# Bedrock geology of the Dease Lake area

British Columbia Geological Survey
Ministry of Energy, Mines and Low Carbon Innovation
Geoscience Map 2022-01
Sheet 1 of 2

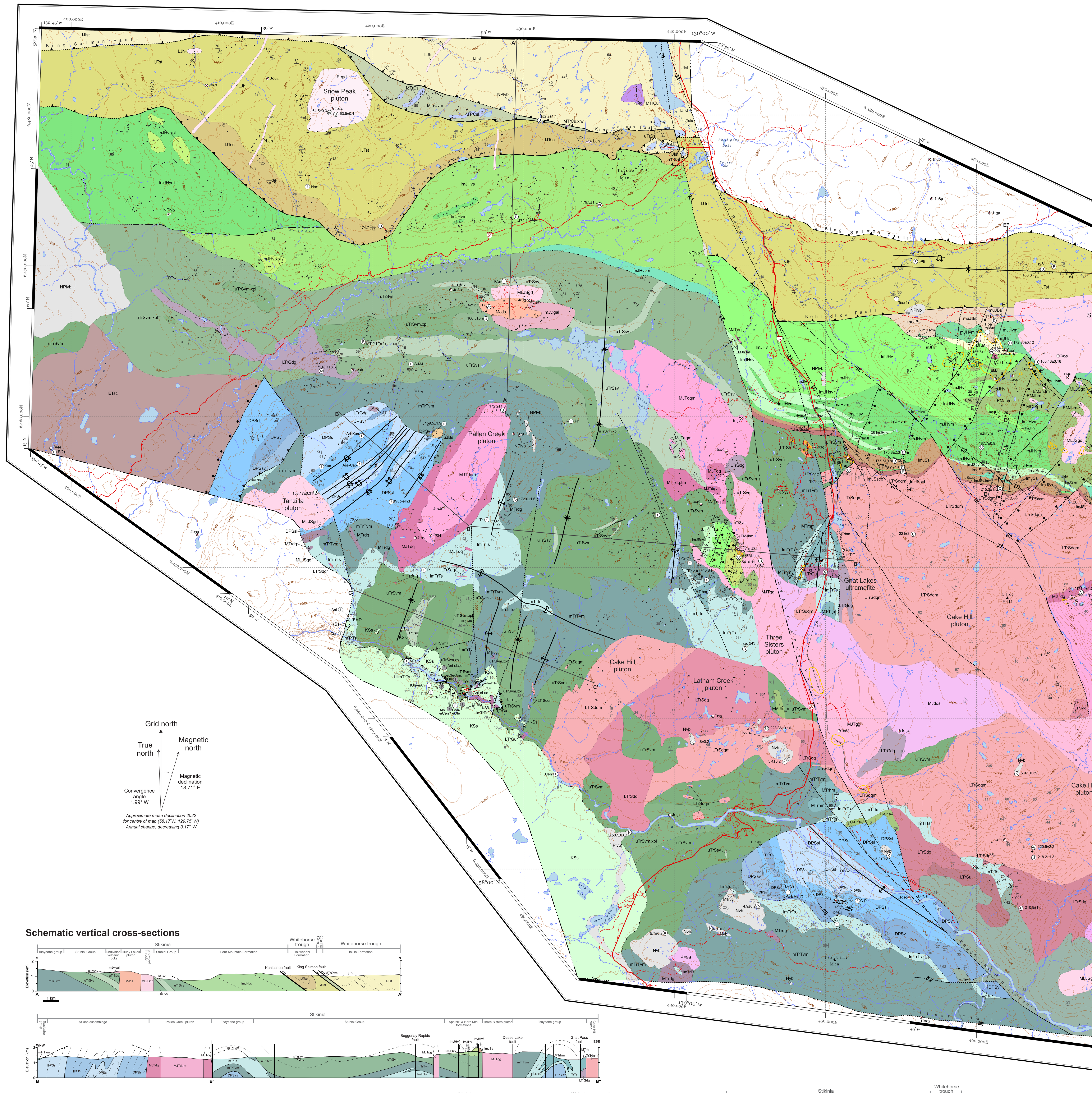
Parts of NTS Sheets 104G, 104H, 104I, 104J

Bram I. van Straaten, James M. Logan, JoAnne L. Nelson, David P. Moynihan, Larry J. Diakow, Rohanna Gibson, Sebastian J. Bichlmaier, Curran D. Wearmouth, Richard M. Friedman, Martyn L. Golding, Emily A. Miller and Terry P. Poulton

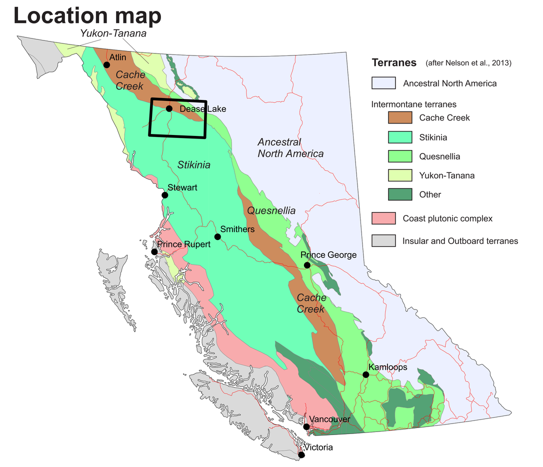
Recommended citation
van Straaten, B.I., Logan, J.M., Nelson, J.L., Moynihan, D.P., Diakow, L.J., Gibson, R., Bichlmaier, S.J., Wearmouth, C.D., Friedman, R.M., Golding, M.L., Miller, E.A. and Poulton, T.P., 2022. Bedrock geology of the Dease Lake area. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Geoscience Map 2022-01, 1:100,000 scale.

1:100,000 scale

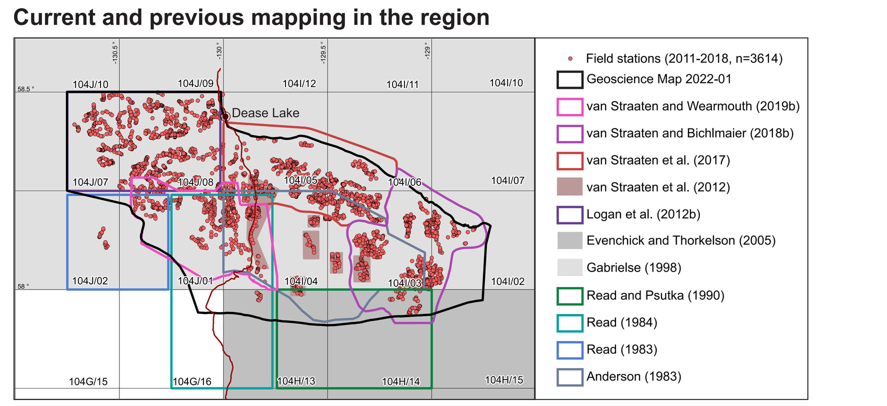
Universal Transverse Mercator Projection, North American Datum 1983, Zone 9 North
100 m contour interval



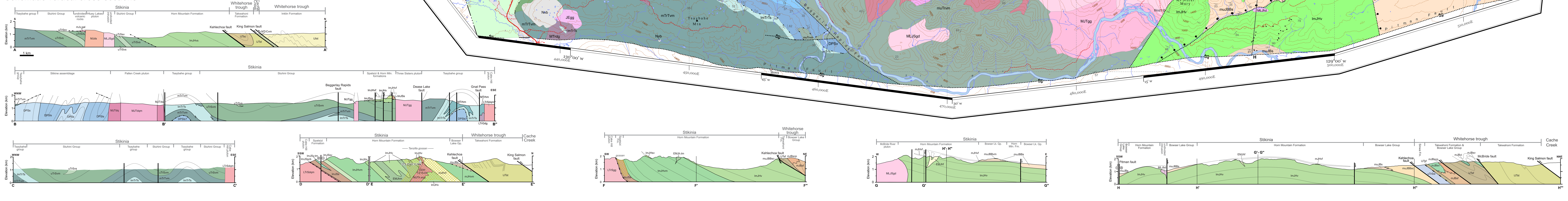
Location map



Current and previous mapping in the region



Schematic vertical cross-sections



## Legend

### Symbols

- Field stations
- Minfile (104)
- Fossil sample site: microfossil (surface, drill core, low accuracy location), macrofossil
- Geochronology sample site: U-Pb zircon, U-Pb detrital zircon, Ar-Ar, K-Ar, Re-Os
- Bedding: tops unknown (inclined, horizontal, vertical); tops known (right-way-up, overturned)*
- Foliation (inclined, vertical)*
- Lineation (inclined, horizontal)*
- Contact: defined, approximate, inferred from aeromagnetic data, inferred
- Unconformity: defined, approximate, inferred from aeromagnetic survey, inferred
- Fault: defined, approximate, inferred from aeromagnetic survey, inferred
- Normal fault: defined, approximate, inferred from aeromagnetic survey, inferred (dot on hanging wall)
- Thrust fault: defined, approximate, inferred from aeromagnetic survey, inferred (tooth on hanging wall)
- Anticline, syncline; overturned synform, overturned antiform (arrows show direction of dip of limbs)
- Altered or gossanous rocks
- Highway 37, Highway 51, rough road, railroad grade
- Extent of mapping
- Named peaks

