Summary Report on U-Pb and Ar-Ar age dating, Penticton map sheet (082E)

Greenwood (082E/02), Beaverdell (082E/06), Almond Mountain (082E/07), Deer Park (082E/08), Burrell Creek (082E/09), Christian Valley (082E/10) and Lightning Peak (082E/15) 1:50,000 map sheets

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All age dating was done by either R. Friedman (U-Pb) or Janet Gabites (Ar-Ar) of The University of British Columbia. The report has been substantially improved by the petrographic analyses of many of the dated samples by Craig Leitch or Kathryn Dunne; their reports are distilled and acknowledged in the individual sample descriptions that follow. Numerous others have contributed to this study, through field visits, discussions on various aspects of the geology, and editing of reports and maps, and their insights and questions have added considerably to our understanding of the geology of the Penticton - Boundary areas. Finally, I wish to acknowledge the work of those that have mapped before us; our work is, in many cases, a compilation of these previous studies.

Summary

This report summarizes U-Pb zircon and Ar-Ar mineral dating in the Penticton east-half map sheet (082E½) during the course of regional mapping and compilation of 1:50,000 map sheets (Figure 1). Ar-Ar mineral dating was done by J. Gabites and U-Pb zircon dating by R. Friedman, both from the Department of Earth and Ocean Sciences, The University of British Columbia. Petrographic analyses of selected samples were done by K.P. Dunne and C. Leitch, consulting geologists. All samples were collected by T. Höy and G.M. DeFields.

Dating of intrusive rocks shows a complex history of episodic intrusive activity throughout the Mesozoic and the Cenozoic. The Josh Creek diorite in the Grand Forks map sheet (NTS 082E/01) and the West Kettle batholith in the Almond Mountain sheet (082E/07) both have late Triassic ages (Acton et al., 2002; Massey et al., 2010). Granodiorite and related phases of the Nelson Plutonic complex have dates that range from ca. 179 to 161 Ma, typical of the dominantly Middle Jurassic ages of the Nelson complex rocks farther east. Several Ar-Ar dates of various intrusive phases of the Averill complex, host to mineralization in the Franklin camp (082E/09, Figure 1), support a middle Jurassic age for this complex (Keep, 1989; Höy et al., 2020). Hornblende orthogneiss in the northern part of the Greenwood map sheet (082E/02), inferred to be Proterozoic in age (Little, 1983), returned a middle Jurassic U-Pb age, indicating a middle Jurassic granodiorite protolith for these gneissic rocks.

Intrusions in the Lightning Peak area (NTS 082E/15), host to some of the gold and base-metal veins in the Lightning Peak camp, returned U-Pb zircon ages of middle Jurassic (ca 164 Ma) and Late Cretaceous (ca.137 Ma). Hence, these veins may be Late Cretaceous in age, or possibly Eocene and related to Okanagan batholith granite that is located several kilometers to the southeast (Höy et al., 2020).

Several magmatic pulses in the early Paleogene record a history of intrusive activity during tectonic extension and denudation. Paleocene granitic magmatism in the Christian Valley map area (NTS 082E/10, Figure 1) is dated at ca. 67 ma (CV-104), and the Taurus Lake granite, located farther south in the Almond Mountain sheet, has an Ar-Ar mineral date of 63.6 Ma (Höy et al., 2020). Farther west in the Beaverdell map sheet (Figure 1), porphyry-style molybdenite mineralization at Carmi is within the 57.8 Ma Carmi stock, and similar mineralization at the Tuzo Creek deposit to the south is assumed to also be related to a late Paleocene intrusion . The Beaverdell silver-lead-zinc vein camp is associated with a granite stock that intrudes Jurassic granodiorite and is dated at 59.8 Ma.

A large part of the Penticton East map sheet is underlain by the "Okanagan batholith" or "Valhalla intrusions" comprising mainly granite and granodiorite that has variably been assigned a Jurassic or Cretaceous age (Tempelman-Kluit, 1989; Little, 1957) or an Early Tertiary age (eg., Journeay et al., 2000). Numerous U-Pb and Ar-Ar dates support an early Paleogene age for the batholith; four U-Pb zircon dates range from 50.97 to 52.6 Ma overlapping ages obtained by Ar-Ar dating (Table 1, Figure 2). These dates are similar to those of the Coryell syenite (51.5 to 52.0 Ma; Table 1; Carr and Parkinson, 1989). Several small, high-level syenite porphyry stocks

occur throughout the larger Coryell batholith. One of these, the Midas prospect in the Deer Park map sheet, has been extensively explored for molybdenite. The Tenderloin intrusive complex, east of the Franklin Mining camp in the Burrell Creek map area, is an unusual zoned mafic-alkalic complex of late Paleocene-early Eocene age.

Hence, the term Okanagan batholith is restricted to granitic rocks of early Paleogene age including the Eocene intrusions that dominate the batholith and the older Paleocene Taurus Lake granite (NTS 082E/07) and related small stocks. Older Mesozoic granitic rocks are included in the Nelson plutonic complex.

Okanagan batholithic rocks and Coryell syenite were locally exposed by early Eocene time as they are overlain unconformably by Penticton Group rocks - the basal Kettle River Formation and a thick overlying accumulation of dominantly alkalic volcanic rocks of the Marron Formation. Elsewhere, as in the Rock Creek graben, rare Coryell dikes and small stocks locally intrude Marron Formation supporting the contention that the alkalic Marron volcanics are extrusive equivalents of Coryell syenite. Felsic tuffs within the Kettle River Formation in the Greenwood and Almond Mountain map sheets range in age from ca. 50.8 - 51.8 Ma (U-Pb zircon). An older Ar-Ar date of a porphyritic K-feldspar lava flow in the southern part of the Almond mountain sheet (AM-391) and other Ar-Ar dates in overlying Marron Formation volcanic rocks cannot be reconciled with these younger ages, perhaps due to inherent Ar loss.

A small exposure of dacitic to trachytic tuff that unconformably overlies Paleocene granite and Paleozoic metavolcanics west of Beaverdell is dated at 48.8 Ma (HM19-149). This succession is lithologically similar to the Marama Formation in the White Lake basin (Church. 1973) and the correlative Klondike Mountain Formation in Washington. The Klondike Mountain Formation has yielded several K-Ar mineral dates that range from 49.1 to 41.3 Ma, with a mean of ca. 46 Ma which is assumed to be the age of the middle member of the formation (Pearson and Obradovich, 1977).

Movement on the normal fault that bounds the western margin of the Rock Creek graben is bracketed by the age of truncated Coryell intrusion and a ca. 49.4 Ma date (CV-294) on an unaltered latite dyke that cuts through sheared and brecciated granite within the fault zone in the Christian Valley map sheet (Höy et al., 2021). Supportive evidence for deposition of the Kettle River and Marron formations during regional extension and within the grabens includes the thick, locally coarse-grained clastic exposures of the Kettle River in the Rock Creek graben in contrast to thin exposures at the Chenier mineral occurrence approximately 15 km west of the graben. As well, the Marron Formation is approximately 1800 m thick in the graben whereas to the west where Marama Formation lies directly on basement rocks it is much thinner to locally absent.

A variety of both base and precious metal deposits occur throughout the eastern part of the Penticton map sheet. Paleogene deposits are controlled by regional structures, including the north-trending extensional faults and their intersections with, most commonly, northwest-trending faults. Furthermore, many are related to high-level Paleogene intrusions, including

silver-lead-zinc vein deposits in the Beaverdell camp and molybdenite mineralization in a syenite porphyry stock at the Midas prospect in the Burrell Creek map sheet (Höy et al., 2020).

Eocene volcanic and sedimentary rocks of the Penticton Group unconformably overlie dominantly Jurassic Nelson plutonic rocks, the Eocene Okanagan batholith and Coryell alkalic intrusions throughout the Boundary District. Intermediate to felsic tuff and epiclastics overlain by megacrystic sanidine flows within the basal Kettle River Formation is a newly recognized paleo-horizon that hosts the recently discovered low-sulfidation epithermal Wad prospect in the Rock Creek graben (Höy et al., 2021); similar showings in the Greenwood camp (Caron, 2015) indicate that this horizon in both the Rock Creek graben and in the extension of the Republic graben north of Greenwood are favourable targets for further exploration. Farther south in the Republic and Curfew areas of Washington, a stratigraphically higher paleohorizon in the basal part of the Klondike Mountain Formation has produced more than 2.5 million ounces of gold from dominantly low-sulfidation epithermal veins (Lasmanis, 1966; Muessig, 1967). The Marama Formation, correlative with the basal part of Klondike Mountain, is recognized west of Beaverdell (Höy et al., 2021), in the White Lake basin area west of Okanagan Lake (Church, 1986) and elsewhere.

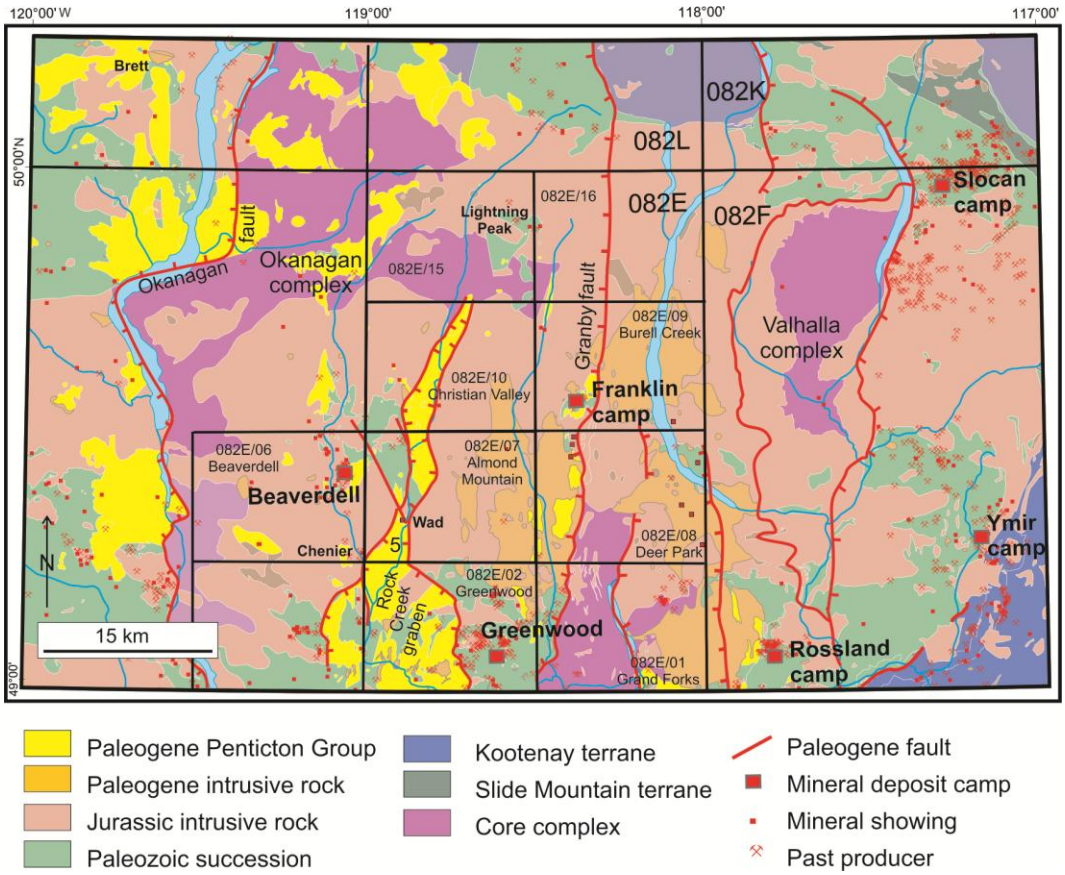


Figure 1: Regional geology map showing location of major mineral deposit camps and 1:50,000 scale maps.

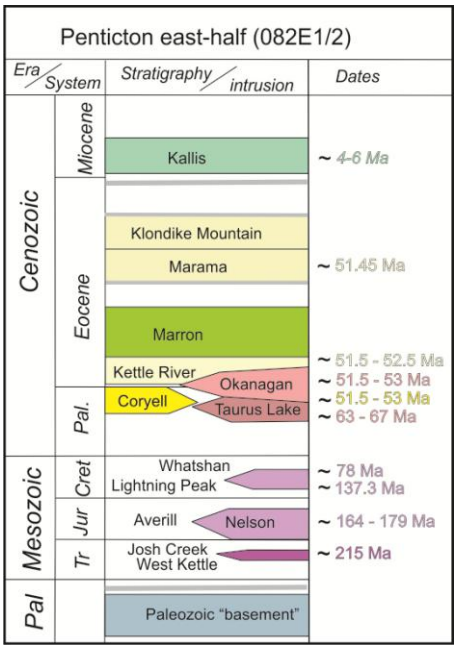


Figure 2: simplified stratigraphic succession, Penticton east-half map sheet showing main stratigraphic and intrusive units, and summary of Ar-Ar and U-P zircon dates

Figure 2a: Schematic diagram showing dominant lithologies, age dates and related mineralization throughout the eastern part of the Penticton map area.

