Provincial Overview of Exploration and Mining in British Columbia, 2015

BRITISH COLUMBIA | Ministry of Energy and Mines

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Ministry of Energy and Mines, British Columbia Geological Survey
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Front Cover: Pretium Resources Inc.'s Brucejack Project Site, June 2015. **Photo courtesy of Pretium Resources Inc.**

Back Cover: Skeena Resources Limited's Spectrum Project. **Photo by Jeff Kyba.**

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Victoria
British Columbia
Canada

January 2016

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 Mine*s* was published. Detailing significant projects region-by-region, the volume complements the British Columbia Coal Industry Overview (British Columbia Geological Survey Information Circular 2016-2).

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. Late in the year, the Regional Geologists conduct informal phone and email surveys. Exploration expenditure estimates, rounded to the nearest $ 1 million, are broken down by category: grassroots exploration, early-stage exploration, advanced exploration, mine evaluation, and mine lease exploration.

- 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, 2016

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Exploration and Mining in British Columbia, 2015: A summary

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1. Introduction

Reflecting its complex geological history, British Columbia is endowed with diverse minerals and deposit types. British Columbia is Canada's largest exporter of coal, leading producer of copper, and only producer of molybdenum. Also produced are significant amounts of gold, silver, lead, and zinc, and over 30 industrial minerals including gypsum, magnesite, limestone, and dimension stone. Numerous quarries produce sand and gravel or crushed aggregate.

Despite decreased commodity prices and continued difficulties securing venture capital, mine development projects and numerous mineral exploration projects remained active in 2015 (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 2016-2) and incorporates reports, presented in this volume, from five 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 estimates total value of mine production for 2015 at $6.9 billion (Fig. 3), including coal, copper, industrial minerals, aggregate, gold, molybdenum, silver, zinc, and lead. This is close to the 2014 preliminary value reported by NRCAN of $7.0 billion (Fig. 4). For 2015, coal remained the highest value mine product from British Columbia, comprising about 44% of the total output, followed by copper (about 35%).

In 2015, 11 metal mines operated during at least part of the year (Table 2) and coal was produced at five large open pit operations in the southeastern part of the province and one underground mine on Vancouver Island (Table 3). About 30 industrial mineral mines and more than 1,000 aggregate mines/quarries were in operation. At the start of 2016, mine closures reduced the number of operating metal mines to seven and operating coal mines to five.

3. Mining highlights

3.1. Metal mines

Metal mines accounted for an estimated $3.02 billion of all mine production in 2015, representing about 44% of all mine production in the province (Table 2). Nine metal mines were in production at the start of 2015. This number dropped to eight by the end of the year, and to seven as of January 2016.

Imperial Metals Corporation's **Mount Polley** mine resumed operations in August after a one-year shutdown due to a tailings pond dam breach in 2014. In June, Nystar N.V.'s **Myra Falls** base metal mine suspended operations, primarily due to low base-metal prices. Also in June, Barkerville Gold Mines Ltd.'s **Bonanza Ledge** mine operation went on care and maintenance as new management decided to assess the operation and carry out an exploration program to identify multiple high-grade gold deposits. In July, Banks Island Gold Ltd.'s, **Yellow Giant** gold was mine shut down due to regulatory compliance issues. Although Huckleberry Mines Ltd.'s **Huckleberry Mine** produced throughout 2015, in January 2016 it was announced that pit operations were to be shut down.

In the Skeena Region, Imperial Metals Corporation's **Red Chris** copper-gold mine shipped their first load of concentrate to Asia in April and commercial production was declared on July 1st. In the Omineca Region, ramp-up activities continued at Thomson Creek Metals Company Inc.'s **Mt. Milligan mine** (Fig. 5) as it completed its second full year of operations. By the end of November, average daily mill throughput reached 59,066 tonnes, essentially reaching a year-end target processing rate of 60,000 tonnes per day.

In the Thompson-Okanagan-Cariboo Region, Copper

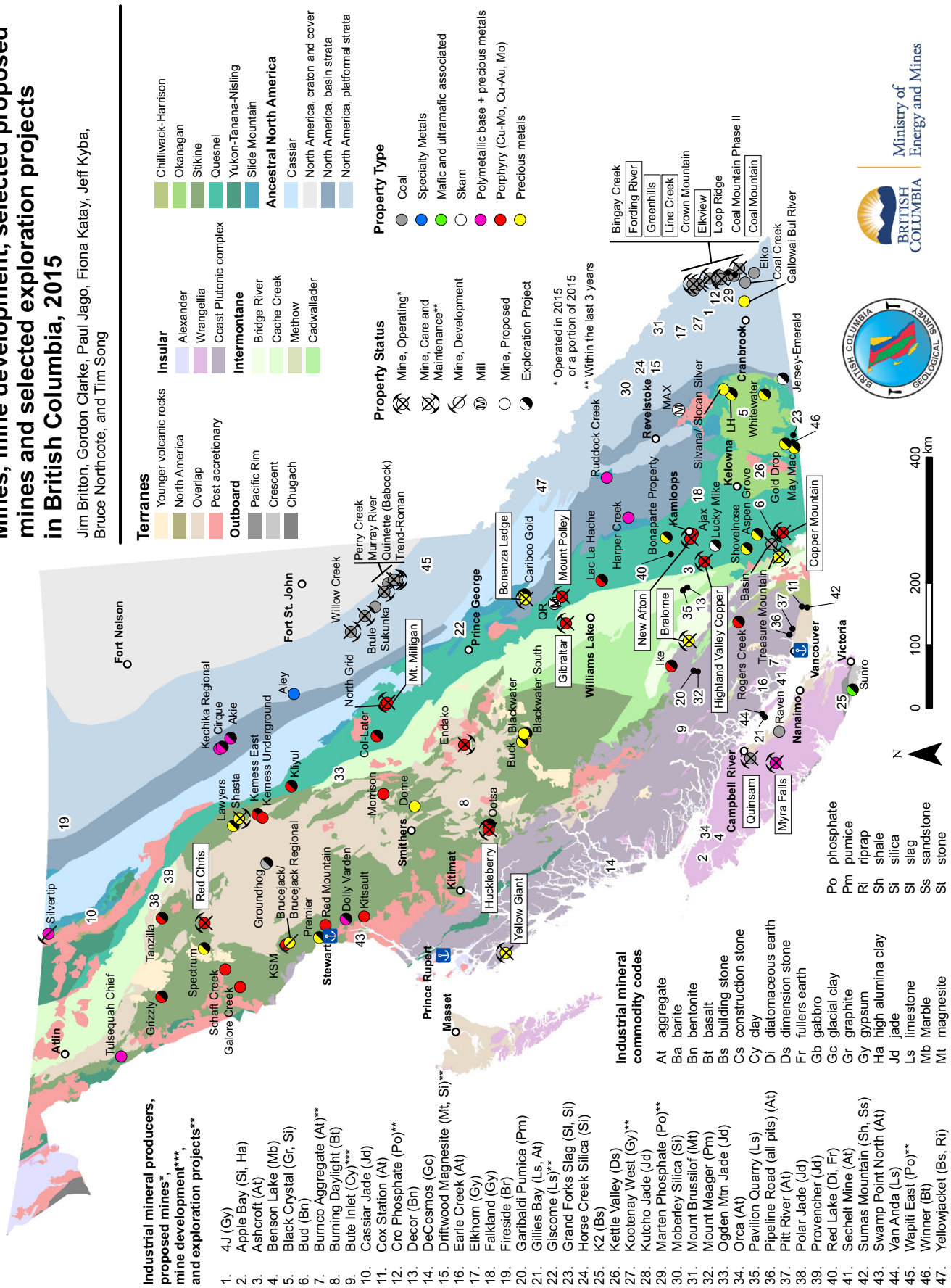

Fig. 1. Mines, mine development, selected proposed mines and selected exploration projects in British Columbia, 2015.

Table 1. Regional Geologists contact information.

Region	Community	Regional Geologist	Phone	email
Skeena	Smithers	Jeff Kyba	250-847-7787	Jeff.Kyba@gov.bc.ca
Omineca and Northeast	Prince George	Paul Jago	250-565-4316	Paul.Jago@gov.bc.ca
Thompson-Okanagan-Cariboo	Kamloops	Jim Britton	250-371-3903	Jim.Britton@gov.bc.ca
Kootenay-Boundary	Cranbrook	Fiona Katay	250-426-1758	Fiona.Katay@gov.bc.ca
South Coast and West Coast	Vancouver	Bruce Northcote	604-660-2713	Bruce.Northcote@gov.bc.ca
Mineral Development Office	Vancouver	Gordon Clarke	604-660-3332	Gordon.Clarke@gov.bc.ca

Fig. 2. The Regional Geologists monitor mining and exploration from bases in Smithers, Prince George, Kamloops, Cranbrook, and Vancouver.

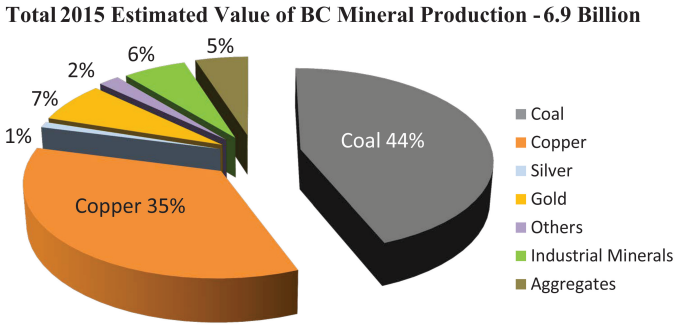

Fig. 3. Estimated value of British Columbia mineral production for 2015.

Mountain Mining Corporation consistently met production targets at its **Copper Mountain** mine after a new secondary crusher was installed in 2014. Teck Resources Ltd's **Highland Valley** mine achieved throughputs of 139,000 tonnes per day, exceeding its rated capacity of 130,000 tonnes per day. New Gold Inc. continued to advance their **New Afton** mine, and their new mill was commissioned ahead of schedule in the second quarter of 2015.

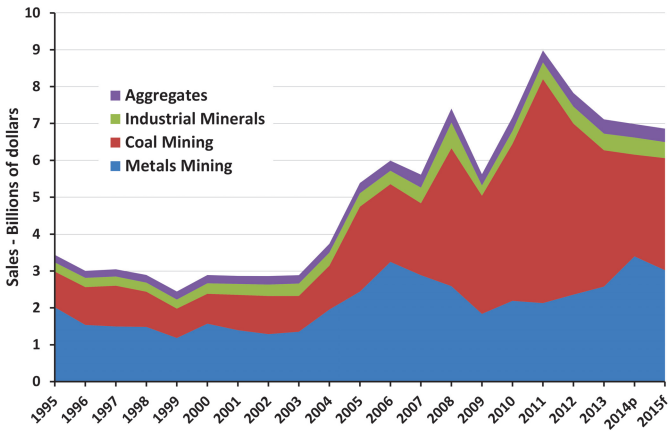

Fig. 4. Value of British Columbia mineral production by year.

Fig. 5. Blast hole drills in pit at Mt. Milligan mine.

3.2. Coal mines

Six operating coal mines (Table 3) accounted for an estimated $3.04 billion of production for 2015, representing about 44% of all mineral production in the province. The mines included five large open-pit operations of Teck Coal Limited. in southeastern British Columbia (Fig. 6) and the underground operation of Hillsborough Resources Ltd. on Vancouver Island.

Teck Coal Limited. carried out cost-cutting measures

Fig. 6. Pit operations at Teck Coal Limited's Greenhills coal mine.

including rotating 3-week shutdowns during the summer. Hillsborough Resources Ltd.'s underground operation shut down for several weeks over the summer. Although production resumed in August, operations were suspended indefinitely in early January 2016. Shutdowns were due to an oversupply in coal and steel markets that caused global prices to fall for the third straight year. Premium hard coking coal dropped to $89 from $121 in 2014, pulverized coal injection coal to $73 from $107, and thermal coal to $64 from $82 (all prices are per tonne, in $US, estimated, West Coast port price).

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 $435 million (6% of total mineral production) and for aggregates of $364 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.

In the Skeena Region, Highbank Resources Ltd. began operations at their new **Swamp Point North** aggregate mine, 51 km south of Stewart. In the Northeast Region, Fireside Minerals Ltd. finished mining of its Bear pit. Overburden pre-stripping prepared the Moose Pit at the **Fireside** barite mine for mining in 2016. In the Kootenay-Boundary Region, Heemskirk Canada Limited continued with redeveloping their **Moberly Silica** operation. In addition to producing high quality silica sand for industrial applications they plan to produce frac sand. Commissioning of a new plant capable of processing up to 300,000 tonnes per year is expected by late 2016 or early 2017. Frac sand will comprise 64% of production.

In the South and West Coast regions, 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 2015 mine development projects are in the Skeena Region (Table 5).

Pretium Resources Inc.'s **Brucejack** high-grade gold project was permitted, and an initial $540 M (US) tranche of construction financing was secured. Mine site construction is underway and operations are scheduled to start up in 2017. In June, JDS Silver received their Mines Act Permit to mill up to 75,000 tonnes per year from their underground **Silvertip,** silver-lead-zinc deposit. In 2015, the company refurbished access to the site. Mill and camp facility construction is planned for 2016; operations are projected to start up in the fall of 2016.

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. Skeena Region

5.1.1. Proposed metal mines

The Skeena Region was the most active in the province, with a number of high-profile projects.

Metal Mountain Resources Inc. and subsidiary Gavin Mines Inc. partnered with Grace Mining Inc. to work towards restarting the historic **Dome Mountain** gold and silver mine. An amended mines act permit is required to allow on site milling and tailings disposal. The **Galore Creek** copper-gold-silver project is owned by the Galore Creek Partnership, in which a wholly owned subsidiary of Novagold Resources Inc. and Teck Resources Ltd. are equal partners. In 2015, 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. In 2015, Alloycorp completed pre-construction earthworks for a new mill site, upgraded a critical bridge access, and increased camp capacity to house several hundred construction workers.

Seabridge Gold Inc. continued work on their fully permitted **KSM** copper-gold porphyry deposit. Drilling at depth intersected higher average grades than the presently defined 2.16 billion tonnes of Reserves. Highlights include 483 m

Table 2. Operating metal mines, 2015, forecast mine production, reserves and resources.

Mine	Region	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Huckleberry	Skeena	Huckleberry Mines Ltd.	copper, gold, silver, molybdenum; porphyry Cu-Mo-Au; 093E 037	15,244 t (33.6 Mlb) Cu, 81 kg (2,616 oz) Au, 4,924 kg (158,339 oz) Ag	42 Mt at 0.33% Cu and 0.01% Mo	180.7 Mt at 0.32% Cu, 0.01% Mo	Year four of Main Zone Optimization Plan completed in 2015. Early 2016 announcement of pit closure and layoffs
Red Chris	Skeena	Red Chris Development Company Ltd.	copper, gold; porphyry Cu-Au; 104H 005	17,282 t (38.1 Mlb) Cu, 495 kg (15,925 oz) Au	301.5 Mt at 0.36% Cu and 0.27 g/t Au	1,034.7 Mt at 0.35% Cu, 0.35 g/t Au, 1.14 g/t Ag	First eight months of production (Feb.-Sept.)
Yellow Giant	Skeena	Banks Island Gold Ltd.	gold, silver; Au-quartz veins 103G 024 103G 026	279 kg (9,555 oz) Au, 866 kg (27,846 oz) Ag	n/a	78,000 t at 23 g/t Au, 43 g/t Ag (2013)	Temporarily shut down
Mt. Milligan	Omineca	Thompson Creek Metals Company Inc.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194	32,124 t (70.8 Mlb) copper; 6771 kg (217,700 oz) gold	542.1 Mt at 0.201% Cu and 0.355 g/t Au; containing 1.092 Mt (2407.4 Mlb) Cu and 192.8 t (6.20 Moz) Au	122.3 Mt at 0.15% Cu and 0.321 g/t Au (additional to reserves)	Ramp-up continued, engineering studies for permanent secondary crushing circuit, second SAG mill discharge screen deck installed, Q1-Q3 reported capex was $43.7 million
Bonanza Ledge (on care and maintenance as of June 2015)	Thompson-Okanagan-Cariboo	Barkerville Gold Mines Ltd.	gold; pyrite replacement; 093H 140	11,162 oz Au	Nil	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)	Previously reported reserves have been reclassified as resources because profitable mining has not been demonstrated since test mining began in 2014. Ore was trucked and processed at the QR mill until June of 2015
Copper Mountain	Thompson-Okanagan-Cariboo	Copper Mountain / Mitsubishi Materials	copper, gold, silver; alkalic porphyry; 092HSE 001	77.6 Mlb Cu; 29,200 oz Au; 288,400 oz Ag	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)	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)	-

Table 2. Continued.

Gibraltar	Thompson-Okanagan-Cariboo	Taseko Mines Ltd.	copper, molybdenum; calc-alkalic porphyry; 093B 012	144 Mlb Cu; 1.3 Mlb Mo.	Proven and Probable reserves (as of 2014-12-31; cut-off not stated): 749 Mt grading 0.256% Cu and 0.008% Mo. (Recoverable metal: 3.3 Blb Cu)	Measured and Indicated resources (as of 2014-12-31; cut-off grade not stated): 1,092 Mt grading 0.254% Cu and 0.008% Mo	-
Highland Valley Copper	Thompson-Okanagan-Cariboo	Teck Highland Valley Copper Partnership	copper, molybdenum; calc-alkalic porphyry; 092ISW012	146,900 t Cu; 3.3 Mlb Mo	Proven and Probable reserves (as of 2014-12-31; cut-off not stated): 608 Mt grading 0.30% Cu; 0.008% Mo. (Recoverable metal: 1,570,000 t Cu; 30,000 t Mo.)	Resources (as of 2014-12-31; cut-off not stated): Measured: 395 Mt grading 0.32% Cu; 0.009% Mo; Indicated: 913 Mt grading 0.22% Cu; 0.011% Mo	-
Mount Polley (operations resumed August 2015)	Thompson-Okanagan-Cariboo	Imperial Metals Corporation	copper; gold; silver; alkalic porphyry; 093A 008	5.8 Mlb Cu; 11,000 oz Au; 30,000 oz Ag	Probable reserves (as of 2014-01-01; 0.15% Cu cut-off): 86 Mt grading 0.295% Cu, 0.30 g/t Au, 0.62 g/t Ag	Measured and Indicated resources (as of 2014-01-01; 0.15% Cu cut-off): 411 Mt grading 0.28% Cu, 0.29 g/t Au, 0.81 g/t Ag	Company did not upgrade reserve and resource information for 2015
New Afton	Thompson-Okanagan-Cariboo	New Gold Inc.	copper, gold; alkalic porphyry; 092INE 023	405,000 oz Au; 1.8 Moz Ag; 95 Mlb Cu	Proven and Probable reserves (as of 2014-12-31; cut-off not stated): 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)	Measured and Indicated resources (as of 2014-01-01; cut-off not stated): 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 Blbs Cu)	-
Myra Falls	West Coast	Nyrstar N.V.	Zn, Cu, Pb, Au, Ag; G06: Noranda/Kuroko Massive Sulphide Cu-Pb-Zn; 092F 330, 092F 073	145,000 t 6.91% Zn 0.47% Pb 0.69% Cu, 1.24 g/t Au, 51.94 g/t Ag (9,000 t Zn, 200 t Pb, 600 t Cu, 4,000 oz Au, 209,000 oz Ag)	5.87 Mt 5.92% Zn 0.61% Pb 0.85% Cu 61.50 g/t Ag 1.54 g/t Au	7.36 Mt 6.41% Zn 0.66% Pb 1.00% Cu 66.31 g/t Ag 1.72 g/t Au	Operations suspended Q2. Resource inclusive of reserves

Table 3. Operating coal mines, 2015, forecast mine production and reserves.

Mine	Region	Operator	Commodity; deposit type	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Fording River	Kootenay-Boundary	Teck Coal Limited (100%)	Coal HCC, TC	7.9 Mt	Proven + Probable: 620.4 Mt HCC + 4.5 Mt TC	Measured + Indicated: 1149 Mt HCC + 9 Mt TC; Inferred: 0.8 Mt HCC + 6 Mt TC	EA approval of Swift expansion (2015); exploration drilling in active pits
Greenhills	Kootenay-Boundary	Teck Coal Limited (80%); POSCAN (20%)	Coal HCC, PCI, TC	5.2 Mt	Proven + Probable: 60.6 Mt HCC + 3.7 Mt PCI + 1.2 Mt TC	Measured + Indicated: 264.5 Mt HCC + 1.8 Mt PCI + 3.6 Mt TC	Cougar Pit Expansion (CPX) is preparing for pre-application of EA; environmental baseline
Line Creek	Kootenay-Boundary	Teck Coal Limited (100%)	Coal HCC, PCI, TC	3.1 Mt	Proven + Probable: 66.8 Mt HCC + 3.1 Mt PCI + 8.7 Mt TC	Measured + Indicated: 712 Mt HCC + 0.7 Mt PCI + 9.1 Mt TC	Burnt Ridge Extension (BRX) in pre-application of EA (2014); pre-stripping at Line Creek Phase II (2013 EA approval)
Elkview	Kootenay-Boundary	Teck Coal Limited (95%); Nippon Steel & Sumimoto Metal Corp. (2.5%), POSCO (2.5%)	Coal HCC	6.3 Mt	Proven + Probable: 215.2 Mt HCC	Measured + Indicated: 705.3 Mt HCC; Inferred: 176.2 Mt HCC	Baldy Ridge Extension (BRE) in pre-application of EA (2014); exploration drilling in active pits; development progressing in new approved mining areas
Coal Mountain	Kootenay-Boundary	Teck Coal Limited (100%)	Coal PCI, TC	2.3 Mt	1.6 Mt Proven+ 5.6 Mt Probable PCI	57.7 Mt Measured + 82.9 Mt Indicated + 9.6 Mt Inferred	Coal Mountain Phase II (CMO2; Marten Wheeler) entered pre-application of EA (2014) but withdrawn late 2015; Mineable resource at CMO is nearing depletion and expected mine shut down in late 2017
Quinsam	Northeast	Hillsborough Resources Ltd.	Coal TC	130,000 t	N/A	N/A	Operated below capacity in 2015. Suspension of operations announced early January, 2016

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

(1,272 m to 1,755 m) grading 0.43g/t Au and 0.56% Cu at the Deep Kerr deposit and 174.4 m averaging 0.55 g/t Au and 0.28% Cu from 1,207.4-1,381.8 m at the Mitchell deposit. An updated resource estimate for the Deep Kerr zone is expected in early 2016.

Pacific Booker Minerals Inc.'s **Morrison** copper-gold-molybdenum-silver porphyry project resumed the Environmental Assessment process in June, after being halted to incorporate recommendations of the panel report on the causes of the Mount Polley mine tailings dam breach. In July, 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 is now undergoing further review.

IDM Mining Ltd. began the Environmental review process for their proposed **Red Mountain** (Fig. 7) gold-silver mine by submitting a project description in August. On-site work in 2015 consisted of environmental baseline studies. The proposed 1,000 tonne per day mine plans to operate during nine months of the year over a forecasted five year mine life. Anticipated capital expenditure is $97.4 million.

At the **Schaft Creek** copper-molybdenum-gold-silver porphyry project, Teck Resources Ltd. (75%) and Copper Fox Metals Inc. (25%) completed exploration drilling (including

Table 4. Selected industrial mineral mines and quarries, 2015, forecast mine production, reserves and resources.

Mine	Region	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Burning Daylight	Skeena	Stone Ridge Quarries Ltd.	columnar basalt; dimension stone;	700 t	n/a	n/a	Seasonal production
Swamp Point North	Skeena	Highbank Resources Ltd.	sand and gravel; medial moraine;	4,000 t	n/a	71.7 Mt	Awaiting aggregate contracts around Prince Rupert
Fireside	Northeast	Fireside Minerals Ltd.	barite; vein barite; 094M 003	32,000 t	485,000 t (non NI 43-101 compliant)	N/A	Bear Pit has been mined out, pre-stripping overburden at Moose Pit.
Ogden Mountain	Omineca	Green Mountain Gemstones Inc.	nephrite jade; jade; 093N 156, 093N 165	N/A	N/A	N/A	Exploration and placer mining of alluvial jade boulders, excavation of in situ jade
Yellowjacket	Omineca	Private individual	Construction stone	3000 t	N/A	N/A	Mined rock for riprap material
Mount Brussilof	Kootenay-Boundary	Baymag Inc.	Magnesite; hydrothermal sparry magnesite; 082JNW001	220,000 t annually	50 Mt Proven	-	MgO, and MgOH; sediment-hosted sparry magnesite
Moberley Silica	Kootenay-Boundary	Heemskirk Canada Ltd.	Silica; industrial use silica, frac sand; 082N001	n/a	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	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 + Indicated	$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
Horse Creek Silica	Kootenay-Boundary	HiTest Sand Inc.	Silica; industrial use, aggregate; 082N 043	n/a	n/a	Estimated: 3 Mt at 99.5% Silica (1987)	Variety of aggregate and industrial use products
Elkhorn	Kootenay-Boundary	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; 082JSW021	400,000 t annually	n/a	n/a	5 years mine-life remaining; the company will replace production by developing the Kootenay West mine (in EA)
4J	Kootenay-Boundary	Georgia-Pacific Canada Limited	Gypsum; evaporitic bedded gypsum; 082JSW009	N/A; Processing stockpiled ore	n/a	20 Mt	Processing stockpiles; updating mine expansion plans

Table 4. Continued.

Black Crystal	Kootenay-Boundary	Eagle Graphite Corp.	Graphite; metamorphic hosted flake graphite; 082FNW260, 082FNW283	N/A; Quarry on Care and Maintenance; company focused on process optimization and exploration	n/a	Regolith: Measured + Indicated: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: Indicated: 4.765 Mt at 1.21% fixed carbon	Exploration drilling to expand the resource; update geological model and pit design; process optimization at plant; produced sample of 99.995% pure spheronized graphite from flake graphite; product suitable for Li-Ion battery specifications
Winner; Friday Quarry	Kootenay-Boundary	Roxul Inc.	Gabbro/basalt; crushed rock for mineral wool; 082ESE265	Quarrying to supply feed stock for mineral wool plant	n/a	n/a	Crushing, screening, stockpiling; environmental
Grand Forks Slag		Granby River Mining Company Inc.	Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264	Quarrying for abrasives and roofing granules	n/a	n/a	Crushing, screening; environmental
Ashcroft	Thompson-Okanagan-Cariboo	IG Machine and Fiber Ltd (IKO Industries Ltd.)	Basalt (roofing granules); 092INW 104	350 000 t	n/a	n/a	-
Bud	Thompson-Okanagan-Cariboo	Absorbent Products Ltd.	Bentonite; 092HSE 162	Not available	n/a	n/a	-
Decor	Thompson-Okanagan-Cariboo	Pacific Bentonite Ltd.	Alumina, landscape rock; 092INW 084	100 000 t	n/a	n/a	-
Falkland	Thompson-Okanagan-Cariboo	Lafarge Canada Inc.	Gypsum; 082LNW 001	6 000 t	n/a	n/a	-
Kettle Valley Quarries	Thompson-Okanagan-Cariboo	Kelowna Sand and Gravel Ltd / Kettle Valley Stone Ltd.	Ashlar, flagstone, thin veneer: 082ENW 109; 111; 112	Not available	n/a	n/a	-
Pavilion	Thompson-Okanagan-Cariboo	Graymont Western Canada Inc.	Limestone; 092INW 081	190 000 t	n/a	n/a	-
Red Lake	Thompson-Okanagan-Cariboo	Absorbent Products Ltd.	Diatomaceous earth; 092INE 081	Not available	n/a	n/a	-
Apple Bay (PEM 100)	South Coast	Electra Stone Ltd.	Silica+alumina; R12:Volcanic glass-perlite; 092L 150	70,000 t	n/a	n/a	Drilling, mapping sampling to assess resource. No results published. Drilling by Ashgrove Cement Company
Benson Lake	South Coast	Imasco Minerals Inc.	High brightness carbonate; R09:Limestone; 092L 295	56,000 t	n/a	100+ years	Reserves and resources not formally stated

Table 4. Continued.

Blubber Bay	South Coast	Ashgrove Cement Company	Limestone, dolostone; R09:Limestone; 092F 479	10,000 t+	n/a	100+ years	First of a multiple-barge dolomite shipment to continue into 2016
Garibaldi Pumice	South Coast	Garibaldi Pumice Ltd.	Pumice; R11:volcanic ash; 092JW 039	18,000 m^3	n/a	14,396,000 m^3 pumice 4,990,000 m^3 pumicite (fines)	2014 resource estimate. Near-lease test pits and LIDAR survey in 2015.
K2	South Coast	K2 Stone Quarries Inc.	Dimension stone, flagstone; R08:flagstone; 092C 159	22,000 t	n/a	n/a	Material extracted from quarry is cut to size
Sumas Shale	South Coast	Sumas Shale Ltd. (Clayburn Industries Ltd., Lafarge Canada Inc.)	Shale, clay, sandstone; B05:Residual kaolin; 092GSE024	480,000 t	n/a	50+ years	Product for cement production
Texada Quarry	South Coast	Texada Quarrying Ltd. (Lafarge Canada Inc.)	Limestone, aggregate; R09:Limestone; 092F 395	3,900,000 t	n/a	100+ years	Mostly limestone for cement production

Table 5. Mine development projects.

Project	Region	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
Brucejack	Skeena	Pretium Resources Inc.	Au, Ag; Au-quartz veins; quartz stockwork breccia; epithermal; 104B 193	16.5 Mt at 14.1 g/t Au, 57.7 g/t Ag	15.3 Mt at 17.6 g/t Au, 14.3 g/t Ag	40,000 m underground infill drill program, underground mine development: 1,573 m of lateral workings and 239 m of raise workings.	Mine construction underway; aiming for commercial production by 2017
Silvertip	Skeena	JDS Silver	Ag, Pb, Zn, Au; Polymetallic manto; 104O 038	n/a	2.455 Mt at 315 g/t Ag, 5.88% Pb, 6.28% Zn, 0.413 g/t Au	Road reconditioning, pre-construction earthworks, mill and process plant acquisition	Fully permitted, construction dependant on financing

182 m grading 0.20% Cu), re-logging of previous drill core and regional mapping.

In 2015, the British Columbia Environment Minister announced that the environmental assessment certificate for Chieftain Metals Corp.'s **Tulsequah Chief** zinc-copper-gold massive sulphide project would remain in effect for the life of the project. A pre-production expenditure of $198 million was announced by Chieftain, and the company is seeking financing.

5.2. Omineca Region

5.2.1. Proposed metal mines

Taseko Mines Limited and subsidiary Aley Corporation Limited continued to gather environmental baseline data at their **Aley** niobium project, and carried out engineering and metallurgical test work to verify and improve results of a 2014 feasibility study. An open-pit mine with a 10,000 tonnes per day processing plant and ferroniobium convertor is proposed. Average annual production over the 24 year mine life would be about 9,000 tonnes niobium in the form of ferroniobium (annual production of about 14,000 tonnes FeNb).

At New Gold Inc.'s **Blackwater** gold and silver project, engineering and environmental studies continued, including a tailings alternatives assessment, in support of their Environmental Assessment, which remained in the screening stage, at the end of the pre-application phase. The project is proposed as an open-pit mining operation, with a 60,000 tonnes

Fig. 7. IDM Mining's Red Mountain project camp (view looking south).

per day processing plant and a mine life of 17 years.

AuRico Metals Inc. continued to advance its proposed **Kemess Underground** (KUG) block cave mine through a Substituted (federally and provincially harmonized) Environmental Assessment, and worked on an updated feasibility study. Geotechnical diamond and auger drilling was undertaken on key infrastructure areas, including the proposed triple decline portal, short tunnel portal, and conveyor areas. Test pitting was completed to determine geotechnical and substrate characteristics. The underground block cave operation would use processing facilities and infrastructure at the former Kemess South mine. A proposed average milling rate of 24,650 tonnes per day would have an annual production of 3,266 kg (105,000 ounces) of Au and 19,958 t (44 million pounds) of Cu, over a mine life of 12 years.

5.2.2. Proposed industrial mineral mines

At their **Giscome** limestone property, Graymont Western Canada Inc. continued engineering and environmental studies in support of an Environmental Assessment draft application and final lime plant and quarry designs. A 1,000 tonne bulk limestone sample was collected for crushing and kilning tests. Graymont proposes a 600,000 tonnes per year limestone quarry that would feed a vertical lime kiln 198,000 tonnes annually over a minimum 50 year mine life.

5.3. Northeast Region

5.3.1. Proposed coal mines

In 2015, HD Mining continued work on their **Murray River** project. Engineering and environmental studies in support of their Environmental Assessment continued, and work progressed on a decline to collect an underground bulk coal sample. Exploration drilling from the face of the decline was undertaken to further delineate seam geometry and establish coal characteristics. An 11-hole surface drilling program was also completed for additional coal resource data and to characterize deep-level groundwater. Coal quality results of the bulk sample will determine if the project is viable. The proposed underground longwall mining operation would have a production rate of 4.8 Mt of saleable coal per year over a 25 year mine life. In October, an Environmental Assessment certificate for the project was issued.

Engineering and environmental studies continued for the **Sukunka** project of Glencore plc (75% interest) and JX Nippon Oil & Energy Corporation (25% interest). An open-pit mining operation with initial production of 1.5-2.5 Mt of saleable metallurgical coal per year is proposed. Addition of a room-and-pillar underground mining component in a future mine plan would increase production to 6 Mt per year. Mine life is expected to exceed 20 years. A substituted Environmental Assessment application for the project was accepted for review in August.

5.3.2. Proposed industrial mineral mines

At the **Wapiti East** phosphate project, Fertoz International Inc. upgraded their JORC resource estimate and completed a scoping study for mining of a surface resource. A seasonal (May-October) shallow open-pit mine, with a mine life of greater than 20 years, is proposed. Planned production is up to 75,000 tonnes per year of phosphate-bearing rock. A Mines Act permit application for the project was submitted in late 2014.

5.4. Kootenay-Boundary Region

5.4.1. Proposed metal mines

Purcell Basin Minerals Inc. is working to restart the **Gallowai Bul River** base and precious metal mine, which has been on care and maintenance since 2009. The property has existing infrastructure, including a 750 tonnes per day conventional mill, assay and metallurgical laboratories, tailings impoundment, waste dumps, and two open pits. Completing environmental baseline work and updating mine plans, the company is working towards fulfilling requirements for permit application.

Klondike Silver Corp's **Slocan Silver,** silver-lead, zinc project consists of several past-producing deposits. In 2015, the company focused on environmental work, and engineering upgrades to the tailings facility and underground structures.

5.4.2. Proposed coal mines

Centermount Coal Ltd. proposes an open pit and underground coal mine for its **Bingay Creek** property. Work in 2015 consisted of engineering, a geological review, and environmental baseline studies. Exploration drilling is planned for 2016. 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 of clean coal.

CrowsNest Pass Coal Mining Ltd. continued environmental baseline studies, geological modeling, engineering review, resource, and pre-feasibility work on their **Coal Creek** property.

Table 6. Selected proposed mine projects.

Project	Region	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
Dome Mountain	Skeena	Dome Mountain Resources of Canada Inc.	Au, Ag; Au-quartz veins; 093L 276	135,131 t at 11.2 g/t Au,	144,144 t at 17.7 g/t Au	Corporate negotiations between Metal Mountain Resources Inc., Gavin Mines Inc. and Grace Mining Inc.; winter drill program preparation.	Awaiting Mines Act permit amendment to allow mill construction on site
Galore Creek	Skeena	Galore Creek Mining Corp.	Cu, Au, Ag; Alkalic Porphyry; 104G 090	528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag	814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.21 g/t Ag	Baseline monitoring	Targeted studies; minimizing expenditure
Kitsault	Skeena	Alloycorp Mining Inc.	Mo, Ag; Porphyry Mo (Low F-type)	228.2 Mt at 0.083% Mo, 5.0 g/t Ag	321.8 Mt at 0.071% Mo, 4.8 g/t Ag	Pre-construction earthworks, Nass River Bridge upgrade, construction finance negotiations	Fully permitted, additional inferred Mo Resources at Bell and Roundy Creek deposits
KSM	Skeena	Seabridge Gold Inc.	Au, Cu, Ag, Mo; Calc-alkalic porphyry, 104B 103	2,164 Mt at 0.55 g/t Au, 0.21% Cu, 2.74 /t Ag, 44.7 g/t Mo	2,779.9 Mt at 0.55 g/t Au, 0.21% Cu, 2.9 g/t Ag, 55 g/t Mo	11,018 m drilling in 11 holes at Deep Kerr and Mitchell deposits, 1,579 line km airborne geophysics	Fully permitted; investigating viability of underground exploration portal
Morrison	Skeena	Pacific Booker Minerals Inc.	Cu, Au, Mo; Calc-Alkalic Porphyry; 93M 007	224.2 Mt at 0.33% Cu, 0.163 g/t Au, 40 g/t Mo	265.9 Mt at 0.35% Cu, 0.17 g/t Au, 50 g/t Mo	Re-submitted environmental assessment application	Ordered to undergo further assessment
Red Mountain	Skeena	IDM Resources	Au, Ag,; porphyry related gold; 103P 086	n/a	1.45 Mt at 8.15 g/t Au, 29.57 g/t Ag	Entered environmental assessment review	Initiated Feasibility study
Schaft Creek	Skeena	Teck Resources Limited	Cu, Mo, Au, Ag Calc-Alkalic porphyry; 104G 015	940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag	1,228.5 at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag	Drilling at La Casse zone, optimization of mine plan	Limited targeted studies
Tulsequah Chief	Skeena	Chieftain Metals Inc.	Au, Ag, Cu, Pb, Zn; Noranda/Kuroko massive sulphide; 104K 002	4.435 Mt at 2.85 g/t Au, 104 g/t Ag, 1.46% Cu, 1.29% Pb, 6.94% Zn	6.575 Mt at 2.82 g/t Au, 104.76 g/t Ag, 1.34% Cu, 1.33% Pb, 6.71% Zn	Construction financing negotiations	Fully permitted; substantially started (EA cert is valid for life of project)
Murray River	Northeast	HD Mining Int'l Ltd.	HCC; Bituminous coal; 093I 010	261.6 Mt mineable; proven	341.2 Mt in situ	Environmental Assessment (issued in October), driving decline, drilling (exploration, hydrogeological), bulk sample	Proposed underground longwall mining operation. Average annual production would be 4.8 Mt saleable coal. Mine life of 25 years
Sukunka	Northeast	Glencore plc	HCC; Bituminous coal; 093P 014	n/a	145 Mt in situ	Environmental Assessment (under review), updated resource and geologic model, engineering and environmental studies	Proposed open-pit mine. Initial annual production would be 1.5 - 2.5 Mt saleable coal. Mine life of >20 years

Table 6. Continued.

Wapiti East	Northeast	Fertoz Int'l Inc.	P_2O_5; Sedimentary phosphate deposits; 093I 008, 093I 022	n/a	0.81 Mt at 22.3% P_2O_5; Indicated	Upgraded resource, scoping study, small mine application submitted (late 2014)	Proposed seasonal shallow open-pit mine. Average annual production would be <75,000 t phosphate rock. Mine life of >20 years
Aley	Omineca	Taseko Mines Limited	Nb; Carbonatite-hosted deposit; 094B 027	83.8 Mt at 0.50% Nb_2O_5; containing 292.9 Mkg* Nb *calculated by Paul Jago	258.8 Mt at 0.37% Nb_2O_5; containing 669.4 Mkg* Nb (including Reserves) *calculated by Paul Jago	Environmental Assessment (pre-ap.), engineering studies, metallurgical testing, environmental data	Proposed open-pit mine with 10,000 t/d processing. Average annual production would be 9,000 t niobium. Mine Life of 24 years
Blackwater	Omineca	New Gold Inc.	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037	344.4 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 254,115 kg (8.17 Moz) Au, 1,891 t (60.8 Moz) Ag	396.9 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 295,483 kg (9.50 Moz) Au, 2,181 t (70.13 Moz) Ag (including Reserves)	Environmental Assessment (pre-ap.), engineering studies, environmental studies	Proposed open-pit mine with 60,000 t/d processing. Life-of-mine average annual production would be 12, 846 kg (413 Koz) Au and 54,182 kg (1.74 Moz) Ag Mine life of 17 years
Kemess Underground (KUG)	Omineca	AuRico Metals Inc.	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au; 094E 094	100.4 Mt at 0.28% Cu, 0.56 g/t Au, 2.0 g/t Ag; containing 280,842 t (619.2 Mlb) Cu, 56,142 kg (1.8 Moz) Au, 205,532 kg (6.6 Moz) Ag	65.4 Mt at 0.24% Cu, 0.41 g/t Au, 1.8 g/t Ag; containing 157,191 t (346.5 Mlb) Cu, 26,562 kg (854 Koz) Au, 118,535 kg (3.8 Moz) Ag (additional to reserves)	Environmental Assessment (pre-ap.), updated feasibility study, geotechnical drilling, test pitting	Proposed underground block cave mine with 24,600 t/d processing. Average annual production would be 3266 kg (105 Koz) Au and 19,958 t (44 Mlb) Cu. Mine life of 12 years
Giscome	Omineca	Graymont Western Canada Inc.	$CaCO_3$; Limestone; 093J 041, 093J 025	n/a	>100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ; Indicated	Environmental Assessment (under review), engineering and environmental studies, bulk sampling, test pitting	Proposed 600,000 t/y limestone quarry to feed a vertical lime kiln producing 198,000 t/y of lime. Mine life of >50 years
Bingay Creek	Kootenay-Boundary	Centremount Coal Ltd.	Coal (HCC); open pit and underground; 082JSE011	-	42.43 Mt Measured + 52.9 Mt Indicated (2012)	Environmental baseline studies; Engineering and geotechnical evaluation for mine design; permitting	Pre-application of EA (2012), on hold; 39Mt; 20-year mine life; 2 Mt/yr
Coal Creek	Kootenay-Boundary	CrowsNest Pass Coal Mining Ltd.	Coal (HCC and PCI); underground; 082GSE035	-	HCC + PCI: 616 Mt in the upper 3 near-surface seams (2014)	Prefeasibility Study (PFS); geological modeling; resource evaluation; baseline studies	Proposed underground mine; review of the historical mine workings of Coal Creek colliery (1897 to 1958)
Coal Mountain Phase II (Marten Wheeler)	Kootenay-Boundary	Teck Coal Ltd.	Coal (PCI and TC); open-pit and underground; 082GNE006	-	PCI + Thermal: 114.3 Mt Measured + 97.3 Mt Indicated (2015)	Environmental and baseline work; mine design; permitting	Pre-application of EA (2014); Potential of 76.5 Mt; 34-year mine life; 2.25Mt/yr; EA withdrawn in late 2015

Table 6. Continued.

Crown Mountain	Kootenay-Boundary	NWP Coal Canada Ltd. (Jameson Resources Ltd.)	Coal (HCC and PCI); open-pit; 082GNE018	HCC: 42.60 Mt Proven + 4.91 Mt Probable; PCI: 7.13 Mt Proven + 1.19 Mt Probable (2014)	HCC + PCI: 68.9 Mt Measured + 6.0 Mt Indicated (2014)	Prefeasibility studies; environmental and baseline work; mine design; permitting	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
Driftwood Magnesite	Kootenay-Boundary	MGX Minerals Inc.	Magnesite; hydrothermal sparry magnesite; quarry; 082KNE 068	-	-	Drilling; bulk sampling; environmental baseline work; metallurgical test work; lease application; mine design; preliminary plant design	Preliminary test work indicates recovery rates of 93.4% reverse flotation and removal of up to 70% silica and 30% calcium oxides
Gallowai Bul River	Kootenay-Boundary	Purcell Basin Minerals Inc.	Cu-Ag-Au+/-Pb-Zn; Cu-Ag veins; underground; 082GNW 002	-	90,720 t at 1.3% Cu, 0.31g/t Au, 21.77g/t Ag	Draft project proposal submitted to EA; Permitting; environmental baseline; mine plan and mine design; ARD/ML	Proposed restart of Bul River Mine; on care and maintenance
Kootenay West	Kootenay-Boundary	CertainTeed Gypsum Canada Inc.	Gypsum; evaporitic bedded gypsum; quarry; 082JSW005, 082JSW020	-	North and South Quarries: Total 18.7 Mt (at average quality of 83-85%)	Environmental baseline work; mine design	Pre-application of EA (2014); 400,000 t/yr; 42-year mine life; blended product to market specifications
Michel Creek (Loop Ridge)	Kootenay-Boundary	CanAus Coal Ltd.	Coal (HCC and PCI); open-pit and underground; 082GSE050	-	HCC: 44.6 Mt Measured + 42.5 Mt Indicated; open-pit and underground (2015)	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)
Slocan Silver (Silvana)	Kootenay-Boundary	Klondike Silver Corp.	Ag-Pb-Zn+/-Au; polymetallic veins; underground 082FNW 050, 013, 082KSW 006	-	-	Engineering reports: underground mining structure and tailings storage facilities; environmental monitoring	Mill on care and maintenance; work focused up upgrades identified in 2014 engineering and environmental reports

Table 6. Continued.

Ajax	Thompson-Okanagan-Cariboo	KGHM Ajax Mining Inc.	Cu, Au; Alkalic porphyry 092INE 012, 013	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)	Resources (M+I; ; NSR cut-off US$7.10/t): 568 Mt grading 0.26% Cu; 0.18 g/t Au; 0.35 g/t Ag	Environmental and engineering studies; exploration and condemnation drilling.	Project application accepted for review in November 2015. Review temporarily suspended by applicant to allow further study by First Nations
Harper Creek	Thompson-Okanagan-Cariboo	Yellowhead Mining Inc.	Cu, Au, Ag; Stratiform, volcanic-hosted 082M 008, 009	Reserves (P+P; cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag		Environmental and engineering studies.	Project application accepted for review in December 2014. Review suspended in October 2015 by company for economic reasons
New Prosperity	Thompson-Okanagan-Cariboo	Taseko Mines Ltd.	Cu, Au; Calc-alkalic porphyry; 092O 041	Reserves (P+P; cut-off not stated): 831 Mt grading 0.23% Cu and 0.41 g/t Au; containing (recoverable) 3.6 Blb Cu; 7.7 Moz Au		Company seeks a judicial review of Federal EA decision. Results pending.	Project at post-decision stage
Ruddock Creek	Thompson-Okanagan-Cariboo	Ruddock Creek Mining Corporation	Pb, Zn, Ag; Monashee-type sediment-hosted massive sulphide; 082M 082		Resources (M+I; cut-off 4.0% Pb+Zn): 6.2 Mt grading 6.50% Zn, 1.33% Pb	Environmental and permitting work.	Project at pre-application stage
Spanish Mountain	Thompson-Okanagan-Cariboo	Spanish Mountain Gold Ltd.	Au, Ag; Sediment-hosted gold; 093A 043		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	Environmental and permitting work.	Project at pre-application stage
BURNCO Aggregate	South Coast	BURNCO Rock Products Ltd.	Aggregate; B12: Sand and Gravel; N/A	-	Approx. 20 Mt	Permitting	Submitting applications for EA and Mines Act permit
Raven	West Coast	Compliance Energy Corporation	Bituminous coal; 092F 333	29.9 Mt	71.998 Mt	Permitting	Application for EA submitted for screening and withdrawn, 2015

Due to low coal prices, Teck Coal Limited. withdrew from the pre-application phase of Environmental Assessment for their **Coal Mountain Phase II** (Marten Wheeler) project. The project was designed to replace production at the Coal Mountain mine, which is now scheduled to shut down in 2017.

At the **Crown Mountain** property of NWP Coal Canada Ltd., (a wholly owned subsidiary of Jameson Resources Ltd.) baseline environmental studies were carried out. The project is in the pre-application stage of Environmental Assessment, and the proposed project would have a production capacity of 1.7 Mt per year of clean coal and a 16-year mine life.

CanAus Coal Ltd., a wholly owned subsidiary of CoalMont Pty Ltd., carried out drilling and collected a bulk sample for carbonization test work on their **Michel Creek** project. The project consists of the Loop Ridge, Tent Mountain and Michel Head deposits; work was concentrated at Loop Ridge. In October, the company entered the pre-application phase of Environmental Assessment, proposing to mine the Loop Ridge deposit. The project has a proposed production rate of 3.5 Mt per year (2.1 Mt per 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 10 years.

5.4.3. Proposed industrial mineral mines

At the **Driftwood Magnesite** property, MGX Minerals Inc. drilled (West zone) and bulk sampled (East zone) in 2015. The bulk sample will be used for further metallurgical testing and to evaluate processing options. The company is completing a NI 43-101 compliant resource. Test work was conducted to develop an optimized process design to remove silica and improve economic cut-off grades. They have applied for a mining lease for quarry operations, are conducting environmental baseline studies, and are evaluating mine designs.

CertainTeed Gypsum Canada Inc. continued to advance the proposed **Kootenay West Mine**, which entered the pre-application stages of Environmental Assessment in 2014. In 2015, the company focused on environmental work and mine design. They hope to begin site preparation in 2016, with a projected start-up in 2018. The proposed mine would have an average production rate of 400,000 tonnes per year, over a 42-year mine life, producing a blended product of 83-85% gypsum.

5.5. Thompson-Okanagan-Cariboo Region

5.5.1. Proposed metal mines

KGHM Ajax Mining Inc. continued engineering and baseline studies to advance their **Ajax** porphyry copper-gold project, a proposed 60,000 tonne-per-day open-pit operation with a projected 20 year life. In September 2015, the company submitted their application to the Environmental Assessment Office and Canadian Environmental Assessment Agency. Although the application was accepted, the company announced that it would suspend the process to allow First Nation partners more time to study the submission.

The **Harper Creek** copper-gold-silver project is owned by Yellowhead Mining Inc. In June 2015, the company requested an extension to their previously submitted application for an Environmental Assessment certificate to incorporate recommendations arising from the Mount Polley tailings spill in 2014. In October 2015, the company suspended work on the project due to a lack of funds. At year end, the company announced it is seeking financing to complete the environmental review. The project has Proven and Probable mineral reserves of 716 Mt grading 0.26% Cu; 0.029 g/t Au and 1.2 g/t Ag. The proposed mine would be a 70,000 tonnes per day operation, with a mine life of 28 years. Initial capital costs would exceed $1 billion.

The **New Prosperity** gold-copper porphyry project of Taseko Mines Limited has defined Proven and Probable reserves of 830 Mt grading 0.42 g/t Au and 0.23% Cu. Taseko continues to seek a judicial review of the February 2014 Federal decision to reject the project. British Columbia granted Taseko a project certificate in November 2013, and has extended the expiry date of the certificate by five years.

Ruddock Creek Mining Corporation (Imperial Metals Corporation (50%) and joint venture partners Mitsui Mining and Smelting Co. Ltd. (30%) and Itochu Corporation (20%), carried out environmental baseline studies at its **Ruddock Creek** zinc-lead project. A mineral resource estimate reports 4.65 Mt grading 6.77% Zn and 1.38% Pb (Indicated) and 5.38 Mt grading 6.69% Zn and 1.31% Pb (Inferred), using a 4.0% combined Pb+Zn cut-off.

Spanish Mountain Gold Ltd. continued to carry out baseline environmental studies at its **Spanish Mountain** gold project as the company prepares for formal environmental review. 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.

5.6. South Coast Region

5.6.1. Proposed industrial mineral mines

BURNCO Rock Products Ltd. submitted its application for Environmental Assessment with both provincial and federal agencies for the **BURNCO Aggregate** project. The proposed sand and gravel mine would ramp up to a 1.5 Mt per year operation, initially barging product to BURNCO Rock Products Ltd.'s ready-mix concrete plants in South Burnaby and Port Kells.

5.7. West Coast Region

5.7.1. Proposed coal mines

Compliance Energy Corporation withdrew the **Raven Underground Coal** Project's application from the British Columbia Environmental Assessment Office screening process in March. Raven is a proposed mine south of Comox on Vancouver Island. As contemplated in a 2011 feasibility study, the main product would be a semi soft coking coal with a thermal by-product. Production would be approximately

830,000 tonnes of clean coal per year, over 16 years. Compliance's original partners, LG International Investments (Canada) Ltd. and Itochu Corporation, have withdrawn from the project. Compliance has not indicated plans for Raven but has expressed doubt that the Environmental Assessment Office would certify the project. It remains in pre-application status.

6. Exploration expenditures

Total metal, aggregate, industrial mineral and coal exploration expenditures are estimated at $272 million for 2015, down $66 million from the 2014 total of $338 million. Of this, $69 million was contributed by coal projects and $203 million by metal, aggregate, and industrial mineral projects (Fig. 8). For many companies, lower commodity prices and a depressed equity market led to reduced exploration. Exploration expenditures can be further divided into five categories: grassroots, early stage, advanced stage, mine evaluation, and mine lease (Fig. 9). Along with reduced total expenditures, difficulty in raising venture capital for new projects resulted in grassroots and early stage exploration only representing 15% of total expenditures.

7. Exploration land tenure

Acquisition of new mineral claims in 2015 was comparable to 2014 (Fig. 10). The total for 2015 was 930,981 hectares vs. 942,181 hectares for the previous year. New coal license applications in 2015 totalled 70,806 hectares, down slightly from the 2014 total of 75,972 hectares. This continues a downward trend. In 2013, applications totalled 197,681 hectares, and in 2012 lease applications totaled a record 710,368 hectares (Fig. 11).

8. Selected exploration project highlights

Although exploration slowed in 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. Below, selected exploration projects are grouped by project type and region (Table 7). A more comprehensive list of selected exploration projects active in 2015 are described in the individual Regional Geologist sections of this volume.

8.1. Precious metal projects

8.1.1. Skeena Region

Pretium Resources Inc. carried out a 20,000 m drilling program on exploration targets that form their **Brucejack Regional** project. The targets are separate from their defined Valley of the Kings deposit, which is scheduled to go into mine production in 2017. Targets tested within two km from the deposit are collectively referred to as the Brucejack Area targets, and the most significant results were returned from the Flow Dome prospect. The Flow Dome zone returned intersections including 2,100 g/t Au uncut over 2.05 m, including 8,600 g/t Au uncut over 0.50 m; and 137 g/t Au over 0.50 m.

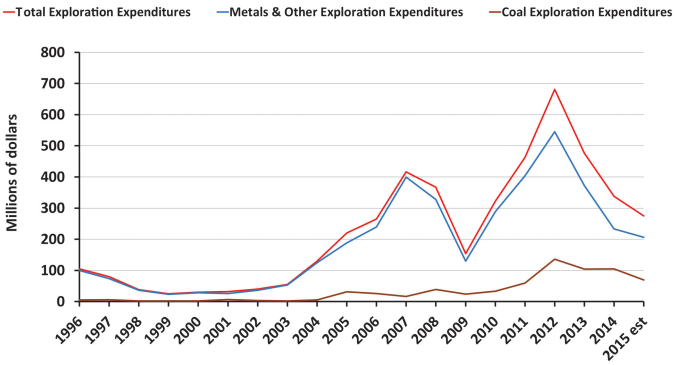

Fig. 8. Total exploration expenditures, metals plus other expenditures, and coal expenditures by year.

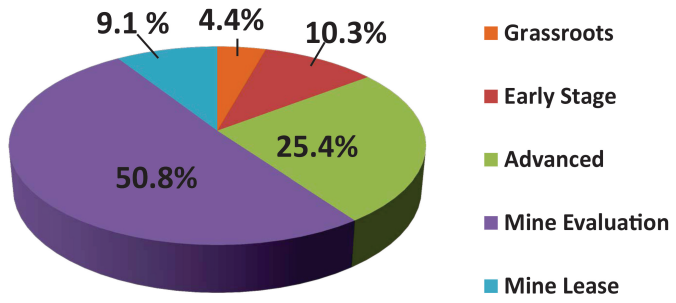

Fig. 9. Exploration expenditures for 2015 by exploration stage.