* grey symbols from Read (1983,1984), Read and Psutka (1990), and Gabrielse (1998)

## Stratified rocks

### Young volcanic rocks

**PLEISTOCENE**

**Plvb** — ***Basalt flows***; grey; augite, olivine, and plagioclase phenocrysts.

**NEOGENE TO PLEISTOCENE**

**NPlvb** — ***Alkali basalt***; grey to brown; columnar jointed; olivine and plagioclase phenocrysts in an aphanitic groundmass; includes alkali basalt flows, minor trachyte and rhyolite of the Level Mountain Group.

**NEOGENE**

**Nvb** — **Maitland Volcanics: *Basalt flows, rare breccia and ash***; grey; augite, olivine, and plagioclase phenocrysts; common ultramafic inclusions.

— unconformity —

### Overlap assemblages

**EOCENE**

**ETsc** — **Tanzilla Canyon Formation: *Conglomerate, sandstone, mudstone, marl***; rare freshwater limestone and high-volatile B bituminous coal; conglomerate contains chert, volcanic and/or other locally derived clasts; poorly consolidated.

— unconformity —

**CRETACEOUS**

Sustut Group

**KSs** — **Tango Creek Formation: *Feldspathic sandstone, siltstone, shale, and carbonaceous shale with conglomerate interbeds; basal monomictic conglomerate***; sandstone locally muscovite bearing; conglomerate contains chert, volcanic, and granitic pebbles to cobbles.

— unconformity —

### Stikinia

**UPPER JURASSIC**

Bowser Lake Group

**uJBs** — ***Mudstone, siltstone, very fine- to medium-grained sandstone***; [illegible] sedimentary rocks, originally mapped as Tsaybahe group, but reinterpreted here as Bowser Lake Group based on ca. 160 Ma U-Pb detrital zircon maximum depositional age.

**MIDDLE TO UPPER JURASSIC**

Bowser Lake Group

**muJBs** — ***Siltstone, sandstone, shale***; minor tuff and lapilli-tuff; basal conglomerate and calcareous sandstone; brown; conglomerate contains mafic augite-plagioclase-phyric volcanic, plagioclase-phyric volcanic, and hypabyssal clasts; typically laminated to thinly bedded; marine with (late Toarcian-) early Bajocian ammonites; ca. 171 Ma U-Pb detrital zircon maximum depositional age.

**muJBBvm** — **Mount Blair unit: *Mafic volcanic flows***, lesser tuff and lapillistone; orange-brown; flows contain 10% brown or red altered augite (0.1-1 mm) and 30-50% plagioclase (0.1-0.2 mm) phenocrysts; laminated, well-sorted and clast-supported tuff and lapillistone; flows commonly have brecciated bottoms and tops, and locally a moderately developed columnar jointed base; interpreted as subaerial flows and air-fall deposits.

**muJBBs** — **Mount Blair unit: *Siltstone, sandstone, and conglomerate***; rare lapilli-tuff; laminated limestone common near base; maroon, green-grey to orange-brown; conglomerate contains chert and rare limestone pebbles to cobbles; laminated to very thick bedded; internally massive to cross-bedded; intercalated mafic flows (unit muJBBvm) and lustrous black organic detritus suggest mainly non-marine; ca. 169 Ma U-Pb detrital zircon maximum depositional age.

**muJBBsc** — **Mount Blair unit: *Conglomerate, minor sandstone***; orange-grey; contains chert pebbles, limestone pebbles to cobbles and rare woody fragments; medium to very thick beds of internally massive to locally normally graded conglomerate, interbedded with very thin to thin beds of medium-grained sandstone to granule conglomerate; likely non-marine.

**MIDDLE JURASSIC**

**mJv.gal** — ***Latite, trachyte, basalt, and epiclastic rocks***; maroon to salmon pink; K-feldspar, plagioclase, augite, and biotite phenocrysts; common calcite-filled amygdules; nepheline normative; originally mapped as Stuhini Group (Upper Triassic), but reinterpreted here as Middle Jurassic based on mineralogical and lithogeochemical similarity to Hluey Lake monzonite (unit MJds).

— local unconformity —

Upper Hazelton Group

Horn Mountain Formation

**mJHvm** — **Zuback unit: *Mafic coherent flows and/or subvolcanic intrusions***; minor mafic volcanic breccia, lapilli-tuff, lapillistone, and tuff; dark grey; coherent rocks and clasts are augite-plagioclase-phyric; very rare coarse platy plagioclase-phyric volcanic rocks; ca. 173 Ma U-Pb detrital zircon maximum depositional age.

**mJHvf** — **Zuback unit: *Felsic tuff, breccia***; lesser felsic lapilli-tuff, lapillistone, and tuff breccia; subordinate felsic flows; rare welded felsic lapilli-tuff; light grey, pale maroon, pale green; clasts are sparsely plagioclase-phyric, hornblende(?)-quartz-plagioclase-phyric to aphyric, flow banded and locally spherulitic; flows are hornblende(?)-quartz-plagioclase-phyric and flow banded; relatively well stratified; 170.99±0.13, 171.0±1.5 Ma U-Pb zircon ages.

**LOWER TO MIDDLE JURASSIC**

Upper Hazelton Group

Horn Mountain Formation

**lmJHvf** — **Sister Mary unit: *Felsic tuff and lapilli-tuff***; lesser felsic coherent flows and/or subvolcanic intrusions; light-medium grey; fragmental rocks are matrix supported to lesser clast supported with angular to very angular clasts that are aphanitic, plagioclase-phyric, and (biotite-) quartz-plagioclase-phyric; lesser flow banded and spherulitic; coherent rocks are biotite(?)-quartz-plagioclase-phyric and commonly flow banded; massive to locally crudely stratified; 172.54±0.11 Ma U-Pb zircon age.

**lmJHv** — **Sister Mary unit: *Mafic to intermediate flows, volcanic breccia, tuff breccia, lapillistone, tuff, and lapilli-tuff***; minor volcaniclastic sandstone and siltstone, felsic volcanic rocks; rare welded lapilli-tuff; dark grey to maroon; mafic flows contain 30-70% equant to lath-shaped plagioclase (0.1-1.5 mm) and 5-30% augite (0.2-1.5 mm) phenocrysts; intermediate flows typically contain 40-45% stubby plagioclase (0.5-4 mm), 0-11% augite (0.1-1 mm), and 0-7% biotite (0.4 mm) phenocrysts; fragmental rocks contain varicoloured mainly subangular augite-plagioclase-phyric clasts and lesser aphyric clasts in a matrix with abundant angular to euhedral plagioclase; crudely stratified; interpreted as mainly subaerial.

**lmJHvm** — **Glacial Mountain unit: *Mafic volcanic breccia, tuff breccia, lapilli-tuff***; rare volcaniclastic sandstone and mafic tuff; very rare felsic volcanic rocks; dark grey to green; monomictic, predominantly clast supported; subangular clasts (0.5-100 cm) contain 40-50% euhedral equant to tabular plagioclase (0.2-2 mm), 15-20% euhedral equant augite (0.2-5 mm), and very rarely up to 5% hornblende (0.5-1 mm) phenocrysts; massive to very thickly bedded; granitoid clasts locally common near basal unconformity; basal felsic volcanic rocks returned 175.28±-0.10 Ma U-Pb zircon age.

**lmJHvs** — **Glacial Mountain unit: *Polymictic conglomerate with mainly mafic volcanic clasts, sandstone***, minor siltstone; rare mafic flows; orange; clasts and flows are augite-plagioclase-phyric and very rarely hornblende-augite-plagioclase-phyric; massive, rarely bedded; ca. 172 Ma U-Pb detrital zircon maximum depositional age.

