# Exploration and mining in the Northwest Region, British Columbia

Mineral Development Office[1]

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## 1. Introduction

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

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

Significant events in the Northwest Region in 2016 include:

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

## 2. Geological overview

Metallogeny in British Columbia is intimately linked to the tectonic evolution of the Canadian Cordillera, first as an accretionary orogen consisting of allochthonous terranes that were welded to, and deformed with, the western margin of ancestral North America primarily during the Jurassic and then as the site of post-accretionary tectonism and magmatism (e.g., Nelson et al., 2013). The region transects all of the physiographic belts of the Canadian Cordillera (Fig. 1).

The Northwest Region spans a transect of the Cordilleran orogen (Fig. 1). From east to west it is underlain by: 1) autochthonous and parautochthonous carbonate and siliciclastic strata of ancestral North America (Laurentia); 2) terranes of the Intermontane tectonic province including the Slide Mountain terrane (back-arc basin); the Yukon-Tanana terrane (rifted Devonian pericratonic arc), the Quesnel and Stikine volcanic arcs (formed outboard of ancestral North America starting in the Late Paleozoic and accreted in the Middle Jurassic), and the late Paleozoic-early Mesozoic accretionary complex of the Cache Creek oceanic terrane, which intervenes between Quesnellia and Stikinia; 3) the Alexander terrane, part of the Insular tectonic province; 4) post-accretionary rocks; and 5) younger cover rocks (Fig. 1).

All of the allochthonous terranes initially accreted to each other and to western North America in the Jurassic. Since then, the mosaic has been intruded by post-accretion plutonic suites and covered in part by Jurassic and younger syn- and post-accretionary siliciclastic deposits.

### 2.1. Ancestral North America

Carbonate platformal rocks of the Laurentian realm are limited to the northeastern corner of the Northwest Region and mark the ancient margin of North America. Platform and deep-water sedimentary rocks host favorable environments for stratiform barite and set the stage for later polymetallic manto

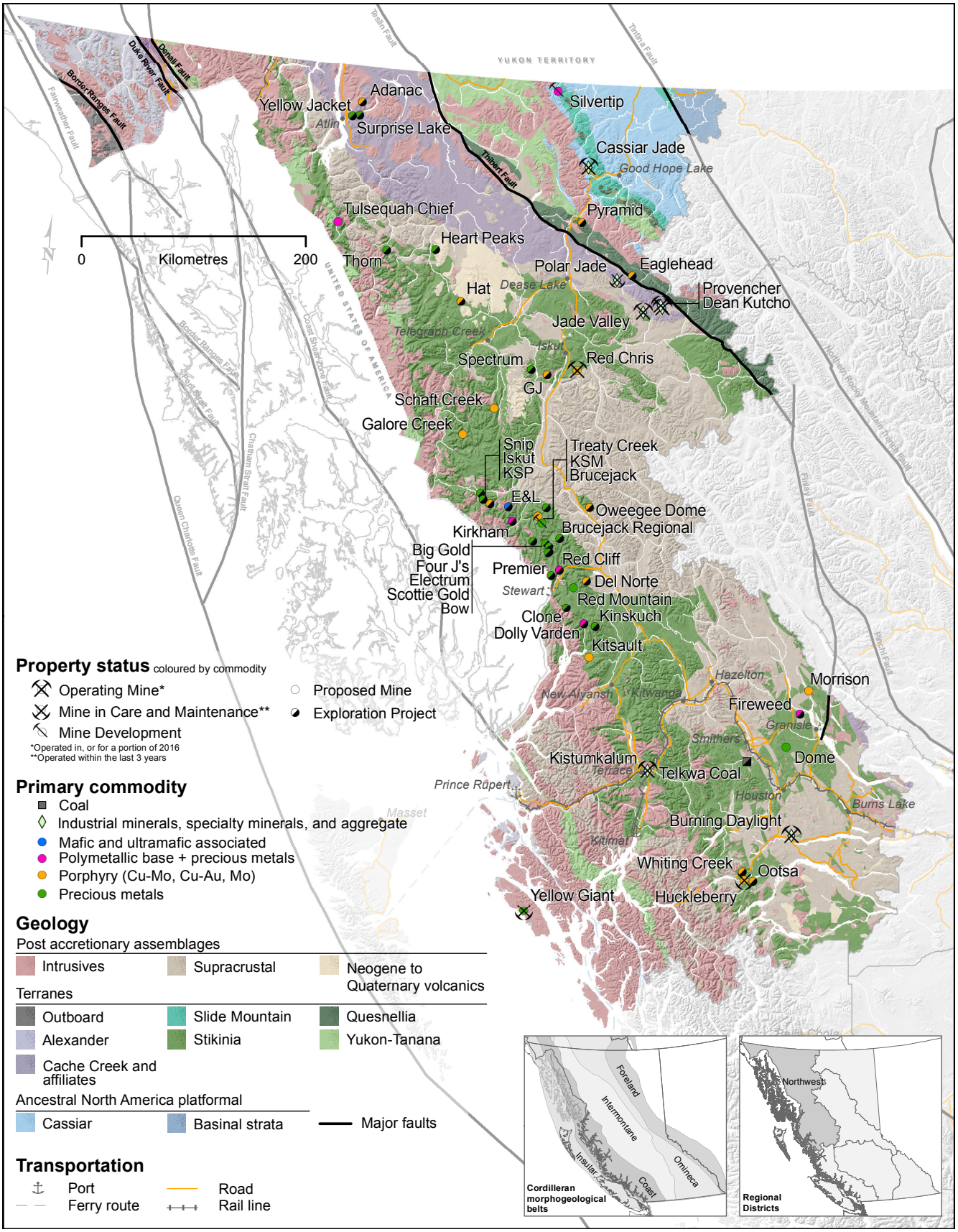


**Fig. 1.** Mines, proposed mines and selected exploration projects, Northwest Region, 2016. Terranes from the BC digital geology map (Cui et al., 2015).

development. Sedimentary exhalative prospects also occur and are better developed to the east in the Kechika basin in the North Central Region (see Jago, this volume).

### 2.2. Intermontane tectonic province

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

#### 2.2.1. Slide Mountain terrane

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

#### 2.2.2. Yukon-Tanana terrane

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

#### 2.2.3. Quesnel terrane

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

#### 2.2.4. Stikine terrane

The Stikine terrane generally trends northwest extending for 1,500 km along the length of the province. It ranges from less than 100 to more than 300 km wide. It is the largest terrane in the Northwest Region and the most metallogenetically significant. It hosts the **Red Chris** mine, and most of the economic mineral potential is in the form of porphyry and associated copper-gold-silver-molybdenum deposits such as KSM and Brucejack. The Philippine microplate with opposite-facing arcs is considered a present-day analog (Marsden and Thorkelson, 1992).

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

#### 2.2.5. Cache Creek terrane

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

### 2.3. Insular tectonic province

#### 2.3.1. Alexander terrane

The Alexander terrane underlies most of north coastal British Columbia. It comprises Neoproterozoic and Cambro-Ordovician primitive arc sequences (Gehrels et al., 1983) that probably accreted to pericratonic crust in the Devonian (Nelson et al., 2013). In coastal British Columbia, small VMS-style occurrences are associated with Ordovician rhyolites. Farther north in southeastern Alaska and far northwest British Columbia, the Alexander terrane hosts Neoproterozoic (Niblack) and Triassic (Greens Creek, Windy Craggy) volcanogenic deposits. The Alexander terrane accreted to the western margin of the Intermontane terranes during the Middle Jurassic (van der Heyden, 1992; McClelland and Mattinson, 2000; 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- to post-accretionary basins and cover much of the north-central part of the Stikine terrane. The Bowser Lake Group sedimentary sequence spans the former basin between the Stikine arch and Skeena arch and contains significant anthracite coal deposits in the Groundhog-Klappan

Coalfield. The Bowser Lake Group consists of nine different sedimentary assemblages; of which, five are known to be coal bearing. Three of these are deltaic facies containing high rank anthracite coal such as at the Groundhog project (see Jago, this volume). The coal-bearing sequences are interbedded with mudstone, siltstone and sandstone and are about 1,100 metres thick. Thirty-three coal horizons, up to 12 metres thick, have been identified.

