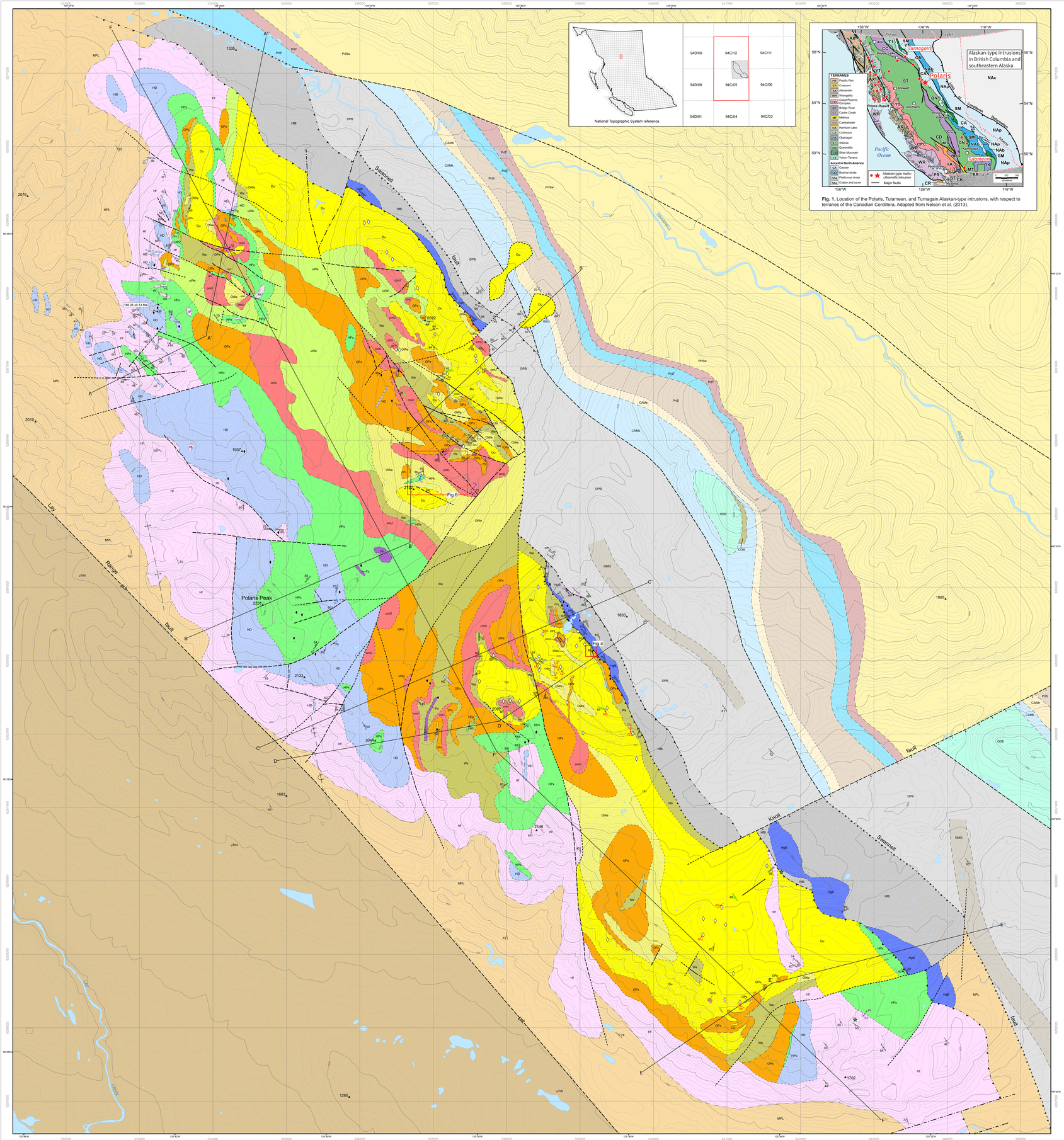

Fig. 1. Location of the Polaris, Tulameen, and Turnagain Alaskan-type intrusions, with respect to terranes of the Canadian Cordillera. Adapted from Nelson et al. (2013).

British Columbia Geological Survey

Open File 2020-04

Geology of the Polaris Alaskan-type ultramafic-mafic intrusion, north-central British Columbia

parts of NTS 94C/12 and 05

Sheet 1 of 2

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0 0.25 0.5 1 1.5 2 Kilometres

Scale 1:15,000

LEGEND

Quesnel terrane

EARLY JURASSIC

Polaris ultramafic-mafic intrusion (ca. 186 Ma)

Fs — **Felsic intrusions (syenite, quartz monzodiorite, leuco-monzonite)**: Fine-grained to pegmatitic; weathers light blue-grey with fresh surface light grey-white; variably saussuritized; intrudes hornblende clinopyroxenite, olivine clinopyroxenite, wehrlite, and dunite; locally forms breccias containing angular clasts of olivine clinopyroxenite, hornblende clinopyroxenite, and hornblendite.