**lmJHsv** — **Glacial Mountain unit: *Volcaniclastic sandstone***, lesser siltstone; minor mafic lapilli-tuff and crystal tuff; brown; sandstone contains abundant angular to subangular plagioclase grains; laminated to thickly bedded.

**lmJHv.xpl** — **Cariboo unit: *Intermediate coherent flows and/or subvolcanic intrusions, intermediate volcanic breccia***; medium grey; coherent rocks and clasts are plagioclase-phyric to aphyric, commonly flow banded and vesicular and locally spherulitic; fragmental rocks are clast supported and monomictic.

**lmJHv.tm** — **Cariboo unit: *Intermediate lapilli-tuff, lapillistone, tuff breccia, and volcanic breccia***; local pillows; dark grey; clasts and pillows contain 20-35% platy plagioclase (0.5-2 cm), 0-5% augite (0.5-1 mm) phenocrysts and common vesicles; moderately to crudely stratified.

Spatsizi Formation

**lmJSsv** — ***Medium- to coarse-grained volcaniclastic feldspathic arenite*** interbedded with lesser siltstone, mafic volcanic rocks, and tuff laminae; medium-dark brown; sandstone contains angular to euhedral plagioclase and augite grains; well stratified.

**lmJSvm** — ***Mafic volcanic breccia***; dark grey-green; clast supported; with augite-plagioclase-phyric clasts.

**lmJSv.tm** — ***Intermediate volcanic breccia***; medium grey; clast supported, monomictic; clasts are medium grey coarse platy plagioclase-phyric and pale grey aphyric, commonly vesicular.

**lmJSs** — ***Argillite, siltstone, and very fine- to medium-grained sandstone***; orange-brown; laminated to medium bedded; internally massive to locally laminated sandstone beds with scoured bases generally fine upward into parallel laminated siltstone; minor medium- to coarse-grained quartz-bearing felspathic arenite, volcaniclastic sandstone, conglomerate, and mafic volcanic rocks; rare pale grey tuff laminae; late Pliensbachian to middle Toarcian fossils; ca. 179, 176, and 176 Ma U-Pb detrital zircon maximum depositional ages with prominent Late Triassic detrital zircon populations.

**lmJSscb** — ***Basal sandstone and conglomerate***; light grey to orange-brown; quartz-rich, medium- to very coarse-grained feldspathic arenite (locally calcite-cemented); rare fossiliferous calcareous sandstone and siltstone; subfeldspathic arenite (likely grus) unconformably overlies Cake Hill pluton; conglomerate contains granitoid clasts similar to subjacent Cake Hill pluton, local augite- and/or plagioclase-phyric and aphyric volcanic clasts; thin to medium bedded; early (to middle) Toarcian fossils, Late Triassic U-Pb detrital zircon population.

— unconformity —

**UPPER TRIASSIC**

Stuhini Group

**uTrSsv** — ***Volcaniclastic sandstone, siltstone, and siliceous siltstone***; dark grey, orange grey, green grey; sandstone contains angular to subangular plagioclase and lesser equant mafic grains; laminated to medium bedded; late Carnian conodonts.

**uTrSvm.xpl** — ***Mafic coherent flows and/or subvolcanic intrusions***, rare mafic fragmental volcanic rocks; green, grey; plagioclase-phyric; massive.

**uTrSvm** — ***Mafic tuff breccia, lapilli-tuff***, lesser volcanic breccia and lapillistone; dark grey; clasts contain 44% lath to rare tabular plagioclase (0.1-1 mm) and 23% equant augite (0.2-3 mm) phenocrysts in an aphanitic groundmass; clasts set in a plagioclase and augite crystal and fine ash matrix; massive to very rarely crudely thin to very thick bedded, clast to matrix supported; includes augite-plagioclase-phyric coherent rocks that may represent subvolcanic intrusions or flows; can be distinguished from mafic volcanic rocks in the Tsaybahe group (unit mTrTvm) by lower augite and higher plagioclase phenocryst content, higher magnetic susceptibility (median 34 x $10^{-3}$ SI units), and less primitive lithogeochemical composition; early Carnian conodonts.

**uTrSvs** — ***Polymictic conglomerate with mainly mafic volcanic clasts, sandstone***, rare basalt flows; orange; augite- and plagioclase-phyric clasts, basal succession contains strata with limestone, chert, and siltstone clasts; augite-phyric flows; massive, rarely bedded.

**MIDDLE TO UPPER TRIASSIC**

**muTrvm** — ***Mafic volcanic breccia, tuff, and flows***; grey-green and green; aphyric to plagioclase- and locally augite-phyric; may be equivalent to Tsaybahe group or Stuhini Group.

**MIDDLE TRIASSIC**

Tsaybahe group

**mTrTvm** — ***Mafic tuff breccia*** and lesser lapilli-tuff; very dark grey; clasts contain 30% equant augite (1-3.5 mm), 10% tabular-equant plagioclase (0.2-1 mm) phenocrysts in an aphanitic groundmass; clasts set in an augite and plagioclase crystal and fine ash matrix; massive, clast to matrix supported; can be distinguished from mafic volcanic rocks in the Stuhini Group (unit uTrSvm) by higher augite and lower plagioclase phenocryst content, lower magnetic susceptibility (median 0.82 x $10^{-3}$ SI units), and more primitive lithogeochemical composition.

**LOWER TO MIDDLE TRIASSIC**

Tsaybahe group

**lmTrTs** — ***Argillite, siliceous argillite, siltstone, and very fine- to fine-grained sandstone***; rare chert; dark grey; sandstone contains predominantly plagioclase and lesser mafic grains; well stratified; commonly cut by mafic sills and dikes (unit MTrhm); Middle (rare Early) Triassic conodonts.

— unconformity —

**DEVONIAN TO PERMIAN**

Stikine assemblage

**DPSsl** — ***Lime mudstone, fossiliferous wackestone and packstone; other undivided limestone; commonly interstratified with chert***; light grey to yellow-grey; massive to laminated to medium bedded; commonly foliated; Artinskian-Kungurian conodonts.

**DPSv** — ***Tuff, crystal tuff, and lapillistone; phyllitic greenstone***; grey to green; contains grey, maroon and green aphanitic to microphenocrystic volcanic clasts, euhedral plagioclase, and minor altered mafic crystals; generally well-developed phyllitic foliation.

**DPSsv** — ***Phyllite, phyllitic greenstone***; minor chert; rare limestone; light to dark green; rusty weathering.

**DPSs** — ***Very fine- to medium-grained meta-sandstone and phyllite***; minor meta-volcaniclastic sandstone or tuff; rare limestone, argillite, siliceous argillite, siltstone, and chert; grey; well-developed phyllitic foliation.

— tectonic contact —

### Whitehorse trough

**MIDDLE JURASSIC**

Bowser Lake Group

**mJBscp** — ***Polymictic conglomerate, sandstone, siltstone, and argillite***; minor intermediate volcanic rocks (similar to unit mJBvi); orange grey, dark to light grey; conglomerate contains pebbles, cobbles, and rare boulders of limestone, (sub)volcanic and plutonic rocks, and quartz; originally mapped as Takwahoni Formation based on very poorly preserved Toarcian ammonites, but re-interpreted here as Bowser Lake Group based on ca. 164 Ma U-Pb zircon maximum depositional age.

**mJBvi** — ***Intermediate lapillistone, lapilli-tuff, and tuff breccia*** interbedded with siltstone, sandstone, volcaniclastic sandstone, and rare polymictic conglomerate; orange-grey; subangular volcanic clasts, hornblende-plagioclase-phyric; originally mapped as Takwahoni Formation, but tentatively re-interpreted here as Bowser Lake Group.

**mJBsv** — ***Fine- to medium-grained volcaniclastic sandstone, sandstone, and siltstone***; lesser intermediate volcanic rocks (similar to unit mJBvi), rare polymictic conglomerate (similar to unit mJBscp); dark grey; moderately sorted volcaniclastic sandstone with subangular to angular plagioclase, subordinate mafic grains, rare quartz grains and locally minor microphenocrystic volcanic clasts; originally mapped as Takwahoni Formation, but tentatively re-interpreted as Bowser Lake Group; ca. 185 Ma U-Pb detrital zircon maximum depositional age.

**mJBsf** — ***Argillite, siltstone, and very fine-, fine- to rarely medium-grained sandstone***; dark grey; laminated to thin bedded; originally mapped as Takwahoni Formation, but tentatively re-interpreted here as Bowser Lake Group.

— tectonic contact —

**LOWER JURASSIC**

Laberge Group

Inklin Formation

**lJIst** — ***Phyllite, phyllitic greywacke, siltstone***; minor limestone and conglomerate; grey to black, grey-green; well cleaved, well stratified.