#### 2.4.2. Coast Plutonic Complex

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

#### 2.4.3. Bulkley and Babine porphyries and Ootsa Lake Group

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

#### 2.4.4. Post-accretionary faults

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

### 2.5. Younger rocks

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

## 3. Mines and quarries

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

### 3.1. Metal mines

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

#### 3.1.1. Huckleberry (Huckleberry Mines Ltd.)

The **Huckleberry** copper-gold-molybdenum mine is approximately 85 km southwest of the town of Houston and is accessed by forest service roads. The mine is owned and operated by Huckleberry Mines Ltd. (HML). Imperial Metals Corporation owns 50% of HML with the remaining 50% owned by the Japan Group consisting of Mitsubishi Materials Corporation, Dowa Mining Co. Ltd. and Furukawa Co.

Production until shut-down in August 2016 totalled 9,270 t (20.4 Mlbs) Cu from 5.1 Mt of ore with an average grade of 0.23% Cu and an 87.5% recovery. Gold and silver production values were not available. Mill throughput averaged 18,785 tpd. Active mining ceased in January and milled material was sourced from stockpiles until August.

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

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

The **Red Chris** copper-gold mine is 16 km southeast of the community of Iskut and is accessed by a controlled mine road from highway 37. The project is owned by Red Chris Development Company Ltd., a subsidiary of Imperial Metals Corporation. **Red Chris** declared its first full year of commercial production in 2016.

Production to the end of the 3rd quarter of 2016 totalled 31.2 t (68.95 Mlbs) Cu and 1,319 kg (42,426 oz) Au from approximately 7.35 Mt of ore grading approximately 0.55%

**Table 1.** Metal mines, Northwest Region.

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

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

| Mine | Operator | Commodity; deposit type; MINFILE | 2016 Q1-Q3 production | Reserves (Proven + Probable) | Resource (Measured and Indicated) | Comments |
|---|---|---|---|---|---|---|
| **Burning Daylight** | Stone Ridge Quarries Ltd. | Columnar Basalt; dimension stone | unknown | n/a | n/a | Basalt quarrying, bulk sampling. |
| **Cassiar Jade** | Dynasty Jade Ltd. | Jade; Gems and semi-precious stones; 104P 005 | unknown | n/a | n/a | Trenching, quarrying, placer production. |
| **Dean Kutcho** | Cassiar Jade Contracting Inc. | Jade; Gems and semi-precious stones | unknown | n/a | n/a | Drilling, trenching, quarrying, up to 200 tonnes. |
| **Jade Valley** | United Oriental Mining Ltd. | Jade; Gems and semi-precious stones; 104I 048 | unknown | n/a | n/a | Drilling, trenching, quarrying, placer production. |
| **Kistumkalum** | Kalum Quarry Ltd. Partnership | Industrial rock; crushed rock | unknown | n/a | n/a | Drilling, blasting, crushing, production for CN railway bed. |
| **Kutcho Creek Jade** | Continental Jade Ltd. | Jade; Gems and semi-precious stones; 104I 078 | unknown | n/a | n/a | Mining, trenching, auger drilling. |
| **Letain** | Cassiar Jade Contracting Inc. | Jade; Gems and semi-precious stones; 104I 079 | unknown | n/a | n/a | Drilling, trenching, mining up to 200 t. |
| **Provencher** | Glenpark Enterprises Ltd. | Jade; Gems and semi-precious stones; 104I 092 | unknown | n/a | n/a | Mining, trenching, auger drilling. |
| **Wolverine** | Cassiar Jade Contracting Inc. | Jade; Gems and semi-precious stones | unknown | n/a | n/a | Drilling, trenching, <2,000 tonnes of material mined. |

Cu and approximately 0.35 g/t Au. Metal recoveries averaged 77.6% for Cu and 51.1% for gold. Target production for the year was forecast between 38,500-40,800 t (85-90 Mlbs) Cu and 1,400-1,500 kg (45-50,000 oz) Au.

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

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

Proven reserves total 301.5 Mt with an average grade of 0.36% Cu and 0.27 g/t Au. Mine life is expected to be 28 years at a 30,000 tonne-per-day milling rate. Measured plus Indicated resources total 1,034.7 Mt with an average grade of 0.35% Cu, 0.35 g/t Au and 1.14 g/t Ag. Additional Inferred resources total 787.1 Mt grading 0.29% Cu, 0.32 g/t Au and 1.04 g/t Ag. Investigations are under way to expand the open pit design and incorporate underground block cave mining methods to access resources not included in the current mine plan.

### 3.2. Industrial mineral mines and quarries

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

#### 3.2.1. Nephrite jade

Jade is a commercial term for jadeite and nephrite. In British Columbia jade occurs as nephrite. Nephrite is composed of interlocking fibrous amphibole minerals derived from an ultramafic protolith that has undergone dynamothermal metamorphism and metasomatism in a subduction-related orogenic belt. There are two significant areas of nephrite jade extraction in the Northwest Region: east of Dease Lake in the Turnagain River area and north of Dease Lake in the Cassiar area.

Production varies between operations and ranges from 200-2,000 t per year. Producers are listed in Table 2 and their locations are illustrated in Figure 1.

#### 3.2.2. Industrial rock quarries

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

The **Kitsumkalum Quarry** is 3 km west of Terrace at the confluence of the Kitsumkalum and Skeena Rivers on the traditional territory of the Kitsumkalum First Nation. The quarry is owned and operated by the Kalum Quarry Ltd. Partnership, a subsidiary of the Kitsumkalum First Nation. There is road access and a 3 km rail line connecting the property to the CN mainline. Rock is drilled, blasted and crushed on site to meet specific contact requirements. Various aggregate size fraction products are produced for industrial and residential purposes. Typical products include large diameter rip-rap, railway ballast, asphalt crush and finer materials for concrete. An estimated 22 million cubic metres of material remains available for development. Quarried rock consists of dark green-grey basalt and andesite of the Hazelton Group.

#### 3.2.3. Placer operations

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

## 4. Mine development

The mine development stage is achieved when a project acquires the required permits and has started mine construction. Essential permits include provincial and federal environmental assessment certificates, a Mines Act permit from the Ministry of Mines and an Environmental Management Act permit from the Ministry of Environment. The two mine development projects in the Northwest region in 2016 include the **Brucejack** and **Silvertip** metal mine projects (Table 3).

### 4.1. Brucejack (Pretium Resources Inc.)

The **Brucejack** underground gold-silver mine project is approximately 65 km north-northwest of the municipality of Stewart and is owned by Pretium Resources Inc. Road access is via combined all weather dirt road and glacier road. An all season airstrip is located on the road access, approximately 20 km southeast of the planned mine site. Pretium completed a feasibility study in 2014 and started construction in September 2015. Since then, full-scale construction efforts (Fig. 2) have focussed on erecting the mill building, underground development, a permanent 330 person mine camp, and connecting a 57 km power line. Construction timelines are on schedule and budget, with a startup scheduled for 2017. **Brucejack** will be a 2,700 tonne-per-day underground mining operation with a forecasted 18-year mine life and will produce an estimated 7.27 million ounces of gold.