HD — **Hornblende gabbro to diorite;** microgabbro to coarse-grained and locally pegmatitic; weathers dark green-grey with fresh surface light grey to greenish-grey; foliated to non-foliated and equigranular; commonly saussuritized; rare modal layering and may contain minor orthomagmatic sulphides.

HPx — **Hornblende clinopyroxenite (90-50% clinopyroxene; 50-10%hornblende), clinopyroxene hornblendite (90-50% hornblende; 50-10% clinopyroxene);** minor hornblende olivine clinopyroxenite, hornblendite, and feldspathic hornblendite; medium-grained to pegmatitic, and commonly biotite-rich; weathers green-black to rusty brown where sulphide rich with fresh surface dark greenish-grey; rare cm- to dm-scale modal layering; locally forms magnetite-hornblende-rich seams and dikes intruding peridotite and pyroxenite.

cmU — **Chaotically mixed ultramafic unit;** dunite, olivine wehrlite, wehrlite, olivine clinopyroxenite and clinopyroxenite; intermingled lithologies with gradational, diffuse, and sharp lithological boundaries; frequently intermixed lithological zones between larger bodies, most commonly between coarse-grained wehrlite (We) and olivine clinopyroxenite (OPx); includes textures that may reflect injection of crystal-rich magma into semi-consolidated host.

OPx — **Olivine clinopyroxenite (40-10% olivine, 90-60% clinopyroxene), clinopyroxenite (10-0% olivine, 100-90% clinopyroxene);** weathers pale grey-green with fresh surface surface dark greenish-grey; fine-grained to pegmatitic; gradational and diffuse to sharp intrusive contacts; cm- to m-scale pegmatitic dikes intrude peridotite and pyroxenite; coarse phlogopite common; locally magnetite rich; rare modal layering; locally hosts magmatic peridotite breccia.

uWe — **Undifferentiated olivine wehrlite to wehrlite;** weathers dark to medium brown with fresh surface dark-grey; medium- to coarse-grained; rare pegmatitic clinopyroxene; heterogeneous textural variation on m-scale.

We — **Wehrlite (65-40% olivine; 60-35% clinopyroxene);** minor olivine clinopyroxenite; weathers rough and orange-brown with fresh surface dark grey; local pitted from recessive olivine and phlogopite weathering; fine- to medium-grained olivine (<2mm); interstitial and locally oikocrystic fine- to coarse-grained, and rarely pegmatitic, clinopyroxene.

OWe — **Olivine wehrlite (90-65% olivine; 35-10% clinopyroxene);** minor chromitite; dark to medium brown weathering with fresh surface dark grey; clinopyroxene is oikocrystic; local pitting from recessive phlogopite weathering.

Du — **Dunite (100-90% olivine; 0-10% clinopyroxene);** minor chromitite; weathers smooth yellow-brown with cm-thick weathering rind and dark grey fresh surface; medium-grained adcumulate olivine with local interstitial clinopyroxene; massive but may also form cm- to dm-scale dikes in wehrlite and olivine clinopyroxenite; locally serpentinized and phlogopite-bearing; contains disseminated fine-grained chromite to m-scale chromitite blocks and schlieren showing brittle to ductile deformation features.

Hf — **Hornfels;** contact aureole rocks; massive to weakly foliated meta-sedimentary (sandalusite) and volcanic rocks of the Lay Range assemblage; local gradational recrystallization textures from distal hornfels to foliated medium-grained amphibolite proximal to intrusion contact.

HfB — **Hornfels in Big Creek group;** strongly to weakly foliated rocks in basal metamorphic aureole at contact with Big Creek group; fissile shale, phyllite, and amphibole-bearing schist; garnet locally present in boudinaged pods of green-grey metavolcanic rocks in basal thrust wedge.

HgB — **Hornblende gabbro to diorite sills;** microgabbro to coarse-grained; weathers dark green-grey; heterogeneously foliated to non-foliated and equigranular; locally mylonitic shear zones include pods of variably deformed to undeformed gabbro-diorite; intruding Big Creek group along eastern thrust margin.

UPPER TRIASSIC

Nicola Group

uTrN — Undifferentiated mafic volcaniclastic flows, tuffaceous sandstone and siltstone, argillite, minor volcanic breccia, and rare limestone. Previously referred to as the Takla Group by Ferri et al. (2001), we follow Ootes et al. (2020a) and adopt the term Nicola Group, as used elsewhere in Quesnel terrane.

Harper Ranch subterrane

MIDDLE MISSISSIPPIAN TO PERMIAN

Lay Range assemblage

MPL — **Metasedimentary and metavolanic rocks;** flows, tuffs, and subvolcanic intrusions (augite and/or plagioclase-phyric and hornblende-phyric); laminated to thickly bedded tuffaceous siltstone and sandstone, phyllite, shale and mudstone; minor impure shaley fossiliferous limestone, chert and conglomerate; predominantly dark grey to green weathering; locally graded and cross-bedded.