— tectonic contact —

Takwahoni Formation

**lJTsc** — ***Polymictic conglomerate, coarse-grained feldspathic sandstone***, lesser siltstone; conglomerate contains cobbles and pebbles of granite, hornblende-quartz porphyry, aphyric volcanic rock, argillite, chert, and recrystallized limestone; ca. 175 Ma U-Pb detrital zircon maximum depositional age.

**lJTs** — ***Siltstone***, lesser fine- to medium-grained feldspathic arenite and rare feldspathic wacke; brown-grey; lithic and quartz-bearing sandstone; well stratified; ca. 188 Ma U-Pb detrital zircon maximum depositional age.

**lJTst** — ***Fine- to medium-grained feldspathic arenite to feldspathic wacke***, and lesser siltstone, mudstone, conglomerate; grey to orange; lithic and quartz-bearing sandstone; well stratified; mostly Pliensbachian fossils; ca. 189 Ma U-Pb detrital zircon maximum depositional age.

— tectonic contact —

**lJTsf** — ***Argillite, siltstone, and very fine-, fine- to rarely medium-grained sandstone***; dark grey; laminated to thin bedded; late Sinemurian fossils; ca. 188 Ma U-Pb zircon maximum depositional age.

**lJTsco** — ***Monomictic conglomerate***; medium grey; subrounded limestone pebbles and rare cobbles.

— unconformity —

**UPPER TRIASSIC**

Sinwa Formation

**uTrSsl** — ***Limestone***; light grey; typically massive and recrystallized, where less recrystallized the protolith is a wackestone to packstone with abundant fossil fragments in a lime mud matrix; middle Norian-early Rhaetian conodonts.

— tectonic contact —

### Cache Creek

**MISSISSIPPIAN TO TRIASSIC**

Cache Creek complex

**MTrCsl** — ***Marble***; local yellow chert and tuffaceous interbeds; white, grey, and black; medium bedded, thinly foliated.

**MTrCvm** — ***Meta-basalt***; dark green; aphyric to fine pyroxene porphyry; metamorphic assemblage includes epidote, chlorite, calcite, and pyrite; pervasively fractured, penetratively foliated.

## Intrusive rocks

### Post-accretionary

**PALEOCENE**

**Pegd** — **Snow Peak pluton: *Quartz monzodiorite to granodiorite***; pink; equigranular to K-feldspar porphyritic; biotite-hornblende; 63.5±0.4 Ma U-Pb zircon age.

**JURASSIC TO EOCENE**

**JEgg** — ***Granite***; pink; biotite.

**LATE JURASSIC**

**LJh** — ***Intermediate to felsic dikes and sills***; light grey to white; (quartz-)hornblende-plagioclase porphyritic; common acicular hornblende; crosscuts Tanzilla alteration system, deformed Takwahoni Formation, the King Salmon fault, and rocks of the Cache Creek terrane; 152.2±1.1 Ma U-Pb zircon age.

**MIDDLE TO LATE JURASSIC**

**MLJhd** — ***Microdiorite***; medium grey; fine grained, equigranular; (biotite-)hornblende-bearing clinopyroxene.

Snowdrift Creek plutonic suite

**MLJSgd** — **McBride River, Snowdrift Creek, Tanzilla plutons and related stocks: *Granodiorite***, minor quartz monzodiorite, rare tonalite; medium to dark grey; medium grained, equigranular; biotite-hornblende; dioritic xenoliths locally common; 163.60±0.09, 160.43±0.16, 158.17±0.31 U-Pb zircon ages.

— intrusive contact —

### Stikinia

**MIDDLE JURASSIC**

**MJds** — **Hluey Lakes pluton: *Monzonite to syenite***; pink; porphyritic to equigranular; biotite-bearing clinopyroxene; local miarolitic cavities; typically nepheline normative; 166.5±0.7 Ma U-Pb zircon age

**MIDDLE JURASSIC(?)**

**MJdqs** — ***Syenite, quartz syenite to syenogranite***; medium grained, equigranular to K-feldspar porphyritic; biotite-hornblende; high magnetic response on airborne magnetic survey; Middle Jurassic or possibly younger.

**MIDDLE JURASSIC**

Three Sisters plutonic suite

Three Sisters pluton

**MJTgg** — **Potassic phase: *Granite***; pink to pink grey; medium grained, equigranular to K-feldspar and/or plagioclase porphyritic; typically contains 3-10% mafic minerals, with biotite and varying proportions of hornblende; 170±1, 169.1±0.8, 168.57±0.54 Ma U-Pb zircon ages.

Three Sisters and Pallen Creek plutons

**MJTdqm** — **Felsic phase: *Quartz monzonite, quartz monzodiorite***, rare monzogranite; medium grey to pink; medium grained, equigranular to K-feldspar porphyritic; hornblende-biotite, biotite or biotite-hornblende; locally with subordinate clinopyroxene; local dioritic xenoliths; 172.75±0.87, 172.2±1.0, 169.0±1.3 Ma U-Pb zircon ages.

Three Sisters pluton

**MJTh.xhb** — **Intermediate phase: *Quartz microdiorite***; fine grained, equigranular to sparsely plagioclase porphyritic; hornblende-biotite; unfoliated; 173.2±1.4 Ma Ar-Ar hornblende cooling age.

**MJTh.xcp** — **Intermediate phase: *Intermediate dikes and stocks***; porphyritic; 25-40% tabular to equant plagioclase (1-4 mm), 3-10% equant clinopyroxene (<2 mm) and minor magnetite; 173.25±0.18 Ma U-Pb zircon age.

Three Sisters and Pallen Creek plutons

**MJTdq** — **Mafic phase: *Quartz diorite***; rare quartz monzodiorite, diorite; green-grey, pink to orange cream; medium grained, equigranular to (biotite-) hornblende porphyritic, locally coarse platy plagioclase porphyritic diorite (unit MJTdq.tm); biotite-clinopyroxene-hornblende; unfoliated to rarely foliated; locally contains microdiorite xenoliths; 172.0±1.6, 171.9±1.7 Ma Ar-Ar hornblende cooling ages.

**EARLY TO MIDDLE JURASSIC**

Upper Hazelton Group

Horn Mountain Formation

**EMJhf** — **Horn Mountain intrusions: *Felsic hypabyssal intrusions***; rare intrusive breccia; yellow; contain 8-27% euhedral tabular to equant plagioclase (0.3-2 mm), 0-12% anhedral quartz (0.2-0.7 mm), and 0-7% altered euhedral hornblende(?) (0.2-0.5 mm) phenocrysts; generally flow banded, locally spherulitic; interpreted as subvolcanic feeders to the Horn Mountain Formation.

**EMJh.tm** — **Horn Mountain intrusions: *Intermediate dikes, sills, and other intrusions***; dark grey; contain 35-45% platy plagioclase (0.5-3 cm), 4-19% augite phenocrysts (0.5-5 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation.

**EMJhm** — **Horn Mountain intrusions: *Mafic dikes, sills, and other intrusions***; dark green-grey; contain 35-65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-4 mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation.

**LATE TRIASSIC TO JURASSIC**

**LTrJds** — ***Meta-syenite***; biotite.

**LATE TRIASSIC**

Stikine plutonic suite

**LTrSh** — **Gnat Pass porphyry: *Hypabyssal intrusions***; plagioclase, rare quartz and hornblende porphyritic; 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 104I 001, 029).

**LTrSgg** — **Cake Hill pluton: *Monzogranite to granodiorite***; grey-white; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages.

**LTrSdqm** — **Cake Hill pluton: *Quartz monzodiorite, quartz monzonite***; pale grey; medium grained, equigranular; hornblende to lesser biotite-hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; trace titanite usually ubiquitous; lacks microdioritic xenoliths; 221±3, 218.2±1.3 Ma U-Pb zircon ages.

**LTrSdq** — **Latham Creek pluton: *Quartz diorite***; black and white; medium grained, equigranular; biotite-bearing clinopyroxene-hornblende; commonly foliated; 228.36±0.16 Ma U-Pb zircon age.

**LTrSdg** — **Beggerlay Creek pluton: *Gabbro***, rare clinopyroxenite; medium grained, equigranular; hornblende-rich to clinopyroxene-rich, locally biotite-bearing; unfoliated to foliated; 210.9±1.6 Ma Ar-Ar hornblende cooling age.

**LTrSu** — **Beggerlay Creek pluton: *Websterite***; medium to coarse grained, equigranular; cumulus framework of touching clinopyroxene and completely serpentinized orthopyroxene crystals; unfoliated.

