MINFILE
NTS 082ESW - PENTICTON

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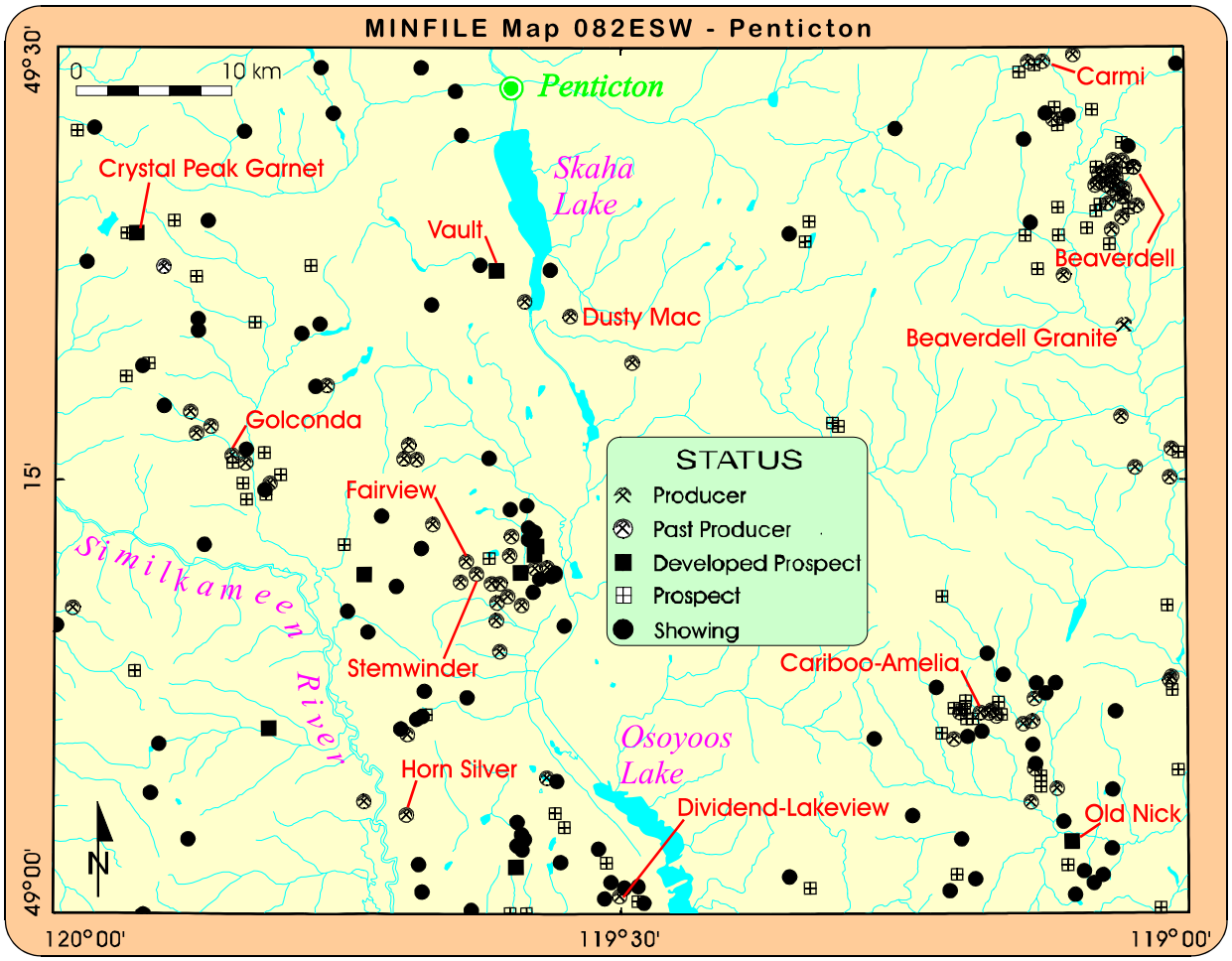
The Penticton map area, located in south-central British Columbia, contains 257 documented mineral occurrences in diverse geological settings. The map area includes the historically important Beaverdell, McKinney, Fairview and Olalla mining camps. These camps and surrounding areas continue to attract exploration interest and activity. The area is roughly divided into an eastern-half physiograpically known as the Okanagan Highland and a western-half known as the Thompson Plateau that coincide respectively, with the Omineca and Intermontane tectonic belts. The two physiographic areas are separated by the Okanagan Valley fault, that trends south-southeast along the Okanagan Valley from Penticton to Osoyoos Lake on the Canada-United States Boundary.



