Exploration and mining in the Southwest Region, British Columbia

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1. Introduction

The Southwest Region (Fig. 1) has a long history of mining. This history includes: the use of native copper by First Nations; silver, gold, and coal mining by the mid-19th century; mining of iron in the mid-20th century; and substantial copper production throughout the 20th century. Although mining and exploration for metals continues in the region, most mining is for construction materials, mainly aggregates for local markets with some exports from the largest coastal quarries.

The area recently had one major polymetallic metal mine, **Myra Falls** (Myra Falls Mine Ltd., Trafigura Mining Group), and numerous industrial minerals and aggregate operations. Operations have been episodic since the mine was placed on care and maintenance in 2015. Although the mine restarted in April 2019, it was once again placed on care and maintenance in December, 2023.

Northisle Copper and Gold Inc. was active with drilling and geophysics on northern Vancouver Island. More than 30 other exploration projects were tracked, mainly grass roots or early stage and small scale. Estimates for exploration expenditures, drilling programs, and other metrics were captured in the British Columbia Mineral and Coal Exploration Survey, a joint initiative of the Province of British Columbia Ministry of Energy, Mines and Low Carbon Innovation, the Association for Mineral Exploration in British Columbia, and EY LLP. For the Southwest Region, exploration expenditures are estimated at $10.1 million. The estimate for exploration drilling is 24,700 m (Clarke et al., 2024; EY LLP, 2024).

2. Geological overview

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

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

Unconformably overlying the Paleozoic rocks are Middle to Upper Triassic oceanic flood basalts and related sedimentary rocks of the Vancouver Group. The upper part of the Vancouver Group contains numerous skarn occurrences adjacent to Jurassic intrusions (Island Plutonic suite). The Tasu past producer on Haida Gwaii is one of the larger examples of numerous iron and iron-copper skarns. Between 1914 and 1983, it produced 12 Mt of iron concentrate as well as copper, gold, and silver.

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

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

The Coast Mountain range is underlain by the Coast Plutonic complex, a large northwest-trending batholith consisting largely of diorite, quartz diorite, tonalite, and granodiorite calc-alkaline rocks with less abundant high-grade metamorphic