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

**Table 3**. Mine development projects, Northwest Region.

| 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 | 16.4 Mt at 17.2 g/t Au, 15 g/t Ag | Mine, mill and infrastructure construction, underground development, regional exploration. | Construction on schedule, aiming for commercial production in 2017. |
| **Silvertip** | JDS Silver | Ag, Pb, Zn, Au; Polymetallic manto; 104O 038 | n/a | 2.35 Mt at 352 g/t Ag, 6.73% Pb, 9.41% Zn | Mine, mill and infrastructure construction near completion, near mine condemnation drilling. | Commissioning underway. |

**Fig. 2.** Brucejack project site, August 2016.

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

Highlight results included 49 intersections grading over 1,000 g/t Au. The drill program increased Measured resources for the VOK by 58%. Measured plus Indicated resources for the VOK zone now total 16.4 Mt grading 17.2 g/t Au and 15.0 g/t Ag. Additional Inferred resources total 4.6 Mt grading 21.0 g/t Au and 26.9 g/t Ag. Proven plus Probable reserves for the VOK and the West zone remain unchanged from the 2014 feasibility study at 18.5 Mt grading 14.6 g/t Au and 53.5 g/t Ag.

Regional exploration efforts continue to follow up new targets outside of the mining lease in their surrounding 1,200 km$^2$ of mineral claims and are discussed in section 6.1.1.

### 4.2. Silvertip (JDS Silver)

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

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

The Silvertip deposit is hosted in Neoproterozoic to Middle Devonian back-arc basin carbonate and siliciclastic rocks of the Cassiar terrane faulted onto the western margin of North America. The ore body consists of five zones; the Silver Creek, the 28, the 65, the Discovery and the Discovery North zones. The zones consist of massive sulphide bodies in limestones in the upper part of the McDame Group and are unconformably overlain by Devonian-Mississippian rift-related, siliciclastic

rock of the Earn Group. The sulphide bodies are in paleokarst features, and along fault surfaces and fold hinges. The Silver Creek zone is the largest and consists of massive pyrite, sphalerite, galena and chalcopyrite. Current resource estimates are 2.35 Mt at 352 g/t Ag, 6.73% Pb and 9.41% Zn.

### 5. Proposed mines or quarries

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

### 5.1. Proposed metal mines

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

#### 5.1.1. KSM (Seabridge Gold Inc.)

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

The project consists of four, gold-copper porphyry deposits: Kerr, Sulphurets, Mitchell and Iron Cap. (Fig. 3). All deposits are related to the Early Jurassic (~194 Ma; Margolis, 1993) Texas Creek intrusions and contain possibly the largest undeveloped copper-gold camp in the world (by reserves). Proven plus Probable reserves were updated in July 2016 and now total 2.198 Bt grading 0.55 g/t Au, 0.21% Cu, 2.6 g/t Ag and 42.6 g/t Mo. An updated Measured plus Indicated resource estimate completed in May (inclusive of reserves) total 2.903 Bt grading 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag and 44 g/t Mo. Additional Inferred resources total 2.719 Bt grading 0.35 g/t Au, 0.32% Cu, 2 g/t Ag and 29 g/t Mo. Seabridge received federal and provincial approval of the project environmental assessment (EA) in 2014 and is actively seeking partnership to advance into construction.