The regional structural features in the Penticton map area are the result of post-Laramide extensional tectonism along a probable east-west axis, marked at its peak by Eocene Marron volcanism and coeval Coryell intrusions. Late Pliocene uplift was probably responsible for extensive block faulting and the development of major north-south fault lineaments such as the Okanagan Valley fault. The region is underlain principally by upper Paleozoic to lower Mesozoic rocks of the Quesnel Terrane. From west to east these consist of the Nicola Group, the Old Tom, Shoemaker, Bradshaw and Independence formations, and the Kobau and Anarchist groups. All groups consist of marine sedimentary and volcanic, arc-related rocks. These strata form a broadly folded, east-dipping

sequence that has an overall increase in age towards structurally higher rocks in the east, formed at least in part by an ancient subduction complex that formed by progressive eastward-directed underthrusting and accretion of successively younger slices of oceanic sediments and volcanic rocks. The Anarchist and Kobau groups consist generally of greenschist metamorphosed (actinolite-biotite-epidote-albite or calcite-tremolite assemblages) rocks derived from a succession of eugeoclinal sedimentary and basic volcanic rocks. Regional metamorphism is more intense in Kobau Group rocks, which locally reaches kyanite-sillimanite grade. The Kobau Group is areally restricted to the southern Okanagan Valley and is bounded to the west by the Similkameen Valley and the Okanagan fault to the east. The Kobau Group rocks are described as highly deformed, low grade metamorphic quartzite, phyllite, mafic schist, greenstone and marble forming up to nine mappable units comprising an estimated 1900-metre structural succession. Three phases of folding have been delineated in the Kobau Group; the initial phase which is coincident with pre-Jurassic regional metamorphism. Later folding is interpreted to be related to intrusions.

The western half of the Penticton map area was first mapped by Bostock (1940, 1941a, 1941b). At this time massive and ribboned chert was referred to as the Shoemaker Formation and meta-andesite (greenstone) was known as the Old Tom Formation. Later, Rice (1947) found that the Shoemaker, Old Tom, Bradshaw and Independence formations could not be readily distinguished as distinct, mappable, regional-scale lithological units in the western-neighbouring Princeton map area. The informal name Apex Mountain Group (Complex), which includes the Old Tom, Shoemaker, Bradshaw and Independence formations, was adopted by Milford (1984). The Apex Mountain Group was divided into five major lithofacies: massive and bedded chert, greenstone, chert breccia, argillite and limestone. The depositional environment is interpreted to be generally deep ocean basin. Microfaunal ages in chert of the Shoemaker Formation provide unambiguous mid-Carboniferous ages. However, a much older maximum Late Devonian (Famennian) age has been obtained from several radiolarian and conodont fauna in chert. Ordovician and Triassic (Ladinian-Carnian) conodonts have been found in limestone near Olalla. The conspicuous absence of Permian and Lower Triassic microfossils may indicate a period when rocks were fully subducted. The youngest Apex Mountain Group rocks and oldest Nicola Group rocks are interpreted to represent a transitional succession, based on their marked similarity in lithologies, spatial distribution and orientation. These rocks have been unconformably overlain by sedimentary and volcanic rocks of the Eocene Penticton Group. This succession forms the White Lake Basin, at least 2400 metres thick and bounded by normal faults. At the base, the Springbrook Formation forms a discontinuous basal conglomerate and breccia unit, locally up to 700 metres thick, derived from the underlying upper Paleozoic and older basement rocks. A rough estimate of fragments composition is: 70 per cent feldspar-rich andesite, 20 per cent grey and black chert, and 10 per cent chlorite schist and other unidentified fragments. The Springbrook Formation is overlain by more than 2100 metres of alkaline and calcalkaline lavas and related breccias of the Marron Formation. These volcanics are unconformably overlain by up to 1000 metres of rhyolite and rhyodacite of the Marama Formation. The overlying White Lake Formation consists of up to 1000 metres of interdigitated volcanic sandstone and conglomerate with feldspar porphyry lavas, lahars, pyroclastic rocks and volcanic breccias. The top of the succession consists of up to 900 metres of conglomerate and epiclastic volcanic breccia that are interpreted to be slide deposits dominantly of nearby Eocene volcanics and lesser pre-Eocene rock. These form the Skaha Formation.