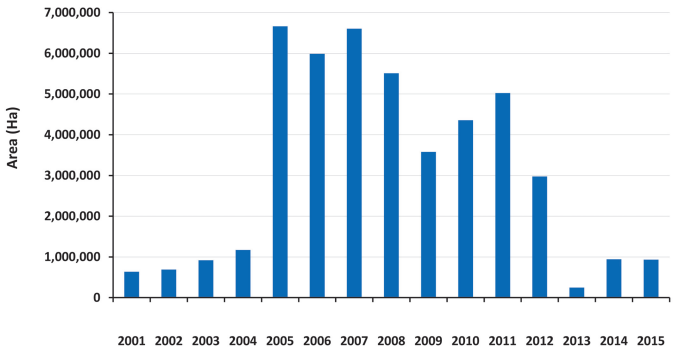

Fig. 10. Tenure, new mineral claims (area Ha) by year.

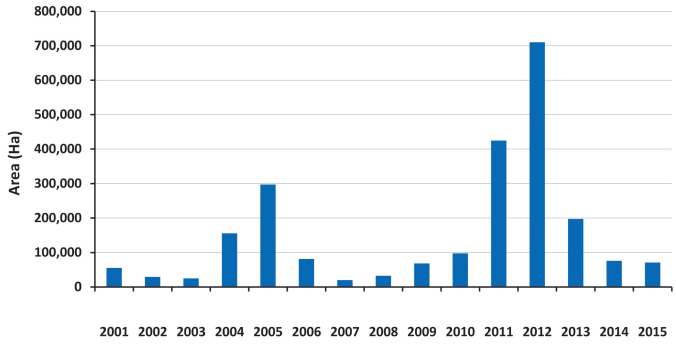

Fig. 11. Tenure, new coal license applications (area Ha) by year.

Table 7. Selected exploration projects.

Project	Region	Operator	MINFILE	Commodity; Deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work Program	Comments
Brucejack Regional	Skeena	Pretium Resources Inc.	104B 193	Au, Ag; Au-quartz veins; quartz stockwork breccia; epithermal;	n/a	Diamond drilling, 20,000 m	Intersections included 2,100 g/t Au uncut over 2.05 m, including 8,600 g/t Au uncut over 0.50 m; and 137 g/t Au over 0.50 m
Grizzly	Skeena	Garibaldi Resources Inc.	104J 063	Au, Cu; Porphyry	n/a	Diamond drilling (1,000 m, 5 holes), prospecting, geological mapping, geophysics (IP)	-
Ootsa	Skeena	Gold Reach Resources Ltd.	093E 105	Cu, Au, Mo, Ag; Porphyry	153.97 Mt at 0.21% Cu, 0.11 g/t Au, 0.016% Mo, 1.89 g/t Ag; Inf: 223,570,000 at 0.18% Cu, 0.075 g/t Au, 0.021% Mo, 1.8 g/t Ag	Initiated PEA; prospecting, soil sampling,	-
Premier	Skeena	Ascot Resources Ltd.	104B 054	Au, Ag; Stockwork quartz veins and breccia;	n/a	Diamond drilling (40,892 m drilling in 198 holes), geology, geochemistry; evaluation high grade underground mining	-
Spectrum	Skeena	Skeena Resources Limited	104G 036	Au, Cu; Stockwork quartz veins; Porphyry	n/a	Diamond drilling (17,350 m in 61 holes), mapping, prospecting, rock (387) and soil (2,992) sampling	-
Tanzilla	Skeena	Kaizen Discovery Inc.	104I 023	Cu, Mo, Au; High sulphidation epithermal, Porphyry	n/a	Diamond drilling, mapping	-
Akie	Omineca	Canada Zinc Metals Corp.	094F 031	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	12.7 Mt at 8.4% Zn, 1.7% Pb, 13.7 g/t Ag; containing 1.07 Mt (2,352.3 Mlb) Zn, 214,000 t (471.8 Mlb) Pb, 174,024 kg (5.6 Moz) Ag; Indicated	Diamond drilling (5,350 m), 2014-15 airborne gravity gradiometry data received, environmental baseline studies	Drilling highlights: 28.51 m of 10.22% Zn, 2.34% Pb, 20.45 g/t Ag (A-15-121); 23.36 m of 8.63% Zn, 1.68% Pb, 14.64 g/t Ag (A-15-122); 21.41 m of 9.47% Zn, 2.11% Pb, 18.22 g/t Ag (A-15-124); 15.76 m of 9.71% Zn, 1.74% Pb, 15.75 g/t Ag (A-15-125)

Table 7. Continued.

Blackwater South	Omineca	New Gold Inc.	093F 037	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation)	n/a	Drilling (5,150 m), heliborne magnetics survey, ground-based geophysics (IP, magnetics), geochemistry (soil, rock), mapping, prospecting	Exploration focused on epithermal Au-Ag targets within 5 km south and west of the Blackwater deposit
Buck	Omineca	New Gold Inc.	093F 043	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	Airborne geophysics (magnetics), geochemical sampling (rock), mapping, prospecting	Granite pluton is considered prospective for mineralized rhyolite dikes or sills
Cirque	Omineca	Teck Resources Limited	094F 008	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	historic non NI 43-101 compliant: 38.5 Mt at 8% Zn, 2.2% Pb, 47.2 g/t Ag (North Cirque); 15.5 Mt at 6.9% Zn, 1.4% Pb, 32 g/t Ag (South Cirque); indicated (MacIntyre, 1992)	Drilling (5,370 m), geochemical sampling (rock, soil), mapping, prospecting, 2014-15 airborne gravity gradiometry data received	Drilling to verify and step-out from historic drilling results at depth beneath a thrust sheet of Ordovician and Silurian sedimentary rocks
Col-Later	Omineca	Pacific Empire Minerals Corp.	093N 101, 093N 169, 093N 216, 093N 032	Cu, Au, Ag, Mo; Alkalic porphyry Cu-Au	historic non NI 43-101 compliant: of 1.81 Mt at 0.6% Cu; indicated (Kookaburra Gold Inc., 1989)	IP survey (68 line-km, 2014-15), drilling (2493 m)	Drilling tested two geophysical anomalies on the till-blanketed western side of the property
Groundhog	Omineca	Atrum Coal Groundhog Inc.	104A 083, 104A 086	HCC, UL coal, industrial mineral: Anthracite	349.4 Mt in situ (Groundhog North), 259.7 Mt in situ (East of Skeena)	Engineering and environmental baseline studies, coal quality tests, upgraded resource and geological model	Planned underground bulk sample. Environmental Assessment yet to be initiated
Kechika Regional (Yuen, Cirque East, Pie, Elf)	Omineca	Teck Resources Limited	094F 013, 094F 023, 094F 011	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	n/a	Geochemical sampling (rock, soil), mapping, prospecting, gravity geophysical survey (12.5 line-km), 2014-15 airborne gravity gradiometry data received	2.2 x 0.5 km Zn-Pb-Ag soil anomaly defined at Yuen with two coincident airborne gravity anomalies
Kemess East	Omineca	AuRico Metals Inc.	094E 094 (Kemess East), 094E 012 (Duncan)	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au	55.86 Mt at 0.41% Cu, 0.52 g/t Au, 2.0 g/t Ag; containing 228.5 Kt (503.7 Mlb) Cu, 29,206 kg (939 Koz) Au, 112,004 kg (3.6 Moz) Ag; Indicated	Drilling (27,719 m), geochemical sampling (rock), mapping, prospecting	Drilling highlights: 305 m of 0.625 g/t Au, 0.433% Cu (KH-15-01); 301 m of 0.466 g/t Au, 0.394% Cu (KH-15-02); 458 m of 0.640 g/t Au, 0.437% Cu (KH-15-23); 590 m of 0.516 g/t Au, 0.366% Cu (KH-15-27); 772 m of 0.465 g/t Au, 0.365% Cu (KH-15-30)

Table 7. Continued.

Kliyul	Omineca	Teck Resources Limited, Kiska Metals Corporation	094D 014, 094D 023, 094D 028, 094D 182	Cu, Au, Ag; Porphyry Cu±Mo±Au	historic non NI-43-101 compliant 2.3 Mt grading 0.3% Cu and 1.03 g/t Au (Gill, 1994a)	Drilling (1908 m), geochemical sampling (rock), mapping, prospecting	Drilling highlights: 245.0 m of 0.18% Cu, 0.53 g/t Au (KLI-15-034), 162.4 m of 0.20% Cu, 0.26 g/t Au (KLI-15-033)
Lawyers	Omineca	PPM Phoenix Precious Metals Corp.	094E 066	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	historic non NI 43-101 compliant: 68.4 Kt at 7.3 g/t Au, 226 g/t Ag (Duke's Ridge; Cheni Mines Ltd., 1990)	Drilling (4,002 m; 3,282 m on Cliff Creek North, 720 m on Duke's Ridge zone), prospecting	Drilling to verify and infill historic results, and step-out deeper into the Cliff Creek north sub-zone and Duke's Ridge zone, first drilling program in 9 years
North Grid	Omineca	Thompson Creek Metals Company Inc.	093N 123, 093N 204	Cu, Mo; Alkalic porphyry Cu-Au	n/a	Drilling (2,000 m)	Drilling targets (Snell and Mitzi) with similar geophysical-geochemical signatures as Mt. Milligan deposit mineralized stocks
Cro Phosphate	Kootenay-Boundary	HighBrix Manufacturing Inc.	082GNE 031, 035	Phosphate; upwelling	n/a	Drilling (7 DDH); trenching; bulk sampling	Product shipped for direct spreading on agricultural area
Gold Drop	Kootenay-Boundary	Ximen Mining Corp.	082ESE 153, 152, 126	Au-Ag-Pb-Zn+/-Cu; vein, alkalic intrusion-associated Au	n/a	Trenching; mapping; sampling	Chip sample results up to 0.60 m grading 43.6 g/t Au, 141 g/t Ag; and 0.55 m grading 56.2 g/t Au, 259 g/t Ag; grab sample grading 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 1.7% Pb
Elko	Kootenay-Boundary	Pacific American Coal Limited	082GSE029	Coal (HCC, PCI)	Measured: 19.2 Mt + Indicated: 57 Mt + Inferred: 181.3 Mt (JORC 2015)	Mapping; sampling; geological modeling; field reconnaissance to locate historic adits and drilling; JORC compliant resource	Mapping of 5 coal seams over the property; 3 seams have hard coking coal quality, 2 seams have PCI coal
Jersey-Emerald	Kootenay-Boundary	Margaux Resources Inc.	082FSW 010, 009	Pb-Zn-Ag+/-W, Au, Mo, Bi; stratiform replacement, skarn	Measured and Indicated: 3.071 Mt grading 0.36% WO_3 (2015)	Dewatering underground workings at Emerald; mapping; sampling; geological modeling	10.2 m grading 24.98 g/t Au with elevated bismuth; 2.75 m grading 0.49% WO_3; 4.5 m grading 0.5% WO_3; 3.35 m grading 0.52% WO_3; 2.65 m grading 0.59% WO_3; 4 m grading 0.35% WO_3; 6.45 m grading 0.33% WO_3, 0.65 g/t Au; 5.15 m grading 0.47% WO_3

Table 7. Continued.

LH	Kootenay-Boundary	Magnum Goldcorp Inc.	082FNW 212	Cu-Ag-Au; subvolcanic, skarn, Au-veins	n/a	Drilling (11 DDH); SP and IP/magnetometer survey	Phase I drilling: 16.9 m grading 13.58 g/t Au, including 10.9 m grading 20.61 g/t Au; 11m grading 20.66 g/t Au; results from Phase II drilling are pending
May Mac	Kootenay-Boundary	Golden Dawn Minerals Inc.	082ESE 045, 116	Au-Ag-Pb-Zn+/-Cu; Cu-Au-Ag skarns, polymetallic veins, Au-veins	37,200 t grading 3.4 g/t Au, 342.8 g/t Ag, 2% Pb, 2% Zn (1981; non-compliant)	Drilling (2,000 m); mapping; rock and channel sampling;	Channel sampling: 0.87m grading 12.97 g/t Au, 34 g/t Ag; 0.2 m grading 36.37 g/t Au, 43 g/t Ag; 0.4 m grading 17.07 g/t Au, 11 g/t Ag; 0.4 m grading 4.46 g/t Au, 529 g/t Ag; Drilling intersected gold-bearing vein and stockwork system with lead and zinc sulphides, assays pending
Marten Phosphate	Kootenay-Boundary	Fertoz Ltd.	082GNE 027	Phosphate; upwelling	n/a	Mapping; sampling; XRF; environmental baseline; permitted bulk sample	XRF of stockpiles: 24 – 27% P_2O_5; product shipped for direct spreading on agricultural area
Referendum/ Whitewater	Kootenay-Boundary	Braveheart Resources Inc.	082FSW 222, 171	Au-Ag-Pb-Zn+/-Mo; polymetallic veins, Au-veins	n/a	Trenching; bulk sampling (1,000 t at Referendum; 100 kg at Whitewater); milling and flotation	Projected gold recoveries of 90% from preliminary flotation testing; further results pending
Aspen Grove (Ketchan)	Thompson-Okanagan-Cariboo	Kaizen Discovery Inc.	092HNE 115	Cu, Au; Porphyry	n/a	Drilling	Improved geological model
Bonaparte	Thompson-Okanagan-Cariboo	WestKam Gold Corp.	092P 050	Au; Cu; Vein; porphyry	n/a	Drilling outside of Discovery zone area	Analytical results pending
Cariboo Gold	Thompson-Okanagan-Cariboo	Barkerville Gold Mines Ltd.	093H 019	Au; Vein; replacement	n/a	Drilling to define resources at BC vein and explore new targets	Improved resource definition; discovery of AG horizons
Ike	Thompson-Okanagan-Cariboo	Amarc Resources Ltd.	092O 025	Cu, Mo, Ag; Porphyry	n/a	Drilling	Mineralized zone extended
Lac la Hache	Thompson-Okanagan-Cariboo	GWR Resources Inc.	092P 002	Cu, Au, Ag Porphyry	n/a	Drilling; prospecting	Discovery of Berkey zone (copper porphyry)

Table 7. Continued.

Lucky Mike	Thompson-Okanagan-Cariboo	Plate Resources Inc.	092ISE 027	W, Cu, Mo; Skarn; porphyry	n/a	Drilling	Mineralized zone extended; improved geological model
Shovelnose	Thompson-Okanagan-Cariboo	Westhaven Ventures Inc.	092HNE 308, 309	Au; Vein; breccia	n/a	Drilling	Mineralized zone extended
Margurete	West Coast	Aldever Resources Inc.	092K 025, 092K 020, 092K 030	Au; I01: Au-quartz veins	n/a	Geology, rock geochemistry, packsack drilling	Reconnaissance program in historic gold camp
Rogers Creek	South Coast	Carube Copper Corp.	092JSE033, 092JSE034, 092JSE035	Cu, Mo, Ag; L04: Porphyry Cu±Mo±Au	n/a	IP survey; soil geochemistry	Chargeability anomaly reported

Ascot Resources Ltd. carried out almost 41,000 m of diamond drilling on their **Premier** gold project, near the past-producing Premier mine. The objective of the drilling was to define a 43-101-compliant resource suitable for high-grade underground mining. Results returned several intersections grading between 250 and just over 1000 g/t Au over intervals of 0.9 to 1.0 m.

Skeena Resources Limited carried out over 17,000 m of diamond drilling on their **Spectrum** gold project as they work towards defining a 43-101-compliant resource. Highlight intersections include 18.0 m grading 6.13 g/t Au, 4.0 m grading 16.97 g/t Au, 2.0 m grading 8.27 g/t Au, 1.0 m grading 23.1 g/t Au, 18 m grading 2.69 g/t Au, 2.0 m grading 4.6 g/t gold, 2.6 m grading 10.18 g/t Au and 0.9 m grading 8.04 g/t Au.

8.1.2. Omineca Region

In 2015, drilling was carried out on the **Lawyers** property owned by a private company, PPM Phoenix Precious Metals Corp. The property covers the former Amethyst Au Breccia (AGB), Cliff Creek and Phoenix mines, which produced over 171,000 ounces of Au and 3.5 million ounces of silver (mainly from the AGB deposit). In 2015, a 24-hole drilling program designed to verify and infill historic drilling results and test for deeper extensions of mineralization was carried out. Assay results have not been made public.

On their **Buck** gold prospect, New Gold Inc., carried out an airborne magnetic survey and prospecting program. The exploration target is gold-mineralized rhyolite dikes or sills.

8.1.3. Kootenay-Boundary Region

At their **LH** gold property, Magnum Goldcorp Inc. drilled known alteration zones and geophysical anomalies identified from SP, IP and magnetometer surveys in 2014. Drilling also targeted extensions of high-grade zones from previous drilling and sampling in the historic underground workings. Drilling highlights include 16.9 m of 13.58 g/t (including 10.9 m of 20.61 g/t) and 11 m of 20.66 g/t Au.

8.1.4. Thompson-Okanagan-Cariboo Region

Barkerville Gold Mines Ltd. underwent management changes that resulted in the **Bonanza Ledge** gold mine operation being suspended. It was decided to concentrate on an aggressive exploration program to better assess the potential of their **Cariboo Gold** project. Drilling highlights for Barkerville Mountain include 43.48 g/t Au over 7.95 m.

Westhaven Ventures Inc. carried out a LIDAR survey, ground based IP, magnetometer and VLF-EM surveys and 1,400 m of drilling on their **Shovelnose** gold project. Drilling returned 50.4 m of 0.2 g/t Au.

8.1.5. West Coast Region

Aldever Resources Inc. (Formerly Glenmark Capital Corp.) conducted a reconnaissance program on their **Margurete** property that included 39 packsack drill holes. Results are not yet available.

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

8.2.1. Skeena Region

Garibaldi Resources Corp. completed a diamond drill program on their **Grizzly** property. The program consisted of five holes totaling approximately 1,000 m. Assay results are pending.

Gold Reach Resources Ltd. carried out prospecting, soil sampling, and environmental baseline programs on their **Ootsa** copper-gold-molybdenum-silver project. In September, they began a Preliminary Economic Assessment for the project.

Kaizen Discovery and joint venture partner Freeport McMoRan of Canada Limited carried out a three-hole 1,877 m drill program on their **Tanzilla** project, 23 km southeast of Dease Lake. Drilling intersected an advanced argillic and phyllic altered lithocap that returned elevated metal values. Additional drilling is required to test the large alteration system.

8.2.2. Omineca Region

Pacific Empire Minerals Corp. tested geophysical anomalies

on their **Col-Later** project with 2,000 m of drilling. Assay results have not been made public.

In 2015, AuRico Metals Inc. carried out a 15 hole, 27,000 m diamond drill program on their **Kemess East** project. The project includes the defined Kemess East deposit, which consists of two structurally offset zones, the Kemess Offset Zone and the Kemess East Zone. The program further delineated and expanded the known mineralization of the Kemess East deposit. Mineralization remains open in three directions in both zones. The Orion and South Dam targets were tested in a nine-hole fly drill program, but no significant values were returned. Grassroots work included rock sampling, mapping, and prospecting over these target areas.

Kiska Metal Corporation's **Kliyul** property (Fig. 12) is under option to Teck Resources Ltd. In 2015, a four-hole drilling program extended known mineralization. Drilling highlight results include 245.0 m of 0.18% Cu, 0.53 g/t Au and162.4 m of 0.20% Cu, 0.26 g/t Au.

In 2015, Thompson Creek Metals Company Ltd. began a multi-year drilling program on their **North Grid** target area about 5 km northwest of the Mt. Milligan mine lease. Geophysical and geochemical targets were tested by five drillholes. Results are pending.

Fig. 12. Core logging at the Kliyul property.

8.2.3. Thompson-Okanagan-Cariboo Region

Kaizen Discovery Inc. (60%) and Itochu Corporation of Japan (40%) drilled 13 holes on their **Aspen Grove** copper-gold project. Drilling was carried out primarily on the Ketchan Lake stock. All holes encountered potassic and/or calc-potassic alteration; 12 intersected copper-gold mineralization with grades up to 0.5% Cu and 0.15 g/t Au over tens of m.

WestKam Gold Corp. drilled seven holes at their **Bonaparte** project. One step out hole intersected ~8 g/t Au, 38 g/t Ag, 29 g/t Te and 0.33% Cu over 1 m.

In September of 2015, Amarc Resources Ltd. announced an option agreement with Thompson Creek Metals Company Inc. on their **IKE** project. Initial investment financed a nine-hole 5,028 m drill program in the fall of 2015. Highlights include 592 m of 0.44% CuEQ of 0.30% Cu, 0.032% Mo and 2.1 g/t Ag. Copper equivalent (CuEQ) calculations used metal prices of Cu US$2.25/lb, Mo US$8.00/lb and Ag US$17.00/oz. Metallurgical recoveries and net smelter returns are assumed to be 100%.

GWR Resources Inc. carried out a prospecting and diamond drill program on its **Lac La Hache** copper-gold-silver project. Drilling targeted the Aurizon-South breccia zone and was designed to test continuity of known mineralization and assess the potential for underground mining. Drilling highlights include 12.40 g/t Au over two m and 11.67 g/t Au over 5 m. The prospecting program resulted in the discovery of the Berkey prospect, where chip sampling returned 0.45% Cu over 2.4 m.

8.2.6. South Coast Region

Carube Copper Corp. carried out an IP survey at its **Rogers Creek** porphyry copper project north of Harrison Lake. Survey results include a chargeability anomaly that may represent a new target, as previous drilling intersected anomalous Cu-Mo-Ag mineralization at the edge of the anomaly.

8.3. Polymetallic base and precious metal projects

8.3.1. Omineca Region

The **Akie** property of Canada Zinc Metals Corp., hosts the Cardiac Creek barite-bearing zinc-lead-silver SEDEX deposit. In 2015, eight holes were drilled to infill gaps in the resource model for the high-grade core of the deposit. All eight holes intersected mineralization (Fig. 13); highlights include 28.51 m of 10.22% Zn, 2.34% Pb, and 20.45 g/t Ag; 23.36 m of 8.63% Zn, 1.68% Pb, and 14.64 g/t Ag; 21.41 m of 9.47% Zn, 2.11% Pb, and 18.22 g/t Ag; and 15.76 m of 9.71% Zn, 1.74% Pb, and 15.75 g/t Ag.

The **Cirque** project, which includes the Cirque, Fluke, and Elf properties, is a joint venture between Teck Resources Ltd. and Korea Zinc Company Limited. In 2015, a five-hole diamond drilling program focused on the South Cirque target. Results have not been made public.

Fig. 13. Akie project, banded sphalerite in drillhole A-15-121.

The Yuen, Cirque East, Pie, Elf zinc-lead-silver properties are currently under option by Teck Resources Ltd. and Korea Zinc Company Limited from Canada Zinc Metals Corp. Collectively they are known as the **Kechika Regional** project. In 2015, a ground-based gravity geophysical survey was completed on selected targets on the Yuen, Pie, Cirque and Elf properties and the results of an airborne gravity gradiometry survey over the properties was received.

8.3.2. Kootenay-Boundary Region

Ximen Mining Corp. carried out mapping, trenching, and sampling on their **Gold Drop** gold, silver, and base metal project. One grab sample from trenching assayed 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 17,000 ppm Pb. Most samples that were elevated in Au also had elevated Ag, Pb, and Cu.

Braveheart Resources Inc. continued bulk sampling and trenching at their **Whitewater/Referendum** gold, silver, lead, and zinc project. Late in 2015, bulk samples were sent for crushing and milling and flotation testing; results are pending.

8.4 Skarn projects

8.4.1. Kootenay-Boundary Region

In 2015, Margaux Resources Ltd. continued work on their **Jersey-Emerald** tungsten project. Work was focused on dewatering the underground workings at the Emerald, in preparation for further underground drilling and sampling. They also mapped and sampled at the Jersey, with plans for drilling in 2016. The company released a new tungsten resource estimate for the Emerald of 3.071 Mt grading 0.34% WO_3 (Measured and Indicated) with 5.48 Mt grading 0.273% WO_3 (Inferred) using a 0.15% WO3 cut-off grade.

Golden Dawn Minerals Inc. channel sampled and drilled at their **May Mac** project. Channel sample results include: 0.87 m grading 12.97 g/t Au, and 34 g/t Ag; 0.2 m grading 36.37 g/t Au, and 43 g/t Ag; 0.4 m grading 17.07 g/t Au, and 11 g/t Ag; and 0.4 m grading 4.46 g/t Au, and 529 g/t Ag. Drilling results include: 4.4 m of 195 g/t Ag, 1.97 g/t Au, 1.48% Pb, and 2.85% Zn; and 2.23 m of 148.8 g/t Ag, 0.24 g/t Au, 1.2% Cu, 1.9% Pb, and 1.9% Zn.

8.4.2. Thompson-Okanogan-Cariboo Region

Plate Resources Inc. has an option agreement with Nexgeo Inc. and Korea Resources Corporation to advance the **Lucky Mike** project 25 km north of Merritt. In 2015, a 17 diamond-drill hole program totalled 4,828 m. Drilling on the Lucky Mike skarn target returned 9.6 m of 0.142% WO_3.

8.5. Industrial mineral and aggregate projects

8.5.1 Kootenay-Boundary Region

Hi Brix Manufacturing Inc. shipped material from their **Cro** phosphate project for agricultural testing; results are pending. The company also conducted environmental baseline work and has received approval for a 10,000 t bulk sample.

8.6. Coal projects

8.6.1. Omineca Region

Atrum Coal Groundhog Inc. completed engineering studies and coal quality tests and upgraded the resource and geological model for the Groundhog North component of their **Groundhog** project. The permitting process for a 100,000 tonne underground bulk sample continued.

8.6.2. Kootenay-Boundary Region

Pacific American Coal Limited mapped and sampled at their **Elko** coal project. Mapping recorded the location of coal outcrops, historic adits, and drill collars. The company also compiled geological data and outlined locations for future drilling.

9. Publically funded geoscience

9.1.The British Columbia Geological Survey

Established in 1895, the British Columbia Geological Survey (BCGS) links government, the minerals industry, and British Columbians to the province's geology and mineral resources. The key roles of the Survey are to: 1) create, maintain, and deliver geoscience knowledge to lead informed decision making; 2) attract exploration for new mineral and coal resources; 3) act as the public steward of mineral and coal resources; and 4) guide public policy by providing assessments on mineral exploration and mining activities. The activities of the Survey and its geoscience products are profiled annually at the AMEBC's Mineral Exploration Roundup in Vancouver, and at regional, national, and international geoscience conferences.

Headquartered in Victoria, the BCGS is a branch in the Mines and Mineral Resources Division of the Ministry of Energy 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 BCGS remains committed to producing geoscience data and knowledge that stimulate exploration activity and attract investment. The Survey strives to be a leader in public government geoscience, providing information to all stakeholders and communities through reports, maps, and databases, which can be freely accessed online.

The Survey supports the minerals industry through the projects that it undertakes. Projects in 2015 focused on porphyry initiatives, 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

between Merritt and Likely 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 recent years the BCGS has expanded and developed new mineral exploration methods. An important theme in 2015 studies was porphyry indicator minerals (PIMs) as an exploration tool. A new BCGS partnership with the Canadian Mining Innovation Council (CMIC), investigated PIMs in till from Highland Valley, continuing the work that was completed at Gibraltar, Mount Polly, and Woodjam by the BCGS and the GSC under the Targeted Geoscience Initiative (TGI-4) program. Another exploration method project, completed in partnership with the University of Victoria, used trace elements in apatite to discriminate major mineral deposit types. This method was field tested on detrital apatite in till from the Woodjam project. The results of these projects and others were presented at the fall BCGS Open House held jointly with a two-day strategic and critical materials symposium that delivered the final results of the TGI-4 Specialty Metals project and served as the launch point for further studies. Survey projects are published annually in Geological Fieldwork (Fig. 14) 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), and regional geochemical surveys 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. Through MapPlace, BCGS databases talk to each other. The next generation of MapPlace, (MapPlace 2), scheduled for release in 2016, is capable of accessing queried BCGS databases to display province-wide maps within seconds. The BC Digital Geology map, using a unique geospatial data model, remains a Survey priority with frequent updates. The Survey has updated the Regional Geochemical Survey (RGS) database and is modernizing the provincial lithogeochemical database. The BCGS's provincial rock and pulp archive, which hosts over 600,000 samples and is valued at more than $20 million, was relocated to a new storage facility on Belleville Street in Victoria.

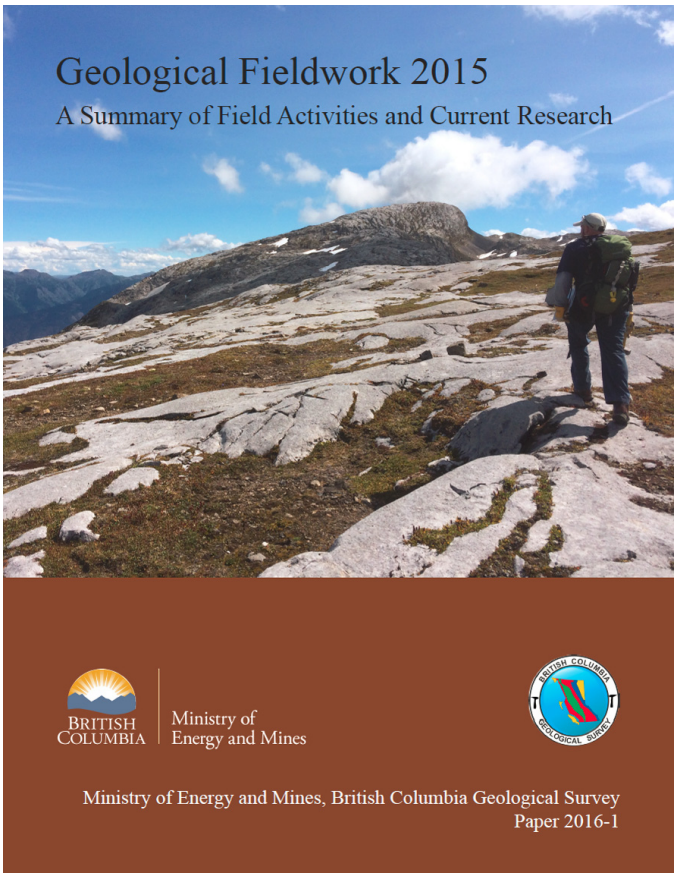

Fig. 14. Geologic Fieldwork contains peer-reviewed papers that summarize field activities and current research by the British Columbia Geological Survey.

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. In the Kootenays, the Geological Survey of Canada is conducting a multi-year project for SEDEX-style and related base metal mineralization, as part of the Targeted Geoscience Initiative (TGI-4). The focus of the project is to generate a regional 3D geoscience model of the Purcell Anticlinorium and the Belt-Purcell Supergroup, which hosts the historic Sullivan Mine. Geological, geophysical, and geochemical data are being compiled to generate new perspectives on ore controls for SEDEX targeting.

In 2013, the second phase of the Geo-mapping for Energy and Minerals program (GEM-2) was announced. The program will run until 2020 and 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 will focus on bedrock geology, crustal architecture, Cordilleran tectonics, and metallogeny to 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 2014, 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.

The Red Chris mine declared official production, and metal mine development projects continued with the Brucejack and Silvertip projects. Lower commodity prices resulted in a reduction in coal production and the shutdown of the Myra Falls base metal mine. In early 2016, shutdowns were announced for the Huckleberry copper, gold, silver, molybdenum mine and the Quinsam underground coal mine.

Exploration and mining in the Omineca and Northeast regions, British Columbia

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1. Introduction

The Omineca (Northcentral) Region has subdued-to-mountainous physiography and varied geology reflecting a tectonic history of volcanic-arc and oceanic terrane accretion onto the western margin of ancestral North America followed by episodes of mountain-building, regional transcurrent faulting, and glaciation. The region is named after the Omineca Mountains which cover much of northcentral British Columbia, west and northwest of the town of Mackenzie (Figs. 1, 2). Rocks of the region are known to be prospective for copper, molybdenum, gold, silver, zinc, lead, nickel, niobium, rare-earth elements (REE), and anthracitic coal. Ore deposit types typically explored for in 2015 (Figs. 1, 3) included epithermal gold-silver (Stikine terrane), porphyry copper-gold ±molybdenum (Stikine and Quesnel terrane), stratiform zinc-lead-silver (ancestral North America), and anthracitic coal (post-accretionary).

Total exploration expenditure in 2015 is estimated at $39.6 million (Fig. 4), largely from mine evaluation-stage projects (Fig. 5), and is about 7% less than in 2014. Drilling, at 55,200 m, was 32% more than in 2014 (Fig. 6). In 2015,

- ramp-up activities continued at the **Mt. Milligan** mine (Thompson Creek Metals Company Inc.)
- engineering and environmental studies in support of Environmental Assessments continued at **Kemess Underground** (AuRico Metals Inc.), **Aley** (Taseko Mines Limited), **Blackwater** (New Gold Inc.), and **Giscome** (Graymont Western Canada Inc.);
- initial and updated resource estimates were provided for **Kemess East** (AuRico Metals Inc.) and **Groundhog** (Atrum Coal Groundhog Inc.);
- drilling programs were undertaken for porphyry copper-gold at **Kemess East** (AuRico Metals Inc.), **Kliyul** (Teck Resources Limited), **Col-Later** (Pacific Empire Minerals Corp.), **North Grid-Mt. Milligan** (Thompson Creek Metals Company Inc.); epithermal gold-silver at **Lawyers** (PPM Phoenix Precious Metals Corp.), **2 X Fred** (Kootenay Silver Inc., Theia Resources Ltd.), **Blackwater South** (New Gold Inc.); and sediment-hosted zinc-lead-silver at **Akie** (Canada Zinc Metals Corp.), and **Cirque** (Teck Resources Limited).

The Northeast Region comprises continental platform and slope, and foreland basin-style sedimentary geology, with a belt of thin-skinned style deformation associated with the Northern Rocky Mountains. Bituminous coal, phosphate rock and barite are the main exploration focus. Metallurgical coal has been proportionately the largest of British Columbia's mined export commodities in recent years, representing about 60% of mineral production in 2013 and 40% in 2014. Roughly 15% of the province's coal production has come from the Peace River Coalfield (Figs. 1, 7). 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. Nevertheless, due to pressures from international oversupply and price decreases, producers in the coalfield were idle in 2015 and exploration activity continued to decrease. Apart from coal mining operations, the region has one industrial mineral mine that produces barite. Total exploration expenditure was $31.3 million (Fig. 4), nearly all from mine evaluation-stage projects (Fig. 5), and is about 37% less than in 2014. Drilling, at 2,150 m, was 92% less than in 2014 (Fig. 6). In 2015,

- the decline at **Murray River** (HD Mining International Ltd.) was driven to 1,351 m, near the designed length for collecting a bulk coal sample;
- engineering and environmental studies in support of Environmental Assessments continued at **Murray River** (HD Mining International Ltd.) and **Sukunka** (Glencore plc);
- updated resource estimates were provided for **Sukunka** (Glencore plc) and **Wapiti East** (Fertoz International Inc.);
- exploration drilling for bituminous coal was undertaken at **Murray River** (HD Mining International Ltd.).

Ridley Terminals Inc., the main port servicing the Peace River Coalfield, reported reduced throughput for the first half of 2015. Rail unloading volumes and ship-loading volumes decreased 50% and 45% respectively.

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

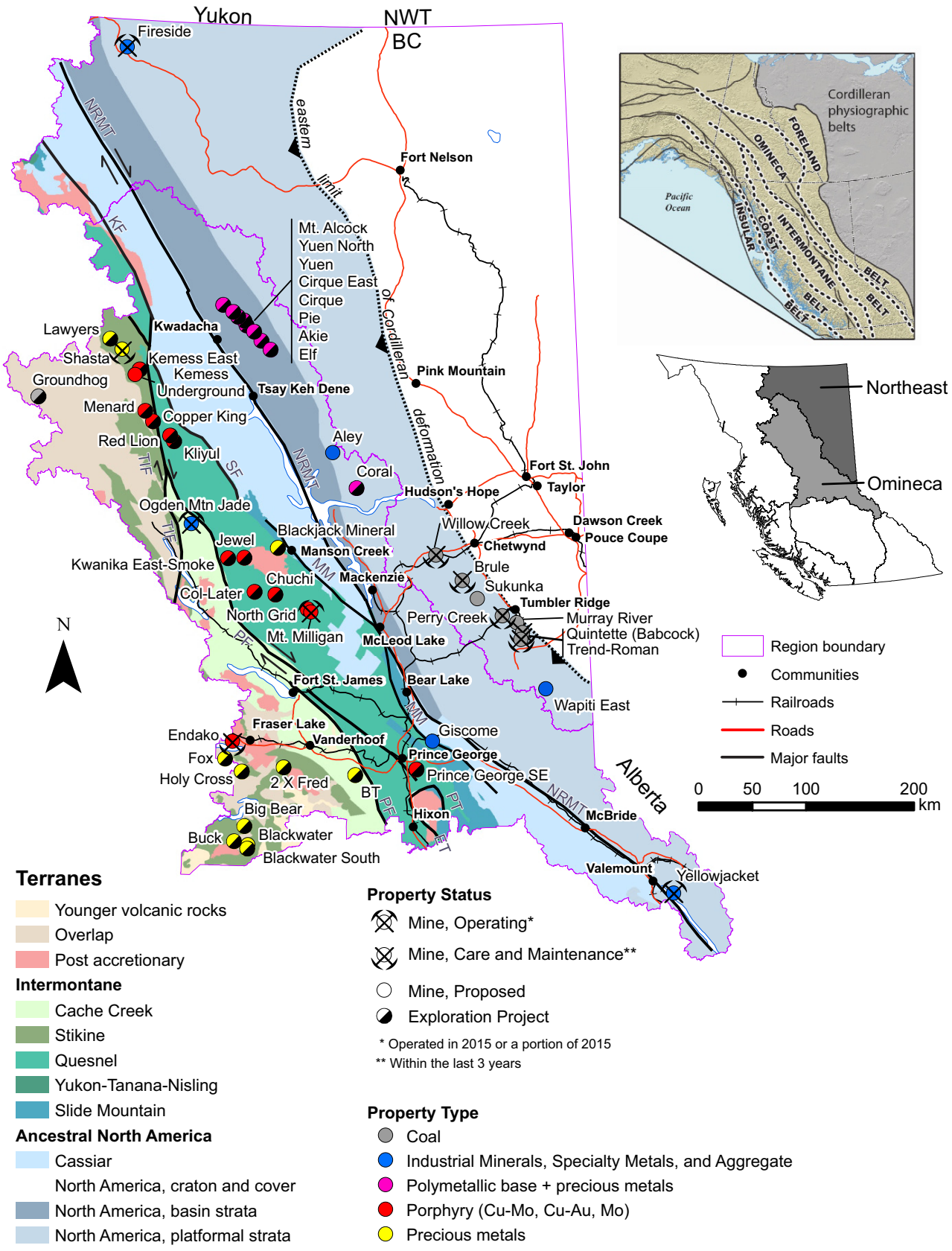

Fig. 1. Mines and selected exploration projects, Omineca and Northeast regions, 2015. Terranes from the BC digital geology map (Cui et al., 2015). Fault abbreviations: ET = Eureka thrust fault, KF = Kechika fault, MM = Manson-McLeod fault system, NRMT = Northern Rocky Mountain trench, PF = Pinchi fault, PT = Pundata thrust, SF = Swannell thrust fault, TIF = Takla-Ingenika-Finlay fault system.

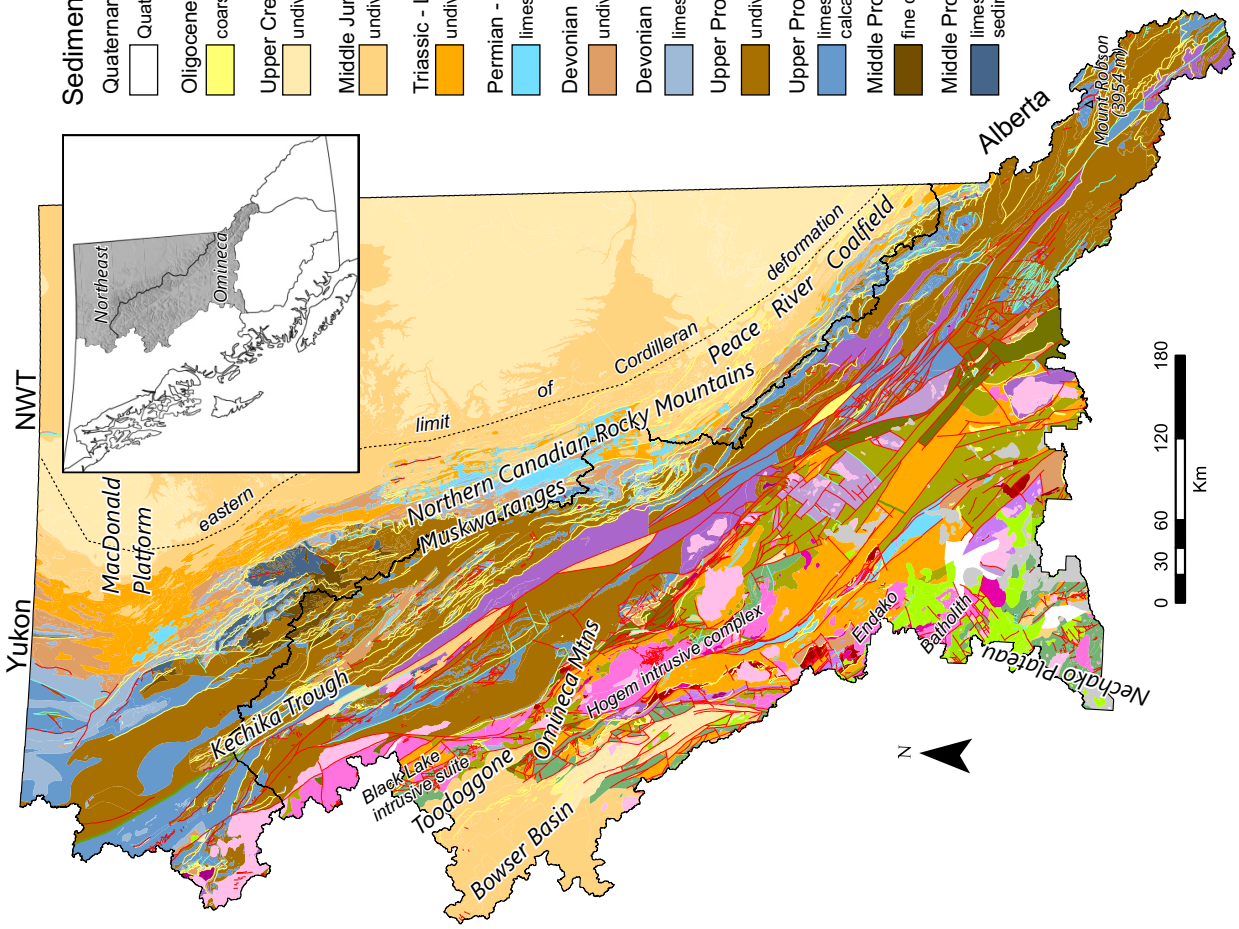

Fig. 2. Bedrock geology of the Omineca and Northeast regions. Map data was sourced in March 2015 from the BC digital geology map.

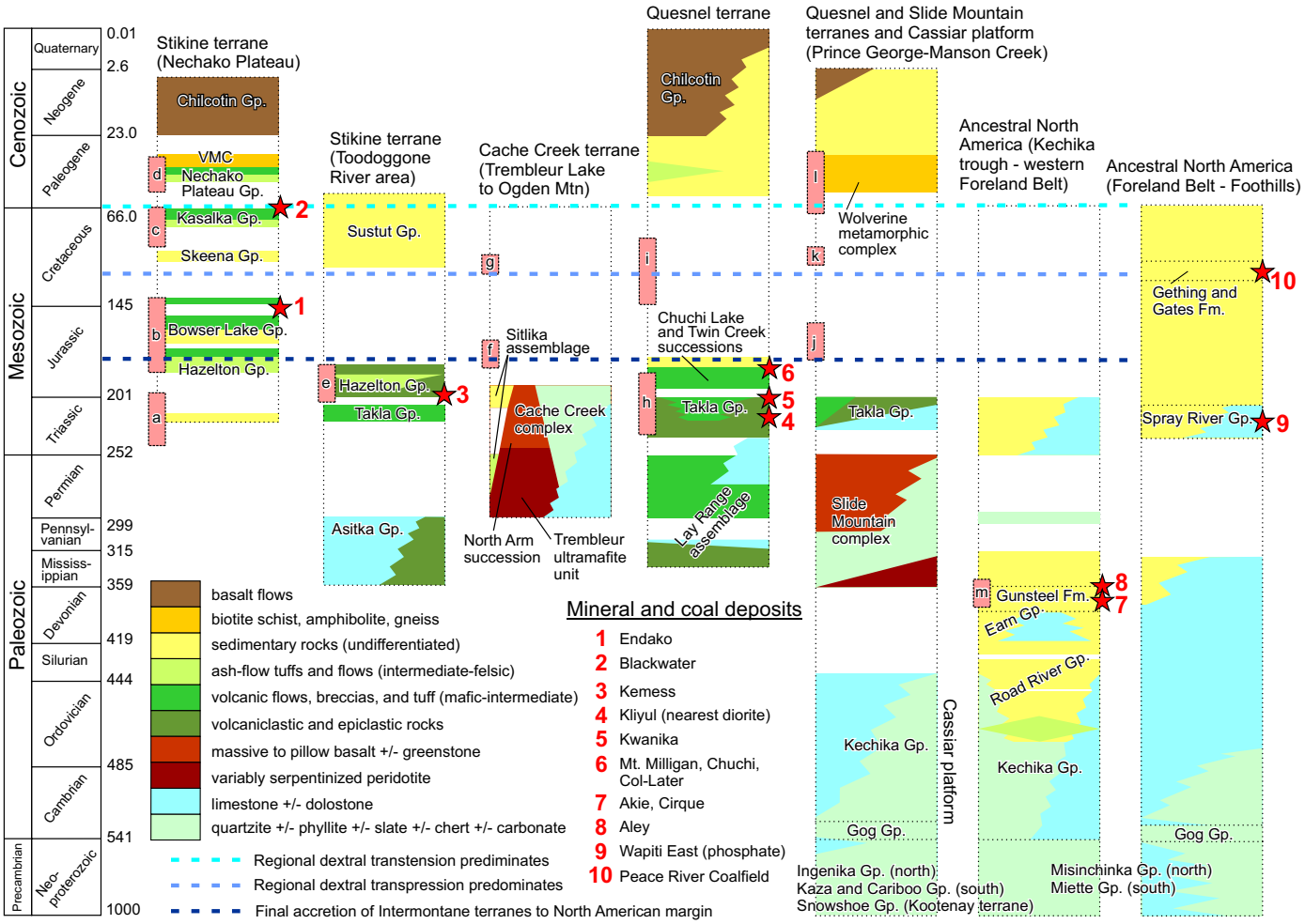

Fig. 3. Generalized stratigraphy, Omineca and Northeast regions. Selected intrusive rocks: a) Brooks diorite complex, b) Endako batholith and Laidman batholith; c) Capoose batholith and Blackwater pluton; d) Chu pluton; e) Black Lake plutonic suite; f) Spike Peak intrusive suite; g) granodioritic plutons (unnamed suite); h) Hogem plutonic suite (Triassic-Jurassic); i) Hogem plutonic suite (Cretaceous) and Germansen Batholith; j) Ste. 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 (1997), Garnett (1978), Nelson and Bellefontaine (1996), MacIntyre (1998), Schiarizza and MacIntyre (1998), Stott (1984), Wetherup and Struik (1996) and the BC digital geology map. VMC is Vanderhoof metamorphic complex. Mineralization ages from Logan and Mihalynuk, (2014), McLeish (2013), Nelson and Bellefontaine (1996), New Gold Inc. (2015), Pell (1994), Schiarizza (2014). Geologic timescale from International Commission on Stratigraphy (2014).

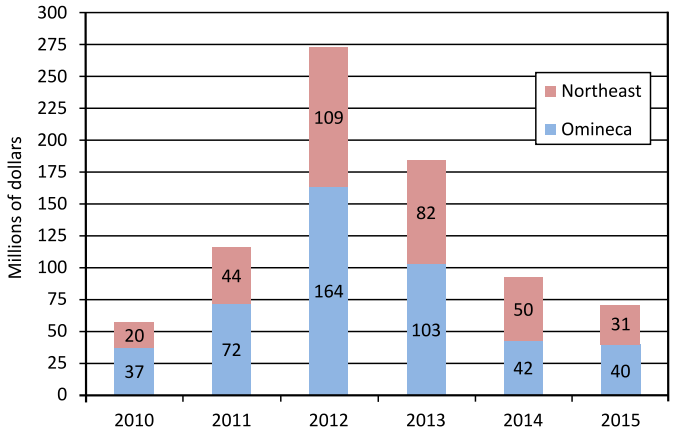

Fig. 4. Annual exploration spending estimates in millions of dollars for the Omineca and Northeast regions from 2010 to 2015. A total of $70.8 million for the combined regions in 2015 was down 23.3% from 2014.

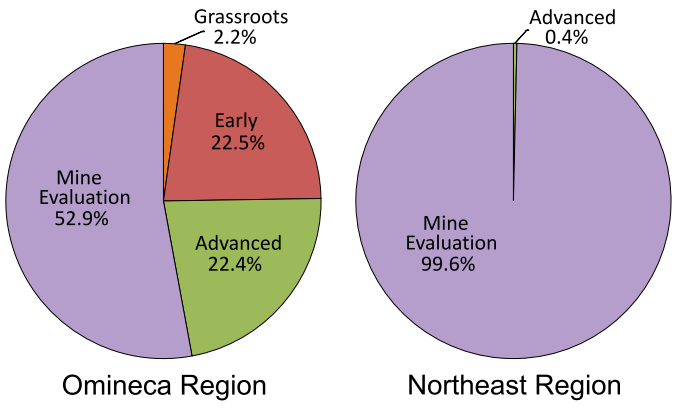

Fig. 5. Exploration expenditures in 2015 by exploration stage for the Omineca and Northeast regions.

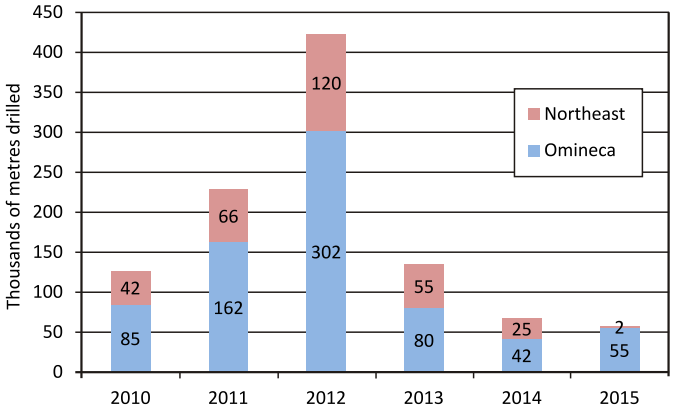

Fig. 6. Annual exploration drilling estimates in thousands of metres for the Omineca and Northeast regions from 2010 to 2015. A total of 57,350 m for the combined regions in 2015 was down 14.6% from 2014.

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 Omineca-Northeast combined region is underlain by:

1. Ancestral North America (Laurentia), including cratonic basement rocks and Proterozoic and Paleozoic siliciclastic and carbonate successions deposited on its western flank;
2. terranes of the Intermontane tectonic province: the Slide Mountain terrane marginal (back-arc) basin; the Quesnel and Stikine volcanic arc terranes, which formed outboard of ancestral North America starting in the Late Paleozoic and were 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 and represents their fore-arcs;
3. post-accretionary rocks; and
4. younger cover rocks (Figs. 1-3).

Two main episodes of mountain building occurred (Monger, 2008), the Columbia-Omineca-Cassiar mountains (Middle Jurassic-Early Cretaceous) and the Northern Rocky Mountains (Late Cretaceous-Paleogene). The first produced a continuous belt of 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 (Wright et al., 1994).

2.1. Ancestral North America

In the Omineca and Northeast regions, Laurentian basement is unconformably overlain by Middle Proterozoic to Middle Paleozoic continental shelf, and deep-water marine siliciclastic and carbonate successions of the Western Canada Sedimentary Basin. These were deposited on the western margin of ancestral North America during protracted rifting and breakup of the supercontinent Rodinia (Fig. 3, see Nelson et al., 2013 for review). The oldest Middle Proterozoic rocks include dolomitic sedimentary rocks of the Muskwa basin (Middle Proterozoic, Fig. 2) which host the oldest known copper mineralization in British Columbia (MINFILE 094K 003). In the Rocky Mountains north of Prince George, rocks of the Windermere Supergroup (Upper Proterozoic) are represented by siliciclastic sedimentary units of the Misinchinka Group and their metamorphic equivalents (Ferri et al., 1994); south of Prince George, the similar Miette Group is representative. The Gog Group (Lower Cambrian) unconformably overlies the Windermere Supergroup and consists predominantly of sandstone, pebble conglomerate, quartzite and limestone. Near Valemount, the highest peak in the Canadian Rockies, Mt. Robson, comprises a succession of Middle-Upper Cambrian calcareous sedimentary and carbonate rocks. In the Rocky Mountains north of Mackenzie, Early to Middle Paleozoic sedimentation is represented mainly by phyllitic siltstone, shale and carbonate units of the Kechika Group (Cambrian-Ordovician), Road River Group (Middle Ordovician-Middle Devonian) and Earn Group (Devonian-Mississippian). This belt of Paleozoic rocks is prospective for sediment-hosted zinc-lead, Carlin-type gold deposits, carbonatite-hosted specialty metals, barite, silica (including frac sand), and quarry limestone.

The Kechika trough is the southeastern extension of the continental margin Selwyn basin of the Yukon and Northwest Territories, which hosts prolific Cambrian to Devonian sedimentary exhalatite (SEDEX) deposits (Yukon Geological Survey, 2007). The trough is in the Northern Rocky Mountain fold and thrust belt (Muskwa ranges), bounded to the west by the Northern Rocky Mountain trench and to the east by the Macdonald Platform (Figs. 1, 2). Siliceous and carbonaceous shale of the Upper Devonian Gunsteel Formation (Earn Group) hosts stratiform baritic zinc-lead deposits including those at **Akie** and **Cirque**. The host shales are preserved in a series of Cretaceous to Early Tertiary northwest-trending thrust sheets and synclinal keels (MacIntyre, 1998).

The **Aley** carbonatite complex (Late Devonian-Early Mississippian) also lies in the Muskwa ranges; it is hosted by Cambrian to Ordovician carbonate and siliciclastic rocks 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 British Columbia (Pell, 1994; Millonig and Groat, 2013).

About 60 km east of the Kechika trough a north-south trending regionally extensive belt in the Muskwa ranges hosts Mississippi Valley-type deposit prospects and showings in thrust-faulted dolomitic carbonate rocks (Silurian-Devonian) adjacent to the continental shelf-slope front (Nelson et al., 2002). These are regarded as being coeval with the Late Devonian SEDEX deposits farther west in the Kechika trough and are similarly associated with subduction-related extensional tectonics, back-arc and intra-arc spreading, in Devonian-Mississippian time.