Penticton East-half: lithologies, ages and mineralization

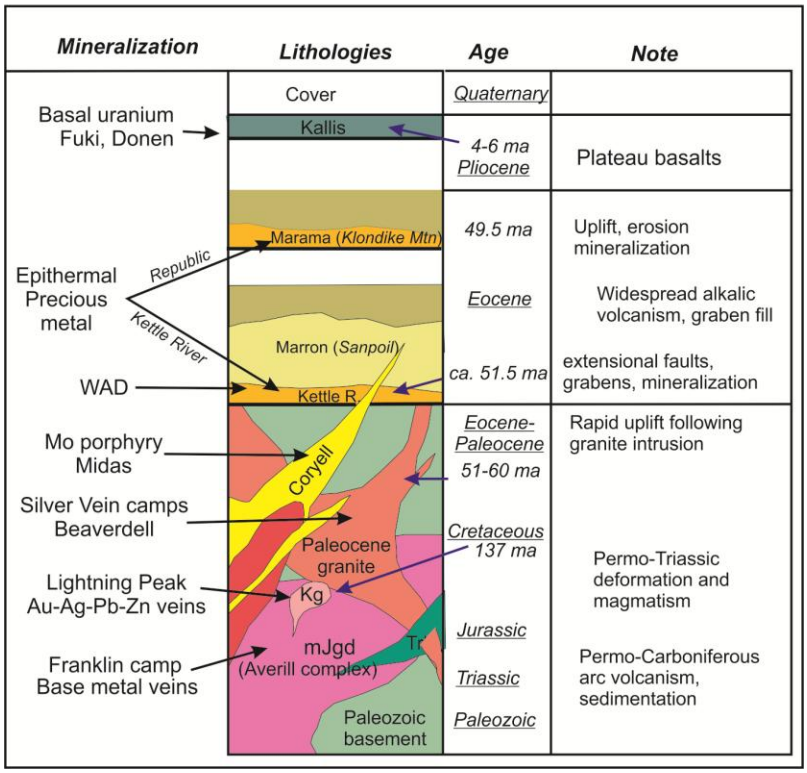


Table 1: Summary of age dates

sample	UTME	UTMN	rock type	Unit	method	age	error
082E/02 Greenwood							
G-167	370256	5452583	Hb gneiss	Nelson complex	U-Pb zr	162.8	1.2
G-200	370764	5453308	granodiorite	Nelson complex	U-Pb zr	168.3	1.2
H20-60	383577	5438992	crystal lithic tuff	Kettle River Fm	U-Pb zr	50.8	0.49
082E/06 Beaverdell							
AM-577	349212	5477455	"granite"	Beaverdell stock	Ar-Ar mu	56.4	0.5
AM-579	349520	5477452	granodiorite	Nelson complex	Ar-Ar hb	168.4	1.6
H19-45	346501	5462996	granodiorite	Okanagan bath	U-Pb zr	163.7	1.0
H19-118	342827	5487005	qtz monzonite	Carmi stock	U-Pb zr	57.8	0.7
H19-118	342827	5487005	qtz monzonite	Carmi stock	Ar-Ar int.	58.37	1.7
H19-149	344974	5482539	rhyolite	Marama Fm	U-Pb zr	48.9	0.5
H20-09	344093	5464081	crystal lithic tuff	Kettle River Fm	U-Pb zr	51.45	0.47
082E/07 Almond Mountain							
AM-391	357372	5468453	granite	Taurus L. granite	Ar-Ar bi	63.6	1.3
AM-404	359883	5482677	granodiorite	Nelson complex	Ar-Ar mu	177.7	3
AM-470	361491	5471677	basalt	Marron Fm	Ar-Ar fsp	57.8	2.1
AM-529	362117	5472621	monzogranite	Nelson complex	Ar-Ar bb	179.3	4.5
AM-563	361875	5459547	porphyritic lava	Kettle River Fm	Ar-Ar fspsp	67.7	8.0
H19-29	386047	5473224	porph. granite	Okanagan bath	U-Pb zr	51.86	0.3
H19-49	369682	5462685	porph. granite	Okanagan bath	U-Pb zr	50.97	0.4
H20-59	366290	5471486	tuffaceous sandstone	Marron Fm	U-Pb zr	51.5	0.44
GC-51	362448	5466545	dacitic tuff	Kettle River Fm	U-Pb zr	51.8	0.75
GC-103A	362832	5465530	dacitic tuff	Kettle River Fm	U-Pb zr	52.38	0.75
082E/08 Deer Park							
H19-8	417248	5466999	monzonite	Coryell	U-Pb zr	51.99	0.69
H19-10	416388	5468517	granite	Nelson complex	U-Pb zr	52.6	0.71
H19-26	399631	5475801	basalt	Marron Fm	Ar-Ar fsp	53.22	0.79
082E/09 Burrell Creek							
BC 193	404862	5489113	hb granite	Tenderloin Cx	Ar/Ar hb	52.8	1.6
BC 213	405233	5490010	pyroxenite	Tenderloin Cx	Ar/Ar bi	50.6	0.6
BC 227	406634	5491346	qtz monzonite	Tenderloin Cx	Ar/Ar bi	51.6	0.6
BC 252	400651	5494199	monzonite	Averill Cx	Ar/Ar hb	161.3	2.4
BC 255	400355	5492907	monzodiorite	Averill Cx	Ar/Ar hb	176	2.5
BC 260	400452	5491927	syenite	Averill Cx	Ar/Ar hb	165.4	1.9
BC 262	399332	5493885	monzogabbro	Averill Cx	Ar/Ar bi	175.9	2.1
BC 313	406496	5490971	diorite	Tenderloin Cx	Ar/Ar bi	58.9	0.7
BC 314	406619	5491078	monzodiorite	Tenderloin Cx	Ar/Ar bi	59.3	0.7
H19-15	404434	5483958	granodiorite	Ladybird granite	U-Pb zr	59.99	0.41
082E/10 Christian Valley							
CV-06	362462	5489153	hb granodiorite	Trapping Cr granite	Ar-Ar hb	50.79	0.69
CV-41	364772	5497380	fspar porphyry	Marron Fm.	Ar-Ar ksp	53.8	1.8
CV-43	364297	5495884	granite	Trapping Cr granite	Ar-Ar bi	47.16	0.36
CV-104	360639	5491943	bi granite	Taurus L. granite	U-Pb rr	67	0.46
CV-113	366127	5489819	bi granodiorite	Trapping Cr granite	Ar-Ar fsp	50.3	0.19
CV-159	365992	5491657	mafic lava	Marron Fm.	Ar-Ar bi	52.77	0.38
CV-258	374323	5492821	granite	Trapping Cr granite	U-Pb zr	51.47	0.45
CV-294	368478	4598093	andesite dyke	dyke	U-Pb zr	49.4	0.77
082E/15; 16) Damfino Creek; Lightning Peak area							
LP-109	389688	5533746	granodiorite	Lightning Peak stock	U-Pb zr	137.33	1.1
LP-143	389688	5533746	granodiorite	Nelson	U-Pb zr	164.07	0.57
LP-227	379632	5522947	granite	Nelson	U-Pb zr	164.88	0.84

Greenwood map sheet (082E/02)

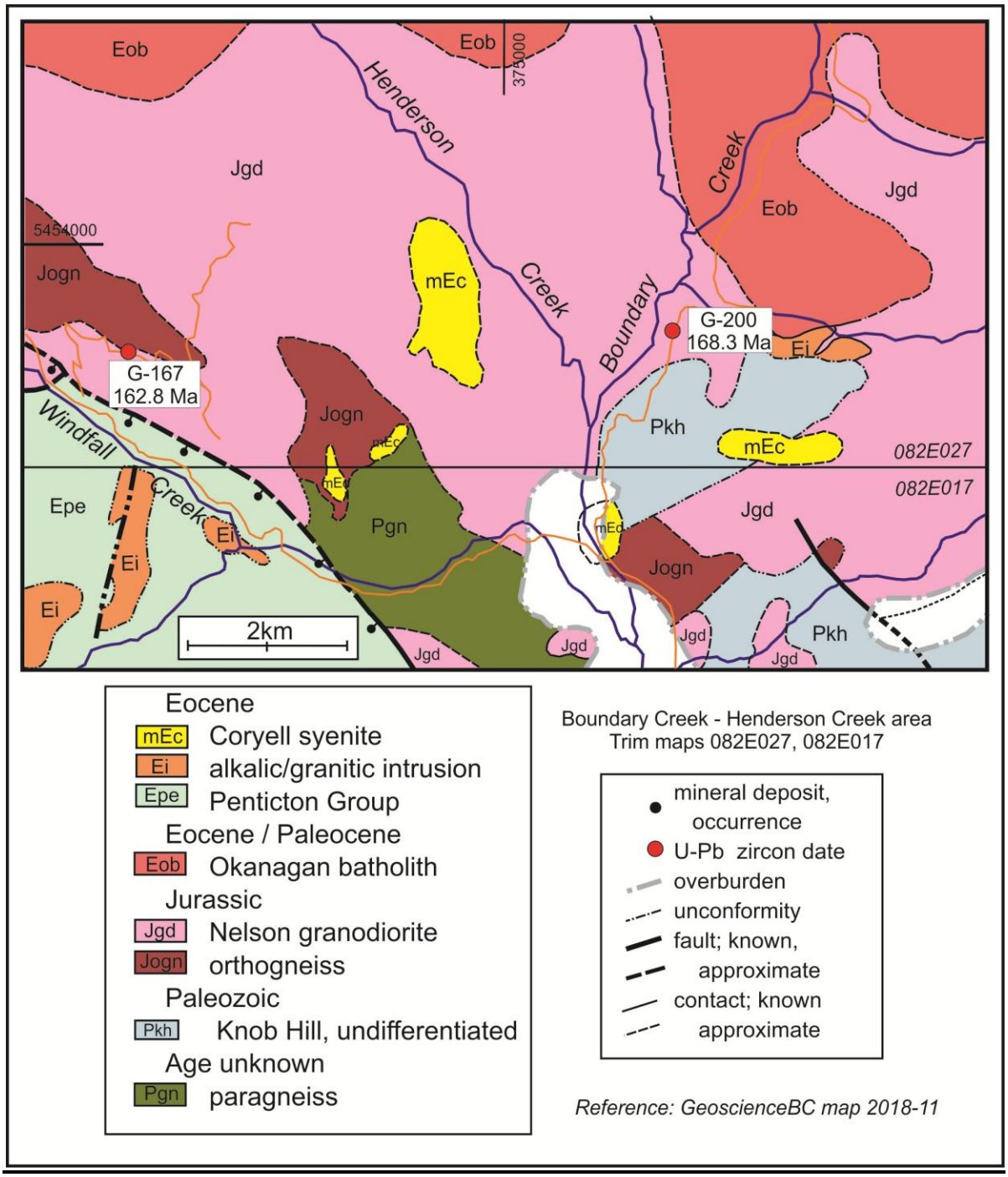


Figure 3: Geology of the Henderson Creek-Windfall Creek area, Greenwood map sheet (NTS 082E/02), showing location of U-Pb age dates; map modified from Little (1983) and Höy and Jackaman (2018, revised 2022).

Greenwood (082E/02)

G-167

Location: UTM 370256E 5452583N; collected along a forest service road, on the northeast slopes of Windfall Creek, approximately 14 km north-northwest of Greenwood.

Map reference: Trim map 082E027; Geoscience BC maps 2018-11 (revised 2022), 2019-04.

Formal map unit: Jogn; orthogneiss.

Description: Medium-grained, hornblende orthogneiss; protolith is correlative with the middle Jurassic "Nelson" plutonic suite.

Petrography: Well banded quartz-feldspar amphibole gneiss; dark layers comprise mainly "hornblende" and magnetite, and light layers, quartz and plagioclase; accessory minerals include trace apatite and titanite, and trace epidote-clinozoisite and illite alteration (Dunne, 2018).

Dating: U-Pb zircon; 162.8 ± 1.2 Ma; R. Friedman, The University of British Columbia.

Comment: The unit is one of several hornblende ortho- and paragneisses in the northern part of the map sheet, and the ca. 163 ma date indicates that they are, in part, orthogneiss derived from middle Jurassic intrusions.

Photo: Hand samples, showing the gneissic textures.

Greenwood (082E/02)

G-200

Location: UTM 377013E 5452682N; on a forest service road, on the east slope of Boundary Creek, approximately 13 km north of Greenwood.

Map reference: Trim map 082E027; Geoscience BC maps 2018-11 (revised 2022); 2019-04.

Formal unit: Jgd; middle Jurassic Nelson plutonic complex.

Description: Medium grained, equigranular, relatively fresh, massive granodiorite.

Petrography: Massive to weakly foliated plagioclase (30%), quartz (15%), K-feldspar (15%) granodiorite with approximately 30% biotite and hornblende, minor magnetite, and trace titanite; generally fresh with only minor chlorite alteration of mafic minerals and illite in plagioclase (Dunne, 2018).

Date: U-Pb zircon; 168.3 ± 1.2 Ma; R. Friedman, The University of British Columbia.

Comment: This intrusion, covering a large area in the northern part of the Greenwood map sheet has been variously assigned to either a Cretaceous-Jurassic age (Little, 1983) or a middle Jurassic age (Tempelman-Kluit, 1989); this date confirms a middle Jurassic age and the unit is informally included as part of the "Nelson" plutonic complex.

Photo: Hand sample of equigranular, medium grained granodiorite**.**

Greenwood (082E/02)

H20-60

Location: UTM 383577E 5438992N; within the Phoenix open pit, approximately 2.5 km east of the town of Greenwood.