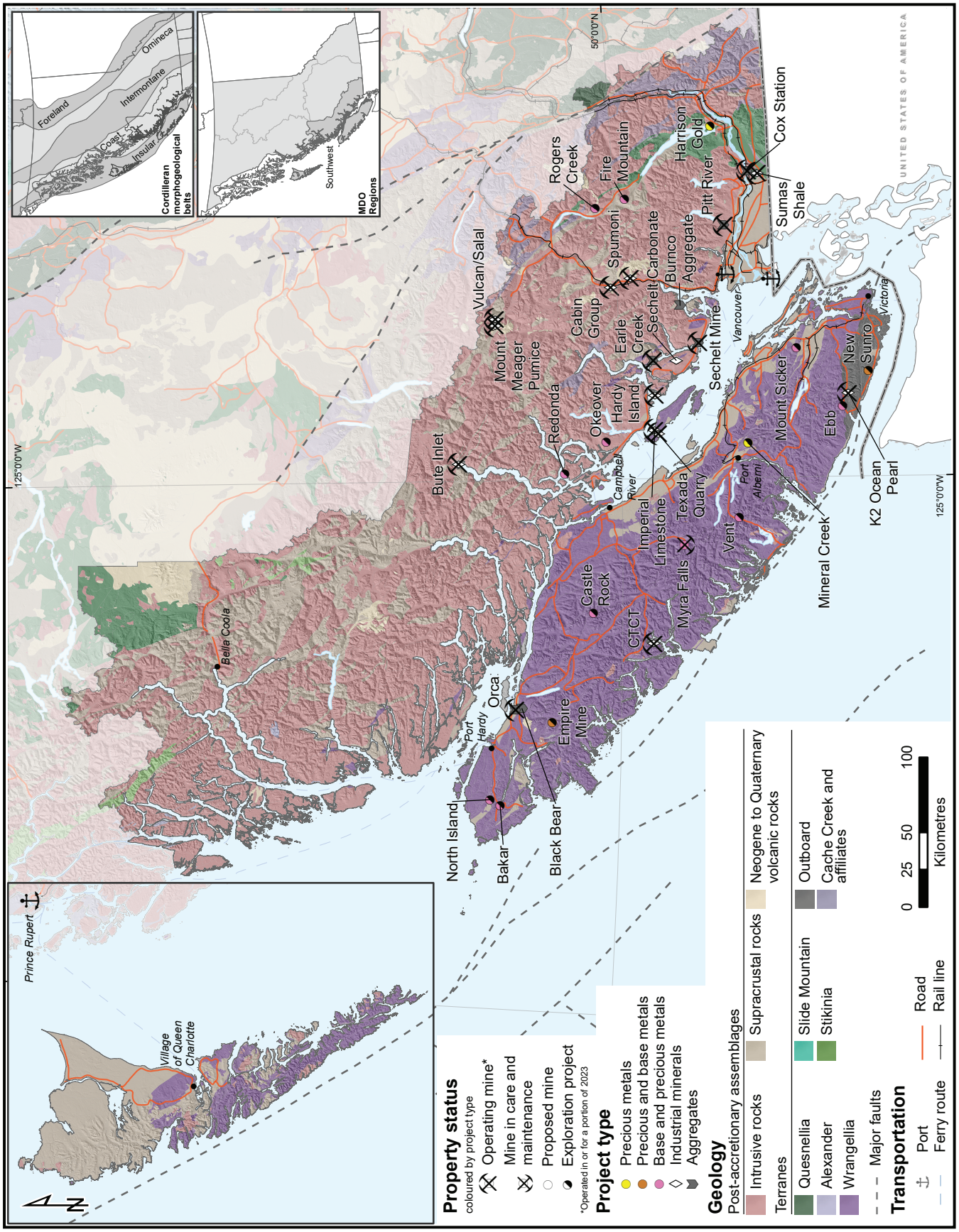

Fig. 1. Mines, proposed mines and selected exploration projects, Southwest Region, 2023. Terranes after Nelson et al. (2013).

rocks. For the most part, uplift and erosion have removed the levels at which epithermal and porphyry mineralization form, with some exceptions. At the southern end of the Coast Plutonic complex, economically important deposits occur in pendants of the Gambier Group, overlapping Late Jurassic to Mid-Cretaceous arc-related volcanic and sedimentary rocks. The most productive of these deposits was the Britannia mine, a Kuroko-type polymetallic volcanogenic massive sulphide deposit that produced 517,000 t of copper along with zinc, silver, gold, lead, and cadmium between 1905 and 1974. At the southeastern edge of the Coast ranges, the Giant Mascot ultramafic-mafic intrusive suite (Late Cretaceous, Manor et al., 2014, 2015, 2016, 2017) hosts the province's only past-producing nickel mine, Giant Mascot Nickel, which operated between 1958 and 1974.

Eocene to Miocene ancestral Cascades arc magmatism extended as far northward as southwestern British Columbia, as does present day Cascades magmatism. Evidence of forearc Paleocene to Miocene magmatism can be traced from southern Oregon through Alaska (Madsen et al., 2006). Mount Washington Copper (Eocene) produced 3548 t of copper, 131 kg gold and 7235 kg silver. Catface Copper (Eocene) has a significant undeveloped resource. Other presumably Cenozoic targets include Giant Copper and **Okeover**. Harmony, on Graham Island, Haida Gwaii (Fig. 1) is a Miocene epithermal deposit with a significant undeveloped gold resource. Some recent exploration targets Neogene mineralization along a magmatic belt between the Brooks Peninsula and Alert Bay on northern Vancouver Island (Nixon et al., 2011a, b; 2020).

Quaternary Cascades magmatism has produced pumice and other volcanic rocks quarried for construction, landscaping, and other applications. The Mount Meager area has also been investigated as a possible source of geothermal energy.

On Vancouver Island, the western and southern margins of Wrangellia are structurally juxtaposed with the Pacific Rim terrane, which consists of possible mélange deposits (Rusmore and Cowan, 1985; Brandon, 1989) and the Leech River complex, an assemblage of greenschist- to amphibolite-grade mudstones, sandstones, and mafic volcanic rocks cut by granitic bodies (Groome et al., 2003). Slate and siltstone are quarried for building stone in the Leech River complex. The Leech River has been an active placer gold camp since 1864. Gold quartz veins have been the subject of recent exploration near the Leech River fault, along the southern margin of the terrane.

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

The southeastern Coast belt, north of the international border is underlain by the Nooksack-Harrison and Chilliwack terranes (equivalent to Stikinia; Monger and Struik, 2006), and the Bridge River, Cadwallader, and Methow terranes, allied with the main Cache Creek terrane (Fig. 1). These represent slices of oceanic and arc-related rocks enclosed between Intermontane and Insular terranes during Middle Jurassic to Middle Cretaceous regional sinistral faulting (Bustin et al., 2013; Monger and Brown, 2016). Gambier Group-equivalent overlap deposits and parts of the Nooksack-Harrison terrane are prospective for VMS mineralization. The Coquihalla serpentine belt, along the Hozameen fault between the Bridge River terrane to the west and the Methow terrane to the east, hosts several gold prospects and five past producers including the Carolin mine, which operated between 1981 and 1984.

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

3. Mines

The Southwest Region has one metal mine, and numerous industrial minerals and aggregate operations (Fig. 1; Tables 1-3). No coal mine is producing. Of eight large-scale industrial minerals operations in the region, two entered care and maintenance in 2016 and remained so through 2023. Aggregate operations in the region number in the 100s and only the most prominent (e.g., those producing at least 1 Mty) are reported here.

3.1. Metal mines

3.1.1. Myra Falls (Myra Falls Mine Ltd., Trafigura Mining Group)

The Myra Falls underground Zn-Cu-Pb-Ag-Au mine produced for most of the period from 1966 to present. It operated for most of 2023 but In December, Myra Falls Mine Ltd. (part of Trafigura Group Pte. Ltd.) announced that the mine would be placed on long-term care and maintenance. The company will be seeking creditor protection to allow corporate restructuring. Although a private multinational commodity trading company not required to publish compliant production or reserves figures, Trafigura had a target throughput of 800,000 tpy of ore and estimated the operation has a lifespan of at least 10 years (Table 1). The mine has a history of replacing reserves through exploration, which continued in 2023 with about 33,000 m of drilling completed by year end. The Myra Falls camp hosts Kuroko-type, or bimodal felsic type Zn-Cu-Pb-Ag- Au VMS deposits (Fig. 2) from which more than 30 Mt of ore were mined between 1966 and 2015. Before the recent shutdown, the mine had a workforce of about 450 people.