Most outboard are the Cassiar platform and Kootenay parautochthonous terrane. Both originated as basement highs

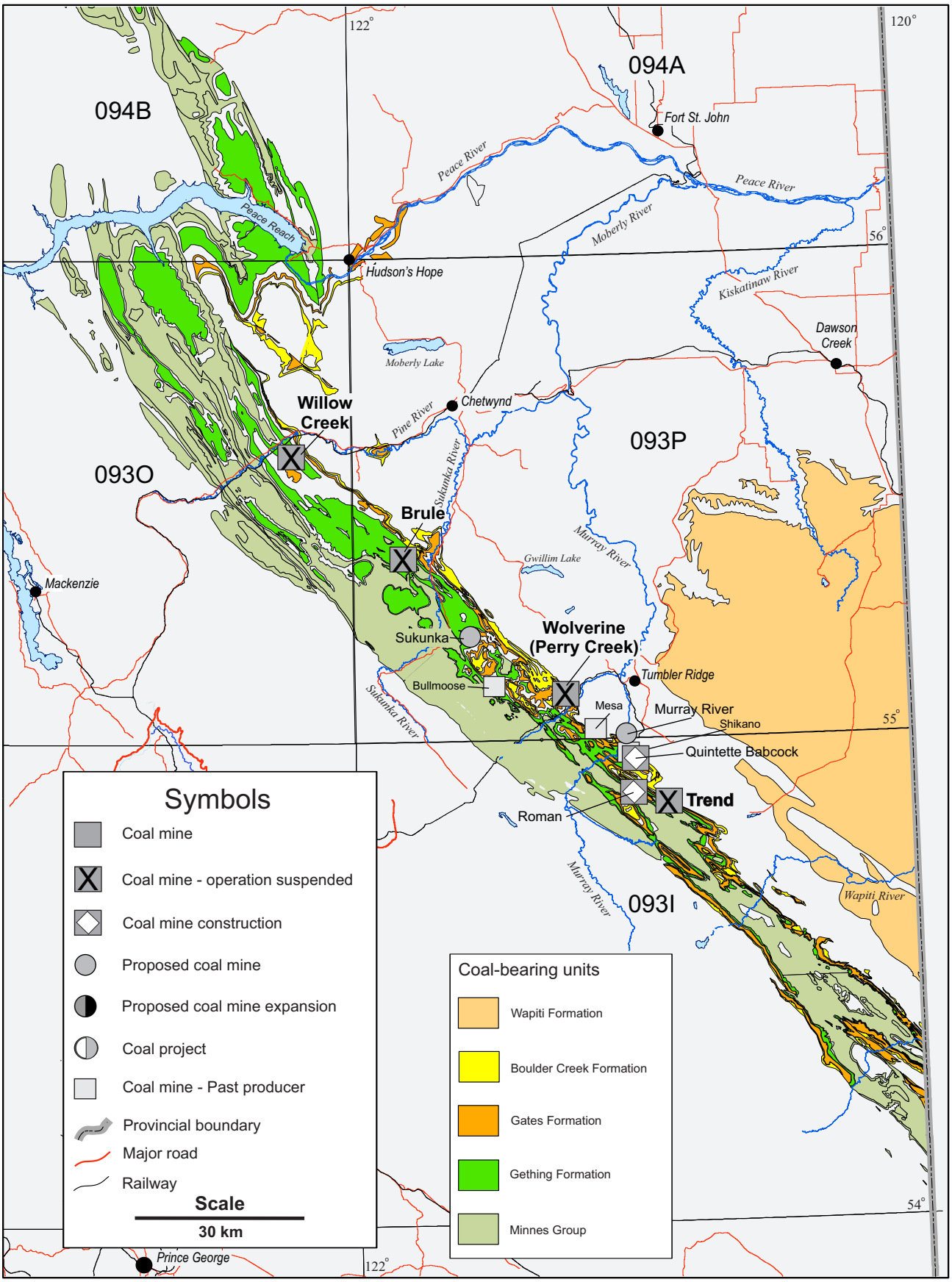

Fig. 7. Coal mines and exploration projects, northeastern British Columbia 2015. From British Columbia Geological Survey (2016).

during fragmentation of the margin as Laurentia rifted in Neoproterozoic to Cambrian time (Nelson et al., 2013). The Cassiar platform lies west of the Tintina-Northern Rocky Mountain Trench fault; restoration of approximately 490 km of Cretaceous-Eocene dextral motion (Gabrielse et al., 2006) places it outboard of the southern Kechika trough. Oldest rocks are Early-Middle Proterozoic and include orthogneiss and crystalline limestone along the Northern Rocky Mountain Trench near Kwadacha (Cassiar platform Fig. 1); and the Malton Gneiss Complex, the northernmost expression of the Monashee Mountains near Valemount (Kootenay terrane; Fig. 2; 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 (Upper Proterozoic) and Kechika Group; whereas southeast of Prince George the Cariboo (Upper Proterozoic-Cambrian), Kaza (Upper Proterozoic), and Gog Group are representative (Ferri et al., 1994). Triassic limestone sequences near **Giscome** are assigned to the North American margin and are interpreted as tectonic windows through overthrust Slide Mountain Group basaltic volcanic units of Mississippian-Permian age (Struik et al., 1990). South of Prince George, metasedimentary rocks of the Snowshoe Group (Upper Proterozoic-Paleozoic) represent the northern extent of the Kootenay terrane. Cassiar platform rocks are locally prospective for quarry limestone and silica (including frac sand), whereas auriferous veins and placer gold are the main focus of Kootenay terrane. 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).

2.2. Intermontane tectonic province

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, 1997). Its crust is preserved as allochthons structurally overlying the deformed continental margin.

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 over 600 km in the Omineca Region. The Mesozoic Quesnel arc developed in two phases above an Upper Paleozoic volcanic-sedimentary subterrane assemblage (Ferri et al., 1994; Nelson and Bellefontaine, 1996). The Takla Group (Upper Triassic) phase comprises basinal sedimentary rocks that are overlain by mafic and intermediate island-arc volcanic successions. These rocks are locally and paraconformably overlain by partially subaerial intermediate volcanic rocks, including the Chuchi Lake and Twin Creek successions (Early Jurassic) which were emplaced on a more mature arc. 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 (roughly 180 km long; Fig. 2) Hogem intrusive complex and its peripheral offshoots locally host porphyry copper-gold ±silver ±molybdenum deposits and prospects including **Kwanika**, **Mt. Milligan**, **Chuchi**, **Col-Later** and **Kliyul**. Petrogenesis of the Hogem intrusive suite was from more mafic peripheral to more felsic central phases generally, and from more weakly alkaline to sub-alkaline 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 (Garnet, 1978; Bath et al., 2014; Devine et al., 2014). Terrane bounding faults include northwest-trending thrust and strike-slip faults -- Swannell fault, Manson-McLeod fault system, and Eureka and Pundata thrusts -- on its eastern side; and the regional Pinchi and Ingenika strike-slip faults on the western side (Fig. 1).

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 Late Permian to Early Jurassic time. Accretion of the terranes is thought to have resulted from westward subduction of oceanic crust beneath Stikinia and eastward subduction beneath Quesnellia (Diakow et al., 1993, Nelson et al., 2013). The Stikine terrane underlies much of the Skeena Region and the westernmost part of the Omineca Region, including the Toodoggone River (northwest) and Nechako Plateau (southwest) areas (Fig. 2).

In the Toodoggone River area, bimodal volcanic and sedimentary rocks of the Asitka Group (Carboniferous-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 (Toodoggone Formation; Lower Jurassic) unconformably overlie the Takla Group. Coeval with Hazelton Group, quartz monzonitic to granodioritic rocks of the Black Lake intrusive suite (Fig. 2) 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 located in the southern portion of the area; whereas epithermal gold-silver deposits of mainly low-sulfidation type, such as **Lawyers**, and lesser high-sulphidation type occur in the central and northern parts. The Finlay-Ingenika fault system bounds the Toodoggone River area on the east (Fig. 1).

2.2.4. Cache Creek terrane

The Cache Creek terrane is an 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 (Schiarizza and MacIntyre, 1998; Nelson et al., 2013). From the Trembleur Lake area north to Ogden Mountain, the terrane consists of the Sitlika assemblage (Permian-Early Jurassic) and the Cache Creek complex (Late Pennsylvanian-Late 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, 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 (see Jago, 2015), 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; a massive limestone unit lies farther to the east. In the Ogden Mountain area, nephrite jade lenses are in high-pressure, low-temperature metamorphic rocks of the Cache Creek complex. Predominantly west-directed structural imbrication and obduction of oceanic rocks onto Stikinia occurred in Early-Middle Jurassic time during terrane accretion. The Takla Fault bounds the Cache Creek terrane on the west.

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

2.3.1. Bowser Basin and Sustut Group

The Omineca Region captures the eastern part of the Bowser Basin, which is more extensive in the Skeena Region. West of the Toodoggone River area, sedimentary rocks of the Bowser Lake Group (Middle Jurassic to Lower Cretaceous) formed in a foreland basin west of the uplifted Cache Creek terrane and Omineca mountains (Evenchick et al., 2007). Basin stratigraphy transitions upward from marine shale through increasingly non-marine conglomeritic clastic formations. The Groundhog Coalfield and **Groundhog** anthracite deposit is hosted in a deltaic sequence of alternating marine and non-marine sedimentary rocks. Non-marine sedimentary rocks of the Sustut Group (Lower to Upper Cretaceous), also derived from the Omineca highland (Diakow et al., 1993), extend for over 100 km along the western margin of the Toodoggone River area and southward, overlapping Upper Paleozoic-Lower Jurassic volcanic and sedimentary units.

2.3.2. Francois Lake plutonic suite

In the Nechako Plateau area, felsic and mafic Hazelton Group island-arc volcanic and volcanogenic sedimentary rocks predominate (Diakow et al., 1997; Angen et al., 2015) and are intruded by syn-accretionary Late Jurassic monzogranitic rocks of the Endako and Laidman batholiths. The Endako Batholith (Figs. 2, 3) is a composite intrusive complex (gabbro to monzongranite) that extends along a northwest trend at the northern end of the Nechako Plateau for roughly 90 km within both the Omineca and Skeena regions; and west of Fort St James, a 60 km long northwest trending body of quartz diorite (Middle Jurassic) is also assigned to it (Fig. 2). The batholith has a protracted history of emplacement (Late Triassic-Early Cretaceous) evolving from more mafic to felsic intrusions from margin to core (Villeneuve et al., 2001). 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).

2.3.3. Late Cretaceous and Eocene intrusions

In the Nechako Plateau area, Hazelton Group rocks are locally overlain by sedimentary and bimodal volcanic rocks of the Bowser Lake Group. Similar to the Sustut Group, coarse clastic sedimentary units of the Skeena Group (Lower-Middle Cretaceous) are exposed locally, but are more widespread in Skeena Region (Alldrick and Lin, 2008). By Late Cretaceous time, regional transpression and the development of a continental arc to the west led to an episode of granodiorite intrusion (Diakow et al., 1997; Nelson et al., 2013) that included the Capoose Batholith and Blackwater Pluton, the latter being spatially related to the **Blackwater** deposit (Christie et al., 2014; Looby, 2015). Episodic volcanism continued with eruption of the intermediate calc-alkaline Kasalka Group rocks (Late Cretaceous), which host the Blackwater deposit; and Eocene rocks of the Nechako Plateau Group, including: the Ootsa Lake Formation (felsic volcanic, also known as the Ootsa Lake Group) and Endako Formation (mafic-intermediate volcanic, also known as the Endako Group). Eocene volcanism was concurrent with regional extension and horst-and-graben faulting, and exhumation of the Vanderhoof metamorphic complex (Wetherup and Struik, 1996). North- to northwest-trending faults and northeast cross faults are important controls on mineral showings developed during Late Cretaceous to Eocene uplift and extension. The Nechako uplift, a northeast-trending horst, 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 faulting of the **Mt. Milligan** deposit may be in part related to motion along a splay of the Manson-McLeod fault zone. The Wolverine metamorphic complex, a core complex related to extensional and strike-slip tectonics, comprises schistose to gneissic amphibolite-grade Laurentian Neoproterozoic basement rocks that were rapidly

exhumed in the Paleogene (Ferri et al., 1994; Staples, 2007).

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, 7). Coal seams of economic thickness and continuity are predominantly medium-volatile bituminous rank and 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 cyclothems were deposited in deltaic and lagoonal settings along the western edge of the basin during marine transgressions and regressions (Stott, 1984; Grieve, 1995). These rocks were shortened during the Laramide Orogeny (Late Cretaceous-Paleogene), lying east of an eastwardly-prograding clastic wedge. Thrusts, northeast-vergent variably 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, 1995). 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, marine and non-marine fine clastic sedimentary rocks (Cretaceous) of the Western Canada Sedimentary Basin comprise much of the shallow bedrock geology.

2.4. Neogene to Quaternary cover rocks

Tertiary fluvial deposits were deposited in large braided and meandering systems (Levson and Giles, 1993) such as the north-flowing ancient Peace River (Turner et al., 2010). Chilcotin Group flood basalts (Miocene and younger) outcrop locally within 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 Omineca Region where outcrop is sparse (Quesnel Trough and Nechako Plateau), and more topographically confined to the north within the Omineca mountains. More recent colluvial and alluvial deposits have formed along rivers and streams, and organic deposits occur in poorly drained depressions (Blais-Stevens and Clague, 2007).

3. Mines and quarries

The combined Omineca-Northeast region has three metal mines, five coal mines, and three industrial mineral mines including nephrite jade and dimension stone quarries. Due to challenges associated with falling commodities prices, two metal mines and all five coal mines have been placed on care and maintenance since 2013.

3.1. Metal mines

In 2015 there was one operating open pit mine (**Mt. Milligan**), one open pit mine that went from temporary suspension to care and maintenance (**Endako**), and one seasonal underground mine (**Shasta**) that remained on care and maintenance since 2013. All three are in the Omineca Region.

3.1.1. Endako

The Endako molybdenum mine (Fig. 1, Table 1; Thompson Creek Metals Company Inc., operator and 75% owner; Sojitz Moly Resources, Inc., 25% owner) is one of many porphyry deposits distributed along the length of Stikinia (Logan,

Table 1. Metal mines, Omineca and Northeast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Endako	Thompson Creek Metals Company Inc.	Mo; Porphyry Mo (Low F-type); 093K 006	n/a	33.4 Mt at 0.049% Mo; containing 16,239 tonnes (35.8 Mlbs) Mo	109.2 Mt at 0.047% Mo (additional to reserves)	Placed on care and maintenance in July
Mt. Milligan	Thompson Creek Metals Company Inc.	Cu, Au, Ag; Alkalic porphyry Cu-Au; 093N 194	32,124 t (70.8 Mlbs) copper; 6771 kg (217,700 oz) gold	542.1 Mt at 0.201% Cu and 0.355 g/t Au; containing 1.092 Mt (2407.4 Mlbs) Cu and 192.8 t (6.20 Moz) Au	122.3 Mt at 0.15% Cu and 0.321 g/t Au (additional to reserves)	Ramp-up continued, engineering studies for permanent secondary crushing circuit, second SAG mill discharge screen deck installed, Q1-Q3 reported capex was $43.7 million
Shasta	Sable Resources Ltd.	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation); 094E 050	n/a	n/a	n/a	Remained on care and maintenance in 2015, operations ceased in September 2012

2013; Logan and Mihalynuk, 2014). The orebody is hosted by the Endako quartz monzonite (Figs. 2, 3; Late Jurassic) and 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, 2001). Due to adverse conditions in the molybdenum market, operations at the Endako mine were temporarily suspended at the end of 2014, and a decision followed to put the mine on care and maintenance at the start of July.

3.1.2. Mt. Milligan

The Mt. Milligan mine (Fig. 1, Table 1; Thompson Creek Metals Company Inc.) is a near-surface, silica-saturated alkalic copper-gold porphyry deposit in central Quesnellia (Lang et al., 1994; Logan, 2013; Logan and Mihalynuk, 2014). It is hosted by mafic-intermediate volcanic and volcaniclastic rocks of the Takla Group (Witch Lake succession) and by Early Jurassic monzonite stocks that are coeval with volcanic rocks of the Chuchi Lake succession (Fig. 3; Mortensen et al., 1995; Nelson and Bellefontaine, 1996). The deposit is a moderately dipping, tabular, approximately 2.5 x 1.5 km body that extends to a depth of 400 m (Clifford and Berthelesen, 2015). Copper-gold mineralization with accessory silver occurs as sulphide disseminations, fracture fills, and lesser veinlets in the monzonitic stocks, their brecciated margins, and hornfelsed and altered volcanic rocks. A core zone of magnetite-rich potassic alteration and copper-gold bearing sulphide mineralization (MBX sub-zone; Fig. 8) transitions southeastwardly to gold-predominant mineralization and carbonate-rich phyllic alteration in a peripheral zone (66 sub-zone) suggestive of an alkalic lithocap structural root (Holliday and Cooke, 2007). An oxidized zone with weak supergene enrichment contains native copper and extends to depths of about 70 m along faults, mainly on the northern margin of the MBX stock.

Commissioned in October 2013, the mine saw its second full-year of operations in 2015 (Fig. 9). Continuing ramp-up activities involved several scheduled and unscheduled mechanical issues and mill shutdowns, working towards a target processing rate of 60,000 t per day by year end. A second SAG mill discharge screen deck was installed to improve throughput, and a temporary secondary crusher is in use while detailed engineering work continues for a permanent circuit. By mid-October, nine shipments of approximately 12,500 dry tonnes of copper-gold concentrate had been made; with 150,000 dry tonnes expected to be shipped by year end. By the end of November, average daily mill throughput reached 59,066 tonnes. An updated NI 43-101 technical report was released in January, updating the resource block model and final pit definition, and extending the mine life to 23.9 years as of the start of 2015 (Clifford and Berthelesen, 2015). Further refinements to the resource and ore recovery models continued throughout the year. Over 300 people are employed by the mine.

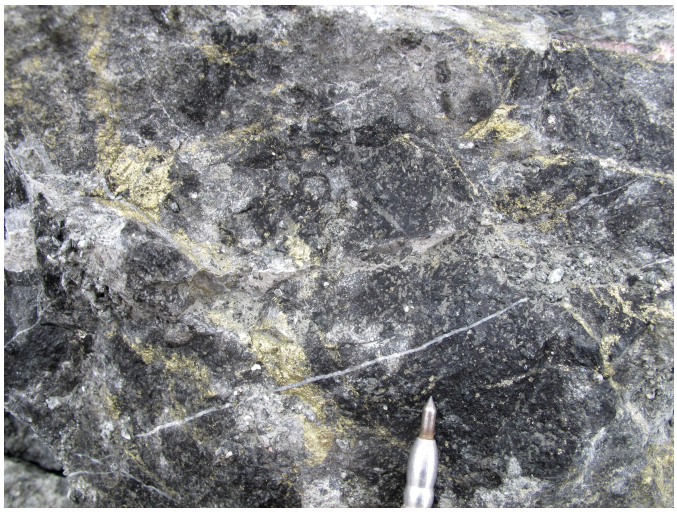

Fig. 8. Biotite hornfelsed, chalcopyrite-pyrite mineralized andesite-monzonite hybrid unit mined from the 995 bench at Mt. Milligan mine.

Fig. 9. Blast-hole drilling on the 1010 bench and shoveling on the 1085 bench at Mt. Milligan mine.

3.1.3. Shasta

The seasonal Shasta gold-silver mine (Fig. 1, Table 1) of Sable Resources Ltd. is underlain by Toodoggone Formation

volcaniclastic rocks and is spatially associated with a dacitic dome. Structurally-controlled low sulphidation-type epithermal gold-silver mineralization is hosted in quartz-carbonate stockwork veins and breccia zones. The mine and mill remained on care and maintenance in 2015; operations ceased in September 2012.

3.2. Coal mines

Coal mining operations in the Peace River Coalfield of Northeast British Columbia were suspended and placed on care and maintenance in 2014 due to adverse market conditions. For the Western Coal Corp. operations, wholly owned by Walter Energy, Inc., the **Perry Creek (Wolverine)** mine remained idle while mined inventory from **Brule** was transported to **Willow Creek** for processing and rail load-out. Processing was completed in May and the plant at Willow Creek was idled in June. At **Trend** and the fully-permitted **Roman Mountain** expansion of Peace River Coal Inc., wholly owned by Anglo American plc, the transport and rail load-out of coal stockpile ceased in late January. The fully-permitted **Quintette (Babcock)** mine of Teck Coal Limited remained idle. The Trend and Perry Creek mines produced mainly hard coking coal (HCC), whereas the Brule mine produced only pulverized coal injection (PCI) coal, a high-rank thermal coal used to sustain blast furnace temperatures in steelmaking.

3.2.1. **Brule** and **Willow Creek**

When in operation, Walter Energy's **Brule** mine (Figs. 1, 7, Table 2) mine produces PCI coal from three seams in the lower part of the Gething Formation with average cumulative thickness of about 12 m. The mine lies within a northwest-trending anticline-syncline fold couplet within a larger structural block bound by northeast-verging thrust faults. Run-of-mine coal is trucked 60 km on a connector road to the processing plant and rail load-out facility at the **Willow Creek** mine (Figs. 1, 7, Table 2) where only one of the mined seams requires beneficiation and the others are crushed and 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 2013.

3.2.2. Perry Creek (Wolverine)

At Walter Energy's **Perry Creek** mine (Wolverine Project; Figs. 1, 7, Table 2) medium-volatile bituminous HCC has been mined from seams in the Gates Formation within the Perry Creek syncline. The median cumulative thickness of the mineable seams is about 15 m. Before idling production in 2014, mining was forecast to continue another four years approximately and then switch over to the EB expansion project with no overlap in operations. Targeted annual production had been about 1.9 Mt of saleable coal.

3.2.3. Trend

At Anglo American-Peace River Coal's **Trend** mine (Table 2) HCC of medium-volatile bituminous rank has been mined from seams in the Gates Formation along the steeply dipping northeast limb of the Waterfall anticline. 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 (Fig. 7, Table 2) lies 1.5 km to the southwest in the Murray syncline and would comprise 5 km of linear open-cuts in three phases to capture the middle Gates coal seams on Roman Mountain, and satellite pits for the upper Gething coal seams (Peace River Coal Inc., 2007). The combined Trend-Roman operation (Fig. 1) was planned to have a production rate of 2.5 Mt saleable coal per year and extend the Trend mine life by 16 years.

3.2.4. Quintette (Babcock)

The proposed **Quintette (Babcock)** mine (Figs, 1, 7, Table 2) 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 fold anticline with a coal sequence similar to that at the Trend mine. The historic Quintette mine operated from 1982-2000 with development in 1998 of the open-cuts on Mt. Babcock. For the next phase of mining, fully permitted in 2014, production averaging 3.5 Mt of saleable coal per year over a 12 year mine life was planned but the project is currently on hold due to low metallurgical coal prices.

3.3. Industrial mineral mines and quarries

In 2015 there was one operating industrial mineral mine in the Northeast Region, the **Fireside** barite mine. In the Omineca Region, nephrite jade was mined at **Ogden Mountain** and riprap material was quarried at **Yellowjacket**.

3.3.1. Barite

At **Fireside** (Fig. 1, Table 3), Fireside Minerals Ltd. mines coarse white barite veins hosted in Kechika Group sedimentary rocks. The north and east-northeast trending, steeply dipping veins are spatially related to Paleozoic(?) gabbro dikes (Wojdak, 2008). Production in 2015 was 32,000 tonnes milled and bagged from 65,000 mined tonnes of barite. The Bear Pit has been mined out and pre-stripping of overburden at the Moose Pit was underway in preparation for the 2016 mining season (Fig. 10). Barite is crushed, milled and bagged on site, and then trucked to a drilling mud supplier in Fort St. John where it is sold as a heavy drilling fluid additive.

3.3.2. Nephrite jade

Jade is a commercial term for jadeite and nephrite. In British Columbia jade occurs as nephrite. Nephrite is a metamorphic rock derived from an ultramafic protolith that has undergone dynamothermal metamorphism and metasomatism near a subduction zone. The **Ogden Mountain** property (Fig. 1, Table 3) of Green Mountain Gemstones Inc. is underlain by metamorphosed, thrust-faulted, and well-foliated ultramafic rocks, including serpentinite mélange and schist, of the Cache

Table 2. Coal mines, Omineca and Northeast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Willow Creek	Walter Energy, Inc. (Western Coal Corp.)	HCC, PCI; Bituminous coal; 093O 008	n/a	16.6 Mt saleable	n/a	Placed on care and maintenance in 2013
Brule	Walter Energy, Inc. (Western Coal Corp.)	PCI; Bituminous coal; 093P 007	n/a	16.6 Mt saleable; Proven	n/a	Placed on care and maintenance in 2014, mined inventory processed to May 2015
Perry Creek (Wolverine)	Walter Energy, Inc. (Western Coal Corp.)	HCC; Bituminous coal; 093P 025	n/a	8.8 Mt saleable; Proven	n/a	Placed on care and maintenance in 2014
Trend	Anglo American plc (Peace River Coal Inc.)	HCC; Bituminous coal; 093I 030	n/a	8.3 Mt saleable	26.5 Mt mineable in situ (additional to reserves)	Placed on care and maintenance in 2014, 50,000 t mined inventory shipped in January 2015
Roman Mountain	Anglo American plc (Peace River Coal Inc.)	HCC; Bituminous coal; 093I 030	n/a	25.8 Mt saleable	4.3 Mt mineable in situ (additional to reserves)	Placed on care and maintenance in 2014
Quintette (Babcock)	Teck Coal Limited	HCC, TC; Bituminous coal; 093I 011	n/a	39.1 Mt saleable	124.4 Mt mineable in situ (additional to reserves)	Placed on care and maintenance in 2014

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

Table 3. Industrial mineral mines and quarries, Omineca and Northeast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Fireside	Fireside Minerals Ltd.	Barite; Vein barite; 094M 003	32,000 t	485,000 tonnes (non NI 43-101 compliant)	n/a	Bear Pit has been mined out, pre-stripping overburden at Moose Pit
Ogden Mountain	Green Mountain Gemstones Inc.	Nephrite jade; Jade; 093N 156, 093N 165	n/a	n/a	n/a	Exploration and placer mining of alluvial jade boulders, excavation of in situ jade
Yellowjacket	Private individual	Construction stone	3,000 t	n/a	n/a	Mined rock for riprap material

Creek complex. These rocks are locally intercalated with massive white calc-silicate rock, historically called rodingite, considered to be a metasomatic replacement of mafic intrusive rocks (Simandl et al., 2000; Zharikov, 2007). Near the rodingite, 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 2015 the company resumed exploration and placer mining of alluvial nephrite boulders, and excavation of in situ nephrite.

3.3.3. Dimension stone

Near Valemount, mining of Windermere Supergroup metamorphic and sedimentary rocks for construction stone

Fig. 10. Barite ore at Fireside mine.

continued at the **Yellowjacket** project (Fig. 1, Table 3). Production was 3,000 tonnes of riprap material.

4. Mine development

Mine Development starts when the project proponent has all key government approvals for constructing and operating a mine and has begun onsite construction activities. There was no mine development in the Omineca and Northeast regions in 2015.

5. Proposed mines

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 direct submission of a Mines Act permit application for smaller scale projects not meeting the threshold criteria for review by the EAO.

The combined Omineca-Northeast region has seven projects at various stages and activity in the pre-application phase of Environmental Assessment, including **Aley**, **Blackwater**, and **KUG**. Two projects, **Giscome** and **Sukunka**, have submitted applications that are currently under review; one project, **Murray River**, was issued an Environmental Assessment certificate in 2015 following review that began in December 2014; and one project below the EAO threshold criteria, **Wapiti East**, has submitted a Mines Act permit application.

5.1. Proposed metal mines

Work was carried out on three proposed metal mines in 2015; the **Blackwater**, **Kemess Underground (KUG)** and **Aley** projects. All three projects are within the Omineca Region.

5.1.1. Blackwater

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 rhyodacites, heterolithic breccia containing altered fragments of other units, and silicified hydrothermal breccias. Bowser Lake Group sedimentary rocks underlie the volcanic sequence at depth. Alteration and mineralization associated with the deposit define a 1,300 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 as micron-scale grains (ranging from about 30 μm up to 200 μm) are spatially associated with sulphide and silicification; and timing of main stage gold 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 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 Inc. continued engineering and environmental studies, including a tailings alternatives assessment, in support of their Environmental Assessment which remained in the screening stage at the end of the pre-application phase throughout the year. A 2014 feasibility study describes an open-pit mining operation with 60,000 t per day processing plant and a mine life of 17 years. Life-of-mine average annual production would be 12,846 kg (413,000 ounces) of gold and 54,182 kg (1.74 million ounces) of silver. Total metal production would be 217,724 kg (7.0 million ounces) of gold and 920,663 kg (29.6 million ounces) of silver. The proposed mine would create 1,200-1,500 jobs during construction, and a permanent workforce of over 500 employees.

5.1.2. Kemess Underground (KUG)

The **Kemess Underground** deposit (Figs. 1, 3; Table 4; AuRico Metals Inc.) is centered on the Kemess North pluton (earliest Jurassic), a quartz monzodiorite of the Black Lake intrusive suite that follows a south-dipping reverse fault. The fault separates Takla Group basaltic-andesites from a barren wedge of Toodoggone Formation (Hazelton Group) dacitic lapilli tuffs to the north, and cuts off the pluton and mineralization at depth (Witte et al., 2013). An 80 m thick sulphate leach zone of clay-rich broken rock overlies the deposit. Subjacent phyllic alteration with pyrite-anhydrite/

Table 4. Selected proposed mines, Omineca and Northeast regions.

Project	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
Blackwater	New Gold Inc.	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation); 093F 037	344.4 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 254,115 kg (8.17 Moz) Au, 1,891 tonnes (60.8 Moz) Ag	396.9 Mt at 0.74 g/t Au, 5.5 g/t Ag; containing 295,483 kg (9.50 Moz) Au, 2,181 tonnes (70.13 Moz) Ag (including reserves)	Environmental Assessment (pre-ap.), engineering studies, environmental studies	Proposed open-pit mine with 60,000 t/d processing. Life-of-mine average annual production would be 12,846 kg (413 Koz) Au and 54,182 kg (1.74 Moz) Ag. Mine life of 17 years
Kemess Underground (KUG)	AuRico Metals Inc.	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au; 094E 094	100.4 Mt at 0.28% Cu, 0.56 g/t Au, 2.0 g/t Ag; containing 280,842 tonnes (619.2 Mlbs) Cu, 56,142 kg (1.8 Moz) Au, 205,532 kg (6.6 Moz) Ag	65.4 Mt at 0.24% Cu, 0.41 g/t Au, 1.8 g/t Ag; containing 157,191 tonnes (346.5 Mlbs) Cu, 26,562 kg (854 Koz) Au, 118,535 kg (3.8 Moz) Ag (additional to reserves)	Environmental Assessment (pre-ap.), updated feasibility study, geotechnical drilling, test pitting	Proposed underground block cave mine with 24,600 t/d processing. Average annual production would be 3,266 kg (105 Koz) Au and 19,958 tonnes (44 Mlbs) Cu. Mine life of 12 years
Aley	Taseko Mines Limited	Nb; Carbonatite-hosted deposit; 094B 027	83.8 Mt at 0.50% Nb_2O_5; containing 292.9 Mkg* Nb *calculated by author	258.8 Mt at 0.37% Nb_2O_5; containing 669.4 Mkg* Nb (including reserves) *calculated by author	Environmental Assessment (pre-ap.), engineering studies, metallurgical testing, environmental data	Proposed open-pit mine with 10,000 t/d processing. Average annual production would be 9,000 tonnes niobium. Mine Life of 24 years
Murray River	HD Mining Int'l Ltd.	HCC; Bituminous coal; 093I 010	261.6 Mt mineable; proven	314.2 Mt in situ	Environmental Assessment (issued in October), driving decline, drilling (exploration, hydrogeological), bulk sample	Proposed underground longwall mining operation. Average annual production would be 4.8 Mt saleable coal. Mine life of 25 years.
Sukunka	Glencore plc	HCC; Bituminous coal; 093P 014	n/a	145 Mt in situ	Environmental Assessment (under review), updated resource and geologic model, engineering and environmental studies	Proposed open-pit mine. Initial annual production would be 1.5-2.5 Mt saleable coal. Mine life of >20 years
Giscome	Graymont Western Canada Inc.	$CaCO_3$; Limestone; 093J 041, 093J 025	n/a	>100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ; Indicated	Environmental Assessment (under review), engineering and environmental studies, bulk sampling, test pitting	Proposed 600,000 t/y limestone quarry to feed a vertical lime kiln producing 198,000 t/y of lime. Mine life of > 50 years
Wapiti East	Fertoz Int'l Inc.	P_2O_5; Sedimentary phosphate deposits; 093I 008, 093I 022	n/a	0.81 Mt at 22.3% P_2O_5; Indicated	Upgraded resource, scoping study, small mine application submitted (late 2014)	Proposed seasonal shallow open-pit mine. Average annual production would be <75,000 tonnes phosphate rock. Mine life of >20 years

gypsum veining is predominant in the Takla Group volcanic rocks; at depth, quartz-magnetite ±biotite 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. Vein density approaches 100% in a high-grade northeast corner of the deposit.

AuRico continued to advance the proposed KUG block cave mine through a Substituted (federally and provincially harmonized) Environmental Assessment and towards an updated feasibility study. Geotechnical diamond and auger drilling was undertaken on key infrastructure areas, including the proposed triple decline portal, short tunnel portal and conveyor areas; and test pitting was completed to determine geotechnical and substrate characteristics. The underground block cave operation would use processing facilities and infrastructure at the Kemess South mine (now on care and maintenance; ERM Rescan, 2014). An average milling rate of 24,650 t per day would annually produce 3,266 kg (105,000 ounces) of gold and 19,958 t (44 million pounds) of copper. Total metal production would be 40,435 kg (1.3 million ounces) gold and 255,373 t (563 million pounds) copper. The operation would run for 12 years, with mining from a single extraction level. Construction is expected to take five years, employing approximately 400 people over the first four years.

5.1.3. Aley

The **Aley** niobium project (Figs. 1, 3; Table 4, Taseko Mines Limited and subsidiary Aley Corporation) is hosted by the Aley Carbonatite complex (Devonian-Mississippian). The complex is an alkaline ultrabasic intrusion that is ovoid in plan-view (2.8-2.0 km) and consists mainly of dolomite carbonatite (80-95%), with lesser calcite carbonatite (McLeish, 2011). An upper zone extending to about 200 m depth consists of multi-phase carbonatite with dense cumulate bands of magnetite-apatite-calcite-phlogopite-zircon-columbite ±olivine, baddeleyite (ZrO_2), and pyrite that have been fragmented and disseminated within the intrusive. A lower zone of silico-carbonatite contains sodic-amphibole and extends to roughly 300 m depth. Niobium occurs in the minerals pyrochlore, fersmite and columbite. The latter two are alteration products of primary pyrochlore and may be related to dolomitization of calcite carbonatite. Pseudomorphs and relict textures of early carbonatite phases are in the dolomitic phase, and pyrite is more abundant. A fenitized aureole with abundant sodic-amphibole is cut by carbonatite dikes or sills and extends up to 500 m into the host rock beyond the brecciated carbonatite margin.

After completing a six-month engineering study and updated mine plan for their Gibraltar mine in May, the in-house construction and commissioning team of Taseko switched focus to the Aley project. Further engineering and metallurgical test work aimed to verify and improve results of the 2014 feasibility study, and environmental baseline data gathering continued. An open-pit mine with a 10,000 t per day processing plant and ferroniobium convertor is proposed. Average annual production over the 24 year mine life would be about 9,000 tonnes niobium in the form of ferroniobium (annual production of about 14,000 tonnes FeNb). The proposed mine would require approximately 700 jobs during construction and 350 direct jobs at full operation (Aley Corporation, 2014), and is moving through the pre-application stage of a Substituted Environmental Assessment.

5.2. Proposed coal mines

Work was carried out on two proposed coal mines in 2015, the **Murray River** and **Sukunka** projects. Both projects are within the Northeast Region.

5.2.1. Murray River

The 35 km-long, 160 km² northwest-trending licensed area for the **Murray River** project (Figs. 1, 7, Table 4) of HD Mining International Ltd. is underlain by Lower to Upper Cretaceous successions of the Fort St. John Group above the Gates Formation. The main geologic structure is modelled as a gently northeast-dipping homocline 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 2015, HD Mining continued engineering and environmental studies in support of their Environmental Assessment, and an underground bulk coal sample project continued (Fig. 11) with the driving of a decline to 1,351 m (close to 400 m vertical depth) where the bulk sample will be extracted. Exploration drilling from the face of the decline was undertaken for further coal seam delineation and characteristics assessment. An 11-hole surface drilling program was also completed for additional coal resource data and deep groundwater system characterization. Contingent on coal quality results of the bulk sample, the proposed underground longwall mining operation would have

Fig. 11. Approaching the decline portal at the Murray River project.

a production rate of 4.8 Mt of saleable coal per year over a 25 year mine life. The construction phase of the project would take an estimated three years and create approximately 1,139 person-years (approximately 380 jobs) of direct employment for Canadian workers. The operations phase would require 764 direct jobs. The company is working with Northern Lights College on curriculum development and a training program for underground longwall mining. In October, an Environmental Assessment certificate for the project was issued.

5.2.2. Sukunka

The **Sukunka** project (Figs. 1, 7, Table 4) of Glencore plc (75% interest) and JX Nippon Oil & Energy Corporation (25% interest) lies in a broad monocline with sub-horizontal limbs that generally dip 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 thickness in the upper part of the Gething Formation are on the property, including the mineable Skeeter and Chamberlain. Seams in the lower part of the Gething Formation have been described historically (BP Coal Limited, 1977) and are also being targeted.

Glencore continued engineering and environmental studies to support their Substituted Environmental Assessment application, which was accepted for review in August. An open-pit mining operation with initial production of 1.5-2.5 Mt of saleable metallurgical coal per year is proposed (Stantec, 2015). Addition of a room-and-pillar underground mining component in a future mine plan would increase production to 6 Mt per year. Mine life is expected to exceed 20 years. Workforce requirements are estimated at up to 250 jobs during construction, and 543 employees during operations. The reported coal resource increased in January by 5 Mt (Measured) to 145 Mt (Measured and Indicated, Table 4). The increase was due to an updated geological model that incorporates both upper and lower members of the Gething Formation and increases confidence in the northern part of the deposit.

5.3. Proposed industrial mineral mines

Work was carried out on two proposed industrial mineral mines in 2015, the **Giscome** and **Wapiti East** projects. Giscome is located within the Omineca Region and Wapiti East in the Northeast Region.

5.3.1. Giscome

The **Giscome** property (Fig. 1, Table 4) of Graymont Western Canada Inc., a subsidiary of Graymont Limited, is underlain by fossiliferous limestone (Triassic) attributed to the Cassiar platform and basaltic volcanic rocks of the Slide Mountain Group (Struik et al., 1990). Paragneiss of the southern portion of the Wolverine metamorphic complex lies about 1.5 km northeast of the project area (Fig. 3). High quality limestone grades of about 98% $CaCO_3$ have been described in the area (Dahrouge and Kluczny, 2006). In 2015, Graymont continued engineering and environmental studies in support of an Environmental Assessment draft application and final lime plant and quarry designs. A 1,000 tonne bulk limestone sample was collected from two outcrops for crushing and kilning tests (Fig. 12). A 600,000 tonnes per year limestone quarry and conveyor system is proposed that would feed a vertical lime kiln producing 600 tonnes of lime daily and 198,000 tonnes 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.

5.3.2. Wapiti East

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 (Sulphur Mountain Formation, Spray River Group; Butrenchuk, 1996). The main ore mineral is microcrystalline francolite, a carbonate-rich variety of fluoroapatite. In 2015, Fertoz upgraded their JORC resource estimate and completed a scoping study for an at-surface resource averaging one metre width and 30 m depth over a strike length of 12.5 km in four zones. A seasonal (May-October) shallow open-pit mine is proposed with slot trenching along strike of a moderate-steeply dipping phosphorite unit and

Fig. 12. Loading blast-holes at Giscome.

production of up to 75,000 tonnes per year of phosphate rock. A Mines Act permit application was submitted in late 2014; mine life is expected to be greater than 20 years. Phosphate rock has agricultural applications as fertilizer.

6. 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 Nation 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.

Of the 38 selected active exploration projects in the combined Omineca-Northeast region in 2015, seven (18%) were at the mine evaluation stage, four (11%) were at the advanced stage, 16 (42%) were at the early stage, and 11 (29%) were at the grassroots stage. Project types included precious metal (10 properties, 26%); porphyry (Cu-Au, Cu-Mo, Mo) projects (12 properties, 31%); polymetallic base and precious metals (nine properties, 24%); specialty metals (one property, 3%); industrial minerals including jade (three properties, 8%); and coal (three properties, 8%).

6.1. Precious metal projects

6.1.1. Stikine terrane

In June, New Gold Inc. resumed exploration near the Blackwater deposit, focusing on epithermal gold-silver targets up to five km south and west of the deposit in the **Blackwater South** project area (including the Dave and Kaolinite Ridge target areas), and about 13 km west of the deposit in the **Buck** project area.

At **Blackwater South** (Fig. 1, Table 5) exploration consisted of infill induced polarization and magnetic geophysical surveys, and drilling. Work followed up on the 2014 discovery of porphyry-style copper-molybdenum-silver mineralization at the northwest margin of the inferred Blackwater granodiorite pluton (Late Cretaceous), where a resistivity high and chargeability low geophysical anomaly had been targeted. Stockwork quartz veining and quartz-cemented breccia with coarse molybdenite and clots of chalcopyrite-pyrite was intercepted over lengths of 414 m and 272 m, and vertical depth of about 460-880 m (Fig. 13). Drilling in 2015 tested a geochemical anomaly coincident with a magnetite destructive linear feature in hornfelsed Bowser Lake Group sedimentary units at the margin of the pluton (Fig. 14).

About two km north at the Dave target, grassroots work was followed by drilling that targeted a coincident geochemical and geophysical (magnetic low, chargeability high) anomaly following a northeast-trending structure in Kasalka Group

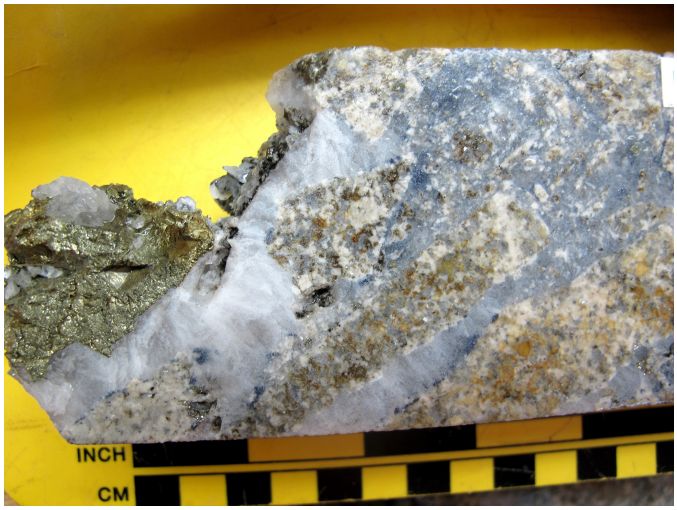

Fig. 13. Quartz-cemented chaotic breccia with disseminated and clotted chalcopyrite-pyrite-molybdenite mineralization in granodiorite at Blackwater South (New Gold Inc., 2015).

Fig. 14. Drilling at Blackwater South.

Table 5. Selected exploration projects, Omineca and Northeast regions.

Project	Operator	MINFILE	Commodity; Deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work Program	Comments
Blackwater South	New Gold Inc.	093F 037	Au, Ag; Epithermal Au-Ag-Cu (intermediate sulphidation)	n/a	Drilling (5,150 m), heliborne magnetics survey, ground-based geophysics (IP, magnetics), geochemistry (soil, rock), mapping, prospecting	Exploration focused on epithermal Au-Ag targets within 5 km south and west of the Blackwater deposit
Buck	New Gold Inc.	093F 043	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	Airborne geophysics (magnetics), geochemical sampling (rock), mapping, prospecting	Granite pluton is considered prospective for mineralized rhyolite dikes or sills
Big Bear	Parlane Resource Corp.	093F 075	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	Geochemical sampling (soil), prospecting	Soil sampling outlined a 400 x 170 m geochemical anomaly south of the 2012 drilling area
Fox	Kootenay Silver Inc., Theia Resources Ltd.	093F 078	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	Trenching and channel sampling (2014)	Six mineralized zones in a 400 x 100 m area; samples grade up to 45 g/t Au and 7,300 g/t Ag
2 X Fred	Kootenay Silver Inc., Theia Resources Ltd.	n/a	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	2014: trenching, geochemical sampling (rock); 2015: drilling (720 m), prospecting	244 channel and composite rock samples from 16 trenches averaged 0.49 g/t Au, 8.7 g/t Ag
Holy Cross	C.J. Greig & Associates Ltd.	093F 029	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	n/a	IP survey (7 line-km)	Two rock samples: 5.62 g/t Ag, 0.349 g/t Au (14EW105A), 4.86 g/t Ag, 0.0342 g/t Au, 1,075 ppm As (14EW108A)
Lawyers	PPM Phoenix Precious Metals Corp.	094E 066	Au, Ag; Epithermal Au-Ag-Cu (low sulphidation)	Historic non NI 43-101 compliant: 68.4 Kt at 7.3 g/t Au, 226 g/t Ag (Duke's Ridge; Cheni Mines Ltd., 1990)	Drilling (4,002 m; 3,282 m on Cliff Creek North, 720 m on Duke's Ridge zone), prospecting	Drilling to verify and infill historic results, and step-out deeper into the Cliff Creek north sub-zone and Duke's Ridge zone, first drilling program in 9 years
BT	Porpoise Bay Minerals Ltd.	093G 002	Au, Mg, Ni: Intrusion-related Au pyrrhotite veins	n/a	Trenching, prospecting	Trenching through glacial till overburden to sample mineralized granite and serpentinite bedrock
Blackjack Mineral	Angel Jade Mines Ltd.	093N 061	Au-Ag; Au-quartz veins	n/a	Trenching, test pitting, geochemical sampling (rock)	Exploring for in situ veins in the Manson Creek placer gold mining area

Table 5. Continued.

Kemess East	AuRico Metals Inc.	094E 094 (Kemess East), 094E 012 (Duncan)	Cu, Au, Ag, Mo; Porphyry Cu±Mo±Au	55.86 Mt at 0.41% Cu, 0.52 g/t Au, 2.0 g/t Ag; containing 228.5 Kt (503.7 Mlbs) Cu, 29,206 kg (939 Koz) Au, 112,004 kg (3.6 Moz) Ag; Indicated	Drilling (27,719 m), geochemical sampling (rock), mapping, prospecting	Drilling highlights: 305 m of 0.625 g/t Au, 0.433% Cu (KH-15-01); 301 m of 0.466 g/t Au, 0.394% Cu (KH-15-02); 458 m of 0.640 g/t Au, 0.437% Cu (KH-15-23); 590 m of 0.516 g/t Au, 0.366% Cu (KH-15-27); 772 m of 0.465 g/t Au, 0.365% Cu (KH-15-30)
Menard	HPX Quesnellia Holdings 1 Inc.	094D 049, 094D 090, 094D 154, 094D 174	Cu, Mo; Porphyry Cu±Mo±Au	n/a	Geochemical sampling (rock, soil, silt), mapping, prospecting	Reconnaissance geochemical sampling generated three targets of interest
Copper King	Pacific Empire Minerals Corp.	094D 004, 094D 149, 094D 150, 094D 151	Cu, Mo; Porphyry Cu±Mo±Au	n/a	IP survey (5 line-km), mapping, prospecting	
Kliyul	Teck Resources Limited, Kiska Metals Corporation	094D 014, 094D 023, 094D 028, 094D 182	Cu, Au, Ag; Porphyry Cu±Mo±Au	Historic non NI-43-101 compliant 2.3 Mt grading 0.3% Cu and 1.03 g/t Au (Gill, 1994a)	Drilling (1908 m), geochemical sampling (rock), mapping, prospecting	Drilling highlights: 245.0 m of 0.18% Cu, 0.53 g/t Au (KLI-15-034), 162.4 m of 0.20% Cu, 0.26 g/t Au (KLI-15-033)
Red Lion	Garibaldi Resources Corp.	094D165, 094D167, 094D168, 094D169	Cu, Au, Mo; Porphyry Cu±Mo±Au	n/a	Aeromagnetic and radiometric survey, IP survey (47 line-km), geochemical sampling, mapping, prospecting	
Kwanika East-Smoke	Serengeti Resources Inc.	093N 152, 093N 168	Cu, Mo; Alkalic porphyry Cu-Au	n/a	Heliborne magnetics survey (328 line-km)	
Jewel	Serengeti Resources Inc.	093N 240	Cu, Au, Ag; Alkalic porphyry Cu-Au	n/a	Heliborne magnetics survey (55 line-km)	Survey identified a 2 km-long ring-shaped cluster of magnetic highs
Col-Later	Pacific Empire Minerals Corp.	093N 101, 093N 169, 093N 216, 093N 032	Cu, Au, Ag, Mo; Alkalic porphyry Cu-Au	Historic non NI 43-101 compliant: of 1.81 Mt at 0.6% Cu; indicated (Kookaburra Gold Inc., 1989)	IP survey (68 line-km, 2014-15), drilling (2,493 m)	Drilling tested two geophysical anomalies on the till-blanketed western side of the property
Chuchi	Kiska Metals Corporation	093N 159, 093N 162	Cu, Au; Alkalic porphyry Cu-Au	Historic non NI 43-101 compliant: 50 Mt at 0.21-0.40% Cu, 0.21-0.44 g/t Au (Digger Resources Inc., 1991)	IP survey (10 line-km), prospecting	IP survey results show chargeability anomalies within and flanking the intrusive centre in the BP zone, new drill targets
North Grid	Thompson Creek Metals Company Inc.	093N 123, 093N 204	Cu, Mo; Alkalic porphyry Cu-Au	n/a	Drilling (2,000 m)	Drilling targets (Snell and Mitzi) with similar geophysical-geochemical signatures as Mt. Milligan deposit mineralized stocks

Table 5. Continued.

Prince George SE	Tech-X Resources Inc.	093G 064	Cu, Mo; Cu+/-Ag quartz veins	n/a	IP survey (6 line-km)	
Akie	Canada Zinc Metals Corp.	094F 031	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	12.7 Mt at 8.4% Zn, 1.7% Pb, 13.7 g/t Ag; containing 1.07 Mt (2,352.3 Mlbs) Zn, 214,000 tonnes (471.8 Mlbs) Pb, 174,024 kg (5.6 Moz) Ag; Indicated	Diamond drilling (5,350 m), 2014-15 airborne gravity gradiometry data received, environmental baseline studies	Drilling highlights: 28.51 m of 10.22% Zn, 2.34% Pb, 20.45 g/t Ag (A-15-121); 23.36 m of 8.63% Zn, 1.68% Pb, 14.64 g/t Ag (A-15-122); 21.41 m of 9.47% Zn, 2.11% Pb, 18.22 g/t Ag (A-15-124); 15.76 m of 9.71% Zn, 1.74% Pb, 15.75 g/t Ag (A-15-125)
Kechika Regional (Yuen North, Mt. Alcock)	Canada Zinc Metals Corp.	094F 013, 094F 015	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	n/a	2014-15 airborne gravity gradiometry data received	
Cirque	Teck Resources Limited	094F 008	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	Historic non-NI 43-101 compliant: 38.5 Mt at 8% Zn, 2.2% Pb, 47.2 g/t Ag (North Cirque); indicated (MacIntyre, 1992)	Drilling (5,370 m), geochemical sampling (rock, soil), mapping, prospecting, 2014-15 airborne gravity gradiometry data received	Drilling to verify and step-out from historic drilling results at depth beneath a thrust sheet of Ordovician and Silurian sedimentary rocks
Kechika Regional (Yuen, Cirque East, Pie, Elf)	Teck Resources Limited	094F 013, 094F 023, 094F 011	Zn, Pb, Ag; Sedimentary exhalative Zn-Pb-Ag	n/a	Geochemical sampling (rock, soil), mapping, prospecting, gravity geophysical survey (12.5 line-km), 2014-15 airborne gravity gradiometry data received	2.2 x 0.5 km Zn-Pb-Ag soil anomaly defined at Yuen with two coincident airborne gravity anomalies
Coral	Minfocus Exploration Corp.	094B 007, 094B 008, 094B 021	Zn, Pb, Ag; Mississippi Valley-type Pb-Zn	n/a	Geochemical sampling (rock), mapping, prospecting	3.21% Zn, 0.70% Pb average grade in 12.9 m long trench sampled at 1 m intervals
Groundhog	Atrum Coal Groundhog Inc.	104A 083, 104A 086	HCC, UL coal, Industrial mineral: Anthracite	349.4 Mt in situ (Groundhog North), 259.7 Mt in situ (East of Skeena)	Engineering and environmental baseline studies, coal quality tests, upgraded resource and geological model	Planned underground bulk sample. Environmental Assessment yet to be initiated

volcanic rocks. About 3.5 km to the west, at the Kaolinite Ridge target, grassroots work and a ground magnetic geophysical survey was followed by drilling that tested a northeast-trending soil geochemical anomaly with a gold-in-till anomaly in the down-ice direction. The target area is underlain by crystal lithic tuff that is superjacent to the rhyolite flow sequence at Blackwater, and may belong to either the Kasalka Group or Ootsa Lake Formation. Further to the west at the **Buck** prospect (Fig. 1, Table 5), a heliborne magnetic survey was completed and grassroots work. The area is underlain by gossanous, hornfelsed tuffaceous sedimentary units and volcanic rocks of the Bowser Lake Group and/or Hazelton Group. A granite pluton was dated as Late Cretaceous, and is considered prospective for gold-mineralized rhyolite dikes or sills.

The **Big Bear** property (Fig. 1, Table 5) of Parlane Resource Corp. is underlain by volcanic units of the Hazelton Group, Bowser Lake Group, and Ootsa Formation; as well as sedimentary units of the Bowser Lake Group 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 where drilling in 2012 returned mineralized intervals in two holes, including BB12-4 that averaged 0.26 g/t Au, 2.67 g/t Ag and 0.21% Zn over its entire length of 330.7 m (Webster, 2013). In 2015, soil sampling outlined a 400 x 170 m geochemical anomaly south of the 2012 drilling area.

In January, Kootenay Silver Inc. and Theia Resources Ltd. announced the results of a trenching and channel sampling program completed at the **Fox** property in 2014 (Fig. 1, Table 5 for assay highlights). The property is underlain by Ootsa Lake Formation felsic volcanic rocks and hypabyssal feldspar porphyry and features two mineralized zones, 400 m apart, near a 3 km long northeast-trending aeromagnetic low anomaly. Subvertical, open-space quartz veins, stockworks and breccias with fine grained pyrite are associated with moderate to strong argillic, sericitic, and silicic alteration.

At the **2 X Fred** property (Fig. 1, Table 5) of Kootenay Silver Inc. and Theia Resources Ltd., twelve subvertical north-south to northeast trending low-sulphidation epithermal chalcedonic quartz veins containing gold and silver have been identified. They occur over a 2.5 x 1.75 km area, with strike lengths up to 500 m or more, and widths up to 40 m. In 2014, a trenching program was carried out and an average grade of 0.49 g/t Au and 8.7 g/t Ag was returned from 244 channel and composite rock samples from 16 trenches. The property is underlain by Endako Formation volcanic rocks on the north side of the fault-bound Brooks diorite complex (Triassic-Jurassic; Fig. 3). The quartz veins (Fig. 15) are centred on a coincident airborne electromagnetic and magnetic high anomaly and feature multiple cross-cutting vein stages, crustiform banding, comb textures, lattice bladed quartz (Fig. 16), internal deformation textures, mosaic and chaotic breccia, and fine grained pyrite mineralization. Wall rock fragments are clay-chlorite-hematite altered. Following up on the 2014 trenching and channel sampling program, a 2015 drill program tested the veins down-dip below trenches in two target areas. Results are pending.

The **Holy Cross** property of C.J. Greig & Associates Ltd. (Fig. 1, Table 5) is underlain by Hazelton Group volcanic rocks, Skeena Group chert-pebble conglomerates, a quartz monzonite plug (Middle Jurassic) assigned to Endako batholith, Kasalka Group andesite to rhyolite flows, and Ootsa Lake Formation rhyolite (Lane and Shroeter, 1997). These units are in fault contact across northeast-trending horst-and-graben style bounding faults and a preceding northwest set. A northwest-trending series of resistant topographic knobs, historically interpreted as a rhyolite flow dome complex of Ootsa Lake Formation, hosts epithermal-style mineralization as pyritic quartz-chalcedony veins and silicified breccia. Recent mapping (Angen et al., 2015) interprets the flow dome complex as a kilometre-wide northwest-trending panel of Kasalka Group rhyolite based on alteration relationships and latest Cretaceous age date of andesite (Friedman et al., 2000). Two mineralized samples were collected from quartz-cemented rhyolite breccia (J.J. Angen, personal communication, November 2015; see Table 5 for assay results).