Map reference: Trim map 082E08; Geoscience BC maps 2018-11 (revised 2022), 2019-04.

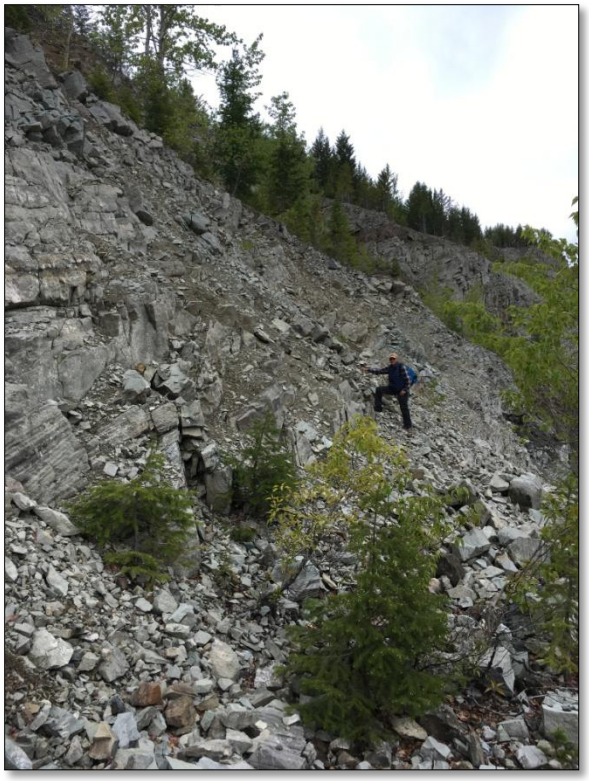
Formal unit: Ekr; Eocene Kettle River Formation.

Description: Light grey, slightly green tinged, medium grained, tuffaceous sandstone, crystal-lapilli tuff; relatively fresh with vague layering.

Date: U-Pb zircon; 50.80 ± 0.49 Ma; R. Friedman, The University of British Columbia.

Comment: Exposures of Kettle River Formation in the Phoenix pit include crystal-lithic tuff, tuffaceous sandstone and thin "conglomeratic" layers . These exposures are conformably overlain by Marron Formation and hence a zircon date provides an age for the basal Penticton Group in the Greenwood area.

Photos: Sample location in Phoenix pit; hand sample of water-lain crystal-lapilli tuff.



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Beaverdell map sheet (082E/06)

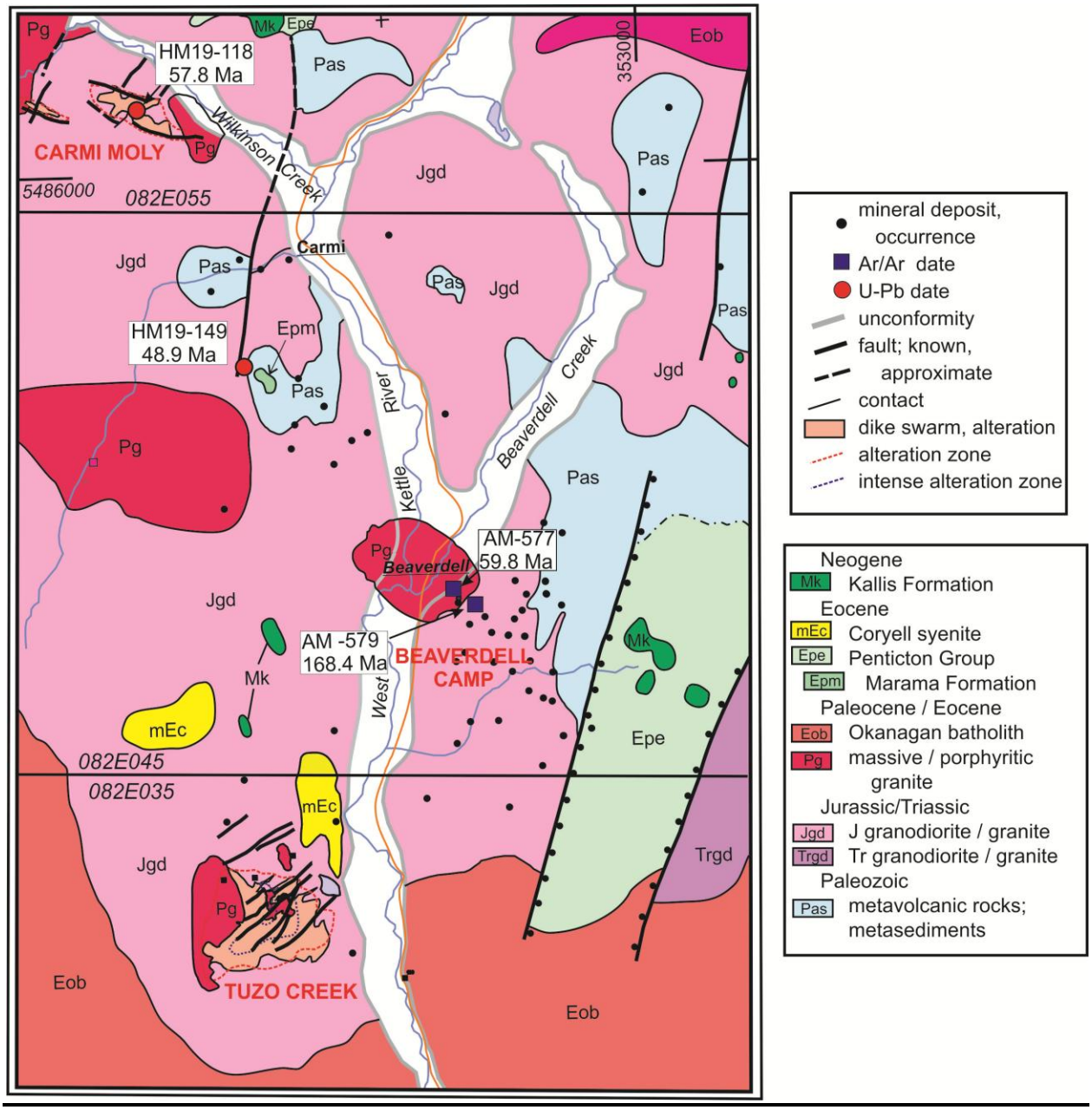

Figure 4: Geology of the Beaverdell, Carmi and Tuzo Creek areas (NTS 82E/06); geology modified from Reinecke (1915), Cairnes (1940),Massey and Duffy (2008), Leary (1987) and Høy et al. (2020).

Beaverdell (082E/06)

AM 577

Location: UTM 349211E 5477455N; located on a switchback of the Highland Bell camp road, approximately 0.5 km east-southeast of the town of Beaverdell (Figure 4).

Map reference: Trim map 082E045; Massey et al. (2008); Reinecke, L., 1915.

Formal map unit: Paleocene Beaverdell stock (Pg).

Description: Small roadside exposure of fresh, pink granite, medium to coarse grained, leucocratic; dominated by K-feldspar, plagioclase and quartz with minor (< 10%) mafics (biotite > hornblende) and muscovite.

Dates: Ar-Ar plagioclase: 59.22 ± 0.83 Ma; J. Gabites, The University of British Columbia. Ar-Ar muscovite: 59.81 ± 0.47 Ma; J. Gabites, The University of British Columbia.

Comment: The plateau date of ca. 59.8 ma may represent the cooling age of muscovite; it is slightly younger than dates of the Taurus Lake megacrystic granite which is a phase of the Okanagan batholith. Although the Beaverdell stock is locally altered, this sample is relatively fresh. Mineralization in the Highland Bell camp is generally within the Jurassic West Kettle batholith but as some vein occurrences and alteration are also in the Beaverdell stock, the age of mineralization is assumed to be Paleocene.

Photo: Hand sample of relatively fresh porphyritic granite; note large subhedral K-feldspar phenocrysts and grey quartz in matrix.

Beaverdell (082E/06)

AM 579

Location: UTM 349520E, 5477452N; located on a switchback of the Highland Bell camp road, approximately 0.8 km southeast of the town of Beaverdell.

Map reference: Trim map 082E045; Massey et al. (2008); Reinecke, L., 1915.

Formal map unit: Middle Jurassic Westkettle batholith (Jgd).

Description: The sample is taken from angular boulders that occur immediately below a large exposure of the Westkettle batholith. The granodiorite is relatively fresh and medium grained with approximately 20% mafic minerals.

Petrography summary: Reinecke (1915) describes the dominant phase of the Westkettle batholith as a quartz diorite with approximately 50% labradorite, 30% quartz, less than 5% orthoclase, and up to 20% biotite and hornblende.

Date: Ar-Ar hornblende; 168.4 ± 1.6 Ma; J. Gabites, The University of British Columbia.

Comment: The West Kettle batholith is intruded by the Paleocene Beaverdell granite and hosts a number of the veins in Beaverdell camp. The ca. 168.4 ma Ar-Ar date is considerably younger than a late Triassic U-Pb zircon age (213.5 Ma) reported by Massey et al. (2010) from a granodiorite located 5 km to the east; as this unit is not contiguous with the Westkettle granodiorite, the latter is assumed to be an older, unrelated intrusive complex.

Photo: Hand sample of fresh, medium grained equigranular granodiorite.

Beaverdell (082E/06)

HM19-45

Location: UTM 346501E 5462996N; located on the Chenier mineral prospect, near the headwaters of Chenier Creek, approximately 15 km west of Kettle River and 25 km north-northwest of the town of Rock Creek.

Map reference: Trim map 082E035; Tempelman-Kluit, D., 1989; Höy, 2007; Höy et al., 2020.

Formal unit: Jgd, Nelson plutonic complex.

Description: Medium-grained massive granodiorite with approximately 30% mafics (dominantly hornblende with minor biotite).

Date: U-Pb zircon; 163.7 ± 1.0 Ma; R. Friedman, The University of British Columbia.

Comment: The granodiorite hosts much of the mineralization of the Chenier porphyry copper prospect. However, mineralization is assumed to be related to late massive to porphyritic granitic dykes that cut the granodiorite. These are assumed to be Paleogene in age, similar to the Paleocene Beaverdell stock to the north.

Photo: Relatively fresh sample of medium-grained massive hornblende granodiorite.

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Beaverdell (082E/06)

HM19-118

Location: UTM 342827E 5487005N; located on a mining exploration road on the Carmi property, approximately 6 km northwest of the town of Carmi.

Map reference: Trim map 082E055; Tempelman-Kluit, D., 1989; Höy et al., 2020.

Formal unit: Paleocene Carmi stock (Pg).

Description: Equigranular to porphyritic quartz monzonite, fine to medium grained, silicified and veined with molybdenite.

Dates: U-Pb zircon; 57.8 ± 0.7 Ma; R. Friedman, The University of British Columbia.
Ar-Ar Bi (inverse isochron): 56.0 ± 1.7; J. Gabites, University of British Columbia.

Comment: The sample is taken from outcrop in a large cleared area that was used as a drill pad in a 2009 exploration program. The intrusion is a phase of the composite Carmi stock, and samples from this locality have hairline fractures filled with quartz and molybdenite; hence the U-Pb and Ar-Ar dates are taken as the age of the Carmi stock and molybdenite mineralization.

Photo:. Left photo shows cleared drill pad and site of sample; right, silicified, medium-grained quartz monzonite, host to the Carmi molybdenite mineralization.

Beaverdell (082E/06)

HM19-149

Location: UTM 344974E 5482539N;

Map reference: Trim map 082E045; Reinecke, L., 1915.

Formal unit: Penticton Group, Marama Formation (Epm).

Description: The latite crystal tuff is tan in colour, fine grained and vaguely banded; fine, widely dispersed biotite occurs throughout.

Petrographic description: Plagioclase-biotite phyric latite, with approximately 50% K-feldspar, 35% plagioclase (matrix and phenocrysts) and 10% biotite phenocrysts; minor sericite alteration and minor opaques (Fe-Ti oxides?) (Leitch, 2019).

Date: U-Pb zircon; 48.9 ± 0.5 Ma; R. Friedman, The University of British Columbia.

Comment: The sample is from a large piece of angular float, several meters across, that lies directly down slope from exposures of similar latite tuff(?). These exposures appear to unconformably overlie medium-grained hornblende granodiorite, assumed to be Paleocene in age, and Paleozoic metavolcanics. The absence of the Kettle River and Marron formations here implies deposition on a paleo-high marginal to the Rock Creek Graben (Höy, Friedman and Gabites, 2020).

Photo: Sample of layered tuff, down-slope from similar exposures of the Marama Formation.

Beaverdell (082E/06)

HM20-09

Location: UTM 344093E 5464081N; located on the Chenier mineral prospect, near the headwaters of Chenier Creek, approximately 15 km west of Kettle River and 25 km north-northwest of the town of Rock Creek. Access to the area is via Chenier Main logging road.

Map reference: Trim map 082E035; Tempelman-Kluit, D., 1989; Höy, 2007; Höy et al., 2020, Thompson, R.I., Cook, F. and Hetherington, R., 2018).

Formal unit: Penticton Group, correlated with the Kettle River Formation (Ekr).

Description: massive to vaguely layered (rhyodacite?) quartz-crystal tuff; tan to light grey in colour, fine to medium grained.

Petrographic description:

Date: U-Pb zircon; 51.45 ± 0.47 Ma; R. Friedman, The University of British Columbia.