Since the production from the **Dusty Mac** (082ESW078) intermittently between 1969 and 1976, the Penticton Group volcanics has been an exploration target for epithermal-style, precious metal mineralization. The hostrocks of the Dusty Mac are part of the White Lake Formation of the Penticton Group, which consists of light coloured pyroclastic rocks, thick feldspathic andesite lahar deposits, minor andesitic lavas, and minor sandstones and carbonaceous shales. Mineralization appears to be structurally controlled by a system of reverse faults. The deposit consists of a lens-like zone of silicified volcanic rocks and sedimentary debris containing disseminated pyrite, native silver, chalcopyrite, galena, sphalerite with minor bornite and tetrahedrite. Silicification was multi-episodic, varying from discrete laminated chalcedony veins to quartz breccia bodies. Distal propylitic and proximal sericitic, argillic and potassic alteration completes vein alteration types. The Dusty Mac produced 93,295 tonnes of ore from which 10,552,750 grams of gold, 606,006 grams of silver, 2432 kilograms of copper, 2312 kilograms of lead and 242 kilograms of zinc were recovered. The **Vault** (082ESW173), near Skaha Lake, was subsequently discovered 5.5 kilometres to the northwest of Dusty Mac. The Vault is underlain principally by the Marama Formation. Drillhole information indicates that alteration is dominated by an elongate zone of intense silicification (chalcedony) and multi-stage stockwork veining near the Kitley Lake Member contact. Veins in the main mineralized zone have typical adularia-sericite-type epithermal textures. Argillic (clay) alteration is also present along faults. Higher precious metal grades generally correlate with the increasing intensity of silicification. The sulphide content associated with precious metal mineralization is typically low. Gold and silver are not visible with the naked eye but likely occur as native elements or possibly electrum. Native gold is found associated with pyrrhotite. Indicated reserves for the North zone are 152,000 tonnes grading 14 grams per tonne gold. On a

regional and vein scale, mineralization at the Dusty Mac and Vault is structurally controlled by major northeast and east-trending faults and parallel fracture systems. In part, mineralization is also lithologically controlled by brecciation in the lower Marama Formation where the porosity and permeability of volcanic breccias and tuffs is highest. Fluid inclusion studies indicate that mineralizing fluids at the Dusty Mac and Vault had a temperature of about 240 degrees Celsius, a low salinity of about 0.5 weight per cent and δ^{18} O values (SMOW) between minus 7 and minus 9 per mil.

Paleozoic and Mesozoic stratified rocks have been intruded by a number of Jurassic, Cretaceous and Eocene intrusions. The main intrusions are discussed below with respect to the regional metallogeny of the Penticton map area. The Beaverdell area is underlain by the Westkettle batholith which ranges in composition from granodiorite to quartz diorite. It is a medium grained, massive intrusion containing hornblende and biotite that are intensely propylitically altered (dominantly chlorite) near mineralized areas. Based on correlations with the Nelson intrusions, a Jurassic (ca. 150 Ma) age is reasonable for the Westkettle batholith. At the Beaverdell mining camp, the Westkettle batholith has intruded stratified rocks of the Permian Wallace Formation. The Wallace Formation is correlated with the upper parts of the Anarchist Group and consists of metamorphosed andesitic tuffs and lavas, intrusions, hornfels and minor limestone. Several Eocene stocks including the Beaverdell porphyry, Eugene Creek and Tuzo Creek stocks intrude both the Wallace Formation and the Westkettle batholith. The Beaverdell stock at Beaverdell is 1.6 by 2.4 kilometres. The stock is composed of intensely chloritized, unfoliated, coarsely porphyritic quartz monzonite, with distinctive pink orthoclase phenocrysts up to 8 centimetres long. A similar porphyritic stock is exposed mainly in the drainage basin of Dominion Creek, 14 kilometres south of Beaverdell. The age date of this intrusion is 49.4 +/- 0.7 Ma based on potassium-argon analysis of biotite.

Since 1993, the Beaverdell porphyry has been quarried for tiles, polished slabs, and crushed and sized fragments for terrazzo and precast concrete slab products (**Beaverdell Granite**, 082ESW169). The Tuzo Creek stock is located east of the Westkettle River and between Tuzo and Goat creeks. The stock is thought to be an inverted saucer-shaped intrusive mass up to 107 metres thick and is referred to as a roof-sill. A potassium-argon age date on biotite from quartz monzonite yielded an age of 49.5 +/- 2 Ma. This stock is host to the **Mo** (082ESW058) low grade, molybdenum porphyry deposit. Mineralization, including oxides, consists of specular hematite, magnetite, molybdenite with minor sphalerite, galena and chalcopyrite, in decreasing order of abundance. Molybdenum grades from drill core range from 0.02 to 0.08 per cent molybdenum. The **Younkin** (082ESW126) showing is another molybdenum porphyry showing hosted by Middle Jurassic granite and granodiorite. The **May** (082ESW101) copper-molybdenum porphyry lies 1.75 kilometres to the east-southeast. Sphalerite, galena, chalcopyrite and cuprite with associated oxides and carbonates have been identified in silicified, and sericite and chlorite altered granodiorite. Porphyry-style copper-molybdenum mineralization frequently occurs as disseminations or as small clots in hairline quartz fractures, separately from lead-zinc mineralization. The best mineralization occurs parallel to and 600 metres north of the contact between granodiorite and granite.