3.2. Coal mines

There are no producing coal mines in the region. Coal was mined on Vancouver Island between ca. 1849 and 2019.

Table 1. Metal mines, Southwest Region.

Mine	Operator (partner)	Commodity; Deposit type; MINFILE	Forecast 2023 Production (based on Q1-Q3)	Reserves	Resource	Comments
Myra Falls	**Myra Falls Mine Ltd. (Part of Trafigura Mining Group)**	Zn, Cu, Pb, Ag, Au; Kuroko massive sulphide; 092F 330, 71, 72, 73	Not reported. Mill capacity 2400 tpd. Long term target 800,000 tpy of ore.	Not reported but estimated sufficient for 10 years.	Not reported	Estimated drilling by year end of more than 30,000 m in 184 holes for infill and addition to known deposits. Entered care and maintenance in December.

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

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

Mine	Operator (partner)	Commodity; Deposit type; MINFILE	Forecast 2023 Production (based on Q1-Q3)	Reserves	Resource	Comments
Bute Inlet	**Ironwood Clay Company Inc.**	Clay; Sedimentary kaolin or illite	na	na	na	Intermittent mining as needed.
Cabin Group	**Northwest Landscape and Stone Supply Ltd.**	Landscaping stone	na	na	na	
Cox Station	**Mainland Construction Materials ULC**	Aggregate; Crushed rock; 092GSE103	Approx. 3-4 Mty	na	na	River and rail access.
CTCT	**Vancouver Island Marble Quarries Ltd.**	Marble; Limestone; 092E 020	Typically, about 400 t annually	na	na	Supplies Matrix Marble and Stone Inc.
Earle Creek	**Lafarge Canada Inc.**	Sand and Gravel	Typically, >1 Mty	na	na	Material barged.
Hardy Island	**Hardy Island Granite Quarries Ltd.**	Dimension stone, building stone; Dimension stone-granite; 092F 425	3000-5000 tpy	na	Approx. 100,000 t	Seasonal quarry.
Imperial Limestone	**Imperial Limestone Co. Ltd.** (Parent Arcosa Specialty Materials Inc.)	Limestone; Limestone; 092F 394	500,000 tpy chemical grade limestone plus 50,000 t dolostone	na	75 years	Most of the chemical grade product is shipped to parent company in Seattle.

Table 2. Continued.

K2 (Ocean Pearl)	**K2 Stone Quarries Inc.**	Dimension stone, flagstone; Flagstone; 092C 159	15,000-20,000 t annually	na	na	Production number represents material extracted.
Mount Meager Pumice	**Great Pacific Pumice Inc.**	Pumice; Volcanic ash; 092JW 039	na	na	na	Production as required.
Orca	**Polaris Minerals Corporation** (Vulcan Materials Company and 'Namgis First Nation partnership)	Sand and Gravel	Up to 6 Mty	na	121.6 Mt initial resource (2005)	Recently 3.5 to 5 Mty. Increase proposed in mine plan. Vulcan Materials Company acquired the previous owner US Concrete Inc. The quarry has a freighter loading facility.
Pitt River	**Lafarge Canada Inc.**	Aggregate; Crushed rock; 092GSE007	Typically, >1 Mty	na	na	River access for barging.
Sechelt Mine	**Heidelberg Materials Canada Limited**	Sand and Gravel	Typically, 4-6 Mty	na	Several decades	Freighter loading facility.
Spumoni	**Northwest Landscape and Stone Supply Ltd.**	Flagstone; Flagstone; 092GNW100	na	na	na	Seasonal quarry.
Sumas Shale	**Sumas Shale Ltd.**	Shale, clay, sandstone; Residual kaolin; 092GSE024	500,000 t annually	na	50+ years	Approximately 55% shale, 45% sandstone for cement production.
Texada Quarry	**Texada Quarrying Ltd. (Lafarge Canada Inc.)**	Limestone, aggregate; Limestone; 092F 395	6 Mt including waste.	na	100+ years	Mostly produces limestone for cement manufacture. Freighter loading facility available.
Vulcan/ Salal	**Garibaldi Pumice Ltd.**	Pumice; Volcanic ash; 092JW 039	Typically, 10,000-20,000 m^3	na	In 2014, 11,396,000 m^3 pumice 4,990,000 m^3 pumicite (fines)	

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

Table 3. Selected proposed mines or quarries, Southwest Region.

Project	Operator (partner)	Commodity; Deposit type; MINFILE	Reserves	Resource	Comments
Black Bear	**Polaris Materials Corporation** (Vulcan Materials Company and and 'Namgis First Nation)	Aggregate; Crushed rock	na	20 years (proposed life)	Orca environmental certificate amendment application withdrawn. Proposed 250,000 tpy 4 km from the Orca quarry revised to 3-4 Mtpy. Indicate intention to re-apply under 2018 Act.
BURNCO Aggregate	**BURNCO Rock Products Ltd.**	Aggregate; Sand and gravel	na	20 Mt	Environmental certificate expired 2023.
Sechelt Carbonate	**Ballinteer Management Inc.**	Limestone, dolostone, aggregate; Limestone, dolomite, crushed rock; 093GNW031	na	Carbonate rock: 76.1 Mt Gabbro: >700 Mt	Proponent requests project remain in environmental assessment pre- application stage.

