British Columbia

Ministry of Employment and Investment
Energy and Minerals Division
Geological Survey Branch

Geological Survey Branch

GEOSCIENCE MAP 1997-1

GEOLOGY OF THE TAGISH LAKE AREA

NTS (104M/8, 9, 10E, 15 & 104N/12W)

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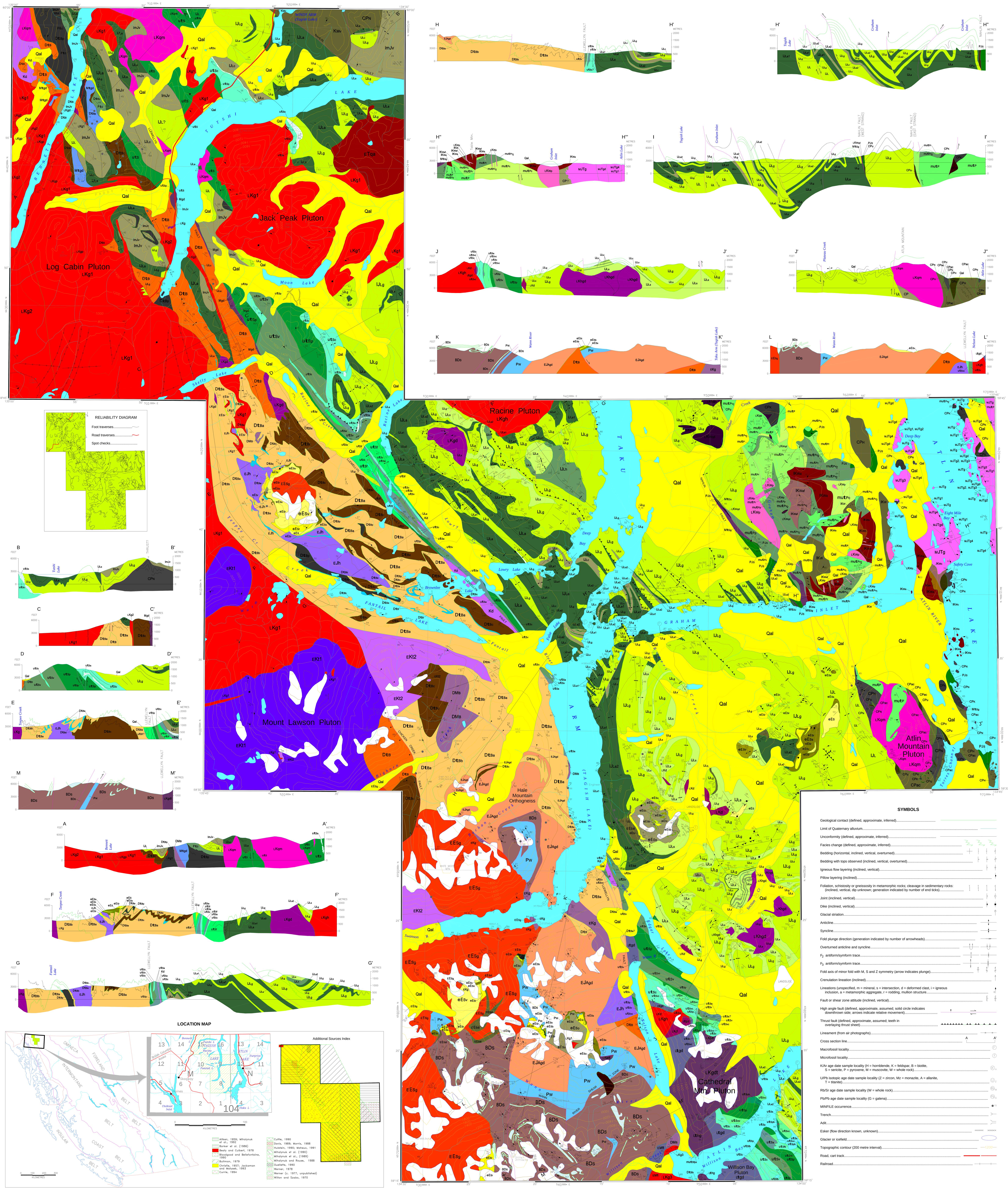
SCALE 1:100 000