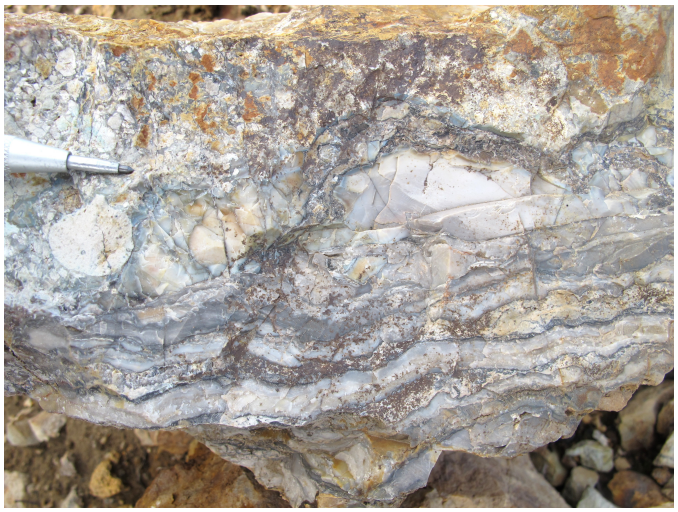

Fig. 15. Trench sample of crustiform banded and brecciated chalcedonic quartz vein at 2 X Fred.

Fig. 16. Trench sample with lattice bladed quartz texture at 2 X Fred.

The **Lawyers** property (Fig. 1, Table 5) of private company PPM Phoenix Precious Metals Corp. is underlain by andesitic volcanic units of the Toodoggone Formation (Hazelton Group). Northwest trending graben-bounding faults cut the property across a three km wide area and are the primary controlling structures for four sub-parallel steeply dipping zones of low-sulfidation epithermal mineralization. A high-sulfidation prospect lies 800 m farther west. 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, producing over 171,000 ounces of gold and 3.5 million ounces of silver, mainly from the AGB deposit, now reclaimed (Lane, 2011). The north sub-zone of the Cliff Creek deposit, two km to the west of AGB was only partially mined (Fig. 17). Underground development to >200 m vertical depth remains intact but is flooded; the remaining mineral resource is unknown. The Cliff Creek deposit has a strike length of about 1,600 m and variable width <58 m. It is

Fig. 17. Slabbed float sample of gold-silver bearing sulphide mineralized multi-stage quartz vein and breccia at Lawyers.

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, quartz-chalcedony veining and stockwork zones, and late quartz-amethyst-calcite fill. Sulphide mineralization comprises finely disseminated pyrite with accessory sphalerite, chalcopyrite, galena, bornite, covellite and acanthite. Alteration consists of silicification, intergrown sericite-clay, and selective-pervasive hematization. In 2015, a 24-hole drilling program began in late August that aimed to verify and infill historic drilling results, and step-out deeper into the north sub-zone at Cliff Creek (Fig. 18) and the Duke's Ridge zone. Assay results have not been made public.

Fig. 18. Drilling the Cliff Creek north zone at Lawyers.

6.1.2. Cache Creek terrane

The **BT** (Bobtail) property of private company Porpoise Bay Minerals Ltd. (Fig. 1, Table 5) is underlain by serpentinized ultramafic rocks and basaltic volcanic rocks of the Cache Creek complex. These are intruded by granite (Eocene) that lies about 6 km west of the Pinchi Fault. A trenching and test pitting program explored a target area where ten anomalous gold samples up to 0.318 g/t Au were previously collected. Trenching penetrated glacial till cover to sample granite bedrock with disseminated and vein-hosted pyrite mineralization, and serpentinite with shear-hosted ribboned quartz veins and foliation-hosted pyrite ±pyrrhotite. A bleaching calcite-chlorite-clay alteration envelopes quartz veins in granite. Assay results have not been made public.

6.1.3. Quesnel terrane

The **Blackjack Mineral** project (Fig. 1, Table 5) of private company Angel Jade Mines Ltd. is underlain by Takla Group sedimentary rocks and metamorphosed equivalents about two km southwest of the Manson fault zone. Bedrock in the area is covered by glacial and post-glacial gravels that have been mined for placer gold since 1871. Gold and silver occurs in quartz vein showings which lie within a kilometre of the property. In 2015, bedrock was exposed and sampled in a trenching and test-pitting program. Assay results have not been made public.

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

6.2.1. Stikine terrane

At the end of 2014, AuRico Metals Inc. announced the discovery of the **Kemess East** copper-gold porphyry (Fig. 1, Table 5) deposit. It is located one kilometre east of AuRico's **KUG** deposit (see section 5.1.2.). In January an initial resource estimate was released (Table 5). 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, between about 850-1600 m depth, is hosted primarily in quartz monzonite (earliest Jurassic) and, to a lesser degree, in Takla Group basaltic-andesite. Auriferous chalcopyrite is mostly disseminated but also occurs in quartz veins within the intrusion. The highest copper-gold grades are associated with biotite and silica in a potassic alteration zone. Phyllic alteration is less intense than at KUG, and late calcite-zeolite alteration spatially associated with a granodiorite pluton south of the deposit appears to be grade destructive (Fig. 19). Two structurally offset zones comprise the Kemess East deposit. The Kemess Offset Zone (KOZ) is downthrown east of KUG, and 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. The Kemess East deposit may represent the deeper portion of a single dissected mineralized system that includes KUG.

A 15-hole drill program in 2015 further delineated and expanded known mineralization at Kemess East (Fig. 20) and KOZ. Mineralization remains open in three directions in

Fig. 19. Quartz-chalcopyrite-pyrite vein in quartz monzonite at Kemess East. Potassic alteration is overprinted by sericite (phyllic) and pink zeolite alteration.

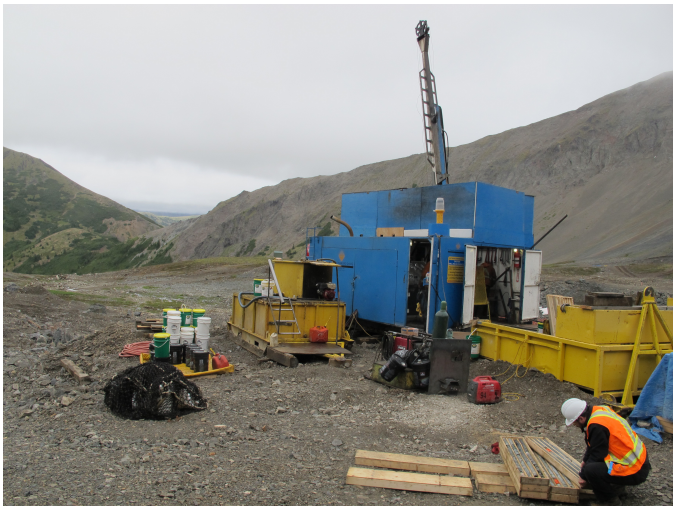

Fig. 20. Drilling at Kemess East.

both zones. Other geophysical and geochemical anomalies across the broader Kemess property (Orion and South Dam) were tested in a nine-hole fly drill program, but no significant values were returned. Grassroots work included rock sampling, mapping and prospecting over these target areas.

About 30 km south of the Kemess property in the McConnell range, the **Menard** property (Fig. 1, Table 5) of HPX Quesnellia Holdings 1 Inc. is cut by two main north- to north-northwest trending splays of the terrane-bounding Ingenika fault. The property is underlain by Takla Group volcanics which are intruded by a ~2.5 km diameter Alaskan-type ultramafic complex (Late Triassic; Nixon et al., 1997) and monzodiorite stocks and dikes (Early Jurassic) that trend predominantly northwest. Sustut Group sedimentary rocks are fault-bound at the property's southwestern margin. Mineralization consists of shear-hosted chalcopyrite ±pyrite disseminations and veinlets near lithological contacts and local gossans. A reconnaissance mapping and geochemical sampling program in 2015 generated three targets of interest.

Contiguous to the south, the **Copper King** property (Fig. 1, Table 5) of private company Pacific Empire Minerals Corp., is underlain by Takla Group basaltic units and Hazelton Group volcaniclastic rocks. These are intruded by quartz diorite plugs and northeast-trending porphyry dikes (Early Jurassic; Bradley, 1991). East-northeast trending epidote-altered fracture zones and epidote veins host bornite-chalcocite ±magnetite mineralization; and quartz-sericite altered porphyry dikes are chalcopyrite-pyrite mineralized. Two circular aeromagnetic high anomalies trend northwesterly across the property. In August, a single-line induced polarization survey was completed.

6.2.2. Quesnel terrane

Kiska Metal Corporation's **Kliyul** property (Fig. 1, Table 5), under option to Teck Resources Limited, lies about five km north of the northern extent of the Hogem plutonic complex. The property is underlain by a basin-to-arc sequence of the Takla Group. Volcanic sandstone on the west side of the property transitions into a sub-unit of intercalated andesite-sandstone-carbonate in the central part, and basaltic volcanic breccia lies farther east (Schiarizza, 2003; Voordouw, 2012). Intrusive rocks include a north to north-northwest trending elongate ultramafic-mafic suite (Late Triassic), a monzonite-diorite suite (early Middle Jurassic), and a northwest-trending granitic suite (Early Cretaceous). A 6.8 km-long, <1 km-wide phyllic alteration zone trends northwest along a fault bounding a mafic intrusion in the southeast part of the property and east-west across an interpreted linkage structure towards a north-south trending dextral strike-slip fault on the western side. The east-west central portion hosts a northwest-trending sheared monzonite-diorite dike swarm and the Kliyul magnetite replacement and breccia body (Fig. 21). An induced polarization survey over this area indicated a moderate chargeability and low-moderate resistivity anomaly. South-southeast trending auriferous polymetallic quartz veins of up to 300 m strike length are spatially associated with inflection points of the alteration zone. Disseminated and quartz-magnetite vein-hosted auriferous chalcopyrite ±bornite mineralization is associated with magnetite ±biotite alteration, and also with dikes. Mineralization in zones of phyllic (sericite-chlorite ±albite, anhydrite) alteration includes chalcopyrite-pyrite veinlets, fracture fill and disseminations. In 2015, a four-hole drilling program extended known mineralization down-dip of the magnetite breccia, to the southeast in a step-out hole, and to the northeast in a geophysical anomaly near an east-west trending fault structure (see Table 5 for assay highlights). Grassroots work was also completed.

Contiguous with the Kliyul property on the north, the **Red Lion** property of Garibaldi Resources Corp. (Fig. 1, Table 5) is underlain by the same geological units, and a portion of the strike-slip fault that borders the west side of the Kliyul zone. Both properties lie within a northwest-trending area of strongly anomalous copper-gold geochemistry in the British Columbia

Fig. 21. Gossanous magnetite breccia outcrop with copper oxide minerals at Kliyul.

Regional Geochemical Survey (RGS) dataset, comparable to anomalies associated with the Mt. Milligan and past-producing Kemess South mine areas. Historic showings on the Red Lion property include quartz vein hosted and disseminated chalcopyrite-pyrite associated with shear zones and diorite contact zones. In 2015, aeromagnetic and radiometric surveys were flown; and a ground-based induced polarization survey covering the eastern half of the property and mapping program were completed in September.

The **Kwanika East-Smoke** property of Serengeti Resources Inc. (Fig. 1, Table 5) 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 Cretaceaous); and by intermediate volcanic rocks of the Takla Group and Twin Creek succession on its eastern side. The property follows an east-northeast trending structure and has a strong VTEM geophysical anomaly. About eight km farther east, the **Jewel** property is underlain by fine clastic sedimentary rocks of the Takla Group at the western margin of the Germansen batholith (Early Cretaceous; Fig. 3), and has a single-line coincident VTEM and aeromagnetic anomaly. In 2015, a low-level high-sensitivity aeromagnetic survey was flown over the properties. The survey identified strong magnetic anomalies on both properties, including a 2 km-long ringed cluster of magnetic highs enclosing a magnetic low at Jewel.

The **Col-Later** property (Fig. 1, Table 5) of private company Pacific Empire Minerals Corp. covers the northern margin of the southeastern tail of the Hogem intrusive complex where it is in fault contact with gently south-dipping intermediate volcanic units of the Chuchi Lake succession. Copper ±gold mineralization has been identified on either side of the hornfelsed contact zone in both northwest and northeast trending structures. A 200 x 200 m mineralized zone in the main target area (Col target) is underlain by an interpreted northwest-trending potassically-altered monzodiorite-syenite dike complex (Early Jurassic) hosted in monzonite (Peters and Ritchie, 2014). Disseminated and vein-hosted chalcopyrite ±bornite and malachite is concentrated in steeply-dipping parallel fracture zones (Fig. 22). A potassic alteration zone forms the core of an interpreted 4.5 km wide zoned alteration footprint coincident with 4 km long copper-in-soil anomaly. An induced polarization geophysical survey completed in 2014-15 covered several target areas across the property and selected anomalies on the till-blanketed western side were drilled. At the Elbow target, eight km northwest of the Col target, drilling tested a coincident resistivity and magnetic high anomaly in an area where a structural bend or break in the regional fabric intersects an apparent northeast-trending transverse linear with a magnetic low geophysical signature. Less than five km farther northwest, at the Sooner target, drilling tested a similar anomaly near the faulted contact between intrusive and volcanic rocks. Drilling was completed by early July. Assay results have not been made public.

Contiguous to the east, the **Chuchi** property (Fig. 1, Table 5) of Kiska Metals Corporation is centered immediately northeast of the southeastern end of the Hogem intrusive complex. It is underlain by a cluster of porphyritic monzonite stocks, dikes, and sills (Early Jurassic) emplaced in Chuchi Lake succession volcanic and sedimentary units. A central target (BP zone) of

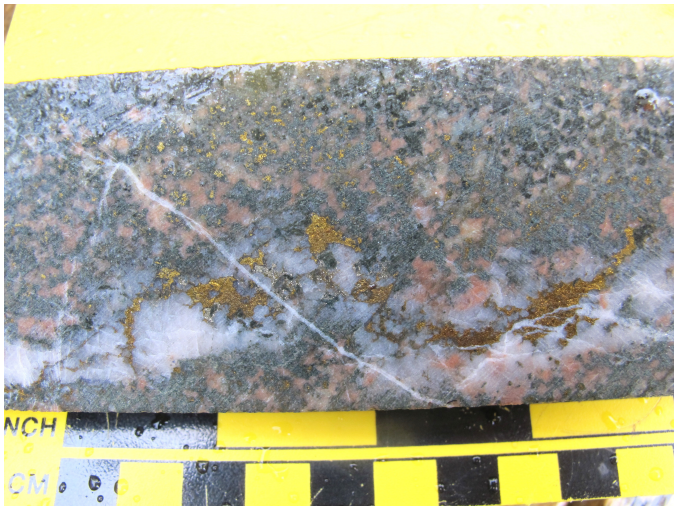

Fig. 22. Quartz-chalcopyrite-pyrite vein with potassic alteration and weak sericite overprint in monzodiorite at Col-Later.

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 and biotite hornfels (Nelson and Bellefontaine, 1996), and is coincident with an inwardly zoned high to moderate ground-based IP chargeability signature. A north-south trending fault bisects the property. Historic drilling west of this fault, 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 anomaly and copper and gold soil geochemical anomalies continue eastward across a fault-bound valley. In 2015, two east-west oriented lines of induced polarization geophysical survey were run 500 m apart across the BP zone. Results confirmed chargeability anomalies coincident with a magnetic high feature and zones of known mineralization, and extending beyond these both laterally and at depth, and also to the east across the fault valley. The southern line crossed an east-northeast striking structure interpreted as a normal fault with down-dropped block on the south.

Thompson Creek Metals Company Ltd. began a multi-year drilling program at the **North Grid** target area (Fig. 1, Table 5) about five km northwest of the Mt. Milligan mine lease. The area is underlain by Takla Group (Witch Lake Formation) volcaniclastic units less than two 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 two km west of an interpreted southeast-trending deep extension of the pluton towards the Mt. Milligan deposit area (Clifford and Berthelsen, 2015). Geophysical and geochemical surveys on the North Grid target area produced the Snell and Mitzi targets which have similar coincident IP chargeability, magnetic, and geochemical anomalies as those associated with mineralized stocks at the Mt. Milligan deposit. These targets were tested with five drill holes in 2015. Results are pending.

The **Prince George SE** property (Fig. 1, Table 5) of private company Tech-X Resources Inc. is underlain by Takla Group sedimentary and basaltic-andesite volcaniclastic rocks that are partially blanketed by glacial till. Showings include shale-hosted quartz veins and shear zones with chalcopyrite, pyrite and malachite mineralization. In 2015, a ground-based induced polarization survey was completed.

6.3. Polymetallic base and precious metal projects

6.3.1. Ancestral North America (Kechika trough and Muskwa ranges)

At the **Akie** property (Figs. 1, 3, Table 5) of Canada Zinc Metals Corp., the Cardiac Creek baritic zinc-lead-silver SEDEX deposit is hosted in Gunsteel Formation shale (Earn Group; Upper Devonian). The steeply southwest-dipping tabular mineralized body averages about 20 m thick (<35 m thickness) and extends for an approximate strike length of 1,950 m, 1,300 m of which is considered potentially economic (Sim, 2012). From bottom to top, mineralization generally defines a stratiform sequence of: 1) bedded to massive barite and minor quartz-carbonate veining at the base; 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; 5) distal fine-grained laminar pyrite and nodular barite. The mineralized zone is commonly interbedded with siliceous Gunsteel Formation shale, and underlain by marine turbidites of the Paul River Formation (Lower Devonian) that include interbedded black shale and limestone debris flows (MacIntyre, 1998). In 2015, an eight-hole drilling program focused mainly on down-dip and lateral resource expansion of Cardiac Creek deposit high-grade core, and infilling of gaps in the resource model. All eight holes intercepted mineralization (Fig. 23, see Table 5 for assay highlights). In the footwall of the Cardiac Creek zone, drilling intercepted a weakly mineralized pyritic massive sulfide lens that graded into an underlying debris flow. Pyrobitumen-calcite veining was also intercepted in one hole; in similar deposits (Broadbent et al., 1998; Leach et al., 2010), thermochemical sulfate reduction in organic-rich sediments is considered a mechanism for sulphide deposition associated with pyrobitumen.

In September, preliminary results of a heliborne gravity gradiometry survey flown between November 2014 and March 2015 over the Akie, **Yuen North**, and **Mt. Alcock** properties were received. The survey was designed to identify significant structural features and gravity high anomalies within the Gunsteel Formation shale. The data in conjunction with previously acquired airborne VTEM, soil geochemistry, and geologic mapping data is being used to further delineate target areas on the properties.

The **Cirque** project (Figs. 1, 3, Table 5) is a joint venture between Teck Resources Limited and Korea Zinc Company Limited that includes the Cirque, Fluke and **Elf** properties. These properties, along with the adjacent **Pie**, **Yuen** and

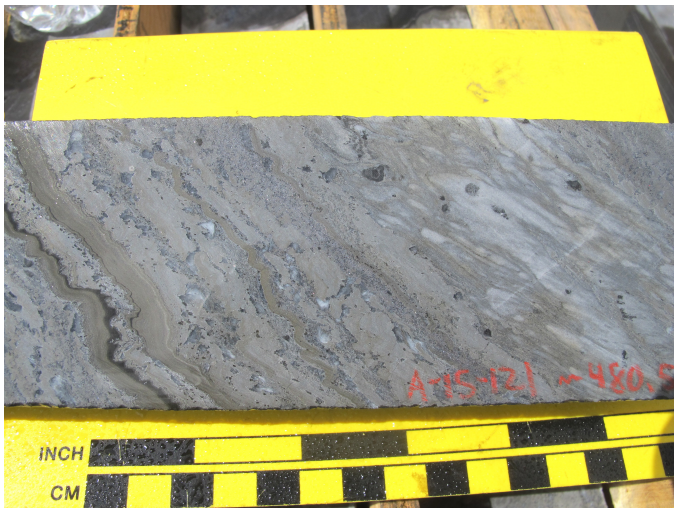

Fig. 23. Mottled sphalerite-galena-pyrite banding with barite near the base of the Cardiac Creek zone at Akie.

Cirque East properties presently under option by Teck and Korea Zinc from Canada Zinc Metals (the "Pie Option"), are located within the prospective Gunsteel Formation trend of the Kechika trough. In 2015, a five-hole drilling program focused on the South Cirque target on the Cirque property (Fig. 24). The program was designed to verify and step-out from historic drilling results at depth beneath a thrust sheet of Ordovician and Silurian sedimentary rocks. The South Cirque occurrence, hosted in Gunsteel Formation shale, is a partially-delineated apparent tabular mineralized body that does not crop out at surface, as does the better defined North Cirque deposit. Zinc-lead-silver mineralization at Cirque may have a replacement-style component instead of being strictly exhalative, similar to the Red Dog deposit in Alaska where mineralization formed by subsea-floor replacement of a sea-floor barite deposit (Leach, 2010).

In addition to drilling at Cirque, a ground-based gravity geophysical survey was completed on select targets on the Yuen, Pie, Cirque and Elf properties; and results of an airborne gravity gradiometry survey were received. Soil sample grids were expanded on Pie and Yuen, and mapping and prospecting continued on these as well as at Cirque. In addition, three historic drill holes from the Yuen property were re-logged.

About 16 km north of the Peace Arm of Williston Lake, the **Coral** property of Minfocus Exploration Corp. is a Mississippi Valley-type deposit prospect underlain by dolomitic carbonate rocks (Upper Silurian-Lower Devonian) in an east-dipping limb of a folded hanging wall sequence above a thrust fault (Thompson, 1986). Zinc-lead mineralization is disseminated within a northwest-trending irregular zone of dolomite breccia with sparry dolomite matrix (Haynes and Hardy, 1987). In 2015, a historic trench and geochemical survey grid was re-established. The trench is less than 100 m from an open-ended 800 x 600 m zinc soil anomaly. Mineralized rock chip samples were collected and diamond drilling is planned for 2016.

Fig. 24. Drilling the South Cirque deposit on the Cirque property.

6.4. Coal projects

6.4.1. Stikine terrane (Bowser Basin)

The Groundhog-Klappan Coalfield, in the northcentral part of the Bowser Basin, extends across the Skeena-Omineca regional boundary. The **Groundhog** (Fig. 1, Table 5) anthracite coal property of Atrum Coal Groundhog Inc. lies within a broad, northwest-southeast trending open-folded synclinorium (Atrum Coal, 2014). The main coal bearing sequence is the Groundhog Unit (Middle-Upper Jurassic; Bowser Lake Group); a 600 m thick alternating marine and non-marine deltaic sequence with 46 modelled coal seams. 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. Following a 2014 prefeasibility study update, Atrum completed engineering studies, coal quality tests and upgraded the resource and geological model for the Groundhog North component of the project. The permitting process for a 100,000 tonne underground bulk sample continued. An underground mine producing 3.2 million tonnes per year of saleable high and ultra-high rank anthracite product is planned, with a mine life of 38 years. The project has yet to enter the Environmental Assessment process; environmental baseline work is continuing. Anthracite coal has both steelmaking and industrial applications.

7. Geological research

7.1. Stikine terrane

In 2015, Geoscience BC continued the Targeting Resources through Exploration and Knowledge project (**TREK**; Clifford and Hart, 2014), which covers part of the Nechako Plateau and includes mineral discoveries made during regional mapping by Diakow et al., (1997). Geologic mapping studies focused on the relationship of rock petrophysics to airborne magnetic data (Angen et al., 2015), the characterization of Late Cretaceous volcanic suites (Kim et al., 2015), and a preliminary surface-of-bedrock geology map for the TREK project area supported by geophysical data (Angen et al., 2015). Surficial geochemical and mineralogical surveys focused on basal till (Sacco and Jackaman, 2015; Jackaman et al., 2015), and re-analysis of archived till samples using modern laboratory techniques (Jackaman et al., 2015).

For the Endako mine area, Geoscience BC also released the results of a geochemical study on the use of tree sap for detecting buried mineralization (Heberlein et al., 2015), and published a comprehensive geo-exploration atlas for of the Endako porphyry molybdenum district (Devine et al., 2015).

Additionally, an M.Sc. thesis on the ore-forming processes and geochronology of the Blackwater deposit was completed through the Mineral Deposit Research Unit at the University of British Columbia and published (Looby, 2015).

7.2. Quesnel terrane

To generate a new structural interpretation of the QUEST survey area, Geoscience BC released data from a geologic mapping study that used a multi-dataset stacking methodology

with public domain airborne geophysical and geological datasets (Sánchez et al., 2015).

7.3. Ancestral North America

The British Columbia Geological Survey (BCGS) and Geoscience BC released the results of studies exploring the use of Wilfley shaking table and Mozley C800 laboratory mineral separator for concentrating specialty metal indicator minerals from stream sediment samples near the Aley niobium deposit (Mackay et al., 2015). In November, a symposium on critical and strategic minerals was held in Victoria, and the proceedings were released with papers relevant to the Rocky Mountain rare metal belt (Simandl and Neetz, 2015).

BCGS also released the study results of a statistically robust treatment of public domain multi-element geochemical data from streams and lake sediments to reveal anomalies in the northern Kechika trough. The results are similar to those associated with Carlin-type gold deposits in Yukon and Nevada, where there is comparable geology (Rukhlov, 2015).

8. Summary

Due to the challenges associated with falling commodities prices, five operational or fully permitted coal mines, and two operational metal mines have gone into care and maintenance in the combined Omineca-Northeast region since 2013. For junior exploration companies the difficulties raising capital through equity financing has significantly slowed exploration since 2012-13. In the past two years, drilling programs have been primarily undertaken by intermediate-level companies or by private exploration companies.

Main highlights for 2015 include the continued ramp-up of the **Mt. Milligan** mine of Thompson Creek Metals Company Ltd. towards its design capacity mill throughput rate as it progresses into Phase 3 of mining; the issuing of an Environmental Assessment certificate for the **Murray River** project of HD Mining International Ltd.; the acceptance of the **Sukunka** (Glencore plc) and **Giscome** (Graymont Western Canada Inc.) Environmental Assessment applications for formal review; increased and upgraded resources at **Groundhog** (Atrum Coal Groundhog Inc.), **Sukunka**, and **Wapiti East** (Fertoz International Inc.); the continued delineation of an orebody through drilling at the **Kemess East** property of AuRico Metals Inc.; and drilling results indicating a more extensive mineralized zone at the **Kliyul** property of Teck Resources Limited and Kiska Metals Corporation. Projects continuing to advance through Environmental Assessment towards final application submission include: **Blackwater** (New Gold Inc.) and **Aley** (Taseko Mines Limited).

New discoveries continue to be made such as the epithermal vein system at the **2 X Fred** property of Kootenay Silver Inc. and Theia Resources Ltd., and underexplored parts of the Omineca Region are generating interest and seeing more grassroots to early-stage exploration. These include, for porphyry-style mineralization, the southern tail of the Hogem intrusive complex and the Ingenika fault corridor (McConnell range) north of the Hogem intrusive complex; and for epithermal-style mineralization, the central part of the Toodoggone River area, north of the Kemess property.

Acknowledgments

The information in this report was derived from news releases, quarterly reports, MD&A 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. I thank the geologists and miners who were generous with their time and resources, and those who provided expenditure and related information. I also thank the Regional Geologists and the Mineral Development Office for additional support, and the skilled staff at the Ministry of Energy and Mines regional office in Prince George.

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Exploration and mining in the Kootenay-Boundary Region, British Columbia

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1. Introduction

The Kootenay-Boundary Region, in the southeast corner of the province (Fig. 1), offers a variety of mining and exploration opportunities, and is accessible by well-developed infrastructure. Five operating metallurgical coal mines in the Elk Valley account for the majority of Canada's coal production, and exports. Several mines produce industrial minerals including silica, magnesite, gypsum, and graphite. The region also hosts the historic lead-zinc-silver Sullivan Mine, which contributed over $50 billion in current US dollars throughout its life, and the Trail smelter is still in operation. Exploration for both base metals and precious metals continues to be an exploration focus for the region.

In 2015, total exploration spending was similar to 2014 (Fig. 2), with about $50.8 million spent on exploration in the region. Relative to last year, spending on mine lease projects remained flat (40%), and there was an increased amount spent on mine evaluation projects (46%), as mine expansion plans moved forward in Environmental Assessment. There were fewer projects in the early (5%) and advanced (7%) exploration stages, and an increased focus on grassroots work (2%) as companies completed assessment work to maintain their claims in good standing (Fig. 4). The decrease in early and advanced stage projects is also reflected by decreased exploration drilling (approximately 92,000 m for 2015; Fig. 3).

Highlights for 2015 include:

- conditional EA approval of the Fording Swift mine expansion
- continued advances in major mine expansion plans at operating coal mines, with several projects in pre-application of Environmental Assessment, including the Elkview Baldy Ridge extension (BRE), and Line Creek Burnt Ridge extension (BRX); and the Greenhills Cougar Pit extension (CPX) nearing pre-application
- advances in new coal projects such as Crown Mountain (NWP Coal Canada Ltd.), and the Michel Creek/ Loop Ridge project (CanAus Coal Limited). Both of these entered pre-application stages of Environmental Assessment in 2014 and 2015 respectively
- advancement of the Kootenay West gypsum mine (CertainTeed Gypsum Canada Inc.), which entered Environmental Assessment in 2014
- lease application for the Driftwood Magnesite magnesite project for quarry development
- submission of a project description for a restart proposal on the Gallowai Bul River mine
- further exploration and process optimization at the Black Crystal graphite mine
- plant construction at Moberly Silica to redesign operations for silica frac sand
- ongoing base metal, precious metal, and industrial mineral exploration.

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 is evidence that the western margin 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, and offshore and basement rocks from Ancestral North America, with a complex history of deformation, intrusion, metamorphism, and mineralization.

The Kootenay-Boundary 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 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

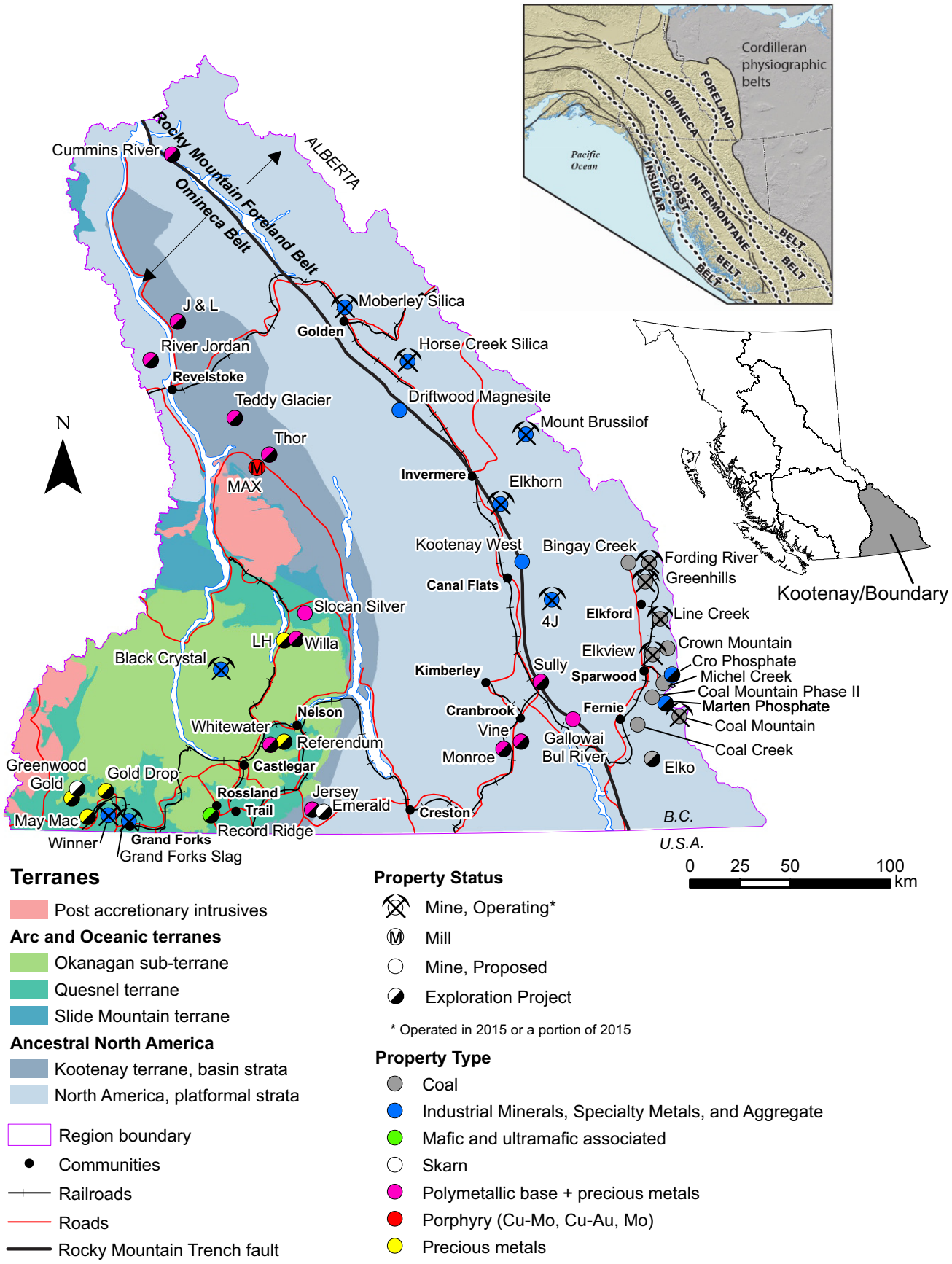

Fig. 1. Mines and selected exploration projects, Kootenay-Boundary Region, 2015. Terranes from Cui et al. (2015).

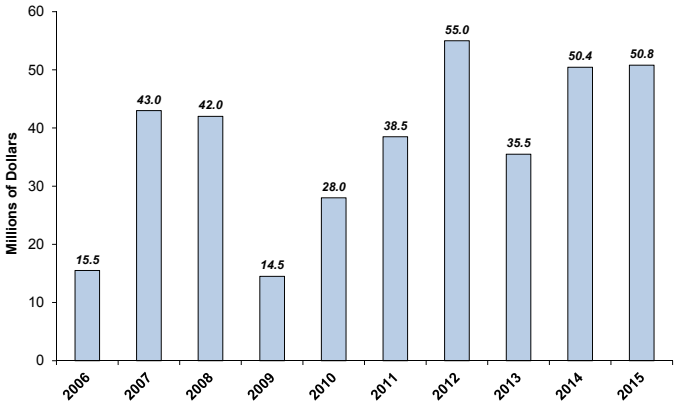

Fig. 2. Exploration spending in the Kootenay-Boundary Region, 2015.

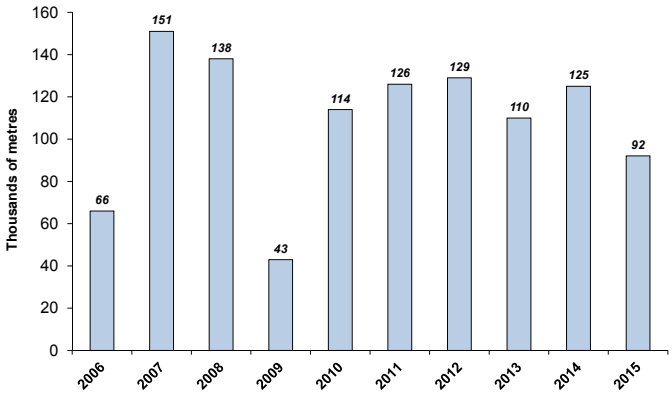

Fig. 3. Drilling in the Kootenay-Boundary Region, 2015.

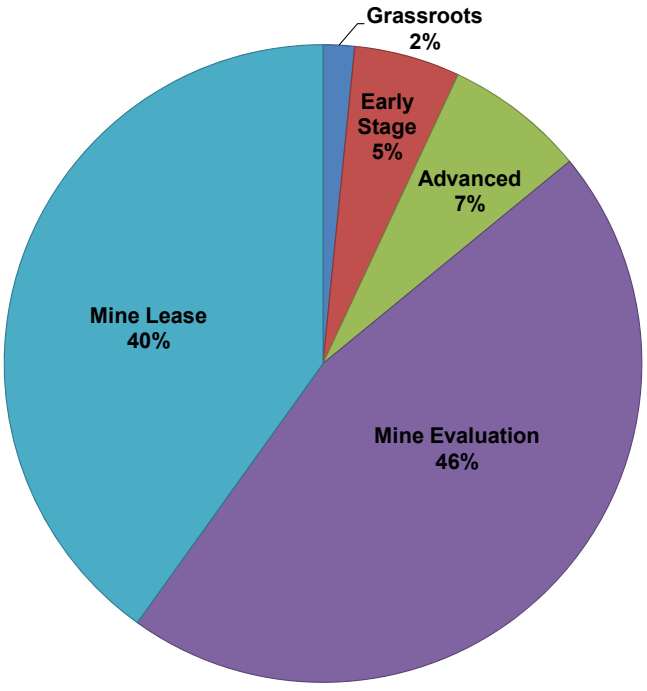

Fig. 4. Expenditures by exploration stage, Kootenay-Boundary Region, 2015.

complexly structured accretionary wedge.

Historically, the Canadian Cordillera has been divided into five northwest-trending physiographic belts. The Kootenay-Boundary Region includes two of these belts (Fig. 5): 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 on the eastern edge of the trench, 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. It is an assemblage of microcontinents and magmatic arcs that formed through progressive accretion from Archean to Mesoproterozoic time. The successive orogenic events that formed the basement assemblage imparted on it a structural grain, which is seen on the regional aeromagnetic map of western Canada (Fig. 6). Northeast-trending basement structures influenced both Cordilleran tectonism and metallogeny (e.g., McMechan, 2012; Nelson et al., 2013; Ross et al., 1991). For example, the Moyie-Dibble Creek (MDC) fault has been interpreted by Price (1981) and McMechan (2012) as the surface expression of the Vulcan Low (Vulcan Tectonic zone, Fig. 5; MDC, Fig. 6). Abrupt changes in thickness and facies in Proterozoic to early Paleozoic strata across northeast-trending structures along this trend suggest periodic reactivation. In the West Kootenays, the southwestward shift in trend at the south end of the Kootenay Arc also suggests a deep structural influence of the basement Vulcan Low.

Although generally deeply buried, crystalline basement is also locally exposed in structural culminations such as the Shuswap-Monashee complex (Fig. 5; MC, Fig. 6; Fig. 7). Located west of the east-dipping Columbia River fault (Fig. 5), the complex is bounded by early Tertiary normal faults, and was exhumed during Tertiary extension (Monger, 1999). Paleoproterozoic granitic and granodiorite gneisses are unconformably overlain by a Neoproterozoic to Paleozoic platformal paragneiss assemblage of calc-silicate gneiss, pelitic gneiss, psammitic gneiss, quartzite and marble. The Valhalla metamorphic complex forms a structural dome and is located at the eastern exposed edge of the Shuswap metamorphic complex. Lithologies consist of amphibolite-facies pelitic schist, marble, calc-silicate gneiss, psammitic gneiss, quartzite and metaconglomerate, amphibolite gneiss, and ultramafic

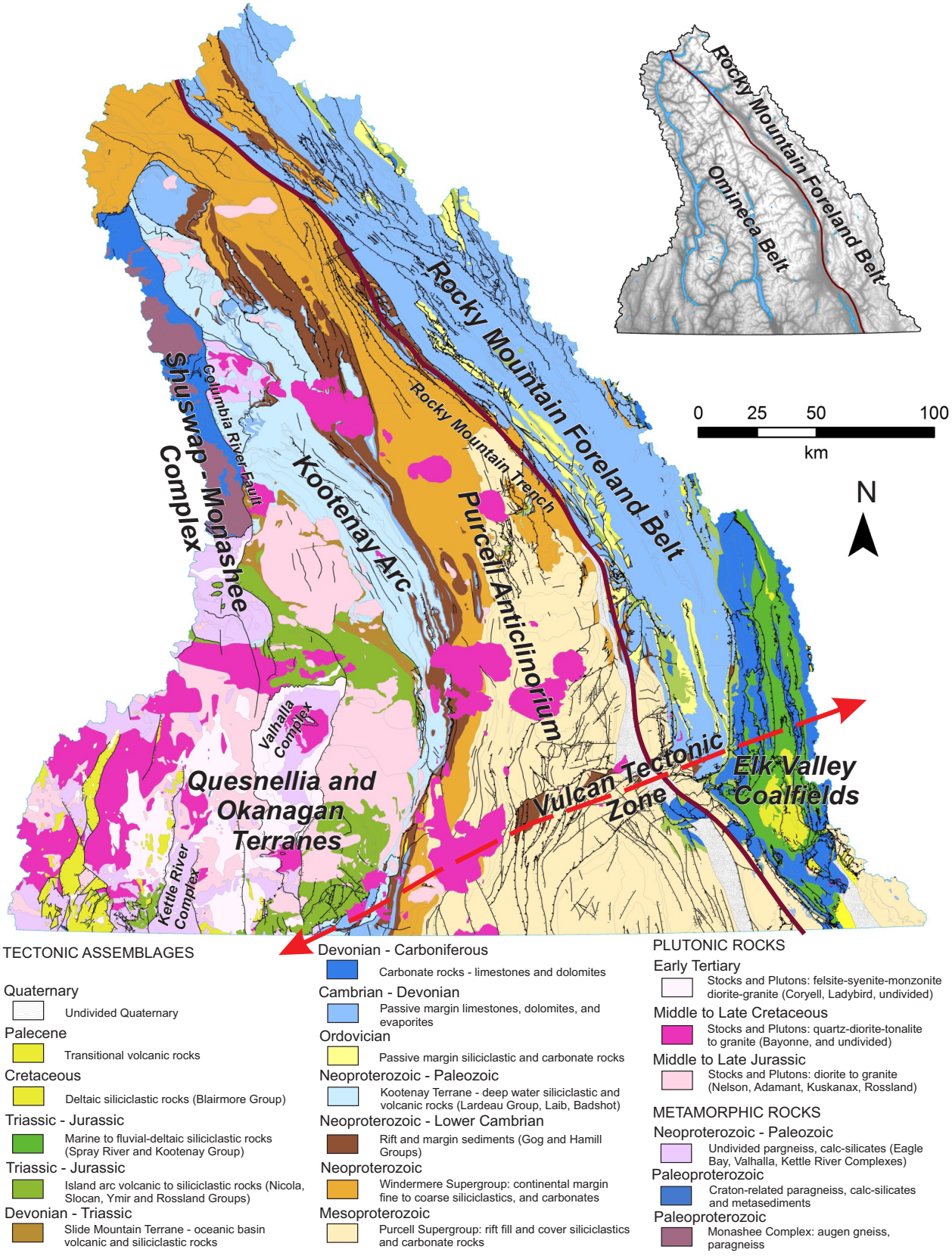

Fig. 5. Geology and physiographic belts of the Kootenay-Boundary Region. Physiographic belts after Nelson et al. (2013). Bedrock units are after Cui et al. (2013), and generalized to highlight temporal and lithological differences in the region for this report. Vulcan tectonic zone is after McMechan (2012).

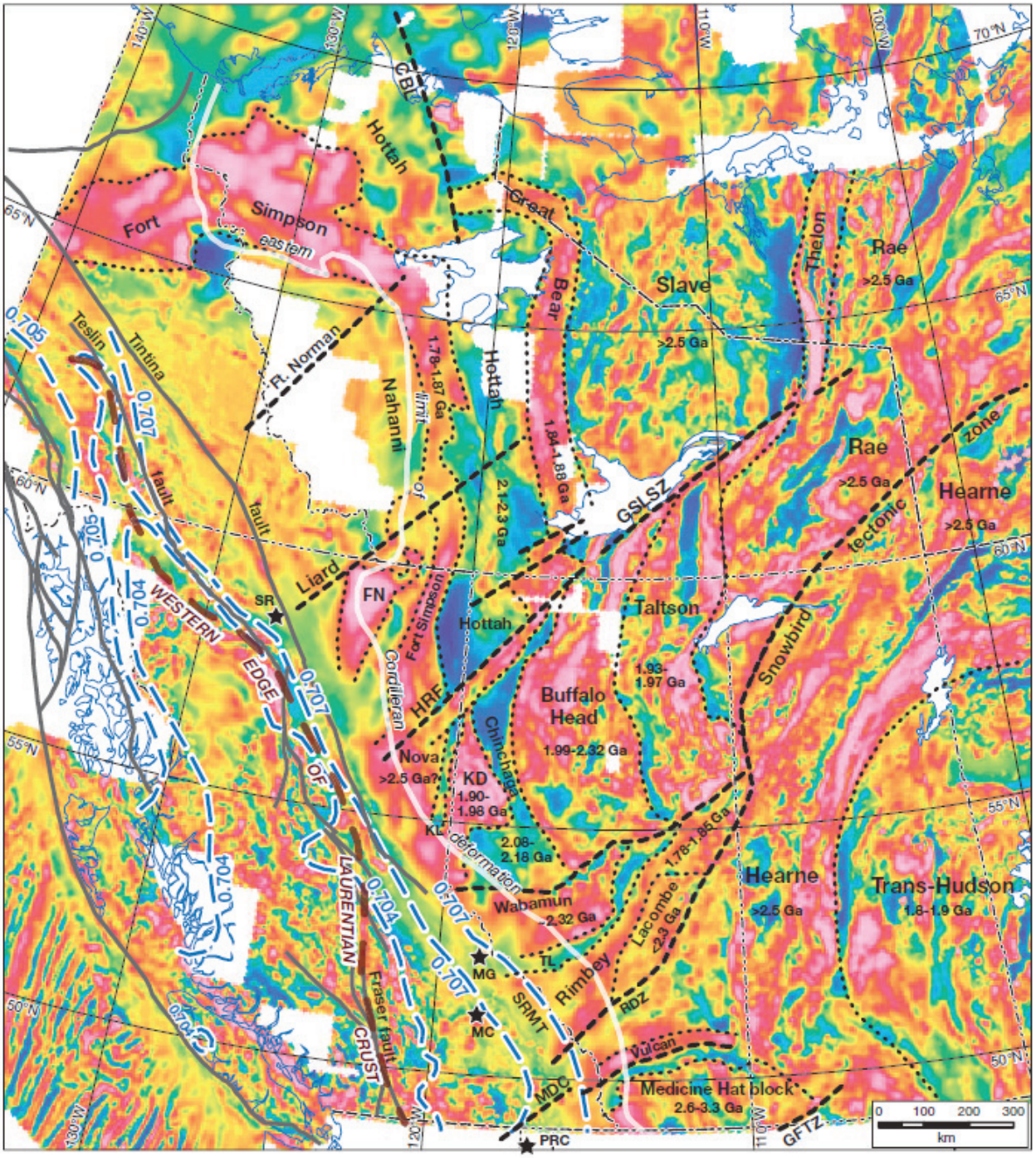

Fig. 6. Residual total field aeromagnetic map of western Canada, showing Precambrian basement domains of the western Laurentian craton with respect to the Cordilleran orogen (eastern limit of Cordilleran deformation indicated by white line). Precambrian basement domains are after Hoffman (1988), Ross 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 $^{87}Sr/^{86}Sr$ 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).

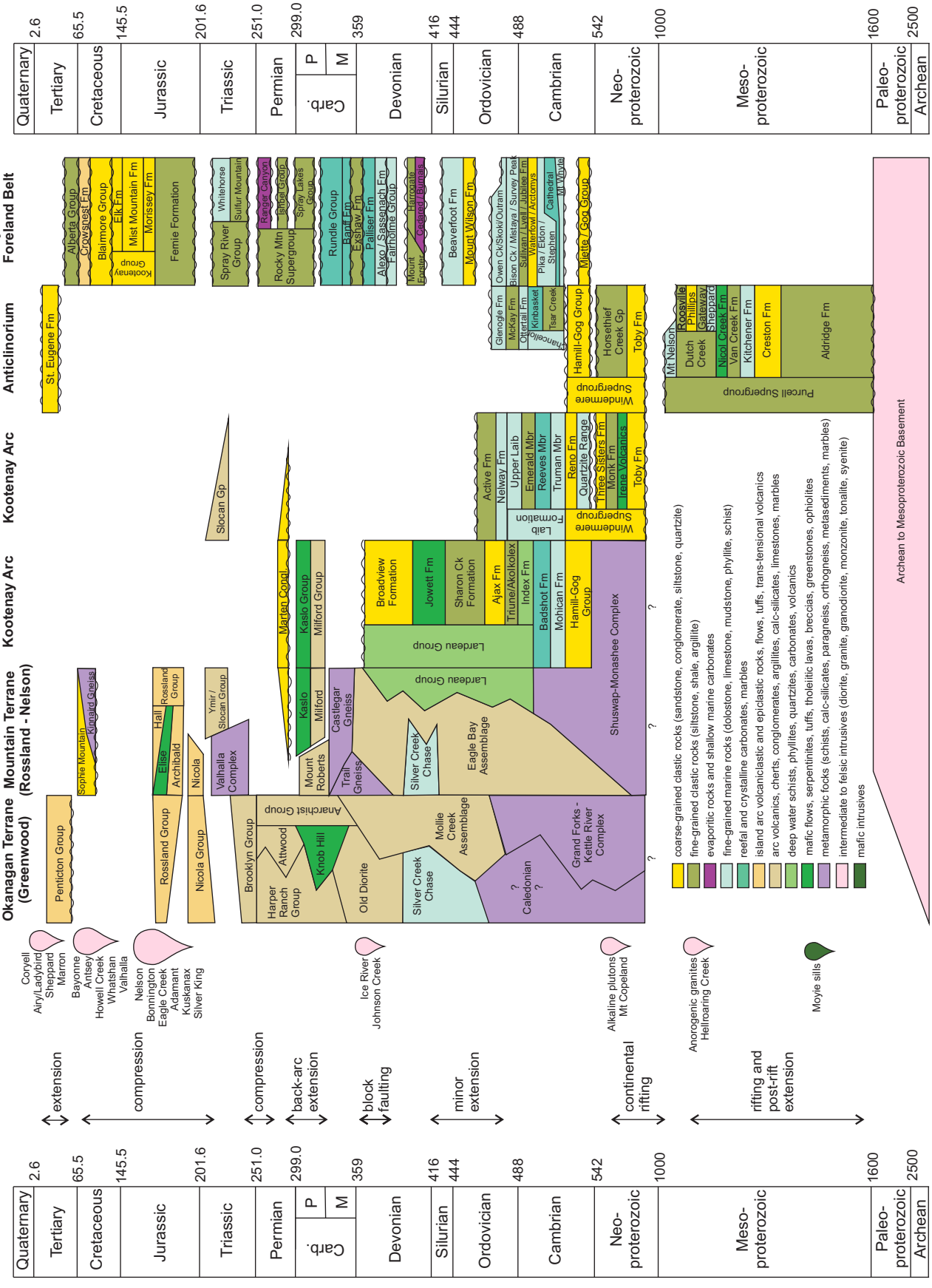

Fig. 7. Generalized stratigraphy, Kootenay-Boundary Region. Tectono-stratigraphic events modified from Nelson et al. (2013). Selected stratigraphy and approximate ages derived from Poulton et al. (2012), Hein and McMechan (2012), Colpron and Nelson (2009), Grieve (1993), Fyles (1967 and 1990), Höy et al. (1995), Logan (2002), Monger et al. (1991), Price (2012), Slind et al. (2014). Geological timescale from Waker and Geissman (compilers), (Geological Society of America; 2009).

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), as well as flake graphite deposits (Black Crystal).

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 Kootenay-Boundary Region, the Belt-Purcell basin (1.47-1.4 Ga) was a north-northwest trending intra-continental pericratonic rift system that extended into what are now northern Idaho and Montana, and formed at the leading edge of Ancestral North America. 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), 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 (Figs. 7, 8). 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; Lydon, 2010 and 2007).

Most exploration has focused on SEDEX Pb-Zn-Ag mineralization within the Aldridge Formation similar to that of the historic Sullivan mine at Kimberley (MINFILE 082FNE052). The mine operated from 1909 to 2001 and produced over 17.5 Mt of zinc, 18.5 Mt of lead, and 297 Moz of silver. The contact between the lower and middle Aldridge members hosts the Sullivan ore body (Fig. 8) 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; McMechan, 2012; Price, 1981), and these fault intersections have been the focus of recent exploration. The upper part of the Purcell Supergroup contains carbonate-hosted, stratiform replacement-style sulphide mineralization in dolomites of the Mount Nelson Formation (Figs. 7, 8), and associated structurally related polymetallic Ag-Pb-Zn veins.

The Purcell Anticlinorium (Fig. 5) 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 of 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. 8) 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 Rodinian 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. 7). 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). Sediments of the Hamill-Gog Group are predominantly sandstones deposited on a subsiding 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). Though the Windermere Supergroup marks a major rifting episode, it hosts 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 faults carried up to 15 km of Belt-Purcell and Paleozoic margin sedimentary rocks eastward over a basement ramp (Fig. 9; 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 Paleozoic and Mesozoic, and into the Tertiary. Transverse structures and basement structures related to the Vulcan Tectonic Zone (Fig. 5) may also have influenced Mesozoic shear and vein gold, a trend which runs east-west through the historic gold rush town of Fort Steele (Kimberley Gold Trend; Seabrook, 2015).

Mineralization in the Proterozoic to Paleozoic rift succession include: sedimentary exhalative (SEDEX) deposits (bedded sulphide, feeder pipe, and vein); massive sulphide replacement deposits (Irish, Mississippi Valley, and manto); Mesoproterozoic intrusion and fault-related Ag-Pb-Zn and Cu-Ag veins; Mesozoic shear and vein gold, and associated placer

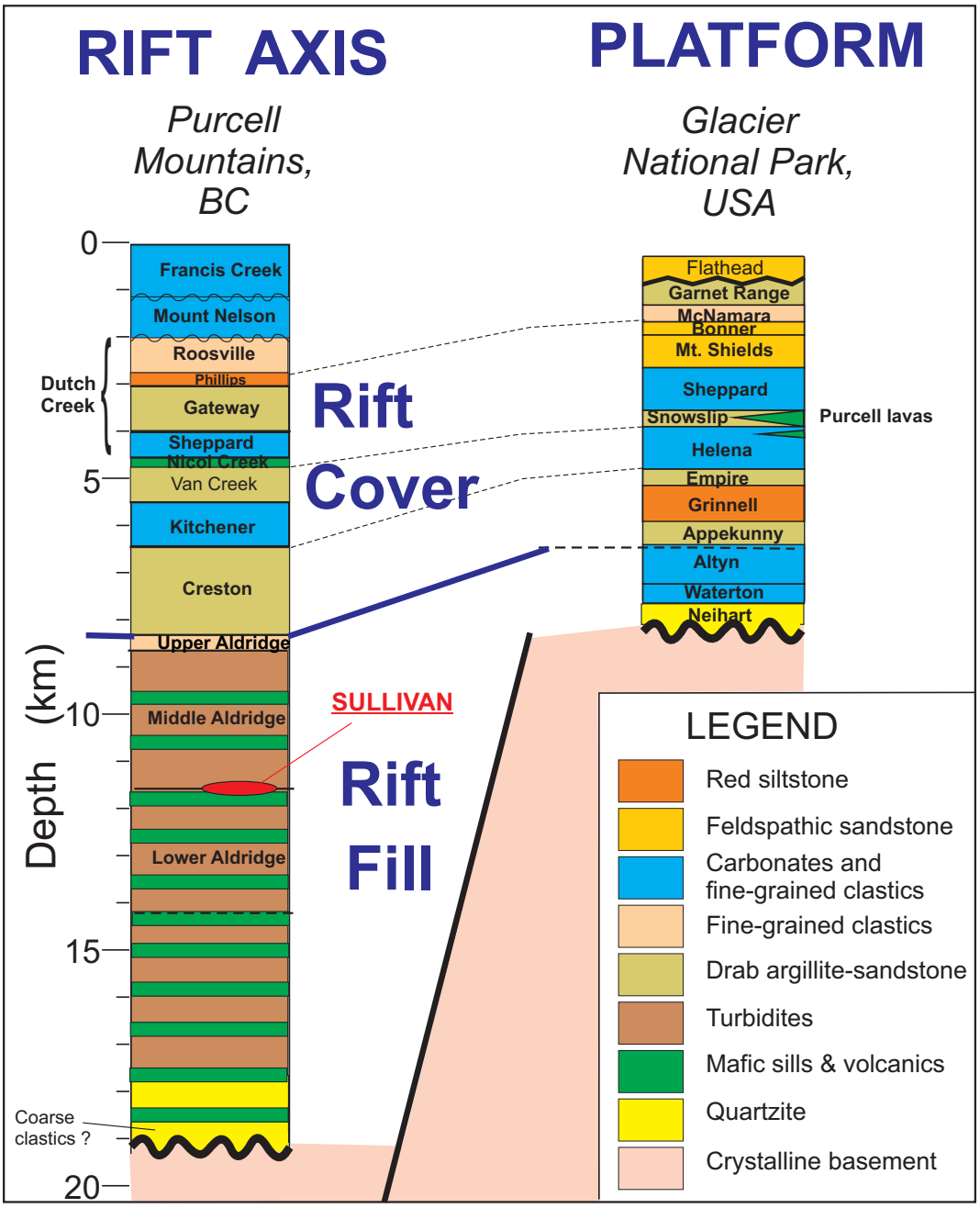

Fig. 8. Stratigraphic correlation and comparison of average thicknesses between formations of the rift-fill, rift-cover, and platform sedimentary sequences of the Belt-Purcell Supergroup. From Lydon (2007).

deposits (Höy, 1993; McMechan, 2012).