Comment: The sample is from a succession of conglomerate, tuff and minor mafic flows that unconformably overlie middle Jurassic granodiorite on the Chenier property. There are no overlying sequences; these are eroded away. The U-Pb zircon age confirms that the succession is part of the Kettle River Formation.

Photos: Lapilli-tuff (left) and quartz-crystal lapilli tuff (sampled); note pale greyish-green matrix and occasional lithic fragments.

Almond Mountain map sheet (082E/07)

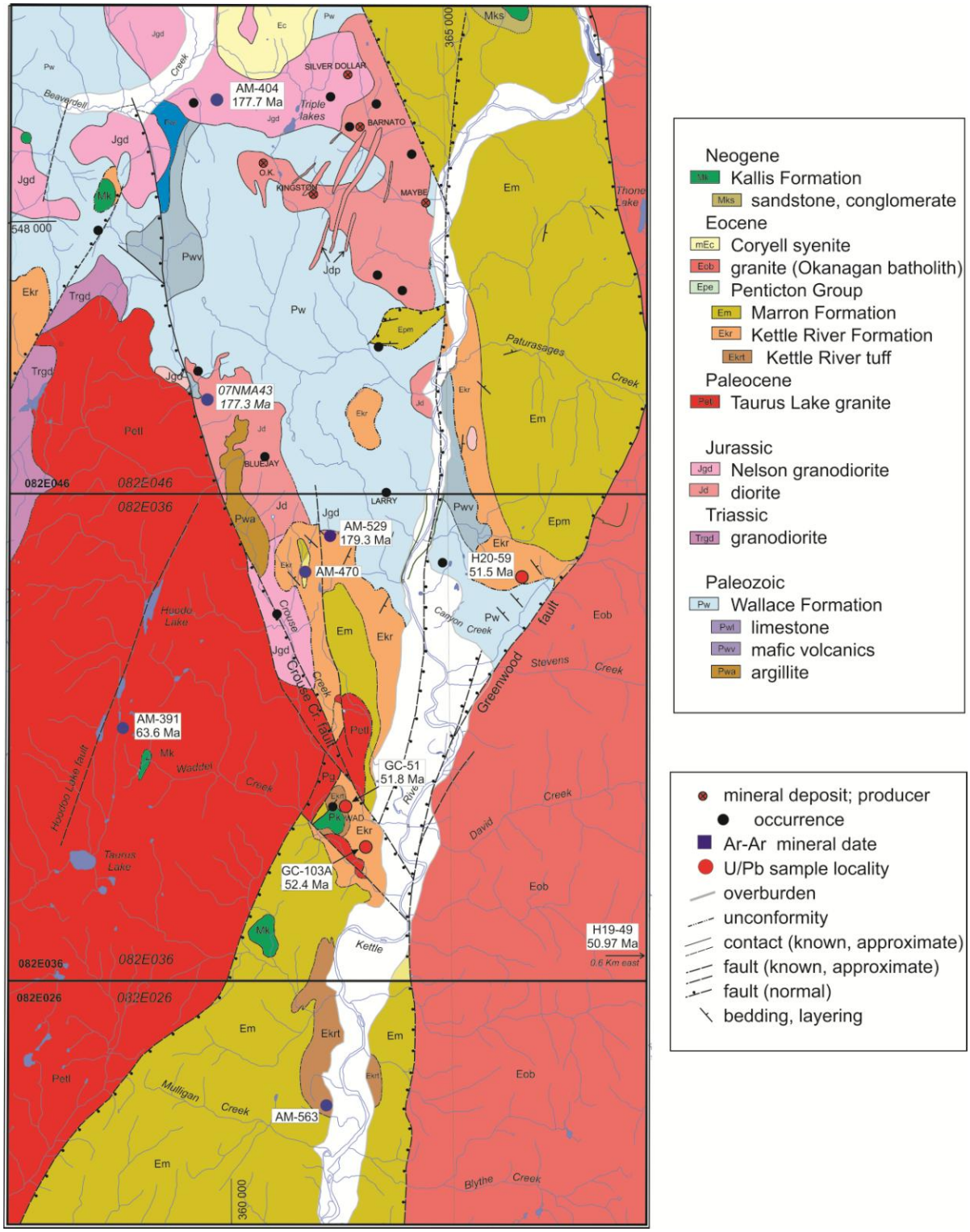


Figure 5: Geology of the Rock Creek graben, Kettle River area (NTS 82E/07) showing age dates; modified from Tempelman-Kluit (1989), Massey and Duffy (2008), Massey et al., 2010) and Høy and Jackaman (2016; revised 2022).

Almond Mountain (082E/07)

AM-391

Location: UTM 357372E 5468453 N; along a forest service road between Taurus and Hoodoo Lakes, 7 km due west of the Christian valley road and the Kettle river (Figure 5).

Map reference: Trim map 082E036; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal unit: Informally named the Paleocene Taurus Lake granite, unit PEtl.

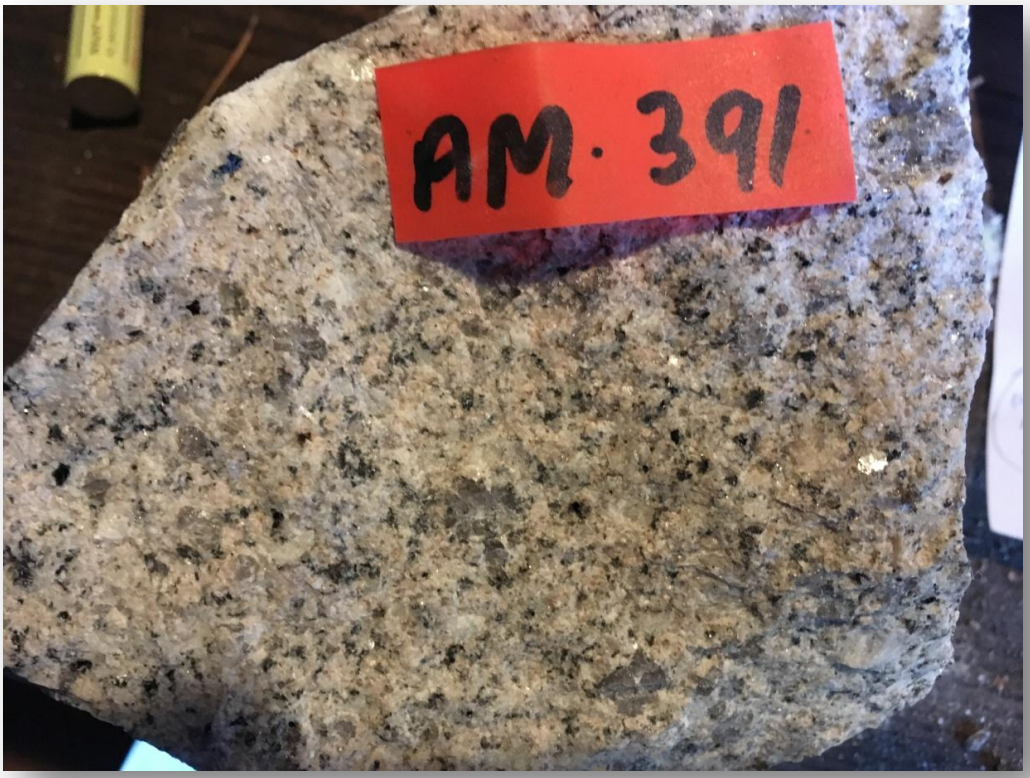
Description: Leucocratic, medium-grained, fresh "granite" with < 5% disseminated biotite.

Petrography: K-feldspar and quartz-phyric biotite monzogranite with minor magnetite, accessory apatite and rare scattered grains of titanite and zircon(?) (Dunne, 2017).

Date: Ar-Ar biotite; 63.6 ± 1.3 Ma; J. Gabites, The University of British Columbia.

Comment: U-Pb zircon analysis of the Taurus Lake granite returned a ca. 67 ma age (CV-104). Younger Ar-Ar ages (AM-563 and this sample) may record mineral cooling temperatures as the granite cools and crystallizes.

Photo: Hand sample of massive, relatively fresh leucocratic monzonite.



Almond Mountain (082E/07)

AM-404

Location: UTM 359883E 5482677N; on the Crouse Creek forest service road, on the east slope of Crouse Creek, approximately 6 km north-northeast of its junction with the Christian Valley road (Figure 5).

Map reference: Trim map 082E046; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal unit: Early Jurassic Nelson plutonic suite, Unit Jgd.

Description: Medium-grained, relatively fresh, hornblende-biotite granodiorite; minor chloritic alteration of mafic minerals.

Date: Ar-Ar muscovite; 177.7 ± 3.0 Ma; J. Gabites, The University of British Columbia.

Comment: Several large exposures of fresh granodiorite occur within splays of the Rock Creek graben; these intrude Paleozoic "basement" and host many of the mineral occurrences in the immediate area (see also AM-529). The age is similar to a date obtained in a granodiorite approximately 4 km to the south (07NMA43; Massey et al., 2010).

Photo: Hand sample of equigranular, massive middle Jurassic hornblende-biotite granodiorite.

Almond Mountain (082E/07)

AM-470

Location: UTM 361491E 5471677N; on the Crouse Creek forest service road, on the east slope of Crouse Creek, approximately 6 km north-northeast of its junction with the Christian Valley road (Figure 5).

Map reference: Trim map 082E036; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal unit: Eocene Marron Formation, Em.

Description: Medium to dark grey, amygdaloidal alkali "andesite" with minor disseminated fine-grained biotite and hornblende and small euhedral plagioclase grains.

Petrography: (hornblende-biotite-clinopyroxene) plagioclase-phyric latite, with a fine to very fine recrystallized groundmass of plagioclase laths and K-feldspar with minor mafic phases and trace accessory minerals (Dunne, 2017).

Date: Ar-Ar feldspar; 57.8 ± 2.1 Ma; J. Gabites, The University of British Columbia.

Comment: The sample is taken from near the base of the Marron Formation that to the south unconformably overlies the Paleocene Taurus Lake granite, PEtl. As a number of samples of the underlying Kettle River Formation have U-Pb zircon ages of ca. 52-51 Ma, this Ar-Ar date is considered spurious (Höy et al., 2021.)

Photo: Hand samples of latite porphyry of the Eocene Marron Formation.

Almond Mountain (082E/07)

AM-529

Location:. UTM 362117E 5472621N; small exposure, 1 km west of Kettle River, 20 km north of the town of Rock Creek (Figure 5).

Map reference: Trim map 082E036; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal unit: Early Jurassic Nelson plutonic suite, Unit Jgd.

Description: Medium-grained, relatively fresh (biotite)-hornblende granite.

Petrography: Monzogranite with granular plagioclase, quartz and lesser biotite as large inclusions within large (microperthite) K-feldspar phenocrysts; minor magnetite, accessory apatite and titanite and trace zircon; minor alteration of biotite and hornblende to chlorite (Dunne, 2017).

Date: Ar-Ar hornblende; 179.3 ± 4.5 Ma; J. Gabites, The University of British Columbia.

Comment: This small exposure is basement to unconformably overlying Kettle River Formation. The older Ar-Ar date and ca. 177-178 Ma dates on similar intrusions immediately to the north (AM 404, 07NMA43) are comparable to Early Jurassic Ar-Ar dates on the Averill complex of the Franklin camp. Of note, a ca. 215 Ma U-Pb zircon date of a similar intrusion 8 km to the northwest (07NMA45; Massey et al., 2010) suggests these intrusions may be late Triassic in age, similar to the Josh Creek diorite in the Grand Forks (082E/01) sheet.

Photo: Hand sample of relatively fresh granodiorite.

Almond Mountain (082E/07)

AM-563

Location: UTM 361875E 5459547N; exposure along the Christian valley road, approximately 13 km north of Westbridge (Figure 5).

Map reference: Trim map 082E026; GSBC maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal unit: Kettle River Formation, unit Ekrt

Description: Megacrystic K-feldspar porphyritic lava with K-feldspar (sanidine?), plagioclase, quartz and minor biotite in a granular matrix; in part, epiclastic.

Date: Ar-Ar feldspar; 67.7 ± 8 Ma; J. Gabites, The University of British Columbia.

Comment: These exposures were originally mapped as a megacrystic porphyritic granite, supported by the Ar-Ar date of 67.7 Ma; however, they are now included as a phase of the Kettle River Formation. The older Ar-Ar date may reflect the age of granitic detritus in the sample or may be a spurious date possibly due to inherent argon loss.

Photo: Hand sample showing large irregular subhedral to anhedral K-feldspar (sanidine) and quartz in a matrix of quartz, feldspar and minor biotite.

Almond Mountain (082E/07)

H19-29

Location: UTM 386047E 5473224N; located on the south side of Gable Creek, approximately 9 km west of Burrell Creek and 35 km north of the town of Greenwood.

Formal map unit: Okanagan batholith, Unit Eob.

Map reference: Trim map 082E048; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Description: Large exposure of K-feldspar porphyritic granite, closely associated with fresh, medium-grained equigranular granite; relatively fresh sample with only occasional chlorite fractures.

Date: U-Pb zircon; 51.86 ± 0.39 Ma; R. Friedman, The University of British Columbia.

Comment: The exposure is near the eastern contact of the Okanagan batholith with the Eocene Coryell batholith.

Photo: Hand sample of relatively fresh megacrystic granite.