SYMBOLS

- Geological contact (defined, approximate, inferred)
- Limit of Quaternary alluvium
- Unconformity (defined, approximate, inferred)
- Facies change (defined, approximate, inferred)
- Bedding (horizontal, inclined, vertical, overturned)
- Bedding with tops observed (inclined, vertical, overturned)
- Igneous flow layering (inclined, vertical)
- Pillow layering (inclined)
- Foliation, schistosity or gneissosity in metamorphic rocks; cleavage in sedimentary rocks: (inclined, vertical, dip unknown; generation indicated by number of end ticks)
- Joint (inclined, vertical)
- Dike (inclined, vertical)
- Glacial striation
- Anticline
- Syncline
- Fold plunge direction (generation indicated by number of arrowheads)
- Overturned anticline and syncline
- F_2 antiform/symform trace
- F_3 antiform/symform trace
- Fold axis of minor fold with M, S and Z symmetry (arrow indicates plunge)
- Crenulation lineation (inclined)
- Lineations (unspecified, m = mineral, s = intersection, d = deformed clast, i = igneous inclusion, a = metamorphic aggregate, r = rodding, mullion structure
- Fault or shear zone attitude (inclined, vertical)
- High angle fault (defined, approximate, assumed; solid circle indicates downthrown side; arrows indicate relative movement)
- Thrust fault (defined, approximate, assumed; teeth in overlaying thrust sheet)
- Lineament (from air photographs)
- Cross section line
- Macrofossil locality
- Microfossil locality
- K/Ar age date sample locality (H = hornblende, K = feldspar, B = biotite, S = sericite, P = pyroxene, M = muscovite, W = whole rock)
- U/Pb isotopic age date sample locality (Z = zircon, Mz = monazite, A = allanite, T = titanite)
- Rb/Sr age date sample locality (W = whole rock)
- Pb/Pb age date sample locality (G = galena)
- MINFILE occurrence
- Trench
- Adit
- Esker (flow direction known, unknown)
- Glacier or icefield
- Topographic contour (200 metre interval)
- Road, cart track
- Railroad

LEGEND

LAYERED ROCKS

QUATERNARY

- **Qal** Unconsolidated glacial till and poorly sorted alluvium; sparse gold flakes and nuggets are reported at Graham Creek and Moon Creek.

EOCENE

SLOKO GROUP (c. 52-56.5 Ma)

- **eEs** Undivided: primarily continental arc volcanic rocks of intermediate to felsic composition of c. 53-56 Ma. Includes some slightly younger volcanic rocks (c. 50-52 Ma) temporally and compositionally equivalent to Skukum Group volcanics. Mainly flat lying, overlying a deeply incised paleosurface.
- **eEsr** Rhyolite flows and ignimbrite: yellow, white to mauve, white or green-weathering, locally rusty; rocks typically aphanitic to feldspar-phyric, commonly with spectacular spherulitic textures.
- **eEsv** Mainly dacite to andesitic flows, breccia, tuff and ignimbrite: brown to mauve, white or green weathering, locally rusty; rocks typically aphanitic to feldspar porphyritic with minor quartz, biotite, and acicular hornblende.
- **eEsb** Basalt: vitreous, black, aphyric or less commonly, plagioclase porphyritic. unaltered with a conchoidal fracture occurs both as flows and flow breccias.
- **eEso** Vitrophyric tuff and breccia: black, well indurated, highly competent, massive, minor plagioclase ± hornblende-phyric flows.
- **eEss** Conglomerate: well-rounded pebbles and boulders of Laberge Group, unfoliated granitic rocks, and Cache Creek basalt and chert in a coarse sand matrix, grading up section into angular volcanic conglomerate.

LATE CRETACEOUS

WINDY-TABLE MOUNTAIN VOLCANIC COMPLEX (c. 72-82 Ma)

- **lKW** Undivided continental arc volcanics, contemporaneous with intrusive suite LKWp
- **lKWc** Conglomerate and tuffaceous conglomerate: directly overlies and contains clasts of Fourth of July batholith and Cache Creek lithologies. Commonly well indurated and may grade into lKWr
- **lKWr** Rhyolite: white-weathering, aphanitic flows and ashflows, locally with well-developed flow foliation and parallel platy parting.
- **lKWb** Basaltic andesite flows: dark brown to black, with vitreous, acicular to tabular plagioclase up to 5 mm. Flow units may be greater than 5 m to less than 0.5 m thick and either planar or with highly irregular bounding surfaces. Flow-top breccias are common. Interflow tuffs are generally blue-green, feldspar porphyritic, blocky to well-bedded ash tuffs.
- **lKWa** Coarse andesitic to dacitic breccias and flows: orange, tan, maroon, grey or light green; generally display some flow layering and weak but pervasive argillic alteration. Blocks are rounded with feldspar ± hornblende comprising 5 - 20%. Also includes sparsely feldspar-phyric mauve dacite with irregular flow banding and subconchoidal fracture, and lesser rhyolitic blocks. Locally intercalated with lKWaf
- **lKWaf** Feldspar-biotite ash flows: volumetrically minor, but distinctive; with or without quartz and altered biotite. May display good welded textures. U-Pb (zircon) dated at c. 81 Ma.