Gnat Lakes plutonic suite

**LTrGdg** — ***Gabbro***; medium to coarse grained, equigranular; clinopyroxene hornblende-rich, locally biotite-bearing; sometimes foliated; locally cumulate-textured, rare ultramafic xenoliths; 218.1±3.6 Ma Ar-Ar hornblende cooling age; high magnetic susceptibility and high magnetic response on airborne magnetic survey.

**LTrGu** — **Gnat Lakes ultramafite: *Hornblende clinopyroxenite, hornblendite, and gabbro***; dark green-grey to black; equigranular, medium to very coarse grained; commonly with a cumulus framework of touching hornblende and/or clinopyroxene crystals with intercumulus plagioclase; whole rock and mineral chemistry suggests an Alaskan-type affinity; 223.3±2.0 Ma Ar-Ar hornblende cooling age.

**MIDDLE TRIASSIC**

Tsaybahe group

**MTrhm** — **Tsaybahe intrusions: *Mafic subvolcanic intrusions***; dark grey; contain 30% equant augite (1-3.5 mm), 10% tabular-equant plagioclase (0.2-1 mm) phenocrysts in an aphanitic groundmass; can be distinguished from mafic volcanic rocks within the Stuhini Group (unit uTrSvm) by higher augite and lower plagioclase phenocryst content, lower magnetic susceptibility (median 0.84 x $10^{-3}$ SI units), and more primitive lithogeochemical composition; interpreted as subvolcanic feeders to the Tsaybahe group.

**MIDDLE TRIASSIC**

**MTrdg** — ***Gabbro***; medium grey to green; medium grained, equigranular; hornblende-clinopyroxene-rich; can be distinguished from Late Triassic gabbro unit (LTrGdg) by lower magnetic susceptibility, lower magnetic response on airborne magnetic survey, and more primitive lithogeochemical composition.

— tectonic contact —

### Cache Creek

**MISSISSIPPIAN TO TRIASSIC**

Cache Creek complex

**MTrCu** — ***Peridotite***; dun; chrome spinel-bearing; variably serpentinized; locally listwanite altered (unit MTrCu.xlw); a probable serpentinized dunite(?) at the southern margin is thoroughly serpentinized and highly magnetic.

British Columbia Ministry of Energy, Mines and Low Carbon Innovation

British Columbia Geological Survey

Geoscience Map 2022-01

Sheet 2 of 2

# Bedrock geology of the Dease Lake area

Parts of NTS Sheets 104G, 104H, 104I, 104J

Bram I. van Straaten, James M. Logan, JoAnne L. Nelson, David P. Moynihan, Larry J. Diakow, Rohanna Gibson, Sebastian J. Bichlmaier, Curran D. Wearmouth, Richard M. Friedman, Martyn L. Golding, Emily A. Miller and Terry P. Poulton

## SUPPLEMENT

**Recommended citation**
van Straaten, B.I., Logan, J.M., Nelson, J.L., Moynihan, D.P., Diakow, L.J., Gibson, R., Bichlmaier, S.J., Wearmouth, C.D., Friedman, R.M., Golding, M.L., Miller, E.A. and Poulton, T.P., 2022. Bedrock geology of the Dease Lake area, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Geoscience Map 2022-01, 1:100,000 scale.

**Digital files**

Supporting digital data, including structural, magnetic susceptibility and GIS data, will be available in a forthcoming publication.

This release is part of a broader compilation for an approximately 8,500 km² area that, once incorporated into the British Columbia digital geology, will be available from <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/geology/bcdigitalgeology>.

**1. Introduction**

[illegible]

**2. Pre-collisional (Paleozoic to Late Triassic)**

**2.1. Stikinia**

**2.1.1. Stikine assemblage**

[illegible]

**2.1.2. Deformation (D1)**

[illegible]

**2.1.3. Tsaybahe group and Stuhini Group**

[illegible]

**2.1.4. Triassic intrusions**

[illegible]

**2.2. Cache Creek terrane**

[illegible]

**3. Syn-collisional (latest Triassic to Early Jurassic)**

**3.1. Stikinia**

**3.1.1. Deformation (D2)**

[illegible]

**3.1.2. Depositional and magmatic hiatus**

[illegible]

**3.2. Whitehorse trough**

**3.2.1. Sinwa Formation and Laberge Group**

[illegible]

**4. Syn-accretionary (late Early to early Late Jurassic)**

**4.1. Stikinia**

**4.1.1. Upper Hazelton Group**

[illegible]

**4.1.2. Three Sisters plutonic suite**

[illegible]

**4.1.3. Hluey Lakes volcano-plutonic complex**

[illegible]

**4.1.4. Bowser Lake Group**

[illegible]

**4.2. Cache Creek terrane and Whitehorse trough**

**4.2.1. Bowser Lake Group**

[illegible]

**4.2.2. Deformation (D3)**

[illegible]

**5. Post-accretionary (late Middle Jurassic and younger)**

**5.1. Snowdrift Creek plutonic suite and other Late Jurassic intrusions**

[illegible]

**5.2. Sustut Group**

[illegible]

**5.3. Deformation (D4)**

[illegible]

**5.4. Snow Peak pluton**

[illegible]

**5.5. Tanzilla Canyon Formation**

[illegible]

**5.6. Deformation (D5)**

[illegible]

**5.7. Young volcanic rocks**

[illegible]