Almond Mountain (082E/07)

H19-49

Location: UTM 369682E 5462685N; located approximately 31 km north-northeast of the town of Rock Creek, east of Kettle River, on Williamson Lake road approximately 0.5 km north of the lake.

Map reference: Trim map 082E028; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Formal map unit: Okanagan batholith, unit JKg of Tempelman-Kluit (1989) and unit Eob of Geoscience BC map 2019-4 (Höy and Jackaman, 2019).

Description: Exposure of fresh, megacrystic granite; pink euhedral K-spar phenocrysts, 2-3 cm in length in a granular matrix of plagioclase, quartz and orthoclase with approximately 10% mafics, mainly biotite and hornblende**.**

Date: U-Pb zircon; 50.97 ± 0.40 Ma; R. Friedman, The University of British Columbia.

Comment: The Okanagan batholith has variously been assigned Jurassic, Cretaceous and Paleocene ages. Recent dating of several phases of the batholith, including the megacrystic granite of this sample, have returned Paleocene or Eocene ages.

Photo: Outcrop exposure of fresh megacrystic granite**.**

Almond Mountain (082E/07)

H20-59

Location: UTM 366290E 5471586N; located on the northwest slopes of Lost Horse Creek, approximately 2.5 km east of Kettle River and 35 km north of the town of Rock Creek.

Formal map unit: Ekr; Kettle River Formation.

Map reference: Trim map 082E036; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04.

Description: Light grey, green tinged crystal-lithic tuff, quartz-feldspar grit, massive to vague layering, suggesting water deposition.

Date: U-Pb zircon; 51.50 ± 0.44 Ma; R. Friedman, The University of British Columbia.

Comment: Thick exposures of the Kettle River Formation, including conglomerate, siltstone, minor shale and massive to crudely layered crystal-lithic tuff unconformably overlie late Paleozoic Wallace Formation and are conformably overlain by Marron Formation. The U-Pb zircon date provides the maximum depositional age of the basal part of the Penticton Group within the Rock Creek graben.

Photo: Hand sample of crystal-lithic tuff**.**

Almond Mountain (082E/07)

GC-51

Location: UTM 362448E 5466545N; located on the WAD mineral prospect, approximately 0.5 km north of the Waddell Creek Forest Service road and 30 km north of the town of Rock Creek.

Map reference: Trim map 082E036; Geoscience maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04; Höy and Murton, 2021.

Formal map unit: Ekr; Kettle River Formation.

Description: Buff-coloured, vaguely layered reworked felsic tuff.

Petrography: Epiclastic rhyolite or reworked tuff with shards of plagioclase, K-feldspar, quartz and minor relict biotite in K-feldspar-sericite matrix (Leitch, 2020a).

Date: U-Pb zircon; 51.8 ± 0.75 Ma; R. Friedman, The University of British Columbia.

Comment: Exposures of the Kettle River Formation at the Wad prospect comprise felsic tuff, unusual K-feldspar megacrystic rhyo-dacite flows and considerable lithic debris, derived mainly from underlying Paleocene? granite basement. The formation is overlain by a thin succession of Marron Formation (<100m) and locally, unconformably overlain by Miocene/Pliocene plateau basalt**.** Detrital zircons range in age from ca. 60 - 80 Ma.

Photo: Hand sample of reworked crystal-(lithic) tuff**.**

Almond Mountain (082E/07)

GC-103A

Location: UTM 362832E 5465530N; located a few hundred meters south of the Waddell Creek Forest Service road, approximately 30 km north of the town of Rock Creek.

Map reference: Trim map 082E036; Geoscience BC maps 2016-8 (Höy and Jackaman, 2016; revised 2022), 2019-04; Höy and Murton, 2021.

Formal map unit: Ekr; Kettle River Formation.

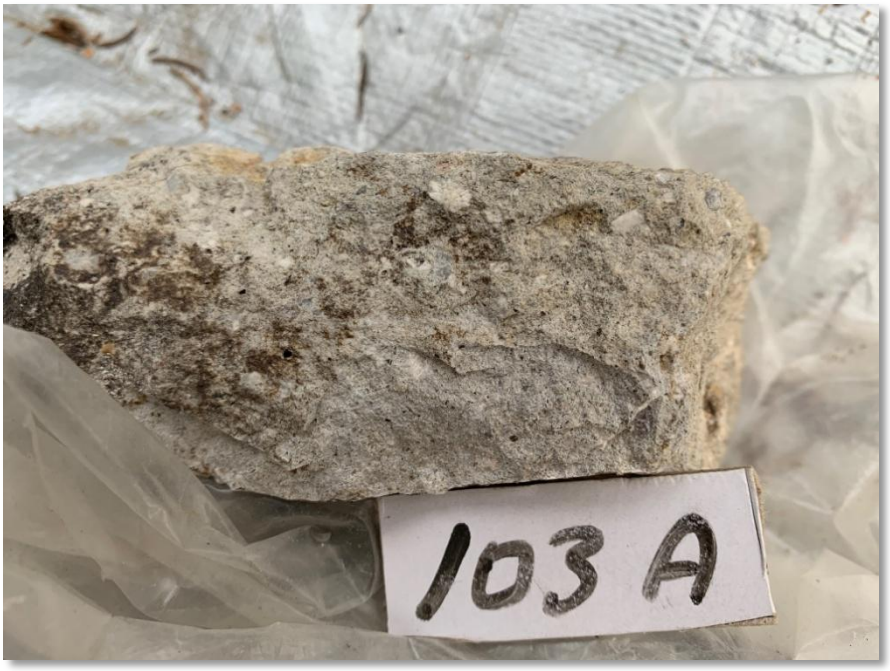
Description: Buff coloured, vaguely layered reworked felsic tuff.

Petrography: Rhyolitic tuff with shards of sanidine, plagioclase, quartz and minor relict biotite in a K-feldspar-quartz matrix; altered with quartz-albite, secondary K-feldspar, minor clay, sericite, chlorite and epidote (Leitch, 2020a).

Date: U-Pb zircon; 52.38 ± 0.75 Ma; R. Friedman, The University of British Columbia.

Comment: Exposures of the Kettle River Formation at the Wad prospect comprise felsic tuff, unusual K-feldspar megacrystic rhyo-dacite flows and considerable lithic debris, derived mainly from underlying Paleocene? and older granite basement. The formation is overlain by thin (less than hundred meters) Marron Formation and locally, unconformably overlying Miocene/Pliocene plateau basalt**.** Detrital zircons range in age from ca. 60-70 Ma.

Photo: Hand sample of reworked crystal-(lithic) tuff**.**



Deer Park map sheet (082E/08)

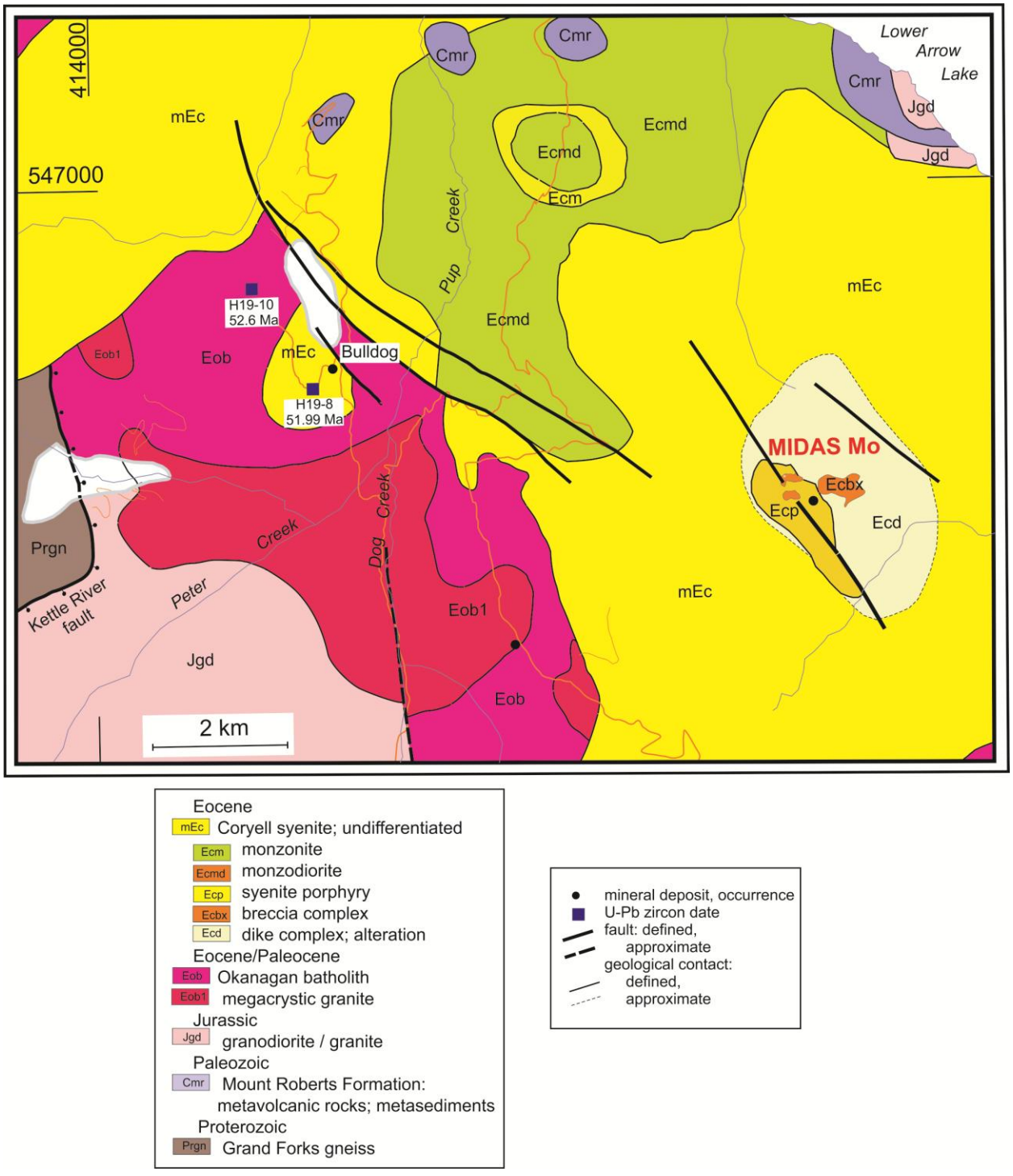


Figure 6: Geology of the Midas property area (NTS 82E/08); geology modified from Tempelman-Kluit (1989) and Høy and Jackaman (2010; revised 2022).

Deer Park (082E/08)

H19-8

Location: UTM 417248E 5466999N; located on a forest service road approximately 1 km west of McRae Creek and 31 km north of the town of Christina Lake (Figure 6).

Map reference: Trim map 082E040; Geoscience BC maps 2010-07-1 (Höy and Jackaman, 2010; revised 2022); 2019-04.

Formal unit: Middle Eocene Coryell; mEc.

Description: Massive to foliated, relatively fresh biotite-hornblende monzonite.

Date:. U-Pb zircon; 51.99 ± 0.69 Ma; R. Friedman, The University of British Columbia.

Comment: This small intrusion, within a stock of leucocratic white "granite", hosts minor base- and precious-metal vein mineralization at the Bulldog occurrence.

Photo: Hand sample of fresh, medium-grained monzonite.

Deer Park (082E/08)

H19-10

Location:. UTM 416388E 5468517N; located on a forest service road, approximately 3 km west of McRae Creek and 32 km north of the town of Christina Lake (Figure 6).

Map reference: Trim map 082E040; Geoscience BC maps 2010-07-1 (Höy and Jackaman, 2010; revised 2022); 2019-04.

Formal unit: Okanagan batholith, Eob.

Description: Leucocratic, medium-grained white granite; fresh, massive and cut by irregular chlorite veins.

Date: U-Pb zircon; 52.60 ± 0.61 Ma; R. Friedman, The University of British Columbia.

Comment: This small stock has a central core of coarse megacrystic granite, surrounded by white, leucocratic medium grained "granite" (this sample). It is intruded by Coryell monzonite (sample H19-8) that hosts Bulldog vein mineralization

Photo: Hand sample of medium-grained, relatively fresh massive granite.

Deer Park (082E/08)

H19-26

Location: UTM 399631 E, 5475801N; located on a narrow forest service road approximately 2.5 km east of Burrell Creek.

Map reference: Geoscience BC maps 2010-07-1 (Höy and Jackaman, 2010; revised 2022); 2019-04.

Formal unit: Eocene Penticton Group (Epe); possibly Kettle River of Marron formation.

Description: Relatively fresh basalt with scattered grains of biotite; the unit is cut by thin pyrite veins and occurs adjacent to some historical exploration workings.

Petrography description: Fragmental alkali basalt, with phyric plagioclase, biotite, apatite and relict pyroxene(?) in a matrix of K-feldspar, carbonate and opaques; minor calcite-chlorite-epidote ± sericite alteration and veins that contain minor pyrite (Leitch, 2019).

Date: Ar-Ar feldspar; 53.22 ± 0.79 Ma; J. Gabites, The University of British Columbia.

Comment: The Penticton Group generally overlies unconformably Eocene granite and syenite. Thin porphyritic trachyte flows occur within the Marron succession at this locality. The older age, and its stratigraphic position near the base of the Penticton Group, suggests that the unit may be part of the basal Kettle River, rather than the Marron Formation.