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

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

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

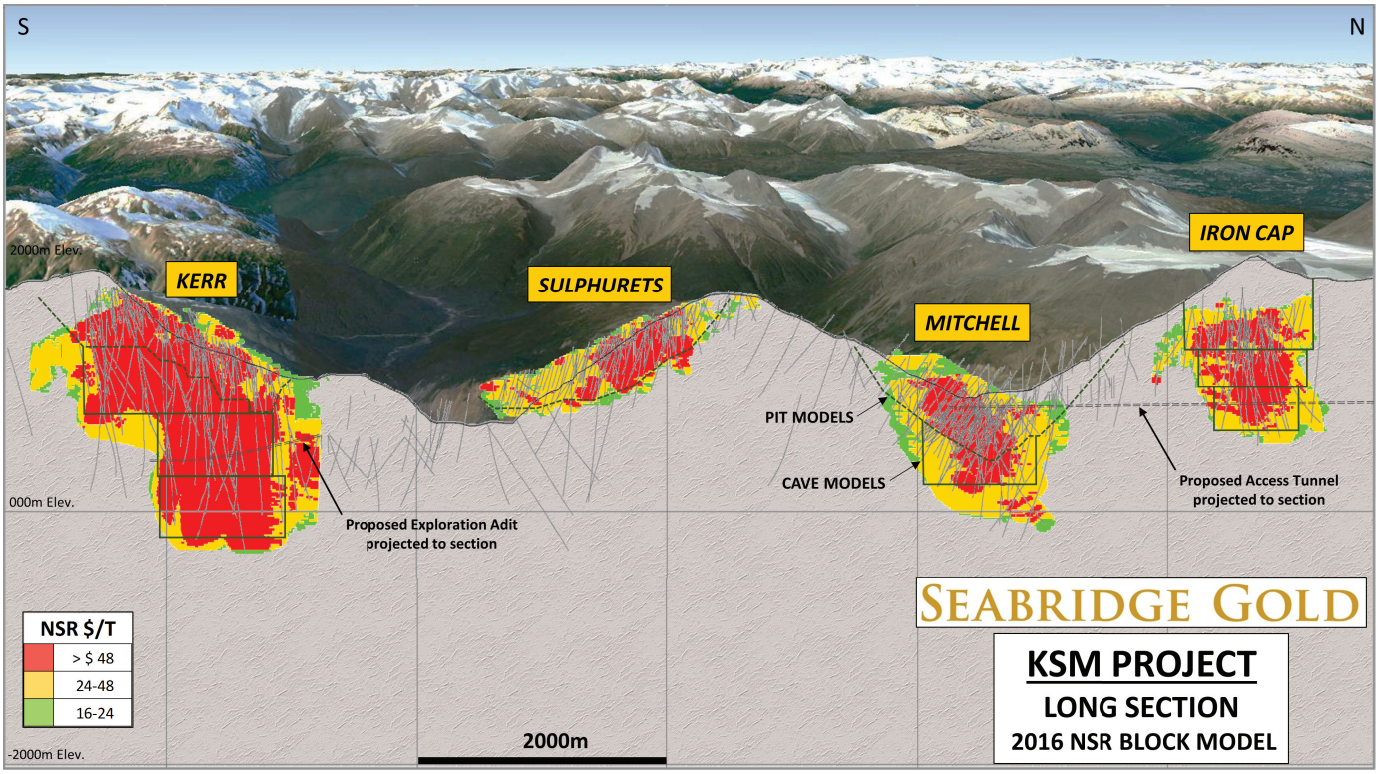


**Fig. 3.** KSM project, longitudinal cross section looking west. Diagram courtesy of Seabridge Gold Inc.

**Table 4.** Selected proposed mines, Northwest Region.

| Project | Operator | Commodity; deposit type; MINFILE | Reserves (Proven + Probable) | Resources (Measured and Indicated) | Work Program | Comments |
|---|---|---|---|---|---|---|
| **Dome Mountain** | Dome Mountain Resources of Canada Inc. | Au, Ag; Vein breccia and stockwork; 093L 022 | 135,131 t at 11.2 g/t Au | 144,144 t at 17.7 g/t Au | Diamond drilling, mine rehabilitation. | Trucked ore to Nicola custom mill in Merritt. |
| **Galore Creek** | Galore Creek Mining Corp. | Au, Cu; 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, 5.2 g/t Ag | Baseline monitoring. | Reduced environmental baseline monitoring. |
| **Kitsault** | Alloycorp Mining Inc. | Mo, Ag, Pb; Porphyry Mo (low F type); 103P 120 | 228.2 Mt at 0.083% Mo, 5.0 g/t Ag | 321.8 Mt at 0.071% Mo, 4.8 g/t Ag | Baseline monitoring, removed mine camp. | Waiting for improved Mo price. |
| **KSM** | Seabridge Gold Inc. | Au, Cu, Ag, Mo; Calc-alkalic porphyry; 104B 191 | 2,198 Mt at 0.55 g/t Au, 0.21% Cu, 2.6 /t Ag, 42.6 g/t Mo | M+I: 2,902.5 Mt at 0.54 g/t Au, 0.21% Cu, 2.7 g/t Ag, 44 g/t Mo; Inf: 2,719.2 Mt at 0.35 g/t Au + 0.32% Cu + 2.0 g/t Ag + 20 g/t Mo | Preliminary feasibility Study, Underground Preliminary Economic Assessment, Deep Kerr exploration portal permitted, exploration drilling at Lower Deep Kerr (7110.4 m) and Iron Cap (1038.4 m). | Significant advantages detailed in PEA with integrating more underground mining. |
| **Morrison** | Pacific Booker Minerals Inc. | Cu, Mo; Calc-alkalic porphyry; 093M 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 | Baseline monitoring, EA permitting saga. | Entered EA in 2010. |
| **Red Mountain** | IDM Mining Ltd. | Au, Ag; Porphyry related gold; 103P 086 | n/a | 1.641 Mt at 8.36 g/t Au, 26 g/t Ag | Preliminary Economic Assessment, resource update, underground rehab, infill resource drilling, metallurgical, geotechnical, environmental baseline, EA package submission prep | Preparing EA application submission. |
| **Schaft Creek** | Teck Resources Limited | Cu, Au; 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 Mt at 0.26% Cu, 0.017% Mo, 0.19g/t Au, 1.69 g/t Ag | Baseline monitoring, in-house engineering, evaluating re-interpreted, re-logged core (43,000 m) for possible resource update | |
| **Tulsequah Chief** | Chieftain Metals Inc. | Au, Ag, Cu, Zn, Pb; 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 | Corporate. | Company entered receivership and is seeking a buyer for project. |

130,000 tpd and then reduced to 95,000 tpd for approximately 10 years once transitioned to underground operations and lastly reduced to approximately 60,000 tpd for the final years of processing stockpiles. Ore would be processed through grinding and flotation circuits to produce a clean concentrate averaging 25% copper with high gold and silver content. Separate circuits would produce Mo concentrate and gold-silver doré. Products would be trucked to the port of Stewart and shipped overseas for smelting.

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

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

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

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

### 5.1.2. Dome Mountain (Gavin Mines Inc.)

The **Dome Mountain** past-producing gold mine is approximately 38 km east of Smithers and is accessed by forest service roads from highway 16. Gavin Mines Inc., a subsidiary of Metal Mountain Resources Inc., owns 54%. Grace Mining Inc. owns 30%, Dome Mountain Resources of Canada Inc. owns 14% and two private shareholders own 2%.

The project has current Mines Act and Environmental Management Act permits in good standing and is allowed to excavate up to 75,000 tpy. In early 2013, the project submitted applications to amend their existing Mines Act and Environmental Management Act permits that would allow for onsite milling and tailings storage. Due to various delays, including regulatory changes due to the 2014 Mount Polley tailings breach, the permit amendments remain outstanding. In 2016, stockpiled material was processed at Nicola Mining Inc.'s custom mill facility near the town of Merritt. The mine is positioned to resume underground excavations by the end of the year and aims to truck ore to the Nicola mill in the near future.

Activities on the property in 2016 included diamond drilling, underground geological mapping, and preparation to resume

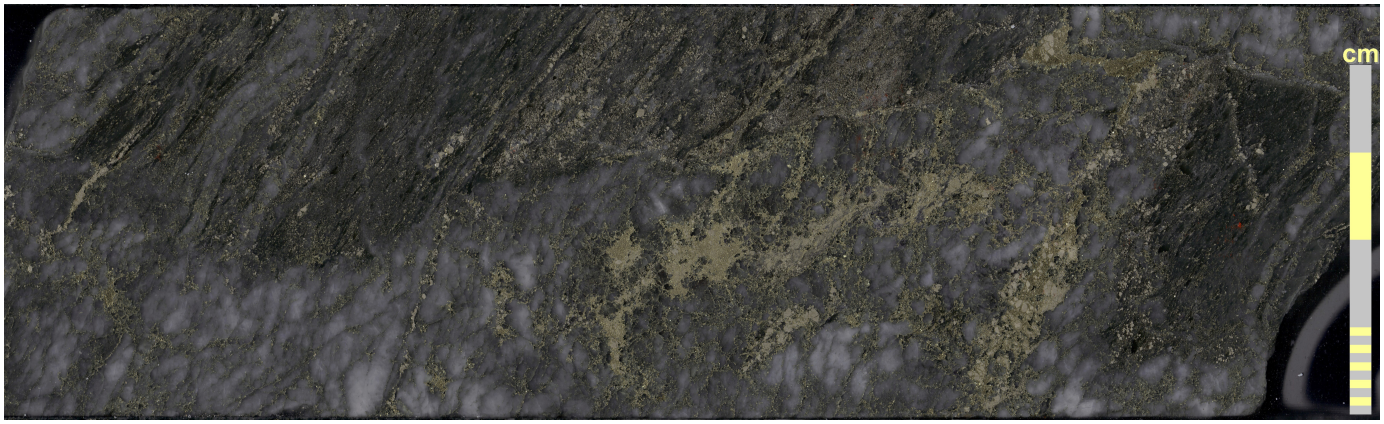


**Fig. 4.** Mineralized core from KSM`s Iron Cap deposit. Drill hole IC-16-062 from 250.7 m depth. Photo courtesy of Seabridge Gold. Inc.

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

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

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

### 5.1.3. Red Mountain (IDM Mining Ltd.)

The **Red Mountain** gold project is about 18 km east-northeast of Stewart. IDM Mining Ltd. can acquire 100% ownership of the 17,125 hectare property under an option agreement from Seabridge Gold Inc. Access to the site is by helicopter. The project contains five known underground gold zones; Marc, AV, JW, 141 and 132.

Mineralized zones consist of crudely tabular, northwesterly trending and moderately to steeply southwesterly dipping gold and silver-bearing iron sulphide stockworks. Mineralized widths vary from less than 2 m to 40 m (average, 16 m). The stockwork zones consist of pyrite microveins, coarse-grained pyrite veins, irregular coarse-grained pyrite masses and breccia matrix pyrite hosted predominately in a pale, strongly sericite altered porphyry. Vein widths vary from 0.1 cm to about 80 cm but widths of 1 to 3 cm are most common. The veins are variably spaced and average 2 to 10 per m. The veins are very often heavily fractured or brecciated, with infillings of fibrous quartz and calcite. The pyrite veins typically carry gold grades ranging from ~3 g/t to greater than 100 g/t. Gold occurs as grains of native gold, electrum, petzite and a variety of gold tellurides and sulphosalts. Pyrite is the predominant sulphide, although pyrrhotite is locally important. The stockwork zones also occur to a lesser extent in rafts of sedimentary and volcaniclastic rocks.

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

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

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

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

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

### 5.1.4. Tulsequah Chief (Chieftain Metals Corp.)

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

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

### 5.1.5. Galore Creek (Galore Creek Mining Corporation)

The **Galore Creek** gold-copper project is about 150 km northwest of Stewart and operated by Galore Creek Mining Corporation (GCMC). Ownership of GCMC is equally split between NovaGold Resources Inc. and Teck Resources Limited. Development of the Galore Creek project is currently on hold. Limited in-house engineering and optimization studies

focussed on tunnel-related infrastructure and mine sequencing. Onsite activities were reduced to baseline data acquisition and maintenance of the camps and equipment.