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

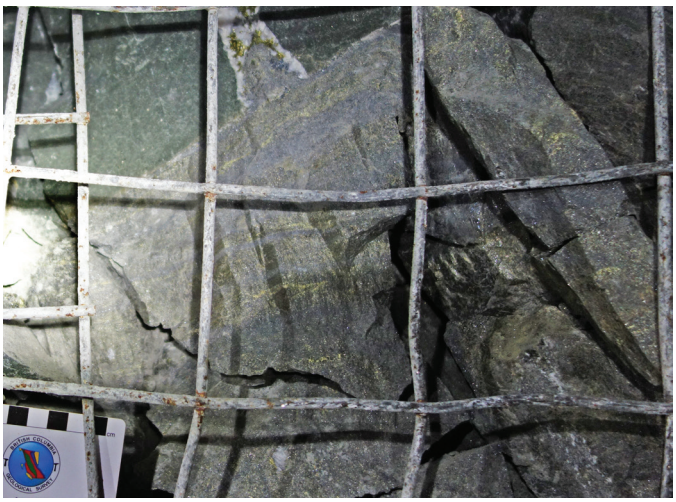

Fig. 2. Interlayered sphalerite and chalcopyrite in an area of former mining (Battle Gap West) at Myra Falls (Myra Falls Mine Ltd., Trafigura Mining Group).

3.3. Industrial minerals and aggregates

Large quarries on the coast (Table 3) serve the Lower Mainland, Vancouver Island, and U.S. Pacific northwest markets by barge. Those with access to freighter loadout facilities can also supply eastern Pacific international markets and Hawaii. Aggregates are an important part of the mining industry on the south coast, generating many more jobs in the region than other mining activities. The area hosts some of the largest aggregate pits and quarries in Canada. Most quarries serve local markets. General sales and production trends follow those of the construction industry. Lafarge Canada Inc., Heidelberg Materials Canada Limited, Vulcan Materials Company, and Mainland Construction Materials ULC, a subsidiary of Summit Materials LLC, doing business as Mainland Sand and Gravel Ltd., are the largest participants in the coast area, although hundreds of pits and quarries produce in the region.

One of the largest aggregate-only operations is the **Sechelt** mine, operated by Heidelberg Materials Canada Limited. The company no longer makes production figures public, but volumes have been in the 4-6 Mt range in recent years. The mine is permitted for up to 7.5 Mty, and the company expect reserves to last several more decades. Barges handle most shipments. There is also a loading facility capable of accommodating Panamax-class freighters.

In addition to the **Texada Quarry**, Lafarge Canada operates two of the largest aggregate quarries in the region each of which typically produces more than 1 Mty and use rivers and tidewater for efficient transportation. The **Pitt River** quarry produces a crushed rock product, and **Earle Creek** produces both crushed rock and natural sand and gravel.

Polaris Materials Corporation, a subsidiary Vulcan Materials Company, operates the **Orca** quarry near Port McNeill, in partnership with the 'Namgis First Nation, which holds a 12% interest. The owner-operator partnership is Orca Sand and Gravel LP. The quarry produces sand and gravel mainly for export to California. The operation was originally permitted for up to 6 Mty. Production has recently ranged from 3-5 Mty. Polaris plans eventual production of more than 8 Mty. In 2017, Polaris applied to the British Columbia Environmental Assessment Office for an amendment to its Orca project certificate to allow for producing aggregate at a site approximately 4 km from

current operations. The new site was previously known as the **Black Bear** project. In 2020, Polaris revised the proposal to 3-4 Mty, then withdrew from the environmental assessment process with the stated intention of re-applying under new legislation.

The **Cox Station** quarry, on the north side of Sumas Mountain, is operated by Mainland Sand and Gravel Ltd. More than 95% of the crushed quartz diorite product goes to the Lower Mainland market via barge on the Fraser River. The quarry also has two CN Rail spur lines, which allow shipment by rail. Production and shipments have recently been about 2-4 Mty.

Small operations produce building stone on Vancouver Island. Island Stone Landscape Supply is a producer and supplier of flagstone, as is San Juan Quarries. Vancouver Island Marble Quarries Ltd. continues to quarry marble on Vancouver Island and fabricate a line of products including countertops, sinks, and tiles at Matrix Marble and Stone Inc. They quarry marbles referred to as 'Tlupana Blue Grey' and 'Vancouver Island White' near Hisnit Inlet (**CTCT** quarry). In addition to the original Port Renfrew Ocean Pearl stone, K2 Stone Quarries Inc. quarries and processes other Vancouver Island products.

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

Hardy Island Granite Quarries Ltd. produces up to 5000 tpy seasonally from a Coast Plutonic complex granodiorite unit. Like Haddington Island, it is an historic quarry that mainly serves the local market. Hardy Island has opened another quarry on Valdes Island that supplies sandstone from the Nanaimo Group, another rock type common to many older buildings in Vancouver and Victoria.