Photo: Samples of fresh Penticton Group. Left photo shows rhyodacite with vague altered mafic grains; right photo, basalt with isolated euhedral biotite (sampled for analysis); fresh and weathered sample.

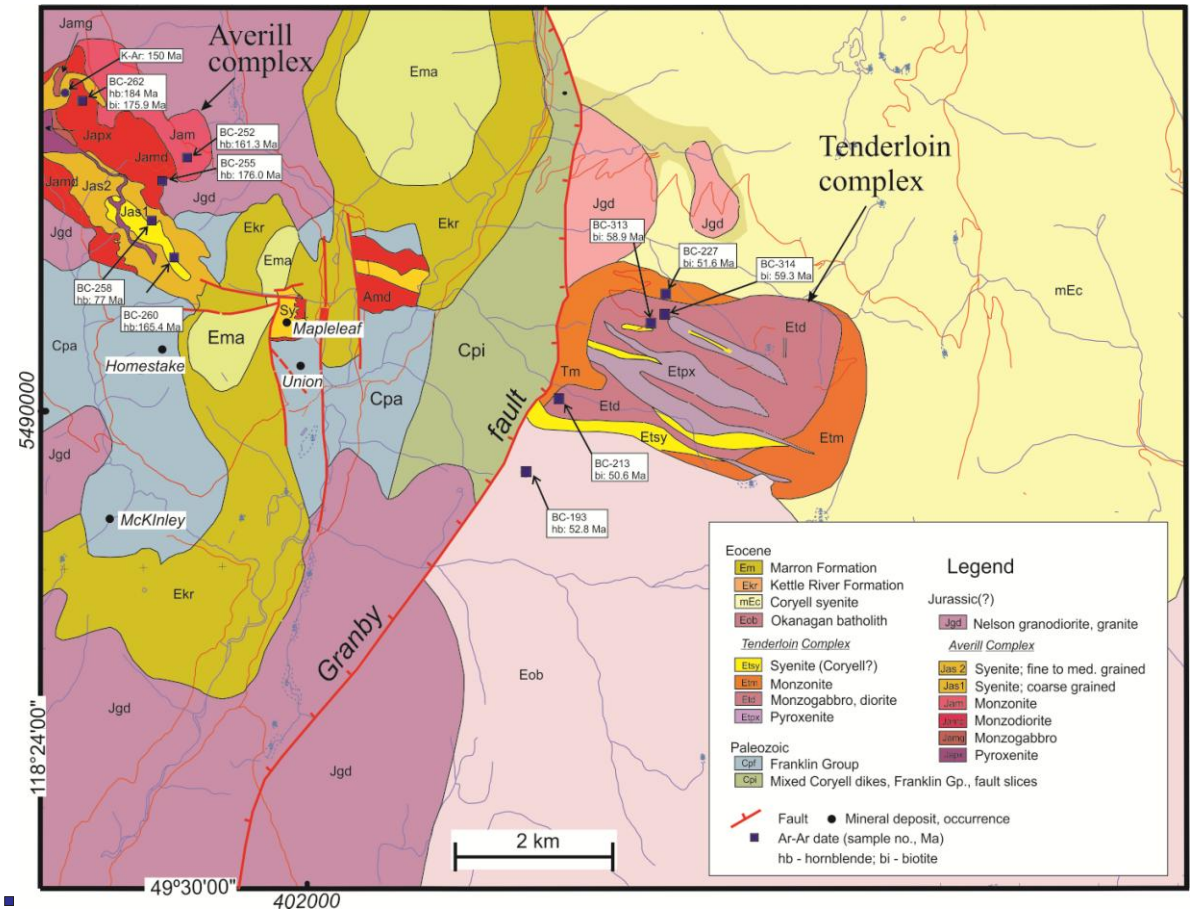


Figure 7: Geology in the area of the Averill and Tenderloin complexes, Franklin Mining camp, and locations of Burrell Creek (BC) samples in Trim map 082E059; after Drysdale (1915), Keep (1989) and Höy and Jackaman (2013).

Burrell Creek (082E/09)

BC-193

Location: UTM 404862E 5489113N; located on a Forest Service road approximately 2.5 km east of Burrell Creek and 5 km east-southeast of the Franklin Mining camp (Figure 7).

Map reference: Trim map 082E059, Geoscience BC maps 2010-07-1 (Höy and Jackaman, 2010; revised 2022); 2019-04.

Formal map unit: "Ladybird granite", unit Eob (a phase of the Okanagan batholith).

Description: Massive to porphyritic hornblende-(biotite) granite with some quartz-feldspar pegmatite lenses, and commonly large (to several cm) subhedral K-feldspar phenocrysts.

Date: Ar-Ar hornblende; 52.8 ± 1.6 Ma; J. Gabites, The University of British Columbia.

Comment: The Ar-Ar date may be a cooling age for the intrusion; a U-Pb date of 56.0 ma (sample 14581; Parrish, 1992) for the "Ladybird granite" is interpreted as the intrusive age.

Burrell Creek (082E/09)

BC-213

Location: UTM 405233E 5490010N; located in the footwall of the Granby fault, on Burrell-Tenderloin forest service road approximately 2 km east of Burrell Creek (Figure 7).

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Paleocene Tenderloin Complex biotite pyroxenite (unit Etd).

Description: Foliated to gneissic biotite pyroxenite that is cut by several fine-grained massive syenite dykes; note minor chlorite alteration of mafic minerals.

Dating: Ar-Ar biotite; 50.6 ± 0.6 Ma; J. Gabites, The University of British Columbia.

Comment:. The Tenderloin complex is a zoned mafic alkalic intrusive complex that lies in the footwall of the Granby fault. As shown in Figure 7, the complex has an inner zone of gabbro and pyroxenite, surrounded by monzogabbro, diorite and monzonite. Syenite dikes commonly cut phases of the intrusive complex.

Photo: Field exposure showing biotite-pyroxenite/gabbro cut by thin syenite dykes.

Burrell Creek (082E/09)

BC-227

Location: UTM 406634E 5491346N; located on a small logging spur road, 3 km east of Burrell Creek and approximately 6 km east of the Franklin Mining camp (Figure 7).

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Paleocene Tenderloin complex quartz monzonite (unit Etm).

Description: Granular, medium to coarse-grained "quartz monzonite" with 20% mafic minerals, biotite and hornblende; numerous chlorite-epidote veins.

Dating: Ar-Ar biotite; 51.6 ± 0.6 Ma; J. Gabites, The University of British Columbia.

Comment:. The Tenderloin complex is a zoned mafic alkalic intrusive complex that lies in the footwall of the Granby fault. As shown simplistically in Figure 7, the complex has an inner zone of gabbro and pyroxenite, surrounded by monzogabbro, diorite and monzonite. BC-227 is a sample from near the northern margin of the complex.

Photos: Exposures of Tenderloin "quartz monzonite" unit, several 100 m west of BC-227.
(left) monzonite, cut by coarser grained dykes
(right) intrusive breccia with clasts of diorite within syenite

Burrell Creek (082E/09)

BC-252

Location: UTM 400651E 5493199N; located on a historical mineral exploration road in the northern part of the Franklin camp, approximately 800 m southwest of Gloucester Creek.

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Averill complex monzonite (unit Jam).

Description: Fine grained, equigranular, fresh monzonite with approximately 70% plagioclase > K-feldspar and 30% hornblende (+biotite); generally fresh, with minor limonite staining.

Dating: Ar-Ar hornblende; 161.3 ± 2.4 Ma; J. Gabites, The University of British Columbia

Comment:. The Franklin mining camp is approximately centered on the Averill complex and this suggests mineralization of the camp is mainly Jurassic in age. The complex is a zoned intrusion with more mafic pyroxenite and diorite central to monzonite and monzodiorite phases (Keep, 1989; Keep and Russell, 1988).

Photo: Broken subcrop exposures of relatively fresh Averill monzonite.

Burrell Creek (082E/09)

BC-255

Location: UTM 400355E 5492907N; located along a historical mineral exploration road in the Franklin mining camp, approximately 1200 m southwest of Gloucester Creek (Figure 7).

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Averill complex monzodiorite (unit Jamd).

Description: Medium grained to coarse grained, equigranular "monzodiorite" with approximately 20% mafics (augite > hornblende).

Dating: Ar-Ar hornblende; 176.0 ± 2.5 Ma; J. Gabites, The University of British Columbia.

Comment: The monzodiorite is the central phase of the zoned Averill complex (Keep, 1989).

Photo: Broken outcrop, Averill complex "monzodiorite".

Burrell Creek (082E/09)

BC-258

Location: UTM 400173E 5492553N; located in the Franklin Mining camp on a mine exploration road approximately 1.5 km northwest of Mount Franklin (Figure 7).

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Unit Jas1, Figure 7.

Description: Coarse grained massive syenite/monzonite; minor alteration of hornblende; rare malachite blebs.

Dating: Ar-Ar plagioclase; 80.9 ± 1.2 Ma; J. Gabites, The University of British Columbia.

Comment: Plagioclase gives a plateau date of 80.9 Ma, and an integrated date of 88.6 ± 0.4 Ma; these late Cretaceous dates are considerably younger than the middle Jurassic age of the Averill complex, but older than the middle Eocene age of the Coryell syenite. There are no other late Cretaceous intrusions in the immediate vicinity (although the Whatshan Lake batholith approximately 25 km to the north is late Cretaceous, dated at ca. 77-79 Ma; Thompson et al., 2004) and hence the reliabilityof this age is uncertain. Keep (1989) considers this "trachytic syenite" to be part of Jurassic Averill complex.

Photo: View to the north, across the trace of the west-dipping Granby fault in the Burrell Creek valley. The prominent hill in the middle distance is underlain by Marron and Kettle River formations, the Franklin camp is located immediately to the south (left in photo). The foreground is in the footwall of the fault in the Tenderloin complex.

Burrell Creek (082E/09)

BC-260

Location: UTM 400452E 5491927E; located along an historical mine exploration road in the Franklin camp approximately 1.2 km northwest of Mount Franklin.

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Averill complex syenite (Unit Jas1).

Description: Fresh, coarse-grained syenite, with subhedral K-feldspar and irregular grains and intergrowths of anhedral hornblende (+ pyroxene).

Dating: Ar-Ar hornblende; 165.4 ± 1.9 Ma; J. Gabites, The University of British Columbia.

Comment:. Many phases of the Averill complex as well as the lithologic zonation are remarkably similar to those in the Tenderloin complex in the footwall of the Granby fault (see Figure 7). Restoration of movement along the fault places the Tenderloin complex beneath the Averill complex, yet the latter is Jurassic in age whereas the Tenderloin complex is Paleocene/Eocene, a coincidence that is difficult to explain!

Photo: Massive, fresh, coarse-grained syenite.

Burrell Creek (082E/09)

BC-262

Location: UTM 339332E 5493885N;

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Averill complex monzodiorite (Unit Jamd).

Description: Medium-grained, equigranular, monzogabbro or monzodiorite; approximately 40% mafics (augite, biotite, hornblende?) and 60% plagioclase; relatively fresh.

Dating: Ar-Ar biotite; 175.90 ± 2.1 Ma; J. Gabites, The University of British Columbia.

Comment: The monzodiorite is the central (and oldest) phase of the zoned Averill complex (Keep, 1988; Keep and Russell, 1989).

Photo: Exposure of Averill complex "monzodiorite", cut by syenite dykes; note hematite staining on fracture surfaces.

Burrell Creek (082E/09)

BC-313

Location: UTM 406496E 5490971N; located on a small logging spur, 3 km east of Burrell Creek and approximately 6 km east of the Franklin mining camp.

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Paleocene/Eocene Tenderloin complex (unit Etd).

Description: Small exposure of foliated "diorite" with approximately 40% plagioclase and 60% mafics (hornblende> biotite).

Dating: Ar-Ar biotite; 58.9 ± 0.7 Ma; J. Gabites, The University of British Columbia.

Comment: Diorite/monzodiorite forms the central phases of a zoned mafic alkalic intrusion, the Tenderloin complex. The Paleocene ages for this unit contrast with younger ages for intermediate and marginal phases of the complex.

Burrell Creek (082E/09)

BC-314

Location: UTM406619E 5491078N; located on a small logging spur, 3 km east of Burrell Creek and approximately 6 km east of the Franklin mining camp.

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1 (revised 2022); 2019-04.

Formal map unit: Paleocene/Eocene Tenderloin complex (unit Etd).

Description: Foliated to massive leucocratic monzodiorite with approximately 25% mafic minerals (hornblende, pyroxene, biotite) and numerous dark inclusions; gneissic textures in part.

Dating: Ar-Ar biotite; 59.3 ± 0.7 Ma; J. Gabites, The University of British Columbia.

Comment:. The older dates for samples of the monzodiorite/diorite phase of the Tenderloin complex (this sample and BC-313) suggest that this phase is the oldest phase in the complex; alternatively, different ages may record variable mineral cooling closure dates.

Burrell Creek (082E/09)

H19-15

Location:. UTM 404434E 5483958N; large roadside exposure approximately 5 km east of Burrell Creek and 1 km north of the headwaters of Nicoll Creek.

Map reference: Trim map 082E059; Geoscience BC maps 2013-07-1, 2019-04.

Formal unit: Paleogene Okanagan batholith, unit Eob (Ladybird granite).

Description: Leucocratic biotite-hornblende granodiorite; generally fresh and locally foliated.

