

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

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Recommended citation: Jago, C.P., 2015. Exploration and mining in the Omineca and Northeast regions, British Columbia. In: Exploration and Mining in British Columbia, 2014. British Columbia Ministry of Energy and Mines, British Columbia Geological Survey, Information Circular 2015-2, pp. 1-27.

1. Introduction

The Omineca Region is prospective for metals including niobium, rare-earth elements (REE), molybdenum, nickel, copper, zinc, lead, silver and gold, whereas coal is of primary focus in the Northeast Region (Fig. 1).

The main deposit types explored for in the Omineca region (Figs. 1, 2) were epithermal gold-silver (Nechako Plateau), porphyry copper-gold (Nechako Plateau, Quesnel Trough and Toodoggone area) and stratiform zinc-lead-silver (Kechika Trough). Total exploration expenditure in 2014 is estimated at \$42 million (Fig. 3), mainly from mine evaluation-stage and advanced-stage projects, about 59% less than in 2013 (Fig. 4). At 42,000 m, drilling was 48% less than in 2013 (Fig. 5). In 2014,

- ramp-up activities continued at the **Mt. Milligan** mine (Thompson Creek Metals Company Inc.)
- a final feasibility study was released for **Blackwater** (New Gold Inc.), and pre-feasibility study completed for **Aley** (Taseko Mines Limited)
- an Environmental Assessment Certificate application was submitted for **Blackwater**, and Project Descriptions (initiating the environmental assessment process) were submitted for **Kemess Underground** (AuRico Gold Inc.) and **Aley**
- updated resource estimates were provided for **Capoose** (New Gold Inc.), **3Ts** (Independence Gold Corp.), **Aley**, and **Blackwater**
- drilling programs were undertaken for porphyry copper-gold at **Kemess East** (AuRico Gold Inc.), **Col-Later** (Pacific Empire Minerals Corp.), **Blackwater South** and **Key** (New Gold Inc.); low-sulfidation epithermal or vein gold-silver at **Fawn** and **Van Tine** (New Gold Inc.), **3Ts** (Independence Gold Corp.) and **Green Gold** (0902744 B.C. Ltd.); SEDEX zinc-lead-silver at **Akie** (Canada Zinc Metals Corp.), and **Cirque** (Teck Resources Limited); and high-purity limestone at **Giscome** (Graymont Western Canada Inc.).

About 18% of the province's coal production comes from the Peace River Coalfield in the Northeast Region (Figs. 1, 6). Metallurgical coal has been British Columbia's biggest mineral export commodity in recent years, representing about

46% of mineral production in 2014. The low-ash, low-sulphur bituminous coal in the region is internationally recognized for producing high-quality coke, a key ingredient in steel making. In concert with international oversupply and price decreases, coal production and exploration decreased in 2014. Total exploration expenditure was \$50 million (Fig. 3), mainly from mine evaluation-stage and advanced-stage projects, a 39% drop from 2013 (Fig. 4). Drilling (25,500 m) decreased 53% from 2013 levels (Fig. 5). In 2014,

- the second component of the Mines Act Permit Amendment was granted for the **Roman Mountain** expansion, fully permitting the combined **Trend-Roman** operation (Anglo American plc)
- the final two permit requirements for the **Quintette (Babcock)** mine (Teck Coal Limited) were granted, fully permitting the proposed mine
- the decline at **Murray River** (HD Mining International Ltd.) was driven beyond 740 m, proceeding toward the length for collecting a bulk sample
- feasibility-level exploration work began at **Sukunka** (Glencore)
- drilling programs were undertaken at **EB** and **Hermann** (Walter Energy, Inc.), **Roman Mountain**, **Roman Northwest**, and **Waterfall** (Anglo American plc), **Sukunka** (Glencore), and **Dunlevy** (Jameson Resources Limited)
- trenching and bulk sampling continued at **Wapiti East** (Fertoz International Inc.) and a small mine application was submitted.

Ridley Terminals Inc., the main port servicing the Peace River Coalfield, continued its Capacity Realization Project, which aims to double the annual terminal capacity to 24 Mt. However, by mid-year the project was curtailed pending recovery of the coal market. As of September 30, outlay for the project was \$15.1 million.

2. Geological overview

The Omineca-Northeast region is underlain by: cratonic basement rocks of ancestral North America (Laurentia); Neoproterozoic and Paleozoic sedimentary and carbonate successions deposited on the western flank of ancestral North

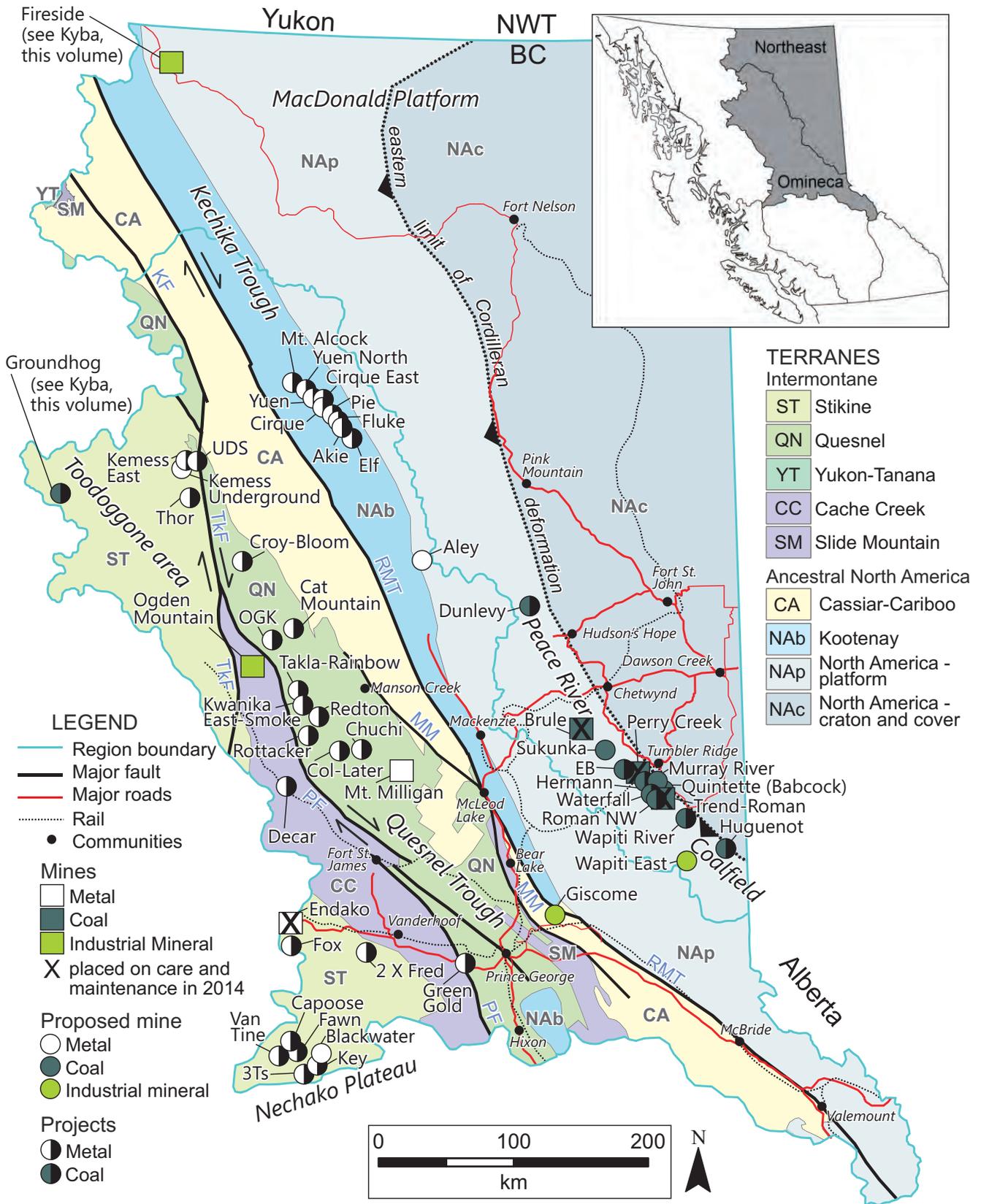


Fig. 1. Mines and selected exploration projects, Omineca and Northeast regions, 2014. Terranes from Nelson et al. (2013). Fault abbreviations: KF = Kechika fault, MM = Manson-McLeod fault system, PF = Pinchi fault, RMT = Rocky Mountain trench, TkF = Takla-Finlay-Ingenika fault system.