Initial prospecting in the Beaverdell area began in the late 1880s and the first ore was shipped in 1896. The mining camp forms a 3.0 by 0.8 kilometre belt, consisting of five distinct, separate, structurally controlled quartz vein systems arranged roughly en echelon. The major producing mines from the Beaverdell silver-lead-zinc mining camp, from west to east, were the **Wellington** (082ESW072), **Sally and Rob Roy** (082ESW073), **Beaver** (082ESW040) and **Beaverdell** (082ESW030) mines with numerous small workings throughout the area. In general, quartz veins and stockworks are so complex that continuous mineralized sections are a maximum of a few metres before being faulted or disrupted. However, some mineralized zones extend up to 150 metres horizontally. Faults have been classified into 5 types based on their orientation, direction and movement, and relative age relationships. The most problematic of these faults are northeast striking, high-angle normal faults, as these faults are commonly spaced only a few metres apart and dividing veins into short segments in a northwest-downward direction. Vein-type mineralization in the Beaverdell mining camp is characterized by a high silver content. Mineralization is composed of galena, sphalerite and pyrite with lesser amounts of arsenopyrite, tetrahedrite, pyrargyrite, chalcopyrite, polybasite, acanthite, native silver and pyrrhotite in a gangue of mainly quartz with lesser amounts of calcite, fluorite and sericite and rare barite. The fault-bounded veins commonly have a banded texture defined by outer, crudely parallel, sulphide stringers. The wallrocks are sheared and brecciated over 30 to 150 centimetres width. The interpretation of galena lead-lead isotope age data with geometrical and age relationships between dikes and veins suggests mineralization was formed around 50 Ma, coeval with neighbouring Eocene stocks. A total of 1,223,655 tonnes were mined intermittently between 1901 and 1991 from the Beaverdell mining camp. Recovery totalled 1,226,623,031 grams of silver, 544,452 grams of gold, 11,657 kilograms of copper, 12,965,868 kilograms of lead, 15,405,037 kilograms of zinc and 58,171 kilograms of cadmium.

The **Carmi** (082ESW029) and **Butcher Boy** (082ESW132) occurrences are located about 6 kilometres northwest of the Beaverdell mining camp. Both are hosted by granodiorite of the Westkettle batholith and appear to lie along the same fault-vein/shear system. The shear zone strikes 090 degrees and dips 45 to 60 degrees south. The shear system has been traced over 550 metres along strike. The vein width varies from 5 to 213 centimetres wide and is mineralized with pyrite and sphalerite with minor chalcopyrite and molybdenite in a gangue of quartz and ankerite. Total intermittent production between 1901 and 1940 was 4980 tonnes yielding 300,922 grams of silver, 93,124 grams of gold, 3540 kilograms of lead and 7937 kilograms of zinc.

Camp McKinney was quickly established after the discovery of the Cariboo vein in 1887. The **Cariboo-Amelia** (082ESW020) remained the main producer from this mining camp. The hostrocks are a complex succession of interlayered metabasalt flows, tuffs, quartzite, argillite and minor marble of the Anarchist Group that have been intensely deformed and metamorphosed to greenschist or amphibolite facies. Intense silicification and carbonatization are evident in hostrocks adjacent to veins. The veins have been offset as much as 120 metres by east dipping, low angle, postmineral faults. The Cariboo vein has been traced on surface for over 1600 metres, mined over a strike length of 750 metres and over 100 metres depth. Quartz and pyrite with lesser sphalerite, galena, chalcopyrite and rare tetrahedrite, pyrrhotite and free gold comprise the mineralogy of the vein. The vein has been classified as mesothermal based on: (1) its strike length, (2) the character of the quartz and sulphides and (3) its similarity to mesothermal veins of the nearby Fairview mining camp. Total recorded production from the McKinney mining camp and surrounding area was 124,699 tonnes from which 1,013,551 grams of silver, 2,540,577 grams of gold, 68 kilograms of copper, 51,582 kilograms of lead and 90,216 kilograms of zinc were recovered.

The Oliver pluton is a heterogeneous intrusion composed of biotite hornblende diorite, porphyritic biotite granite, garnet muscovite granite, porphyritic quartz monzonite and syenite. The age of the pluton from a uranium-lead age date on zircon is 152 +/- 3 Ma. The Fairview intrusion consists dominantly of granodiorite. A potassium-argon age date of 111 +/- 5 Ma was obtained on biotite from granodiorite from the Fairview intrusion. This age is suggested as a minimum age.