2.1.3. Kootenay Arc

The Kootenay Arc is a 400 kilometre-long curved belt of sedimentary, volcanic, and metamorphic rocks that lies between the Purcell Anticlinorium to the east, and the Shuswap-Monashee complex and the Quesnel terrane to the west (Fig. 5; Reesor, 1973). Deflection of the arc to a southwest trend near its southern end is coincident with the Vulcan Low (Vulcan Tectonic Zone; Fig. 5), and may reflect reactivation this basement structure (Vulcan, Fig. 6; Price, 1981).

Following the breakup of Rodinia, continental margin successions were deposited on the western flank of ancestral North America. These rocks consist of the Cambrian through Devonian siliciclastic, carbonate, and evaporitic rocks that are now exposed in the Purcell and Rocky mountains (Fig. 7). Correlative deep-water equivalents of these successions, now exposed in the Selkirk Mountains, were deposited outboard of the ancestral North American platform (Colpron and Price, 1995). Though the rift-phase created a passive margin, block faulting and volcanism existed offshore, suggesting that eastward subduction existed beneath an overlying volcanic arc

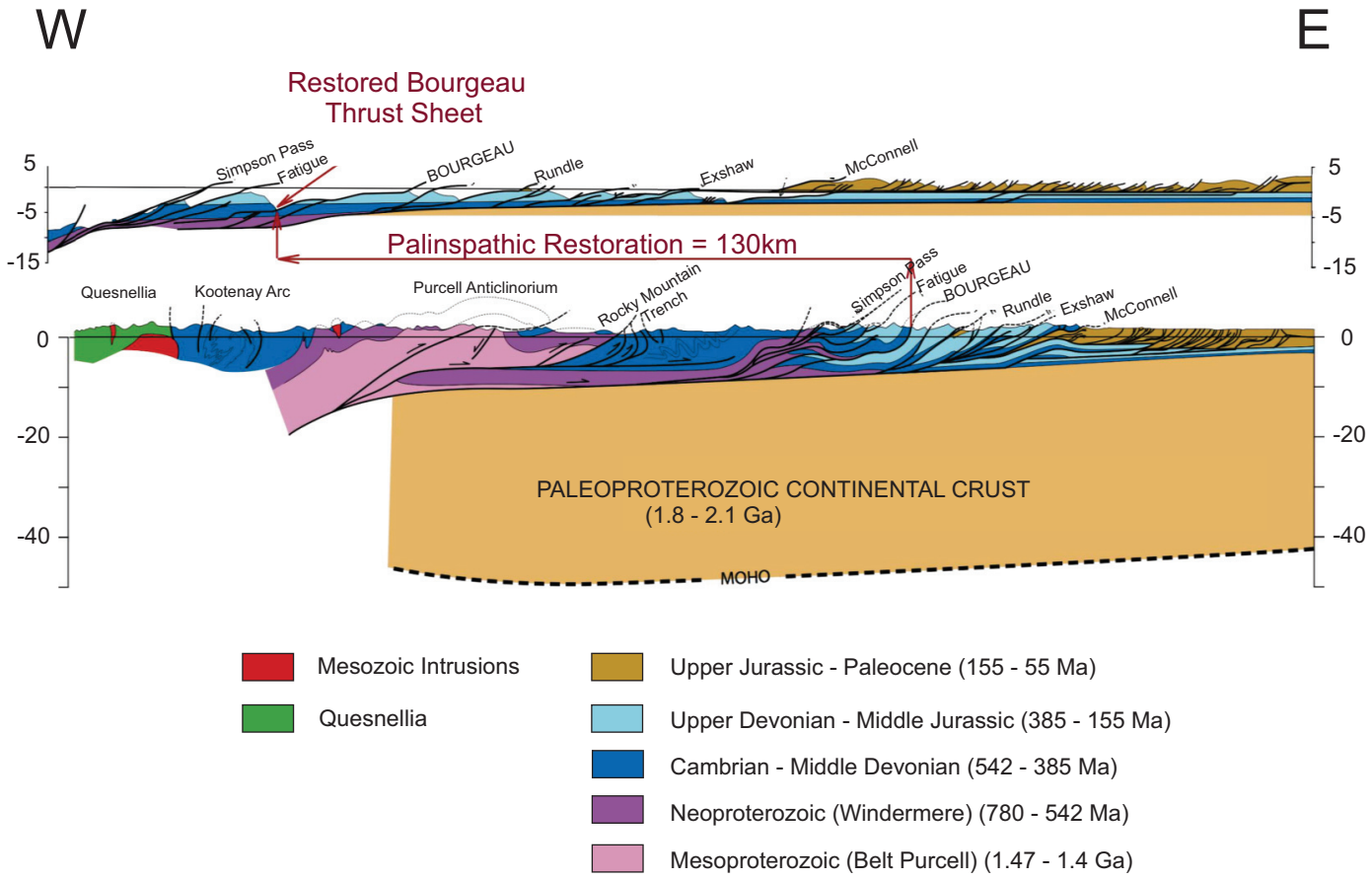

Fig. 9. Palinspathic restoration of the Rocky Mountain fold and thrust belt, southeastern British Columbia. Modified from Price and Fermor (1985).

that lay outboard of the miogeocline. During the Devonian, this eastward subduction also led to extension and bimodal arc magmatism in the outer continental margin (Piercy et al., 2006). Further evidence of this extensional regime is the stratigraphic relief in the Devonian successions across the Moyie-Dibble Creek fault.

This backarc extension caused the opening of the Slide mountain Ocean in Pennsylvanian 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 (Piercy et al., 2006; Nelson et al., 2006). The rocks consist of variably metamorphosed Neoproterozoic and Paleozoic strata, including the Badshot limestone (Lower Cambrian), and the clastics, carbonates, and volcanic rocks of the Lardeau Group (mid Cambrian-Mississippian) (Fig. 7; 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 (Fyles, 1967). Early Paleozoic volcanism (Eagle Bay Assemblage), late Devonian granitic intrusions (Ice River Complex), bimodal arc magmatism in the outer continental margin, and early Mississippian deformation are characteristic of the Kootenay terrane (Price, 2012). Magmatism in these rocks slowed after ca. 360 Ma, and ceased altogether by ca. 350 Ma (Nelson et al., 2006).

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. 7), were accreted and imbricated between the rocks of Quesnellia and Ancestral North America.

Deposits that occur within 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. 7), 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 in the western Rockies and Omineca belt are also related to backarc extension, and include the Ice River and Fir showings in the Kootenay-Boundary 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, 7), where mafic to felsic arc-related volcanic rocks and carbonates 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 Permian cherts, clastics, and basalts (Harper Ranch, Mount Roberts, and Attwood Groups; Fig. 7); coeval volcaniclastic rocks, pelites, 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. 5, 7; 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. 5, 7; 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. 5) is also related to the Eocene extension (Vanderhaeghe et al., 2003).

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 in composition, 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. 7).

Cretaceous intrusions of the Bayonne magmatic belt (Figs. 5, 7) were emplaced inboard of the main magmatic arc in continental margin rocks. They are generally intermediate to felsic alkalic to calc-alkalic, including: peraluminous, subalkalic hornblende-biotite granodiorites, highly fractionated two-mica granites, aplites, and pegmatites. Mineralization related to the suite includes Mo-Au±W-quartz veins; W-Cu-Au skarns; Au-Ag-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. 5), are magmatic-hydrothermal mineral deposits (Fyles and Hewlett, 1959).

Intrusions emplaced during regional Tertiary extension include the Coryell suite of alkalic plutons (with local extrusive equivalents) and stocks of granite and augite-biotite syenite and monzonite (Figs. 5, 7). 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. 5) 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. 5, 7). The Rocky Mountain Foreland Belt consists mainly of these mid-Proterozoic to Mesozoic sedimentary platformal and craton margin deposits, which were detached and thrust eastward during the Mesozoic to Tertiary terrane accretion.

Siliciclastic, carbonate, and evaporitic rocks were uplifted and displaced northeastward, to create a classical thin-skinned fold-thrust belt, with eastward-vergent, piggyback thrusts detaching along a basement-cover décollement (Fig. 9; Price and Fermor, 1985). These upturned 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, and shed eastward into the basin (Cant and Stockmal, 1989). The Fernie Formation and Kootenay Group (Fig. 7) consist of a coarsening-upwards sequence of basinal to coastal plain sandstones, shales, and coals that were deposited in the foreland, adjacent to the uprising Canadian Cordillera in the Jurassic to early Cretaceous. They represent the first of a series of coarsening-upwards clastic wedges within the foreland basin that were derived from uplift (Poulton, 1988; Stott, 1984). The coal seams of the Kootenay Group were upturned and structurally thickened as thrusting continued, and the accretionary wedge propagated eastward. They are now exposed along strike for 175 km in the Rocky Mountain Front Ranges, and portions of the section permit open-pit mining (Fig. 5). Mineable coal seams make up 8-12% of the total thickness of the Mist Mountain Formation (Kootenay Group), 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 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.

3. Mines and quarries

The Kootenay-Boundary 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. 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 Ltd. (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 approximately 70% of Canada's annual coal exports. Production from the Elk Valley in 2014 was 26.5 Mt of clean coal; however in 2015 Teck Coal Ltd. implemented rotating shutdowns in order to align production and inventory with weaker commodity prices. Expected production volumes for 2015 are around 25 Mt, and the company focused on implementing cost reductions and improved efficiencies at all operations.

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. Public consultation was also part of the process. The West Line Creek water-treatment facility is a water treatment facility currently being commissioned at the **Line Creek** Mine (Fig. 10), and is the first of six that Teck plans for the Elk Valley. The second will be at the **Fording River** mine. Together they are part of a selenium management plan that will cost a projected $600 million over the next five years, and $40 million to operate annually.

3.1.1. Fording River (Teck Coal Ltd.)

Fording River (Fig. 10) produces mainly metallurgical coal from their Eagle Mountain, Turnbull, and Henretta pits. In 2015, 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. 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 74-year mine life at the current production rate.

In September, 2015, the **Swift** expansion received conditional environmental assessment approval. The project will need to meet specifications outlined in the Elk Valley Watershed Management Plan, including the construction of a selenium water treatment facility. With an initial construction cost of

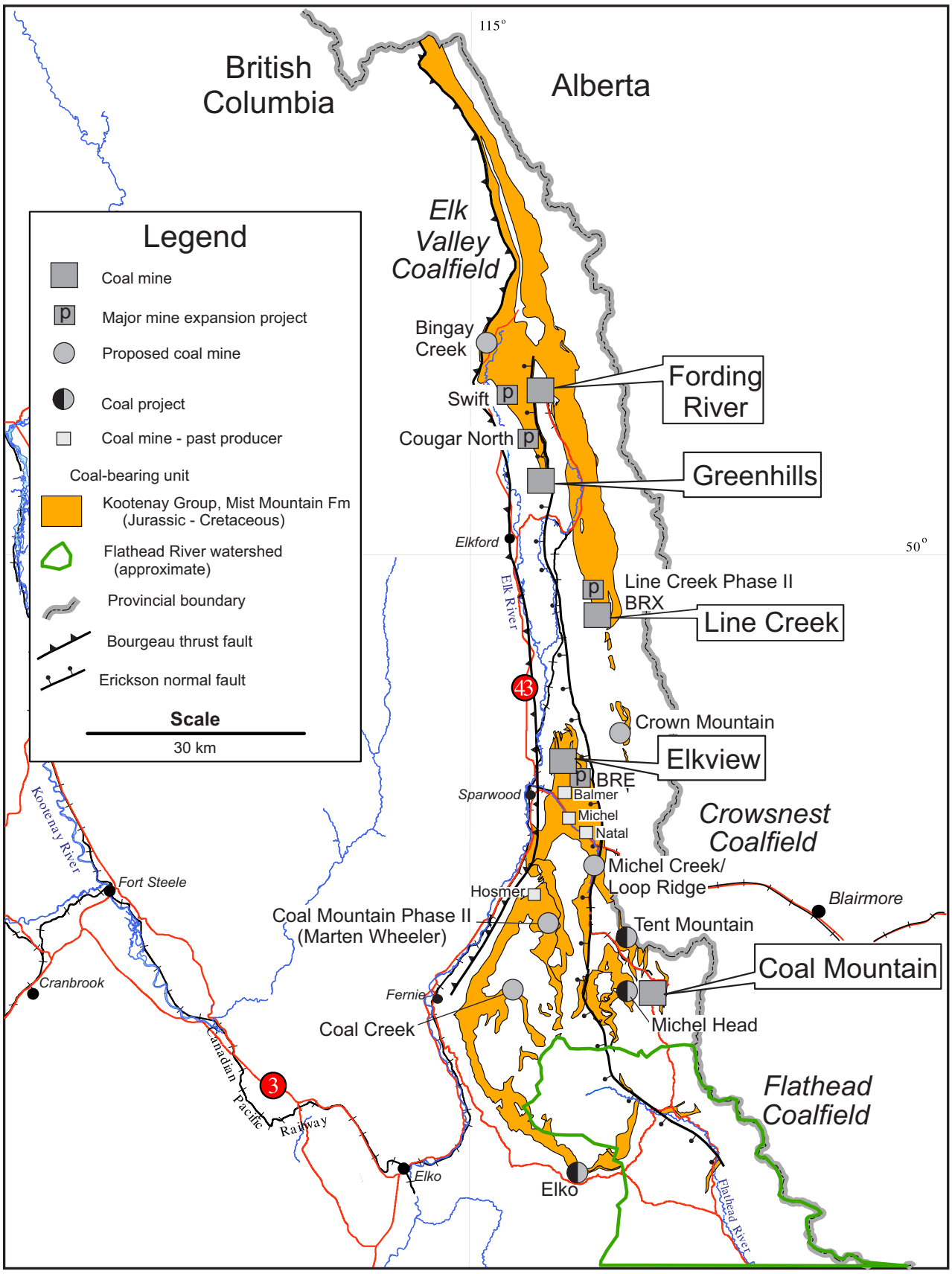

Fig. 10. Map of the Kootenay Group and East Kootenay coalfields, including the major coal mines and projects in southeastern British Columbia near Sparwood, BC.

Table 1. Operating coal mines, Kootenay-Boundary Region, 2015.

Mine	Operator	Commodity	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured + Indicated)	Mine Expansion Plans and Comments
Fording River	Teck Coal Ltd. (100%)	HCC, TC	7.9 Mt	Proven + Probable: 620.4 Mt HCC + 4.5 Mt TC	Measured + Indicated: 1149 Mt HCC + 9 Mt TC; Inferred: 0.8 Mt HCC + 6 Mt TC	EA approval of Swift expansion (2015); exploration drilling in active pits
Greenhills	Teck Coal Ltd. (80%); POSCAN (20%)	HCC, PCI, TC	5.2 Mt	Proven + Probable: 60.6Mt HCC + 3.7 Mt PCI + 1.2 Mt TC	Measured + Indicated: 264.5 Mt HCC + 1.8 Mt PCI + 3.6 Mt TC	Cougar Pit Expansion (CPX) is preparing for pre-application of EA; environmental baseline
Line Creek	Teck Coal Ltd. (100%)	HCC, PCI, TC	3.1 Mt	Proven + Probable: 66.8Mt HCC + 3.1Mt PCI + 8.7Mt TC	Measured + Indicated: 712 Mt HCC + 0.7 Mt PCI + 9.1 Mt TC	Burnt Ridge Extension (BRX) in pre-application of EA (2014); pre-stripping at Line Creek Phase II (2013 EA approval)
Elkview	Teck Coal Ltd. (95%); Nippon Steel & Sumimoto Metal Corp. (2.5%), POSCO (2.5%)	HCC	6.3 Mt	Proven + Probable: 215.2Mt HCC	Measured + Indicated: 705.3 Mt HCC; Inferred: 176.2 Mt HCC	Baldy Ridge Extension (BRE) in pre-application of EA (2014); exploration drilling in active pits; development progressing in new approved mining areas
Coal Mountain	Teck Coal Ltd. (100%)	PCI, TC	2.3 Mt	1.6 Mt Proven + 5.6 Mt probable PCI	57.7 Mt Measured + 82.9 Mt Indicated + 9.6 Mt Inferred	Coal Mountain Phase II (CMO2; Marten Wheeler) entered pre-application of EA (2014) but withdrawn late 2015; Mineable resource at CMO is nearing depletion and expected mine shut down in late 2017

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

approximately $88.5 million dollars and an annual operating cost of $16.9 billion, the open-pit project will use the existing Fording mine facilities and is expected to produce 175 Mt of clean coal over 25 years. Located west of the Fording River 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; and eventually the two will merge and collectively become the **Swift**.

3.1.2. Greenhills (Teck Coal Ltd.)

Greenhills is on the west limb of the Greenhills syncline (Figs. 10, 12). 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. Proven and probable reserves are projected to support another 14 years of mining from current pits at the current rate. The **Cougar Pit Extension (CPX)** project 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 2015, Teck conducted further baseline work and mine-planning to prepare to enter pre-application of Environmental Assessment. Exploration drilling in 2015 focused mainly on the active Cougar pit.

3.1.3. Line Creek (Teck Coal Ltd.)

Line Creek produces from the Burnt Ridge South, North Line Creek, and Horseshoe Pits (Figs. 10, 13). Expansion plans are well underway with the **Line Creek Phase II**, which received conditional Environmental Assessment approval in

Fig. 11. Previously mined seams of the Swift expansion area, looking westward from Fording River Operations, towards Cougar Ridge North.

Fig. 13. Coal seams in the Alexander Creek syncline at the Line Creek mine. Photo courtesy of Teck Coal Ltd.

Fig. 12. Greenhills mine (Cougar Pit), looking north towards Cougar Ridge North.

2013. 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, and 18 years of mine life to the mine. Coal seams are predominantly medium-volatile bituminous in rank, with some high volatile-A bituminous coals near the top of the section. In June, 2014, the **Burnt Ridge Extension (BRX)** project entered the pre-application stage of Environmental Assessment. The project will connect the current Phase I operating area at **Line Creek** to the recently approved (2013) **Phase II** area by pushing back the highwall of Burnt Ridge South pit to the north. It will add 8.3 Mt of clean coal to the mine. Drilling was focused on the Burnt Ridge and North Line Creek extension areas to update geological and geotechnical models.

3.1.4. Elkview (Teck Coal Ltd.)

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. Teck estimates a remaining reserve life of approximately 32 years at the current production rate. Production is mainly from their Baldy Ridge BR1 and Natal PH1 Pit, and 2015 exploration drilling was focused mainly in the active pits. 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)** also entered pre-application of Environmental Assessment in June, 2014. 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. The **BRE** expansion is expected to be brought on stream to maintain production at Elkview at around 6.8 Mt per year.

3.1.5. Coal Mountain (Teck Coal Ltd.)

Coal Mountain (Fig. 10) produces mainly PCI and thermal coal from seams at 37-Pit and 6-Pit, and 2015 activity was mainly focused on active pits. The **Coal Mountain Phase II (Marten Wheeler)** project, which entered the pre-application

phase of environmental assessment in 2014, was designed to replace production after depletion of the resource at **Coal Mountain**. Late in 2015 however, Teck Coal Ltd. removed the proposal from the pre-application process as a result of lower commodity pricing. The **Coal Mountain** mine will remain active at current rates of production, and then is 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 the 2.25 Mt of planned production from the cancelled **Coal Mountain Phase II** expansion after 2017.

3.2. Industrial mineral mines and quarries

The Kootenay-Boundary Region hosts several industrial mineral mines, the largest of which, are located 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).

3.2.1. Mount Brussilof (Baymag Inc.; Magnesite)

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 carbonates of the Cathedral Formation (Fig. 7) that were originally deposited on the edge of the Cathedral escarpment, which formed 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). Production in 2015 was approximately 220 kt.

Fig. 14. Blast hole drilling at the Mount Brussilof mine, which produces magnesite from Cambrian carbonates of the Cathedral formation.

3.2.2. Moberly Silica (Heemskirk Canada Limited; Silica)

Silica is produced by Heemskirk Canada Limited at the **Moberly Silica** operation. The deposit is in regionally extensive orthoquartzites of the Mount Wilson Formation (middle to upper Ordovician; Fig. 7). 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 at a 35-year mine life. In 2014, the company updated the feasibility study and the resource estimate specific to producing 20 to 140-mesh frac sand (Fig. 15). 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 late 2016 or early 2017.

Fig. 15. Stockpiled silica sand at the Moberly Silica mine, which produces silica for glass-making, and other industrial uses. Heemskirk Canada Limited is currently re-developing operations for production of 20 to 140-mesh frac sand for the oil and gas industry.

3.2.3. Horse Creek Silica (HiTest Sand Inc.; Silica)

At the **Horse Creek Silica** mine, HiTest Sand Inc. operates a seasonal quarry in Mount Wilson quartzites (Fig. 7) for a variety of industrial use and aggregate products. The quarry is located further to the south and in an area where the formation is more consolidated than at Moberly (Fig. 1). The company is also evaluating processes for the production of alternate products, including silicon metal.

3.2.4. Elkhorn Mine (CertainTeed Gypsum Canada Inc.; Gypsum)

Gypsum is produced near the western edge of the Rocky

Table 2. Selected industrial mineral mines and quarries, Kootenay-Boundary Region, 2015.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Mount Brussilof	Baymag Inc.	Magnesite; Hydrothermal sparry magnesite; 082JNW001	220,000 t annually	50 Mt proven	-	MgO, and MgOH; sediment-hosted sparry magnesite
Moberly Silica	Heemskirk Canada Ltd.	Silica; Industrial use silica, frac sand; 082N001	-	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	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 + Indicated	$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
Horse Creek Silica	HiTest Sand Inc.	Silica; Industrial use, aggregate; 082N 043	-	-	Estimated: 3 Mt at 99.5% Silica (1987)	Variety of aggregate and industrial use products
Elkhorn	CertainTeed Gypsum Canada Inc.	Gypsum; Evaporitic bedded gypsum; 082JSW021	400,000 t annually	-	-	5 years mine-life remaining; the company will replace production by developing the Kootenay West mine (in EA)
4J	Georgia-Pacific Canada Limited	Gypsum; Evaporitic bedded gypsum; 082JSW009	n/a; Processing stockpiled ore	-	20 Mt	Processing stockpiles; updating mine expansion plans
Black Crystal	Eagle Graphite Corp.	Graphite; Metamorphic-hosted flake graphite; 082FNW260, 082FNW283	n/a; Quarry on care and maintenance; company focused on process optimization and exploration	-	Regolith: Measured + Indicated: 0.648 Mt at 1.83% fixed carbon; Calc-silicate: Indicated: 4.765 Mt at 1.21% fixed carbon	Exploration drilling to expand the resource; update geological model and pit design; process optimization at plant; produced sample of 99.995% pure spheronized graphite from flake graphite; product suitable for Li-Ion battery specifications
Winner; Friday Quarry	Roxul Inc.	Gabbro/ basalt; Crushed rock for mineral wool; 082ESE265	Quarrying to supply feed stock for mineral wool plant	-	-	Crushing, screening, stockpiling; environmental
Grand Forks Slag	Granby River Mining Company Inc.	Slag/Silica; tailings from Grand Forks smelter dumps; 082ESE264	Quarrying for abrasives and roofing granules	-	-	Crushing, screening; environmental

Mountain Fold and Thrust belt from a thinly-bedded evaporite unit in the Burnais Formation (middle Devonian; Figs. 7, 16) that was deposited in a restricted shallow gulf. Gypsum-bearing strata are structurally disturbed, occurring as sections of steeply dipping, contorted rock gypsum, 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 5 years.

3.2.5. 4J Mine (Georgia-Pacific Canada Limited; Gypsum)

Georgia-Pacific Canada Limited operates the **4J** gypsum mine and rail load-out facility southeast of Canal Flats. The deposit is

Fig. 16. Inter-bedded gypsum and finely laminated mudstones in the middle Devonian Burnais Formation. Gypsum is produced from the Burnais formation at the Elkhorn and 4J mines, with a new mine development proposal in EA for the Kootenay West mine.

within Burnais Formation evaporites (middle Devonian; Figs. 7, 16). The company re-evaluated their mine design for the next stages of pit expansion, and produced mainly from stockpiled material in 2015.

3.2.6. Black Crystal (Eagle Graphite Corp.; Graphite)

Eagle Graphite Corp. operates the **Black Crystal** flake graphite operation where graphite ore is mined from the open-pit quarry on Hodder Creek and processed at a pilot plant 10 km west of Passmore. The property is in the central part of the Valhalla complex (Fig. 5) in the Valhalla dome, a structural complex of upper amphibolite-grade gneisses in Paleozoic rocks of the Kootenay terrane that was exhumed during Tertiary extension. Disseminated fine- to coarse-flake graphite is distributed along foliation in organic-rich calc-silicates and marbles, across an area of about 500 m^2. 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 2015, the open-pit quarry was on care and maintenance, and efforts were focused on exploration drilling in order to update the geological models and more fully define and expand the resource on the property. The company also focused efforts 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.

3.2.7. Winner and Friday Quarries (Roxul Inc.; mineral wool: Gabbro and basalt)

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.

3.2.8. Grand Forks Slag (Granby River Mining Company Inc.; Smelter slag)

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. Proposed mines

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 (Fig. 1; Table 3).

There are several proposed mines for the Kootenay-Boundary Region, including five proposed coal mines, several proposed industrial mineral mines and quarries of various scales, and two proposed metal mines. The five coal projects are **Crown Mountain**, **Michel Creek/Loop Ridge**, **Coal Mountain Phase II**, **Coal Creek** and **Bingay Creek**. Two of the industrial mineral projects include the **Kootenay West Mine** and the **Driftwood Magnesite** project, and the two metal mines are the **Gallowai Bul River** and **Slocan Silver** projects.

4.1. Proposed coal mines

4.1.1. 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. NWP Coal completed a prefeasibility study, with upside potential in a Southern Extension; and updated coal resource estimates at 74.9 Mt (measured + indicated categories). Coal

Table 3. Selected proposed mines, Kootenay-Boundary Region, 2015.

Project	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured + Indicated)	Work Program
Crown Mountain	NWP Coal Canada Ltd. (Jameson Resources Ltd.)	Coal (HCC and PCI); open-pit; 082GNE018	HCC: 42.60 Mt Proven + 4.91 Mt Probable; PCI: 7.13 Mt Proven + 1.19 Mt Probable (2014)	HCC + PCI: 68.9 Mt Measured + 6.0 Mt Indicated (2014)	Prefeasibility studies; environmental and baseline work; mine design; permitting
Michel Creek (Loop Ridge)	CanAus Coal Ltd.	Coal (HCC and PCI); open-pit and underground; 082GSE050	-	HCC: 44.6 Mt Measured + 42.5 Mt Indicated; open-pit and underground (2015)	Drilling; trenching; environmental and baseline work; mine design; coal quality; permitting
Coal Mountain Phase II (Marten Wheeler)	Teck Coal Ltd.	Coal (PCI and TC); open-pit and underground; 082GNE006	-	PCI + Thermal: 114.3 Mt Measured + 97.3 Mt Indicated (2015)	Environmental and baseline work; mine design; permitting
Coal Creek	CrowsNest Pass Coal Mining Ltd.	Coal (HCC and PCI); underground; 082GSE035	-	HCC + PCI: 616 Mt in the upper 3 near-surface seams (2014)	Prefeasibility Study (PFS); geological modeling; resource evaluation; baseline studies
Bingay Creek	Centremount Coal Ltd.	Coal (HCC); open pit and underground; 082JSE011	-	42.43 Mt Measured + 52.9 t Indicated (2012)	Environmental baseline studies; Engineering and geotechnical evaluation for mine design; permitting
Kootenay West	CertainTeed Gypsum Canada Inc.	Gypsum; Evaporitic bedded gypsum; quarry; 082JSW005, 082JSW020	-	North and South Quarries: Total 18.7 Mt (at average quality of 83-85%)	Environmental baseline work; mine design
Driftwood Magnesite	MGX Minerals Inc.	Magnesite; Hydrothermal sparry magnesite; quarry; 082KNE068	-	-	Drilling; bulk sampling; environmental baseline work; metallurgical test work; lease application; mine design; preliminary plant design
Gallowai Bul River	Purcell Basin Minerals Inc.	Cu-Ag-Au+/-Pb-Zn; Cu-Ag veins; underground; 082GNW002	-	90,720 t at 1.3% Cu, 0.31g/t Au, 21.77g/t Ag	Draft project proposal submitted to EA; Permitting; environmental baseline; mine plan and mine design; ARD/ML
Slocan Silver (Silvana)	Klondike Silver Corp.	Ag-Pb-Zn+/-Au; Polymetallic veins; underground 082FNW050, 13, 082KSW006	-	-	Engineering reports: underground mining structure and tailings storage facilities; environmental monitoring

quality test work indicates coal quality characteristics that are similar to the Elk Valley coking coals.

4.1.2. Michel Creek/Loop Ridge (CanAus Coal Ltd.)

In October 2015, CanAus Coal Ltd., a wholly owned subsidiary of CoalMont Pty Ltd., entered pre-application phase of environmental assessment for their **Michel Creek** project, which consists of licenses at **Loop Ridge, Tent Mountain,** and **Michel Head** (Fig. 10). 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. The project will comply with environmental targets identified in the Elk Valley Water Quality Plan in the design, construction and operational phases of the project. Drill results identified twenty Mist Mountain coal seams ranging from 5 to 20 m in thickness, 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. Further bulk sample carbonization testwork is underway. 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. Drilling in 2015 focused on the Loop Ridge project, with samples collected for coal quality testing from **Loop Ridge** and McGillvray pit. The company trenched on Loop Ridge South, with plans for follow up drilling in 2016 to extend the resource southward.

4.1.3. Coal Mountain Phase II (Teck Coal Ltd.)

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, Teck focused on environmental baseline, geotechnical, and mine design work, however, the project was withdrawn from environmental assessment and put on hold late in the year as a result of Teck Coal Ltd. implementing cost-saving measures. The project was proposed to replace production and use infrastructure from the **Coal Mountain** mine. 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.

4.1.4. 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). The company has been testing the down-dip 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. Although the project remained on hold in 2015, environmental baseline studies, including water quality surveys are ongoing.

4.1.5. 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, with further environmental work required. 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. Based on previous exploration results, the coal at Bingay Creek is medium-volatile to high volatile-A bituminous in rank. Work in 2015 consisted of engineering and geological review and environmental baseline studies, with drilling planned for 2016.

4.2. Proposed industrial mineral mines

4.2.1. Kootenay West Mine (CertainTeed Gypsum Canada Inc.; Gypsum)

CertainTeed Gypsum Canada Inc. continued to advance the proposed **Kootenay West Mine**, 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, within the Burnais Formation (Fig. 7). 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 2015, the company focused on environmental work and mine design, with two pits (North and South). They hope to begin site preparation in 2016, with a projected start-up in 2018.

4.2.2. Driftwood Magnesite (MGX Minerals Inc.; Magnesite)

At the **Driftwood Magnesite** property, cliff-forming, upturned beds of sparry magnesite (Fig. 17) are interlayered with dolostones and dolomitic limestones of the Mount Nelson Formation (Proterozoic; Fig. 7). The coarse-grained textures in the magnesite zone suggest that hydrothermal alteration and recrystallization of magnesite occurred during regional metamorphism (Kikauka, 2000). In 2014, MGX Minerals Inc. drilled the East zone, and resampled cores from earlier drilling at the West zone. In 2015, the company focused drilling at the West zone, which varies from 100 to 200 m in thickness along a strike length of 400 m, to a depth of approximately 125 m. The company is currently working on completing a NI 43-101 compliant resource, and testwork was conducted to develop an optimized process design to remove silica and improve economic cut-off grades. They have applied for a mining lease for quarry operations, are conducting environmental baseline studies, and are evaluating mine design options. They began bulk sampling from the **East** zone late in 2015 for further metallurgical testwork, and are evaluating mineral processing options.

Fig. 17. Sparry magnesite of the Mount Nelson Formation (Proterozoic) at the Driftwood Magnesite property.

4.3. Proposed metal mines

4.3.1. Gallowai Bul River (Purcell Basin Minerals Inc.; Cu-Ag-Au±Pb-Zn)

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. 7). 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.

4.3.2. Slocan Silver (Klondike Silver Corp; Ag-Pb-Zn±Au)

Klondike Silver Corp's **Slocan Silver** project consists of several past producers in a rich historic Ag-Pb-Zn mining area. The area is underlain by sheared and brecciated argillite and slates of the Slocan Group (Triassic) that are cut by Nelson granodiorite and quartz monzonite dikes (Middle Jurassic; Fig. 7). 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 within 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, mainly as argentiferous galena and sphalerite. The company's mill at Sandon is a 100 t per day concentrator that operated at an average rate of 40 t per day (Fig. 18). It was shut down in the latter half of 2013 as the company re-evaluated geological modeling and furthered exploration targets, and engineering studies in 2014. In 2015, the mine and mill remained on care and maintenance, and the company focused on environmental work, and engineering upgrades to the tailings facility and underground structures.

Fig. 18. Klondike Silver Corp's (Slocan Silver) mill at Sandon.

5. 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 Kootenay-Boundary Region in 2015 (Fig. 1; Table 4) for a variety of targets. Over last year, there was a decreased amount of exploration dollars spent on drilling and advanced stage projects, but increased spending on grassroots projects and assessment work (Fig. 4).

5.1. Precious metal projects

5.1.1. Gold Drop (Ximen Mining Corp.)

Ximen Mining Corp. continued work on their **Gold Drop**

property. The company carried out mapping, trenching and sampling at the North Star and Gold Drop vein systems (Fig. 19), and over their surrounding claims, including the Amandy, Lakeview and Moonlight. One grab sample from trenching on the Northstar-Gold Drop vein assayed 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 17,000 ppm Pb. Most samples that were elevated in Au also had elevated Ag, Pb, and Cu.

The property is underlain by metamorphic rocks of the Knob Hill complex (Paleozoic) that have been intruded by granodiorite and diorite of the Nelson Plutonic suite and by biotite syenite and diorite/andesite dikes of the Coryell suite (Fig. 7). Gold-bearing veins in the area post-date the Nelson intrusives and pre-date the Coryell suite. The Gold Drop-North Star veins range in thickness from 10 cm to 2 m. North-trending, steeply-dipping strike-slip and normal faults, and low-angle detachment faults post-date mineralization (Caron, 2014). The property hosts at least 8 known low-sulphide, gold-bearing veins, and hundreds of metres of historic underground workings.

Fig. 19. Trenching at the Gold Drop-North Star vein system, near one of the historic adits on the property.

5.1.2. Greenwood Gold (Grizzly Discoveries Inc.)

Grizzly Discoveries Inc. continued working at their **Greenwood Gold** property, which consists of over 90,000 hectares in eight different claim groups that extend from east of Greenwood to west of Anarchist Summit. In 2015, the company conducted a field program to re-evaluate their claim group, and have outlined a variety of targets for further exploration. Exploration and reconnaissance target types identified for future exploration on the Dayton, Rock Creek (Ket 28), Motherlode, Sappho, Overlander, and Mount Attwood claim groups include; Cu-Au-Ag skarn, Au-Ag epithermal, Ag-Pb-Zn±Au shear-hosted, stockworks and breccias and Cu-Au-Ag alkalic porphyry targets. Drilling is planned for the Ket 28 target in 2016. The company also signed an option agreement with Kinross Gold Corporation's wholly owned subsidiary, KG Exploration (Canada) Inc., to earn 75% interest in approximately one third of the **Greenwood Gold** land holdings. The property hosts similar geology and mineralization to Kinross Gold Corporation's Kettle River-Buckhorn mine and mill (1,800 tonne per day capacity), which is located just to the south of the project area, across the border in Washington State, USA.

The area is underlain by rocks of the Paleozoic Knob Hill and Anarchist Groups, Brooklyn Formation (Triassic), and Penticton Group (Eocene; Fig. 7). Intrusions of Jurassic, Cretaceous, and Eocene age occur throughout the area.

5.1.3. May Mac (Golden Dawn Minerals Inc.)

Golden Dawn Minerals Inc. has been evaluating several historic mineralized areas on their Greenwood project, including the Deadwood, Wild Rose, Amigo, and **May Mac**. Golden Dawn's land holdings are adjacent to Grizzly Discovery Inc.'s properties near Greenwood, with similar geology hosting similar deposit types. In 2015, the company began sampling and mapping at the **May Mac** and Amigo, and then began drilling and bulk sampling late in the year. Channel samples collected from the historical underground workings showed elevated gold and silver values, and the initial drilling intersected similar quartz vein and/or stockwork zones with iron, lead, and zinc sulphides. Drill and assay results are pending, as the company continues their work program into 2016.

5.1.4. LH (Magnum Goldcorp Inc.)

Magnum Goldcorp Inc. continued work at the **LH** property as a follow up to their 2014 program. Drilling was carried out on anomalies identified from 2014 SP, IP and magnetometer surveys, and along alteration zones at the Ridge zone. Drilling also targeted extensions of high-grade zones from previous drilling and sampling in the historic underground workings.

Mineralization follows a 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. 7). Gold mineralization occurs within a structural zone up to 13.7 m in width, in 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.

Table 4. Selected exploration projects, Kootenay-Boundary Region, 2015.

Project	Operator	MINFILE	Commodity; Deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work Program	Comments
Gold Drop	Ximen Mining Corp.	082ESE 153, 152, 126	Au-Ag-Pb-Zn+/-Cu; Vein, alkalic intrusion-associated Au	-	Trenching; mapping; sampling	Chip sample results up to 0.60 m grading 43.6 g/t Au, 141 g/t Ag; and 0.55 m grading 56.2 g/t Au, 259 g/t Ag; grab sample grading 159 g/t Au, 744 g/t Ag, 70 ppm Cu, and 1.7% Pb
Greenwood Gold	Grizzly Discoveries Inc.	082ESW 022, 210, 034, 221	Au-Cu-Pb-Zn-Ag+/-Mo; Cu-Au-Ag skarn, polymetallic vein, Au-vein, porphyry	-	Mapping; sampling; geological evaluation	Option agreement with KG Exploration (Canada) Inc; extensive landholding with numerous targets
May Mac	Golden Dawn Minerals Inc.	082ESE 045, 116	Au-Ag-Pb-Zn+/-Cu; Cu-Au-Ag skarns, polymetallic veins, Au-veins	37,200 t grading 3.4 g/t Au, 342.8 g/t Ag, 2% Pb, 2% Zn (1981; non-compliant)	Drilling (2,000 m); mapping; rock and channel sampling;	Channel sampling: 0.87m grading 12.97 g/t Au, 34 g/t Ag; 0.2 m grading 36.37 g/t Au, 43 g/t Ag; 0.4 m grading 17.07 g/t Au, 11 g/t Ag; 0.4 m grading 4.46 g/t Au, 529 g/t Ag; Drilling intersected gold-bearing vein and stockwork system with lead and zinc sulphides, assays pending
LH	Magnum Goldcorp Inc.	082FNW 212	Cu-Ag-Au; subvolcanic, skarn, Au-veins	-	Drilling (11 DDH); SP and IP/ magnetometer survey	Phase I drilling: 16.9 m grading 13.58 g/t Au, including 10.9 m grading 20.61 g/t Au; 11m grading 20.66 g/t Au; results from Phase II drilling are pending
Vine	PJX Resources Inc.	082GSW 050, 049, 035	Pb-Zn-Ag+/-Au; polymetallic vein, SEDEX	1.3 Mt grading 2.2 g/t Au, 3.12% Pb, 36.3 g/t Ag, 3.12% Zn (2011; non-compliant)	Drilling (20 DDH; 5000 m); gravity survey; geophysical and geological modeling	Infilled gravity survey grid; detailed geophysical and geological model
Monroe	Sonoro Metals Corp.	082GSW 069, 035, 041	Pb-Zn-Ag+/-Au, Cu; SEDEX	-	Drilling (1114 m); petrographics; mapping	Drilling on UTEM anomaly; encountered tourmalinized breccia zones
Sully	Santa Fe Metals Corp.	-	Pb-Zn-Ag+/-Au; Gravity anomaly, sediment-hosted	-	Mapping; magnetic surveys; geophysical modeling	Mass models suggest two gravity anomalies may be stratiform sulphide mineralization; complex faulting on property
Cummins River	MMG Limited	083D 001, 002, 015	Pb-Zn-Ag+/-Cu; sediment-hosted	Indicated: 5 Mt grading 7g/t Ag, 0.6% Pb, 2.3% Zn (1987; non-compliant)	Heli-borne VTEM (623 line-km); soil and rock geochemistry; mapping	Stratiform sulphides; soil survey followed up on conductive and magnetic anomalies from VTEM; Zn-Pb-Mn anomaly in soil survey

Table 4. Continued.

River Jordan	Silver Phoenix Resources Inc.	082M 001, 002	Zn-Pb-Ag; Broken hill, SEDEX, Irish-type carbonate-hosted	-	Drilling (494 m); mapping; sampling	1.85 m grading 1.27% Pb, 6.04% Zn, 12.0 ppm Ag; 1.48 grading 4.01% Pb, 11.6% Zn, 33.8 ppm Ag
J & L	Huakan International Inc.	0825M 003	Ag-Pb-Zn+/-Au; SEDEX, Irish-type carbonate-hosted, polymetallic veins	Main Zone: 3.95 Mt grading 5.68 g/t Au, 56.5 g/t Ag, 1.94% Pb, 3.56% Zn (Measured +Indicated); Yellowjacket Zone: 1.0 Mt grading 64.1 g/t Ag, 2.77% Pb, 9.08% Zn, 0.21 g/t Au (Indicated) (2011)	Engineering and environmental baseline studies; metallurgical test work; preliminary economic assessment	Care and maintenance underground mine; process optimization; upgrades to facilities
Thor	Taranis Resources Inc.	082KNW 030, 031, 060, 061	Ag-Pb-Zn+/-Au; polymetallic veins and breccia, stratiform manto	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)	Panel sampling; surveying and sampling stockpiles, environmental baseline studies	Panel sampling at SIF zone: 17.6 m grading 30.59 g/t Au; Panel sampling at Gold Pit: 2.04 m grading 52.4 g/t Au, 1,528 g/t Ag, 1.39% Pb, 0.08% Zn and 1.64 m grading 14.3 g/t Au, 254.9 g/t Ag, 0.99% Pb, 0.52% Zn
Teddy Glacier / Spider Mine	Jazz Resources Inc.	082KNW 069	Ag-Pb-Zn+/-Au; polymetallic veins	Inferred: 44,000 t grading 4.46 g/t Au, 7.94% Pb, 6.74% Zn (2007; non-compliant)	Metallurgical test work (flotation); ML/ARD; bulk sample permitting; environmental baseline studies	Pb flotation concentrate with 62% Pb, 83% Au and 92% Ag; Zn flotation concentrate with 48.7% Zn; Permitting pilot mill and tailings pond at Spider Mine
Jersey-Emerald	Margaux Resources Inc.	082FSW 010, 009	Pb-Zn-Ag+/-W, Au, Mo, Bi; stratiform replacement, skarn	Measured and Indicated: 3.071 Mt grading 0.36% WO_3 (2015)	Dewatering underground workings at Emerald; mapping; sampling; geological modeling	10.2 m grading 24.98 g/t Au with elevated bismuth; 2.75 m grading 0.49% WO_3; 4.5 m grading 0.5% WO_3; 3.35 m grading 0.52% WO_3; 2.65 m grading 0.59% WO_3; 4 m grading 0.35% WO_3; 6.45 m grading 0.33% WO_3, 0.65 g/t Au; 5.15m grading 0.47% WO_3

Table 4. Continued.

Willa	Discovery Ventures Inc.	082FNW 070, 071	Ag-Pb-Zn +/-Au-Cu-Mo; subvolcanic breccia, polymetallic veins, porphyry Mo, Au-skarn	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)	Preliminary Economic Assessment; geological modeling; mine design; MAX facility upgrades; environmental baseline studies	Acquisition of the MAX Mine and mill facilities; plan to process ore from the Willa; estimated mine life of approximately 4.1 years at 500 t/day
Referendum/ Whitewater	Braveheart Resources Inc.	082FSW 222, 171	Au-Ag-Pb-Zn+/-Mo; polymetallic veins, Au-veins	-	Trenching; bulk sampling (1,000 t at Referendum; 100 kg at Whitewater); milling and flotation	Projected gold recoveries of 90% from preliminary flotation testing; further results pending
Record Ridge/ Midnight	West High Yield (W.H.Y) Resources Ltd.	082FSW 119, 116, 117	Au-Ag-Pb-Zn, Mg; polymetallic veins, ultramafic-hosted talc, magnesite	-	VLF-SP surveys; mapping; sampling; environmental baseline	Identified drill targets and plan on bulk sampling at the Midnight and Record Ridge properties
Marten Phosphate	Fertoz Ltd.	082GNE 027	Phosphate; upwelling	-	Mapping; sampling; XRF; environmental baseline; permitted bulk sample	XRF of stockpiles: 24- 27% P_2O_5; product shipped for direct spreading on agricultural area
Cro Phosphate	HighBrix Manufacturing Inc.	082GNE031, 035	Phosphate; upwelling	-	Drilling (7 DDH); trenching; bulk sampling	Product shipped for direct spreading on agricultural area
Elko	Pacific American Coal Limited	082GSE029	Coal (HCC, PCI)	Measured: 19.2 Mt + Indicated: 57 Mt + Inferred: 181.3 Mt (JORC 2015)	Mapping; sampling; geological modeling; field reconnaissance to locate historic adits and drilling; JORC compliant resource	Mapping of 5 coal seams over the property; 3 seams have hard coking coal quality, 2 seams have PCI coal

5.2. Polymetallic base and precious metal projects

5.2.1. Vine (PJX Resources Inc.)

PJX Resources Inc. continued drilling in 2015 at the **Vine** property, and updating their geological-geophysical model. Gravity geophysical surveys have 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. 7). Recent drilling on the east and west gravity targets has identified disseminated and replacement style sphalerite (zinc) along fractures and associated with carbonate-rich beds. At the East target, localized sericite, chlorite, albite, garnet, and biotite alteration, and complex structures suggest that the source of the gravity anomaly may be flat-lying and bedding parallel, or contorted within the hanging wall of the Moyie fault. Additional drilling is planned to attempt to explain anomaly sources in the target areas.

The property hosts the shear-related Vine Vein (Pb-Zn-Ag-Au) occurrence, which was discovered in the late 1970s, in middle Aldridge Formation argillites and quartzites. Historic trenching and drilling 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. Bedded massive

sulphides were intersected in two historic drill holes at the Vine vein, and led to re-evaluation of the gravity and EM survey data.

5.2.2. Monroe (Sonoro Metals Corp.)

At the **Monroe** property, Sonoro Metals Corp. re-evaluated historic drilling, soil geochemistry, and geophysics, targeting sulphide mineralization in the Aldridge Formation (Fig. 7). Historic drilling on the property has encountered disseminated and stratiform sphalerite, pyrrhotite, pyrite and galena at the Sullivan time-horizon, and pervasive zones of hydrothermal alteration. The property lies in a favorable structural corridor at the intersection of two major fault zones, with numerous other showings, including vent and breccia complexes, and abundant sericite, albite, chlorite, garnet and biotite alteration. In 2015, the company and their partner Eagle Putt Ventures Inc., drilled on a UTEM anomaly offsetting a historic hole that had intersected distal-style mineralization at the lower-middle Aldridge contact. The 2015 hole encountered tourmalinized zones and pyrrhotite breccia-style mineralization.

5.2.3. Sully (Santa Fe Metals Corp.)

Santa Fe Metals Corp. expanded their magnetic surveys at the **Sully** property, with additional drilling planned to target two subsurface gravity anomalies in the Purcell Supergroup (Fig. 7). Mass models of the anomalies are consistent with contrasting specific gravities of sulphide mineralization, relative to the country rocks on the property. Recent mapping, drill-hole correlations, and interpretations suggest the anomalies may represent fault repetition of an upturned and rotated stratabound horizon in the Aldridge Formation. Drilling has intersected traces of Pb-Zn-Cu sulphide mineralization and sericite alteration, and correlations indicate complex fault structures on the property. The company intends to continue exploration in 2016.

5.2.4. Cummins River (MMG Limited)

MMG Limited worked at the **Cummins River** property this year on both their 100% owned claims, and their joint venture claims with Tsar Creek Holdings Ltd. In 2015, the company conducted geological mapping and an airborne VTEM survey, and followed up on conductive and magnetic anomalies with soil geochemical surveys and rock sampling. Results identified a large zinc-lead-manganese anomaly near the Bend North Road MINFILE showing.

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. 7) on the western limb of the Porcupine Creek anticlinorium. At the Cummins River Canyon, pyrite, pyrrhotite, sphalerite and galena are hosted in the Tsar Creek Formation (Chancellor Group) as intensely deformed, stratiform massive sulphides, siliceous sulphides, and mineralized manganiferous dolomite, 5 to 10 m thick.

5.2.5. River Jordan (Silver Phoenix Resources Inc.)

Silver Phoenix Resources Inc. conducted a TDEM geophysical survey in 2013, and followed up with drilling in 2015 at the **River Jordan** property. The drilling targeted the down-dip extension of sulphide mineralization that extends over a two km strike length on surface. Two zones of sphalerite, galena, pyrite, and pyrrhotite mineralization were intersected and there are plans for further follow-up drilling. The property is within a series of gneissic domal structures along the eastern margin of the Shuswap Metamorphic Complex (Fig. 5). Replacement-style massive sulphides are hosted in calc-silicate gneisses of Proterozoic to Lower Paleozoic aged rocks on the southern flank of the Frenchman Cap Dome.

5.2.6. J&L (Huakan International Mining Inc.)

At the **J&L** gold-silver-zinc-lead property, Huakan International Mining Inc. continued pre-feasibility work, environmental baseline work, and engineering design work on tailings and mine facilities. The property is underlain by metasedimentary and metavolcanic rocks of the Hamill and Lardeau groups (Fig. 7). Mineralization is hosted by the Hamill Group (Badshot and Mohican formations), which consist of sheared and intensely folded impure quartzites, quartz sericite, sericite, and chlorite schists and phyllites, and grey banded to carbonaceous limestones. The main zone is a shear hosted, sheeted Au-Ag-Pb-Zn vein deposit that averages 2.5 m in thickness. Underground drilling and drifting has defined the zone over a 1.4 km strike length and for 850 m down dip; on surface the zone has been traced for 1.6 km. The Yellowjacket Zone sub-parallels, and is in the immediate hanging wall of the main Zone. Stratabound Ag-Pb-Zn is interpreted as a structurally controlled contact-related replacement deposit. A NI 43-101 resource estimate for the main zone that was released in 2012 reported 3.95 million tonnes combined in the measured and indicated categories, containing 722,000 ounces of gold and 7,179,000 ounces of silver at grades of 5.68 g/t Au and 56.2 g/t Ag, along with 1.94% Pb and 3.56% Zn.

5.2.7. Thor (Taranis Resources Inc.)

The **Thor** property is underlain by a thick succession of folded and faulted rocks of the Badshot Formation and Lardeau Group (Fig. 7), with potential for stratiform base metal sulphides (Ag-Pb-Zn-Au-Cu). In 2015, the company surveyed and sampled stockpiles at the Broadview, Great Northern, and True Fissure zones, and channel sampled at the Gold Pit zone, with results pending. Primary stratiform mineralization predates folding and faulting, and parallel horizons of galena, chalcopyrite, pyrite, and sphalerite extend along a 2 km strike length. High-grade gold is also found in late quartz veins that flank sulphide deposits (Fig. 20). A number of other targets have been identified on the property, which appear as VLF conductors and gossans. In 2014, Taranis Resources Inc. followed up on 2013 work with EW-sized core drilling at the SIF zone, where visible gold occurs in quartz-ankerite veins, and discovered mineralization at the SIF Carbon zone. An initial shaker table test from the

Fig. 20. Quartz veining and sulphide mineralization at the Thor property.

Fig. 21. Skarn mineralization in the underground at the Jersey-Emerald.

SIF Carbon zone yielded a sulphide concentrate that graded 512.4 g/t Au and 540 g/t Ag. The NI 43-101 resource estimate (2013; Table 4), based on drilling of 152 holes between 2007 and 2008, highlights both open-pit (62% of the property) and underground mining potential. Historic production on the property was from the Silvercup, Triune, Nettie L. and True Fissure mines.

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

The **Teddy Glacier** property has been intermittently explored since the 1920s. In 2015, the company continued mapping and sampling, and conducted environmental baseline studies and mill upgrades to satisfy permit conditions. Jazz Resources Inc. plans to collect a bulk sample and process it at the **Spider Mine** mill.

The property is underlain by tightly folded and sheared limestones, carbonaceous phyllites, and grits of the Index and Jowett formations (Lardeau Group; Fig. 7). 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).

5.2.9. Jersey-Emerald (Margaux Resources Ltd.)

Margaux Resources Ltd. continued work at **Jersey-Emerald** (Fig. 21) to follow-up on their 2014 drilling. 2015 work was focused on dewatering the underground workings at the **Emerald**, in preparation for further underground drilling and sampling. They also conducted mapping and sampling work at the **Jersey** with plans for drilling in 2016. The company released a new tungsten resource estimate for the **Emerald** of 3.071 Mt grading 0.34% WO_3 (measured and indicated) with 5.48 Mt grading 0.273% WO_3 (inferred) using a 0.15% WO_3 cut-off grade.

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. 7). Coarse-grained marble to garnet-pyroxene skarn occurs in the Truman and Reeves members at contacts with small Cretaceous granitic stocks, and Nelson (Jurassic) intrusions. The property contains: stratiform lead-zinc mineralization; tungsten (with minor molybdenum) skarn mineralization; quartz veins, silicified limestone, and greisen-type alteration with Au, and Bi; and Mo porphyry. Exploration on the property dates back to the late 1800s, when gossanous outcrops were discovered by early prospectors. The **Emerald** Tungsten mine has stratabound Pb-Zn mineralization in the Reeves member, and a W-skarn zone in the Truman member, and operated from 1942 to 1943, then intermittently until 1973. The **Jersey** mine has stratiform Pb-Zn mineralization at the base of the Reeves, and the mine operated between 1949 and 1970.

5.2.10. Willa (Discovery Ventures Inc.)

Discovery Ventures Inc. continued work on the **Willa** property, and acquired the interest of Forty Two Metals Inc. in the **MAX** mine, mill, and tailings facilities. The resource was updated in 2012, and in 2015, the company updated their Preliminary Economic Assessment and continued mapping, sampling, and environmental baseline work. They have also begun repairs, maintenance, and modifications to the **MAX** facilities. The **MAX** mine is located 135 km to the west near Trout Lake, and has been on care and maintenance since 2011. The company plans to use the mill initially for bulk sample processing of ore from the **Willa**.