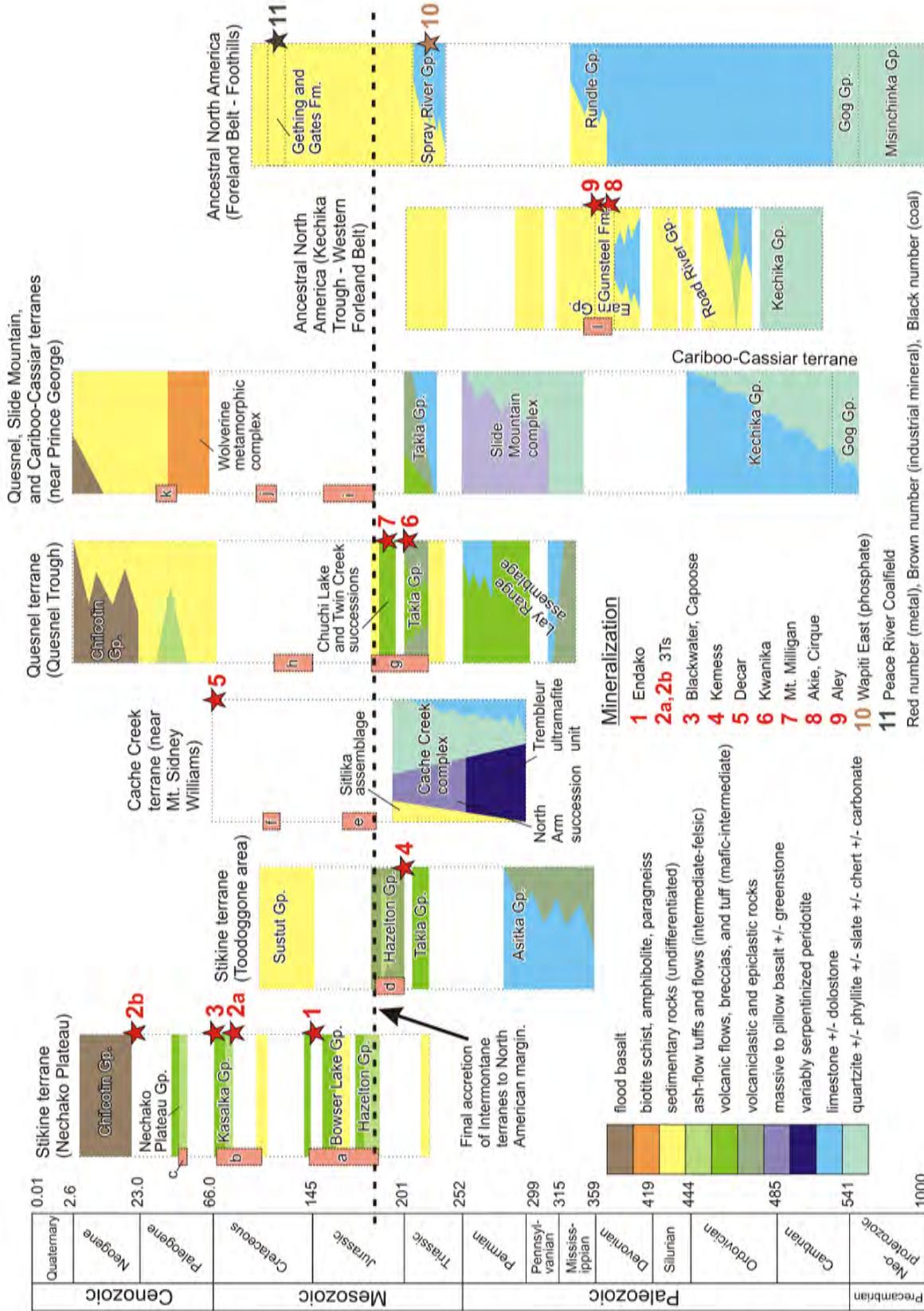


Fig. 2. Generalized stratigraphy, Omineca and Northeast regions. Selected intrusive rocks: a) Endako batholith and Laidman batholith; b) Capoose batholith and Auro pluton (Blackwater pluton); c) Chu pluton; d) Black Lake intrusive suite; e) Spike Peak intrusive suite; f) granodioritic plutons (unnamed suite); g) Hogem plutonic suite (Triassic-Jurassic); h) Hogem plutonic suite (Cretaceous) and Germansen Batholith; i) Ste. Marie plutonic suite; j) Bayonne Range plutonic suite; k) Wolverine Range plutonic complex. Mineralization ages at 3Ts are represented by the microdiortite sill (2a) and hydrothermal quartz breccia vein at the margin of the Johnny vein (2b). Unit ages from Stott (1975), Diakow et al. (1993, 1997), Nelson and Bellefontaine (1996), Ferri (1997), MacIntyre (1998), and Schiarizza and MacIntyre (1998). Mineralization ages from Andrew (1988), Pell (1994), McLeish (2013), Logan and Mihalynuk, (2014), New Gold Inc. (2013), David Pawliuk (personal communication, 2014) and Ron Britton (personal communication, 2014). Geologic timescale from International Commission on Stratigraphy (2014).

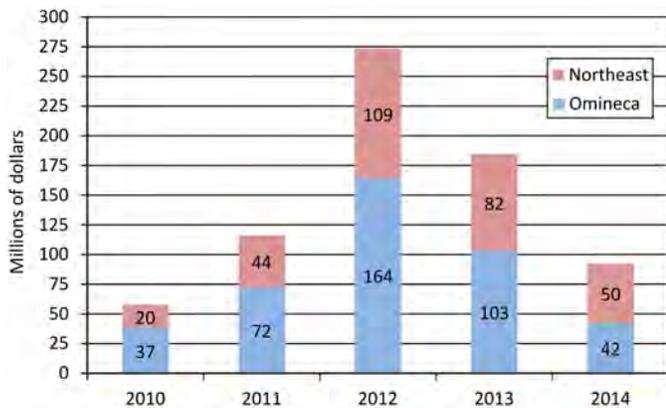


Fig. 3. Annual exploration spending estimates in millions of dollars for the Omineca and Northeast regions from 2010 to 2014. A total of \$92 million for the combined regions in 2014 was down 50% from 2013.

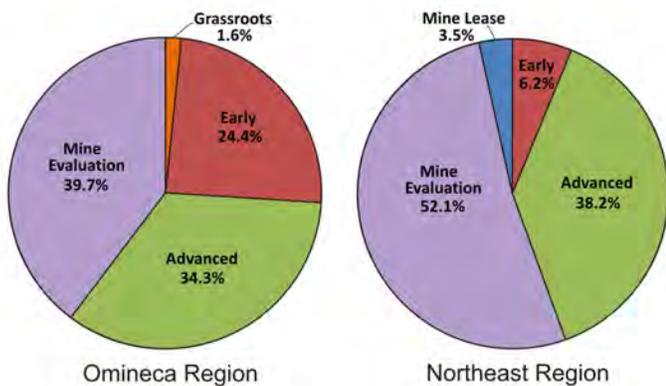


Fig. 4. Exploration expenditures in 2014 by exploration stage for the Omineca and Northeast regions.

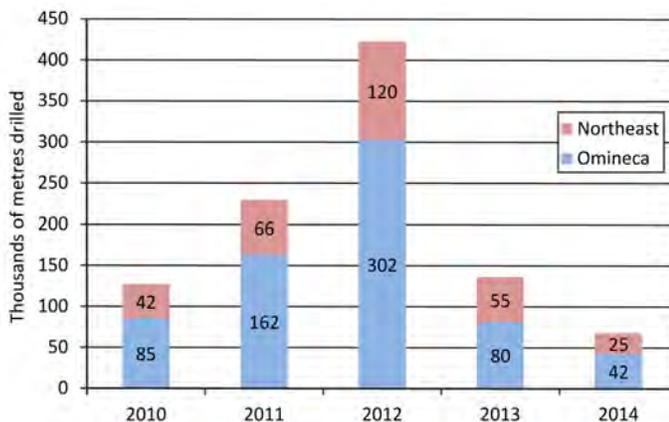


Fig. 5. Annual exploration drilling estimates in thousands of metres for the Omineca and Northeast regions from 2010 to 2014. A total of 67,200 m for the combined regions in 2014 was down 50% from 2013.

America; the Quesnel and Stikine island arc terranes, which formed outboard of ancestral North America starting in the Late Paleozoic and were accreted in the Middle Jurassic; the

Slide Mountain and Cache Creek oceanic terranes, which intervene between Quesnellia and Stikinia and formed in the Late Paleozoic to Mesozoic; post-accretionary rocks; and younger cover rocks (Figs. 1, 2).

2.1. Ancestral North America

In the Omineca and Northeast regions, Laurentian basement is unconformably overlain by Neoproterozoic to Early Paleozoic continental, shelf, and deep-water marine siliciclastic and carbonate successions that were deposited on the western margin of ancestral North America during protracted rifting and breakup of the supercontinent Rodinia (Fig. 2, see Nelson et al., 2013 for review). Local units of the Windermere Supergroup (Neoproterozoic) include predominantly siliciclastic rocks and their metamorphic equivalents (Misinchinka and Ingenika groups; Ferri et al., 1994). The Gog Group (Lower Cambrian) unconformably overlies the Windermere Supergroup and consists mainly of sandstone, granulestone, and conglomerate. In the Northern Rocky Mountains, Early to Middle Paleozoic sedimentation is represented by units containing mainly carbonate rocks, such as the Kechika Group (Cambrian), and the Road River Group (Middle Devonian).

2.2. Cassiar, Kootenay, and Slide Mountain terranes

In Devonian to Mississippian time, subduction of oceanic crust eastward beneath ancestral North America led to back-arc extension and opening of the Slide Mountain ocean. Subsidence from attenuation of the continental margin generated the Cassiar-Cariboo and Kootenay pericratonic terranes (Nelson et al., 2013). The Cassiar-Cariboo terrane is underlain by the same Neoproterozoic to Cambrian successions as ancestral North America. The Kechika Trough (Kootenay terrane) is the southeastern extension of the Selwyn Basin of the Yukon and Northwest Territories, which hosts prolific Ordovician to Early Devonian sedimentary exhalative (SEDEX) deposits. The trough is in the Northern Rocky Mountain fold and thrust belt, bounded to the west by the Rocky Mountain trench and to the east by the Macdonald Platform (Fig. 1). Siliceous and carbonaceous shale of the Upper Devonian Gunsteel Formation (Earn Group) hosts barite-bearing SEDEX 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 fold and thrust belt. 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).

2.3. 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 660 km in the Omineca Region. The Quesnel arc developed in

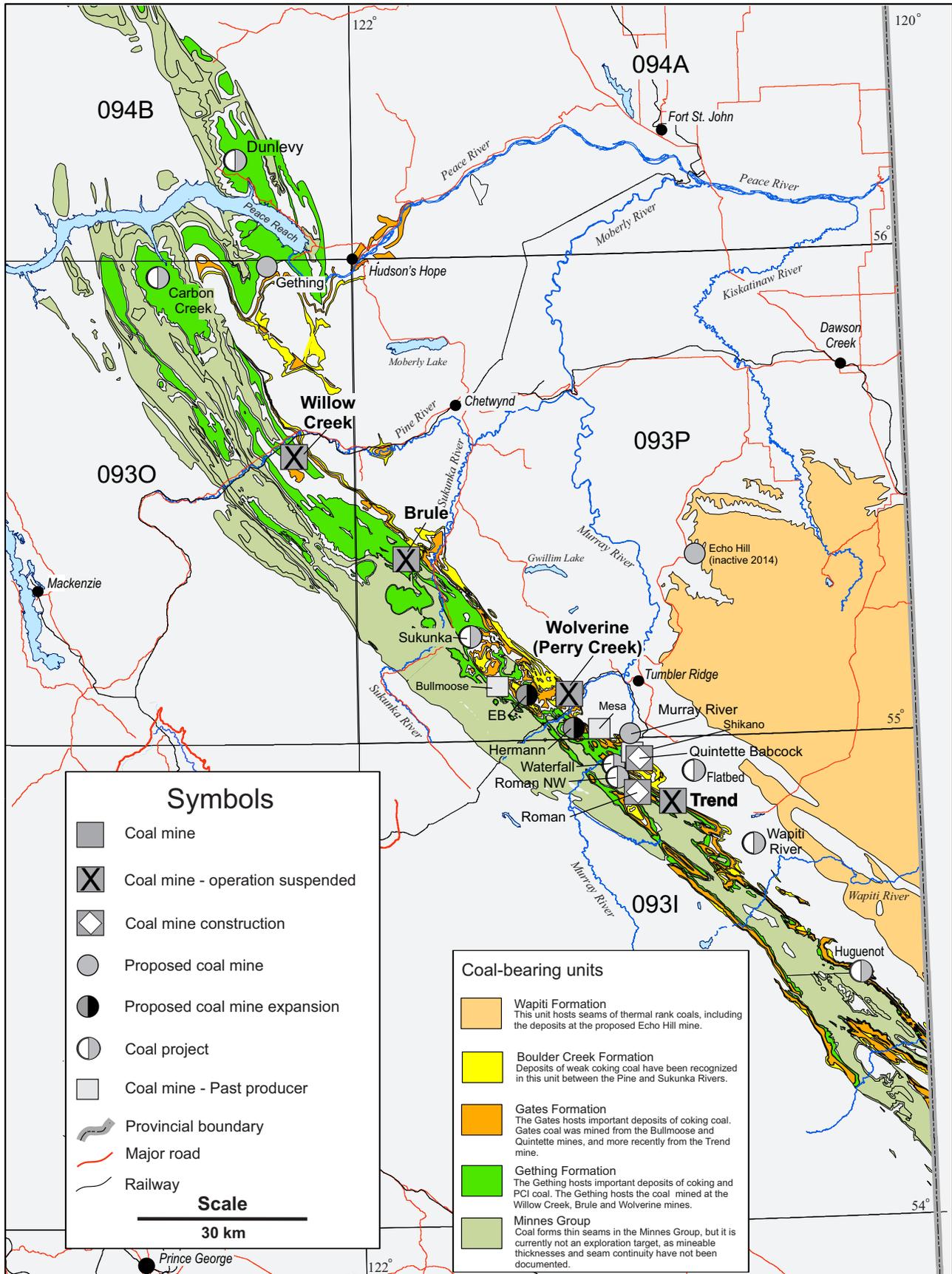


Fig. 6. Coal mines and exploration projects, northeastern British Columbia 2014. From British Columbia Geological Survey (2015).

two-phases above Late Paleozoic basement rocks (Nelson and Bellefontaine, 1996). The Takla Group (Late Triassic) phase comprises basal sedimentary rocks that are overlain by mafic and intermediate volcanic successions. These rocks are locally 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. Coeval with the Takla Group, the Hogem Intrusive complex and its peripheral offshoots hosts porphyry copper-gold \pm silver \pm molybdenum deposits such as **Kwanika** and **Mt. Milligan**. The Hogem Intrusive suite generally evolved from more alkaline compositions in the Early Mesozoic to more subalkaline in the Cretaceous (Garnett, 1978), with the exception of Early Jurassic alkaline bodies such as the Duckling Creek syenite complex (Bath et al., 2014; Devine et al., 2014). Regional northwest-trending strike-slip faults bound the northern Quesnel terrane on its eastern (Manson-McLeod fault system) and western (Pinchi fault) margins.