The Fairview mining camp, northwest of Oliver, has been the site of sporadic mineral exploration and production of mesothermal, auriferous quartz veins for over 90 years. Exploration began in the late 1880s and production began by the early 1890s. The quartz veins are hosted in the Kobau Group adjacent to and less commonly in the Fairview and Oliver plutons. The veins form planar bodies that are locally concordant to the regional foliation, striking northwesterly and dipping northeast. The vein system has been traced up to 4 kilometres strike length from the **Morning Star** (082ESW006) northwest to the **Stemwinder** (082ESW007) and the **Fairview** (082ESW008). The system consists of two main veins, often with third and fourth subsidiary veins present. Individual veins, ranging up to 500 metres length, pinch and swell both along strike and downdip, and reach thicknesses up to 9 metres. Veins commonly exhibit centimetre-scale banding marked by concentrations of oxides, sulphides and graphite. The contacts between veins and hostrocks contain rare angular wallrock fragments and slickensides on parting surfaces with shallow southeast plunges, indicating they formed by accretion through a crack-seal vein growth mechanism. Fluid inclusion and stable isotope studies of the Morning Star, Stemwinder and Fairview occurrences indicate mesothermal fluids were responsible for mineralizing events. The fluids are characterized by a high carbon dioxide content, temperatures of 280 to 330 degrees Celsius, salinities of 4 to 6 weight per cent NaCl, and δ^{18} O values (SMOW) of 4 to 6 per mil. The mineralization occurred at depths of 3 to 4 kilometres. At the Morning Star, up to six high-grade ore shoots were discovered. Pyrite, visible gold, sphalerite and galena comprise mineralization. Three high-grade gold zones or shoots were discovered at the Stemwinder: the Fairview Extension, Stemwinder and Brown Bear zones. Three veins occur at the Fairview: the North, Main and South veins. These veins strike 290 to 315 degrees and the South vein has been developed by about 500 metres of underground and surface development. Sulphide mineralization appears to be of two ages and three styles. Higher gold values are associated with galena occurring along regional (S1), ribbon-textured fractures trending 130 degrees. Galena occurs with pyrite, sphalerite, chalcopyrite and rare pyrrhotite in quartz veins. The fractures frequently contain sericite, biotite and graphite alteration envelopes. The second style is pyrite and/or galena forming clots up to 20 centimetres width. In general, the best galena-chalcopyrite-sphalerite mineralization and highest gold and silver values occur in the hangingwall parts of the veins. The main producers from the Fairview mining camp were the Morning Star, Stemwinder, Fairview, **Gypo** (082ESW084), **Smuggler** (082ESW089), **Susie** (082ESW090), **Standard** (082ESW091), **Empire** (082ESW093) and others. A total of 162,445 tonnes were mined intermittently between 1893 and 1976 for precious and base metals. Recovery included 766,728 grams of gold, 7,013,353 grams of silver, 149,054 kilograms of lead, 29,304 kilograms of zinc and 14,414 kilograms of copper. The Fairview, Morning Star, Gypo and Susie were also major producers of silica as a source of flux for the Trail smelter. Fluorite, mica and feldspar were also recovered from the Gypo. Total production for these commodities was 981,786 tonnes

from which 980,486 tonnes of silica, 658 tonnes of fluorite, 339 tonnes of mica and 16 tonnes of feldspar were recovered.

The Okanagan batholithic complex, occurring between Princeton and Okanagan Lake in the northwest corner of the Penticton map area, is a composite, spatially and temporally crudely zoned, mesozonal intrusion consisting of nine rock units which intrude the Apex Mountain Group. The oldest, margin diorite phases were enveloped and intruded by quartz diorite. The youngest phases are porphyritic granodiorite, quartz monzonite and granite. Potassium-argon age dates (160.4 +/- 4.8 to 133 +/- 4.1 Ma) and rubidium-strontium age dates (isochron of 154 +/- 6 Ma) for the younger granodiorite-granite phase are in good agreement, providing a Late Jurassic age. The older diorite-quartz diorite phase produced an imprecise rubidium-strontium isochron of 166 +/- 53 Ma, within error limits of potassium-argon age dates ranging from 165 +/- 9.7 to 185 +/- 6.6 Ma. The **Fob** (082ESW138) is a copper-molybdenum porphyry showing hosted within the Okanagan batholithic complex.