Date: U-Pb zircon; 52.79 ± 0.41 Ma; R. Friedman, The University of British Columbia.

Comment: The ca. 52.8 ma date is essentially the same age as a sample of the intrusion taken 5.5 km to the north (BC-193); a sample located approximately 6 km to the southeast returned a date of ca. 56 Ma (Parrish, 1992).

Photo: Roadside exposure of foliated granodiorite.

Christian Valley map sheet (082E/10)

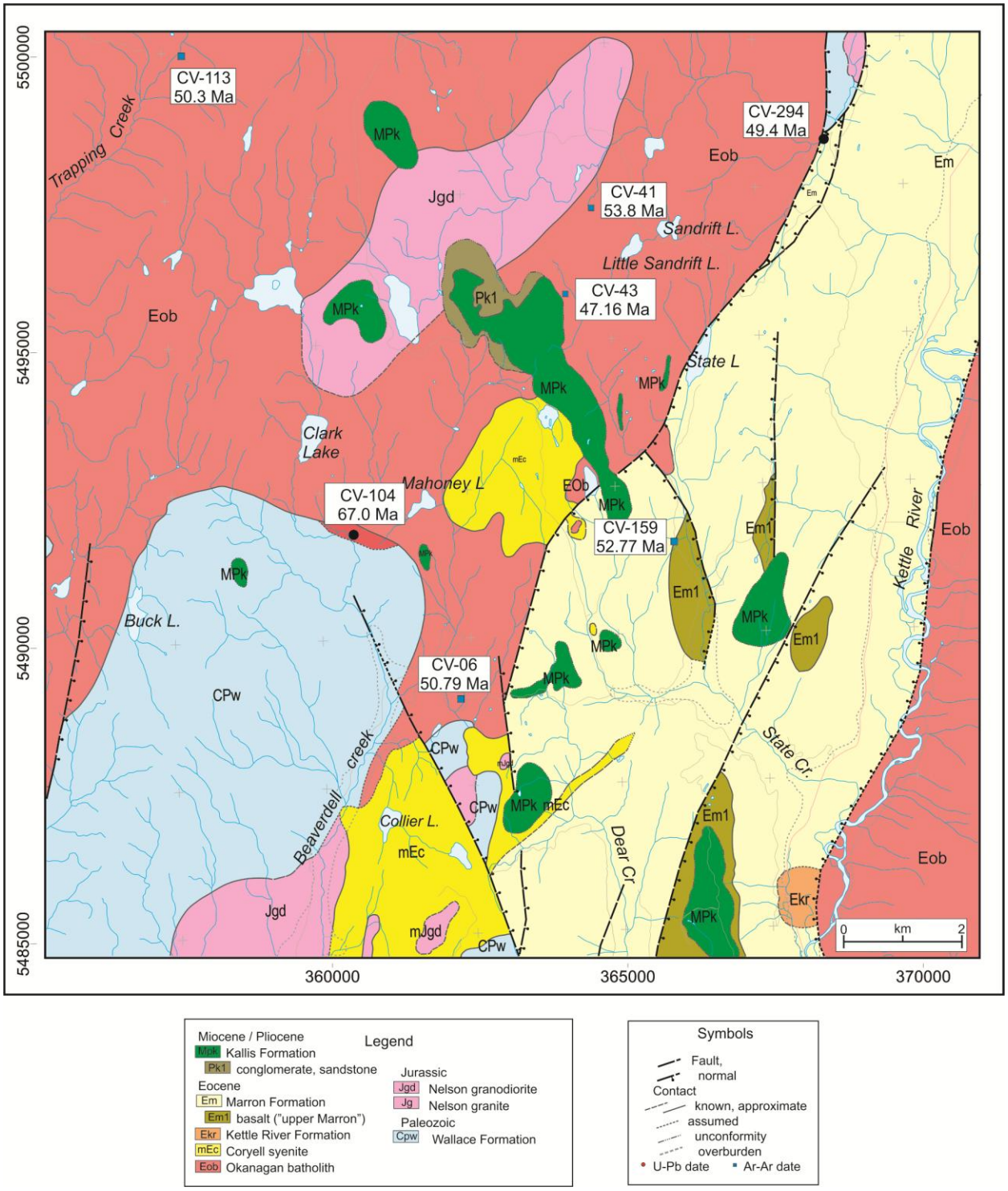


Figure 8: Geological map of the southwestern part of the 1:50,000 Christian Valley map-sheet; modified from Christopher (1978), Tempelman-Kluit (1989) and Höy and Jackaman (2017).

Christian Valley (082E/10)

CV-06

Location: UTM 362462E 5489153 N; located 7 km west of Christian valley, in a large clear cut, 50 m south of State FSR.

Map reference: Trim map 82E056; Geoscience BC maps 2017-10 (revised 2022); 2019-04.

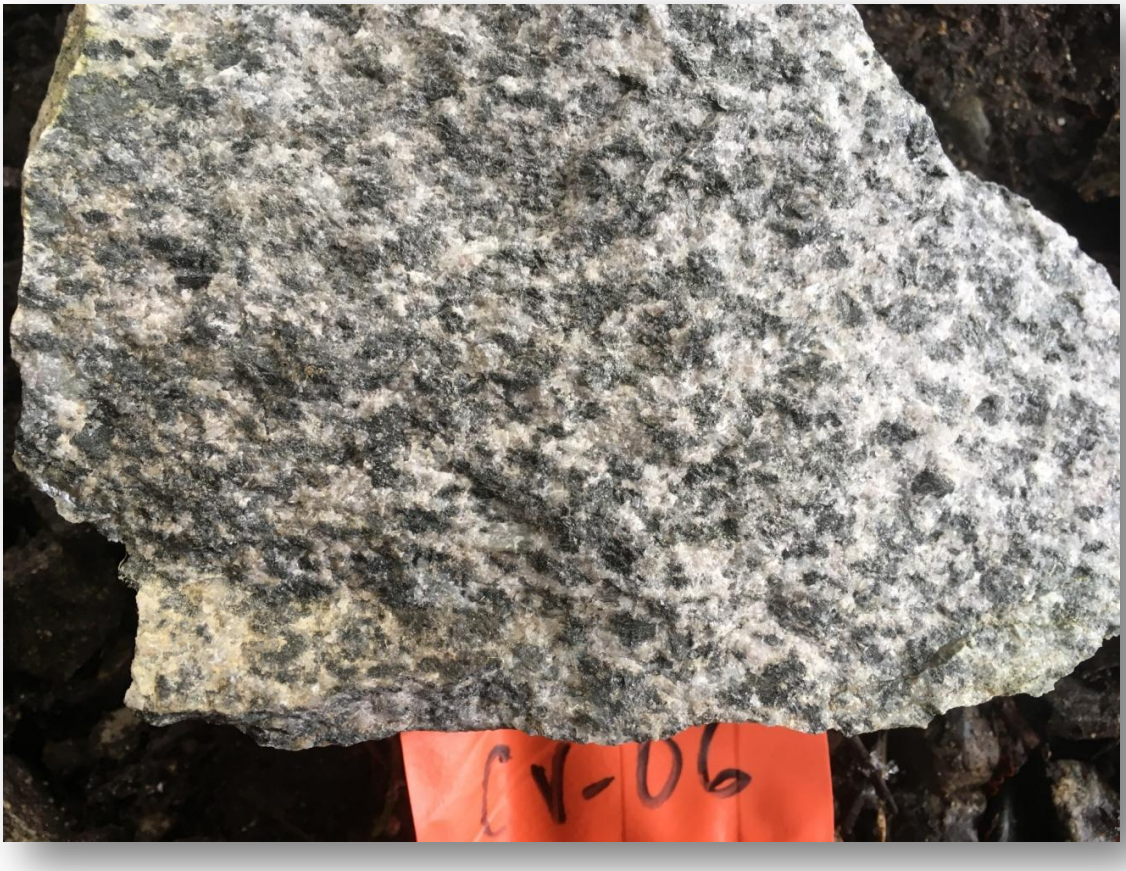
Formal map unit: Eocene "Trapping Creek" granite, Okanagan batholith; unit Eob.

Description: Fresh, medium-grained, massive to foliated granite/granodiorite with approximately 20% hornblende and biotite.

Dating: Ar-Ar hornblende; 50.79 ± 0.69 Ma; J. Gabites, The University of British Columbia.

Comment: The Ar-Ar date is similar to a U-Pb zircon age of 51.47 ma (sample CV-258) from east of the Rock Creek. The Trapping Creek granite is part of the Okanagan batholith, unit JKg (Tempelman-Kluit, 1989) or Valhalla the intrusions (Little, 1957).

Photo: Hand sample of massive, medium-grained, leucocratic granodiorite.



Christian Valley (082E/10)

CV-41

Location: UTM 364772E 5497380N; located along a spur road that connects Sandrift and State forest service roads, approximately 1 km northwest of Little Sandrift Lake.

Map reference: Trim map 82E066; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Eocene Marron Formation (?), Em.

Description: Fresh, crowded feldspar porphyry; grey, fine-grained matrix with numerous subhedral 2-3 mm white feldspar phenocrysts; minor biotite and hornblende in matrix.

Dating: Ar-Ar K-feldspar; 53.8 ± 1.8 Ma; J. Gabites, The University of British Columbia.

Comment: The sample is from a small exposure within the Trapping Creek granite. Contact relationships are not known, but the unit is mapped as Marron Formation that unconformably overlies the granite. This date cannot be reconciled with the age of the Kettle River Formation, dated at ca. 50.5-51.5 Ma, that elsewhere underlies the Marron.

Photo: Field hand sample of intermediate, alkalic lava flow(?) (trachy andesite?) or altered intrusive.

Christian Valley (082E/10)

CV-43

Location: UTM 364297E 5495884N; located approximately 1 km southwest of Little Sandrift Lake on a spur road the connects Sandrift and State forest service roads.

Map reference: Trim map 82E066; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Eocene "Trapping Creek" (Okanagan batholith, unit Eob).

Description: Fresh, fine to medium-grained, equigranular, leucocratic granite; some swirled pegmatite.

Petrography summary: Medium-grained, weakly porphyritic biotite monzogranite comprising 30-40% plagioclase, 25-30% quartz, 20-25% K-feldspar and 5-10% quartz. Accessory minerals include apatite, rare titanite and zircon (Dunne, 2017).

Dating: Ar-Ar biotite; 47.16 ± 0.36 Ma; J. Gabites, The University of British Columbia

Comment: The Trapping Creek granite is part of the Okanagan batholith (Tempelman-Kluit (1989) or Valhalla intrusions (Little, 1957). The Ar-Ar date is interpreted as a cooling age or may record argon loss. At this locality it is unconformably overlain by Miocene plateau basalt.

Photo: Hand sample of massive, medium-grained granite.

Christian Valley (082E/10)

CV-104

Location: UTM 360639E 5491943N; located approximately 1 km southwest of Maloney Lake, on a spur road north from the Beaverdell FSR.

Map reference: Trim map 82E056; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Paleocene "Taurus Lake" granite; unit PEtl.

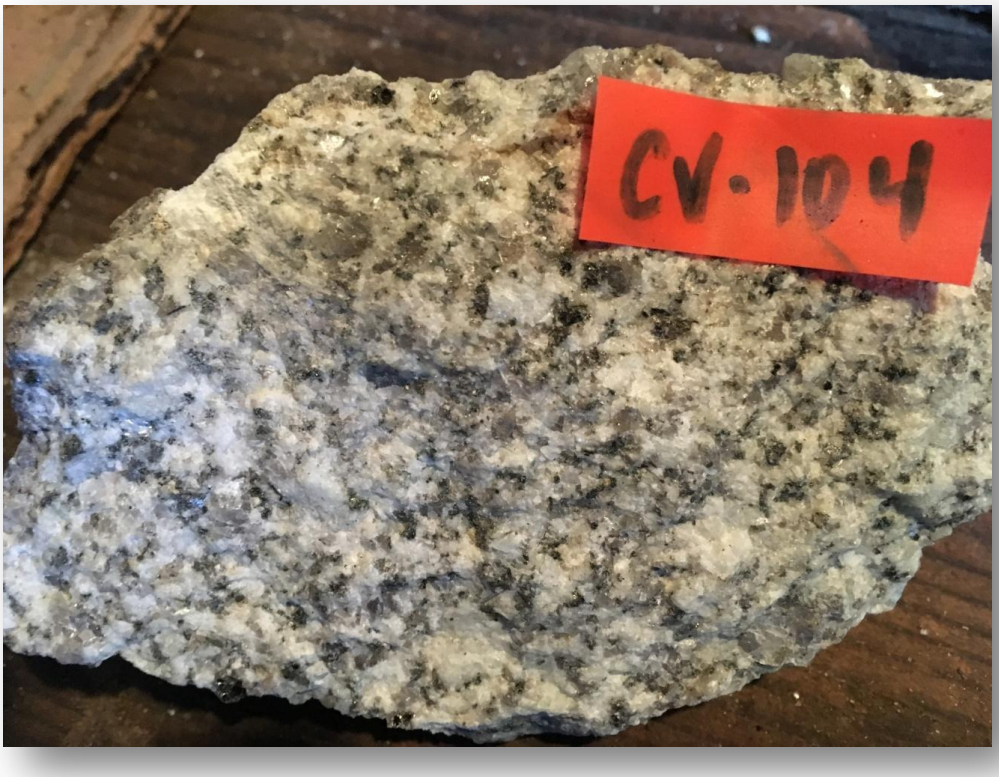
Description: Fresh, medium-grained, equigranular, leucocratic biotite granite.