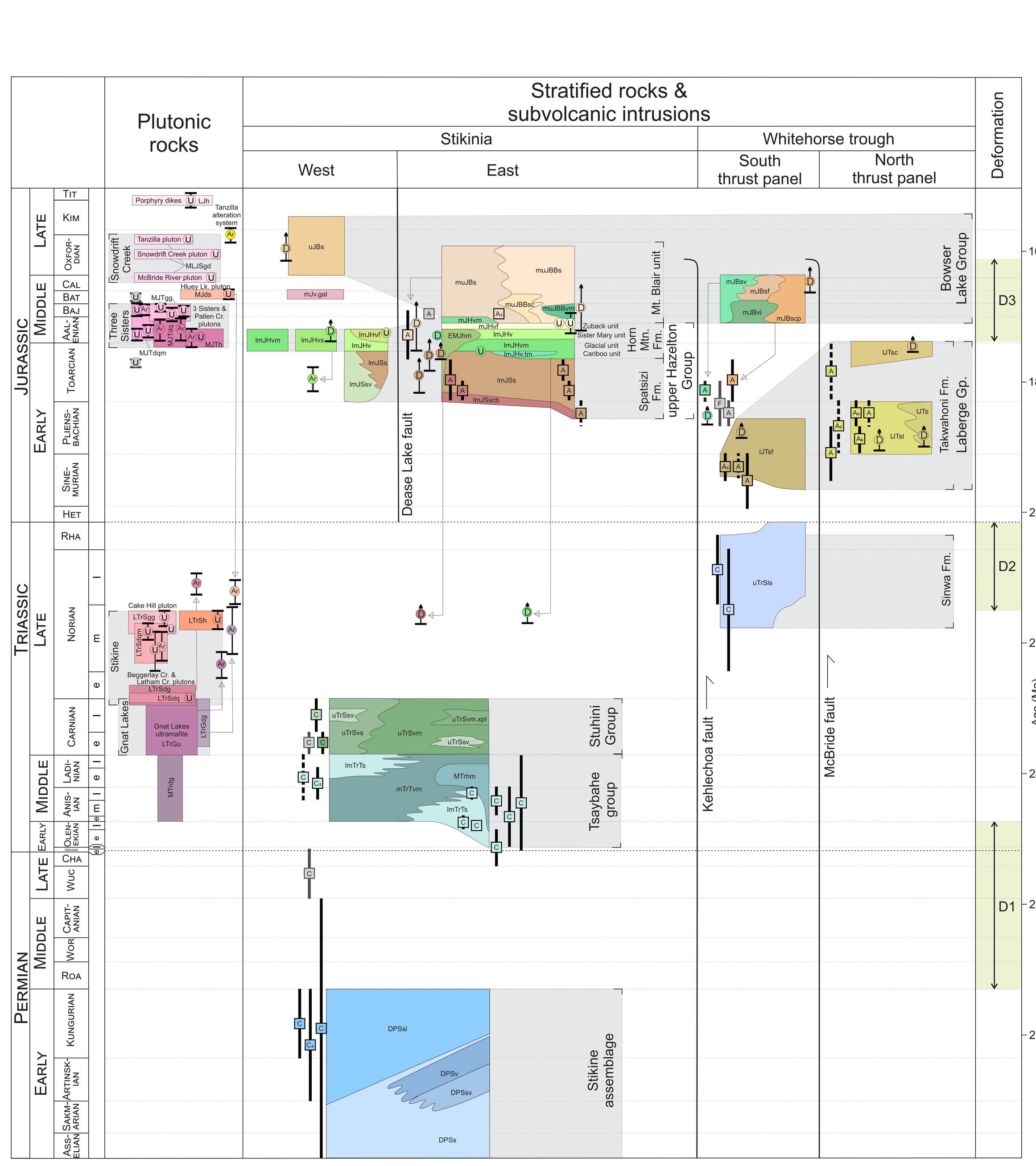



**Figure 1:** Permian to Jurassic stratigraphic, magmatic, and structural framework for the Dease Lake area. Geochronological samples (circles; Table 2): U = U-Pb, D = detrital (arrow on all denotes maximum depositional age), Ar = Ar-Ar. Fossil samples (squares; Table 1): F = macrofossil, A = ammonoid, C = conodont, subscript = number of collections, long dashed black lines = probable age, short dashed black lines = possible age. Symbols coloured by rock unit; grey colour = uncertain unit assignment. Geological time scale after Cohen et al. (2013); with modifications for Triassic (sub)stage boundary numerical ages for early-late Induan by Burgess et al. (2014) early-late Olenekian by Ogg et al. (2014), early-middle Anisian and middle-late Anisian by Li et al. (2018), early-late Ladinian by Kozur and Bachmann (2008), early-middle Norian by Diakow et al. (2011), early-late Carnian, Carnian-Norian, middle-late Norian using long-Rhaetian option of Ogg et al. (2014), and Norian-Rhaetian by Wotzlaw et al. (2014).

## Table 1: Fossil data

[illegible]

## Table 2: Geochronology data

| Sample | Easting | Northing | Unit | Age (Ma) | Type | Quality | Sample description | Source | Location source |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | | | | | | | |
| 11BVA-42-333 | 463692 | 6431161 | LTrSdqm | 220.5±2.2 | Ar-Ar Hbl | Good | Hbl Qtz monzonite | van Straaten et al. (2012) | 1 |
| AN-78-569-3 | 455820 | 6452253 | LTrSdqm | 221±3 | U-Pb Zrn | Moderate | Qtz monzonite | Anderson and Bevier (1992) | 2 |
| 18CWE-20-149 | 446099 | 6439366 | LTrSdq | 228.36±0.16 | U-Pb Zrn | Good | Hbl-rich diorite to Qtz diorite; foliated, equigranular | B.I. van Straaten, unpublished | 1 |
| 11JLO-23-232 | 416617 | 6463076 | LTrGdg | 218.1±3.6 | Ar-Ar Hbl | Good | Hbl gabbro to diorite; equigranular, medium- to coarse-grained | J.M. Logan, unpublished | 1 |
| ZE09-057C (Z10117) | 450041 | 6449776 | LTrGu | 223.3±2.0 | Ar-Ar Hbl | Good | Hornblendite to pyroxenite; layered to discordant | A. Zagorevski, unpublished | 1 |
| 18CWE-18-137 | 444668 | 6444671 | lmTrTs | ca. 243 | U-Pb Zrn (D) | Moderate | Very fine-grained sandstone to siltstone | B.I. van Straaten, unpublished | 1 |

UTM NAD83 Zone 9N

Type: U-Pb Zrn (D) - U-Pb detrital zircon maximum depositional age, calculated using the Youngest Statistical Population method of Coutts et al. (2019) or TuffZirc routine in Isoplot (Ludwig, 2012).

Location source: 1. This study; 2. Breitsprecher and Mortensen (2004); 3. Gabrielse (1998) - a) location digitized from 1:100,000 scale map; 4. Read (1983, 1984), Read and Psutka (1990) - a) location digitized from 1:50,000 scale map

## References

Anderson, R.G., 1983. Geology of the Hotailuh batholith and surrounding volcanic and sedimentary rocks, north-central British Columbia. Unpublished Ph.D. thesis, Carleton University, Ottawa, Ontario, Canada, 669p.

Anderson, R.G., 1984. Late Triassic and Jurassic magmatism along the Stikine arch and the geology of the Stikine batholith, north-central British Columbia. In: Current Research, Part A, Geological Survey of Canada Paper 84–1A, pp. 67–73.

Anderson, R.G., and Bevier, M.L., 1992. New Late Triassic and Early Jurassic U-Pb zircon ages from the Hotailuh batholith, Cry Lake map area, north-central British Columbia. In: Radiogenic Age and Isotopic Studies: Report 6, Geological Survey of Canada Paper 92–02, pp. 145–152.

Anderson, R.G., Loveridge, W.D., and Sullivan, R.W., 1982. U-Pb isotopic ages of zircon from the Jurassic plutonic suite, Hotailuh batholith, north-central British Columbia. In: Current Research, Part C, Geological Survey of Canada Paper 82–1C, pp. 133–137.

Ash, C., 2001. Ophiolite related gold-quartz veins in the North American Cordillera. British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Bulletin 108, 140p.

Bamber, E.W., 2011. Report on 2 collections of upper Paleozoic invertebrate fossils from the Dease Lake area, northwestern British Columbia, submitted by D.P. Moynihan, British Columbia Ministry of Energy and Mines. Geological Survey of Canada, Paleontological Report 01-EWB-2011, 3p.

Breitsprecher, K., and Mortensen, J.K., 2004. BC age 2004A-1: A database of isotopic age determinations for rock units from British Columbia. British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Open File 2004-03.

Brown, D.A., Gunning, M.H., and Greig, C.J., 1996. The Stikine project: Geology of western Telegraph Creek map area, northwestern British Columbia. British Columbia Ministry of Employment and Investment, British Columbia Geological Survey Bulletin 95, 130p.

Burgess, S.D., Bowring, S., and Shen, S., 2014. High-precision timeline for Earth's most severe extinction. Proceedings of the National Academy of Sciences, 111, 3316–3321. doi: 10.1073/pnas.1317692111.

Cohen, K.M., Finney, S.C., Gibbard, P.L., and Fan, J.-X., 2013. The ICS International Chronostratigraphic Chart. Episodes, 36, 199–204 (updated version 2021/10 available from https://stratigraphy.org/ICSchart/ChronostratChart2021-10.pdf).

Colpron, M., Crowley, J.L., Gehrels, G., Long, D.G.F., Murphy, D.C., Beranek, L., and Bickerton, L., 2015. Birth of the northern Cordilleran orogen, as recorded by detrital zircons in Jurassic synorogenic strata and regional exhumation in Yukon. Lithosphere, 7, 541–562. doi: 10.1130/L451.1.

Cordey, F., 2018. Report on radiolarians submission by Dr. Bram van Straaten, British Columbia Geological Survey. Paleontological Report No. FC_BCGS2018-1, Laboratoire de Géologie de Lyon, Université Claude Bernard Lyon 1, 2p.

Coutts, D.S., Matthews, W.A., and Hubbard, S.M., 2019. Assessment of widely used methods to derive depositional ages from detrital zircon populations. Geoscience Frontiers, 10, 1421–1435. doi: 10.1016/j.gsf.2018.11.002.

Devine, F.A.M., Chamberlain, C.M., Davies, A.G.S., Friedman, R., and Baxter, P., 2014. Geology and district-scale setting of tilted alkalic porphyry Cu-Au mineralization at the Lorraine deposit, British Columbia. Economic Geology, 109, 939–977. doi: 10.2113/econgeo.109.4.939.

Diakow, L., Orchard, M.J., and Friedman, R., 2011. Absolute ages for the Norian stage: a contribution from southern British Columbia, Canada. Proceedings of the 21st Canadian Paleontology Conference, Vancouver, B.C., Canada, pp. 27–28.

Evenchick, C.A., 1991. Geometry, evolution, and tectonic framework of the Skeena fold belt, north central British Columbia. Tectonics, 10, 527–546. doi: 10.1029/90TC02680.

Evenchick, C.A., and Thorkelson, D.J., 2005. Geology of the Spatsizi River map area, north-central British Columbia. Geological Survey of Canada Bulletin 577, 276p.

Gabrielse, H., 1998. Geology of Cry Lake and Dease Lake map areas, north-central British Columbia. Geological Survey of Canada Bulletin 504, 147p.