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

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

The **Schaft Creek** copper-gold-silver molybdenum project is about 80 km southwest of Iskut and is owned by Teck Resources Limited (75%) and Copper Fox Metals Inc. (25%). Access to the project is via helicopter or fixed wing aircraft to a gravel airstrip. The project has been in the pre-application phase of environmental assessment since 2006. In 2016, the collection of baseline environmental data continued. As well, 43,000 m of legacy core was relogged and the results might contribute to an update of the project's mineral resource estimate.

The Schaft Creek project consists of three deposits: the Main (Liard) zone, the Paramount zone and the West Breccia zone. The deposits host a Measured and Indicated resource of 1,228.6 Mt grading 0.26% Cu, 0.017% Mo, 0.19 g/t Au and 1.69 g/t Ag and a 597.2 Mt Inferred resource grading 0.22% Cu, 0.016% Mo, 0.17 g/t Au and 1.65 g/t Ag.

#### 5.1.7. Kitsault (Alloycorp Mining Inc.)

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

The project is fully permitted for construction and requires project financing to start construction. Pre-production costs are estimated to be $1.2 billion.

The proposed operation would have a 45,500 tpd throughput, which will recover both molybdenum and silver. Measured plus Indicated resources are 321.8 Mt at 0.071% Mo, 4.8 g/t Ag. The Kitsault deposit is hosted in the Eocene Lime Creek intrusive complex that cuts Jurassic argillite and greywackes of the Bowser Lake Group. Molybdenite is hosted in aplite dikes and quartz-molybdenite stockwork.

#### 5.1.8. Morrison (Pacific Booker Minerals Inc.)

The **Morrison** copper-gold-molybdenum-silver project is 65 km northeast of Smithers and 35 km northeast of Granisle and is owned by Pacific Booker Minerals Inc. Access to the site is by road and barge. Measured and Indicated resources are reported as 265.9 Mt at 0.35% Cu, 0.17 g/t Au and 0.005% Mo (at a 0.20% Eq copper cutoff). Proposed is an open pit operation with a 30,000 tpd mill, equating to a 21-year mine life.

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

## 6. Exploration activities and highlights

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

Early stage activities include more focussed sample grids, geophysical surveys, prospect scale geological mapping, drill target generation and testing that will set the stage for future mine evaluation. The initiation of baseline environmental data collection is also recommended at this stage. Selected exploration projects active during 2016 are summarized in Table 5.

### 6.1. Precious metal projects

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

#### 6.1.1. Brucejack Regional (Pretium Resources Inc.)

Outside of the **Brucejack** proposed mine area, evaluation of the surrounding 1,200 km$^2$ of mineral claims continued. Work in the previous two years included airborne geophysical surveys and regional sampling. In 2016, the regional program was focussed approximately 20 km southeast of the mine project. New work included additional airborne magnetic, radiometric and hyperspectral surveys. Ground work included magneto-telluric geophysical surveys, property scale mapping, prospecting and diamond drilling.

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

The **Clone** gold property is 20 km southeast of Stewart and is owned by Makena Resources Inc. 50%, Silver Grail Resources Ltd. 25% and Teuton Resources Corp. 25%. Makena Resources Inc. completed seven diamond drill holes and hole lengths were reported to range between 38 and 137 m. Reported assay results for the first hole included 6.43 m grading 17.83 g/t Au from 46.33 to 52.76 m downhole.

#### 6.1.3. Del Norte and Big Gold (Teuton Resources Corp.)

Teuton Resources Corp. intersected copper-gold mineralization in a six-hole drill program and completed a magnetotelluric geophysical survey at their **Del Norte** project. As well, an eight-hole drill program was completed at their

**Table 5.** Selected exploration projects, Northwest Region.

| Project | Operator | MINFILE | Commodity; Deposit type | Resource (NI 43-101 compliant unless indicated otherwise) | Work Program 2016 |
|---|---|---|---|---|---|
| **Adanac** | Global Drilling Solutions Inc. | 104N 052 | Mo, W, Cu; Porphyry (Low F-type) | M+I: 212.907 Mt at 0.063% Mo | Diamond drilling (3,188 m, 14 holes) compilation of legacy data. |
| **Kinskuch** | OK2 Minerals Ltd. | 103P 014 | Au, Cu; Subvolcanic | | Geological mapping, rock sampling, channel sampling, petrography, corporate. |
| **Big Gold** | Teuton Resources Corp. | | Au, Ag; porphyry related | | Diamond drilling. |
| **Bow** | Decade Resources Ltd. | | Au, Ag, Co in quartz veins | | Chip and grab sampling, diamond drilling. Highlight drilling results included 6.09 m of 17.17 g/t Au, 47.27 g/t Ag and 0.165% Co and 5.80 m of 21.18 g/t Au, 48.81 g/t Ag and 0.227% Co. |
| **Brucejack Regional** | Pretium Resources Inc. | | Au, Ag, Zn, Cu; Precious metal veins, VMS | | Diamond drilling, geological mapping, rock sampling (4,500), hyperspectral imagery, geochronology, geophysics (Magnetotelluric, magnetics, radiometrics). |
| **Clone** | Makena Resources Inc. | 103P 251 | Au, Ag, Cu, Co; Au; precious metal veins | | Diamond drilling (7 holes), rock sampling. Reported assay results for the first hole included 6.43 metres grading 17.83 g/t Au from 46.33 to 52.76 metres downhole. |
| **Del Norte** | Teuton Resources Corp. | 104A 176 | Cu, Au; calc-alkalic porphyry | | Diamond drilling (6 holes) MT geophysical survey, legacy data compilation. |
| **Dolly Varden** | Dolly Varden Silver Corporation | 103P 188 | Ag, Zn; Noranda / Kuroko massive sulphide | Ind: 3.073 Mt at 321.6 g/t Ag;<br>Inf: 898,500 t at 373.3 g/t Ag | Diamond drilling (~2,311.6m, 13 holes), mapping, prospecting, soil sampling. Drilling highlights included 19.4 m grading 485 g/t Ag. |
| **E&L** | Garibaldi Resources Corp. | 104B 006 | Ni, Cu, Pt, Ag; Tholeiitic intrusion | | Geological mapping, prospecting, rock sampling, hand trenching, legacy data compilation. |
| **Eaglehead** | Carmax Mining Corp. | 104I 008 | Cu, Mo; calc-alkalic porphyry | Inf: 102.5 Mt at 0.29% Cu + 0.01% Mo + 0.08 g/t Au | Re-logging and sampling, petro physical characterization, geophysical modelling. |
| **Electrum** | American Creek Resources Ltd. | 104B 033 | Au, Ag; in quartz veins | | Diamond drilling (1,406 m, 19 holes), trenching, u/g rehab, rock sampling, geological mapping. |
| **Fireweed** | Shamrock Enterprises Inc. | 93M 151 | Ag, Pb, Zn, Cu; Sedimentary exhalative | 640 kt at 277 g/t Ag, 1.34% Pb, 2.22% Zn (1989, non 43-101 compliant) | Diamond drilling (700 m program announced in late 2016). |