The **Willa** deposit is in a roof pendant of the Nelson batholith, containing mafic volcanic rocks of the Rossland Group, intruded by felsic dikes. To the north are Slocan Group metasedimentary rocks that contain silver-lead-zinc mineralization. Lamprophyre dikes and faults post-date and crosscut the metavolanics 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).

5.2.11. Whitewater/Referendum (Braveheart Resources Inc.)

Braveheart Resources Inc. continued their bulk sampling and trenching exploration work at the **Whitewater** and **Referendum** properties. Late in 2015, bulk samples were sent for crushing/milling and flotation testing, with results pending. Further work is planned for 2016.

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. 7). Mineralized quartz veins hosted by granitic rocks and northeasterly 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 present in shear-hosted banded quartz veins that are up to 2 m in width and 400 m in length.

5.2.12. Record Ridge/Midnight (West High Yield Resources Ltd.)

In 2015, West High Yield (W.H.Y.) Resources Ltd. worked on their **Record Ridge** and **Midnight** properties. The property hosts gold mineralization in silicified zones, and magnesium and nickel in serpentinized ultramafic rocks. In 2015, the company conducted VLF and SP surveys, conducted mapping and sampling, generated drill targets, and conducted environmental baseline studies for the 2016 drill and bulk sampling programs for both the **Midnight** and **Record Ridge** projects. The company released a Preliminary Economic Assessment for their **Record Ridge** magnesium project in 2013, and sampled mainly on reject rock piles of several historic mines in 2014.

The IXL, **Midnight** and OK claims straddle the north-dipping contact between a Permian serpentinized ultramafic body to the south, and Rossland Group (Elise Formation) volcanic rocks and Mount Roberts Formation sedimentary rocks to the north (Fig. 7). The volcanic rocks are hornfelsed, with irregular zones of disseminated magnetite, pyrite, pyrrhotite, and local tungsten mineralization. Gold mineralization occurs in quartz veins near the ultramafic contacts. Veins are typically 0.1-0.6 m wide, extend along strike for up to 70 m, and consist of quartz with minor ankerite, pyrite, chalcopyrite and galena. Gold mineralization also occurs in local areas of pyrrhotite-pyrite bearing carbonate-talc-quartz alteration and carbonate veining (listwanite-type) in the serpentinites. Dikes and irregular bodies of Rossland monzonite, Coryell syenite and biotite lamprophyres cut both the ultramafic and the volcanic rocks.

5.3. Industrial mineral projects

5.3.1. 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. 7). Mapping and sampling on the property in 2015 followed up on 2014 work that included a drilling and trenching program and excavation of a small bulk sample that was sent for agricultural testing. The phosphoritic beds have been mapped for over 1,200 m from historical shafts. Initial handheld XRF analysis indicates 24-27% P_2O_5. The company also conducted environmental baseline work and has received approval for a 10,000 t bulk sample.

5.3.2. Cro Phosphate (High Brix Manufacturing Inc.)

Hi Brix Manufacturing Inc. is also targeting the basal Fernie phosphatic zone at the **Cro** project. In 2015, they carried out drilling, trenching, and bulk sampling. Material was shipped for agricultural testing, and results are pending.

5.4. Coal projects

5.4.1. Elko (Pacific American Coal Limited)

In 2015, Pacific American Coal Limited carried out mapping and sampling on their **Elko** coal project property to confirm the location of coal outcrops, and to locate and compile historical adits and drill data on the property. They also compiled geological data, and outlined locations for future drilling.

The project is located in the Crowsnest Coal field (Fig. 10), targeting Mist Mountain coal seams within 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.

6. Geological research

6.1. Geological Survey of Canada: TGI-4

The Geological Survey of Canada (GSC) has been working on a multi-year project that began in the area in 2010 as part of the **Targeted Geoscience Initiative (TGI-4).** A portion of the project was to develop geoscience knowledge and techniques to better understand and model SEDEX mineral systems, and mineral potential of the Purcell Anticlinorium (Fig. 5). Geological, geophysical, and geochemical data throughout the Purcell Basin were compiled into a database, in order to generate a regional 3D digital model and maps over a large area of the Purcell Anticlinorium, and give new perspectives and understanding on ore controls. In 2015, a compilation of papers was released on the processes and implications for exploration in Zn-Pb deposits (Open File 7838; Paradis (Ed.), 2015), as well as a 3D drillhole database (Open File 7817; Schetselaar et al., 2015).

In addition to the 2015 compilation and data release, preliminary releases since 2010 also include results of: magnetic susceptibility studies and geophysical perspectives of the Purcell Anticlinorium and Moyie anticline (Thomas, 2012; Thomas, 2013; Thomas, 2015; Thomas et al., 2013); the geology and geochemistry of Ag-Pb-Zn veins (Paiement et al., 2012), and carbonate-hosted non-sulphide Zn-Pb mineralization (Paradis et al., 2011); discussions of SEDEX concepts in the Cordillera (Paradis and Goodfellow, 2012); and zircon ages on the western margin of the Purcell Basin (Lydon and van Breeman, 2013). Preliminary interactive digital maps and data (Joseph et al., 2011) have been released, along with concepts on 3D modeling and interpolation of geological surfaces (Hillier et al., 2013b) and strike and dip observations (Hillier et al., 2013a).

6.2. Geoscience BC

Geoscience BC's **SEEK** project (Stimulating Exploration in the East Kootenays) is a partnership program with the East Kootenay Chamber of Mines focused on mineral potential in the Belt-Purcell Basin (Purcell Anticlinorium; Fig. 5). Ground geophysical data have been compiled for the region into a single database (Sanders, 2012; Hartlaub, 2013), and in 2013 new data were added in the St. Mary Valley area, near Kimberley and the historic Sullivan mine (Sanders, 2013). In 2014 and 2015, SEEK projects included a paleomagnetic study on structures in the Northern Hughes Range (Clifford, 2014; Ransom, 2015), geological mapping and compilation along the Kimberley Gold Trend (Seabrook, 2015), and mapping of vent systems and sub-basins in the middle Aldridge Formation near Cranbrook (Kennedy, 2015). 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.

7. Summary

In 2015, exploration and mining continued in the region and development continued on several of the larger projects in environmental assessment process, but investment funding was lower than in the previous year for exploration-stage projects. Major mine development, expansion plans, and projects in the East Kootenay coalfields with long-term timelines will likely continue to advance in 2016. As coal companies scale back exploration in response to low coal prices however, they are seeking to reduce capital costs by optimizing efficiencies at their existing operations. Several mine development projects for industrial minerals and the Gallowai Bul River mine restart, 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, but there has been an increased focus on grassroots exploration work due to a reduction in the availability of venture capital for larger projects. Despite this, several drill and bulk sampling programs are planned for 2016.

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Exploration and mining in the Thompson-Okanagan-Cariboo Region, British Columbia

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1. Introduction

Thompson-Okanagan-Cariboo is an administrative region in south-central BC, established after the province reorganized its natural resource agencies in 2010. Mining predates Confederation and today the region is 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; bentonite; 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 2015, major mines focused on their tailings storage facilities in the aftermath of the breach at Mount Polley mine in August 2014. Most small mines remained on care and maintenance. Some projects in the pre-application stage of environmental review made progress while others were suspended pending better economic conditions.

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. The pace of exploration slowed in 2015, continuing a decline that started in late 2011. Many projects were inactive because operators were unable to raise venture capital or unwilling to spend it in the region. Exploration expenditures for the region were included in the provincial total (Clarke, this volume) but for confidentiality reasons, specific expenditures are not presented herein. The geological overview section was written by Paul Schiarizza, British Columbia Geological Survey, and is republished from last year (Britton, 2015).

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). The Thompson-Okanagan-Cariboo Region straddles three of British Columbia's five morphogeological belts (from east to west: Omineca; Intermontane; Coast). 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, not shown on Figure 1, include Jura-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 northwestward 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 Devono-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 volcanogenic massive sulphide occurrences, as well as the Harper Creek bulk tonnage copper deposit.

2.2. Arc and oceanic terranes

Slide Mountain terrane comprises the most inboard tract of oceanic rocks in the Canadian Cordillera. It includes the

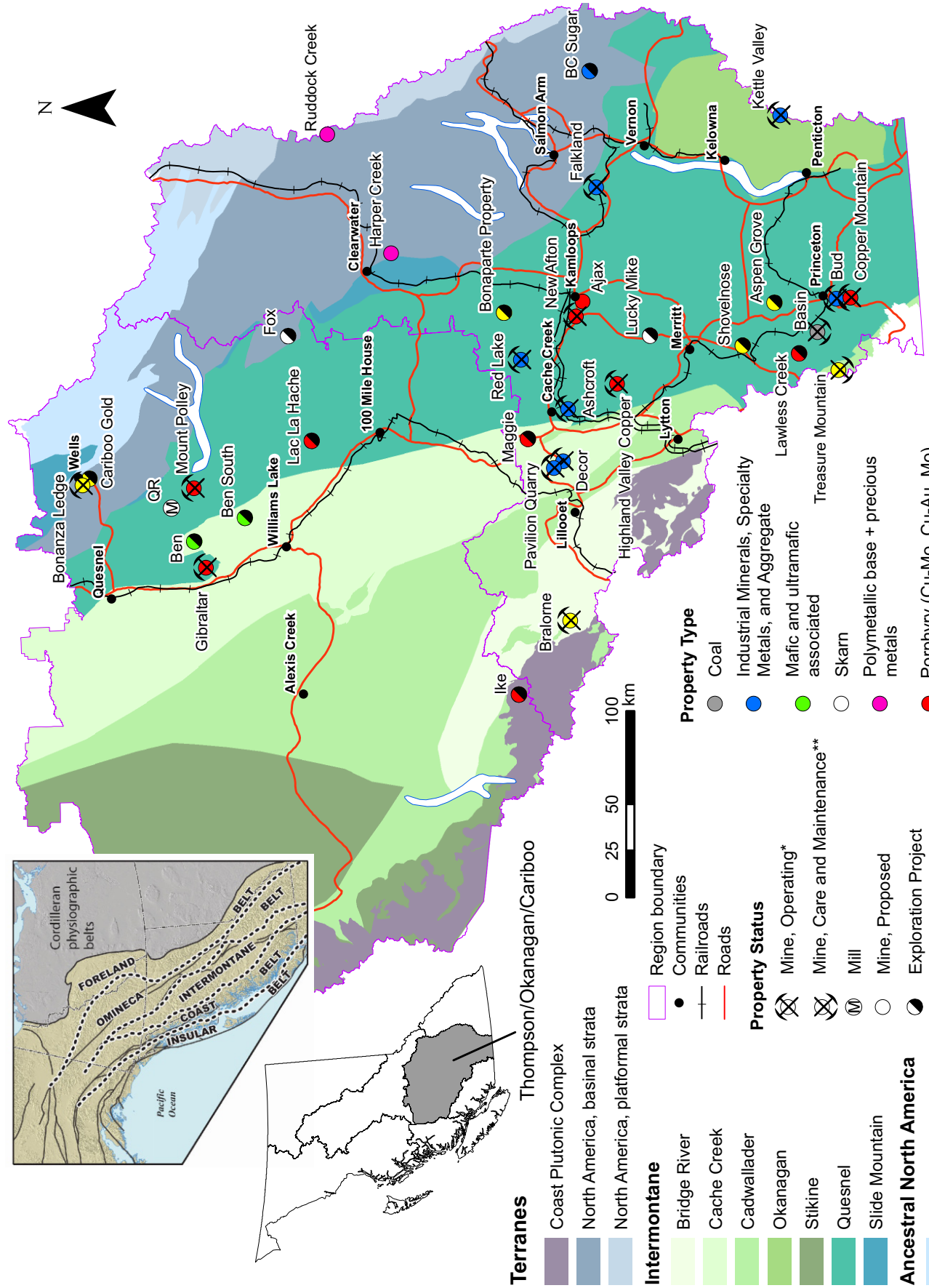

Fig. 1. Mines and selected mineral projects in the Thompson-Okanagan-Cariboo Region, 2015. Terranes modified after Colpron and Nelson (2011).

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 Cu-Mo massive sulphide mineralization at the Chu Chua occurrence.

Quesnel terrane 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-phyric shoshonitic basalts, but the western part of the group locally includes a belt of calc-alkaline volcanic rocks with substantial amounts of rhyolite and dacite (Mortimer, 1987; Preto, 1977, 1979). A younger stratigraphic component of Quesnel terrane comprises Lower to Middle Jurassic sedimentary rocks (Ashcroft formation, Windy Mountain succession, Dragon Mountain succession) 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 Cu, Au, and Mo (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 Cu-Mo mines, and the Granite Mountain batholith, host to the Gibraltar Cu-Mo mine. A well-defined belt farther east comprises younger, latest Triassic alkaline plutons, which host alkalic porphyry Cu-Au 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

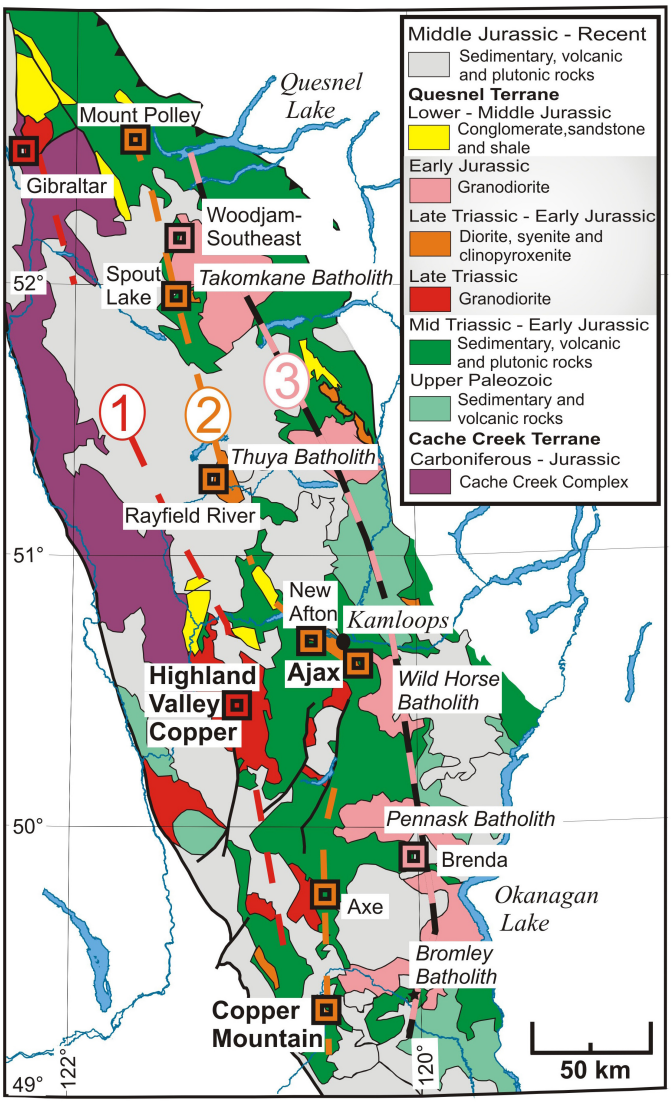

Fig. 2. Generalized geology of southern Quesnellia and Cu±Mo±Au deposits. Mesozoic arc plutons align along the length of southern Quesnellia to define three, north-trending, temporally distinct belts that get younger to the east: 1) Late Triassic; 2) Late Triassic-Early Jurassic; and 3) Early Jurassic. Discrete porphyry copper mineralizing events are directly linked to each of these magmatic episodes. From Logan (2013).

Jurassic chert, argillite, basalt, limestone, sandstone, gabbro and serpentinized ultramafic rocks of the Cache Creek complex, forms a belt to the west of Quesnel terrane in the central and northern parts of the region. It 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 Lytton 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 Lytton 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 Ar-Ar ages (Cordey and Schiarizza, 1993; 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 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 Thompson-Okanagan-Cariboo 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. Although not shown in Figure 1, 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 rocks are predominant in some locations, and 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 in age 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

3.1. Metal mines

The Thompson-Okanagan-Cariboo Region hosts roughly half of the province's metal mines (Fig. 1, Table 1). Major mines include Gibraltar, Mount Polley, New Afton, Highland Valley, and Copper Mountain. Smaller mines include Bonanza Ledge, QR, Bralorne, and Treasure Mountain.

2015 began and ended with a focus on tailings. Following the breach of a tailings dam at Mount Polley in August 2014, government convened a committee of experts to provide an independent review of the disaster. In January 2015, the experts released their report and recommendations (Independent Expert Engineering Investigation and Review Panel, 2015). In December 2015, the Chief Inspector of Mines published his official investigation into the Mount Polley incident (Chief Inspector of Mines, 2015). Apart from formal investigations, government ordered all mines to evaluate their tailings storage facilities.

The **Gibraltar** copper-molybdenum mine (Fig. 2) operated by Taseko Mines Limited and Cariboo Copper Corp, began production in 1972 and completed its first full year of operation after modernization in 2013. The mine has generally met guidance of 85,000 t/d from combined mills, but in 2015 closed its molybdenum circuit and laid off staff to reduce operating costs. The deposit occurs in the Granite Mountain batholith (Late Triassic; see van Straaten et al., 2013 for detailed mine geology) within a fault bounded section of Nicola Group sedimentary and volcanic rocks (Quesnel terrane; Schiarizza 2014; 2015).

Mining at the **Mount Polley** copper-gold-silver mine (Fig. 2) of Imperial Metals Corporation resumed in August 2015, a full year after its tailings dam breached. Before restarting, the company spent more than $65 million assessing the cause of the failure and repairing the damage it caused. Before shutdown, the mill had begun processing the first ore extracted from underground workings at the Boundary zone. The alkalic intrusive complex at Mount Polley has at least 8 discrete zones with a total resource inventory of ~411 million tonnes at 0.48% Cu equivalent (Measured and Indicated; as of 1 January 2013). Rees (2013) provides a comprehensive review of the Mount Polley deposit.

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). Following tests of higher mining and milling rates in 2013, the company installed a new mill to increase capacity from a design rate of 11,000 t/d to 14,000 t/d. The new mill was commissioned in the second quarter of 2015, ahead of schedule. 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 expand resources in the C zone, a down-plunge extension of

Table 1. Metal mines, Thompson-Okanagan-Cariboo Region, 2015.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Bonanza Ledge (on care and maintenance as of June 2015)	Barkerville Gold Mines Ltd.	gold; pyrite replacement; 093H 140	11,162 oz Au	Nil	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 ox Au); M+I: 420,000 t grading 7.63 g/t Au (containing 102,000 oz Au)	Previously reported reserves have been reclassified as resources because profitable mining has not been demonstrated since test mining began in 2014.
Bralorne (on care and maintenance)	Avino Silver and Gold Mines Ltd.	gold; vein; 093JNE 001	Not available	Reserve data not available. .	Measured and indicated resources (as of 2012-08-31; cut-off not stated): 154,750 t grading 9.11 g/t Au	2015 work improved tailings storage facilities and mine infrastructure.
Copper Mountain	Copper Mountain / Mitsubishi Materials	copper, gold, silver; alkalic porphyry; 092HSE 001	77.6 Mlb Cu; 29,200 oz Au; 288,400 oz Ag	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; 560,000oz Au)	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)	-
Gibraltar	Taseko Mines Ltd.	copper, molybdenum; calc-alkalic porphyry; 093B 012	144 Mlb Cu; 1.3 Mlb Mo.	Proven and Probable reserves (as of 2014-12-31; cut-off not stated): 749 Mt grading 0.256% Cu and 0.008% Mo. (Recoverable metal: 3.3 Blb Cu)	Measured and Indicated resources (as of 2014-12-31; cut-off grade not stated): 1,092 Mt grading 0.254% Cu and 0.008% Mo	-

Table 1. Contiuned.

Highland Valley Copper	Teck Highland Valley Copper Partnership	copper, molybdenum; calc-alkalic porphyry; 092ISW 012	146,900 t Cu; 3.3 Mlb Mo	Proven and probable reserves (as of 2014-12-31; cut-off not stated): 608 Mt grading 0.30% Cu; 0.008% Mo. (Recoverable metal: 1,570,000 t Cu; 30,000 t Mo.)	Resources (as of 2014-12-31; cut-off not stated): Measured: 395 Mt grading 0.32% Cu; 0.009% Mo; Indicated: 913 Mt grading 0.22% Cu; 0.011% Mo	-
Mount Polley (operations resumed August 2015)	Imperial Metals Corporation	copper; gold; silver; alkalic porphyry; 093A 008	5.8 Mlb Cu; 11,000 oz Au; 30,000 oz Ag	Probable reserves (as of 2014-01-01; 0.15% Cu cut-off): 86 Mt grading 0.295% Cu, 0.30 g/t Au, 0.62 g/t Ag	Measured and Indicated resources (as of 2014-01-01; 0.15% Cu cut-off): 411 Mt grading 0.28% Cu, 0.29 g/t Au, 0.81 g/t Ag	Company did not upgrade reserve and resource information for 2014.
New Afton	New Gold Inc.	copper, gold; alkalic porphyry; 092INE 023	405,000 oz Au; 1.8 Moz Ag; 95 Mlb Cu.	Proven and probable reserves (as of 2014-12-31; cut-off not stated): 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)	Measured and Indicated resources (as of 2014-01-01; cut-off not stated): 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)	-
QR (mine on care and maintenance; mill operates)	Barkerville Gold Mines Ltd.	gold; skarn; 093A 121	Not available	Not available	Not available	QR deposit depleted. Mill processes ore from Bonanza Ledge mine near Wells. -
Treasure Mountain (on care and maintenance)	Nicola Mining Inc.	silver, lead, zinc; vein; 092HSW 016	Not available	Not available	Not available	-

the area now being mined (Fig. 3; Rennie et al., 2015).

The **Highland Valley Copper** copper-molybdenum mine (Fig. 2), operated by Teck Highland Valley Copper Partnership (97.5% Teck and 2.5% Highmont Mining Company Ltd.), is the largest base metal mine in Canada. Mine production focused on the Valley pit as pre-stripping continued for the Lornex pit extension. In 2014 the company commissioned a new mill, a $475 million investment to help extend mine life to 2026. The company has achieved throughputs of 139,000 tonnes per day, exceeding its 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 and their **Valley** pit. One hundred million tonnes of ore have been delineated at Bethlehem Phase 1. Engineering and feasibility studies are underway. A detailed description of deposits in the Highland Valley camp may be found in Byrne et al. (2013).

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

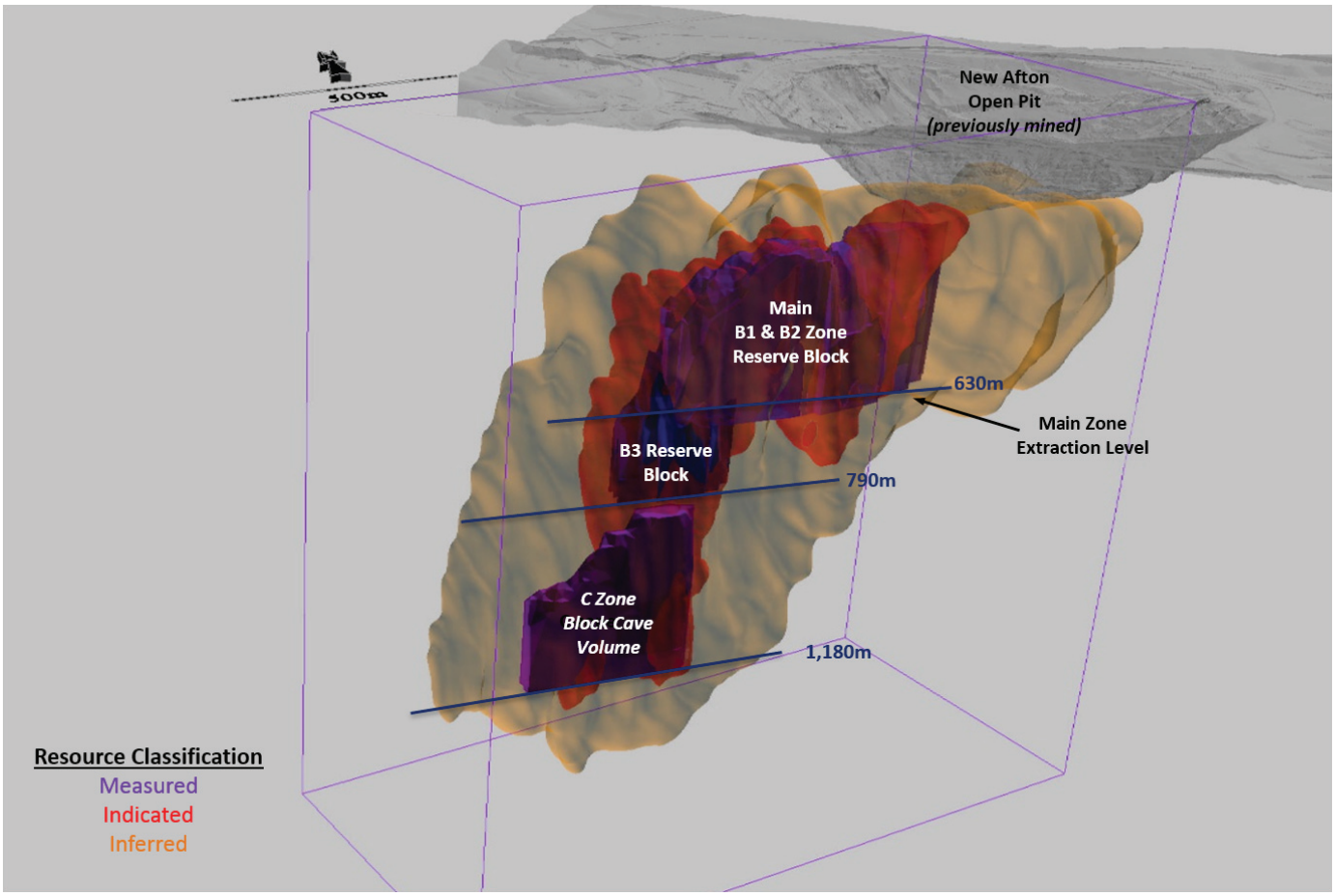

Fig. 3. New Afton's ore body forms a narrow keel under the former open pit mine. The C zone represents potential for future block-cave mining below current workings. (Image courtesy of New Gold Inc.).

Corporation (25%). The rate of mining has met or exceeded guidance figures, but until a new secondary crushed was installed in mid-2014, milling operations struggled to achieve the targeted 35,000 t/d. Quarterly mine production in 2015 has consistently exceeded targets. Copper Mountain received permits to mine the Virginia and Oriole deposits, respectively northeast and southeast of the main pit. Stripping at the Virginia pit commenced in 2015. Oriole will be mined once Virginia is depleted. A multi-year exploration program seeks to upgrade resources, test ore depths and find mineralization outside the current mine plan. In 2015, the company drilled (4 holes; 1,500 metres) the southern edge of the Virginia deposit looking for extensions.

The **Bonanza Ledge** mine, near Wells, is owned and operated by Barkerville Gold Mines Ltd. It is 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 costs 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).

The **QR** mine of Barkerville Gold Mines Ltd has operated sporadically in recent years due to depleting ore and is now essentially closed. The mill at QR processes ore trucked in from Bonanza Ledge mine 110 km away.

The **Treasure Mountain** mine, 40 kilometres west of Princeton, was on care and maintenance in 2015. By December its owner, Huldra Silver Inc., completed restructuring under the Companies' Creditors Arrangement Act, changed its name to Nicola Mining Inc., and consolidated shares (five old for one new). 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, non-NI 43-101 compliant) 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. Other targets near the mine have not been drilled but have returned high-grade grab samples. Nicola Mining's mill is at the former Craigmont tailings facility, near Merritt.

Avino Silver & Gold Mines Ltd. acquired the **Bralorne** gold mine, near Gold Bridge, in 2014 and suspended mining shortly

thereafter. Work in 2015 included raising the tailings dam, mill improvements, underground development, and exploration (discussed below). Ore comes from gold-bearing mesothermal quartz veins between three former mines (Bralorne, King and Pioneer).

3.2. Coal

The **Basin** mine, operated by Coalmont Energy Corporation, continued on care and maintenance in 2015, pending restructuring under the Companies' Creditors Arrangement Act. The mine produced thermal coal between June and October 2013 at an initial rate of 250,000 tonnes per year of thermal coal (Table 2). Production halted due to a spill of mine water and has not restarted because of poor coal prices. Basin mine is 18 kilometres west of Princeton uses a 250 tonne per hour Parnaby wash plant, which eliminates the need for a tailings pond. Cleaned coal moves by truck and barge to Texada Island for shipment to local and overseas markets. Production comes from Eocene rocks in 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 minerals

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

The **Kamloops** cement plant and **Harper Ranch** limestone quarry of Lafarge Canada Inc. continue to supply cement to meet demand in western Canada. 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.

The **Decor** pit of Pacific Bentonite Ltd., 20 kilometres west of Cache Creek, supplies alumina-rich burnt shale to the Lafarge cement plant in Kamloops. The property also hosts a large bentonite deposit, which is being investigated for municipal engineering and tile manufacturing applications.

A few kilometres west of Decor, Graymont Western Canada Inc. operates the **Pavilion** limestone quarry and lime plant. The operation produces 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 are Ts'kw'aylaxw.

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.

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, but are expected to resume early in 2016. The plant captures magnetite from the mine`s tailings stream and produces a dense media used for coal washing operations.

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.

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.

Opal Resources Canada Inc. produces gem quality fire opal from the **Klinker** property, 25 kilometres northwest of Vernon. Opal forms fracture and vesicle-fillings in andesitic to basaltic lahars and breccias in the Kamloops Group (Eocene).

Decorative rock and dimension stone are produced at small quarries throughout the region. Kelowna Sand and Gravel 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.

Table 2. Coal mine, Thompson-Okanagan-Cariboo Region, 2015.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven and Probable)	Resource (Measured and Indicated)	Comments
Basin	Coalmont Energy Corp.	TC; 092HSE 157	On care and maintenance in 2015	Not available	Not available	-

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

Table 3. Industrial mineral mines, Thompson-Okanagan-Cariboo Region, 2015 (listed alphabetically).

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Ashcroft	IG Machine and Fibers Ltd. (IKO Industries Ltd.)	Basalt (roofing granules); 092INW104	350,000 tons	Not available	Not available	-
Bromley Creek (Zeotech)	Canadian Mining Company Inc.	Zeolite; 092HSE243	On care and maintenance in 2015	Not available	M+I as of 2013-06-30): 550,000 t	-
Bud	Absorbent Products Ltd.	Bentonite; 092HSE162	Not available	Not available	Not available	-
Decor	Pacific Bentonite Ltd.	Alumina, landscape rock; 092INW084	100,000 tons	Not available	Not available	-
Falkland	Lafarge Canada Inc.	Gypsum; 082LNW001	6,000 tons	Not available	Not available	-
Harper Ranch	Lafarge Canada Inc.	Limestone; 092INE001	220,000 tons	Not available	Not available	-
Kettle Valley quarries	Kelowna Sand and Gravel Ltd./Kettle Valley Stone Ltd.	Ashlar, flagstone, thin veneer; 082ENW109, 111, 112	Not available	Not available	Not available	-
Klinker	Opal Resources Canada Inc.	Opal; 082LSW125	Intermittent operation	Not available	Not available	-
Lady King Basalt	Spectral Gold Corp.	Basalt columns; N/A	Intermittent operation	Not available	Not available	-
Mount Polley Magnetite	Craigmont Industries Ltd.	Magnetite (recovered from tailings); 093A 008	Not available. Plant will resume operating January 2016	Not available	Not available	-
Pavilion	Graymont Western Canada Inc.	Limestone; 092INW081	190,000 tons	Not available	Not available	-
Red Lake	Absorbent Products Ltd.	Diatomaceous earth; 092INE081	Not available	Not available	Not available	-

3.4. Placer, aggregate, and rock

A recent tally of 'active' placers, pits and quarries that have valid Mines Act permits, shows there are 419 placer surface mines; 1 placer underground mine (Wingdam); 298 sand and gravel pits; and 46 quarries in the region (A. Hart, pers. comm., January 2016). 'Active' is an administrative classification and includes mines undergoing reclamation and closure. Most of these operations are small, intermittent or seasonal, and lack production data.

4. Proposed mines

Five projects are in this category: **Ajax**, **Harper Creek**, **New Prosperity**, **Ruddock Creek**, and **Spanish Mountain** (Fig. 1, Table 4).

KGHM Ajax Mining Inc. continued engineering and baseline studies to advance their **Ajax** porphyry copper-gold project, on the outskirts of Kamloops. In September 2015, the company submitted their application to the Environmental Assessment Office and Canadian Environmental Assessment Agency. Although the application was accepted by reviewing agencies, the company announced it would suspend the process to allow First Nation partners more time to study the 18,000 page submission. Ajax is a proposed 60,000 tonne-per-day open pit operation with a projected 20 year life. The company is a joint venture between KGHM Polska Miedź S.A. (KGHM SA) and Abacus Mining and Exploration Corporation. Exploration continued at nearby deposits such as DM-Audra and Rainbow. All mineralization occurs in the Iron Mask Batholith, a Triassic, multi-phase, alkaline intrusive complex (Fig. 2).

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 June, the company requested an extension to incorporate recommendations of the expert panel on tailings facilities. In October, the company

Table 4. Proposed mines, Thompson-Okanagan-Cariboo Region, 2015.

Project	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
Ajax	KGHM Ajax Mining Inc.	Cu, Au; Alkalic porphyry 092INE012, 13	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)	Resources (M+I; ; NSR cut-off US$7.10/t): 568 Mt grading 0.26% Cu; 0.18 g/t Au; 0.35 g/t Ag	Environmental and engineering studies; exploration and condemnation drilling; feasibility study	Project application accepted for review in November 2015. Review temporarily suspended by applicant to allow further study by First Nations
Harper Creek	Yellowhead Mining Inc.	Cu, Au, Ag; Stratiform, volcanic-hosted 082M 008, 9	Reserves (P+P; cut-off 0.14% Cu): 716 Mt grading 0.26% Cu; 0.029 g/t Au; 1.18 g/t Ag	n/a	Environmental and engineering studies	Project application accepted for review in December 2014. Review suspended in October 2015 by company for economic reasons
New Prosperity	Taseko Mines Ltd.	Cu, Au; Calc-alkalic porphyry; 092O 041	Reserves (P+P; cut-off not stated): 831 Mt grading 0.23% Cu and 0.41 g/t Au; containing (recoverable) 3.6 Blb Cu; 7.7 Moz Au	n/a	Company seeks a judicial review of Federal EA decision. Results pending	Project at post-decision stage
Ruddock Creek	Ruddock Creek Mining Corporation	Pb, Zn, Ag; Monashee-type sediment-hosted massive sulphide; 082M 082	n/a	Resources (M+I; cut-off 4.0% Pb+Zn): 6.2 Mt grading 6.50% Zn, 1.33% Pb	Environmental and permitting work	Project at pre-application stage
Spanish Mountain	Spanish Mountain Gold Ltd.	Au, Ag; Sediment-hosted gold; 093A 043	n/a	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	Environmental and permitting work	Project at pre-application stage

suspended further work on the project (including baseline environmental studies) due to a lack of funds. At year's end the company announced that it was seeking financing to complete the environmental review. Proven and Probable mineral reserves now stand at 716 million tonnes grading 0.26% Cu; 0.029 g/t Au and 1.2 g/t Ag. The study proposes a 70,000 tonne per day operation with a mine life of 28 years. Initial capital costs would exceed $1 billion.

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.

The **New Prosperity** 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.

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. For the previous three years, the company has used reverse circulation drilling to gain more accurate sampling of friable mineralized layers. 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.

5. Exploration activities and highlights

Exploration in 2015 focused on defining or expanding porphyry and porphyry-related deposits (copper-gold; copper-molybdenum; copper-tungsten), skarn deposits (tungsten), gold deposits of various types, stratiform base-metal deposits, and magmatic deposits (nickel). Industrial minerals (graphite; gypsum; jade) were also sought. Herein, projects are grouped by deposit type and location (Fig.1; Table 5).

5.1. Porphyry and porphyry-related deposits

Over the past few years, the southern end of the Quesnel terrane, between Aspen Grove and Princeton, has seen renewed exploration interest (see also Mihalynuk et al., 2013a, b, 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** (Fjordland Exploration Inc./Sumac Mines Ltd.); Allison Lake; **Hit/Aspen Grove South** (Colorado Resources Ltd.); **Axe** (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.

Kaizen Discovery Inc. acquired the **Aspen Grove** copper-gold project in 2013 and commenced drilling in 2014. Claims at Aspen Grove include a number of known mineral occurrences (Zig, Par, Ketchan Lake, Coke; Fig. 4). Drilling in 2014 focused on the Par prospect. In 2015, drilling mostly targeted the Ketchan Lake stock. All 13 holes encountered potassic and/or calc-potassic alteration; 12 holes intersected Cu-Au mineralization with grades up to 0.5% Cu and 0.15 g/t Au over tens of metres. Some holes had positive results from surface. Drilling at Ketchan Lake confirmed the size of the porphyry intrusive and the continuity of mineralization along 1,800 metres of strike length. Drilling at the Par prospect also intersected mineralization. The Aspen Grove project is owned 60% by Kaizen and 40% by Itochu Corporation of Japan.

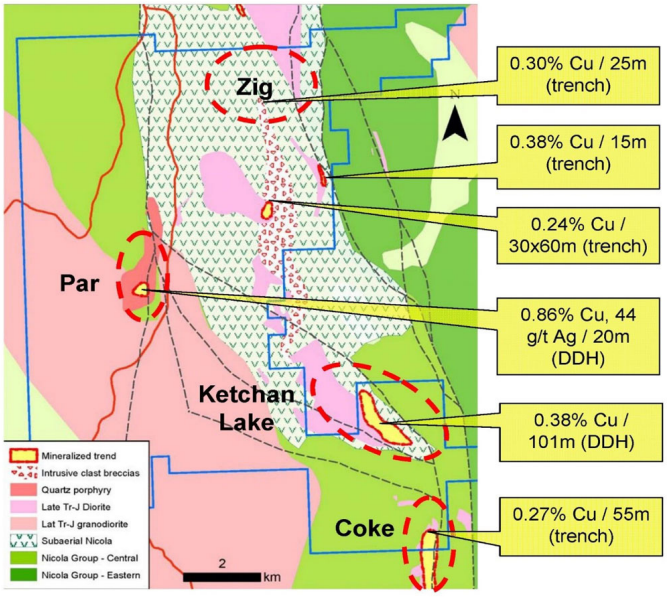

Fig. 4. Drilling at the Par and Ketchan Lake zones was the focus of exploration for Kaizen Discovery Inc. at its Aspen Grove project, between Merritt and Princeton (Image courtesy of Kaizen Discovery Inc.).

5.1.1. Copper-tungsten

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. Phase 1 drilling, completed late in 2014, focused on the Lucky Mike tungsten-copper(-silver) skarn but also discovered molybdenum mineralization over tens of metres of core. In 2015, Phase 2 drilling (17 holes; ~4,800 metres) further explored both the skarn and the molybdenum targets. The molybdenum target is a 25 hectare area with high magnetic and high chargeability values. Molybdenum mineralization occurs in small veins and fracture fillings over tens of metres of core (Fig. 5). The company's current geological model is a broad porphyry Mo(-Cu) porphyry with subordinate Cu-W skarn zones in altered calcareous horizons on the flanks.

Table 5. Selected exploration projects, Thompson-Okanagan-Cariboo Region, 2015 (listed alphabetically).

Project	Operator	MINFILE	Commodity; Deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work Program	Comments
Aspen Grove (Ketchan)	Kaizen Discovery Inc.	092HNE 115	Cu, Au; Porphyry	n/a	Drilling	Improved geological model
BC Sugar	Lithium Corporation	n/a	Graphite; Disseminated/ Vein	n/a	Geophysics; mapping; sampling; trenching	Analytical results pending
Ben	Westhaven Ventures Inc.	n/a	Ni; Magmatic(?)	n/a	Metallurgy; geophysics; drilling	Improved geological model
Bethlehem	Teck Highland Valley Copper Partnership	092ISE001	Cu, Mo; Porphyry	n/a	Engineering and feasibility studies; permitting	-
Bonaparte	WestKam Gold Corp.	092P 050	Au; Cu; Vein; porphyry	n/a	Drilling outside of Discovery zone area	Analytical results pending
Bralorne	Avino Silver & Gold Mines Ltd.	092JNE001	Au; Vein	n/a	Drilling (Alhambra, 52 and 77 veins)	Improved geological model
Cariboo Gold	Barkerville Gold Mines Ltd.	093H 019	Au; Vein; replacement	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)	Drilling to define resources at BC vein and explore new targets	Improved resource definition; discovery of AG horizons
Fox / Ridley Creek	Happy Creek Minerals Ltd.	093A 259	W, Mo, Ag; Skarn	n/a	Drilling, rock and soil sampling	Improved geological model for Creek zone
Ike	Amarc Resources Ltd.	092O 025	Cu, Mo, Ag; Porphyry	n/a	Drilling	Mineralized zone extended
Lac la Hache	GWR Resources Inc.	092P 002	Cu, Au, Ag	n/a	Drilling; prospecting	Discovery of Berkey zone (copper porphyry)
Lucky Mike	Plate Resources Inc.	092ISE027	W, Cu, Mo; Skarn; porphyry	n/a	Drilling	Mineralized zone extended; improved geological model
Maggie	Constantia Resources Ltd.	092INW015	Cu, Mo, Ag; Porphyry	n/a	Drilling; community engagement	Analytical results pending; Web site: www.constantiaresources.com
Shovelnose	Westhaven Ventures Inc.	092HNE308, 309	Au; Vein; breccia	n/a	Drilling	Mineralized zone extended; Web site: www.westhavenventures

Fig. 5. A deep zone of molybdenum mineralization was discovered this year at the Lucky Mike project, near Merritt (Image courtesy of Plate Resources Inc.).

5.1.2. Copper-molybdenum

Late in 2015, Constantia Resources Ltd commenced a second phase of drilling at the **Maggie** project, a porphyry copper-molybdenum prospect north of Cache Creek. The first phase of drilling, completed in early 2014, confirmed historic grade and continuity of mineralization. The second phase will test 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 intrusive is a multi-phase, quartz monzonite porphyry with a radiometric (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.

As part of its ongoing community engagement, Constantia maintains a community office in Cache Creek and has sponsored scholarships for students to become drill core technicians, held a job fair, and reached cooperation and benefits agreements with local First Nations.

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 target is copper-molybdenum-silver porphyry mineralization in an extensive alteration zone in the Coast Plutonic complex. The project includes the Tasco (or Chilcotin Belle) mineral occurrence. The 9-hole, 5,400 metre drill program in 2015 encountered mineralization in all holes. The mineralized zone currently covers an area of 1200 x 1000 metres and extends to depths of 500 metres. It remains open in all directions. Drill intersections range up to almost 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.

Work on the Ike project has revived interest in nearby properties such as the **Mike** (Bridge River; Griswold; Russnor) owned by Cresval Capital Corporation, and the **Lorn** operated by Jet Gold Corporation.

Teck Resources Limited continued to explore targets near its **Highland Valley** copper-molybdenum mine hosted by the Guichon Creek batholith (Fig. 2) with a focus on the Valley and Bethlehem pits. To date drilling has confirmed 100 million tonnes of new ore at Bethlehem. Engineering and feasibility studies are underway.

In one of the few generative or grassroots exploration efforts in the region, private company Tech-X Resources Inc. followed up alteration mapping, completed in 2014, with induced polarization surveys at **Lawless Creek**, Nicola Lake, and southeast of Prince George. The Lawless Creek area, 50 kilometres south of Merritt, has not seen exploration since the early 1980s.

5.2. Skarn

Happy Creek Minerals Ltd continued to explore its **Fox** tungsten skarn property, 115 kilometres east of Williams Lake. Best intercepts from a limited drill program (8 holes; 1500 metres) at the Creek target within the Nightcrawler zone returned up to 1% WO_3 over 5 metres. Soil sampling on the South Grid has generated new targets that the company plans to pursue next year. Skarn mineralization is in flat-lying, Neoproterozoic to Lower Paleozoic Snowshoe Group sedimentary rocks that have been intruded by the Deception stock, a mid-Cretaceous (106 Ma) pluton that ranges in composition from quartz monzonite to muscovite-biotite granite.

GWR Resources Inc. drilled the Aurizon-South breccia zone (Fig. 6) on its **Lac La Hache** project with closely-spaced holes. The purpose was to test continuity of copper-gold-silver mineralization and assess potential for underground mining. The company announced discovering the new, **Berkey** zone which has chalcopyrite disseminated in a porphyritic syenite dike. Berkey was found in a recently logged but unexplored

Fig. 6. Breccia textures and copper mineralization at the Aurizon South prospect (Image courtesy of GWR Resources Inc.).

part of the 400 km^2 project area. The Berkey zone adds to the inventory of deposit types and exploration targets, ranging from high-grade, massive to semi-massive, skarns, veins, replacements and breccias to lower grade porphyries and disseminations, for which the Lac La Hache project is known.

5.3. Gold deposits (including vein, breccia, disseminated, sediment-hosted)

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 more than 117,000 hectares of claims, including three historic groups of Crown grants (Cariboo Group, Island Mountain Group, and Mosquito Creek Group).

During 2015, the company released a technical report with updated resource estimates (Snowden, 2015), made a new, blind discovery ("AG horizons"), and started a 55,000 metre drill program. Drilling had three goals: to define resources in the BC vein; to explore mineralized zones in the BC vein's hangingwall and footwall; and to test soil geochemical anomalies.

The current resource estimate for the Cow Mountain portion of Cariboo Gold project, centred on the BC vein, has 2.8 million ounces of gold (Indicated) and 2 million ounces of gold (Inferred) at grades of 2.4 g/t and 2.3 g/t, respectively (Snowden, 2015).

The AG horizons discovery is in an area with no outcrop and no previous drilling about 550 metres east of the Bonanza Ledge open pit. A coincident gold and silver soil anomaly provided the target for drilling. Mineralization grading from 2 to 11 g/t Au were reported in two, separate (upper and lower) AG horizons. The discovery occurs in the hangingwall of the BC vein and establishes an untested structural / stratigraphic interval as a new exploration target. Metamorphosed siliciclastic sedimentary and subordinate volcanic rocks of the Snowshoe Group (Neoproterozoic-Lower Paleozoic) host BC vein and wall rocks (Fig. 7).

WestKam Gold Corp. has explored its **Bonaparte** project, 50 kilometres northwest of Kamloops, since acquiring the property in 2013. Historically, high-grade near-surface gold veins in quartz diorite have been the focus of exploration at Bonaparte. WestKam has two targets: shear-hosted, high-grade gold in quartz veins (Discovery zone); and bulk-tonnage, porphyry copper-gold located southwest of the Discovery zone. Following geophysical and geochemical surveys in 2013-2014, drilling in 2015 (7 holes; ~600 metres) evaluated high-grade gold intercepts within the Discovery zone and completed the first holes ever drilled outside the Discovery zone. One of the step-out holes found a new vein that returned ~8 g/t Au, 38 g/t Ag, 29 g/t Te and 0.33% Cu over 1 metre (drilled width).

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).

Fig 7. Metamorphosed siliciclastic rocks of the Snowshoe Group host disseminated and vein-controlled gold mineralization at Barkerville Gold Mines Ltd.'s Cariboo Gold Project (Image courtesy of Lesley Stokes, The Northern Miner).

Westhaven Ventures Inc. enlarged its stake in the Spences Bridge gold belt, 30 kilometres south of Merritt. It has acquired 100% of the **Shovelnose** gold property and 70% of the **Prospect Valley** gold property (from Strongbow Exploration Inc. and Berkwood Resources Ltd., respectively).

Work on Shovelnose included a LIDAR survey and ground based IP, magnetometer and VLF-EM surveys followed by 1,400 metres of drilling. The goal of the drill program is to expand or outline an epithermal gold zone that was recognized in 2014. Gold-silver mineralization occurs in quartz stockworks and silicified zones that appear to form a sub-horizontal, silicified, near-surface cap within felsic volcanic rocks of the Spences Bridge Group (Cretaceous). Previous assays of core returned ~0.5 g/t Au and ~5 g/t Ag over 50 metres.

Previous work by Berkwood Resources Ltd. at the **Prospect Valley** property, 30 km west of Merritt, has identified the North and South Discovery zones as well as a prospective trend (the QCA zone) with quartz-chalcedony veins and silicified rocks extending some 1200 metres south from the South Discovery zone. Mineralization discovered to date is described as a low-grade, epithermal gold system with potential for higher grade zones. Drilling has outlined an NI 43-101 compliant mineral resource. Taken together, the North and South Discovery zones have approximately 10 million tonnes grading 0.5 g/t Au (Inferred; using 0.3 g/t Au cut off). A number of geophysical and geochemical targets remain to be tested. In 2015, Berkwood carried out a program of prospecting, sampling, mapping, and geophysical surveys.

Avino Silver & Gold Mines Ltd. carried out surface drilling on its **Bralorne** property near Gold Bridge. Almost 6,600 metres

(in 22 holes) explored the Alhambra, 52 and 77 veins. Many gold-bearing intercepts were reported, some with mineable widths (at least 1.2 metres). Follow-up drilling is planned.

5.4. Stratiform base metal deposits

In the Mabel Lake area, 60 kilometres northeast of Vernon, prospectors Robert Thompson, Renee Hetherington, and Colin Dunn used biogeochemical and geophysical methods to find new showings of Monashee-type massive sulphide mineralization in dense forests on the **TL** and **CD** properties. Grab samples returned up to 19% zinc. The trio have plans to drill untested, strong geophysical anomalies in 2016.

5.5. Nickel

In May 2015, Westhaven Ventures Inc. reported results from preliminary metallurgical tests on drill core from the **Ben** and **Ben South** projects, 50 kilometres north of Williams Lake. Ninety per cent of the nickel occurs as sulphide minerals (heazlewoodite; pentlandite); 10% is in serpentine. Flotation methods produced a concentrate containing 12% nickel. Nickel sulphide mineralization occurs as disseminations in serpentinized ultramafic rocks of the Cache Creek group (Carboniferous-Permian). Geophysical methods have been useful in tracking favourable rock units. So far, large amounts of low grade material (~0.2% Ni) have been found. One goal of future exploration is to find higher-grade zones.

5.6. Graphite

Lithium Corporation followed up ground penetrating radar and a GEM-2 EM survey with trenching at the **BC Sugar** graphite project. The current focus of interest is the Weather Station zone but the property comprises a large block of claims between Mabel Lake and Sugar Lake, east of Vernon. Targets are exploitable concentrations of flake graphite. Crystalline graphite occurs in gneiss and marble of the Shuswap metamorphic complex (Neoproterozoic).

6. Outlook for 2016

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

Ajax will be the only project to continue its formal environmental review, unless Harper Creek secures alternative financing. Most of the exploration projects active in 2015 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), Eagle Bay assemblage near Barriere, and the Quesnel terrane, in particular between Merritt and Princeton and between 100 Mile House and Quesnel.

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Exploration and mining in the South and West Coast regions, British Columbia

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1. Introduction

This report covers the Coast Area natural resource sector, comprising the South Coast and West Coast regions, including Haida Gwaii (Fig. 1). 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. Nyrstar N.V. suspended production at **Myra Falls** mid-year and halted further investment in the operation in the fall. Following a workforce reduction at the **Quinsam** coal mine in 2014, Hillsborough Resources Ltd. continues to produce below that operation's capacity. The **Raven** coal project's application for environmental assessment was withdrawn from the BC Environmental Assessment Office's screening process. In a more positive development, BURNCO Rock Products Ltd. submitted an environmental assessment application for its large aggregate project, **BURNCO Aggregate**, on Howe Sound. Exploration spending in 2015 is estimated at $3.7 million (Fig. 2). Exploration projects were generally limited to surface surveys, with no significant off-lease exploration drilling programs reported during 2015. Total metres drilled were approximately 19,000 (Fig. 3). There were several trenching and bulk sample programs. Exploration spending by exploration stage is illustrated in Figure 4. Exploration spending in the region is at a 10 year low. A significant portion of spending and nearly all drilling is attributable to a largely successful on-lease exploration campaign that continued until October at **Myra Falls**.

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, Clarke, this volume).

The South and West Coast regions include 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 South and West Coast regions are tied to Cordilleran terranes (Fig. 5).

2.1. Insular Superterrane

2.1.1. Wrangellia

Wrangellia is a long-lived (Devonian to Jurassic) island arc terrane that underlies most of Vancouver Island and Haida Gwaii. The oldest rocks on Vancouver Island are Devonian volcanic arc andesites, basalts, breccias, tuffs, and tuffaceous sediments of the Sicker Group and allied intrusive rocks. The Sicker Group is overlain by Mississippian-Permian limestones, argillites, and minor conglomerate of the Buttle Lake Group. This Paleozoic basement is exposed in two major uplifts on southern and central Vancouver Island. The Cowichan Anticlinorium and the Buttle Lake Anticlinorium have particular economic significance as they host past and

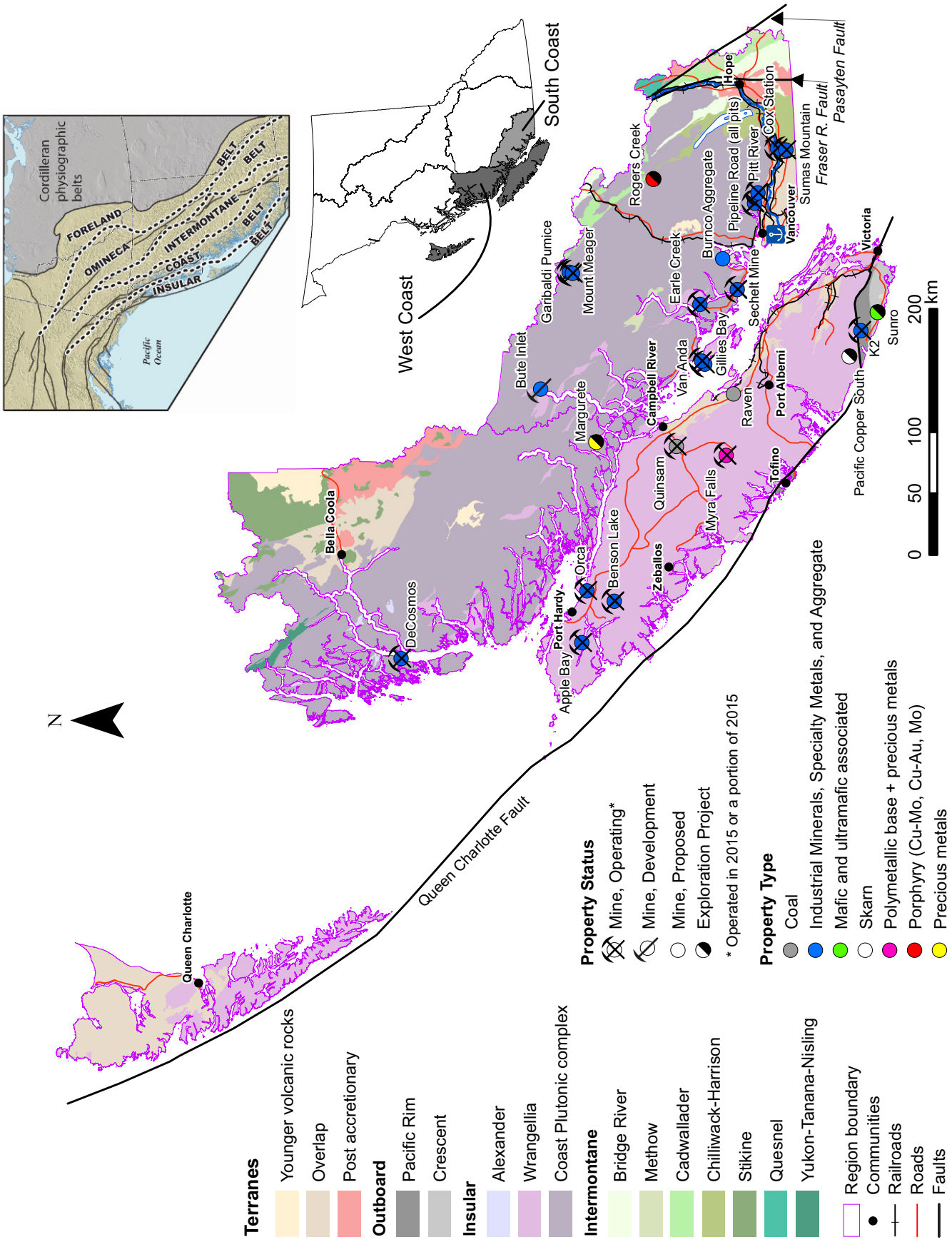

Fig. 1. Operating mines and selected exploration projects in the Coast Area, 2015. Terranes from BC digital geology map (Cui et al., 2015).