Gagnon, J.-F., Barresi, T., Waldron, J.W.F., Nelson, J.L., Poulton, T.P., and Cordey, F., 2012. Stratigraphy of the upper Hazelton Group and the Jurassic evolution of the Stikine terrane, British Columbia. Canadian Journal of Earth Sciences, 49, 1027–1052. doi: 10.1139/e2012-042.

Golding, M.L., 2019. Report on 17 (2 productive) microfossil samples submitted for analysis by B. van Straaten, British Columbia Geological Survey (2017-2018), Cry Lake (104I) and Dease Lake (104J) map areas. Geological Survey of Canada, Paleontological Report 5-MG-2019, 7p.

Golding, M.L., Orchard, M.J., and Zagorevski, A., 2017. Conodonts from the Stikine terrane in northern British Columbia and southern Yukon. Geological Survey of Canada Open File 8278, 23p.

Hanson, G., and McNaughton, D.A., 1938. Eagle-McDame area, Cassiar district, British Columbia. Geological Survey of Canada Memoir 194, 16p.

Henderson, J.R., Kirkham, R.V., Henderson, M.N., Payne, J.G., Wright, T.O., and Wright, R.L., 1992. Stratigraphy and structure of the Sulphurets area, British Columbia. In: Current Research, Part A, Geological Survey of Canada Paper 92-1A, pp. 323–332.

Henderson, C.M., and Perry, D.G., 1981. A Lower Jurassic heteroporid bryozoan and associated biota, Turnagain Lake, British Columbia. Canadian Journal of Earth Sciences, 18, 457–468. doi: 10.1139/e81-040.

Hunt, P.A., and Roddick, J.C., 1992. A compilation of K-Ar and 40Ar-39Ar ages: Report 22. In: Radiogenic Age and Isotopic Studies: Report 6, Geological Survey of Canada Paper 92–2, pp. 179–226.

Iverson, O., Mahoney, J.B., and Logan, J.M., 2012. Dease Lake geoscience project, part IV: Tsaybahe group: Lithological and geochemical characterization of Middle Triassic volcanism in the Stikine arch, north-central British Columbia. In: Geological Fieldwork 2011, British Columbia Ministry of Energy, Mines and Natural Gas, British Columbia Geological Survey Paper 2012–1, pp. 17–22.

Jones, G., Ootes, L., Milidragovic, D., Friedman, R., Camacho, A., Luo, Y., Vezinet, A., Pearson, D.G., Zhang, S., and Schiarizza, P., 2021. Geochronology of northern Hogem batholith, Quesnel terrane, north-central British Columbia. In: Geological Fieldwork 2020, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey Paper 2022–02, pp. 37–56.

Kozur, H.W., and Bachmann, G.H., 2008. Updated correlation of the Germanic Triassic with the Tethyan scale and assigned numeric ages. Berichte Geologische Bundesanstalt, 76, 53–58.

Lang, J.R., Roberts, K., Galicki, M., van Straaten, B.I., and Bui, P., 2020. Magmatic, hydrothermal, and structural features of the Gnat Pass porphyry copper deposit, British Columbia. In: Sharman, E.R., Lang, J.R., and Chapman, J.B. (Eds.), Porphyry Deposits of the Northwestern Cordillera of North America: A 25-Year Update, CIM Special Volume 57, pp. 324–340.

Li, M., Huang, C., Hinnov, L., Chen, W., Ogg, J., and Tian, W., 2018. Astrochronology of the Anisian stage (Middle Triassic) at the Guandao reference section, South China. Earth and Planetary Science Letters, 482, 591–606. doi: 10.1016/j.epsl.2017.11.042.

Logan, J.M., and Koyanagi, V.M., 1994. Geology and mineral deposits of the Galore Creek area. British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Bulletin 92, 76p.

Logan, J.M., Moynihan, D.P., and Diakow, L.J., 2012a. Dease Lake geoscience project, Part I: Geology and mineralization of the Dease Lake (NTS 104J/08) and east-half of the Little Tuya River (NTS 104J/07E) map sheets, northern British Columbia. In: Geological Fieldwork 2011, British Columbia Ministry of Energy, Mines and Natural Gas, British Columbia Geological Survey Paper 2012–1, pp. 23–44.

Logan, J.M., Moynihan, D.P., Diakow, L.J., and van Straaten, B.I., 2012b. Dease Lake - Little Tuya River geology (NTS 104J/08, 07E). British Columbia Ministry of Energy, Mines and Natural Gas, British Columbia Geological Survey Open File 2012–04, 1:50,000 scale.

Ludwig, K.R., 2012. Isoplot 3.75. A geochronological toolkit for Microsoft Excel. Special Publication No. 5, Berkley Geochronology Center.

McGoldrick, S., Zagorevski, A., and Canil, D., 2017. Geochemistry of volcanic and plutonic rocks from the Nahlin ophiolite with implications for a Permo–Triassic arc in the Cache Creek terrane, northwestern British Columbia. Canadian Journal of Earth Sciences, 54, 1214–1227. doi: 10.1139/cjes-2017-0069.

Mihalynuk, M.G., Erdmer, P., Ghent, E.D., Cordey, F., Archibald, D.A., Friedman, R.M., and Johannson, G.G., 2004. Coherent French Range blueschist: Subduction to exhumation in <2.5 m.y.? Geological Society of America Bulletin, 116, 910–922. doi: 10.1130/B25393.1.

Mihalynuk, M.G., Meldrum, D., Sears, S., and Johannson, G., 1995. Geology and mineralization of the Stuhini Creek area (104K/11). In: Geological Fieldwork 1994, British Columbia Geological Survey Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Paper 1995–1, pp. 321–342.

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

Mihalynuk, M.G., Zagorevski, A., Joyce, N.L., and Creaser, R.A., 2016. Age of magmatism and mineralization at the Star (Sheslay, Copper Creek) copper porphyry prospect: Inception of the Late Triassic mineralized arc. In: Geological Fieldwork 2015, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2016–1, pp. 65–75.

Moynihan, D.P., and Logan, J.M., 2012. Dease Lake geoscience project, part III: Age, emplacement and mineralization of the Snow Peak pluton (NTS 104J/08). In: Geological Fieldwork 2011, British Columbia Ministry of Energy, Mines and Natural Gas, British Columbia Geological Survey Paper 2012–1, pp. 69–74.

Nelson, J., Colpron, M., and Israel, S., 2013. The Cordillera of British Columbia, Yukon and Alaska: Tectonics and metallogeny. In: Colpron, M., Bissig, T., Rusk, B., and Thompson, J.F.H. (Eds.), Tectonics, Metallogeny and Discovery: The North American Cordillera and Similar Accretionary Settings, Society of Economic Geologists, Special Publication 17, pp. 53–109.

Nelson, J.L., Waldron, J., van Straaten, B.I., Zagorevski, A., and Rees, C., 2018. Revised stratigraphy and regional digital map representation of the Hazelton Group in the Iskut River region, northwestern British Columbia. In: Geological Fieldwork 2017, British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Paper 2018–1, pp. 15–38.

Nelson, J.L., van Straaten, B., and Friedman, R., 2022. Latest Triassic-Early Jurassic Stikine – Yukon-Tanana terrane collision and the onset of accretion in the Canadian Cordillera: insights from Hazelton Group detrital zircon provenance and arc-back-arc configuration. Geosphere, 18, 670–696. doi: 10.1130/GES02444.1.

Nixon, G.T., Hammack, J.L., Ash, C.A., Cabri, L.J., Case, G., Connelly, J.N., Heaman, L.M., Laflamme, J.H.G., Nuttall, C., Paterson, W.P.E., and Wong, R.H., 1997. Geology and platinum-group-element mineralization of Alaskan-type ultramafic-mafic complexes in British Columbia. British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Bulletin 93, 150p.

Ogg, J.G., Huang, C., and Hinnov, L., 2014. Triassic timescale status: A brief overview. Albertiana, 41, 3–30.

Orchard, M.J., 2012. Report on 12 (4 productive) microfossil samples submitted for analysis by James Logan, British Columbia Geological Survey. Geological Survey of Canada, Paleontological Report 002-MJO-2012, 8p.

Orchard, M.J., and Bucher, H., 1992. Conodont - ammonoid intercalibration around the Lower - Middle Triassic boundary: Nevadan clocks help tell British Columbia time. In: Current Research, Part E, Geological Survey of Canada Paper 92–1E, pp. 133–140.

Poulton, T.P., 2011. Report on 3 collections of Triassic and Jurassic samples collected in 2011 by Jim Logan, Larry Diakow, and David Moynihan (British Columbia Geological Survey) in Dease Lake map area, northern British Columbia (NTS 104J 08). Geological Survey of Canada, Paleontological Report TJ1-2011-TTP, 3p.