2.4. Stikine terrane

The Stikine terrane shares ancestry with the Quesnel terrane (Logan and Mihalyuk, 2014). Both are thought to have been part of a larger arc complex lying offshore of ancestral North America in Late Permian to Triassic 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, particularly in the Toodoggone (northwest) and Nechako Plateau (southeast) areas.

In the Toodoggone 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). 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 suite form a 62-km long, north-northwest trending pluton that locally hosts porphyry mineralization. Intrusive rocks follow the margins of an elongate structural depression that was filled by voluminous 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 monoclinical blocks. Porphyry copper-gold-silver-molybdenum deposits such as **Kemess Underground**, and epithermal gold-silver deposits of both low- and high-sulphidation type are known in the area. The Finlay-Ingenika fault system bounds the Toodoggone area on the east.

In the Nechako Plateau area, Hazelton Group island-arc volcanic rocks predominate (Diakow et al., 1997) and are intruded by syn-accretionary monzogranitic rocks of the Endako and Laidman batholiths. The Endako Batholith is a

composite intrusive complex that extends for 95 km along a northwest trend at the northern end of the Nechako Plateau. The Endako subsuite (Late Jurassic) of the Francois Lake plutonic suite hosts the Endako low-fluorine porphyry molybdenum deposit (Pond, 2013).

2.5. Cache Creek terrane

The Cache Creek terrane is an oceanic fore-arc assemblage that formed outboard of the combined Stikine-Quesnel arc terrane and contains exotic fossils of Tethyan (Asian) affinity (Schiarizza and MacIntyre, 1998; Nelson et al., 2013). In the Mt. Sidney Williams area the Cache Creek terrane consists of the Sitlika assemblage (Permian-Triassic) and the Cache Creek complex (Late Paleozoic to Early Jurassic). In the Sitlika assemblage, a lower unit of mafic and felsic metavolcanic rocks is overlain to the east by a siliciclastic unit. The Cache Creek complex includes an ophiolite sequence of variably serpentinized peridotite (Trembleur ultramafic unit), which hosts the **Decar** deposit, 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 Sitlika rocks are considered to be part of a primitive oceanic arc complex, the Sitlika-Kutcho-Venables arc (Logan and Mikalynuk, 2014).

2.6. Post-accretionary rocks (Late Jurassic to Paleogene)

In Stikine terrane, non-marine sedimentary rocks of the Sustut Group (Lower to Upper Cretaceous), derived from the Omineca Belt to the east (Diakow et al., 1993), extend for over 100 km along the western margin of the Toodoggone area, overlapping Upper Paleozoic to Lower Jurassic units.

In the Nechako Plateau area, Hazelton Group rocks are locally overlain by sedimentary and volcanic rocks of the Bowser Lake Group (Late Jurassic to Early Cretaceous), which formed in a foreland basin west of the obducted Cache Creek complex (Evenchick et al., 2007). By Late Cretaceous time, regional shortening 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 Auro Pluton, which are spatially related to the **Capoose** and **Blackwater** deposits (Simpson and Rotert, 2014; Christie et al. 2014). Episodic volcanism continued with eruption of the intermediate Kasalka Group rocks (Late Cretaceous), which host the **Blackwater** deposit; and Eocene rocks of the Nechako Plateau Group, the Ootsa Lake Formation (felsic volcanic) and Endako Formation (intermediate volcanic). Eocene volcanism was concurrent with regional extension and horst-and-graben faulting. 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.

In the Quesnel terrane, 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 Tertiary sedimentary and minor volcanic rocks (Nelson and Bellefontaine, 1996). The moderate tilt of the **Mt. Milligan** deposit may be 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, was rapidly exhumed in the Tertiary and comprises amphibolite-grade Neoproterozoic basement rocks (Ferri et al., 1994).

In northeastern British Columbia, the Peace River Coalfield extends nearly 400 km along the Northern Rocky Mountain inner foothills, from the Alberta border to the Pink Mountain area (Figs. 1, 6). Medium- to low-volatile bituminous coal seams of economic thickness and continuity are hosted in Lower Cretaceous sections of the Gething and Gates formations (Cunningham and Sprecher, 1992; Gibson, 1992). Coal-bearing cyclothems were deposited in deltaic and lagoonal settings along the western edge of the Western Canadian Sedimentary Basin during marine transgressions and regressions (Stott, 1984; Grieve, 1995). These rocks were shortened during the Laramide Orogeny (Late Cretaceous to Tertiary). 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. Coals from both the Gething and Gates formations are relatively low in ash and sulphur (Grieve, 1995). In 2012, the Government of British

Columbia estimated 4900 Mt of potentially mineable resources in the Peace River Coalfield.

2.7. 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. Quaternary glacial, glaciofluvial, fluvial, and colluvial deposits are extensive in the southern part of the Omineca region, and bedrock is exposed mainly at higher elevations.

3. Operating mines and quarries

3.1. Metal mines

3.1.1. Endako mine

The Endako molybdenum mine (Figs. 1, 2; Thompson Creek Metals Company Inc., operator and 75% owner; Sojitz Moly Resources, Inc., 25% owner) is one of many porphyry deposits that extend discontinuously along the length of Stikinia (Logan, 2013; Logan and Mihalynuk, 2014). The orebody is hosted by the Endako quartz monzonite (Fig. 2; Late Jurassic) and consists of subparallel or en-echelon quartz-molybdenite-pyrite veins, and stockworks (Pond, 2013). Open-pits (Fig. 7) extend across four structural blocks separated by south southwest-trending faults that appear to be offset as a series of Tertiary listric normal faults (Lowe, 2001). Pond (2013) summarized the geology of the deposit and provided operational updates. Although mining of in situ and stockpiled ore continued in 2014 (Table 1), the mine was placed on temporary suspension, effective December 31.

3.1.2. Mt. Milligan mine

The Mt. Milligan mine (Thompson Creek Metals Company

Table 1. Metal mines, Omineca and Northeast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Forecast production (estimate based on Q1-Q3)	Reserves (Proven and Probable)	Resource (Measured and Indicated)	Near-mine exploration	Website
Endako	Thompson Creek Metals Company Inc. (75% share)	molybdenum; porphyry; 093K 006	4309 tonnes (9.5 Mlbs) molybdenum oxide	65.8 Mt at 0.052% molybdenum; containing 34,382 tonnes (75.8 Mlbs) molybdenum	109.4 Mt at 0.051% molybdenum - additional to reserves	N/A	http://www.thompsoncreekmetals.com/s/home.asp
Mt. Milligan	Thompson Creek Metals Company Inc.	copper, gold, silver; porphyry; 093N 194	28,395 tonnes (62.6 Mlbs) copper; 5645 kg (181,500 oz) gold	477.5 Mt at 0.199% copper and 0.388 g/t gold; containing 951,637 tonnes (2098 Mlbs) copper and 185,066 kg (5.95 Moz) gold	226.2 Mt at 0.14% copper and 0.204 g/t gold - additional to reserves	ground IP survey (31.2 line-km)	http://www.thompsoncreekmetals.com/s/home.asp



Fig. 7. Mining in the southeast corner of the Endako pit, Endako mine.

Inc.) is a near-surface, alkalic copper-gold porphyry deposit in central Quesnellia (Figs. 1, 2; Logan, 2013; Logan and Mihalynuk, 2014). It is hosted by mafic-intermediate volcanic rocks of the Witch Lake succession (Takla Group) and by Early Jurassic monzonite stocks (Fig. 2). Copper-gold mineralization occurs as sulphide disseminations, fracture fills, and lesser veinlets in the monzonitic stocks, their brecciated margins, and hornfelsed and altered volcanic country rocks.

The deposit is a moderately dipping, tabular, ca. 2.5 x 1.5 km body that extends to a depth of 400 m (Mills et al., 2009). A core zone of magnetite-rich potassic alteration and copper-gold mineralization (MBX sub-zone; Fig. 8) transitions peripherally to gold-only mineralization and carbonate-rich phyllic to intermediate argillic alteration (66 sub-zone) suggestive of an alkalic lithocap (Holliday and Cooke, 2007). An oxidized zone with weak supergene enrichment contains native copper extends to depths of 70 m along faults.



Fig. 8. Blast-hole drilling for Phase 2 mining in the MBX pit, Mt. Milligan mine.

Commissioned in October 2013, the mine saw its first full-year of operations in 2014. Ramp-up activities, including mechanical and electrical maintenance, and adjustments to mining and milling continued throughout 2014. Commercial production, defined as mill operation at 60% throughput capacity for 30 days, was reached in mid-February. Milling operations are expected to be consistently near 80% of design capacity by the end of 2014. Nine shipments of approximately 10,000 dry tonnes of copper and gold concentrate were made by October. About 328 people worked at the mine in 2014.

Near mine exploration in 2014 consisted of a ground IP geophysical survey northeast of the mine on a claims block underlain by volcanic rocks and limestone of the Takla Group, and biotite schist and paragneiss of the Wolverine metamorphic complex.

3.2. Coal mines

The year began with three open-pit coal mines operating in the Northeast Region (Fig. 6): the **Trend** mine of Peace River Coal Inc., wholly owned by Anglo American plc; and the **Perry Creek** (Wolverine) and **Brule** mines of Western Coal Corp., wholly owned by Walter Energy, Inc. The Trend and Perry Creek mines produce mainly hard coking coal (HCC), whereas the Brule mine produces only pulverized coal injection (PCI) coal, a high-rank thermal coal used to sustain blast furnace temperatures in steelmaking. In mid-April, Walter Energy announced that coal mining in the region would be suspended due to low prices. Mining at Perry Creek was suspended immediately, but operations continued at Brule until mid-late June. In September, Anglo-PRC announced that it would be suspending operations at the combined **Trend-Roman** mine by the end of 2014.

3.2.1. Trend

At the **Trend** mine (Table 2) HCC of medium-volatile bituminous rank is being mined from seams in the Gates Formation along the steeply dipping northeast limb of the Waterfall anticline. The Roman Mountain expansion lies 1.5 km to the southwest, in the Murray syncline. Coal seams, have been followed over a 3 km strike length; the cumulative thickness of Gates Formation seams is about 18 m. Seams in the Gething Formation have a cumulative thickness of 7.5 m and can be blended with Gates Formation coals. Metallurgical coal production for the first three quarters was 1.30 Mt, down slightly (2%) from 2013.