The Middle Jurassic Similkameen batholithic complex is zoned, grading outward from quartz monzonite and granodiorite to monzonite. The monzonite in turn grades outward into the Kruger alkalic complex. Potassium-argon age dates on hornblende from core phases of the Similkameen batholithic complex yield isochron ages between 191 and 177 Ma. The Jurassic Kruger alkalic complex consists predominantly of potassium feldspar (microcline) porphyritic syenite and nepheline syenite. The main outcrops form a near-rectangular mass, 11.4 by 3.3 kilometres, along the margin of and intruded by the Similkameen batholith, roughly centred on Mount Kruger. Other Kruger alkalic complex outcrops form small lenticulars to the south and northwest of the main body. The complex shows a weak to moderately developed zonal structure with melanocratic, nepheline-poor syenite forming the matrix of other phases. Augite-bearing, melanocratic syenite or diorite are most common in the southern portion. More leucocratic and nepheline-rich phases occur as sills in Kobau Group rocks to the northwest. Nepheline occurs as euhedral phenocrysts and is strongly altered to natrolite and sericite. The nepheline syenite contains three mineralogical zones defined by the mafic mineral content; these are the hornblende, aegerine-augite and biotite zones. All phases exhibit a strong trachytic foliation parallel to contacts. Hastingsite and biotite comprise mafic minerals. Garnet is present in all phases. Separate potassium-argon analyses on the Kruger alkalic complex have yielded ages of 139 and 152 to 154 +/- 8 Ma, respectively. The **Horn Silver** (082ESW002) and **Mak Siccar** (082ESW004) are two shear-hosted, polymetallic vein occurrences located within or 1.5 kilometres east of the Mount Kruger alkalic complex. The Horn Silver mine produced 433,177 tonnes of ore intermittently between 1915 and 1984. A total of 127,194,850 grams of silver, 332,992 grams of gold, 371,863 kilograms of zinc, 328,458 kilograms of lead and 30,034 kilograms of copper were recovered. The controlling structure at the Horn Silver mine is a 24-metre wide shear zone within a monzonitic phase of the Kruger alkalic complex. The shear zone strikes 095 degrees and dips 40 degrees south. Lenticular quartz veins, striking 120 degrees and dipping 35 degrees south, occupy tension fractures along this shear zone. The quartz veins range from a few centimetres to 1.8 metres wide and are often sheeted. Mineralization consists of argentite, native silver, cerargyrite, pyrite, galena, sphalerite, tetrahedrite, chalcopyrite, pyrargyrite and acanthite. Silver grades were reported to be greater than 1500 grams per tonne in several of the veins mined. At the nearby Mak Siccar mine, four years production between 1934 and 1939 yielded 189 tonnes of ore from which 1960 grams of silver and 4012 grams of gold were recovered. Gold, silver and copper mineralization is hosted in a shear striking 030 degrees and dipping 60 degrees west. The mineralization is hosted in a quartz-carbonate stockwork up to 40 metres wide and containing veins 0.02 to 1.4 metres wide. Mineralization consists of chalcopyrite and pyrite with minor malachite and azurite staining. Trace tourmaline is also present. The **Mount Kruger** prospect (082ESW106) is a nepheline syenite industrial mineral occurrence hosted in the Kruger alkalic complex. Several nepheline syenite sills at the prospect, known as the Main and East sills, contain inferred reserves of 11.5 and 13.2 million tonnes of nepheline syenite, respectively. However, analyses indicate the low alumina and high iron contents limit the potential of commercial applications. A number of porphyry-style occurrences are located near the contact or within the Similkameen batholithic complex. These include the **Allegro** (082ESW027), **Joe 7** (082ESW028), **Joe 5** (082ESW037), **Old 9** (082ESW054), **YRD** (082ESW080), **Cat Fraction** (082ESW083), **Walt 32** (082ESW131) and **Richter** (082ESW246). Most of these occurrences are silver-copper-molybdenum-bearing.

The Penticton map area contains 18 skarn occurrences occurring in three main areas: Camp McKinney, the Mount Kruger area west of Osoyoos, and the Mount Riordan area. Gold was first discovered on the eastern slopes of Kruger Mountain, 3 kilometres southwest of Osoyoos near the International Boundary, around 1894. The Lakeview and Dividend claims were staked in 1900 and the first production reported in 1907. The occurrence consists predominantly of a gold-bearing skarn deposit enriched in arsenic, cobalt and bismuth. The mine area is underlain by micaceous quartzite, mica and chlorite schist, limestone, greenstone, andesitic and basaltic flows of the Kobau Group. The limestones form discontinuous lenses which are totally recrystallized near ore-bearing horizons.