Poulton, T.P., 2017. Report on an examination of photographs of Early Jurassic ammonites collected from the Takwahoni Formation in Cry Lake map area east of Dease Lake and near McBride River, NW British Columbia (NTS 104I) and submitted October 6, 2017, by Bram van Straaten, British Columbia Geological Survey. Geological Survey of Canada, Paleontological Report J1-2017-TPP, 6p.

Read, P.B., 1983. Geology, Classy Creek (104J/2E) and Stikine Canyon (104J/1W), British Columbia. Geological Survey of Canada Open File 940, 1:50,000 scale.

Read, P.B., 1984. Geology, Klastine River east (104G/16E), Ealue Lake west (104H/13W), Cake Hill west (104I/4W) and Stikine Canyon east (104J/1E), British Columbia. Geological Survey of Canada Open File 1080, 1:50,000 scale.

Read, P.B., and Psutka, J.F., 1990. Geology of Ealue Lake east-half (104H/13E) and Cullivan Creek (104H/14) map areas, British Columbia. Geological Survey of Canada Open File 2241, 1:50,000 scale.

Rees, C., Riedell, K.B., Proffett, J.M., Macpherson, J., and Robertson, S., 2015. The Red Chris porphyry copper-gold deposit, northern British Columbia, Canada: Igneous phases, alteration, and controls of mineralization. Economic Geology, 110, 857–888. doi: 10.2113/econgeo.110.4.857.

Rhys, D.A., 1993. Geology of the Snip mine, and its relationship to the magmatic and deformational history of the Johnny Mountain area, northwestern British Columbia. M.Sc. thesis, University of British Columbia, Vancouver, B.C., Canada. Available from https://circle.ubc.ca/handle/2429/2173 accessed April 12, 2012.

Ryan, B., 1991. Geology and potential coal and coalbed methane resource of the Tuya River coal basin. In: Geological Fieldwork 1990, British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Paper 1991-01, pp. 419–432.

Schiarizza, P., 2012. Geology of the Kutcho assemblage between the Kehlechoa and Tucho rivers, northern British Columbia (NTS 104I/01, 02). In: Geological Fieldwork 2011, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2012–1, pp. 75–98.

Shirmohammad, F., Smith, P.L., Anderson, R.G., and McNicoll, V.J., 2011. The Jurassic succession at Lisadele Lake (Tulsequah map area, British Columbia, Canada) and its bearing on the tectonic evolution of the Stikine terrane. Volumina Jurassica, 9, 43–60. doi: 10.5604/17313708 .1114171.

Souther, J.G., 1971. Geology and mineral deposits of Tulsequah map area, British Columbia (104K). Geological Survey of Canada Memoir 362, 59p.

Souther, J.G., 1992. The late Cenozoic Mount Edziza volcanic complex, British Columbia. Geological Survey of Canada Memoir 420, 279p.

Takaichi, M., 2013a. Assessment report on the 2012 geological, geochemical, and geophysical program at the Eagle property, BC, Canada. British Columbia Ministry of Energy and Mines, Assessment Report 34266, 22p.

Takaichi, M., 2013b. Assessment report on the 2012 geological, geochemical, program at the McBride property, BC, Canada. British Columbia Ministry of Energy and Mines, Assessment Report 34265, 17p.

Takaichi, M., and Johnson, C., 2012. Assessment report on the 2011/2012 geological, geochemical, and geophysical program at the Eagle property, BC, Canada. British Columbia Ministry of Energy and Mines, Assessment Report 33330, 27p.

van Straaten, B.I., and Bichlmaier, S.J., 2018a. Late Early to Middle Jurassic Hazelton Group volcanism and its tectonic setting, McBride River area, northwest British Columbia. In: Geological Fieldwork 2017, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2018–1, pp. 39–66.

van Straaten, B.I., and Bichlmaier, S.J., 2018b. Preliminary bedrock geology of the McBride River area (parts of NTS sheets 104H/14,15; 104I/02,03,06). British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Open File 2018-3, 1:50,000 scale.

van Straaten, B.I., and Gibson, R., 2017. Late Early to Middle Jurassic Hazelton Group volcanism and mineral occurrences in the McBride-Tanzilla area, northwest British Columbia. In: Geological Fieldwork 2016, British Columbia Ministry of Energy Mines and Petroleum Resources, British Columbia Geological Survey Paper 2017–1, pp. 83–115.

van Straaten, B.I., Gibson, R., and Nelson, J.L., 2017. Preliminary bedrock geology of the Tanzilla and McBride area (NTS 104I/03,04,05,06). British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Open File 2017-9, 1:50,000 scale.

van Straaten, B.I., Logan, J.M., and Diakow, L.J., 2012. Mesozoic magmatism and metallogeny of the Hotailuh batholith, northwestern British Columbia. British Columbia Ministry of Energy, Mines and Natural Gas, British Columbia Geological Survey Open File 2012-06, 1:50,000 scale and 58p.

van Straaten, B.I., Logan, J.M., Hunter, R.C., Nelson, J.L., and Miller, E.A., 2022. Igneous lithogeochemistry data for the Dease Lake, Kitsault River, Galore Creek, Telegraph Creek, Foremore, and other areas in northwestern British Columbia. British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey GeoFile 2022-12, 14p.

van Straaten, B.I., and Nelson, J.L., 2016. Syncollisional late Early to early Late Jurassic volcanism, plutonism, and porphyry-style alteration on the northeastern margin of Stikinia. In: Geological Fieldwork 2015, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2016–1, pp. 113–143.

van Straaten, B.I., and Wearmouth, C.D., 2019a. Geology of the Latham and Pallen Creek area, northwestern British Columbia: Distinguishing the Tsaybahe group, Stuhini Group, and Hazelton Group, and the onset of Triassic arc volcanism in northern Stikinia. In: Geological Fieldwork 2018, British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Paper 2019–1, pp. 79–96.

van Straaten, B.I., and Wearmouth, C.D., 2019b. Preliminary bedrock geology of the Latham and Pallen Creek area (parts of NTS Sheets 104I/04, 05, 104J/01, 08). British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey Open File 2019-05, 1:50,000 scale.

Wheeler, J.O., 1967. Tectonics. In: Canadian Upper Mantle Report, Geological Survey of Canada Paper 67–41, pp. 3–59.

Woodsworth, G.J., Anderson, R.G., Armstrong, R.L., Struik, L.C., and van der Heyden, P., 1991. Chapter 15: Plutonic regimes. In: Gabrielse, H., and Yorath, C.J. (Eds.), Geology of the Cordilleran Orogen in Canada, Geological Survey of Canada, Geology of Canada 4, pp. 491–531.

Wotzlaw, J.-F., Guex, J., Bartolini, A., Gallet, Y., Krystyn, L., McRoberts, C.A., Taylor, D., Schoene, B., and Schaltegger, U., 2014. Towards accurate numerical calibration of the Late Triassic: High-precision U-Pb geochronology constraints on the duration of the Rhaetian. Geology, 42, 571–574. doi: 10.1130/G35612.1.

**Data sources:**

**Aeromagnetic data:** Aeroquest Airborne, 2012. Report on a helicopter-borne magnetic survey (Aeroquest Job #11-046) for Geoscience BC. Geoscience BC Report 2012-2, 11p.

**Minfile:** MINFILE BC mineral inventory, BC Ministry of Energy and Mines, https://minfile.gov.bc.ca/. Accessed November 2021.

**Topographic data:** BC Terrain Resource Information Mapping Digital Map Products, BC Ministry of Forests, Lands and Natural Resource Operations, Crown Registry and Geographic Base Branch, http://geobc.gov.bc.ca/base-mapping/atlas/trim/. Accessed June 2018.

**Mapping by**: Bram van Straaten (2011-2012, 2015-2018), Jim Logan (2011), JoAnne Nelson (2014-2015), David Moynihan (2011), Larry Diakow (2011), Rohanna Gibson (2016), Sebastian Bichlmaier (2017) and Curran Wearmouth (2018)

**Geology compiled by:** Bram van Straaten

**Cartography by**: Emily Miller and Bram van Straaten

**Acknowledgements:** We thank Meagan Hogg, Olivia Iverson, Travis McCarron, Catie Young, Erin Bros, Carly Smythe, Marc Beaton, Rachel Gavin, Sadye Butler and Natashia Drage for their capable and enthusiastic assistance during the field season, and Pacific Northwest Helicopters (now Lakelse Air) and Tundra Helicopters for safe flying.