At the end of March, the second component of the Mines Act Permit Amendment was granted for access and start of mining on Roman Mountain, making the combined Trend-Roman operation (Fig. 1) fully permitted. The remaining effluent permit has also been received. Construction projects continuing into 2014 included ditching for runoff management, two sedimentation ponds, and a selenium treatment test plant that was commissioned in the first half of the year. A causeway was constructed to provide better access to Roman Mountain (Fig. 9). The expansion will comprise 5 km of linear open-cuts in

Table 2. Coal mines, Omineca and Northeast regions.

Mine	Operator - mine status	Commodity; deposit type; MINFILE	Forecast production (estimate based on Q1 to Q3)	Reserves (Proven and Probable)	Resource (Measured and Indicated)	Near-mine exploration	Website
Trend	Anglo American plc (Peace River Coal Inc.) Placed on care and maintenance, Dec. 2014	metallurgical coal; 093I 030	1.71 Mt	10.0 Mt saleable (excluding Roman Mountain)	27.7 Mt mineable in situ (exclusive of reserves, excluding Roman Mountain)	N/A	http://www.angloamerican.com/
Perry Creek	Walter Energy, Inc. (Western Coal Corp.) Placed on care and maintenance, Apr. 2014	metallurgical coal; 093P 025	564,000 t	9.4 Mt saleable; Proven	N/A (28.0 Mt in situ, March 31, 2010)	N/A	http://walterenergy.com/
Brule	Walter Energy, Inc. (Western Coal Corp.) Placed on care and maintenance, June 2014	metallurgical coal; 093P 007	1.02 Mt	17.5 Mt saleable; Proven	N/A (28.0 Mt in situ, December 31, 2011)	N/A	http://walterenergy.com/

**Fig. 9.** Looking southeast down the completed open-cuts Trend Mine. The causeway was constructed to access Roman Mountain (Trend-Roman mine).

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). Once in operation, the mine will require 450 full-time employees. The combined Trend-Roman operation will extend the life of the existing Trend mine by 16 years. The decision to suspend mining affected 360 mine employees and about 30 contractors.

3.2.2. Perry Creek mine (Wolverine)

At Walter Energy's **Perry Creek mine** (Wolverine Project; Fig. 1, Table 2) medium-volatile bituminous HCC is being mined from seams in the Gates Formation. In mid-April the company announced it would immediately idle production, but continue operating the wash plant to process coal already in inventory. A care and maintenance crew is to remain on site once coal processing is complete. Layoffs affected 415 employees.

3.2.3. Brule mine

Walter Energy's **Brule mine** (Figs. 1, 10; Table 2) mine

produces PCI coal from three, 3.0-4.6 m thick seams in the lower part of the Gething Formation. The mine forms part of the Brazion Group of properties that includes the Willow Creek mine. Production of about 2.2 Mt of run-of-mine coal was targeted for the year, but the mine was placed on idle status at the end of June and 280 employees were laid off. Hauling of stockpiled coal for processing and rail load-out at the Willow Creek mine continued for the remainder of the year.

3.3. Industrial mineral mines and quarries

3.3.1. Nephrite jade

Nephrite and soapstone are metamorphic rocks derived from an ultramafic protolith that has undergone dynamothermal metamorphism and metasomatism near a subduction zone. The Ogden Mountain property is underlain by metamorphosed, thrust-faulted, and well-foliated ultramafic rocks, including serpentinite melange, of the Cache Creek complex. These rocks are locally intercalated with massive white calc-silicate rock (Simandl et al., 2000). Near the calc-silicate rocks, the ultramafic rocks appear to grade from serpentinite to nephrite



Fig. 10. Walter Energy, Inc. geologist looking southeast over the South Brule Pit, Brule mine.

to soapstone (talc schist). The nephrite forms lenses that pinch and swell along the regional fabric.

Green Mountain Gemstones Inc. continued work at the **Ogden Mountain** property (Fig. 1, Table 3), including placer trenching for alluvial jade boulders and excavation of in situ jade.

3.3.2. Dimension stone

Near Valemount (Fig. 1), construction and building stone projects continued in 2014 with limestone quarrying at the **Yellowjacket** project and continued stockpiling of talus-derived quartzite slabs at **Hunterstone Quarries**.

4. Mine development and proposed mines

4.1. Metal projects

4.1.1. Kemess Underground (KUG)

The Kemess Underground deposit (Figs. 1, 2; Table 4; AuRico Gold Inc.) is centered on the Kemess North pluton, a quartz monzodiorite of the Black Lake intrusive suite that follows a south-dipping thrust 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. An 80 m thick oxidized sulphate leach zone of clay-rich hematite-stained broken rock overlies the deposit. Subjacent phyllic alteration with pyrite-anhydrite/gypsum veining is predominant in the Takla volcanic rocks; at depth, quartz-magnetite ± biotite alteration becomes prevalent. Auriferous chalcopyrite-pyrite mineralization with trace molybdenite occurs as disseminations, fracture fills and quartz ± magnetite veins in the pluton, and less so in hangingwall Takla Group volcanic rocks.

In February, AuRico submitted a Project Description to initiate environmental assessment. An underground block cave operation is proposed that would use infrastructure at the Kemess South mine (now on care and maintenance; Witte et al., 2013). Annual production would be approximately 3266 kg (105,000 oz) of gold and 19,958 tonnes (44 Mlbs) of copper. The operation would run for 12 years with mining from a single

extraction level. Construction is expected to take five years, employing up to 400 people for the first four years.

4.1.2. Blackwater

The **Blackwater** deposit (Figs. 1, 2; Table 4; New Gold Inc.) is interpreted as an intermediate sulphidation epithermal gold-silver system hosted by Kasalka Group rocks (Late Cretaceous; Christie et al., 2014). The volcanic section includes andesite flows, lapilli tuffs, and volcanic breccias, flow-banded and tuffaceous rhyodacites, heterolithic breccia containing altered fragments of other units, and silicified hydrothermal breccias. Alteration and mineralization define a 1300 x 950 m west-trending, shallowly north-plunging deposit. A fragmental zone with average vertical extent of 350 m tapers down to 600 m in a low-grade core. It contains pervasive muscovite-illite ± silica, smectite, biotite, and chlorite alteration accompanied by disseminated and replacement 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. Local Mn-rich spessartine garnet, an important indicator mineral, occurs with pyrrhotite-bearing potassic alteration in the western part of the deposit. Steep, north-plunging higher-grade ore shoots are thought to be related to subvertical fault intersections. Highest grades (up to 47.49 g/t Au over 15 m) are along the margins of silicified breccia bodies. Illite and rare buddingtonite alteration suggests a late volatile phase common to shallow hydrothermal systems (Krohn et al, 1993).

In January 2014, New Gold Inc. released the NI 43-101 technical report. It describes an open-pit mining operation with 60,000 t/d processing plant and a mine life of 17 years. Life-of-mine average annual production would be 12,846 kg (413,000 oz) of gold and 54,182 kg (1.74 Moz) of silver. Total metal production would be 217,724 kg (7.0 Moz) of gold and 920,663 kg (29.6 Moz) of silver. New Gold worked to advance the project through permitting, which required additional engineering studies on the transmission line, tailings storage

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

Mine	Operator	Commodity; deposit type; MINFILE	Production	Reserves	Resource (Measured and Indicated)	Near-mine exploration	Website
Ogden Mountain	Green Mountain Gemstones Inc.	nephrite jade; jade; 093N 156, 165	less than 5 tonnes raw; 8 tonnes high-grade from stockpiles	N/A	N/A	placer trenching and in situ mineral exploration	http://gmgemstone.ca/
Yellowjacket	Private individual	limestone	1000 tonnes	N/A	N/A		N/A
Hunterstone Quarries	Private individual	quartzite slabs	200 tonnes	N/A	N/A		http://www.hunterstonequarries.com/

Table 4. Mine development and proposed mines, Omineca and Northeast regions.

Mine	Operator	Commodity; deposit type; MINFILE	Reserves (Proven and Probable)	Resource (Measured and Indicated)	Work program	Significant results	Website
Kemess Underground (KUG)	AuRico Gold Inc.	copper, gold, silver; porphyry; 094E 021	100.4 Mt at 0.28% copper, 0.56 g/t gold, 2.0 g/t silver; containing 280,842 tonnes (619.2 Mlbs) copper, 56,142 kg (1.8 Moz) gold, 205,532 kg (6.6 Moz) silver	65.4 Mt at 0.24% copper, 0.41 g/t gold, 1.8 g/t silver; containing 157,191 tonnes (346.5 Mlbs) copper, 26,562 kg (854 Koz) gold, 118,535 kg (3.8 Moz) silver (excluding reserves)	Environmental Assessment, care and maintenance (Kemess South)	Project Description to initiate Environmental Assessment submitted	http://www.auricogold.com/
Blackwater	New Gold Inc.	gold, silver; epithermal (intermediate sulfidation); 093F 037	344.4 Mt at 0.74 g/t gold, 5.5 g/t silver; containing 254,115 kg (8.17 Moz) gold, 1891 tonnes (60.8 Moz) silver	396.9 Mt at 0.74 g/t gold, 5.5 g/t silver; containing 295,483 kg (9.50 Moz) gold, 2181 tonnes (70.13 Moz) silver (including reserves)	Engineering studies for Environmental Assessment	Feasibility study released. Environmental Assessment application submitted	http://www.newgold.com/
Aley	Taseko Mines Limited	niobium; carbonatite- hosted; 094B 027	83.8 Mt at 0.50% Nb ₂ O ₅ ; containing 292.9 Mkg* of niobium *calculated by author	258.8 Mt at 0.37% Nb ₂ O ₅ ; containing 669.4 Mkg* of niobium (including reserves) *calculated by author	Pre-feasibility study, metallurgical testing, mineralogical, engineering and baseline studies	Achieved +50% recovery of niobium in test processing. Pre- feasibility study released	http://www.tasekominer.com/home
Roman Mountain	Anglo American plc (Peace River Coal Inc.)	metallurgical coal; 093I 030	26.6 Mt saleable	4.2 Mt mineable in situ (additional to reserves)	percussion drilling (7735 m)		http://www.angloamerican.com/
Quintette (Babcock)	Teck Coal Limited	metallurgical coal; 093I 011	41.1 Mt clean coal	124 Mt raw coal (excluding reserves)	detailed engineering, 50,000 tonne saleable coal test sample		https://www.teck.com/
Murray River	HD Mining International Ltd.	metallurgical coal; 093I 010	261.6 Mt (proven mineable)	314.2 Mt (in Plot-1 area)	Decline construction, drilling (330 m), engineering and environmental studies.	Decline to 742 m in October. Environmental Assessment application submitted (under review)	http://www.hdmimgmtl.com/

Table 4. Continued.

Mine	Operator	Commodity; deposit type; MINFILE	Reserves (Proven and Probable)	Resource (Measured and Indicated)	Work program	Significant results	Website
EB (Mt. Spieker)	Walter Energy, Inc. (Western Coal Corp.)	metallurgical coal; 093P 015	15.6 Mt clean coal	N/A	core drilling (860 m), auger drilling (180 m); test pitting		http://walterenergy.com/
Hermann	Walter Energy, Inc. (Western Coal Corp.)	metallurgical coal; 093I 031	9.1 Mt clean coal	N/A (30.6 Mt in situ, including reserves, March 31, 2010)	infill core drilling (999 m)		http://walterenergy.com/
Sukunka	Glencore. Glencore is operator with 75% interest. JX Nippon Oil & Energy Corporation has 25% interest.	metallurgical coal; 093P 012	N/A	140 Mt in situ	drilling (exploration, geotechnical, hydro-geological), 10 tonne bulk sample, trenching, coal quality testing, feasibility studies		http://www.glencore.com/
Griscome	Graymont Western Canada Inc.	limestone 093J 041	N/A	+100 Mt of limestone (>95% calcium carbonate, <5% magnesium carbonate) in situ - Indicated	infill drilling (1854 m), oriented core drilling, auger drilling, test pitting, Environmental Assessment		http://www.graymont.com/
Wapiti East	Fertoz International Inc.	phosphate; 093I 008	N/A	1.54 Mt at 21.6% P ₂ O ₅ (Inferred)	trenching, bulk sample (1250 tonnes of 20 Kt permitted)	1.2 - 2.5 m width of 13 - 27% P ₂ O ₅ in mineralized zone	http://www.fertoz.com/

facility, and water management. In early October, the final application for an Environmental Assessment certificate was submitted. The proposed mine would require 1200-1500 jobs during construction, and a permanent workforce of over 500 employees.