Cassiar terrane

UPPER(?) DEVONIAN TO PERMIAN

Big Creek group

DPB — **Shale, mudstone, siltstone, sandstone, wacke, chert, conglomerate;** minor limestone and felsic tuff; predominantly black to dark grey; thinly and wavy bedded; locally bordered on the west by variably deformed and foliated gabbro and diorite.

LOWER DEVONIAN TO UPPER MISSISSIPPIAN

DMG — **Gilland tuff: Felsic tuff;** grey; quartz and/or feldspar bearing; lesser grey quartz-feldspar porphyry flows; minor argillite.

MIDDLE ORDOVICIAN TO UPPER DEVONIAN

Echo Lake Group

ODE — **Limestone and dolomite;** minor shales; pale to medium grey; thinly bedded to massive; locally bioclastic, oolitic and may contain carbonate breccia horizons; locally silicified and almost cherty; sandy dolomite is locally fossiliferous.

CAMBRIAN AND ORDOVICIAN(?)

Razor Back Group

COR — **Calcareous argillite, dolomitic limestone, and shale;** dark grey to silvery-green; thinly bedded; may contain intervals of sericitic phyllite or schist.

CAMBRIAN

Atan Group (Lower Cambrian)

CAMk — **Mount Kison Limestone:** Mottled grey to white; recrystallized: thin, wavy, indistinct and discontinuous bedding; slightly argillaceous; may be dolomitized.

CAMb — **Mount Brown Quartzite:** Impure quartzite; interlayered with siltstone and phyllite, minor limestone.

NEOPROTEROZOIC

Ingenika Group

PrIS — **Steikuz Formation:** **Phyllite, schist, and impure quartzite, limestone, slate, siltstone;** phyllite, schist, and impure quartzite are green-grey and crenulated; limestone is white, yellow to bluish grey and clean with thin micaceous partings; phyllite, slate, and siltstone is dark blue-grey to black, graphitic, locally biotite- and garnet-bearing.

PrIE — **Espee Formation:** **Limestone;** dark grey to white; mottled; thin to moderately bedded; locally dolomitic; locally white marble.

PrIT — **Tsaydiz Formation:** **Slate, phyllite, limestone;** minor sandstone; locally contains biotite.

PrISw — **Swannell Formation:** **Quartzite, impure quartzite, feldspathic quartzite and sandstone;** grey to tan; thin to thickly bedded; interlayered with garnet-biotite-muscovite-bearing schist.

MAP SYMBOLS

- Geological contact, defined, approximate, inferred
- Geological contact, geophysically inferred
- Steeply dipping fault, defined (dip known), approximate, inferred
- Normal fault defined (dip known), approximate
- Strike-slip fault approximate
- Thrust fault, defined, approximate, inferred
- Steeply dipping fault, thrust fault; geophysically inferred
- Synclinal fold axis, overturned, approximate
- Anticlinal fold axis, upright, approximate
- A — A' Cross-section location
- 55 Bedding, tops known, inclined
- 45 Bedding, tops unknown, inclined
- 78 Schistosity/cleavage, inclined
- 78 Bedding-cleavage intersection
- 55 Foliation (igneous or metamorphic), inclined
- 78 Igneous contact, inclined
- 34 Igneous mineral foliation/modal layering, inclined
- 66 Chromitite schlieren, inclined
- 25 Chromitite fold axis with plunge
- 78 Dike, dip known or steeply dipping
- 78 Dunite dike, inclined
- 52 Sill, inclined
- 63 Magnetite hornblendite seams and dikes, inclined
- 67 Tabular peridotite xenoliths, inclined
- 18 Slickenlines on tabular peridotite xenoliths with plunge
- 76 Igneous veins, mafic to felsic, inclined
- 74 Shear zone, with S/C fabric, dip known
- 55 Intersection lineation of S and C fabric with plunge
- 54 Mineral lineation with plunge
- 55 Serpentine slickenfibres with plunge
- 12 Minor fold axis with plunge
- Field station (1988-89, 2019, 2020)
- Andalusite locality
- Sulphide locality
- Chromitite locality
- $^{206}Pb/^{238}U$ (zircon), 186.26 ±2σ Ma (Nixon et al., 2019)
- 1742 Spot height, metres
- Contour (20m, 100m)
- Stream or river; pond or lake

N — Magnetic North; 2°15.12' East of North; Magnetic Declination

Approximate mean declination for centre of map area, July 2019: 18° 8.10' East. Annual change: 15.1' to West. Convergence 2° 15.12' West

Base Map Information

Base map produced from digital TRIM (Terrain Resource Inventory Management) 1:20,000, British Columbia Ministry of Natural Resource Operations.

North American Datum 1983 (NAD83). Universal Transverse Mercator Projection (Zone 10). Elevation in metres above sea level. Contour interval 20m.

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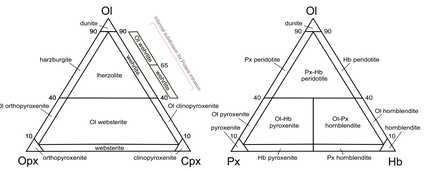
IUGS Classification of Ultramafic Rocks



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