At the main workings of the **Dividend-Lakeview** (082ESW001), limestone lenses are hosted in greenstone exhibiting a weak to moderate schistose foliation and overprinted by an epidote stockwork and intense chlorite-carbonate alteration. Skarn mineralization consists of finely banded to massive pyrrhotite, pyrite, chalcopyrite and arsenopyrite preferentially replacing marble. Garnet, epidote, chlorite, amphibole, quartz, calcite and magnetite comprise skarn minerals in the surrounding greenstone. Quartz-calcite veining with pyrite, chalcopyrite and minor malachite and azurite cut sheared greenstone and extend well beyond the limits of skarn overprinting. Of eight main occurrences in this area, the Dividend-Lakeview was the only occurrence with reported production over its intermittent mine life. A total of 111,252 tonnes were mined from which 504,396 grams of gold, 87,244 grams of silver, 73,351 kilograms of copper, 71 kilograms of lead and 71 kilograms of zinc were recovered. The main skarn occurrence at and centred on Mount Riordan is the **Crystal Peak Garnet** skarn (082ESW102), 26 kilometres west-southwest of Penticton. The Crystal Peak Garnet is a tungsten-copper skarn hosted in a roof pendant of carbonate-rich sediments of the Upper Triassic French Formation of the Nicola Group that has been almost entirely replaced by garnet-rich skarn. The skarn replacement forms an elongate mass trending north-northwest over 900 metres and containing three major high-grade zones: North, South and West. The combined drill indicated reserves are 40,466,580 tonnes grading 77 to 80 per cent garnet. The skarn consists of massive to coarsely crystalline garnetite composed of approximately 90 per cent andradite and 10 per cent grossularite. Garnet, diopside, quartz, calcite, epidote, actinolite, hedenbergite, clinopyroxene and magnetite comprise the main skarn mineral assemblage. Traces of chlorite, wollastonite, scheelite, pyrite, pyrrhotite, chalcopyrite and bornite also occur in pockets, irregular veinlets and blebs.

A second alkalic complex is the Middle Jurassic Olalla alkalic complex, centred on Olalla. The intrusion consists of magnetite-bearing pyroxenite peripheral zone inward to a diorite and syenite core. The pyroxenite is composed primarily of augite, potassic altered to biotite, orthoclase, calcite and quartz. The syenite is fine grained, light grey to buff to pink and is also potassic altered to orthoclase and quartz. Coarse grained syenite dikes occur at the contact with the peripheral pyroxenite zone. The historic Olalla mining camp has explored mineralization related to the Olalla alkalic complex. The main producers from this mining camp and the surrounding area were the **Dolphin** (082ESW012), **Sunrise** (082ESW015), **Golconda** (082ESW016) and **Olalla** (082ESW096). Total production from these four mines was 1842 tonnes from which 41,677 grams of silver, 4977 grams of gold, 45,502 kilograms of copper, 765 kilograms of lead, and 2660 kilograms of molybdenum were recovered. All are vein and/or shear-hosted deposits along the contact or adjacent to the Olalla alkalic complex.

The largest Eocene intrusions in the Penticton map area include the Beaverdell porphyry, centred 14 kilometres south of Beaverdell, the Allendale Lake stock, immediately west of Allendale Lake, and the Shingle Creek porphyry, immediately west of Penticton on the Penticton Indian Reserve. Potassium-argon age dates on biotite from these intrusions are tightly constrained between 49.4 +/- 0.7 to 54.5 +/- 1.9 Ma. The Allendale Lake stock is host to the **Lynx** prospect (082ESW060). Low grade, copper porphyry-style mineralization was discovered in the late 1960s. Pyrite, chalcopyrite, bornite and trace molybdenite are disseminated within syenite and monzonite. Locally, chalcopyrite and bornite have replaced mafic minerals in xenoliths up to 6 metres length in syenite. Several potassic alteration and shear zones have also been explored at the occurrence. The syenite phase of the Allendale Lake stock is also a source of dimension stone (**Allendale**, 082ESW211). The Allendale dimension stone is a distinctive, dark grey to black, rhomb-shaped anorthoclase syenite. The Shingle Creek porphyry contains bipyramidal quartz and large sanidine crystals which commonly weather free of the hostrock (**Shingle Creek**, 082ESW166). These minerals are of interest to rock and mineral collectors. The Beaverdell porphyry is host to the **Beaverdell Granite** quarry (082ESW169). The stone has been marketed for several products under the trade name Cascade Coral.