4.1.3. Aley

The **Aley** niobium project (Figs. 1, 2; Table 4, Taseko Mines Limited), the second largest in the world, is hosted by the Aley Carbonatite complex (Devonian-Mississippian). The complex is an alkalic-ultramafic 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 \pm 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. The fenitized aureole with abundant sodic-amphibole is cut by carbonatite dikes or sills and extends for over 500 m into the host rock beyond the brecciated carbonatite margin.

In the first half of 2014, Taseko Mines Limited continued metallurgical test work. Engineering and environmental studies also continued, as did upgrading the March 2012 resource estimate. In September, the company released the results of a pre-feasibility study and submitted a Project Description to initiate a formal environmental assessment. The company proposes an open-pit mine with a strip ratio of 0.5:1, and a 10,000 t/d processing plant. Average annual production over the 24-27 year mine life would be about 9000 tonnes (9 Mkg) 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. In November, it was announced that the project had been federally approved for a harmonized Environmental Assessment to be conducted by the province.

4.2. Coal projects

4.2.1. Roman Mountain

The **Roman Mountain** expansion project (Fig. 1, Table 4; Peace River Coal Inc.-Anglo American plc) is 1.5 km southwest of the Trend mine. Infill drilling in 2014 was designed to better define fold-fault structures.

4.2.2. Quintette (Babcock)

After delaying the restart of the **Quintette (Babcock)** mine (Fig 1, Table 4) in mid-2013, Teck Coal Limited continued detailed engineering work and completed the extraction of a saleable coal test sample. The final two permit requirements for

the mine were received in late summer. The mine is to reopen the Windy (Big and Little Windy) and Window pits on the northern side of Mt. Babcock. The historic Quintette mine operated from 1982-2000 with development in 1998 of the open-cuts on Mt. Babcock producing about 2 Mt/y clean coal. The new operation would start mining on the northeast in the Window Pit area. The mine is expected to produce an average of 3.5 Mt/y clean coal over a 12 year mine life. In April, Teck announced that the project was being deferred until market conditions improve, and by July the site had transitioned to care and maintenance. The decision affected 80 employees at the site.

4.2.3. Murray River

The 35 km-long, 160 km² northwest-trending licensed area for the **Murray River** project (Fig 1., Table 4) of HD Mining International Ltd. (co-owned by Huiyong Holdings (BC) Ltd. and Canadian Dehua Lvliang Limited) is underlain by Lower to Upper Cretaceous successions above the Gates Formation. The main geologic structure is modeled as an open asymmetric syncline, with reverse faults bringing coal beds in the middle part of the Gates Formation to shallower depths. The Project Description (Rescan Environmental Services Ltd., 2012) identifies 5-6 underground workable Gates Formation seams about 2 to 5 m thick.

In 2014, an underground bulk coal sample project continued (Fig. 11) with driving of a decline starting in January. The decline is planned to be 1500 m long and extend to a depth of 400 m. Contingent on coal quality results of the bulk sample, the proposed mine would have a production rate of 4.8 Mt/y of saleable coal over a 25 year mine life at an estimated capital cost of \$668 million (ERM Rescan, 2014). Commissioning and first production is anticipated before 2018, subject to permitting approval. Over 450 direct jobs are anticipated for the three year construction phase and over 640 jobs during operations. The company plans to use nearly 480 skilled temporary foreign workers at the start of operations, but to replace them with



Fig. 11. Workers entering decline portal at the South Decline site, Murray River.

Canadian workers over ten years. An agreement with Northern Lights College has been signed to train Canadian workers. The company's Environmental Assessment certificate application was accepted in mid-September, and the project is under review.

4.2.4. EB (Mt. Spieker) and Hermann

Walter Energy, Inc continued preparatory work at Wolverine Group expansion projects about 10 km west (EB) and southeast (Hermann) of the Perry Creek mine (Fig. 1). Both projects are certified under the provincial Environmental Assessment. The **EB** project (Fig 1., Table 4) is in a 3.5 x 1.4 km north-northwest trending area that captures the Gates Formation coal sequence. Four gently-to-moderately dipping coal seams (12.6 m average cumulative thickness) of medium-volatile bituminous rank are targeted on the northeastern limb of the Spieker syncline. Start-up is anticipated as early as mid-2016. Production of 2 Mt/y is expected over a mine life of 8 years. A 14-hole drilling (core and auger) and test-pitting program was completed in 2014.

The **Hermann** property (Fig 1., Table 4) is divided into three prospects (Hermann North, Hermann Syncline, and Hermann Gething) with the Hermann North prospect having the best surface mining potential (Minnes, 2007). Five main coal seams in the middle part of the Gates Formation of medium volatile bituminous rank have a cumulative thickness of up to 12.5 m. The proposed mine would have production rate of about 1 Mt/y of clean coal with a 10 year mine life. Three open-pits are proposed, covering an area of 3200 x 490 m. A six-hole core drilling program was completed in 2014 in the Hermann North prospect area. The provincial Environmental Assessment certificate for the project was extended in 2013 for another 5 years.

4.2.5. Sukunka

Glencore's **Sukunka** project (Fig. 1, Table 4) lies in a broad asymmetric syncline with beds that generally dip gently to the southwest. Southwest-dipping thrust faults cut across the property. Three coal seams (1.5-4.5 m thick) 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 seams have been described historically (COALFILE 669) and are being targeted. In February, feasibility stage assessment began and exploration continued. Drilling focused on two target areas: the Nose Pit area (Fig. 12, upper Gething seams), and a northwest target area (lower Gething seams). Geochemical and geotechnical drilling to collect environmental and slope stability data was also completed. In August, a bulk coal sample of the upper Gething seams was collected for quality, coking and washing tests. Test trenches were also excavated for geotechnical investigation. The proposed Sukunka mine (Stantec Consulting Ltd., 2013) is a combined surface and underground operation that would initially produce 1.5-2.5 Mt/y of clean coal from surface contour mining. Addition of the underground component would increase production to 6 Mt/y. Mine life is estimated at 20 years minimum. Workforce requirements are

estimated at 250 jobs during construction, and 700 employees during operations. The project has been federally approved for a harmonized Environmental Assessment to be conducted by the province and is in the pre-application stage.

4.3. Industrial mineral projects

4.3.1. Giscome

The **Giscome** property of Graymont Western Canada Inc., is underlain by basaltic volcanic rocks and fossiliferous limestones (Fig. 13) of the Slide Mountain Group. High quality limestone grades of about 98% CaCO₃ have been historically described in the area. In 2014, Graymont continued to move the project (Fig. 1; Table 4) through the pre-application stage of Environmental Assessment. In March, eleven infill holes of 300-400 m depth were drilled to better define the available resource. Geotechnical and hydrogeological studies were also completed. The company aims to start construction in mid-2015 with production in 2016. Mine life is estimated at a minimum 50 years. The mine would create 40-60 jobs during



Fig. 12. Skeeter seam in the Nose pit area, Sukunka.



Fig. 13. Coral clast-bearing limestone near the proposed Giscome project. Photo by John DeGrace.

construction and 15-20 full time jobs during operations.

4.3.2. Wapiti East

At the **Wapiti East** project (Fig. 1., Table 4) of Fertoz International Inc., pelletal and nodular phosphate-bearing units (Fig. 14) are interbedded with siltstones in folded and thrust 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 August, Fertoz began a trenching and bulk phosphate sampling program after being delayed by forest fires. The raw bulk sample was to be used in trials by certified organic farmers. A resource estimate (inferred) was also released for an at-surface resource averaging 1m wide and 30 m deep over a strike length of 12.5 km in four target areas. Environmental baseline studies in support of a small mine application were also completed. In November, Fertoz submitted an application to extract up to 75,000 t/y of phosphatic rock.

5. Exploration highlights

5.1. Nechako Plateau (Stikine terrane)

5.1.1. Epithermal gold-silver and porphyry copper-gold

In late May, New Gold Inc. resumed its **Blackwater Regional** exploration program, which includes the **Van Tine, Van Tine South, Capoose, Fawn, Fawnie, Emma, Blackwater South/East, Key, and Auro** properties (Figs. 1, 2; Table 5). At the **Key** property, exploration focused on ring-shaped magnetic anomalies and a known copper-molybdenum mineralized feldspar porphyritic intrusive. By August, two drills were on site coring to an average depth of 500 m, and ground IP surveys were completed. The property is underlain by Hazelton and Nechako Group volcanic and sedimentary rocks and is cut by three main northwest to north-northwest trending faults and a northeast-trending cross fault. At **Blackwater South**, drilling was to test the northwest side of the interpreted Auro Pluton for mineralized volcanic rocks in an area historically mapped as Ootsa Lake Formation. The property is underlain by Hazelton, Kasalka, and Nechako Group volcanic and sedimentary rocks in the northwestern part of a large (7 km diameter) ring-shaped magnetic anomaly south of the Blackwater deposit. In October, New Gold reported that drilling at Key and Blackwater South encountered a broad area of porphyry-style mineralization (gold, silver, copper and molybdenum) in intrusive host rock (Fig. 15). Surface reconnaissance work at **Van Tine** and **Fawn** identified epithermal and deeper intrusive-related alteration styles and local high gold grades over narrow widths in Hazelton Group volcanoclastic rocks. Only about 2.5 drill holes were completed at Van Tine and Fawn before drilling was suspended because of forest fires.

In May, New Gold released a NI 43-101 technical report on the **Capoose** project. The deposit is hosted by Late Jurassic sedimentary and mafic-to-intermediate volcanic rocks of the Bowser Lake Group (Simpson and Rotert, 2014). Quartz monzonite of the Capoose Pluton lies a kilometre to the west and is thought to dip eastward under the deposit area (Awmack

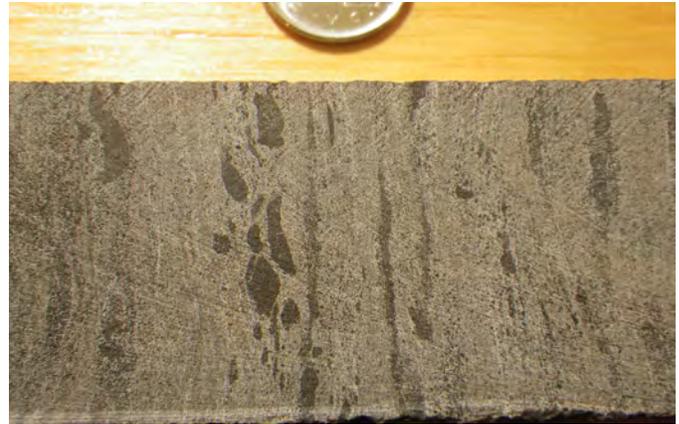


Fig. 14. Phosphate-rich intraclasts in Wapiti East drill core. Core size is AQ (27 mm wide). Photo by John DeGrace.