3.3.1. Bute Inlet (Ironwood Clay Company Inc.)

Ironwood Clay Company Inc. mines glacial marine clay on the central coast. Until 2015, production was from the **De Cosmos Lagoon** south of Bella Bella (Fig. 1). The company has a site at the head of **Bute Inlet**, which is mined intermittently. Ironwood manufactures cosmetic products using the clay at its Richmond plant, a business that has continued for 30 years. Glacial Bay Organic Clay Inc. has also extracted material by hand near the head of Bute Inlet. Other individuals and companies supply the cosmetic clay market at smaller scales from locations on the central coast (**Kisameet Bay**) and Vancouver Island. Generally, Mines Act permits are not required where material is collected by hand, and these glacial marine clay operations are unreported.

3.3.2. Imperial Limestone (Imperial Limestone Co.)

The **Imperial Limestone** quarry near Van Anda on Texada Island (Figs. 1, 3) expects to produce about 500,000 tonnes of mostly chemical grade limestone in 2023. A 99% $CaCO_3$ product is shipped to their parent company, Arcosa Specialty Materials Inc. in Seattle. About 50,000 t of dolostone is shipped to Ash Grove Cement Company in Portland. Imperial Limestone Co. also stockpiles limestone that meets specifications for cement, though they do not currently have customers. Quarrying at the Imperial site dates to the 1930s. The company anticipates reserves will last about 75 years.

3.3.3. K2 Ocean Pearl (K2 Stone Quarries Inc.)

K2 Stone is a natural stone product supplier with a quarry near Port Renfrew on Vancouver Island (**K2**). They extract 15,000-20,000 t annually. The rock is trucked to Nanaimo for processing into masonry and landscaping products. The company has additional sources near Nanaimo and Courtenay, producing sandstone and a salt-and-pepper granite (granodiorite).

3.3.4. Mount Meager Pumice (Great Pacific Pumice Inc.)

Great Pacific Pumice Inc. produces smaller quantities of pumice than its neighbouring quarry (Vulcan/Salal) but has stockpiles in Squamish from which they can ship year-round.

Fig. 3. Imperial Limestone quarry on Texada Island (Imperial Limestone Co.).

The pumice is dacitic ejecta of the Pliocene to recent Mount Meager volcanic complex.

3.3.5. Sumas Shale (Sumas Shale Ltd.)

The **Sumas Shale** quarry of Sumas Shale Ltd., operated by contractor Fraser Pacific Enterprises Inc., delivers sandstone and shale product to the Lafarge and Heidelberg Materials cement plants in Richmond and Ash Grove in Seattle. Production and shipments have been approximately 500,000 tpy or more in recent years. Mining plans include an average 475,000 tpy of approximately 55% shale and 45% sandstone. Because Clayburn's brick and refractory products plant in Abbotsford closed, fire clay is no longer produced separately.

3.3.6. Texada Quarry (Texada Quarrying Ltd.)

The largest limestone quarry on the coast is the **Texada Quarry** operation near Gillies Bay (Figs. 1, 4). Texada Quarrying Ltd. is a subsidiary of Lafarge Canada Inc. The quarry also produces aggregate, mainly from quartz monzonite to gabbro dikes and sills, which would otherwise be waste rock. The site also hosts a white carbonate quarry, one of only a few sources on the coast. The quarry, which has operated for more than 60 years, has extensive reserves and, at current rates of 3.5 to 6 Mt annually, could produce for more than 100 years.

3.3.7. Vulcan/Salal Quarry

Garibaldi Pumice Ltd. produces 15,000-20,000 m^3 of pumice annually from their quarry (**Vulcan/Salal**). Like the neighbouring Mount Meager quarry, the product is Pliocene to recent dacitic volcanic ejecta of the Mount Meager volcanic complex.

4. Placer gold

Historic placer camps include the Lower Fraser River, Leech River, and China Creek. Although short lived, a gold rush in the Fraser Canyon, which began in 1858 at Hills Bar, led miners farther up the Fraser River into the Chilcotin and Cariboo; the Lillooet River camp was also on an historic route to the Cariboo. Both camps continue to be worked. In 1864, reports of gold in the Leech River on southern Vancouver Island led to another brief gold rush; it too remains an active placer camp.

5. Mine development

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

6. Proposed mines

Proposed mines are feasibility-stage projects for which proponents have begun the environmental certification process (in the case of large projects) or have submitted applications for Mines Act permits (in the case of projects below British Columbia Environmental Assessment Act thresholds) or are waiting for existing permit amendments. Projects that have permits in place but have yet to obtain financing to begin site construction are also considered to be at the proposed stage. The Southwest Region had three such projects in 2023 (Table 3); several small-scale and inactive larger projects are not covered in this report.

6.1. Proposed metal mines

The Southwest Region had no proposed major metal mine projects active in 2023.

6.2. Proposed coal mines

The region has no active proposed coal mine projects.

6.3. Selected proposed industrial minerals mines

Proposed mines include the **BURNCO Aggregate** project and the **Sechelt Carbonate** project, which has been inactive apart from a request by the owner to remain in the provincial environmental assessment process. The **Black Bear** aggregate project near Port McNeill was the subject of an application to amend the Orca Environmental Certificate. The application was withdrawn with a request for review under new legislation.