**Table 5.** Continued.

| | | | | | |
|---|---|---|---|---|---|
| **Four J's** | Rotation Minerals Ltd. | 104B 128 | Zn, Pb, Ag, Au; polymetallic veins | | Diamond drilling (2 holes). |
| **GJ** | Skeena Resources Limited | 104G 034 | Cu, Au; calc-alkalic - porphyry | M+I: 133.670 Mt at 0.32% Cu + 0.36 g/t Au; Inf: 53.69 Mt at 0.26% Cu + 0.330 g/t Au | Diamond drilling (2,872 m, 8 holes), prospecting, legacy data compilation, camp rebuild. |
| **Hat** | Doubleview Capital Corp. | 104J 015 | Au, Cu; calc-alkalic porphyry | | Diamond drilling (~2,000 m) geology, geochemistry, pack sack drilling, camp upgrades. |
| **Iskut** | Seabridge Gold Inc. | 104B 107 | Au, Ag, Cu; intrusion related, calc-alkalic porphyry | 24 kt at 11.3 g/t Au, 22 g/t Ag, 0.23% Cu (Johnny Mtn); | diamond drilling (3,368 m in 13 holes), MT geophysics, hyperspectral imagery, geological mapping, prospecting, legacy data compilation, reclamation. |
| **Kirkham** | Metallis Resources Inc. | 104B 079 | Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related | | VTEM/magnetic/radiometric survey carried out. |
| **KSP** | Colorado Resources Ltd. | 104B 111 and 104B 013 | Au, Cu; calc-alkalic porphyry and Au, Ag; intrusion related | | Diamond drilling (6 holes (2 at Tami, 4 at Khyber)) geological mapping, prospecting, rock sampling, ground magnetics. Diamond drilling ( 8,861.8 m, 59 holes) sampling (990 soils, 511 rock), geological mapping (50 km2), Geophysics (IP, 10 line km; ground mag, 47 line km VTEM, 126 line km)at Inel occurrence. |
| **Ootsa** | Goldreach Resources Ltd. | 093E 105 | Cu, Au; calc-alkalic porphyry | M+I: 224.189 Mt at 0.22% Cu, 0.15 g/t Au, 0.021% Mo, 2.8 g/t Ag; Inf: 5.212 Mt at 0.18% Cu, 0.09 g/t Au, 0.019 % Mo, 2.6 g/t Ag (at $8.50 / NSR cut-off) | Prospecting, soil sampling, geology, (Troitsa target area) PEA release March 2016. Sampling at Troitsa returned up to 4.78% Cu and 96.9 g/t Ag. |
| **Oweegee Dome** | Millrock Resources Inc. | 104A 165 | Cu, Au, Mo, Zn; calc-alkalic porphyry | | Regional reconnaissance, legacy data compilation, airborne geophysical survey (ZTEM), corporate. |
| **Premier** | Ascot Resources Ltd. | 104B 044 | Au, Ag; Au in quartz veins | | Diamond drilling (69,123 m in 279 holes). Highlight intersections include 125.50 g/t Au over a core length of 1.50 meters within a broader interval grading 13.71 g/t Au over 14.80 metres. |

**Table 5.** Continued.

| | | | | | |
|---|---|---|---|---|---|
| **Pyramid** | OK2 Minerals Ltd. | | Cu, Au; calc-alkalic porphyry | | RC drilling (2000 m, 5 holes), geological mapping, prospecting, soil sampling, ground geophysics (IP), corporate. Grab samples graded up to 82.96 g/t Au (zone 37), 0.15% Cu and 0.18 g/t Au. (Chili zone). |
| **Red Cliff** | Decade Resources Ltd. | 104A 037 | Cu, Au, Ag, Zn; polymetallic veins | | Geochemical surveys, rock sampling and diamond drilling. |
| **Scottie** | Rotation Minerals Ltd. 80%, Red Eye Resources Ltd. 20% | 104B 034 | Au, Ag; Au in quartz veins | | Diamond drilling, prospecting Drilling highlights included 1.13 m of 31.54 g/t Au. |
| **Snip** | Skeena Resources Limited | 104B 250 | Au, Ag; Au in quartz veins | | Diamond drilling (7,180 m in 28 holes), ground magnetics, corporate. Drilling highlight results included 33.07 g/t Au over 2.4 m for the Lamp Zone, 16.24 g/t Au over 13.5 m for the 200 Footwall Zone and 16.01 g/t Au over 4.7 m at the Twin West structural corridor. |
| **Spectrum** | Skeena Resources Limited | 104G 036 | Au, Cu; Au in quartz veins, high k calc-alkalic porphyry | Ind: 8.59 Mt at 1.04 g/t Au, 6.58 g/t Ag, 0.11% Cu<br>Inf: 22.63 Mt at 1.03 g/t Au, 3.85 g/t Ag, 0.11% Cu (0.50 g/t eAu cut-off) | Diamond drilling (6,826 m, 24 holes), mapping, prospecting, soil sampling, ground magnetics, maiden Resource established. |
| **Surprise Lake** | Decoors Mining Corp. | 104N 032 | Au; Au in quartz veins | | Trenching, sampling. Five 1 m trench samples of new bedrock gold discovery returned assays of 0.01, 6.89, 42.1, 3.05 and 0.15 g/t Au. |
| **Telkwa Coal** | Telkwa Coal Ltd. | 093L 156 | bituminous coal | M: 89.113 Mt<br>I: 42.037 Mt<br>Inf: 33.412 Mt | Corporate, updated feasibility; scoping study on multi-phased mine plan. |
| **Thorn** | Brixton Metals Corporation | 104K 031 | Ag, Au; Subvolcanic | Inf: 7.4 Mt at 35.54 g.t Ag + 0.51 g/t Au + 0.13% Cu + .032% Pb + 0.59% Zn | Diamond drilling (1,645 m total; (1,190 m in 5 holes at Outlaw, ; 455 m in 4 holes at Aberlour)), mapping, prospecting, soil sampling, ground geophysics 20 line km IP, Lidar mapping, increased mineral claims to 99,560 ha. Drilling highlights included 10 m of 3.61 g/t Au within 52 m of 0.94 g/t Au at the Outlaw zone and 1 m of 4.42 g/t Au within 3 m of 1.72 g/t Au at the Abelour zone. |

**Table 5.** Continued.

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

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

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

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

### 6.1.5. Four J's (Rotation Minerals Ltd.)

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

### 6.1.6. Iskut

The 294 km$^2$ **Iskut** project is about 110 km north of Stewart and is owned by Seabridge Gold Inc. The project was obtained through the acquisition of SnipGold Corp. by Seabridge in June of 2016.

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

### 6.1.7. KSP (Colorado Resources Ltd.)

The 305 km$^2$ **KSP** property is about 95 km northwest of Stewart and is under option to Colorado Resources Ltd. from Seabridge Gold Inc.

In 2016, Colorado's exploration program included sampling (990 soil, 511 rock), geological mapping (50 km$^2$), ground geophysics (IP, 10 line km; ground mag, 47 line km) an airborne VTEM survey (126 line km) and 8,862 m of diamond drilling in 59 holes. Drilling (53 holes) focussed around the former **Inel** underground workings. Drilling highlight results include one metre grading 138.5 g/t Au and broader intersections including 25.7 m averaging 9.24 g/t Au.

### 6.1.8. Oweegee Dome (Millrock Resources Inc.)

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

### 6.1.9. Premier (Ascot Resources Ltd.)

The **Premier** project is about 13 km north of Stewart. In 2009, Ascot signed an option agreement with Boliden Ltd. to acquire a 100% interest in the >100 km$^2$ property that includes the historic Premier gold mine. Until operations were suspended in 1996, the Premier mine produced 2 million ounces of gold and 42.8 million ounces of silver. Under the terms of a 2015 amending agreement, Ascot can acquire 100% of the project by making a payment of $4.775 million on or before June 30, 2017.

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

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

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

with an average head grade of 16.20 g/t Au. Production totalled 2,967,748 grams of Au (95,426 oz Au) from 183,147 t.

In 2016, drilling on the property was focused on gold-bearing areas outside of the immediate mine workings and reported intersections included 1.13 m of 31.54 g/t Au.