Petrography summary: Dominantly intergrown plagioclase, quartz and lesser K-feldspar with minor biotite, trace amphibole and opaques; minor replacement of feldspars with carbonate and illite, and biotite with chlorite, epidote and carbonate (Dunne, 2017).

Dating: U-Pb zircon; 67.0 ± 0.46 Ma; R. Friedman, The University of British Columbia.

Comment: This exposure is interpreted to be part of the Taurus Lake granite, rather than the younger Trapping Creek granite which occurs immediately to the north. The U-Pb date is considered to be the intrusive age of the Taurus Lake granite, part of the Okanagan batholith, unit JKg of Tempelman-Kluit (1989) or Valhalla intrusions (Little, 1957).

Photo: Hand sample of massive, medium-grained granite/granodiorite.



Christian Valley (082E/10)

CV-113

Location: UTM 357626E 5499989N; collected from a small exposure on the south bank of Trapping Creek, near the junction of Trapping Creek and Big White West forest service roads.

Map reference: Trim map 82E066; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Eocene "Trapping Creek" (Okanagan batholith, unit Eob).

Description: Porphyritic to massive, medium-grained granite.

Petrography summary: Weakly porphyritic monzogranite, with ~35% plagioclase, 30% K-feldspar and 30% quartz; mafics include biotite and trace opaques; minor alteration of plagioclase to illite and biotite to sericite and/chlorite (Dunne, 2017).

Dating: Ar-Ar feldspar; 50.3 ± 0.19 Ma; J. Gabites, The University of British Columbia.

Comment: The Ar-Ar date is interpreted to be a cooling age; a U-Pb zircon date of 51.47 ma from a sample east of the Rock Creek graben (CV-258) is considered the intrusive age. The Trapping Creek granite is part of the Okanagan batholith, unit JKg (Tempelman-Kluit, 1989) or Valhalla intrusions (Little, 1957).

Photo: Hand sample of slightly altered, porphyritic granite; note minor biotite.

Christian Valley (082E/10)

CV-159

Location: UTM 365992E 5491657N; located on a road cut approximately 2.5 km south of State Lake on a spur road north of State FSR.

Map reference: Trim map 82E056; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Eocene Marron Formation; unit Em.

Description: Black, fine-grained amygdaloidal lava flow with widely scattered biotite.

Petrography summary: Biotite-clinopyroxene-phyric trachyte lava with ~5% biotite and~3-5% plagioclase phenocrysts in a very fine-grained groundmass (Dunne, 2017).

Dating: Ar-Ar biotite; 52.77 ± 0.38 Ma; J. Gabites, The University of British Columbia.

Comment: The sample is taken from higher exposures of the Marron, possibly within or near the Park Rill member of Church (1973) or Unit Epm1 (map 2017-10).

Photo: Hand sample of dark grey to black, amygdaloidal trachytic lava; note small biotite grains. Regionally, Kettle River Formation dated at ca 51 Ma underlies the Marron Formation; hence, this date is spurious and may reflect excess Ar.

Christian Valley (082E/10)

CV-258

Location: 374323E 5492821N; located on the east side of Christian Valley, east of the Rock Creek graben, on the Grano Creek forest service road.

Map reference: Trim map 82E057; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Okanagan batholith, unit Eob.

Description: Unaltered megacrystic quartz monzonite, with large 2-3 cm K-feldspar phenocrysts in a matrix of K-feldspar, plagioclase, quartz and minor (15%) mafics - biotite and hornblende.

Petrography summary: Fine to coarse-grained porphyritic quartz monzonite. K-feldspar phenocrysts have a microperthite texture and contain inclusions of fine-grained plagioclase, biotite and titanite (Dunne, 2017).

Dating: U-Pb zircon; 51.47 ± 0.45 Ma; R. Friedman, The University of British Columbia.

Comment: This ca. 51.5 Ma date of the Okanagan batholith is similar to dates of the Trapping Creek granite west of the Rock Creek graben, but contrasts with older dates of the Taurus Lake granite; hence, rocks referred to as Okanagan batholith (Tempelman-Kluit, 1979) range from early Paleocene to early Eocene in age.

Photo: Hand samples (wet and dry) show large K-feldspar phenocrysts in a granular matrix.

Christian Valley (082E/10)

CV-294

Location: 368478E 4598093N; located along a road cut near the junction of Copper Creek and Sandrift creeks, approximately 2.5 km due east of Sandrift Lake.

Map reference: Trim map 082E066; Geoscience BC maps 2017-10 (revised 2022), 2019-04.

Formal map unit: Eocene dyke.

Description: Light grey microporphyritic alkalic dyke comprised of mainly plagioclase and K-feldspar with acicular hornblende and rare biotite phenocrysts.

Petrography summary: Selectively altered plagioclase-hornblende-phyric latite with approximately 10-15% medium-grained plagioclase phenocrysts, 15% hornblende phenocrysts and trace fine-grained biotite in a groundmass of plagioclase, K-feldspar and minor mafic minerals (Dunne, 2017).

Dating: U-Pb zircon; 49.4 ± 0.77 Ma; R. Friedman, The University of British Columbia.

Comment: This relatively fresh, undeformed dyke cuts a prominent shear zone along the west margin of the Rock Creek graben; this date constrains movement on this splay of the Rock Creek graben fault to pre ca. 50 Ma. The age of the dike is similar to that of felsic Marama Formation volcanic rocks that overlie Marron Formation (sample H19-149, p. 16).

Photo: Hand sample showing acicular hornblende and minor biotite laths in a fine-grained feldspar matrix.

Damfino Creek and Lightning Peak area (082E/15, 16)

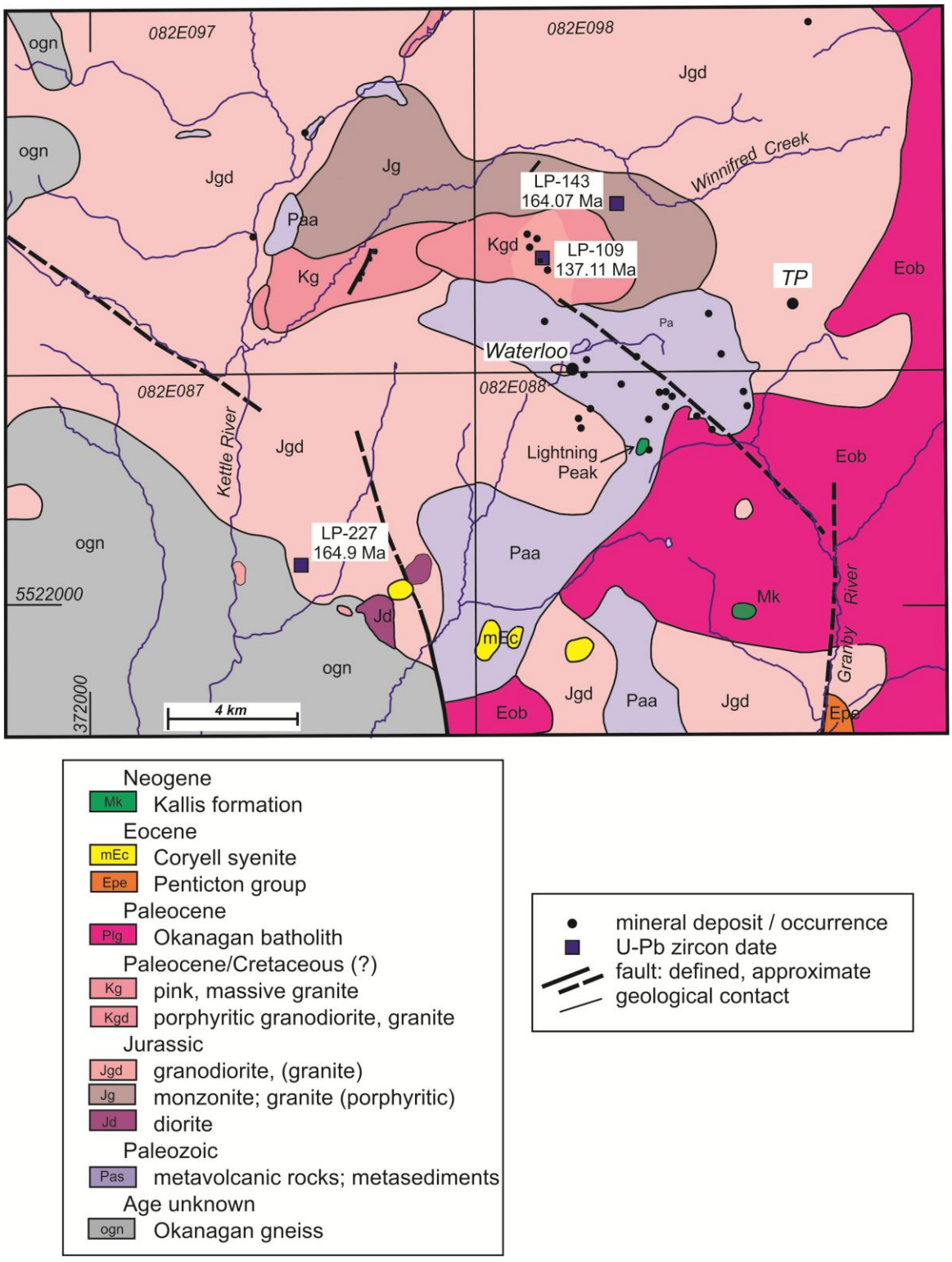


Figure 8: Geology of the Lightning Peak camp and surrounding area; geology is modified from Cairnes (1931) and Tempelman-Kluit (1989).

Damfino Creek (082E/15)

LP-109

Location: UTM 387216E 5532209N; located on a mineral exploration road in the Lightning Peak camp, 6 km west-northwest of Lightning Peak and 8 km east of Kettle River.

Map reference: Trim map 082E099; Geoscience BC map 2019-04.

Formal unit: Kgd; unnamed Cretaceous granodiorite; informally, Lightning Peak stock.

Description: Fresh, medium-grained porphyritic granodiorite, grey coloured; 10% biotite and hornblende; numerous euhedral K-feldspar phenocrysts.

Petrography summary: Medium-grained biotite granodiorite with 45% plagioclase, 20% K-feldspar, 20% quartz, 8% biotite, and accessory sphene, opaques, apatite and zircon; weak deuteric alteration to chlorite-clay and sericite-carbonate (Leitch, 2020).

D**ate:** U-Pb zircon; 137.33 ± 1.1 Ma; R. Friedman, The University of British Columbia.

Comment: This unit is a small stock within middle Jurassic Nelson granodiorite; it hosts some of the north-trending gold-quartz veins in the northern part of the Lightning Peak camp. The 137 Ma date is the weighted average of 11 zircons and is assumed to record the age of final crystallization. A middle Jurassic age of ca 160 Ma, the weighted average of 13 zircons, may reflect the age of inherited zircons from a Jurassic sourced magma.

Photo: Hand sample of LP-109, showing large, irregular K-feldspar phenocrysts in a granular matrix**.**

Damfino Creek (082E/15)

LP-143

Location: UTM 389688E 5533746N; located on a mineral exploration road in the Lightning Peak camp, immediately south of Winnifred Creek and 11 km east of Kettle River.

Map reference: Trim map 082E098; Geoscience BC map 2019-04.

Formal unit: Jgd; Nelson plutonic suite.

Description: Porphyritic granodiorite with large euhedral, flesh-coloured K-feldspar phenocrysts in a relatively fresh, grey granitic matrix.

Petrography summary: Medium-grained K-feldspar megacrystic granite/granodiorite with 40% plagioclase, 25% megacrystic microcline, 20% quartz, 10% biotite and accessory sphene, apatite, zircon and magnetite; weak deuteric alteration throughout (Leitch, 2020).

Date: U-Pb zircon; 164.07 ± 0.57 Ma; R. Friedman, The University of British Columbia; weighted average of 29 zircon grains.

Comment: The unit is a small porphyritic stock that is in relatively sharp contact with the Cretaceous Lightning peak stock to the south (sample LP-109). It is within more massive middle Jurassic granodiorite.

Photo: Field sample showing euhedral K-feldspar phenocrysts in a porphyritic granite; note rare limonitic fractures.

Damfino Creek (082E/15)

LP-227

Location: UTM 379632E 5522947N; located on the Mohr Creek road, 2.5 km east of Kettle River and 15 km southwest of Lightning Peak.

Map reference: Trim map 082E098; Geoscience BC map 2019-04.

Formal unit: Unit mJg, Spruce Creek batholith (Nelson plutonic suite).

Description: Pink-tinged granite/granodiorite; generally massive to slightly foliated, with approximately 15% hornblende and minor biotite**.**

Date: U-Pb zircon; 164.88 ± 0.84 Ma; R. Friedman The University of British Columbia.

Comment: The sample is from near the southern margin of the Spruce Creek batholith that extends north into the 1:50,000 Eureka Mountain sheet. Two samples farther north in the batholith have a similar Ar-Ar (hornblende) and U-Pb (zircon + titanite) date of ca. 174 Ma (Thompson et al., 2004).

Photo: Samples of medium-grained granodiorite; note slight cloudiness of amphiboles and vague foliation, both characteristic of Jurassic intrusions.

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