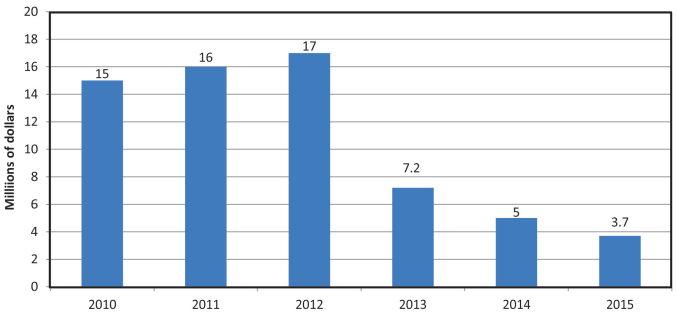

Fig. 2. Exploration spending estimates for the Coast Area, 2010-2015.

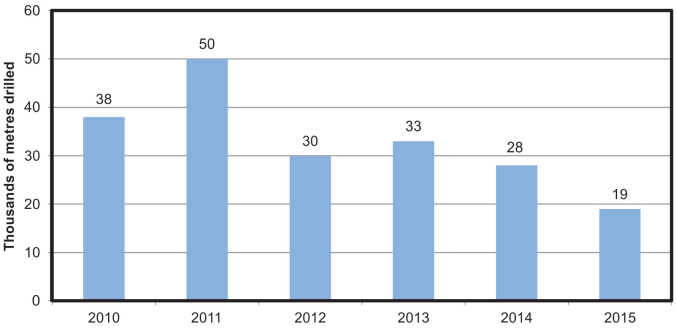

Fig. 3. Exploration drilling in the Coast Area, 2010-2015.

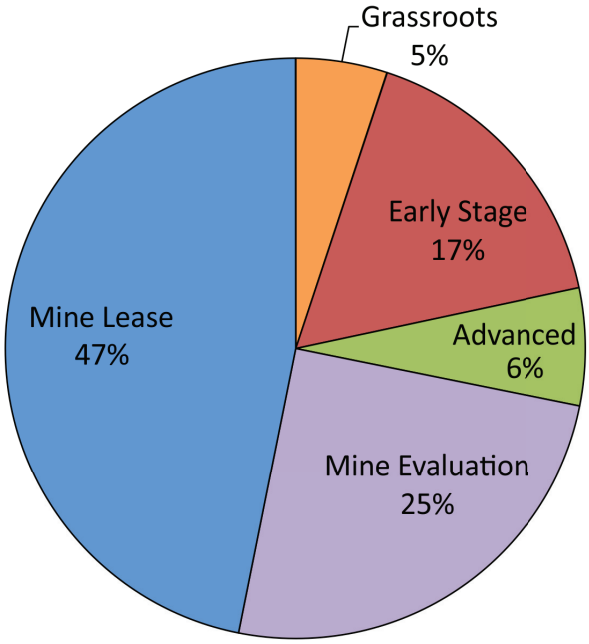

Fig. 4. Coast Area exploration spending by exploration stage, 2015.

present volcanogenic massive sulphide polymetallic producers at Mount Sicker (MINFILE 092B 001, 092B 002, 092B 003) and **Myra Falls**, probably emplaced in back-arc settings.

Unconformably overlying the Paleozoic rocks are Middle to Upper Triassic oceanic flood basalts and related sedimentary rocks of the Vancouver Group. The Vancouver Group consists of a thick (up to 6 km) sequence of flood basalts (Karmutsen Formation), and limestones (Quatsino Formation; on Haida Gwaii, Kunga Formation). The upper part of the Vancouver Group contains numerous skarn occurrences adjacent to Jurassic intrusions (Island Plutonic suite). Iron and iron-copper skarns are particularly abundant. The Tasu past producer (MINFILE 103C 003) on Haida Gwaii is one of the larger examples. Between 1914 1nd 1983, it produced 12 Mt of iron concentrate as well as copper, gold and silver.

The Vancouver Group is overlain by arc rocks of Bonanza Group (Upper Triassic-Middle Jurassic), which consist of a volcano sedimentary succession (Parson Bay Formation), and Lemare Lake subaerial basal to rhyolitic flows and tuffs (Nixon and Orr, 2007). The Bonanza Group rocks are of economic significance on northern Vancouver Island. North of Holberg Inlet, they host the past-producing Island Copper Cu-Mo-Au porphyry deposit (MINFILE 092L 158) and other undeveloped porphyry and epithermal prospects where the Bonanza Group volcanic rocks are intruded by Island Plutonic suite granodiorite and quartz diorite.

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

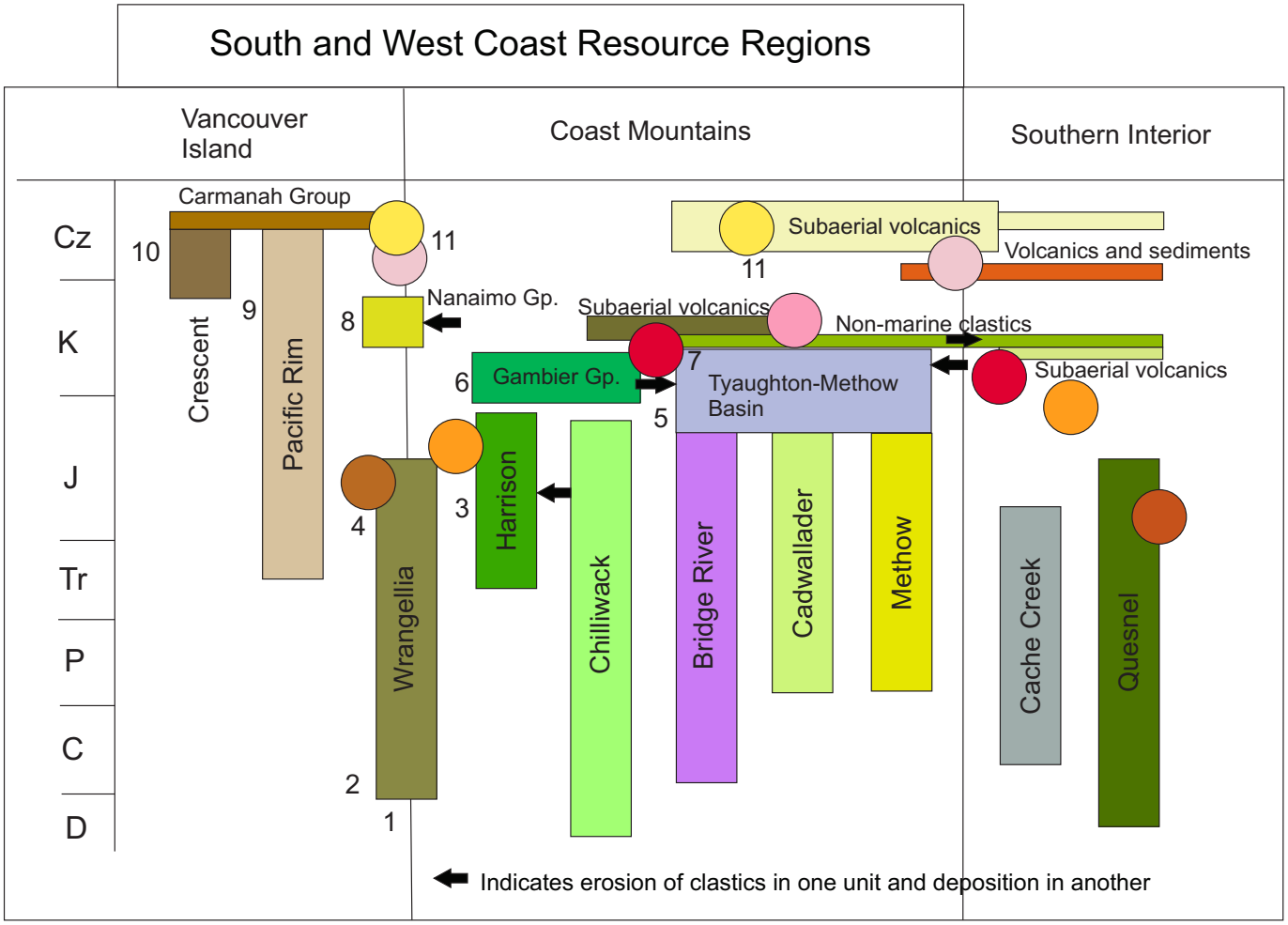

Fig. 5. Time-space diagram showing relations between terranes, basins, plutonic rocks (circles), and some significant mineralizing events in southwestern British Columbia. 1: Sicker Group volcanogenic massive sulphide; 2) orogenic gold veins in Sicker Group 3) Harrison Formation volcanogenic massive sulphide 4) Island plutonic suite porphyry Cu-Mo, Fe, Cu skarn 5) orogenic Au vein (Coquihalla serpentine 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). Modified from Bustin et al. (2013).

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

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 are currently 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 (MINFILE 103F 034) is a Miocene epithermal deposit with a significant undeveloped gold resource on Graham Island, Haida Gwaii (Fig. 1). More recent Cascades magmatism has produced pumice and other volcanic rocks quarried for construction, landscaping and other applications. The Mount Meager area has also been investigated as a possible source of geothermal energy.

2.6. 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 and Luternauer 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 and quarries

This section covers significant metal and coals mines that operated within the past year, as well as 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. At that time the workforce was reduced, however work proceeded on the restoration and upgrading of power facilities and other infrastructure. Mine development planning focussed on the western orebodies with exploration and definition drilling directed at those targets (Fig. 6). Generally, exploration was successful, producing high grade intercepts as well as identifying untested targets.

In October 2015, Nyrstar halted investment at the mine, responding to a combination of low zinc prices, deficiencies in site infrastructure, planning, operation and maintenance practices and development of future mining areas. The suspension is part of a company-wide effort to preserve cash and mineral resources during a prolonged period of low commodity prices.

Nyrstar does not outline a long term plan for **Myra Falls**, but says evaluation of all of its mining assets is ongoing. Furthermore, it is considering an exit from the mining business entirely. Formed by a combination of smelting, alloying and materials technology companies in 2007, it expanded into mining in 2009.

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. Currently there are 56 workers on site.

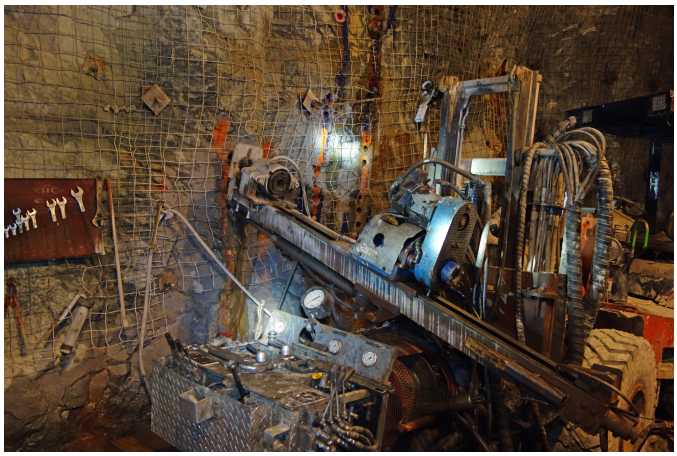

Fig. 6. A mobile drill rig underground at Myra Falls, part of a multi-year, near-infrastructure exploration effort.

Table 1. Metal mines, West and South Coast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Myra Falls Operations	Nyrstar N.V.	Zn, Cu, Pb, Au, Ag; G06: Noranda/Kuroko Massive Sulphide Cu-Pb-Zn; 092F 330, 092F 073	145,000 t 6.91% Zn, 0.47% Pb, 0.69% Cu, 1.24 g/t Au, 51.94 g/t Ag (9,000 t Zn, 200 t Pb, 600 t Cu, 4,000 oz Au, 209,000 oz Ag)	5.87 Mt 5.92% Zn 0.61% Pb 0.85% Cu 61.50 g/t Ag 1.54 g/t Au	7.36 Mt 6.41% Zn 0.66% Pb 1.00% Cu 66.31 g/t Ag 1.72 g/t Au	Operations Suspended Q2. Resource inclusive of reserves

Table 2. Coal mines, West and South Coast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Quinsam	Hillsborough Resources Ltd.	TC; A04: Bituminous coal; 092F 319	130,000 t	n/a	n/a	Operating below capacity

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

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 (Figs. 1, 7) has operated since 1986, and is currently the only active coal mine in the South and West Coast regions. The mine 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 produces from coal seams in the upper part of the Comox Formation, the basal unit of the Nanaimo Group (Late Cretaceous). The mine is capable of producing 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. Currently they supply local cement plants. The mine can also serve international markets using a freighter loading facility on Texada Island.

Similar to other coal mines in the province, **Quinsam** has been affected by low thermal coal prices; 61 workers were laid off in 2014, leaving a workforce of 69. Production is accordingly lower (estimated 130,000 t clean coal, Table 2). Mining operations were suspended for eight weeks in the summer, resuming near the end of August. Neither mine site nor off site exploration activities are reported in 2015. There has been on site exploration and work at sites to the east and proposed to the south in recent years.

Fig. 7. A barge preparing to load coal in October 2015 at Quinsam's Middle Point facility near Campbell River.

Hillsborough has been testing and researching underground waste and tailings disposal. The mine now disposes of coarse rock rejects underground in disused flooded workings.

Table 3. Industrial mineral mines and quarries, West and South Coast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast 2015 Production (based on Q1-Q3)	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Apple Bay (PEM 100)	Electra Stone Ltd.	Silica+alumina; R12:Volcanic glass-perlite; 092L 150	70,000 t	n/a	n/a	Drilling, mapping sampling to assess resource. No results published. Drilling by Ashgrove Cement Company
Benson Lake	Imasco Minerals Inc.	High brightness carbonate; R09:Limestone; 092L 295	56,000 t	n/a	100+ years	Reserves and resources not formally stated
Blubber Bay	Ashgrove Cement Company	Limestone, dolostone; R09:Limestone; 092F 479	10,000 t+	n/a	100+ years	First of a multiple-barge dolomite shipment to continue into 2016
Garibaldi Pumice	Garibaldi Pumice Ltd.	Pumice; R11:volcanic ash; 092JW 039	18,000 m^3	n/a	14,396,000 m^3 pumice 4,990,000 m^3 pumicite (fines)	2014 resource estimate. Near-lease test pits and LIDAR survey in 2015
Imperial Limestone	Imperial Limestone Co. Ltd.	Limestone; R09:Limestone; 092F 394	250,000 t (high grade), 360,000 t (low grade)	n/a	50+ years	Forecast based on Jan-Nov production
K2	K2 Stone Quarries Inc.	Dimension stone, flagstone; R08:flagstone; 092C 159	22,000 t	n/a	n/a	Material extracted from quarry is cut to size
Sumas Shale	Sumas Shale Ltd. (Clayburn Industries Ltd., Lafarge Canada Inc.)	Shale, clay, sandstone; B05:Residual kaolin; 092GSE024	480,000 t	n/a	50+ years	Product for cement production
Texada Quarry	Texada Quarrying Ltd. (Lafarge Canada Inc.)	Limestone, aggregate; R09:Limestone; 092F 395	3,900,000 t	n/a	100+ years	Mostly limestone for cement production

Potentially acid generating tailings are currently disposed of subaqueously in an open pit. Underground tailings injection infrastructure is in place.

3.3. Industrial mineral mines and quarries

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

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. 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 63 years and employs 69 people. The quarry has extensive reserves and, at current rates, is capable of producing for more than 100 years.

The Imperial Limestone Co. Ltd. quarry near **Van Anda** on Texada Island (Fig. 1) produces approximately 250,000 to 270,000 t annually and produced approximately 250,000 t of their high grade carbonate product in 2015. 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.

Ashgrove 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 dolomite to lower Mainland and northwest US markets intermittently. It will barge dolomite to Ashgrove's Rivergate Limestone Plant in Oregon starting in December 2015 or January 2016.

On northern Vancouver Island, Electra Stone Ltd. continues to mine silica and alumina products from silicified and clay-altered rhyolitic flows and volcaniclastic rocks at the **PEM 100** or **Apple Bay** quarry (Figs. 8 and 9). The quarry ships raw product by barge to the Ash Grove Cement Company in Seattle. They had sales of 48,396 t in the first three quarters of 2015. If the fourth quarter is similar to the third they would have sales of approximately 70,000 t in 2015. Ash Grove and Electra conducted a mine site exploration program to better define its resources.

At the **Benson Lake** white carbonate deposit, also on northern Vancouver Island, Imasco Minerals Inc. reported 2015 shipments totalling approximately 56,000 t. The high-brightness product is used mainly as white filler.

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 480,000 t in 2015. Because Clayburn's brick and refractory products plant in Abbotsford closed, fireclay is no longer produced separately.

Fig. 8. Electra Stone Ltd.'s PEM 100 quarry near Apple Bay, Northern Vancouver Island.

Fig. 9. Intensely altered rhyolite mined as a source of silica and alumina at Electra Stone Ltd.'s PEM 100 quarry.

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. Ironwood produces cosmetic products using the clay at its Richmond plant, a business that has continued for 27 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 report 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.

In the Mount Meager area, Garibaldi Pumice Ltd. produced 18,000 m^3 of pumice from the **Garibaldi Pumice** quarry in 2015, an increase over 2014 and significantly more than 2013. Garibaldi Pumice Ltd. did some off lease exploration consisting of test pits and a LIDAR survey in the vicinity of its quarry.

Neighbouring Great Pacific Pumice Inc. produced over 1000 m^3 in 2015 at their **Mount Meager** quarry, partly from a new area on the site. They had been relying on stockpiles to satisfy orders the previous year.

K2 Stone is a natural stone product supplier with quarries near Port Renfrew on Vancouver Island, (**K2**). 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. The rock is trucked to Nanaimo for processing into masonry and landscaping products. Other smaller producers of slate quarry rocks of the Leech River complex. Van Isle Slate has been offering a line of hand cut products. This quarry produced again in 2015 and the new owner plans to increase volumes in 2016. Island Stone Landscape Supply is another established producer and supplier of flagstone from the area. 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 Spumoni quarry and their Cabin Group property which now has a Mines Act quarry permit. Others active in the area include Bedrock Granite Sales Ltd., Citadel Stone Ltd., Alpine Natural Stone Ltd.

Haddington Island and Hardy Island (MINFILE 092F 425, 092L 146) are two regular producers 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 2015, but expects to return in 2016. Most of the product is used in restoration work on historic 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 regular annual production, mainly serving the local market. It mined and shipped approximately 950 t in 2015, but sales were approximately 1800 t. Hardy Island has opened another quarry on Valdes Island which supplies sandstone (Nanaimo Group), another rock type that can be found on many older buildings in Vancouver and Victoria. Production in 2015 was 900 t.

Aggregates are an important part of the mining industry on the south coast, generating more jobs in the region than metal and coal mining. The area hosts some of the largest aggregate pits and quarries in Canada. Most quarries serve local markets, although a few of the largest also export. General sales and production trends follow those of the construction industry. Lafarge North America, Lehigh Hanson Materials Ltd. and a local company Mainland Sand and Gravel Ltd., are the three largest participants in the Coast Area, although hundreds of pits and quarries produce in the region.

One of the largest aggregate-only mines is the **Sechelt Mine**, operated by Lehigh Hanson. The company no longer makes production figures public, but volumes have been in the 5 million tonne range in recent years. It is permitted for up to 7.5 Mt per year. A loading facility capable of accommodating Panamax class freighters handles most of the shipments.

In addition to the **Texada Quarry**, Lafarge North America operates two of the largest aggregate quarries in the region, **Earle Creek** and **Pitt River** quarries, each of which typically produces more than 1 Mt per year. Production and employment estimates for 2015 reported by Lafarge include: 3.9 Mt and 69 people at **Texada Quarry**; 1.3 Mt and 24 people at **Earle Creek**, 1.3 Mt and 27 people at **Pitt River Quarry**; 1.0 Mt and 18 people at **Central Agg**; and 0.75 Mt and 15 people at **Ward Road**. Remediation work continues at Lafarge's **Pipeline Road** site.

Also on **Pipeline Road** 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 (Fig. 10) near Port McNeill, which produces sand and gravel mainly for export. Polaris Minerals Corporation reported sales of approximately 1.9 Mt for the first three quarters of 2015. 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. Over 95% of the crushed quartz diorite product goes to the Lower Mainland market via barge on the Fraser River. The quarry also has two CN Rail spur lines, which allow shipment by rail. Production and shipments have recently been 2-3 Mt per year. The quarry employs 45-50 people.

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 South or West Coast regions.

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 as well as inactive larger projects are not covered.

5.1. Proposed metal mines

There are no proposed major metal mines in the South or West Coast regions considered to be active projects in 2015.

5.2. Proposed coal mines

Compliance Energy Corporation withdrew the **Raven Underground Coal** Project's application from the BC Environmental Assessment Office's screening process in March. Raven is a proposed mine south of Comox on Vancouver Island (Fig. 1). As contemplated in a 2011 feasibility

Fig. 10. Polaris Materials Corporation's Orca quarry. It has produced 18 Mt since 2007.

Table 4. Selected proposed mines, West and South Coast regions.

Project	Operator	Commodity; deposit type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
BURNCO Aggregate	BURNCO Rock Products Ltd.	Aggregate; B12: Sand and Gravel; N/A	-	Approx. 20 Mt	Permitting	Submitting applications for EA and Mines Act permit
Raven	Compliance Energy Corporation	SSCC+TC; A04: Bituminous coal; 092F 333	29.9 Mt	71.998 Mt	Permitting	Application for EA submitted for screening and withdrawn, 2015

SSCC = semisoft coking coal; TC = thermal coal

study, the main product would be a semi soft coking coal with a thermal by-product. Production would be approximately 830,000 t of clean coal per year, over 16 years. Compliance's original partners, LG International Investments (Canada) Ltd. and Itochu Corporation, have since withdrawn from the project. Compliance has not indicated plans for Raven but has expressed doubt that the Environmental Assessment Office would certify the project. It remains in pre-application status with the Environmental Assessment Office.

5.3. Proposed industrial minerals mines

The **BURNCO Aggregate** Project in the McNab Creek Valley 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 2014 changing production rate, relocating some facilities and specifying a mine life of 16 years.

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 discovery of new resources away from ore bodies in an existing mine plan can be considered mine-lease or on-site exploration. The South and West Coast had few large off lease exploration programs in 2015 (Table 5). The following are notes on smaller scale projects and updates on properties with significant defined deposits.

6.1. Precious metal projects

Aldever Resources Inc. (Formerly Glenmark Capital Corp.) conducted a reconnaissance program at the **Margurete** property, including 39 packsack drill holes. Results are not yet published. The property is in the Phillips Arm gold camp. Past producers in the area (Alexandria, Doratha Morton, Enid-Julie) mined gold in quartz veins.

Ashlu Mines Inc. is a private company that has assembled a land position around the former Ashlu Mine near Squamish (Ashlu property). In 2015, they reported continuing geophysics and geochemistry at the property (MINFILE 092GNW045, 47, 55, 62; MINFILE 092GNW013). A five-year rock, soil, and silt sampling program has relocated showings around the former mine. The Ashlu Mine is a past producer that exploited a narrow (<1 to 4.6 metre) 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 largely underlain by the Cloudburst pluton (Jurassic).

Bear Mountain Gold Mines Ltd. repaired a portal at the Discovery zone at the Abo gold property where they propose 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.

New Carolin Gold Corp. negotiated the purchase of a further 30% interest in the portion of the Ladner Gold project it optioned from Century Mining Corporation and now owns 40%. The company also filed a technical report with restated resource estimates intended to represent open pit and 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.

A two week mapping and sampling program covered the McMaster zone in the fall. The past producing underground mine exploited a different area (Idaho zone). 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 which is generally not well explored by modern methods. Veins of economic interest are

Table 5. Selected Exploration projects, West and South Coast regions.

Project	Operator	MINFILE	Commodity; Deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work Program	Comments
Margurete	Aldever Resources Inc.	092K 025, 092K 020, 092K 030	Au; I01: Au-quartz veins	n/a	Geology, rock geochemistry, packsack drilling	Reconnaissance program in historic gold camp
Pacific Copper South	Canadian Dehua International Mines Group Inc.	092C 022, 092C 091, 092C 023	Cu, Au, Fe; K03: Fe skarn; K01: Cu skarn	14.3 Mt 43.2% Fe (inferred, 2011)	Soil, stream and rock geochemistry	Formerly part of Pacific Iron property. Targets not limited to magnetite
Rogers Creek	Carube Copper Corp.	092JSE033, 092JSE034,092JSE035	Cu, Mo, Ag; L04: Porphyry Cu±Mo±Au	n/a	IP survey; soil geochemistry	Chargeability anomaly reported

found in sediments and mafic volcanics northeast of the East Hozameen fault and Coquihalla serpentine belt.

Siwash Minerals Inc. began access and trenching in November at its Lucky D (also known as Monument) property near Yale. Targets are gold bearing quartz veins. Continuation of the work was deferred until spring. Siwash has an agreement with Nicola Mining Inc. to process material at Nicola's custom mill at the Craigmont mine site near Merritt. Monument lies at the northern end of the Coquihalla gold belt. Clibetre Exploration Inc. also has an agreement to process a stored bulk sample from Mount Washington at Nicola's mill.

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

6.2.1. Wrangellia, Island Plutonic Suite

Between 1971 and 1994, the Island Copper mine produced 345 Mt with average head grades of 0.41% Cu, 0.017% Mo, and 0.19 g/t Au. Several porphyry copper and epithermal gold targets extend along a 40 km west-north-west trend from Island Copper. Hushamu (MINFILE 092L 240), a copper-molybdenum-gold porphyry prospect, is the most advanced with Indicated 304,000 t of 0.21% Cu, 0.29 g/t Au, 0.010% Mo, and 0.56 ppm Re and Inferred 205,600 t of 0.18% Cu, 0.26 g/t Au, 0.008% Mo and 0.38 ppm Re.

Northisle Copper and Gold Inc. did not resume drilling on its large North Island project in 2015, but acquired an option on the Red Dog property, approximately 9 km west-northwest of the Hushamu deposit, last drilled in 2014. NorthIsle conducted reconnaissance mapping and sampling at Red Dog, testing for a northwestern extension of mineralization in the direction of a 2012 IP chargeability anomaly.

Red Dog has historical resource estimates of 25 Mt at grades of 0.35% copper, 0.44 g/t gold and 0.006% molybdenum or 20 Mt of 0.30% copper, 0.55 g/t gold and 0.012% molybdenum. Mineralization remains open to the west, where tenures are held by NorthIsle. There is an apparently separate mineralized zone 400 m east of the Red Dog zone, cut by post mineralization dikes. Since it was detected as a geochemical anomaly in 1962, Red Dog has seen approximately 9,000 m of reported drilling.

The Hushamu deposit, the most advanced of the porphyry prospects in the North Island project area has a 2012 resource estimate, with an indicated resource of 304,000 t of 0.21% Cu, 0.29 g/t Au, 0.010% Mo, and 0.56 ppm Re and an inferred resource of 205,600 t of 0.18% Cu, 0.26 g/t Au, 0.008 % Mo and 0.38 ppm Re. 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.

Western gateway Minerals Inc. conducted a geological mapping program at its Gooseneck Lake property. The target is porphyry copper mineralization. A report is filed for assessment.

Limited surface work was reported at Macktush in 2015. The property covers numerous vein and porphyry-type gold, copper-silver, and copper-molybdenum-gold occurrences. MINFILE documents 18 occurrences, many more are reported elsewhere. World Organics Inc., which has an option on the property held by Nahminto Resources Ltd., filed a technical report. Mapping and geochemical sampling work was filed for assessment. The property has a long history of exploration, but drilling has been limited.

6.2.2. Cenozoic intrusions

There are several advanced Eocene to Miocene porphyry copper targets in southwestern British Columbia. Those in the South and West Coast regions saw modest levels of exploration in 2015. Imperial Metals Corporation did not report new work at Catface, a copper-molybdenum prospect on the west coast of Vancouver Island. There was a limited surface program in 2014. They last drilled the deposit in 2010, subsequent to a 2009 resource estimate. Eastfield Resources Ltd. and Prophecy Resource Corp.'s OK copper-molybdenum prospect north of

Powell River had a 2014 geochemical survey, but no new work reported in 2015. Carube Copper Corp. reports a chargeability anomaly following an IP survey at its **Rogers Creek** porphyry copper project north of Harrison Lake. It may represent a new target as previous drilling intersected anomalous Cu-Mo-Ag mineralization at the edge of the anomaly. Imperial's Giant Copper, with copper-gold porphyry targets southeast of Hope had a modest soil sampling and mapping program in 2015. Mineralization intersected at depth in 2007 has not been followed up with additional drilling.

6.3. Polymetallic base and precious metal projects

6.3.1. Wrangellia

Nitinat Minerals Corporation mapped and sampled its Jasper property in July. They discovered quartz-sulphide mineralization and reported high zinc values (up to 24.7% Zn) in surface sampling. The Jasper property currently covers eight MINFILE occurrences, and Nitinat Minerals documents additional occurrences. Among these are skarn, vein and VMS style mineralization.

Treasury Metals Inc. has not reported new work at their Lara property near Chemainus, but they reported a late 2014 geological mapping and geochemical sampling program in 2015.

6.3.2. Nooksack-Harrison

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 geological work for assessment. The Vent and Seneca prospects themselves are held by Goldsource Mines Inc.

6.4. Iron, copper and gold skarn projects

6.4.1. Wrangellia

Canadian Dehua International Mines Group Inc. has done geochemical surveys on three of its Vancouver Island properties. Its large land holding on southern Vancouver Island is divided into two blocks, the southernmost one surrounding the most advanced prospects, the Bugaboo and Reko iron skarns (**Bugaboo-Reko**, or **Pacific Copper South** property). The new property to the north is currently called Pacific Copper North. There was also work at the Head Bay project near Tahsis on Northern Vancouver Island. The three programs consisted mainly of soil, stream and rock geochemistry. These were reconnaissance level surveys on large properties and not restricted to magnetite targets. Canadian Dehua has not yet reported results.

6.5. Mafic and ultramafic associated projects

6.5.1. Pacific Rim, Metchosin Complex

New Sunro Copper Ltd., a private company, carried out underground rehabilitation and an airborne magnetic and radiometric survey on the New Sunro property (Fig. 11), including the **Sunro** past producer.

Fig. 11. The Olympic Mountains and the southward continuation of the Crescent terrane, viewed from the Sunro property of New Sunro Copper Ltd. Sunro is near the northernmost extent of the Coast Range Basalt Province.

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, 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 to1974. 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.

6.5.2. Giant Mascot ultramafic intrusion

Ridgeline Exploration Services Inc. reported soil and bio-geochemical surveys at the Lekcin property. These covered the Big Nic area and a 2014 discovery named the RP showing. Lekcin is adjacent to the Giant Mascot past Ni-Cu producer. Targets at Lekcin are magmatic sulphide Ni-Cu +/-PGE concentrations similar to those exploited at Giant Mascot. The property is owned by Mike Blady, Chris Paul, John Chapman and Gerry Carlson.

6.6. Industrial mineral and aggregate projects

Exploration for industrial minerals and aggregates is often carried out by individuals and private companies and typically goes unreported; in some cases it remains private as they must compete in limited local markets.

6.6.1. Wrangellia

Cataract Enterprises Ltd. is permitted to extract a bulk sample from the T&S Mine marble project near Skull Lake on the west coast of Vancouver Island. Vancouver Stone Quarries Inc.is also

permitted to trench and sample a marble prospect near Tahsis. Both hope to proceed in December. White Rose Holdings Ltd. reported mapping at its Leo D'Or marble prospect.

As noted above, Polaris Materials Corporation conducted exploration near its **Orca** sand and gravel quarry for sources of crushed aggregate and is testing bulk samples. Electra Stone Ltd. conducted a drilling and mapping program to define resources at its **Apple Bay** quarry.

6.6.2. Quaternary sediments

Another public company, Nomad Ventures Inc., acquired a permit to quarry aggregate at Saint Vincent Bay on Jervis Inlet, however at the time of writing it had not acquired the property on which the quarry was to operate. The Ministry of Energy and Mines received more than 25 Notices of Work for aggregate in the region by November 2015 and 40 in 2014, typical for recent years. There are more than 600 active quarry and sand and gravel permits in total, although not all are currently producing or conducting investigative work.

7. Geological research

7.1. Wrangellia

Geoscience BC commissioned a catchment analysis applying to stream sediment data gathered as part of its recent Northern Vancouver Island project (Arne and Brown, 2015).

Research culminating in a University of British Columbia Ph.D. thesis (Ruks, 2015) was is part funded by Geoscience BC. This work on Sicker Group stratigraphy and VMS mineralization began in 2007 as a Geoscience BC project.

7.2. Nooksack-Harrison terrane

Rukhlov and Ferbey, 2015a, b, published findings of a study using the Seneca VMS prospect as a field area for a test of the application of 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.

7.3. Giant Mascot ultramafic intrusion

Nixon et al., 2015, Manor et al, 2015 and Manor et al., in press, have published results of recent work at the Giant Mascot Ni-Cu-PGE deposit. This work results from collaboration between the British Columbia Geological Survey, 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.

8. Summary

While 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 two years. There were no major exploration drill programs for metals in the southwest, other than the on-lease program at **Myra Falls**, where operations are now suspended. Production at the **Quinsam** coal mine is supported by sales to local cement plants, making it effectively a supplier to the local construction materials market.

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Note added in proof

Hillsborough Resources Ltd. announced in January 2016 that the Quinsam mine would suspend mining operations indefinitely. Hillsborough would fulfill current contracts from stockpiles.

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Exploration and mining in the Skeena Region, British Columbia

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1. Introduction

The Skeena Region covers approximately 263,213 square kilometres of northwestern British Columbia, roughly 25% of the province. The region transects all of the physiographic belts of the Canadian Cordillera (Fig. 1). There are 2,951 documented MINFILE occurrences distributed through all of the geologic terranes of the Skeena Region. Current exploration and mining activities are predominantly hosted in the Stikine terrane of the Intermontane tectonic province.

At least 92 projects remained active in the Skeena Region in 2015. Of which, 52 were monitored by the author. Thirty-two grassroots, early and advanced staged projects, five mine evaluation stage projects, two mine development stage projects, three producing metal mines and seven industrial mineral quarries were also monitored.

Mineral exploration expenditure in 2015 totalled approximately $117 million, down 27% from 2014 (Fig. 2). Despite the decrease in expenditure, significant exploration and mining activity was carried out in the region. The previous four years of strong activity have yielded six permitted metal mines including the Red Chris copper-gold mine, now in production, and the Brucejack gold-silver mine now in construction. Remaining permitted mine projects including Kitsault, KSM, Tulsequah Chief and Silvertip all require critical capital investment prior to commencing construction.

Regional exploration drilling metres totalled 103,000 (Fig. 3). Grassroots and early stage exploration projects were responsible for 23,830 metres and represent roughly 21% of the overall regional exploration expenditure (Fig. 4). Mine development investment totalled approximately $347.5 million and is attributed to mine construction and expansion costs. Mining related infrastructure investment totalled at least $460 million which includes construction and expansion expenditures of marine port facilities and power projects.

Significant events in the Skeena Region during 2015 include:

- Pretium Resources Inc. received provincial and federal permits and started construction of the underground high-grade gold **Brucejack** mine
- Imperial Metals Corporation shipped the first copper-gold concentrate from the **Red Chris** mine and declared commercial production
- Seabridge Gold extended boundaries of known copper-gold mineralization of the Deep Kerr and Mitchell deposits of the fully permitted **KSM** project
- JDS Silver received a Mines Act permit for the **Silvertip** silver-zinc-lead project
- Banks Island Gold produced over 9,500 ounces of gold in the first half of 2015 at **Yellow Giant**
- Alloycorp Mining Inc. started pre-construction activities at **Kitsault**
- Colorado Resources Ltd. discovered new copper-gold porphyry mineralization at the **KSP** project.

Producing metal mines in the region included the **Huckleberry** copper-gold-silver-molybdenum mine which produced concentrate for the duration of 2015. The **Red Chris** copper-gold mine started producing concentrate in February and declared commercial production in July. Lastly, the **Yellow Giant** gold-silver mine maintained production status until July. Seasonal placer mining for gold and jade was carried out between May and October but not comprehensively monitored.

Exploration projects focussed on porphyry copper-gold and vein hosted gold-silver veins predominantly focussed in the geographic and geological areas of the Stikine Arch, Eskay-Stewart and the Skeena Arch. In the northern areas, Atlin and Goodhope, limited exploration work and desktop evaluations were conducted on carbonate hosted, manto replacement and volcanogenic massive sulphide projects. Exploration for ultra-high-rank anthracite coal in the Bowser Basin slowed to minimal levels.

1.1. Exploration and mining activity overview

Producing metal mines in the region included the **Huckleberry** copper-gold-silver-molybdenum mine which produced concentrate for the duration of 2015. The **Red Chris** copper-gold mine started producing concentrate in February and declared commercial production in July. Lastly, the Y**ellow Giant** gold-silver mine maintained production status until July. Seasonal placer mining for gold and jade was carried out between May and October but not comprehensively monitored.

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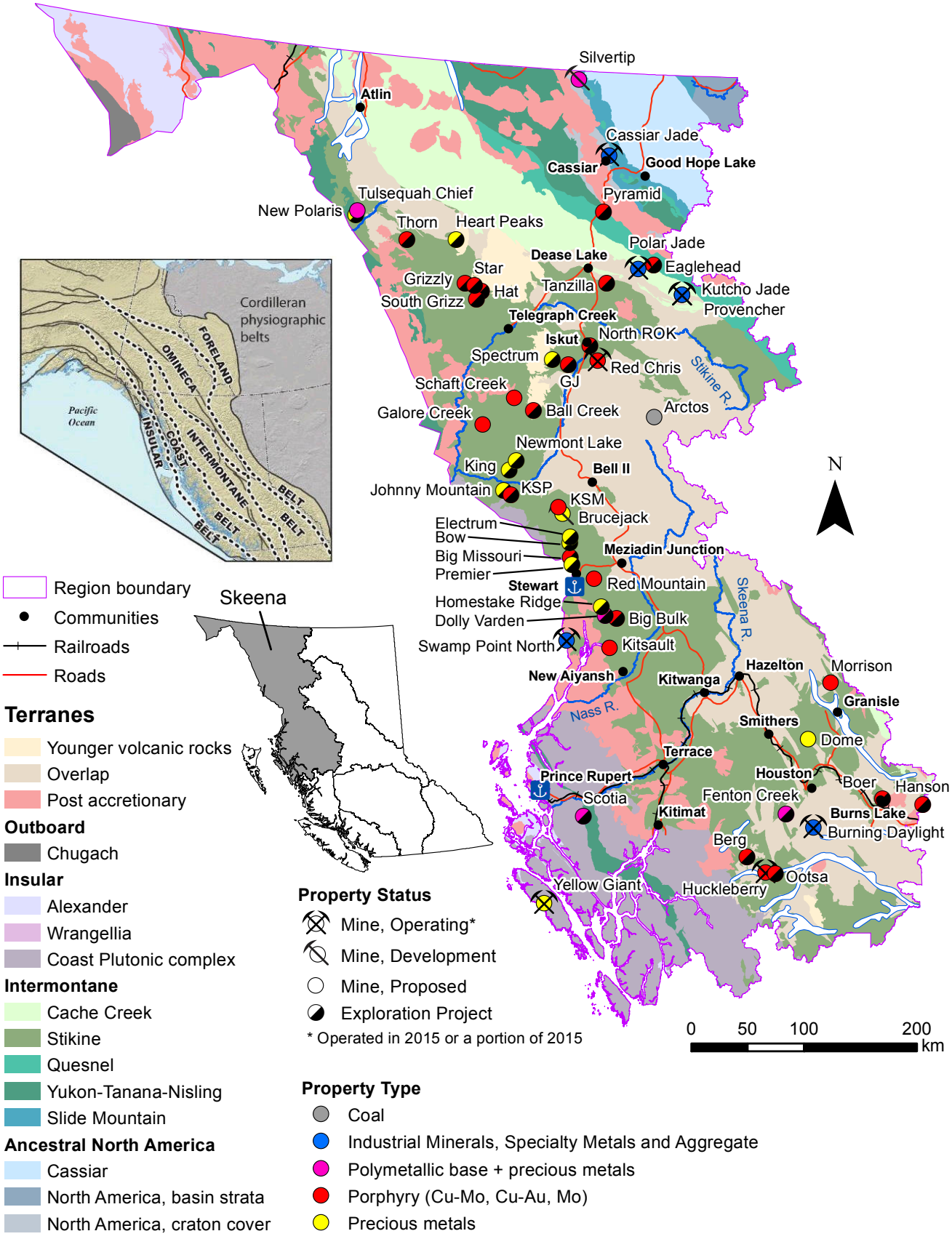

Fig. 1. Mines, proposed mines and selected exploration projects in the Skeena Region, 2015.

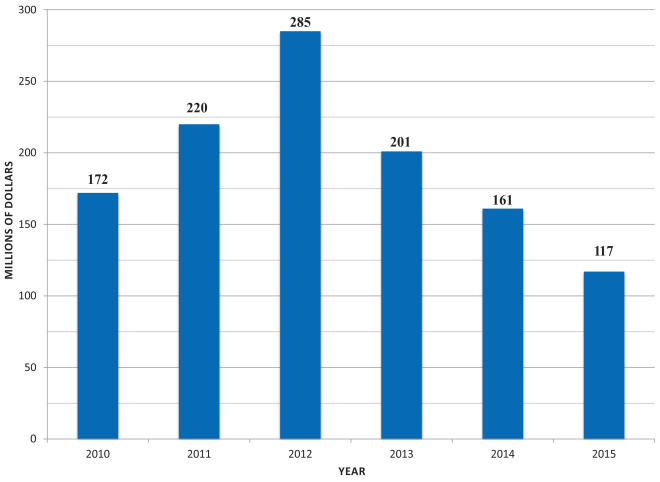

Fig. 2. Annual exploration expenditures in millions of dollars for the Skeena Region from 2010-2015.

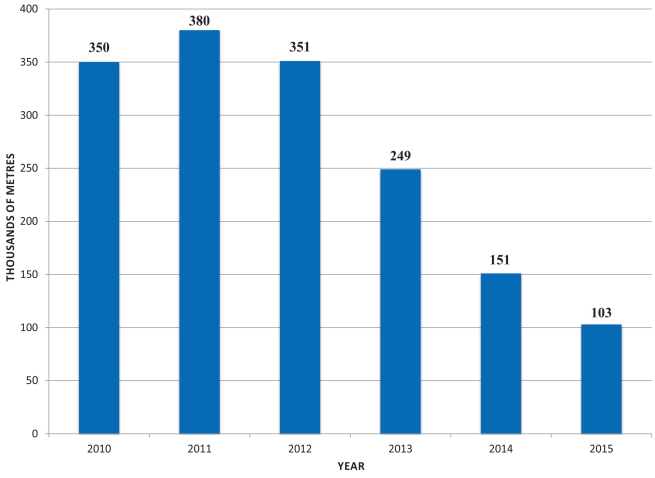

Fig. 3. Annual exploration drilling estimates in thousands of metres for the Skeena Region from 2010-2015.

vein hosted gold-silver veins predominantly focussed in the geographic and geological areas of the Stikine Arch, Eskay-Stewart and the Skeena Arch. In the northern areas, Atin and Goodhope, limited exploration work and desktop evaluations were conducted on carbonate hosted, manto replacement and volcanogenic massive sulphide projects. Exploration for ultra-high-rank anthracite coal in the Bowser Basin slowed to minimal levels.

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, Clarke, this volume). The Skeena Region

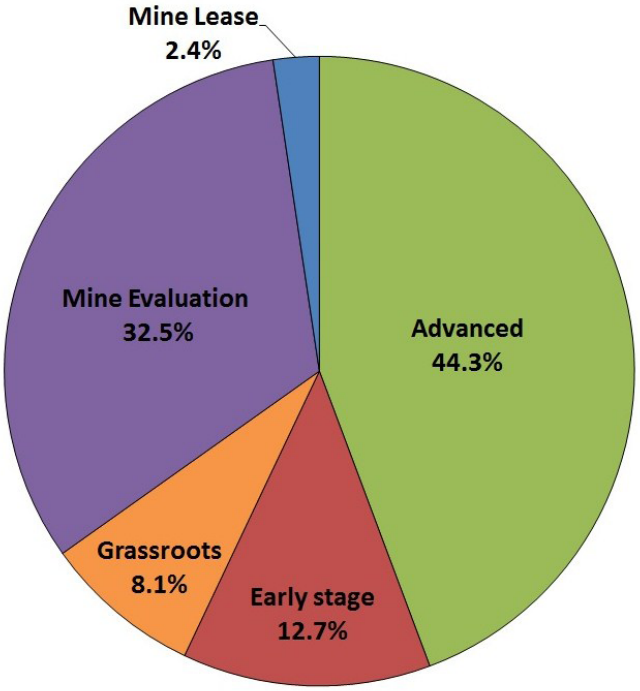

Fig. 4. Percentage of exploration expenditures in 2015 by exploration stage for the Skeena Region.

spans a transect of the Cordilleran orogen (Fig. 1). From west to east it is underlain by:

1. autochthonous and parautochthonous carbonate and siliclastic strata of ancestral North America (Laurentia)
2. terranes of the Intermontane tectonic province: the Slide Mountain terrane marginal (back-arc) basin; the Yukon-Tanana terrane, a rifted Devonian pericratonic arc terrane; the Quesnel and Stikine volcanic arc terranes, which formed outboard of ancestral North America starting in the Late Paleozoic and were accreted in the Middle Jurassic; and the late Paleozoic-early Mesozoic accretionary complex of the Cache Creek oceanic terranes, which intervenes between Quesnellia and Stikinia and represents their fore-arcs.
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 siliclastic deposits.

2.1. Ancestral North America

Carbonate platformal rocks of the Laurentian realm are limited to the northeastern corner of the Skeena Region and mark the ancient margin of the North America. Platform and deep water sediments host favorable environments for

stratiform barite and set the stage for later polymetallic manto development. Sedimentary exhalative prospects also occur and are better developed to the east in the Kechika basin in the Omineca Region (see Jago, this volume).

2.2. Intermontane tectonic province

2.2.1. Slide Mountain terrane

The Slide Mountain terrane is exposed in the Sylvester allochthon, a complex klippe that structurally overlies Cassiar platform near Cassiar, British Columbia. It contains imbricated marginal ocean basin lithosphere, including ultramafic upper mantle, gabbro, basalt and pelagic sedimentary strata. Extensively serpentinized ultramafites 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 founded on a pericratonic rifted block. The terrane hosts volcanogenic massive sulphide such as the **Scotia** prospect located in the Ecstall belt near Prince Rupert.

2.2.3. Quesnel terrane

The Quesnel terrane is a multi-phase late Paleozoic-early Mesozoic volcanic arc assemblage that is extensively exposed in central (Omineca Region) and southern British Columbia. Its northern extension in the Skeena Region contains stratigraphic equivalents of the Takla Group, intruded by the Eagle granodiorite, which is considered a faulted extension of the northern Hogen batholith (Gabrielse, 1985). Two porphyry copper-gold-molybdenite prospects, the **Eaglehead** deposit and the grassroots **Pyramid** prospect are located within Quesnellia and the Skeena Region.

2.2.4. Stikine terrane

The Stikine terrane generally trends northwest spanning over 1,500 km across the length of the province and varies in width from over 300 km wide to less than 100 km. It is the largest terrane in the Skeena Region and the most metallogenetically significant. It hosts a new major producing mine, **Red Chris**, and the majority 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 complex, opposite-facing arcs is considered a present day analog (Marsden and Thorkelson, 1992).

The Stikine terrane is a complex volcanic arc assemblage built during three episodes of island arc formation between the late Paleozoic and early Mesozoic. Each is represented by an unconformity-bounded 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); 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 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 contained within sub-volcanic intrusive complexes related to the Stuhini and Hazelton groups. The unconformity between the Hazelton and Stuhini groups has been identified as an important regional targeting feature for porphyry and related deposits (Northern Miner, 2015). More importantly, fault systems located near, or which cross cut 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 observed 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 is an oceanic fore-arc assemblage 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). Serpentinized ultramafite bodies host nephrite jade now mined in 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 (Gehrels et al., 1992; van der Heyden, 1992; McClelland and Mattinson, 2000; Saleeby, 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- 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 and three of those are deltaic facies containing high ranking anthracite coal and include the **Arctos** project and the **Groundhog** project in the Omineca Region (see Jago, this volume). The coal-bearing sequences of the Groundhog coalfield reach approximately 1,100 metres in thickness, with 33 identified coal horizons up to 12 metres thick interbedded with mudstone, siltstone and sandstone.

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 in age from Late Jurassic in the west, through to mainly Cretaceous in its centre, 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 Thompson–Okanagan–Cariboo 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 host arc and related terranes accreted to the western margin of North America. These deposits are interpreted to occur in continental back arc settings and individual deposits are hosted by a variety of older country rocks. In the Skeena Region, deposits are generally hosted within the Hazelton Group and show a spectrum of metal associations; copper-molybdenum at **Huckleberry**, **Morrison** and **Berg;** copper-gold at past producing Bell and Granisle mines; molybdenum at **Kitsault** (McMillan et al., 1995). Coeval and younger volcanic rock such as the Ootsa Lake Group host polymetallic precious metal veins such as 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. Here, a 72 Ma intrusion is interpreted to be related to polymetallic manto development at **Silvertip** hosted in the 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 Skeena Region. Faults record mainly dextral displacement from mid Cretaceous to Eocene and with a cumulative offset up to 800 km (Gabrielse et al., 2006).

2.5. Younger rocks

Youngest cover rocks are comprised of volcanic rocks of the Mt. Edziza complex (Pliestocene). Some of the oldest quarries of obsidian mined by First Nations peoples are hosted in the Mt Edziza volcanics (MINFILE 104G 101).

3. Mines and quarries

3.1. Metal mines

There were three producing metal mines (Table 1) in the Skeena Region in 2015. **Huckleberry** remained in operation for the duration of the year but by the end of 2015 low metal prices had triggered an internal review. In early January of 2016, Imperial Metals Corporation announced it had suspended pit operations. **Red Chris** started commissioning in late 2014 and declared commercial production in July. **Yellow Giant** maintained production status until July.

3.1.1. Huckleberry

Imperial Metals Corporation and Japan Group's co-owned (50-50) **Huckleberry** copper-gold-silver-molybdenum mine continued through year four of the main zone optimization mine plan (Fig. 5). Production by the end of the third quarter totalled 15,244 tonnes (33.6 million pounds) copper, 81 kilograms (2,616 oz) gold and 4,924 kilograms (158,339 oz) silver from 5,025,638 tonnes of ore. Forecasted annual production was on target to produce 19,958 tonnes (44 million pounds) of copper and 7,464 kilograms (240,000 oz) silver. Mill throughput averaged 18,409 tonnes per day. Average head grade was 0.338% copper with 89.6% recovery. Low metal prices resulted in a review of operations and in early January 2016 pit operations were suspended. Milling of stockpiled ore will continue. Exploration activities included diamond drilling of three holes totalling 1,194 m at the nearby Whiting Creek project.

Fig. 5. Looking west-southwest over the **Huckleberry** Main Zone Extension pit. Year four of the Main Zone Optimization plan continued to remove formerly deposited tailings to recover ore below and around the former Main Zone Pit (former Main zone pit outline highlighted by dotted red line). Photo courtesy of Justin Schroff, Huckleberry Mine geologist.

Table 1. Metal mines, Skeena Region.

Mine	Operator	Commodity; deposit type; MINFILE	2015 Q1-Q3 Production	Reserves (Proven + Probable)	Resource (Measured + Indicated)	Comments
Huckleberry	Huckleberry Mines Ltd.	Copper, gold, silver, molybdenum; Porphyry Cu-Mo-Au; 093E 037	15,244 t (33.6 Mlbs) Cu, 81 kg (2,616 oz) Au, 4,924 kg (158,339 oz) Ag	42 Mt at 0.33% Cu and 0.01% Mo	180.7 Mt at 0.32% Cu, 0.01% Mo	Main Zone Optimization Plan in year 4; under review due to low metal prices
Red Chris	Red Chris Development Company Ltd.	Copper, gold; Porphyry Cu-Au; 104H 005	17,282 t (38.1 Mlbs) Cu, 495 kg (15,925 oz) Au	301.5 Mt at 0.36% Cu and 0.27 g/t Au	1,034.7 Mt at 0.35% Cu, 0.35 g/t Au, 1.14 g/t Ag	First eight months of production (Feb.-Sept.)
Yellow Giant	Banks Island Gold Ltd.	Gold, silver; Au-quartz veins; 103G 024, 103G 026	279 kg (9,555 oz) Au, 866 kg (27,846 oz) Ag	n/a	78,000 t at 23 g/t Au, 43 g/t Ag (2013)	Temporarily shut down

The Huckleberry deposit is located 123 km south of Houston and is hosted in and around two Late Cretaceous (~82 Ma) intrusions of the Bulkley Plutonic Suite, the Main and East Zone stocks. Both are granodiorite in composition and intrude volcanic tuffs of the Lower Jurassic Hazelton Group Telkwa Formation (MacIntyre et al., 1994). Most of the copper mineralization occurs within the margins of the stocks and on the eastern hornfelsed selvages around them. The Main Zone ore body measures approximately 1400 x 400 m in a crescent shaped plan with an arc open to the west and extends to at least 380 m deep. Reserves total 42,157,300 tonnes grading 0.327% copper and 0.01% molybdenum.

3.1.2. Red Chris

Eight years after being purchased and after three years of construction and strong community support, Imperial Metals Corporation's **Red Chris** copper-gold mine shipped their first load of concentrate to Asia in April. Community support, tested via referendum, showed 87% in favor of the project and resulted in an Impact Benefit and Co-Management Agreement between the Tahltan Nation and Red Chris Development Company Ltd., the operating company. Commissioning activities started in late 2014 and commercial production was achieved on July 1st 2015 when mill throughput surpassed the designed capacity of 30,000 tonnes per day. By the end of the third quarter, average mill throughput was 23,668 tonnes per day. Copper production totalled 17.2 tonnes (38.1 million pounds) and 495 kg (15,925 oz) gold from 5.3 million tonnes of milled ore. Higher grade ore (Fig. 6) mined from the East Zone was blended with Main Zone ore, resulting in an average grade of 0.482% copper and 0.25 g/t gold. Metal recoveries averaged 67% for copper and 37% for gold; both of which should improve with installation of additional launders in the roughing circuit. Construction activities on the North dam of the tailings facility finished for the year in early October and will resume in April 2016.