Fig. 15. Propylitically altered Hazelton Group andesite at the Key property.

et al., 2010). Fragmental rhyolite sills are the main host of mineralization and are pervasively altered with a quartz-sericite and garnet-bearing assemblage similar to the Blackwater deposit. Based on garnet geochemistry the sills are of similar age (Late Cretaceous) to the east margin of the Capoose Pluton (Andrew, 1987; Green and Diakow, 1993). Mineralization occurs as pyrite-sphalerite-marcasite-pyrrhotite ± chalcopyrite, galena, arsenopyrite disseminations and garnet replacements. Quartz-garnet-sulphide veins and veinlets are less abundant. Native gold and electrum are spatially associated with pyrite, and silver with hessite (Ag₂Te) and argentite. High gold and silver grades are not always coincident and appear to be controlled by intrusive contacts and structural intersections. The mineralized zone (above 0.4 g/t AuEq.) is irregularly shaped and extends 825 x 715 m along a north-south trend, with a vertical extent of over 500 m.

The **3Ts** property (Figs. 1, 2, Table 5) of Independence Gold Corp. is underlain by Hazelton Group rhyolite tuffs and flows about 10 km south of Capoose Batholith quartz monzonite (Diakow et al., 1997). The 3Ts project is a low-sulfidation

Table 5. Exploration, Omineca and Northeast regions.

Property	Operator	MINFILE	Commodity; deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work program	Significant results	Website
Blackwater Regional (Van Tine, Van Tine South, Fawn, Blackwater South, Key)	New Gold Inc.	093F 037, 43, 45, 50, 52, 53, 56, 69	gold, silver, zinc, lead, copper, molybdenum; epithermal, porphyry, skarn		drilling (11,045 m; 23 drill holes), ground geophysics (IP, VLF-EM, magnetics) at Key, Fawn and Van Tine	Broad area of porphyry-style mineralization at Key and Blackwater South; epithermal and deeper intrusive-related alteration styles at Van Tine and Fawn	http://www.newgold.com/
Capoose	New Gold Inc.	093F 040	silver, gold (zinc, lead, copper); epithermal	20.3 Mt at 0.50 g/t gold and 22.4 g/t silver; containing 9953 kg (320,000 oz) gold and 454,733 kg (14.62 Moz) silver - Indicated	NI 43-101 technical report	Updated resource estimate incorporated 2013 drilling program	http://www.newgold.com/
3Ts	Independence Gold Corp.	093F 055, 68	gold, silver; epithermal	5.45 Mt at 2.52 g/t gold, 71.5 g/t silver, containing 13,717 kg (441,000 oz) gold and 390,038 kg (12.54 Moz) silver (Inferred)	drilling (2683 m)		http://www.ingold.ca/s/Home.asp
Fox and 2 X Fred	Kootenay Silver Inc.	N/A	gold, silver; epithermal	N/A	48 grab samples (Fox) and 175 composite vein samples (2 X Fred)	32.6 g/t gold and 6049 g/t silver peak values (Fox); 0.34 g/t gold average value and 4.31 g/t gold peak value (2 X Fred)	http://www.kootenaysilver.com/s/home.asp
Decar	Cliffs Natural Resources Inc. (60%), First Point Minerals Corp. (40% and 1% NSR)	093K 039, 41, 72	nickel; ultramafic-hosted	1159.5 Mt of 0.124% nickel (Davis Tube Recovered, DTR); containing 1,438 Mt (3169.7 Milbs) nickel Indicated	Bench scale market test		http://www.cliffsnaturalresources.com/EN/PaPag/default.aspx http://www.firstpointminerals.com/s/Home.asp
Green Gold	0902744 B.C. Ltd.	093G 032	Gold; vein		drilling (388 m)	23 m at 1.64 g/t Au, including 8 m at 4.0 g/t Au (Discovery trench, 2011)	N/A
Cat Mountain	Rift Valley Resources Corp.	094C 069	copper, gold, silver; porphyry		geochemical sampling (rock chip and grab), blasting, trenching	1.2 m of 72.7 g/t gold, 11.45 g/t silver, 0.33% copper; grab samples up to 278 g/t gold, 22.92 g/t silver, 0.27% copper (No. 1 Magnetite Vein)	http://www.riftvalley.ca/Welcome_to_Rift_Valley_Resources_Corp.html

Table 5. Continued.

Property	Operator	MINFILE	Commodity; deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work program	Significant results	Website
OGK	Blackeagle Development Corp.	094C 097, 170, 093N 176	copper, gold		mapping and sampling (rock, soil)		
Takla-Rainbow	Manado Gold Corp.	093N 082	gold, silver; epithermal, porphyry	Non NI 43-101 compliant resource estimate of 291,298 tonnes (321,101 tons) at 8.57 g/t (0.25 oz/ ton) gold; inferred and potential (Imperial Metals Corporation, 1988)	drilling (late 2013), mapping, prospecting, geochemical sampling (rock, till)	24.52 m (drilling length) of 0.18% copper, 2.01 g/t gold, 2.0 g/t silver (IR-13-88); 5 m chip sample of 0.292% copper, 0.553 g/t gold and 10.9 g/t silver; historic core samples up to 0.811% copper, 4.51 g/t gold, 10.9 g/t silver	http://www.manadogold.com/
Croy-Bloom	Serengeti Resources Inc.	094D 019, 25, 105	gold, copper, iron, magnetite; porphyry		geochemical sampling (historic drill core)	0.97% copper; 3.1 g/t gold (core sample); three grab samples at 0.38%, 0.84%, and 0.93% copper	http://www.serengetiresources.com/s/Home.asp
Rottacker	Serengeti Resources Inc.	093N 098, 093N 073 (Kwanika)	copper, gold, silver; porphyry	Kwanika Central Zone; 243.6 Mt at 0.23% copper, 0.21 g/t gold, 0.69 g/t silver; containing 559,279 tonnes (1233 Milbs) copper; 51,632 kg (1.66 Moz) gold, and 167,959 kg (5.4 Moz) of silver; indicated	geochemical sampling (rock)	6.7% copper; 5.9 g/t gold and 464 g/t silver	http://www.serengetiresources.com/s/Home.asp
Kwanika East-Smoke	Serengeti Resources Inc.	093N 152, 168	copper, molybdenum; porphyry	N/A	ground IP survey		http://www.serengetiresources.com/s/Home.asp
Redron (Halobia)	Kiska Metals Corporation	093N 167	copper, molybdenum; porphyry		ground geophysics (11 line-km; magnetics, IP), geochemistry (soil)	N/A	http://www.kiskametals.com/s/Home.asp
Chuchi	Chlormet Technologies Inc., Kiska Metals Corporation	093N 159	copper, gold; porphyry	Non NI 43-101 compliant resource estimate of 50 Mt at 0.21% Cu, 0.21 g/t gold; inferred (Digger Resources Inc., 1991)	ASTER satellite survey (Chlormet), field review, rock sampling (Kiska)	N/A	http://www.kiskametals.com/s/Home.asp

Table 5. Continued.

Property	Operator	MINFILE	Commodity; deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work program	Significant results	Website
Col-Later	Pacific Empire Minerals Corp.	093N 101	copper, gold, silver; porphyry	Non NI 43-101 compliant resource estimate of 1.81 Mt at 0.6% copper; indicated (Kookaburra Gold Inc., 1989)	drilling (848 m), ground IP survey	N/A	www.pencorp.ca/Welcome_to_Pacific_Empire_Minerals.html
Thor	Copper North Mining Corp.	094D 064, 5	copper, gold, silver; porphyry		ground IP survey (80 line-km)	N/A	http://www.coppernorthmining.com/s/Home.asp
Kemess East	AuRico Gold Inc.	094E 021	copper, gold, silver; porphyry		drilling (16,877 m), mapping, geochemistry (rock), airborne geophysics (VTEM, 1111 line-km), metallurgical studies	768 m of 0.442 g/t gold and 0.392% copper (KH-14-04); 304 m of 0.557 g/t gold and 0.421% copper (KH-14-09); 601 m 0.500 g/t gold and 0.391% copper (KH-13-08)	http://www.auricogold.com/
UDS	Serengeti Resources Inc.	094E 070, 115, 117, 120, 121, 244	gold, silver, copper, zinc, lead; porphyry, epithermal	N/A	mapping, geochemical sampling (rock, soil, silt)	10 samples between 0.1 - 0.7% copper (August 30 target); skam sample 0.26% copper, 1.0 g/t gold	http://www.serengetiresources.com/s/Home.asp
Akie	Canada Zinc Metals Corp.	094F 031	zinc, lead, silver; sedimentary exhalative	12.7 Mt at 8.4% zinc, 1.7% lead and 13.7 g/t silver; containing 1.07 Mt (2352.3 Mlbs) zinc, 214,000 tonnes (471.8 Mlbs) lead, and 174,024 kg (5.6 Moz) silver indicated	drilling (2855 m), geophysics (airborne gravity)	9.44 m of 8.93% zinc, 1.25% lead, 10.54 g/t silver (A-14-111); 7.87 m of 5.97% zinc, 0.94% lead, 8.02 g/t silver (A-14-12); 8.42 m of 7.43% zinc, 1.19% lead, 10.72 g/t silver (A-14-115); 5.72 m of 5.45% zinc, 0.94% lead, 8.49 g/t silver (A-14-117)	http://www.canadazincmetals.com/
Kechika Regional (Yuen North, Mt. Alcock)	Canada Zinc Metals Corp.	094F 013, 15	zinc, lead, silver; sedimentary exhalative	N/A	airborne gravity survey (940 line-km), geochemical sampling (soil) at Yuen North	zinc-lead-barite anomaly expanded to 4500 x 500 m at Yuen North	http://www.canadazincmetals.com/

Table 5. Continued.

