areas identified by previous drilling and geophysical programs, and followed up with a 3,765 m eight hole drill program. Highlights included 54 m grading 1.12 g/t Au within a broader zone of 0.53 g/t Au over 630 m.

6.1.15. Yellow Jacket (African Queen Mines Ltd.)

The Yellow Jacket project is 9 km east of Atlin and is owned by African Queen Mines Ltd. In 2016, the company completed a four hole, 2,000 m diamond drilling program designed to target the down dip potential of the historic Yellowjacket gold mine. Results included 37.1 g/t Au over 1.08 m.

6.2. Porphyry (Cu-Au, Cu-Mo, Mo) projects

The Northwest Region is highly prospective for porphyry deposits related to island arc assemblages that had collided before accretion with North America and also with post-accretionary intrusive suites.
6.2.1. Adanac (Global Drilling Solutions Inc.)

The Adanac molybdenum project is about 24 km northeast of Atlin. In 2016, Global Drilling Solutions completed 3,188 m of drilling on the Ruby Creek deposit, which has a combined Measured and Indicate resource of 275.4 Mt grading 0.067% Mo.

6.2.2. Eaglehead (Carmax Mining Corp.)

The Eaglehead copper-molybdenum-gold project is about 52 km east of Dease Lake and is owned by Carmax Mining Corp. Access to the project is by helicopter or via a rough road. The Eaglehead project consists of six mineralized zones. Two of those zones, the East and Bornite zones, contain estimated Inferred resources of 102.5 Mt averaging 0.29% Cu, 0.01% Mo and 0.08g/t Au.

Work in 2016 consisted of relogging historic core from 40 diamond-drill holes and sampling or re-sampling of this core. All available sample pulps (approximately 15,000) were re-analyzed to standardize sample digestion and analytical methods and to determine the silver content of the mineralization. Diamond drill core samples of mineralized zones and non-mineralized zones were also selected for measurement of chargeability and resistivity. Results were to be used to model Titan 24 geophysical survey responses. In December of 2016, Carmax announced positive results from grindability and flotation testing performed on mineralized samples.

6.2.3. Hat (Doubleview Capital Corp.)

The Hat gold-copper project is about 100 km east-southeast of Dease Lake. Doubleview Capital Corp. is exploring the property under an option agreement whereby they can obtain 100% of the project. The project contains the Lisle gold-copper alkali porphyry zone. In 2016, Doubleview completed 2,020 m of diamond drilling in five holes and results are pending.

6.2.4. Ootsa (Gold Reach Resources Ltd.)

The Ootsa copper-gold-molybdenum-silver project is approximately 90 km south-southwest of Houston, about 6 km east-southeast of the Huckleberry copper mine. The project is owned by Gold Reach Resources Ltd. Gold Reach released an updated resource estimate and Preliminary Economic Assessment (PEA) for the Ootsa project in March 2016. The PEA envisioned a toll-milling scenario whereby material would be milled and processed on a fee-basis at the Huckleberry mill facilities. Estimated capital costs for the proposed mining operation are $64 million.

No agreements are in place to conduct toll milling of Ootsa mill-feed at the Huckleberry facilities. The PEA presents initial details of a conventional pit and shovel mining operation at the East and West, Ox and Seel deposits. A 7-9 km partially floating conveyor system would transfer crushed material to the Huckleberry mill at 850 t per hour. Conventional grinding and flotation circuits already in place would produce a copper-gold-silver and separate molybdenum concentrates (Puritch et al., 2016).

A pit-constrained mineral resource estimate using a $8.50/t NSR cut-off is Measured plus indicated totaling 224.189 Mt grading 0.22% Cu, 0.15 g/t Au, 0.021% Mo and 2.8 g/t Ag. Inferred resources total 5.212 Mt grading 0.18% Cu, 0.09 g/t Au, 0.019% Mo and 2.6 g/t Ag.

Ground work on the Ootsa project in 2016 included evaluation of the Troitsa Peak prospect area about 8 km south of the Seel deposit. An alteration system of strong argillic replacement and silicified breccia zones of approximately 250 m by 1,700 m has been identified. Forty-seven rock outcrop and float samples were collected and returned anomalous gold-silver grades up to 1.4 g/t Au and 197 g/t Ag. A high-grade sample described returned values of 4.78% Cu and 96.9 g/t Ag. Follow up work is planned for 2017.

6.2.5. Pyramid (OK2 Minerals Ltd.)

The Pyramid gold-copper project is about 50 km north-northwest of Dease Lake and is owned by OK2 Minerals Ltd. Access to the project is via helicopter from Dease Lake.