### 6.1.11. Snip (Skeena Resources Limited)

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

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

### 6.1.12. Surprise Lake (Gray Rock Resources Ltd.)

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

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

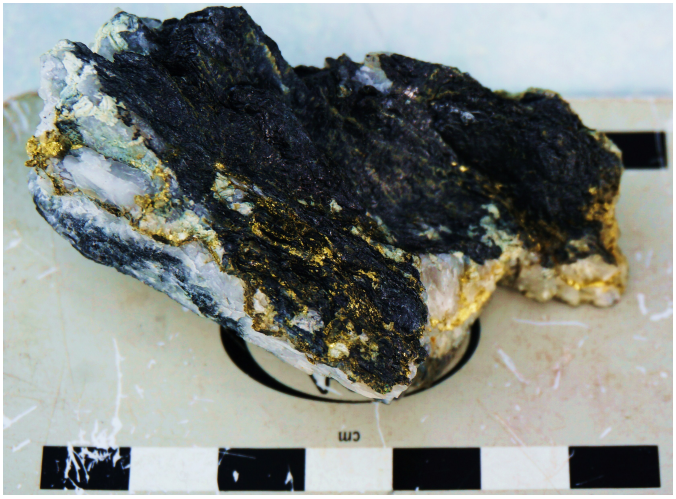


**Fig. 5.** Coarse gold in bedrock from the Otter Creek area, Surprise Lake project. Photo courtesy of Matt Fraser, DeCoors Mining Corp.

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

### 6.1.13. Thorn (Brixton Metals Corporation)

The 996 km$^2$ **Thorn** property is about 120 km southeast of Atlin and is owned by Brixton Metals Corporation. Access to the project is via helicopter or fixed wing aircraft from Atlin or Dease Lake.

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

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

The 179 km$^2$ **Treaty Creek** project is 75 km north of Stewart and immediately north-northwest of the KSM and **Brucejack** projects. Ownership is divided between Tudor Gold Corp. (60%), Teuton Resources Corp. (20%) and American Creek Resources Ltd. (20%). Access to the project is by helicopter.

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

### 6.1.15. Yellow Jacket (African Queen Mines Ltd.)

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

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

The Northwest Region is highly prospective for porphyry deposits related to island arc assemblages that had collided before accretion with North America and also with post-accretionary intrusive suites.

### 6.2.1. Adanac (Global Drilling Solutions Inc.)

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

### 6.2.2. Eaglehead (Carmax Mining Corp.)

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

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

### 6.2.3. Hat (Doubleview Capital Corp.)

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

### 6.2.4. Ootsa (Gold Reach Resources Ltd.)

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

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

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

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

### 6.2.5. Pyramid (OK2 Minerals Ltd.)

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

The 2016 work program was the fourth year of grassroots and early-stage exploration activities and included geological mapping, rock sampling, prospecting and reconnaissance reverse circulation (RC) drilling. Two new zones of gold mineralization, Zone 3 and the Chili zone were discovered. Grab samples from zone 37 returned assays up to 82.96 g/t Au. The Chili zone is a 15 $km^2$ alteration assemblage from which rock samples graded up to 0.15% Cu and 0.18 g/t Au. The RC drilling was carried out on the known West zone and results will be used to rank areas for follow-up diamond drilling in 2017.

### 6.2.6. Spectrum-GJ (Skeena Resources Limited)

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

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

**6.2.7. Whiting Creek (Huckleberry Mines Ltd.)**

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

**6.3. Polymetallic base and precious metal projects**

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

**6.3.1. Bow (Decade Resources Ltd.)**

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

**6.3.2. Dolly Varden (Dolly Varden Silver Corporation)**

The 88 km$^2$ **Dolly Varden** silver project is about 145 km north-northwest of Terrace and is owned by Dolly Varden Silver Corporation. The project is most easily accessed from Terrace, via a 224 km long all-weather road to the historical mining town and port of Kitsault, which is 25 km south of the property, and then by a 15-minute helicopter flight. Alternatively, the village of Alice Arm is accessed from Kitsault by passenger boat or Prince Rupert, via a privately contracted barge or float plane service. From Alice Arm, the property can be accessed by an all-weather gravel surfaced road that is currently being maintained by stakeholders in the Kitsault Valley, including Homestake Resources Corp. (formerly Bravo Gold Corp.) and by Kitsault Hydro Electric Corporation. The Alice Arm access road is not maintained in the winter.

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

**6.3.3. Fireweed (Shamrock Enterprises Inc.)**

The 24.1 km$^2$ **Fireweed** project is about 20 km northeast of Smithers and is under option to Shamrock Enterprises Inc. from Regulus Resources Ltd. In late 2016, Shamrock announced a planned 700 m diamond drill program designed to test a polymetallic target known as the South Zone. A mineralized float sample from the South Zone assayed 479 g/t Ag, 2.6 g/t Au, 0.28% Cu, 1.3% Pb and 2.6% Zn.

**6.3.4. Kirkham (Metallis Resources Inc.)**

The 106 km$^2$ **Kirkham** project is about 65 km north of Stewart and is owned by Metallis Resources Inc. The property is prospective for high-grade precious metal veins, Eskay Creek-type stratiform mineralization and porphyry copper-gold deposits. In the fall of 2016 a VTEM/magnetic/radiometric airborne survey was carried out on portions of the property not covered by the same survey methods in 2013. Results will be integrated and interpreted to design a 2017 exploration program that includes proposed drilling.

**6.3.5. Red Cliff (Decade Resources Ltd.)**

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

**6.4. Mafic and ultramafic hosted projects**

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

**6.4.1. E&L (Garibaldi Resources Corp.)**

The **E&L** property is about 50 km southwest of the Bob Quinn airstrip and Garibaldi Resources Corp. is the operator. Garibaldi can acquire a 100% interest in the property under the terms of a four-year option agreement signed in June 2016.

Garibaldi carried out prospecting, geological mapping and rock sampling. Highlights at E&L include a 12 m wide channel sample that returned 1.6% Ni and 1.57% Cu and included 8 m at 2.3% Ni and 2.2% Cu.

**6.5. Coal projects**

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

**6.5.1. Telkwa (Telkwa Coal Limited)**

The **Telkwa** coal project is about 10 km southwest of Telkwa and 18 km south-southeast of Smithers. The project was

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

A technical report filed in February of 2015 confirmed a global estimate of 165 Mt of semi-soft coking coal including 131 Mt of Measured plus Indicated resources and 33.4 Mt of Inferred resources. During 2015 and the first half of 2016, TLC completed two internal scoping studies. One study focussed on updating aspects of a 1996 feasibility study assuming a constant rate of production versus the second study which proposed a staged approach of an initial small mine gradually transitioning into a major mine.

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

## 7. Geological research

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

The Porphyry Environment Transitions project is a collaboration with the GSC through the Geo-mapping for Energy and Minerals (GEM 2) program. In 2016, mapping was completed in the Turtle Lake map area, a region assumed to have been part of the Stuhini forearc (Late Triassic). Topical studies are also being directed at establishing a lithostratigraphic framework of prospective Upper Cretaceous rocks using new geochronologic and geochemical data, documenting Middle to Late Triassic Alaskan-type utramafic intrusions with Ni-Cu-PGE potential in northern Stikinia and establishing the boundary between Intermontane arc terranes and the Cache Creek terrane. Another BCGS project builds on recent studies in the Dease Lake area, providing a regional update of the geology east of Dease Lake and north of the Hotailuh batholith. The project investigates late Early to early Late Jurassic alkaline and subalkaline magmatism and its relationship to porphyry copper potential. BCGS has partnered with the Mineral Development Research Unit at the University of British Columbia and Geoscience BC to examine and map the Bulkley (Late Cretaceous) and Babine and Nanika intrusive suites (Eocene) in central British Columbia. These intrusions and mineral occurrences are largely restricted to the Skeena arch, a northeast-trending structure that extends transverse to the general trend of Stikine terrane. Geoscience BC has also continued with their SeArch Phase II project with airborne geophysical coverage that adds 116,200 line kilometres of magnetic data between Smithers and Vanderhoof. BCGS completed a topical study that examined major porphyry deposits in the Stikine terrane, such as Red Chris and KSM, and their spatially associated with major, long-lived faults that probably originated as high-strain zones in pre-Devonian basement. This project targets two ready accessible areas: 1) along a transect from the Terrace area of western Stikinia into the Ecstall belt of the Coast Mountains; and 2) west of the Anyox deposit, where Devonian to Middle Jurassic rocks are exposed. BCGS, in collaboration with the GSC's Targeted Geoscience Initiative (TGI-5) program examined the orogenic gold potential of the Llewellyn fault, a north-northwest striking structure near the British Columbia-Yukon border, ~50 km west of the town of Atlin. A number of disparate gold prospects and past-producing mines (e.g., Engineer, Venus, Mt Skukum) occur near the fault and show a variety of characteristics from intrusion- to mesothermal-related styles of mineralization. This project will assess the genetic relationship of these deposits and determine if they are part of an 'orogenic' gold system, intrinsically related to crustal-scale deformation along the Llewellyn fault.