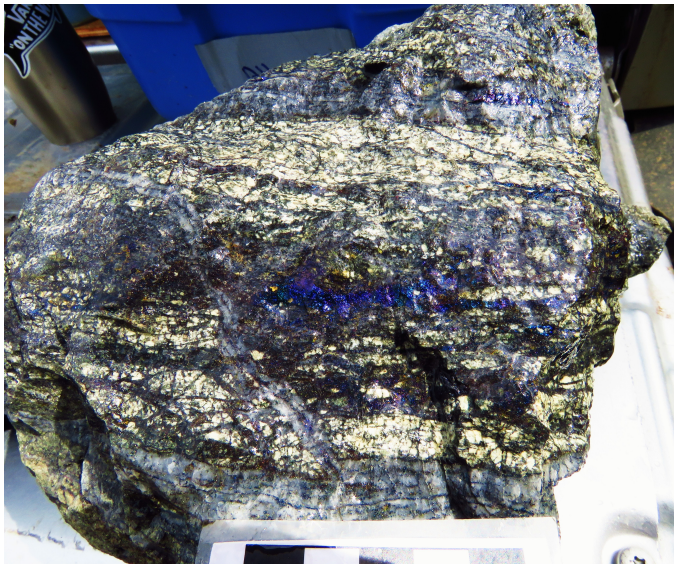

Fig. 6. High grade quartz-bornite-chalcopyrite-magnetite 'A' veins cutting 'P2' porphyry from the East Zone of the **Red Chris** mine.

Permitting for the South dam of the tailings facility is scheduled to be completed in time for the 2016 construction season.

The **Red Chris** copper-gold porphyry deposit is located 16 km southeast of Iskut and is hosted in the 204 Ma diorite-monzonite Red Stock which intrudes late Triassic Stuhini Group rocks. The 6.5 x 1.5 km crowded porphyry is comprised of four main intrusive phases. The second phase (P2), contains most of the copper and gold and measures greater than 2 km x 650 m in plan and has been proved to be over 1.5 km deep. 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 million tonnes, with an average grade of 0.36% copper and 0.27 g/t gold. Forecasted mine life

is 28 years at a 30,000 tonne per day milling rate. Measured plus indicated resources total 1,034.7 million tonnes with an average grade of 0.35% copper, 0.35 g/t gold and 1.14 g/t silver. Additional inferred resources total 787.1 million tonnes grading 0.29% copper, 0.32 g/t gold and 1.04 g/t silver. 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 (Fig. 7).

3.1.3. Yellow Giant

Banks Island Gold Ltd. produced gold-silver concentrate from their **Yellow Giant** mine located approximately 70 km southeast of Prince Rupert. Production continued until July and totalled 297 kg (9,555 ounces) gold and 866 kg (27,846 ounces) silver. Processing rates averaged 223 tonnes per day with an average grade of 9.25 g/t gold and 31.3 g/t silver. Underground mining occurred at the Tel, Bob and Discovery deposits. Ore was processed on site utilizing both a dense media separation plant and a grinding and floatation circuit. Metal recoveries averaged 87% for gold and 73% for silver. Operations shut down in July due to compliance related issues which require an amendment to their Mines Act permit before operations can resume.

Near mine exploration activities included 4,143 m of diamond drilling in 16 holes at the Kim zone and Quartz Hill. Four diamond drill holes targeted deposit extensions at the Bob and Tel zones. A lake sediment geochemical orientation survey showed elevated gold-arsenic-bismuth values around known prospects. A larger, property-scale survey was not completed due to the halt of mine operations.

Gold and silver are contained within massive to semi-massive veins of pyrite, chalcopyrite, arsenopyrite, sphalerite and galena hosted in fault bounded quartz veins. Veins are steeply dipping and trend northwest proximal to an intrusive-metasedimentary lithologic contact and are widest at the intersection with east-northeast trending faults.

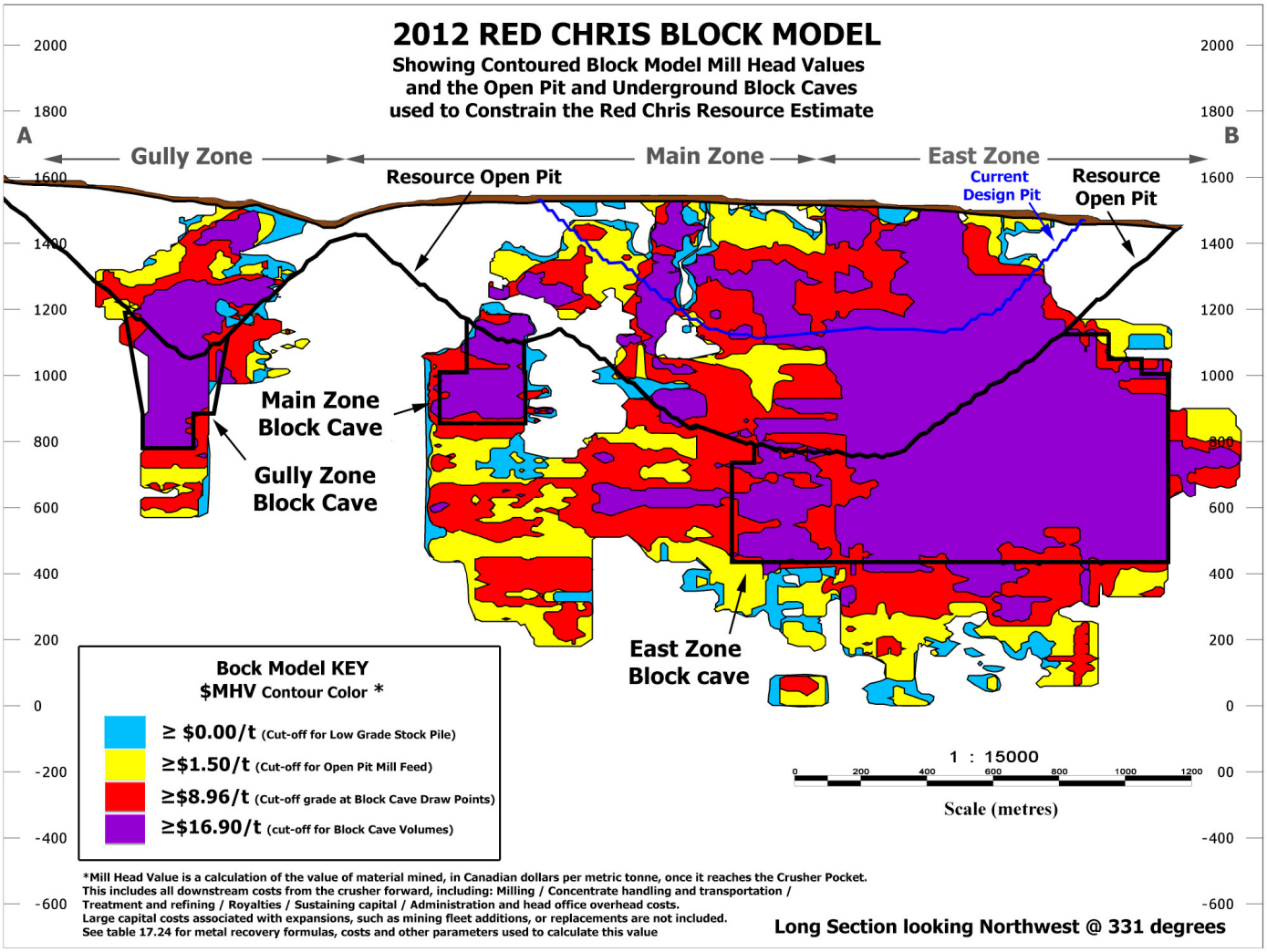

Fig. 7. Long section of for the **Red Chris** copper-gold mine. Section illustrates current pit design and possible pit extension and underground block cave areas. http://www.imperialmetals.com/our-operations-and-projects/operations/red-chris-mine/reserve-and-resource.

3.2. Industrial mineral mines and quarries

Several aggregate pits and quarries supplied mainly local construction requirements throughout the region and were not monitored by the author. Monitored projects include one new aggregate operation at **Swamp Point North**, one dimension stone basalt quarry, **Burning Daylight**. Several Jade quarries east of Dease Lake in the Turnagain River area and in the Cassiar area carried out seasonal mining activities (Table 2).

3.2.1. Swamp Point North

Highbank Resources Ltd. developed their tidewater accessible **Swamp Point North** aggregate mine and shipped their first 4,000 tonnes off site. Located on the east side of the Portland Canal and 51 km south of Stewart, the project site is positioned to supply ongoing and future construction projects around Prince Rupert. Aggregate is mined by excavator, crushed, washed and loaded onto barges by conveyor. Sand and gravel occur in horizons within a medial moraine.

3.2.2. Burning Daylight

Columnar basalt was mined approximately 35 km south of Houston at the **Burning Daylight** dimension stone quarry. Stone Ridge Quarries Limited mined approximately 700 tonnes of basalt columns. Processed product is marketed for architectural and landscaping uses.

3.2.3. Nephrite Jade

Several operators explored for placer nephrite jade and to a lesser degree, in-situ lenses at **Cassiar**, **Kutcho, Polar** and **Provencher Lake** areas. Within these areas, at least thirteen jade properties were active with varying degrees of exploration and mining activities. Production values were largely not available.

In one case, Pacific Bay Minerals Ltd. and joint venture partner reported 56.7 tonnes of jade from the around Wolverine Lake. Individual boulders varied in size from 0.18 to 10.3 tonnes. Nephrite Jade is found in sheared serpentinized ultramafic rocks in the Cache Creek and Slide Mountain terranes. Placer boulders and quarried stones are generally trucked to Vancouver and auctioned mainly to international markets.

4. Mine development projects

The mine development stage is achieved when a project receives the required permits and begins mine construction. The main permitting processes include provincial and federal environmental assessment certificates. For smaller (less than 75,000 tonnes per year) operations, a Mines Act permit and environmental Management Act permit. There were two mine development projects active in the Skeena Region in 2015 and include the **Brucejack** and **Silvertip** projects (Table 3). Permitted mine development projects, KSM, Kitsault, and Tulsequah Chief are described later in the proposed mine section as construction activities are not scheduled in the foreseeable future.

4.1. Metal mine development

4.1.1 Brucejack

Pretium Resources Inc. received an initial $540 M (US) tranche of construction financing for their underground, **Brucejack** high-grade gold project located 65 km north of Stewart. Provincial and Federal environmental assessment certificates were issued by the end of July and were followed by Mines Act and Environmental Management Act permits by September. A positive production decision was made and the company is aiming to achieve commercial production by 2017. The timeline of discovery of the Valley of the Kings Zone, reserve delineation and now construction has spanned approximately six years. Various aspects of site construction including access roads, camps and site infrastructure have been ongoing during the past four years and are now increasing capacity to host the required workforce and final mine-site layout (Fig. 8). The initial tranche of construction financing represents approximately 70% of the total forecasted capex of $747 M (US) detailed in their 2014 feasibility study. The Brucejack mine will consist of a 2,700 tonne per day mill and recover gold and silver via gravity and sulphide floatation circuits. Gold-silver dore will be produced on site.

Underground mine development and the balance of approximately 40,000 m of infill drilling will continue through the winter. Additional underground drilling throughout the year increased confidence in gold distribution of the first stopes scheduled to be mined. By the end of October, underground 2015 development totalled 1,573 m of lateral workings and

Table 2. Selected producing quarries, Skeena Region.

Mine	Operator	Commodity; deposit type; MINFILE	2015 Q1-Q3	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Comments
Burning Daylight	Stone Ridge Quarries Ltd.	Columnar basalt; dimension stone	700 t	n/a	n/a	Seasonal production
Swamp Point North	Highbank Resources Ltd.	Sand and gravel; medial moraine	4,000 t	n/a	71.7 Mt	Awaiting aggregate contracts around Prince Rupert

Table 3. Mine development projects, Skeena Region.

Project	Operator	Commodity; Deposit Type; MINFILE	Reserves (Proven + Probable)	Resource (Measured and Indicated)	Work Program	Comments
Brucejack	Pretium Resources Inc.	Au, Ag; Au-quartz veins; Quartz stockwork breccia; Epithermal; 104B 193	16.5 Mt at 14.1 g/t Au, 57.7 g/t Ag	15.3 Mt at 17.6 g/t Au, 14.3 g/t Ag	40,000 m underground infill drill program, 20,000 m surface exploration drill program, underground mine development: 1,573 m of lateral workings and 239 m of raise workings.	Mine construction underway; aiming for commercial production by 2017
Silvertip	JDS Silver	Ag, Pb, Zn, Au; Polymetallic manto; 104O 038	n/a	2.455 Mt at 315 g/t Ag, 5.88% Pb, 6.28% Zn, 0.413 g/t Au	Road reconditioning, pre-construction earthworks, mill and process plant acquisition	Fully permitted, construction dependant on financing

Fig. 8. Mine construction at Pretium Resources Inc.'s **Brucejack** gold project. Photo courtesy of Pretium Resources Inc.

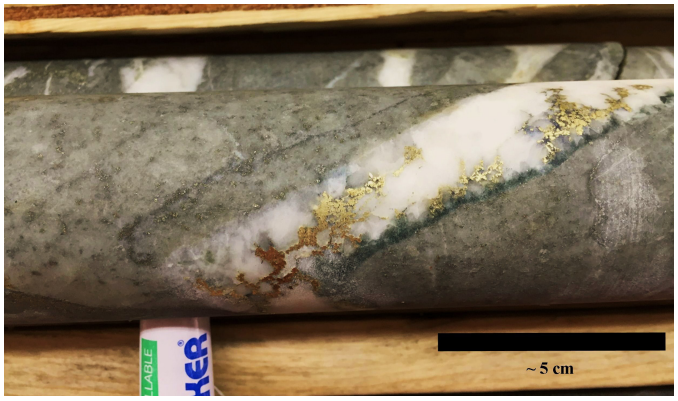

Fig. 9. Drillhole Su-666 intercepted 0.5 m grading 8,600 g/t gold at 1,267.7 metres depth under the Flow Dome zone located over 1 km away from known reserves at the Valley of the Kings zone. Photo courtesy of Pretium Resources Inc.

239 m of raise workings.

Nearly 20,000 m of surface exploration drilling in 38 holes focussed on nearby geological and geophysical targets including the Flow Dome, Kitchen View, Hanging Glacier, Nip and the Lookout zones. The Flow Dome prospect located over 1 km laterally from the Valley of the Kings zone, returned the most significant results including 0.5 m grading 8,600 g/t Au from drillhole Su-666 at 1267.45 m depth (Fig. 9).

At the Kitchen View zone, drilling intercepted a sheared massive sulphide unit and returned 4.5 m grading 2 g/t gold, 43.8 g/t silver and 0.09% copper. Follow up ground based geophysics is planned for 2016. Lower grade gold-silver mineralization was intercepted at the Lookout and the Hanging Glacier zones resulting in relative decreased follow up priorities.

The Brucejack deposit is a transitional epithermal gold silver occurrence hosted in stockwork veining located up stratigraphy from several large porphyrytic intrusions. Gold and silver mineralization occurs as coarse electrum in several generations of quartz-carbonate veins and vein breccias. Background vein-hosted mineralization also includes pyrite, sphalerite, galena, chalcopyrite, and pyargyrite.

4.1.2. Silvertip

JDS Silver received their Mines Act Permit in June to mill up to 75,000 tonnes per year from their underground **Silvertip,** silver-lead-zinc mine located approximately 190 km northeast of Atlin and 8 km south of the Yukon border. The company refurbished the access road into the project site from the Alaska Highway and purchased a used mill which is being stored 90 km away at Watson Lake. Re-assembly of the mill and mine site construction is planned upon completion of project financing.

Precious and base metal mineralization occur in massive sulphide and unconformably overlying exhalite zones, both hosted in carbonate and clastic sediments of the Cassiar terrane. A Late Cretaceous intrusion (~72 Ma, Nelson and Bradford, 1987) proximal to the Cassiar batholith, intrudes the

carbonate sequence nearby and is inferred to be related to the mineralizing fluids responsible for the manto-style massive sulphide replacement of the limestone; the exclusive focus of the project.

5. Proposed mines

The proposed mine (mine evaluation) stage involves all aspects pertaining to the planning of a profitable, environmentally and socially responsible mine operation. In general, this stage is achieved after successful completion of an advanced exploration program and delineation of a mineral resource. Key milestones include application for an Environmental Assessment certificate and/or a Section 10 permit which states that a project is reviewable by the Environmental Assessment Office (EAO); or the direct submission of a Mines Act permit application for smaller scale projects (milling rates less than 75,000 tonnes per year) not meeting the criteria for review by the EAO. The Skeena Region hosts nine proposed mine projects which are listed in (Table 4).

5.1. Proposed metal mines

5.1.1. KSM

Seabridge Gold Inc. continued to expand their fully permitted **KSM** copper-gold porphyry deposit and identify higher average grades than those for the presently defined 2.16 billion tonnes of Reserves. 2015 was the third successful year of testing deeper, higher grade cores of the Texas Creek intrusive suite hosting the Kerr, Sulphurets and Mitchell deposits. The KSM porphyry deposits are associated with the Mitchell intrusions of the Texas Creek plutonic suite. High level diorite to monzonite plugs and dikes intrude along the Sulphurets fault into the volcanic and sedimentary rocks of the Hazelton and Stuhini groups.

At the Deep Kerr deposit, nine holes tested the down-dip continuity of higher copper-gold grades for zones amenable to underground block-cave mining. Results indicate the west limb of the deposit extends over 450 m along strike and 400 m down dip and remains open. Highlight intercepts include 483 m (from 1,272 m to 1,755 m downhole) grading 0.43g/t gold and 0.56% copper in hole K-15-49 and 340 m (from 1,304 m to 1,644 m downhole) grading 0.53 g/t gold and 0.60% copper in hole K-15-49A. Future exploration efforts are being considered to be staged from an underground exploration adit, located near valley bottom elevation. An updated resource estimate for the Deep Kerr zone is expected in early 2016.

At the Mitchell deposit, two drillholes targeted the down plunge projection of the highest copper-gold grades centrally exposed at surface. Results returned up to 174.4 m averaging 0.55 g/t gold and 0.28% copper from 1,207.4-1381.8 m in hole M-15-130 and 167 m averaging 0.81 g/t gold and 0.25% copper from 1,190.5-1357.5 m in hole M-15-131. Drillholes were collared over 200 m apart and encountered magnetite-copper rich intervals located above the Mitchell Fault (and current reserves) including 191.5 m grading 0.14 g/t gold and 0.39% copper. This zone of mineralization has the potential to convert planned in-pit waste into a definable resource. Below the Mitchell fault, the broad zones of higher than average gold and copper grades correlate with abundant quartz veins and pervasive hydrothermal altered intrusive rock. Alteration assemblages grade from intense quartz-sericite-pyrite to chlorite-magnetite-potassium feldspar indicating increasing temperature with depth.

Activities included the successful evaluation of a new water treatment plant process to remove selenium; a key condition of the 2014 issued environmental assessment. Engineering studies continued to optimize mine designs with a particular focus on underground mining options which would likely have significant positive impacts to overall project economics. The current permitted project is forecast to have a 52 year mine life and expected to cost approximately $5.3 billion to construct.

5.1.2. Kitsault

The past producing **Kitsault** molybdenum-silver mine is fully permitted and requires project financing to start construction for a new mining operation. Alloycorp Mining Inc. completed pre construction earthworks for a new mill site (Fig. 10), upgraded the critical Nass River bridge and increased camp capacity to house several hundred construction workers. A front end engineering study completed in November detailed a re-designed process plant to support a 45,500 tonne-per-day throughput which will recover both molybdenum and silver. The study also forecasted an increase of pre-production costs now totalling $1.2 billion. The company has sourced approximately half of the capex from a syndicate of lending facilities including a life of mine off-take agreement with ThyssenKrupp.

The Kitsault deposit is hosted in the Eocene Lime Creek multi-phase intrusive complex which intrudes the Jurassic argillite and greywackes of the Bowser Group sediments. Molybdenite is hosted in aplite dikes and quartz-molybdenite stockwork.

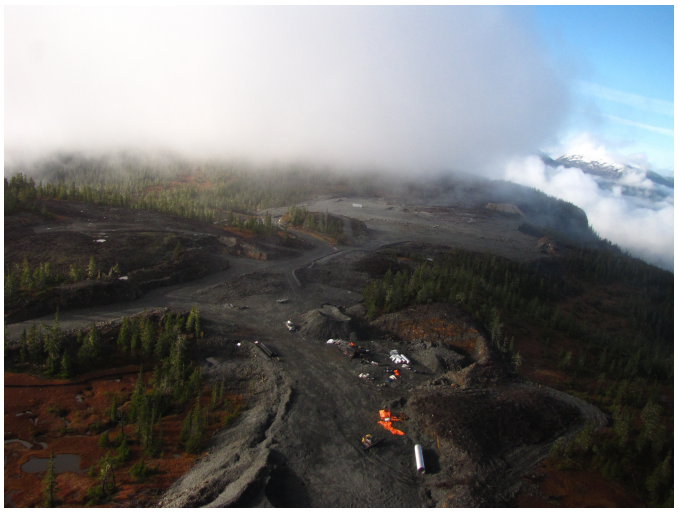

Fig. 10. Alloycorp Mining Ltd. completed pre construction earthworks for the planned mill site of their proposed Kitsault molybdenum-silver mine.

Table 4. Selected proposed mine and mine evaluation projects, Skeena Region.

Project	Operator	Commodity; deposit type; MINFILE	Reserves (Proven +Probable)	Resource (Measured and Indicated)	Work Program	Comments
Arctos	Fortune Minerals Limited	Anthracite coal; 104H 021	125 Mt	192.8 Mt	Baseline monitoring	Project sold to BC Rail with buy back rights in 10 years
Dome Mountain	Dome Mountain Resources of Canada Inc.	Au, Ag; Au-quartz veins; 093L 276	135,131 t at 11.2 g/t Au	144,144 t at 17.7 g/t Au	Corporate negotiations between Metal Mountain Resources Inc., Gavin Mines Inc. and Grace Mining Inc.; winter drill program preparation.	Awaiting Mines Act permit amendment to allow mill construction on site
Galore Creek	Galore Creek Mining Corp.	Cu, Au, Ag; Alkalic porphyry; 104G 090	528 Mt at 0.59% Cu, 0.32 g/t Au, 6.02 g/t Ag	814.7 Mt at 0.50% Cu, 0.31 g/t Au, 5.21 g/t Ag	Baseline monitoring	Targeted studies; minimizing expenditure
Kitsault	Alloycorp Mining Inc.	Mo, Ag; Porphyry Mo (Low F-type)	228.2 Mt at 0.083% Mo, 5.0 g/t Ag	321.8 Mt at 0.071% Mo, 4.8 g/t Ag	Pre-construction earthworks, Nass River Bridge upgrade, construction finance negotiations	Fully permitted, additional inferred Mo Resources at Bell and Roundy Creek deposits
KSM	Seabridge Gold Inc.	Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 103	2,164 Mt at 0.55 g/t Au, 0.21% Cu, 2.74 g/t Ag, 44.7 g/t Mo	2,779.9 Mt at 0.55 g/t Au, 0.21% Cu, 2.9 g/t Ag, 55 g/t Mo	11,018 m drilling in 11 holes at Deep Kerr and Mitchell deposits, 1,579 line km airborne geophysics	Fully permitted; investigating viability of underground exploration portal
Morrison	Pacific Booker Minerals Inc.	Cu, Au, Mo; Calc-alkalic porphyry; 93M 007	224.2 Mt at 0.33% Cu, 0.163 g/t Au, 40 g/t Mo	265.9 Mt at 0.35% Cu, 0.17 g/t Au, 50 g/t Mo	Re-submitted environmental assessment application	Ordered to undergo further assessment
Red Mountain	IDM Resources	Au, Ag; Porphyry-related gold; 103P 086	n/a	1.45 Mt at 8.15 g/t Au, 29.57 g/t Ag	Entered environmental assessment review	Initiated Feasibility study
Schaft Creek	Teck Resources Limited	Cu, Mo, Au, Ag Calc-alkalic porphyry; 104G 015	940.8 Mt at 0.27% Cu, 0.018% Mo, 0.019 g/t Au, 1.72 g/t Ag	1,228.5 at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag	Drilling at La Casse zone, optimization of mine plan	Limited targeted studies
Tulsequah Chief	Chieftain Metals Inc.	Au, Ag, Cu, Pb, Zn; Noranda/Kuroko massive sulphide; 104K 002	4.435 Mt at 2.85 g/t Au, 104 g/t Ag, 1.46% Cu, 1.29% Pb, 6.94% Zn	6.575 Mt at 2.82 g/t Au, 104.76 g/t Ag, 1.34% Cu, 1.33% Pb, 6.71% Zn	Construction financing negotiations	Fully permitted; substantially started (EA certification is valid for life of project)

5.1.3. Tulsequah Chief

Chieftain Metals Corp.'s **Tulsequah Chief** zinc-copper-gold Kuroko type massive sulphide project was deemed "substantially started" in early 2015 by the Minister of Environment for the Province of British Columbia. That means the environmental assessment certificate will remain in effect for the life of the project. The proposed mine is located 95 km south of Atlin and permitted for construction. A 2014 feasibility and optimization study reduced the pre-production expenditure to $198 million. Further optimization is ongoing as well as desktop review of exploration targets. The 30,547 hectare property hosts several targets surrounding known mine reserves and untested geophysical and geochemical anomalies.

The Tulsequah deposit is underlain by Devono-Mississippian to Permian volcanic arc rocks of the Stikine assemblage; the oldest and lowest stratigraphic assemblage of the Stikine terrane. The deposit consists of several stacked massive sulphide lenses within rhyolite flows and fragmental rocks which 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.

5.1.4. Red Mountain

IDM Mining Ltd. began the Environmental review process for their **Red Mountain** gold-silver project located 18 km east of Stewart. Their project description was submitted in August followed by initiation by the British Columbia government in November. Baseline environmental studies continued for the second year and were the only groundwork on the property completed by the company during 2015. Engineering studies continued to detail various aspects of the mine design as well as initiate a feasibility study in late 2015. An updated resource estimate will include drill results from 2014 as well as historic drilling data in order to upgrade resource confidence of the 141 zone. The proposed 1,000 tonne per day mine plans to operate on a seasonal basis during nine months of the year over a forecasted five year mine life. Anticipated capital expenditure is $97.4 million.

Gold mineralization occurs within stockwork pyrite veining associated with the youngest of three intrusive phases of the Hillside intrusive suite; the Hillside porphyry. Less mineralization is hosted in the later intrusive phases Goldslide porphyry and surrounding Upper Stuhini Group and Lower Hazelton Group sediments. Veins vary in widths from sub-millimetre scale to over 80 cm and can occur as breccia matrix-fill. Gold occurs as native gold, electrum and various gold telluride and sulphosalts (Rhys et al., 1995).

The British Columbia Geological Survey conducted preliminary field investigations in the area as part of future studies of the metallogeny of western Stikinia (Fig. 11).

Fig. 11. British Columbia Geological Survey staff in front of the Hillside intrusive suite hosting IDM Mining Ltd.'s **Red Mountain** gold deposit (photo looking northwest).

5.1.5. Dome Mountain

Metal Mountain Resources Inc. and subsidiary Gavin Mines Inc. partnered with Grace Mining Inc. to keep the **Dome Mountain** gold mine poised for construction upon receipt of an amended Mines Act Permit expected before 2016. The amendment will allow a 250 tonne per day mill to be constructed on site. Over the winter months, an infill drill program will aim to define additional inferred resources and extend the mine life to 7 years. Drilling targets include near-mine extensions of the Boulder vein as well as deeper drilling on the Argillite vein.

Gold-silver mineralization mainly occurs as electrum inclusions within pyrite that is hosted in quartz- carbonate veins that are in folded fragmental volcanic rocks of the Lower Hazelton Group. Veins occur within deformation zones typically less than 10 m thick which parallel penetrative foliation that is most pronounced at vein margins. Bleached vein alteration selvages of carbonate and sericite extend for several metres into the wall rock. Alteration intensity generally correlates with higher gold values.

5.1.6. Schaft Creek

Teck Resources Limited completed a comprehensive geological program at their 75% owned (25% Copper Fox Metals Inc.) **Schaft Creek** copper-molybdenum-gold-silver porphyry project located 135 km southeast of Dease Lake. The program included exploration drilling, re-logging, regional mapping and optimization studies on the 2013 feasibility study. Mineralization identified at the LaCasse zone during 2014 was followed up with 2,634 m of diamond drilling in five drillholes. Drilling tested the volcanic-intrusive contact with the Discovery zone and depth extension of surface mineralization. Results returned broad low grade copper values in hydrothermal and intrusive breccias containing disseminated and vein concordant chalcopyrite and bornite within granodiorite and quartz monzonite. The longest intercept was 182 m grading 0.20% copper from drillhole SCK-15-444. In addition, nearly 12,000 m of historic drill core was re-logged so that it can be incorporated into a revised geologic model and aid overall optimization of the Liard and Paramount resource areas. Regional mapping around the deposit was conducted to identify additional targets and gain a better understanding of district scale metallogeny of the Hickman batholith and Stuhini Group volcanic rocks. Investigations during the past two field seasons have included studies up to 40 km away, including the **Galore Creek** alkalic copper-gold porphyry deposit also partially owned by Teck. Work at the Galore Creek project, which is 50% owned by Novagold Resources Inc., was limited to baseline monitoring and targeted engineering studies.

5.1.7. Morrison

Pacific Booker Minerals Inc.'s **Morrison** copper-gold-molybdenum-silver porphyry project resumed the Environmental Assessment process in June after being halted to incorporate recommendations of the panel report on the causes of the Mount Polley mine tailings dam breach. One month later, a letter from the British Columbia Minister of Environment and Minister of Energy and Mines stated that concerns still remained surrounding the fundamental aspects of the project design and level of certainty that mitigation measures will succeed as modelled. The project is now undergoing further review of several project components including mine design

alternatives.

The Morrison deposit is hosted in a biotite-feldspar-porphyry; part of the Eocene Babine Intrusions which cut the Late Jurassic Bowser group sediments. The semi-circular plug bifurcates and diffuses into dikes of variable width trending roughly parallel to the regional north-northwest structural fabric.

6. Exploration activities and highlights

Thirty selected 2015 exploration stage projects in the Skeena Region are summarized (Table 5). Eight (28%) grassroots projects, eleven (38%) early stage projects and twelve (34%) advanced stage projects. Targets varied between porphyry copper–gold ±molybdenum (18 projects) gold ±silver bearing stockwork veins and breccias (10 projects) and volcanogenic massive sulphide deposits (3 projects). Exploration stage activities undertaken by more advanced projects are reported in previous sections of this report.

6.1. Precious metal projects

6.1.1. Premier

Ascot Resources Ltd. explored for a high grade gold deposit near the past producing **Premier** mine, approximately 13 km north of Stewart. Two company owned diamond drills completed 40,892 m in 198 holes aiming to define a 43-101 compliant resource to support selective high-grade underground mining. Results returned several intercepts grading between 250 and greater than 1,000 g/t gold over 0.9-1.0 m. Broader high grade gold zones were also intercepted, in particular at the Lunchroom subzone where hole P15-914 returned 14 m averaging 113.53 g/t gold. A revised option agreement with Boliden Group extends terms and timelines for Ascot to keep developing the project. New terms of the agreement include partial payment of $13 M by the start of 2016 and the remaining balance to be fully paid by the end of June, 2017.

Gold occurs in quartz veins and silicified breccias (Fig. 12) spatially associated with porphyritic dykes hosted in Lower Hazelton volcanic rocks. Aldrick (1993) interprets the dykes to radiate from a parasitic vent on the flank of a major strata volcano centred near the **Dilworth**, **Big Missouri** and **Martha Ellen** deposits.

Approximately 25 km north, American Creek Resources Ltd. conducted an eight drill-hole program at the past producing **Electrum** gold property. The company targeted approximately 309 m of drilling at structures proven to host high-grade gold at surface and previously mined by hand. Drill results are pending.

6.1.2. Spectrum

Skeena Resources Limited completed an aggressive exploration program at their **Spectrum** gold project (Fig. 13) located 34 km southwest of Iskut. A total of 17,350 m of drilling in 61 holes was carried out. Results are expected to define a maiden resource estimate planned for release in early 2016. Geological mapping, prospecting and sampling complimented the program and resulted in several new showings. Gold occurs in steeply dipping quartz-breccia zones roughly parallel to the contact of a north trending monzonite intrusion hosted in Stuhini Group greywacke and tuff. Highlight results include two m grading 75.5 g/t gold and 8.5 g/t silver. Porphyry-style mineralization is also present and returns copper grades up to 0.93%, 7.95 g/t gold and 35.5 g/t silver over 7 m; part of a broader, 209 m intercept grading 1.22 g/t gold, 4.8 g/t silver and 0.17% copper from drillhole S15-014. Mineralization occurs in pyrite and minor electrum. Bench scale metallurgical tests indicate several viable options for processing including, floatation, cyanide leaching and gravity. The company also acquired the nearby **GJ** copper-gold project in November which adds a defined mineral resource to their inventory as well as contiguous mineral tenures to highway 37.

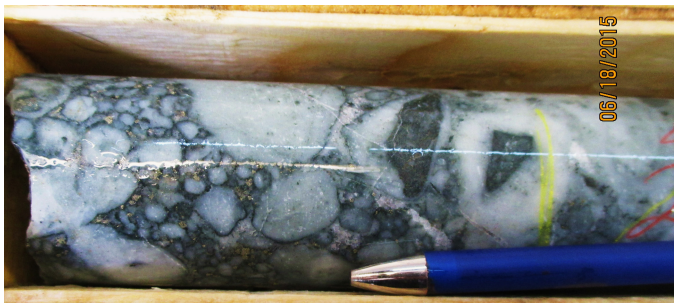

Fig. 12. Silicified breccia zone with interstitial, blebby auriferous pyrite intersected in drilling at Ascot Resources Ltd.'s **Premier** gold project.

Fig. 13. Skeena Resources Limited completed 17,350 m of drilling in 61 holes at the **Spectrum** gold project (foreground) and acquired the **GJ** copper-gold porphyry (background ridge). The expanded mineral claim package now exceeds 41 km^2.

6.1.3. Hearts Peaks

Colorado Resources Ltd. partnered with Centerra Gold Inc. and conducted a late season exploration program at the **Hearts Peaks** gold prospect located 120 km west of Dease Lake. The fall program completed collection of over 400 combined rock, silt and soil samples, 46 km^2 of drone aerial photography, 13 line km of IP geophysics and 70 km^2 of geological mapping.

Table 5. Selected exploration projects, Skeena Region.

Project	Operator	MINFILE	Commodity; Deposit type	Resource (tonnes)	Work Program 2015
Ball Creek	Evrim Resources Corp.	104G 072	Cu, Au, Mo; Porphyry	n/a	Geological mapping, rock sampling
Berg	Berg Metals Limited Partnership	093E 046	Cu, Mo; Porphyry	Measure + Indicated: 506 Mt at 0.30% Cu, 0.037% Mo, 3.8 g/t Ag	Geological mapping, rock (92), soil (46) and silt (1,763) sampling
Big Bulk	LCT Holdings Inc.	103P 291	Au, Cu; Subvolcanic	n/a	Geological mapping, rock sampling, channel sampling, petrography
Boer	KGE Management Ltd	093K 114	Cu, Mo; Porphyry	n/a	Soil sampling, prospecting
Bow	Decade Resources Ltd.	104B 132	Au, Ag; Intrusion-related pyrrhotite veins	n/a	Trenching, prospecting
Dolly Varden	Dolly Varden Silver Corporation	103P 188	Ag, Zn, Pb, Au; Noranda/Kuroko massive sulphide	Indicated: 3.07 Mt at 321.6 g/t Ag; Inferred: 898,500 t at 373.3 g/t Ag	Diamond drilling (2,037 m in 10 holes), mapping, prospecting, rock (264) & soil (1,728) sampling
Eaglehead	Carmax Explorations Ltd.	104I 008	Cu, Mo; Porphyry	Inferred: 102.5 Mt at 0.29% Cu, 0.01% Mo, 0.08 g/t Au	Diamond drilling, (2 holes, 1183 m), re-logging
Electrum	American Creek Resources Ltd.	104B 033	Au, Ag; Stockwork quartz veins	n/a	Diamond drilling (309 m, 8 holes), rock (100) sampling
Fenton Creek	Similco Mines Ltd.	093L 248	Au, Ag, Zn, Pb; Epithermal related	n/a	Geology, geophysics, geochemistry
GJ	Skeena Resources Limited	104G 034	Cu, Au; Porphyry	Measured + Indicated: 153.3 Mt at 0.321% Cu, 0.369 g/t Au; Inferred: 23 Mt at 0.26% Cu, 0.310 g/t Au	Corporate, change of ownership
Grizzly	Garibaldi Resources Inc.	104J 063	Au, Cu; Porphyry		Diamond drilling (1,000 m, 5 holes), prospecting, geological mapping, geophysics (IP)
Hanson Lake	Stone Ridge Exploration Corp.	093K 078	Cu, Mo; Porphyry		Geology, geochemistry, auger drilling
Hat	Doubleview Capital Corp.	104J 021	Au, Cu; Porphyry		Diamond drilling, geology, geochemistry
Heart Peaks	Colorado Resources Ltd	104K 084	Au; Epithermal high sulphidation		Rock , soil, silt sampling, geological mapping, 13 line km IP, drone photography
Homestake Ridge	Homestake Resource Corporation	103P 216	Au, Ag; Intrusion-related pyrrhotite veins	Indicated: 604,000 t at 6.4 g/t Au, 48.3 g/t Ag, 0.18% Cu; Inferred: 6.76 Mt at 402 g/t Au, 93.6 g/t Ag, 0.11% Cu	Optioned to Banks Island Gold Corp.

Table 5. Continued.

Johnny Mountain	Snip Gold Corporation	104 B 107	Au, Ag; Intrusion-related pyrrhotite veins	24,000 t at 11.3 g/t Au, 22 g/t Ag, 0.23% Cu	14.7 line km of ground VLFEM geophysics targeting near mine extensions and the McFadden float zone source
King	Ram Explorations Ltd	104B 338	Au; Stockwork quartz veins		Prospecting, rock sampling
KSP	Colorado Resources Ltd.	104B 116	Au, Cu; Porphyry		Channel sampling, geological mapping
New Polaris	Canarc Resource Corp.	104K 003	Au, Ag; Shear hosted quartz veins	Measured + Indicated: 1.67 Mt at 10.62 g/t Au; Inferred: 2.06 Mt at 10.5 g/t Au	Metallurgical testing
Newmont Lake	Romios Gold Resources Inc.	104B 335	Cu, Au, Ag, Zn; Porphyry, Intrusion-related skarn	n/a	Burgundy Ridge zone, Rock chip sampling, prospecting, geological mapping
North ROK	Colorado Resources Ltd.	104H 035	Cu, Au; Porphyry	Inferred: 142.3 Mt at 0.22% Cu, 0.26 g/t Au	Corporate
Ootsa	Gold Reach Resources Ltd.	093E 105	Cu, Au, Mo, Ag; Porphyry	153.97 Mt at 0.21% Cu, 0.11 g/t Au, 0.016% Mo, 1.89 g/t Ag; Inferred: 223,570,000 @ 0.18% Cu, 0.075 g/t Au, 0.021% Mo, 1.8 g/t Ag	Initiated PEA; prospecting, soil sampling
Premier	Ascot Resources Ltd.	104B 054	Au, Ag; Stockwork quartz veins and breccia	n/a	Diamond drilling (40,892 m drilling in 198 holes), geology, geochemistry; evaluation high grade underground mining
Pyramid	Ore Vista		Au, Cu; Porphyry	n/a	Geology, rock and soil sampling, prospecting, geophysics (IP)
Scotia	Glenmark Capital Corp.	103I 007	Zn, Pb, Ag, Au; Noranda/Kuroko massive sulphide	Measured + Indicated: 802,000 t at 4.9% Zn, 13.9 g/t Ag, 0.2 g/t Au; Inferred: 702,000 t at 4.5% Zn, 13.7 g/t Ag, 0.2 g/t Au	Drilling, rock sampling
South Grizz	Divitae Resources Ltd.	104J 059	Cu, Au; Porphyry	n/a	Prospecting
Spectrum	Skeena Resources Limited	104G 036	Au, Cu; Stockwork quartz veins; Porphyry	n/a	Diamond drilling (17,350 m in 61 holes), mapping, prospecting, rock (387) and soil (2,992) sampling
Star	Prosper Gold Corp.	104J 035	Cu, Au; Porphyry	n/a	Prospecting, soil sampling
Tanzilla	Kaizen Discovery Inc.	104I 023	Cu, Mo, Au; High sulphidation epithermal; Porphyry	n/a	Diamond drilling, mapping
Thorn	Brixton Metals Corp	104K 031	Ag, Au, Cu; Subvolcanic; Porphyry	Inferred: 7.4 Mt at 35.54 g/t Ag, 0.51 g/t Au, 0.13% Cu, .0.32% Pb, 0.59% Zn	Corporate; targeted studies

Results indicate gold mineralization correlates with a two km, northwest trending corridor and a four km, north trending corridor. Several zones within the mineralized trends returned high grade gold values over 151 g/t gold and 195 g/t silver from the Midas zone.

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

6.2.1. Stikine terrane

Porphyry copper projects include copper-gold and copper-molybdenum prospects and are hosted almost entirely within the geographic footprint of the Stikine terrane. The Stikine Arch hosts most of the copper-gold deposits and includes the **Red Chris** mine, **Galore Creek** and **Schaft Creek** deposits. These Mid-Triassic to Early Jurassic intrusions are related to the Stuhini and Hazelton Group volcanic arcs which define the two younger assemblages of pre-accretionary Stikine terrane architecture.

Copper-molybdenum deposits such as the **Huckleberry** mine and **Morrison** deposit are located within the geographic footprint of the Stikine terrane, however they are related to post accretionary intrusive suites occurring along the northeast trending fault network separating the Bowser and Netchako basins; named, the Skeena Arch.

Exploration activity continued with some interruptions from protests in the Sheslay area located approximately 100 km west of Dease Lake. Doubleview Capital Corp. resumed drilling in early July at their **Hat** copper-gold project and was blockaded and forced to stop activity soon after. Drilling resumed over the fall months to test extensions of the Lisle zone. Garibaldi Resources Corp. completed the first drill program on the **Grizzly** property totalling five holes and approximately 1,000 m. Assay results are pending. However, similar mineralogical features to surrounding gold-copper bearing prospects have been reported. Limited prospecting and soil sampling were completed at the nearby **South Grizz** property by Divitae Resources Ltd., and at the **Star** property by Prosper Gold Corp.

Kaizen Discovery and joint venture partner Freeport McMoRan of Canada Limited continued to explore the **Tanzilla** prospect located 23 km southeast of Dease Lake. Drilling followed up 2014 results and further validated the presence of a multi-phase porphyry system beneath the seven kilometre hydrothermal alteration footprint (Fig. 14). Three drillholes totalled 1,877 m and tested three different high chargeability anomalies. The most significant results were returned from hole TZ15-01 where the top 288 m intercepted an advanced argillic and phyllic altered lithocap overlying a suite of high-level, variably altered diorite porphyries and hydrothermal breccias to the end of hole at 840 m. The intrusive suite contained widespread quartz-sulphide-chlorite and anhydrite / gypsum veining including 20 m of dense stockworks with minor bornite and chalcopyrite. Metal values were elevated over hundreds of metres in both the lithocap and porphyry bodies but were overall, sub-economic. However, much of the alteration system remains to be drill tested.

Colorado Resources Ltd. continued exploring their 33,593 hectare **KSP** property located approximately 85 km northwest of Stewart and 12 km from road access at the Altagas McLymont power project. Follow up prospecting from 2014 work conducted by the company and the BCGS, led workers to discover abundant quartz-magnetite-pyrite-chalcopyrite stockwork veins (Fig. 15) hosted in monzodiorite in a recently deglaciated cirque; now termed the Never Give Up (NGU) porphyry. One metre channel samples results returned up to 0.93% Cu and 0.28 g/t Au. The NGU showing is less than 2 km from the Pins prospect which includes a 2 x 3 km alteration footprint partially masked by recent volcanic air-fall vitric tuff. In addition, ~6.5 km to the northwest, Colorado validated and expanded the Tami prospect with geological mapping, channel sampling, prospecting and a ground magnetometer survey. Channel sample results returned 15 m grading 2.94 g/t Au and 0.51% Cu (Fig. 16). A substantial follow up program is planned

Fig. 14. The advanced argillic and phyllic altered lithocap of the **Tanzilla** prospect that was tested with 3 drillholes by Kaizen Discovery and Freeport-McMoRan of Canada Limited.

Fig. 15. Discovery outcrop of the Never Give Up porphyry; quartz-magnetite-pyrite-chalcopyrite stockwork veins cutting pyritic monzodiorite discovered on the **KSP** project area owned by Colorado Resources Ltd. and joint venture partner Snip Gold Corporation.

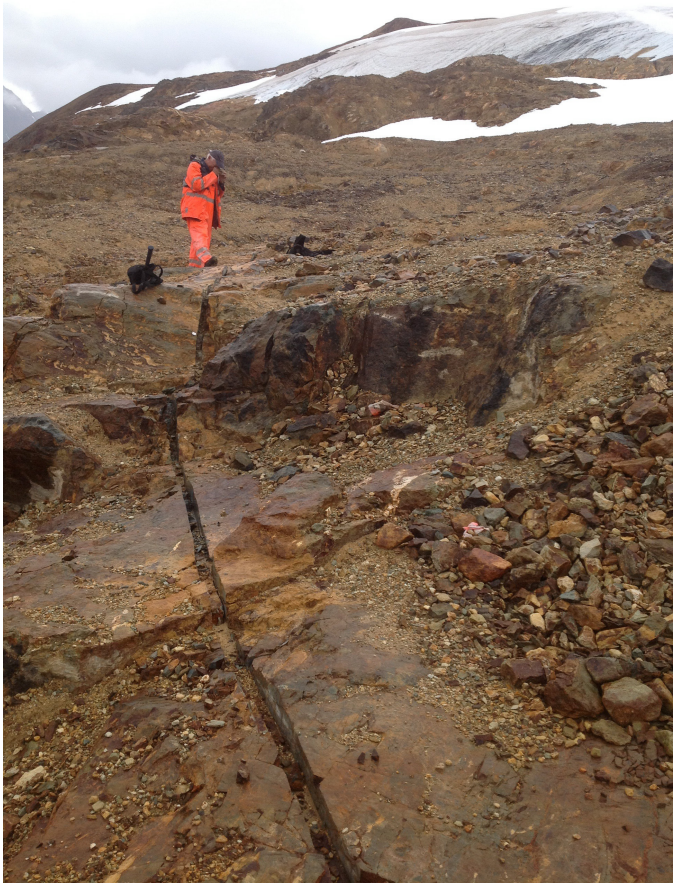

Fig. 16. Channel sampling by Colorado Resources Ltd. on the **KSP** project near the Tami showing which returned 15 m grading 2.94 g/t Au and 0.51% Cu.

for 2016 to meet option commitments with joint-venture partner Snip Gold Corporation.

On adjoining claims to the north, Snip Gold Corporation completed 14.7 line km of very-low-frequency electromagnetic ground surveys near the historic **Johnny Mountain** mine. The source of high-grade gold boulders in the McFadden zone is a target of interest. Interpretations and hand sample assay results are pending.

In September, Gold Reach Resources Ltd. commenced a Preliminary Economic Assessment of their **Ootsa** copper-gold molybdenum-silver project located 6 km southeast of the producing Huckleberry copper mine. Ground activities during 2015 were limited to prospecting, soil sampling, and environmental baseline monitoring. Several prospects acquired in 2014 remain to be investigated on the 67,937 hectare property.

The Ootsa project contains two main mineral resource areas: The Ox and Seel deposits which are further subdivided into east and west zones. Copper, gold, molybdenum and silver mineralization are related to the Late Cretaceous Bulkley Intrusive suite.

Berg Metals Limited Partnership, a wholly owned subsidiary of Thompson Creek Metals Company Inc., conducted property scale reconnaissance on the **Berg** copper-molybdenum-silver porphyry project located 84 km southwest of Houston. Ground crews completed geological mapping, rock, soil and silt sampling across eight zones outside of the main Berg deposit.

North of Fraser Lake, on the border of the Skeena and Omineca regions, Stone Ridge Exploration Corp. undertook a 45-hole auger drilling program at the **Hanson** property to explore for porphyry copper-molybdenum mineralization beneath glacial till and sandy alluvium cover. The area of drilling is underlain by the Hanson Lake (Early Cretaceous) phase of the Endako batholith and features an enclosed aeromagnetic low anomaly coincident with a moderate-strong airborne ZTEM conductivity anomaly.

6.2.2. Quesnel terrane

The **Eaglehead** project is owned by Copper Fox Metals Inc. and Carmax Mining Corp. and is located 52 km east of Dease Lake. Efforts were focussed mainly at the Pass zone located northwest of the Bornite and East zone mineral resource areas. The 2015 work program included two exploration drillholes and re-logging of nine historic drillholes. Drilling totalled 1,182 m and targeted Titan-24 high chargeability anomalies. Copper-molybdenum-gold and silver mineralization at the Pass zone occur within strong potassic and phyillic altered intermediate intrusive rocks.

Grassroots exploration at the **Pyramid** prospect expanded copper-gold anomalies for the third consecutive year. Gold Jubilee Capital Corp. analysed over 400 combined rock and soil samples and extended a Volterra-3D IP geophysics survey at the MT and Central zones. The project area is underlain by a multi-phase intrusive complex ranging from ultramafic pyroxinites? to megacrystic diorite and equigranular quartz diorite (Fig. 17). Pervasive, weak to moderate epidote-chlorite-magnetite alteration extends across the property. Disseminated

Fig. 17. Boulder illustrating the contact between mega-crystic diorite and equigranular quartz diorite with interstitial blebby disseminated magnetite, pyrite and trace chalcopyrite at Gold Jubilee Capital Corp.'s **Pyramid** prospect.

chalcopyrite occurs in zones quartz stockwork veining within the equigranular diorite intrusive phase. Copper-gold-silver grades appear to correlate with higher silica concentrations and pyrite.

6.3. Polymetallic base and precious metal projects

In August, Dolly Varden Silver Corporation delivered a maiden mineral Resource estimate for the **Dolly Varden** silver project located approximately 140 km northwest of Terrace. The project area encompasses several past producing mines and mineral occurrences which were explored in two phases of exploration during 2015. Phase one consisted of extensive groundwork and included geological mapping, prospecting, lithogeochemical rock sampling and soil sampling. Data acquired during phase one helped define drill targets for the second phase. Drilling totalled 2,037 m in ten diamond-drill holes. Three holes targeted the VMS prospective Trout Horizon at the Ace-Galena showing, MINFILE 103P 208 (Fig. 18). All holes intercepted stratiform silver-lead-zinc mineralization. Best results include 3.15 m grading 591 g/t silver from drillhole DV15019 from 46.35 m depth. Three drillholes followed up 2014 results at the Kitsol vein and returned up to seven metres grading 21.6 g/t silver and 0.16% zinc. One drillhole tested a multi-element geochemistry anomaly along a geological contact between volcanic and sedimentary rocks but failed to return significant results.

The Dolly Varden area is underlain by Upper Triassic Stuhini Group sediments and Lower Jurassic Hazelton Group volcanic rocks. High-grade silver and base metals occur in massive sulphide horizons and as meso-epithermal veins.

To the northwest, adjoining mineral claims are held by Homestake Resource Corporation and have been optioned to Banks Island Gold Ltd. Preliminary investigations are underway to evaluate small-scale mining at the **Homestake** deposit and transport mined material by barge to the mill established at the Yellow Giant gold mine on Banks Island.

Grassroots exploration at the **Big Bulk** gold-copper prospect (Fig. 19) included extensive channel sampling, geological mapping and drone orthophotography. A private company, LCT Holdings Inc. acquired the 26 km^2 property in early 2015 and is exploring the high level intrusive complex as well as following up high-grade gold at surface discovered in 2003. Big Bulk is centrally located within the surrounding 625 km^2 **Kinskuch** project area located approximately 130 km northwest of Terrace.

Fig. 18. Hand sample of massive sulphide from the Ace-Galena showing of Dolly Varden Silver Corporation's **Dolly Varden Silver** project. Photo courtesy of Chris Sebert, Dolly Varden Silver Corporation.

Fig. 19. Looking northeast over Kinskuch Lake and LCT Holdings Inc.'s **Big Bulk** gold project.

Between Terrace and Smithers, prospecting activities identified several unmapped intrusions. Quartz vein hosted, polymetallic, copper-gold-silver-lead-zinc mineralization was identified along with epidote-magnetite-chlorite altered diorite. Bedrock exposure in moderate to steep terrane has improved due to recent logging activity.

7. Coal projects

7.1. Bowser Basin

The Bowser Basin contains the Middle Jurassic to Lower Cretaceous Bowser Lake Group sedimentary sequence located between the Stikine Arch and Skeena Arch and contains significant anthracite coal deposits in the Groundhog-Klappan Coalfield.

Fortune Minerals Limited and joint venture partner POSCO Canada Limited sold the 61 coal licences containing the **Arctos** anthracite project to the Province of British Columbia and The British Columbia Railway Company. Both joint venture partners have exclusive rights to re-purchase the licenses for the same price after 10 years. The agreement allows time for the Province and the Tahltan First Nation to resolve complex issues surrounding the area.

8. Current research

Geological research in the region was completed by the British Columbia Geological Survey, Geological Survey of Canada and Geoscience BC. Focus areas included Sheslay, Tanzilla, King Mountain, Kinskutch Lake, the western Skeena Arch and the Nechako Plateau.

8.1. British Columbia Geological Survey (BCGS)

van Straaten and Nelson (2016) examined an unusual late Early to Middle Jurassic volcano-sedimentary succession (newly named Horn Mountain Formation) exposed on the northeastern margin of Stikinia, approximately 25 km southeast of Dease Lake. The volcano-sedimentary sequence is host to several early-stage mineral exploration projects, including the **Tanzilla** porphyry system.

Investigations included lithogeochemical, and geochronological studies as well as a revised regional structural interpretation. Results indicate volcanic rocks and related subvolcanic intrusions are quartz deficient, K-feldspar-rich and alkaline in composition. A U-Pb zircon age of 174 Ma is reported for the calc-alkaline plagioclase porphyry associated with the **Tanzilla** system. A Re-Os analysis of molybdenite mineralization age is pending (van Straaten and Nelson, 2016).

The alkaline Horn Mountain Formation, calcalkaline Tanzilla intrusions, and nearby Three Sisters Plutonic suite and Snowdrift Creek Pluton are interpreted to have formed due to remelting of subduction-modified lithosphere during Stikine-Quesnel arc-arc collision (van Straaten and Nelson, 2016). The protracted late Early to early Late Jurassic syncollisional magmatic event represents a potential new metallogenic epoch for the Canadian Cordillera and is prospective for calc-alkalic to alkalic porphyry- and epithermal-style mineralization.

8.2. British Columbia Geological Survey and Geological Survey of Canada (GEM-2)

The geomapping for Energy and Minerals II program (GEM-2) supported British Columbia Geological Survey and Geological Survey of Canada collaborative Porphyry Transitions and Cache Creek projects. The Porphyry Transitions activity aims to modernize the Triassic and Jurassic magmatic and sedimentary framework of northwestern Stikinia through regional framework mapping. This year, Porphyry Transitions activity supported regional mapping in the Inklin River area, detailed mapping of ultramafic volcanic rocks around the Hickman batholith and reconnaissance sampling of plutonic suites in the Tatsamenie Lake areas (Zagorevski et al., 2015a; Milidragovic et al., 2016). The Cache Creek activity aims to improve the understanding of the tectonostratigraphy of the northern Cache Creek terrane through framework mapping, This year, the Cache Creek activity supported detailed mapping in the Letain Creek, Menatatuline Range, Peridotite Peak and Atlin areas (Zagorevski et al., 2015b).

8.3. Geoscience BC

Geoscience BC launched their $2.4 million multi-year Search project in September 2015 to help explorers to focus their efforts in west central British Columbia. By November 2015, a 6,700 square kilometre airborne magnetic survey between Terrace, Kitimat and Smithers was completed at a 250 metre line spacing providing new, detailed data. The magnetic survey data will be released to the public in early 2016, and planning is underway for 2016 activities which will include more airborne surveying, community outreach and possible fieldwork.

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