The 2016 work program was the fourth year of grassroots and early-stage exploration activities and included geological mapping, rock sampling, prospecting and reconnaissance reverse circulation (RC) drilling. Two new zones of gold mineralization, Zone 3 and the Chili zone were discovered. Grab samples from zone 37 returned assays up to 82.96 g/t Au. The Chili zone is a 15 km² alteration assemblage from which rock samples graded up to 0.15% Cu and 0.18 g/t Au. The RC drilling was carried out on the known West zone and results will be used to rank areas for follow-up diamond drilling in 2017.

6.2.6. Spectrum-GJ (Skeena Resources Limited)

The Spectrum-GJ gold-copper project is about 30 km west of the Red Chris mine and is owned by Skeena Resources Limited. The property contains two separate mineral resources (Spectrum and GJ) that will be combined in a NI 43-101 Preliminary Economic Assessment, expected to be released in April, 2017. Currently, Spectrum has a pit constrained Indicated resource using a 0.5 g/t Au-equivalent cut-off of 8.59 Mt grading 1.04 g/t Au, 6.58 g/t Ag and 0.11% Cu and a pit constrained Inferred resource of 22.63 Mt grading 1.03 g/t Au, 3.85 g/t Ag and 0.11% Cu. For the GJ deposit using a 0.20% Cu cut off, Measured plus Indicated resources total 133.67 Mt averaging 0.32% Cu and 0.36 g/t Au. Inferred resources total 53.69 Mt grading 0.26% Cu and 0.33g/t Au.

In 2016, Skeena drilled 2,872 m in 8 holes at the GJ Donnelly deposit, and 6,279 m were drilled in 22 holes at the Spectrum Central Zone. The drilling was carried out to collect samples for metallurgical test work and to also better define the resource within planned mining areas. Highlights included 180 m grading 0.55 g/t Au and 0.15% Cu, including 73 m grading 0.97 g/t Au and 0.26% Cu at Spectrum. Results for the GJ Donnelly deposit are pending.
6.2.7. Whiting Creek (Huckleberry Mines Ltd.)

The Whiting Creek area is about 8 kilometres from the Huckleberry processing plant. In 2016, a small exploration program was conducted on the Whiting Creek portion of the Huckleberry claim group to meet the assessment requirement for these claims. Three diamond-drill holes were drilled to test the edges of the Creek zone, one of three known zones of mineralization at Whiting Creek. All three holes intersected copper mineralization with WC16-01 intersecting 70.1 m of 0.39% Cu and 0.02% Mo from surface, WC-16-02 intersecting 222.5 m of 0.31% Cu and 0.02% Mo both mineralized intervals starting from near surface and WC16-03 intersecting 152.4 m of 0.25% Cu and 0.02% Mo starting at a depth of approximately 185.0 m. The drilling shows that the Creek zone is open to the west, and has potential to have higher grades, as the intersection in WC16-01 included a 36.6 m intersection of 0.57% Cu.

6.3. Polymetallic base and precious metal projects

The Northwest Region hosts many significant volcanogenic and polymetallic vein deposits, the past producing Eskay Creek mine and the undeveloped Windy Craggy being prime examples. Precious metal enriched polymetallic prospects were a particular focus of attention in 2016.

6.3.1. Bow (Decade Resources Ltd.)

The Bow gold-copper project is about 45 km north of Stewart. Decade Resources Ltd. has an option agreement on the property allowing them to earn an 80% interest. In 2016, Decade carried out chip sampling and diamond drilling. Highlight drilling results included 6.09 m of 17.17 g/t Au, 47.27 g/t Ag and 0.165% Co and 5.80 m of 21.18 g/t Au, 48.81 g/t Ag and 0.227% Co.

6.3.2. Dolly Varden (Dolly Varden Silver Corporation)

The 88 km² Dolly Varden silver project is about 145 km north-northwest of Terrace and is owned by Dolly Varden Silver Corporation. The project is most easily accessed from Terrace, via a 224 km long all-weather road to the historical mining town and port of Kitsault, which is 25 km south of the property, and then by a 15-minute helicopter flight. Alternatively, the village of Alice Arm is accessed from Kitsault by passenger boat or Prince Rupert, via a privately contracted barge or float plane service. From Alice Arm, the property can be accessed by an all-weather gravel surfaced road that is currently being maintained by stakeholders in the Kitsault Valley, including Homestake Resources Corp. (formerly Bravo Gold Corp.) and by Kitsault Hydro Electric Corporation. The Alice Arm access road is not maintained in the winter.

In 2016, Dolly Varden carried out surface mapping and sampling, and completed 2,311 m of diamond drilling in 13 holes. Diamond drilling was carried out on the Torbit deposit and in the Ace-Galena area. Drilling at Torbit intersected multiple mineralized zones including 2.0 m of 2.488.5 g/t Ag within a broader intersection of 19.4 m grading 485 g/t Ag. Drilling at Ace-Galena extended known mineralized horizons 300 m along strike and results included 3.25 m of 405.77 g/t Ag, 0.12% Pb and 0.16% Zn within a broader intersection of 66.46 m of 59.97 g/t Ag, 0.12% Pb and 0.10% Zn.