6.3.1. Black Bear (Polaris Materials Corporation)

Polaris Materials Corporation included the **Black Bear** project near its **Orca** sand and gravel quarry in an Environmental Certificate amendment for Orca. If the project proceeds, it will be a source of up to 3-4 Mty of crushed basalt, an increase over the 250,000 tpy proposed in a 2017 project description. Mine life would be extended from 10 to 20 years. This application was withdrawn with a request by the proponent to re-apply under the 2018 Environmental Assessment Act. A 2022 engagement plan between the Province of British Columbia and the Kwakiutl First Nation describes the nature of the Nation's participation

Fig. 4. Texada Quarry on Texada Island (Lafarge Canada Inc.).

in the Environmental Assessment Office's amendment process. Polaris submitted an engagement plan detailing their proposed engagement activities for the Orca quarry with the Kwakiutl First Nation.

6.3.2. BURNCO Aggregate (BURNCO Rock Products Ltd.)

The **BURNCO Aggregate** project in the McNab Creek Valley (Fig. 1) received environmental certification in 2018. Fisheries and Oceans Canada also concluded that the project is unlikely to cause significant environmental harm. The environmental certificate expired in 2023. The proposed sand and gravel mine would ramp up to a 1.6 Mty operation, initially barging product to BURNCO Rock Products Ltd.'s ready-mix concrete plants in South Burnaby and Port Kells.

6.3.3. Sechelt Carbonate (Ballinteer Management Inc.)

Ballinteer Management Inc. now holds the property comprising the **Sechelt Carbonate** project. They filed engineering, archeological, and baseline environmental studies for assessment in 2016; activity was not reported for 2017-22, other than maintenance of tenures. The property contains resources of calcite- and dolomite-bearing carbonate rock and gabbroic rock for potential use as aggregate. The original proposal was for a 4-6 tpy carbonate quarry producing both limestone and dolostone. Product was to be shipped from a barge load out on Sechelt Inlet.

7. Selected exploration activities and highlights

Exploration projects are categorized as grassroots, early stage, advanced, and mine evaluation, depending upon the nature of recent work. Work directed at discovering new resources away from ore bodies in an existing mine plan can be considered mine-lease or on-site exploration. The Southwest Region had few large exploration programs in 2023 (Table 4), however, it has several small programs.

7.1. Selected precious metal projects

This section includes projects for which precious metals are the main commodities sought.

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

Bear Mountain Gold Mines Ltd. continued underground rehabilitation at **Harrison Gold** and conducted laser-based ore sorting tests that were based on quartz content. Gold mineralization occurs in narrow (1-30 cm) quartz+pyrrhotite veins in unmineralized quartz diorite (Fig. 5) and tests indicate it is amenable to sorting. The company is considering the possibility of accessing underground targets with minimal disruption to nearby communities. An historical (1989, restated 2002) resource estimate has 1.845 Mt grading 2.79 g/t Au in the indicated category and 0.6 Mt grading 2.8 g/t Au in the inferred category. Bear Mountain has made the site available to post-secondary institutions for educational purposes. Bear Mountain has an option to acquire 100% of the property from Omineca Mining and Metals Ltd.

Fig. 5. Gold-bearing quartz-pyrrhotite veins in quartz diorite at Harrison Gold (Bear Mountain Gold Mines Ltd.).

7.1.2. Mineral Creek (Theia Gold Corp.)

Theia Gold Corp. conducted a drill program at **Mineral Creek**, following geochemical surveys and geophysics. Theia is currently a private company and has not reported details. Karus Gold Corp. announced a binding letter of intent to acquire Theia in a reverse takeover of Karus by Theia. Mineral Creek is an orogenic-type gold vein prospect hosted by Sicker Group volcanic rocks (Paleozoic).

7.2. Selected precious and base metal projects

This category includes projects for which precious metals represent the primary target commodities, with base metals as significant potential co- or by-products.

7.2.1. Empire Mine (Coast Copper Corp.)

Coast Copper Corp. reported an updated resource estimate, identified four exploration targets a new showing to the south of the resource area. The 2023 Inferred resource estimate has 594,000 t grading 3.52 g/t Au and 0.50% Cu at a $30 net smelter return cut off. The deposits are Cu-Fe skarns in Vancouver Group and lower Bonanza Group rocks intruded by diorite to gabbro of the Island Plutonic suite. Coast Copper has an option to acquire 100% interest in the central part of the property from Mirva Properties Ltd.

7.2.2. New Sunro Copper (New Sunro Copper Ltd.)

The company mapped and prospected on its **New Sunro Copper** (a.k.a. **Jordan River**) project. Eocene mineralization occurs in veins and lenticular bodies mainly in basalts at contacts with gabbro of the Metchosin Igneous Complex. The Sunro mine produced Ag, Au and Cu between 1962 and 1977.

7.3. Selected base and precious metal projects

Jurassic porphyry mineralization is a target on Vancouver Island. Southwestern British Columbia also has several advanced Eocene to Miocene porphyry copper targets. Base and precious metals targets can include other deposit types such as VMS and mafic-ultramafic hosted mineralization.

Table 4. Selected exploration projects, Southwest Region.