Property	Operator	MINFILE	Commodity; deposit type	Resource (NI 43-101 compliant unless indicated otherwise)	Work program	Significant results	Website
Cirque	Teck Resources Limited	094F 008	zinc, lead, silver; sedimentary exhalative	Non NI 43-101 compliant resource estimate of 24.7 Mt at 8.5% zinc, 2.3% lead and 50.8 g/t silver; indicated (Curragh Resources Inc., 1991)	drilling (5200 m), airborne VTEM survey, airborne gravity survey	N/A	https://www.teck.com/
Kechika Regional (Elf, Fluke, Pie, Cirque East, Yuen)	Teck Resources Limited	094F 008, 9, 11, 13 23	zinc, lead, silver; sedimentary exhalative	N/A	airborne VTEM survey, airborne gravity survey (840 line-km), re-logging and sampling historic core (3500 m), geochemical sampling (rock), mapping, prospecting	N/A	https://www.teck.com/
Wapiti River	Canadian Dehua International Mines Group Inc.	093I 013	metallurgical coal;	201.9 Mt (coal seam thickness >1.0 m); Measured and Indicated	feasibility study, baseline studies	N/A	http://www.dehua.ca/
Roman Northwest	Anglo American plc (Peace River Coal Inc.)	N/A	metallurgical coal;	N/A	percussion drilling (2121 m), core drilling (1535 m), trenching	N/A	http://www.angloamerican.com/
Waterfall	Anglo American plc (Peace River Coal Inc.)	N/A	metallurgical coal;	N/A	percussion drilling (1410 m), core drilling (360 m), trenching	N/A	http://www.angloamerican.com/
Huguenot	Colonial Coal International Corp.	093I 014	metallurgical coal;	132.0 Mt (surface), 145.7 Mt (underground) in situ; Measured and Indicated	carbonization testing, coal washing studies, baseline studies	N/A	http://ccoal.ca/
Dunlevy	Jameson Resources Limited (Dunlevy Energy Inc.)	094B 023, 25	metallurgical coal;	N/A	drilling (1302 m)	clean coal intersections up to 1.52 m thick; unoxidized samples indicate high- volatile A bituminous coals	http://www.jamesonresources.com.au/

epithermal vein system with more than a dozen subvertical, north-striking mineralized veins up to 900 m long and 20 m wide that appear to have formed by open space filling along faults (Fig. 16). The veins have quartz-calcite \pm sericite-adularia-amethyst gangue encompassing wall rock fragments, and feature crustiform banding and comb crystal textures. Fragments of breccia in the veins indicate multiple pulses of vein formation. Sparse sulphide mineralization occurs as pyrite and Cu-Ag sulphosalt(?) disseminations and sooty hairline veinlets, with accessory chalcopyrite, sphalerite, and galena. An 80 m thick Late Cretaceous (73.8 Ma, U-Pb zircon; Friedman et al., 2001) microdiorite sill crosscuts the veins. However, an Early Miocene (21.2 Ma Re-Os; David Pawliuk, personal communication, 2014) hydrothermal quartz breccia vein above the sill implies a protracted mineralizing history. In early May, an updated NI 43-101 compliant inferred resource estimate was released that incorporates data from 2012 and 2013 drilling programs. Drilling of new targets started in late May, but was suspended in late August after samples from 18 holes failed to return significant gold values.

In April, Kootenay Silver Inc. announced discovering two high-level epithermal systems resulting from grassroots exploration near their Copley (MINFILE 093F 070) property. The **Fox** property (Fig. 1, Table 5) features two northeast-trending mineralized zones, 400 m apart, near a 3 km long magnetic low. Subvertical, open-space quartz-sulfide veins and breccia fills have been identified in zones of quartz-sericite-pyrite alteration. The area is underlain by Ootsa Lake Formation felsic volcanic rocks and feldspar porphyry. At **2 X Fred** (Two Times Fred; Fig. 1, Table 5), gently west-dipping chalcodinic and banded quartz veins, stockwork, and breccia fill were found across a 2.5 x 1.75 km area in Endako Formation volcanic rocks. Veins are centered on a coincident airborne EM and magnetic high anomaly. The magnetic anomaly has intersecting north-south and northeast-trending components. Sampling of quartz

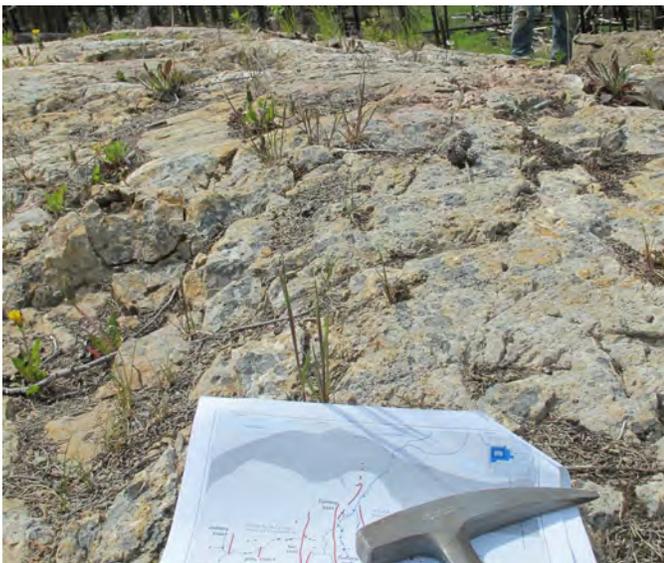


Fig. 16. Johnny vein at the 3Ts property.

vein material returned anomalous gold and silver values.

In 2014, 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). Releases included results of geochemical and mineralogical surveys (Sacco et al., 2014), airborne magnetic data (Aeroquest Airborne Ltd., 2014; Geoscience BC), basal till geochemical and mineralogical data (Jackaman and Sacco, 2014), basal till potential maps (Sacco et al., 2014), and geologically constrained 3D Earth modeling of gravity and magnetic data (Mira Geoscience Ltd., 2014).

5.2. Cache Creek terrane

5.2.1. Ultramafic-hosted nickel

At the **Decar** project (Figs. 1, 2, Table 5), managed and operated by Cliffs Natural Resources Exploration Canada Inc., nickel occurs as a fine-grained, pervasively disseminated nickel-iron alloy (awaruite; Ni_{2-3}Fe) in serpentinized peridotites of the Trembleur ultramafic unit, an obducted ophiolite sequence (Schiarizza and MacIntyre, 1998). Typically, nickel is mined from magmatic Ni-sulphide or lateritic deposits and the Decar project is the first to assess the economic viability of awaruite. Two broad northwest-trending mineralized zones of awaruite and magnetite, alteration products of nickeliferous olivine, are recognized on the property. A near-vertical foliation is thought to parallel diffuse shear zones that developed prior to and during serpentinization. The age of mineralization is unknown, but is thought to be related to post-accretionary strike-slip faulting.

A recent NI 43-101 compliant technical report and preliminary economic assessment (McLaughlin et al., 2013) describes an open-pit mining operation with 114,000 t/d milling rate that would produce an average 37,369 tonnes (82.4 Mlbs) of nickel annually over a 24 year mine life. Although Cliffs elected to proceed with a pre-feasibility study in 2013, which was scheduled for completion in August 2015, their continued interest is uncertain. Activities in 2014 included First Nations engagement and baseline environmental studies. In April, First Point Minerals Corp. reported completing an initial market test for concentrate produced from the Decar project. The bench-scale tests indicate that Decar concentrate can be blended with laterite nickel as feedstock in ferronickel production, and as direct feed in stainless steel circuits.

5.2.2 Listwanite-associated lode gold

In October, private company 0902744 B.C. Ltd. completed a 4-hole diamond drilling program at the **Green Gold** property (Figs. 1, 17; Table 5) in the Pinchi fault zone west of Prince George. At the intersection of north-northwest and north-northeast trending faults, Cache Creek complex pelagic sedimentary rocks and limestones are juxtaposed against metabasalts, diabase, and metagabbro. Drilling encountered fine-to-medium grained intrusive rock with varying alteration assemblages including pervasive argillic (with chlorite and talc), quartz-sericite-pyrite, and pervasive silica. Secondary



Fig. 17. Core drilling at Green Gold.

biotite and fuchsite were identified as disseminations and vein components; and disseminated and veinlet-hosted pyrite and local crackle breccia were noted.

5.3. Quesnel trough (Quesnel terrane)

5.3.1. Porphyry copper-gold

The **Cat Mountain** property (Fig. 1, Table 5) of Rift Valley Resources Corp is a kilometre outside the east margin of the Hogem intrusive complex. It is underlain by mafic-intermediate volcaniclastic rocks of the Witch Lake succession (Takla Group; Upper Triassic) that host small syenitic intrusions. The intrusions appear to form a ring-dike complex along the summit of Cat Mountain, and are spatially associated with a 700 x 400 m variably altered and mineralized area (Macdonald, 2013). Steeply dipping, northwest- and north-trending magnetite-sulphide \pm quartz-calcite veins up to 0.6 m wide occur in an area of complex syn- and post-mineral faulting. Gold-copper \pm silver mineralization occurs in the magnetite veins, and as sulphide and secondary copper mineral disseminations and fracture fills. The deposit type appears to be transitional between shear-hosted vein and alkalic porphyry. Sampling was conducted in July 2014 to better determine the strike length of high-grade gold mineralization. A blasting and sampling program followed later in the season.

About 13 km to the west, the **OGK** property (Fig. 1, Table 5) is underlain by granodiorite to monzonitic rocks of the Hogem intrusive complex in its northern portion and by the Duckling Creek syenite complex, a multi-stage alkaline dike swarm, in its southern portion. Vein-hosted and disseminated copper sulphide, and secondary copper mineralization has been recognized. The property is under option to Blackeagle Development Corp. and a grassroots program of mapping and sampling was conducted in 2014.

The **Takla-Rainbow** property (Fig. 1, Table 5) of Manado Gold Corp. is in Twin Creek succession volcanic rocks (Takla Group) at the east margin of the Hogem intrusive complex. Sub-vertical auriferous quartz veins follow the east-southeast-striking Twin Creek Fault zone that cuts the contact between dioritic and volcaniclastic rocks. Sheared quartz syenite-to-granite porphyry dikes of probable Early Cretaceous age appear spatially related to mineralization. Mineralization occurs as fracture-controlled and disseminated sulphide and native gold with silica-carbonate alteration. The results of a 5-hole drilling program conducted in late 2013 were announced in January 2014. Several silicified, pyrite-bearing mineralized zones were intersected in two of the drill holes, including an interval over 24 m that ended in gold-silver-copper mineralization. Low-grade gold and silver mineralized intervals were returned in the other holes. A grassroots exploration program in mid-summer 2014 focused on identifying porphyry style mineralization in historic drill core. Geologic mapping and sampling covered four target areas, and historic drill collars were re-surveyed.

Serengeti Resources Inc. conducted grassroots exploration in 2014 at the **Croy-Bloom**, **Rottaker**, and **Kwanika East-Smoke** properties (Fig. 1, Table 5). At the historic Soup prospect on **Croy-Bloom** copper-gold mineralized microdiorite associated with a lens of magnetite skarn was sampled from historic drill core. The area is underlain by Takla Group volcanic rocks and a 700 m wide, northwest-trending monzodiotitic pluton at the northern end of the Hogem intrusive complex. The target area comprises stratiform magnetite skarn exposed over a kilometre of strike length, and a 1000 x 600 m copper-gold soil anomaly. About 3 km to the south, composite grab samples of copper mineralized garnet-diopside skarn and chlorite schist were collected from the historic Kli showing, where copper soil anomalies are known. The **Rottaker** prospect is contiguous with the southern portion of the Kwanika property, for which a recent NI 43-101 compliant technical report and preliminary economic assessment was released proposing a 15,000 Mt/y combined open-pit and underground block cave operation with 13.4 year mine life and initial capital cost of \$364 million (Gray and Robillard, 2013). Two porphyry deposits at Kwanika, one copper-gold, the other copper-gold-silver-molybdenum are roughly a kilometre apart within the western margin of the Hogem intrusive complex near the Pinchi fault. At **Rottaker**, disseminated and vein sulphide has been identified in sheared, chlorite-sericite altered monzodiorite of the Hogem intrusive complex about 4 km east of the Pinchi fault. About 8 km northeast of the Kwanika camp, a reconnaissance IP survey was

completed at **Kwanika East-Smoke**. The property is underlain by Takla Group volcanic rocks (Twin Creek and Witch Lake successions) and monzodiorite of the eastern margin of the Hogem intrusive complex. The claims follow an east-northeast trending structure and the property contains a strong VTEM anomaly.