6.3.3. Fireweed (Shamrock Enterprises Inc.)

The 24.1 km² Fireweed project is about 20 km northeast of Smithers and is under option to Shamrock Enterprises Inc. from Regulus Resources Ltd. In late 2016, Shamrock announced a planned 700 m diamond drill program designed to test a polymetallic target known as the South Zone. A mineralized float sample from the South Zone assayed 479 g/t Ag, 2.6 g/t Au, 0.28% Cu, 1.3% Pb and 2.6% Zn.

6.3.4. Kirkham (Metallis Resources Inc.)

The 106 km² Kirkham project is about 65 km north of Stewart and is owned by Metallis Resources Inc. The property is prospective for high-grade precious metal veins, Eskay Creek-type stratiform mineralization and porphyry copper-gold deposits. In the fall of 2016 a VTEM/magnetic/radiometric airborne survey was carried out on portions of the property not covered by the same survey methods in 2013. Results will be integrated and interpreted to design a 2017 exploration program that includes proposed drilling.

6.3.5. Red Cliff (Decade Resources Ltd.)

The Red Cliff gold-copper project is 20 km north-northeast of Stewart. Decade Resources Ltd. owns 65% of the project. In 2016, Decade carried out geochemical surveys, rock sampling and a small diamond drilling program. Drill results are pending.

6.4. Mafic and ultramafic hosted projects

Although not numerous, the Northwest Region has several advanced ultramafic-hosted metallic prospects, including magmatic intrusion-hosted and serpentinite-hosted nickel occurrences. One project had significant reported activity in 2016.

6.4.1. E&L (Garibaldi Resources Corp.)

The E&L property is about 50 km southwest of the Bob Quinn airstrip and Garibaldi Resources Corp. is the operator. Garibaldi can acquire a 100% interest in the property under the terms of a four-year option agreement signed in June 2016. Garibaldi carried out prospecting, geological mapping and rock sampling. Highlights at E&L include a 12 m wide channel sample that returned 1.6% Ni and 1.57% Cu and included 8 m at 2.3% Ni and 2.2% Cu.

6.5. Coal projects

The Northwest Region contains the Tuya and Telkwa coalfields and a portion of the Groundhog-Klappan coalfield, which are prospective for anthracite coal deposits.

6.5.1. Telkwa (Telkwa Coal Limited)

The Telkwa coal project is about 10 km southwest of Telkwa and 18 km south-southeast of Smithers. The project was
recently acquired by Allegiance Coal Ltd. but remains subject to shareholder approval from seller, Telkwa Coal Limited (TLC) who had optioned the property from Altius Minerals Corporation. Access to the project is via a gravel road that spur southwest from provincial highway 16 and the Canadian National Railway mainline is within 10 km of the project.

A technical report 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. During 2015 and the first half of 2016, TLC completed two internal scoping studies. One study focussed on updating aspects of a 1996 feasibility study assuming a constant rate of production versus the second study which proposed a staged approach of an initial small mine gradually transitioning into a major mine.

Both studies focussed on producing a low ash semi-soft coking coal at a yield of around 70% to be marketed to Asian steel markets. Both studies indicated favorable economics using a late 2015 coal spot price.

7. Geological research

In 2016, geological research in the Northwest Region was carried out by the British Columbia Geological Survey (BCGS), Geological Survey of Canada (GSC) and Geoscience BC.

The Porphyry Environment Transitions project is a collaboration with the GSC through the Geo-mapping for Energy and Minerals (GEM 2) program. In 2016, mapping was completed in the Turtle Lake map area, a region assumed to have been part of the Stuhini forearc (Late Triassic). Topical studies are also being directed at establishing lithostratigraphic framework of prospective Upper Cretaceous rocks using new geochronologic and geochemical data, documenting Middle to Late Triassic volcanics and high-sulfidation deposits. BCGS, in collaboration with the GSC’s Targeted Geoscience Initiative (TGI-5) program examined the orogenic gold potential of the Llewellyn fault, a north-northwest striking structure near the British Columbia-Yukon border, ~50 km west of the town of Atlin. A number of disparate gold prospects and past-producing mines (e.g., Engineer, Venus, Mt Skukum) occur near the fault and show a variety of characteristics from intrusion- to mesothermal-related styles of mineralization. This project will assess the genetic relationship of these deposits and determine if they are part of an ‘orogenic’ gold system, intrinsically related to crustal-scale deformation along the Llewellyn fault.

8. Summary

The Northwest Region is highly prospective for mineral deposit discovery. The region has a number of advanced and proposed mine projects. The Silvertip and Brucejack projects are expected to reach production status in the near term. The region also has numerous active exploration projects, primarily for precious and base metals.

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