Project	Operator (partner)	Commodity; Deposit type; MINFILE	Resource (NI 43-101 compliant unless indicated otherwise)	Comments
Bakar	**Sherpa II Holdings Corp.** (District Metals Corp.)	Cu, Ag; Volcanic redbed Cu; 102I 010, 7, 6, 15, 16, 17, 092L 080, 462, 247	na	Airborne geophysics (continued from 2022).
Castle Rock	**Trailbreaker Resources Ltd.**	Au, Cu; Vein, possible porphyry; 092L 399, 398, 288	na	Soil and rock sampling, geological mapping.
Ebb	**Neotech Metals Corp**.	Cu, Ni, Co, Ag; Mafic-ultramafic; 092C 141, 222, 89	na	Prospecting, mapping rock and soil sampling, ground geophysics.
Empire Mine	**Coast Copper Corp.**	Au, Ag, Cu, Fe, Co; Fe skarn, Cu skarn; 092L 044, 45, 46	Inf: 594,000 t 3.52 g/t Au, 0.50% Cu	Updated resource estimate, identified new targets.
Fire Mountain	**Cascade Copper Corp.**	Cu, Au, Ag; Porphyry; 092GNE004, 3 2, 42	na	Porphyry mineralization identified, highlight sample 14.96 g/t Au, 1.58% Cu and 52 g/t Ag.
Harrison Gold	**Bear Mountain Gold Mines Ltd.**	Au, Ag; Au-quartz veins; 092HSW092	Historical 2002 I: 1.845 Mt 2.79 g/t Au Inf: 0.6 Mt 2.8 g/t Au	Underground rehabilitation, ore sorting tests.
Mineral Creek	**Theia Gold Corp.**	Au, Ag; Au-quartz veins; 092F 079, 331	na	Induced polarization and drilling. Theia is a private company, proposed reverse takeover by Karus Gold Corp.
Mount Sicker	**Sasquatch Resources Corp.**	Cu, Au, Ag, Pb, Zn; Kuroko massive sulphide Cu-Pb-Zn; 092B 040, 76, 110, 1	na	Portable drilling with highlight interval of 7.55 m grading 5.4 g/t Au, 7.5% Cu, 125 g/t Ag and 5.9% Zn. Also evaluating historical waste and tailings. Ground-based gravity survey.
New Sunro	**New Sunro Copper Ltd.**	Cu, Au, Ag; Tholeiitic intrusion hosted; 092C 073	na	Geological mapping and prospecting.

Table 4. Continued.

North Island	**Northisle Copper and Gold Inc.**	Cu, Au, Mo, Re; Porphyry Cu±Mo±Au; 092L 185, 240, 200	I: 527,344,000 t 0.20% Cu, 0.24 g/t Au, 0.008% Mo, 0.31 ppm Re Inf: 417,272,000 t 0.15% Cu, 0.18 g/t Au, 0.006% Mo, 0.29 ppm Re	Drilling (year-end estimate of more than 10,000 m, 24 holes) and ground magnetic survey. Highlight from Northwest Expo 130 m grading 1.65 g/t Au and 0.33% Cu. Resource estimate (2020) combines Hushamu and Red Dog.
Okeover	**Alpha Copper Corp**.	Cu, Mo; Porphyry Cu±Mo±Au; 092K 008, 57, 168	Inf: 86.8 Mt 0.31% Cu, 0.014% Mo	Mineralized intervals included 78.67 m 0.27% Cu 0.02 g/t Au, 1.00 g/t Ag, 82.8 ppm Mo, and 134.5 m 0.20% Cu, 0.01 g/t Au, 0.84 g/t Ag, 40.7 ppm Mo.
Redonda	**Stamper Oil & Gas Corp.**	Cu, Mo; Porphyry Cu±Mo±Au; 092K 092, 183, 39, 2	na	Mobilized for drilling late in fall, completing 850 m in 5 holes.
Rogers Creek	**Cascade Copper Corp.**	Cu, Mo, Au, Ag; Porphyry Cu±Mo±Au; 092JSE033, 34, 35, 36	na	Permitting, reported results of lidar and orthophoto imaging surveys.
Vent	**Vital Battery Metals Inc.**	Cu, Mo; Porphyry Cu±Mo±Au; 092F 229, 482	na	Geological mapping, prospecting, soil survey, ground geophysics.

M = Measured; I = Indicated; Inf = Inferred

7.3.1. Bakar (District Metals Corp. 20%, Sherpa II Holdings Corp. 80%)

To date, the District Metals Corp.-Sherpa II Holdings Corp. joint venture has been unable to obtain a permit for proposed drilling at **Bakar**. Airborne VTEM, and magnetic surveys begun in late 2022 were processed and filed for assessment in 2023. Known mineralization includes Cu-Ag veins and volcanic-hosted redbed copper. Porphyry copper mineralization is also a target.

7.3.2. Castle Rock (Trailbreaker Resources Ltd.)

Trailbreaker reported soil sampling, rock sampling, and geological mapping at its **Castle Rock** property in 2023, following up on a gold-in-soil anomaly and a channel sample taken in 2022 at the Heart showing, a brecciated granodiorite dike with chalcopyrite and historic and recent gold assay values.

7.3.3. Ebb (Neotech Metals Corp.)

Neotech Metals (formerly Caravan Energy Corp.) reported prospecting, mapping, rock and soil sampling, and ground magnetic and VLF surveys at **Ebb**. The target is copper-nickel-cobalt mineralization in mafic-ultramafic rocks of the Westcoast Crystalline complex. Neotech has an option to earn 100%. The owner is Geomap Exploration Inc.