The Penticton map area is host to fourteen 'young' surficial uranium deposits in two areas: northwest of Oliver and east of Penticton. The term 'young' is used to denote uranium deposition which is still occurring today. All deposits are underlain by intermediate to felsic intrusions of Cretaceous or Eocene age. The deposits have been dated by disequilibrium studies involving total uranium and uranium-thorium activity ratios. An apparent age of 1000 to 20,000 years has been determined. Two broad classes of deposits have been recognized: lacustrine/playa and fluviatile types. Several subtypes defined on local, specific environments of deposition include closed basin, cyclically closed basin, valley fill swamp and flood plain oxbow-levee. The deposits are formed at or within a few metres of the surface by the leaching of labile uranium from igneous rocks and interaction of ground or surface waters with the organic components of various soil and/or sediments; the process involves evaporation and adsorption. The uranium in these deposits is loosely bonded and easily remobilized. Conventional uranium exploration techniques are limited in application for these deposits because they are characterized by undetectable concentrations of daughter products. Molybdenum is a common companion to uranium and vanadium is

characteristically absent. The most significant uranium concentrations outlined to date in the map area are from the **Covert Basin** (082ESW164), **Sinking Pond and Flats** (082ESW174) and **North Wow Flat** (082ESW177). The Covert Basin contains 23 tonnes measured reserves of 0.018 per cent uranium. The deposit covers a 72,000 square metre surface area and has an average depth of 1.6 metres, 0.7 metre below the surface. The Sinking Pond and Flats contains 23 tonnes grading 0.02 per cent uranium. The North Wow Flat contains 14 tonnes grading 0.05 per cent uranium. Sources of the surficial uranium include the **Allendale Lake** showing (082ESW189), a uraniferous pegmatite dike occurrence. The pegmatite dike is hosted in syenite and monzonite of the Allendale Lake stock and is quartz-rich with very coarse albite. Betafite, cyrtolite and possibly brannerite and euxenite in association with hematite and magnetite comprise identified uranium-bearing minerals.

The western-half of the Penticton map area is host to 7 rhodonite occurrences: **Mo** (082ESW009), **Dief** (082ESW017), **Louis** (082ESW082), **Orofino Mountain** (082ESW113), **Marron Flat** (082ESW162), **Cawston** (082ESW163) and **Pinky** (082ESW208). These occurrences are mostly hosted in cherts of the Shoemaker Formation and have been explored intermittently over an unknown period of time. The rhodonite occurs as irregular replacement zones with chert and/or jasper interbedded with quartzite. The rhodonite is typically oxidized to black manganese oxides on surface. The manganese minerals rhodochrosite and braunite may also be present. The Pinky is known to have recently produced less than 100,000 tonnes per year as a commercial operation. Up to 1.02 grams per tonne gold occurs with rhodonite at the Pinky. In 1956, a 36-tonne bulk sample was shipped from the Dief for testing; 14,515 kilograms of manganese were recovered.

Three known nickel occurrences are found in the Penticton map area: **Old Nick** (082ESW055) and the **Dan** (082ESW168) near Bridesville, and the **Homestead (M47)** (082ESW088) near Olalla. The Old Nick and Dan are hosted by Anarchist Group biotite schist, quartzite, quartzite schist, metasediments, massive greenstone and serpentinite. At the Old Nick developed prospect, nickel occurs in mackinawite and valleriite associated with pyrrhotite, pentlandite and chalcopyrite found as widespread disseminations within serpentinite units. In the 1996, 30 million tonnes of indicated resource were defined grading 0.22 per cent nickel and 0.015 per cent cobalt. Bench-scale agitated metallurgical test results indicated greater than 80 per cent nickel and 60 per cent cobalt extraction from three samples. Recent exploration in the area has identified further potential for mafic-ultramafic-associated nickel. At the Dan showing, 1.35 and 1.38 cent nickel were obtained from two serpentinite samples. Nickel-copper mineralization at the Homestead (M47) showing is hosted in the pyroxenite border phase of the Olalla alkalic complex. Mineralization consists of fracture or shear-hosted quartz veins containing pentlandite, chalcopyrite, pyrrhotite, magnetite and pyrite.

Six known ophiolite-related, podiform chromite occurrences are found in a relatively restricted area surrounding Rock Creek in the southeastern corner of the Penticton map area. The occurrences are: **Anarchist Chrome** (082ESW024), **Bridon** (082ESW025), **Rock Creek** (082ESW149), Old Nick (082ESW055), **Jolly Creek Chrome** (82ESW159) and **Ket 20** (082ESW232). All occurrences are found within serpentinite lenses hosted in the Anarchist Group, from either a dunite or peridotite protolith. Associated minerals include magnetite, antigorite, calcite, carbonate, talc, chlorite, serpentine, garnierite, anthophyllite, tremolite and possibly mariposite or fuchsite. The Anarchist Chrome prospect is atypical of most chrome deposits; massive chromite is almost entirely surrounded by carbonate. Platinum and palladium, ranging from 3 to 100 parts per billion, were detected in samples from the Bridon prospect. Where analysed, chromite grades range from 8 to 29 per cent Cr_2O_3 in massive lenses with chromite to iron ratios of 1.84 to 3.15.

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