Kiska Metal Corporation undertook grassroots and early-stage work at the **Redton** and **Chuchi** properties (Fig. 1, Table 5) in 2014. At Redton (Halobia), an area underlain by altered intrusive rocks of the Hogem intrusive complex, ground based geophysics and soil sampling were completed to expand a 3 x 1 km copper-in-soil geochemical anomaly and define drill targets. At **Chuchi**, on the east end of the southeastern leg of the Hogem intrusive complex, a field review and rock sampling was completed ahead of a decision on an option agreement with Chlormet Technologies Inc. The property is underlain by a cluster of porphyritic monzonite stocks, dikes, and sills that cut Chuchi Lake succession (Takla Group) volcanic and hornfelsed sedimentary rocks. The central target area features gold, copper, and silver soil anomalies over a 1 x 3 km area of drilling-established copper-gold mineralization, and IP anomalies in the immediate vicinity. Geological relationships suggest that sedimentation, hypabyssal intrusions and mineralization were roughly coeval (Nelson and Bellefontaine, 1996).

The **Col-Later** property (Fig. 1, Table 5) of Pacific Empire Minerals Corp. covers the northern margin of the southeastern leg of the Hogem intrusive complex where it cuts alkaline volcanic rocks of the Chuchi Lake succession (Takla Group). Mineralization is hosted in altered monzonite, syenite, and andesitic rocks and occurs as disseminated and vein-hosted copper sulphide and secondary copper minerals in steeply dipping shear zones. The best mineralization has been identified in potassic and calc-potassic alteration suites. Mineralization with a higher bornite-chalcopyrite ratio appears to be controlled by the intersection of northwest- and northeast-trending fracture zones. Late in the year, a ground IP survey was carried out on the east side of the property and two drill holes were completed on the west side, where targets are covered by till.

5.4. Toodoggone area (Stikine terrane)

5.4.1. Porphyry copper-gold

The **Thor** property (Fig. 1, Table 5), under option to Copper North Mining Corp., straddles a north-trending fault that separates Sustut Group sedimentary rocks on the west from Asitka Group carbonate and volcanic rocks, Takla Group mafic volcanic rocks, and monzodioritic intrusive rocks (Early Jurassic) on the east. Regional magnetic data suggest that a large intrusive body underlies Sustut Group rocks and coincident IP chargeability anomalies are being targeted for porphyry style mineralization. Mineralization on the property occurs as sulphide disseminations, veins, and semi-massive pods in north- to northwest-trending silicified shear zones. A ground IP survey was conducted in 2014 to better define targets for drill testing.

The **Kemess East** (Fig. 1, Table 5) deposit of AuRico Gold

Inc. appears to be similar in size as KUG about two km to the west (see above). Mineralization is hosted primarily in a quartz monzonite body and, to a lesser degree, in Takla Group basaltic andesites. Gold is hosted in chalcopyrite in veins and disseminations; the highest copper-gold grades are associated with biotite alteration. Late calcite-zeolite alteration related to the Sovereign pluton appears to be grade destructive. Exploration drilling continued in 2014 with twelve steeply-inclined holes up to 1600 m long (Fig. 18). An airborne VTEM geophysical survey was flown and metallurgical test work completed.

The **UDS** property (Fig. 1, Table 5) of Serengeti Resources Inc. is also underlain by Takla Group and Toodoggone Formation volcanic rocks, and intrusive rocks of the Black Lake plutonic suite. Grassroots exploration in 2014 identified two target areas with potential porphyry copper-gold signatures. Copper mineralized outcrops and phyllic alteration is associated with felsic dikes that occupy a faulted contact between Black Lake intrusive and Takla Group volcanic rocks. Mineralized skarn occurrences were identified nearby. Several MINFILE occurrences in the area describe epithermal style polymetallic mineralization in northwest-trending, shear-hosted, brecciated quartz-calcite-barite veins.

5.5. Kechika trough and Rocky Mountain Trench area (ancestral North America)

5.5.1. SEDEX zinc-lead-silver

At the **Akie** property (Figs. 1, 2, Table 5) of Canada Zinc Metals Corp., the Cardiac Creek deposit is a zone of baritic zinc-lead-silver SEDEX mineralization hosted in Gunsteel Formation shale (Earn Group; Upper Devonian). The moderate to steeply southwest-dipping tabular mineralized body is about 20 m thick and extends for a strike length of 1400 m. From bottom to top, mineralization defines a stratiform sequence of: 1) bedded to massive barite; 2) mottled sphalerite-galena-pyrite with decreasing barite-calcite; 3) grey-white sphalerite bands with thickly banded pyrite and minor galena and barite; 4) fine



Fig. 18. Newly drilled core (KH-14-02), Kemess East.

banded pyrite; 5) fine banded barite-pyrite; and 6) fine 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). An 8-hole drilling program in 2014 focused on the Cardiac Creek deposit (Fig. 19). Canada Zinc Metals has an approved exploration permit and completed engineering design for an underground drilling program. Environmental baseline studies are ongoing.

As part of the **Kechika Regional** project, soil samples were collected at the **Yuen North** property (Fig. 1, Table 5). The survey expanded historic soils data to cover the western panel of Gunsteel Formation on strike with Teck Resources' Cirque project, 17 km to the southeast, and confirmed a northwest-trending linear zinc-lead-barite anomaly. In November, a helicopter-borne FALCONTM gravity gradiometry and LIDAR survey was flown at 200 m line spacing over the **Akie**, **Yuen North** and **Mt. Alcock** properties.

The **Cirque** project (Figs. 1, 2, Table 5) is a joint venture between Teck Resources Limited and Korea Zinc Company, Ltd. that includes the **Cirque**, **Elf**, **Fluke**, **Pie**, **Cirque East**, and **Yuen** properties. As part of a multi-year exploration program searching for SEDEX mineralization in shales of the Gunsteel Formation, the 2014 program included drilling (Fig. 20), airborne VTEM and gravity surveys, re-logging and sampling of historic drill core, mapping and prospecting.

5.5.2. Carlin-type gold?

Prompted by recent Carlin-type gold and realgar discoveries in Proterozoic to Paleozoic strata of Selwyn basin in Yukon Territory, the British Columbia Geological Survey initiated a project to evaluate the potential of similar mineralization in Kechika trough, the southern continuation of Selwyn basin (Rukhlov et al., 2015). Robust statistical analysis of multi-element geochemical data from the National Geochemical Reconnaissance (federal) and Regional Geochemical Survey (provincial) surveys, document $Au \pm As \pm Hg \pm Tl \pm Sb$ enrichment in stream and lake sediments from Kechika trough and Selwyn basin. In both areas, anomalous values are spatially related to platform to deep-water basin transitions and to extensional structures that originated during basin subsidence and then reactivated as thrusts during regional shortening. These anomalies and geologic setting suggest that Kechika trough may hold potential for Carlin-type deposits (Rukhlov et al., 2015).

5.6. Peace River Coalfield

5.6.1. South of Tumbler Ridge

The **Wapiti River** property of Canadian Dehua International Mines Group Inc. (Canadian Dehua) lies 25 km southeast of the Trend mine (see above; Fig. 1). Canadian Dehua reports a total of 63 coal seams in the Gates and Gething formations. Seismic interpretations (2-D) show a gently-folded syncline-anticline pair cut by reverse faults. A feasibility study for the No. 1 mine at Wapiti River, completed in 2014 by Golder Associates



Fig. 19. Drilling at the Cardiac Creek deposit, Akie. Photo by John DeGrace.



Fig. 20. Drilling at the Cirque deposit. Photo by John DeGrace.

Ltd. and Snowden Mining Consultants Inc., proposes a three-level underground longwall mining operation with a clean coal production rate of 8.5 Mt/y and a mine life of 46.4 years. The study identified 14 mineable coal seams based on thickness, depth, geologic structure and coal quality. The mineable coal

seams have an average cumulative thickness of 30 m, lie at depths between 300-1200 m, are medium-to-high volatile bituminous in rank, and washable to a low ash (about 10%) clean coal product. Employment requirements are forecast at 600-800 direct jobs. In 2014, Dehua focused on permitting, making arrangements for rail and power lines, and continuing environmental baseline studies.

The Trend mine expansion projects **Roman Northwest** and **Waterfall** (Fig. 1, Table 5; Peace River Coal Inc.-Anglo American plc) lie northwest of Roman Mountain following the close-folded Murray syncline and Waterfall anticline fold pair. Winter drilling and trenching programs were completed at both projects from January through early April 2014. Additional drilling at Waterfall was to start in December 2014 to continue into 2015.

At the **Huguenot** project of Colonial Coal International Corp. (Fig. 1, Table 5) the average cumulative thickness of Gates Formation coal seams in three separate blocks is 15 to 19 m. A recent NI 43-101 compliant preliminary economic assessment study (Evenson, 2013) described a combined surface and underground longwall mining operation that would produce between 1.4 Mt-5.9 Mt/y, averaging 3.0 Mt/y of clean coal over 31 years. Total clean coal production over the life of mine would be 89 Mt. Carbonization testing and coal washing optimization studies were undertaken in 2014, and environmental baseline studies continued.

5.6.2. Hudson's Hope area

At the **Dunlevy** property (Fig. 1, Table 5) of Jameson Resources Limited, a 13-hole drilling program testing Gething Formation coal seams was completed in 2014. The work confirmed coal seams previously located by hand trenching, and found clean coal intersections up to 1.5 m thick. Dunlevy geologists consider that the thickest coal seam is one that has been mined elsewhere in the north Peace region (Grant seam). Unoxidized samples taken from several seams demonstrate that the property hosts high-volatile A bituminous coal. The company is targeting a single seam 1.5-2.5 m thick for potential underground extraction by longwall mining, and speculates that 100-150 Mt of metallurgical coal may be recoverable outside the Coal Land Reserves restricted area.

6. Outlook for 2015

Thompson Creek Metals Company Inc. will likely complete their second full year of production at the **Mt. Milligan** mine and approach full design throughput capacity and metal recoveries by the end of the year. New Gold Inc. will likely move **Blackwater** through the final stages of permitting for a mining operation. AuRico Gold Inc. will continue advancing **Kemess Underground** through Environmental Assessment and delineating the orebody at **Kemess East** with additional drilling. Taseko Mines Limited will optimize the economics and technical aspects of the **Aley** project as it moves through Environmental Assessment. Canada Zinc Metals Corp. and Teck Resources Limited will continue drilling at **Akie** and

Cirque, and exploring the southern portion of the Kechika Trough SEDEX belt. Teck may also have a drilling program less than 10 km northwest of the Serengeti Resources Inc. Croy-Bloom property at **Kliyul**, recently optioned from Kiska Metals Corporation. Private company 0902744 B.C. Ltd. will continue drilling at **Green Gold**. Graymont Western Canada Inc. will continue advancing the **Giscome** project through Environmental Assessment and final permitting approval.

In the Northeast region, Anglo-PRC will continue to explore expansion projects of the **Trend-Roman** mine. Walter Energy, Inc will continue evaluating and preparing the remaining Wolverine Group projects for replacement of the **Perry Creek** mine. HD Mining International Ltd's decline at **Murray River** will likely reach the target depth for extracting a bulk coal sample. Glencore will continue feasibility stage exploration at **Sukunka**. Canadian Dehua will conduct a 3-D seismic program to further characterize geology and structure for mine development at **Wapiti River**, and will continue working on infrastructure permits. Fertoz International Inc. will continue their bulk phosphate sample program at **Wapiti East** and may be granted a small mine permit.

Acknowledgments

The information in this report was derived from news releases, quarterly reports, MD&A reports, company websites, technical reports, MINFILE reports, COALFILE reports, Geological Survey of British Columbia publications, 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. Very special thanks to John DeGrace (P.Geol., P.Eng.) for acting as Regional Geologist for the better part of the field season, and for providing thoughtful review and editing of this chapter.

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