7.3.4. Fire Mountain (Cascade Copper Corp.)

Cascade Copper reported reconnaissance work at its recently acquired **Fire Mountain** property. A recent discovery of porphyry mineralization and alteration returned values of 14.96 g/t Au, 1.58% Cu and 52 g/t Ag in quartz-magnetite-chalcopyrite-epidote veins. Most of the property is subject of an option agreement with vendor Torr Resources Corp.

7.3.5. Mount Sicker (Sasquatch Resources Corp.)

Sasquatch Resources Corp. reported results of portable drilling, including 7.55 m grading 5.4 g/t Au, 7.5% Cu, 125 g/t Ag and 5.9% Zn. A gravity survey was scheduled for November. The company is also investigating reprocessing waste rock and tailings from historic mining. **Mount Sicker** hosts several past-producing VMS deposits hosted by Sicker Group volcanic rocks (Paleozoic) and Mount Hall gabbro (Triassic).

7.3.6. North Island (Northisle Copper and Gold Inc.)

Northisle Copper and Gold Inc. reported drilling at the Northwest Expo, Goodspeed, and Pemberton Hills targets, with results including 130 m grading 1.65 g/t Au and 0.33% Cu at Northwest Expo and conducted a late 2023 round of drilling (year-end estimate of more than 10,000 m in 24 holes) and ground magnetic surveys at Northwest Expo and Goodspeed. Of more than seven Cu-Au-Mo±Re porphyry targets and deposits spanning approximately 40 km west-northwest of the past-producing Island Copper mine, two central deposits have resource estimates. Hushamu has an Indicated resource of 472.9 Mt grading 0.20% Cu, 0.23 g/t Au, 0.008% Mo, and 0.35 ppm Re plus a large Inferred resource. Red Dog has an Indicated resource of 54.5 Mt grading 0.22% Cu, 0.31 g/t Au, and 0.004% Mo.

7.3.7. Okeover (Alpha Copper Corp.)

Alpha Copper Corp. reported results from 2000 m of drilling done at the North Lake zone of the **Okeover** project in late 2022. Longer mineralized intersections included 78.67 m 0.27% Cu, 0.02 g/t Au, 1.00 g/t Ag, 82.8 ppm Mo, and 134.5 m 0.20% Cu, 0.01 g/t Au, 0.84 g/t Ag, and 40.7 ppm Mo. Alpha terminated its option agreement, but subsequently closed a new deal with Northwest Copper Corp. for 100% of the property in 2023. The North Lake zone is at the northern end of a north-northwest trending string of porphyry Cu-Mo targets related to younger intrusions in Cretaceous diorite-granodiorite of the Coast Plutonic complex.

7.3.8. Redonda (Stamper Oil & Gas Corp.)

Redonda is a porphyry copper-molybdenum occurrence at the western edge of the Coast Plutonic complex, a setting similar to **Okeover**. It has seen little exploration since Teck Corporation drilled it in 1979. Stamper has an option to acquire 100% of the property under a 2021 agreement with Homegold Resources Ltd. The company mobilized for drilling in the late fall, completing 850 m in 5 holes.

7.3.9. Rogers Creek (Cascade Copper Corp.)

Cascade Copper Corp. proposed drilling following a data compilation and review to refine targets. As of late 2023, their Notice of Work was in process. The company also reported results of lidar and orthophoto imaging surveys.

7.3.10. Vent (Vital Battery Metals Inc.)

Vital Battery Metals announced mapping, prospecting, soil sampling, and ground geophysical work at its **Vent** copper project, which has porphyry Cu-Mo showings. The company has an option to acquire up to 100% interest in the property from owner Geomap Exploration Inc.

8. Geological research

Canil and Morris (2023) presented new U-Pb zircon ages, rock geochemistry, and field observations in the Bonanza Arc of Vancouver Island, identifying three separate, distinct periods of arc development from latest Triassic through middle Jurassic. Providing large-n U-Pb LA-ICP-MS zircon crystallization ages from pre-, syn- and post-kinematic intrusions, Wang et al. (2023) documented large-scale sinistral motion along the western flank of the Coast mountains from at least 114 to 101 Ma and suggested kinematic links between the Insular and Intermontane superterranes as early as 114 Ma.

Harris et al. (2023) presented $^{40}Ar/^{39}Ar$ ages and chemical data to refine understanding of four separate episodes of mafic volcanism in the northern Garibaldi volcanic complex in the last 4500 years and Borch et al (2023) mapped the Cheakamus lavas north of the Garibaldi complex and presented geochemical, $^{40}Ar/^{39}Ar$, and paleomagnetic data, distinguishing three phases of continuous effusive eruption during the early stages of the Fraser glaciation while major drainages were ice free. Several studies related to the geothermal potential of the Mount Meager volcanic complex were published in the last year: Hanneson et al. (2023) developed an electrical resistivity model beneath Mount Meager using magnetotelluric data; Hormozzade et al. (2023) used resistivity modelling and other rock property data to determine the relationship between electrical resistivity and fluid flow in an active volcanic system; Chen et al. (2023) tested ground surface temperature monitoring as an exploration tool for geothermal resources; Chai et al. (2023) developed an in-situ stress model for the prospective geothermal resource area; and Muhammad et al. (2023) examined the structural geology of the complex with a view towards better understanding geohazards. Fischer et al. (2023) used spectral reflectance data to differentiate tourmaline subspecies at the Giant Copper deposit, testing tourmaline as a possible guide to mineralization.

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