## 8. Summary

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

## References cited


Barresi, T., Nelson, J.L., Dostal, J., and Friedman, R., 2015. Evolution of the Hazelton arc near Terrace, British Columbia: Stratigraphic, geochronological, and geochemical constraints on a Late Triassic-Early Jurassic arc and Cu-Au porphyry belt. Canadian Journal of Earth Sciences, Volume 52, pp. 466-494.

Cui, Y., Miller, D., Nixon, G., and Nelson, J., 2015. British Columbia digital geology. British Columbia Ministry of Energy and Mines, British Columbia Geological Survey, Open File 2015-2.

Dostal, J., Gale, V., and Church, B.N., 1999. Upper Triassic Takla Group volcanic rocks, Stikine terrane, north-central British Columbia: Geochemistry, petrogenesis, and tectonic implications. Canadian Journal of Earth Sciences Volume 36 pages 1483-1494.

Ernst & Young LLP (EY), 2017 (in press). British Columbia Mineral and Coal Exploration Survey 2016 Report. (http://www.ey.com/ca/en/industries/mining---metals/bc-minerals-and-coal-exploration-survey-2016).

Gabrielse, H., 1998. Geology of the Cry Lake and Dease Lake map areas, north-central British Columbia. Bulletin - Geological Survey of Canada. 147p.

Gabrielse, H., Murphy, D.C., and Mortensen, J.K., 2006, Cretaceous and Cenozoic dextral orogen-parallel displacements, magmatism and paleogeography, north-central Canadian Cordillera, *in* Haggart, J.W., Monger, J.W.H., and Enkin, R.J., Eds., Paleogeography of the North American Cordillera: Evidence For and Against Large-Scale Displacements: Geological Association of Canada Special Paper 46, pp. 255-276.

Gehrels, G.E., Saleeby, J.B., and Berg, H.C., 1983. Preliminary description of the Klakas orogeny in the southern Alexander terrane, southeastern Alaska; in Stephens, C.H., ed., Pre-Jurassic Rocks in Western North American Suspect Terranes; Pacific Section, Society of Economic Paleontologists and Mineralogists, pp. 131-141.

Gehrels, G.E., 2001. Geology of the Chatham Sound region, southeast Alaska and coastal British Columbia; Canadian Journal of Earth Sciences, Volume 38, pp. 1579-1599.

Gunning, M.H., Hodder, R.W.H., and Nelson, J.L., 2006. Contrasting volcanic styles within the Paleozoic Stikine assemblage, western Stikine terrane, northwestern British Columbia. In Paleozoic Evolution and Metallogeny of Pericratonic Terranes at the Ancient Pacific Margin of North America, Canadian and Alaskan Cordillera. Edited by M. Colpron and J.L. Nelson, Geological Association of Canada, Special Paper 45, pp. 201-227.

Kyba, J., and Nelson, J.L., 2015. Stratigraphic and tectonic framework of the Khyber-Sericite-Pins mineralized trend, lower Iskut River, northwest British Columbia. In: Geological Fieldwork 2014, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2015-1.

Logan, J.M., Drobe, J.R., and McClelland, W.C., 2000. Geology of the Forest Kerr - Mess Creek Area, Northwestern British Columbia (104B/10,15 & 104G/2 & 7W). British Columbia Ministry of Energy and Mines, Bulletin pages 104, 164.

Maclntyre, D.G., Ash, C.H., and Britton, I.B., 1994. Geological Compilation, Skeena Nass Area, West Central British Columbia; B.C. Ministry of Energy, Mines and Petroleum Resources, Open File 1994-14.

Margolis, J., 1993. Geology and intrusion-related copper-gold mineralization, Sulphurets, British Columbia, unpublished PhD thesis, University of Oregon, 289p.

Marsden, H., and Thorkelson, D.J., 1992. Geology of the Hazelton volcanic belt in British Columbia: Implications for the Early the Middle Jurassic evolution of Stikinia. Tectonics, 11: 1266-1287.

McClelland and Mattinson, J.M., (2000): Cretaceous-Tertiary evolution of the western Coast Mountains, central southeastern Alaska; in Stowell, H.H., McClelland, W.C., Eds., Tectonics of the Coast Mountains, Southeastern Alaska and British Columbia; Geological Society of America, Special Paper 343, pp. 159-182.

Mihalynuk, M.G., Zagorevski, A., Devine, F.A.M., and Humphrey, E., 2017. A new lode gold discovery at Otter Creek: Another source for the Atlin placers. In: Geological Fieldwork 2016, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2017-1, pp. 179-193.

Monger, J.W.H., 1977. The Triassic Takla Group in McConnell Creek map-area, north-central British Columbia. Geological Survey of Canada, Paper 76-29, p45.

Nelson, J., Colpron, M., and Israel, S., 2013. The Cordillera of British Columbia, Yukon and Alaska: tectonics and metallogeny. In: Colpron, M., Bissig, T., Rusk, B., and Thompson, J.F.H., (Editors), Tectonics, Metallogeny, and Discovery - the North American Cordillera and similar accretionary settings. Society of Economic Geologists, Special Publication 17, 53-109.

Nelson, J., and Kyba, J., 2014. Structural and stratigraphic control of porphyry and related mineralization in the Treaty Glacier – KSM – Brucejack – Stewart trend of western Stikinia. In: Geological Fieldwork 2013, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2014-1, 111-140.

Puritch, E., Ray, B., Barry, J., Hayden, A., Yang, D., and Schmitt, H.R., 2016. Updated Resource Estimate and Preliminary Economic Assessment on the Ootsa Property British Columbia Canada by P & E Mining Consultants. 43-101 Technical Report.

Rees, C., Riedell, B., Proffett, J.M., Macpherson, J., and Robertson, S., 2015.The Red Chris Porphyry Copper-Gold Deposit, Northern British Columbia, Canada: Igneous Phases, Alteration, and Controls of Mineralization; Economic Geology, June-July 2015, volume. 110, pp. 857-888.

Saleeby, J.B. 2000. Geochronologic investigations along the Alexander-Taku terrane boundary, southern Revillagigedo Island to Cape Fox areas, southeast Alaska; in Stowell, H.H., McClelland, W.C., eds., Tectonics of the Coast Mountains, Southeastern Alaska and British Columbia; Geological Society of America, Special Paper 343, pp. 107-143.

Souther, J.G., 1977. Volcanism and tectonic environments in the Canadian Cordillera – a second look. In Volcanic Regimes of Canada, Geological Association of Canada Special Paper, 16: 1-24. page 47 of 80.

van der Heyden, P., 1992. A Middle Jurassic to Early Tertiary Andean-Sierran arc model for the Coast Belt of British Columbia; Tectonics, Volume 11, pp. 82-97.