MONTANA MOUNTAIN VOLCANIC COMPLEX (c. 94 Ma)

- **KMv** Intermediate to felsic pyroclastics and flows; typically altered and orange-weathering.

LOWER TO MIDDLE JURASSIC

- **lmJv** Variegated pyroclastic lapilli tuff, bladed feldspar porphyry flows and comagmatic? porphyritic intrusions.
- **lmJc** Conglomerate: clast-supported, derived primarily from the underlying Laberge Group siltstone and argillite.

LOWER JURASSIC

LABERGE GROUP

- **lJL** Undivided wacke, argillite and siltstone.
- **lJLs** Siliciclastics: > 100 m thick; indurated siltstones to quartz-rich lithic wackes; centimetre-scale trough cross-stratification; well-layered; well-indurated; rusty weathering.
- **lJLa** Argillites: undivided or mixed.
  - **lJLa1** Rhythmically bedded argillites: form successions 10 - 100 m or more thick; 2 - 5 cm beds, good normal grading; bioturbated tops and feeding trails especially prominent in < 10 cm calcareous beds; very sparse cobbles of various protoliths.
  - **lJLa2** Irregularly and thinly bedded argillites: as recessive sets between wacke beds; dark brown to black; 1 - 30 mm; may be silty; rusty weathering.
- **lJLg** Greywacke: Feldspar < lithic grains; very fine sand to granules; < 5% mafic minerals, especially hornblende; calcareous with bulbous concretions m's long; beds massive or graded, cm's to 10 m+ thick; grey to green and orange weathering; resistant.
- **lJLc** Conglomerates: generally < 200 m thick. Clasts can include volcanic, sedimentary, and intrusive rock types. Typically clast-supported with a coarse wacke matrix, or 1 - 30% clasts floating in an argillite matrix. Matrix-supported and intraformational conglomerates are also common.
- **lJLq** Quartz subarenites: sandstones and granule conglomerates comprised largely of quartz with lesser feldspar. Altered biotite flakes are common accessories.
- **lJLh** Conglomerate wacke dominated by hornblende-feldspar porphyry clasts and derived crystals.

UPPER TRIASSIC

STUHINI GROUP VOLCANICS

- **utS** Undivided arc volcanics and associated sediments; apparent thickness varies from < 500 m to > 3 km.
- **utSf** Foliated rhyolite to intermediate tuff and breccia, may possibly be as old as Permian.
- **utSs** Sinwa Formation equivalent(?) limestone: light grey, fossil poor, massive to less commonly well bedded and argillaceous. Extensive calcite veining and internal deformation are displayed locally.
- **utSa** Argillite: finely laminated, dark brown and fissile, locally foliated and recessive.
- **utSl** Limestone; fetid argillaceous limestone, rare biohermal mounds; mainly Carnian.
- **utSvc** Volcanic litharenite/feldspathic wacke: (up to 800 m) Coarse-grained quartz-rich, massive to well stratified with vague but widespread large-scale trough cross-stratification. In upper portions blocks of pyroxene porphyry and hornblende-feldspar-phyric dacite are common. near the very top, carbonate clasts and bioclastic pods increase until carbonates dominate.
- **utSpb** Phreatomagmatic pyroxene-phyric breccia: (300 m) monolithologic, poorly lithified, forming a conspicuous marker horizon. Black, indurated blocks and olive-green pyroxene-crystal and ash tuff comprise varying proportions of the unit.
- **utSp** Coarse pyroxene-phyric breccia, agglomerate and subaqueous flows: (400 - 700 m); with local interpillow laminated micrites and interlayered, disrupted interflow, fossiliferous siltstones.
- **utSv** Heterolithic lapilli tuff: dark green to grey maroon, angular, scoriaceous fragments to rounded volcaniclasts. Fragments are aphanitic or porphyritic and may show alignment of plagioclase phenocrysts and microlites; hornblende, pyroxene and quartz-phyric varieties are also common.
- **utSc** 'Basal' conglomerate: (250 to > 600 m) matrix and clast-supported in which clasts range in size up to 2m, but are typically 2 - 20 cm in diameter. Volcanic, intrusive and metamorphic clasts dominate locally; volcanic clasts include pyroxene and feldspar porphyries and clasts of volcanic conglomerate.
- **utSfb** Coarse plagioclase porphyry flow and interflow breccia: feldspars up to 2 cm and 30%.
- **mutSfpx** Strongly foliated pyroxene porphyries: compositionally similar to utSp but strongly foliated flows and breccias, in places carbonatized; includes structurally juxtaposed, coarse pyroxene gabbros; possibly part of the Late Paleozoic Stikine Assemblage.

MIDDLE TO UPPER TRIASSIC(?)

PENINSULA MOUNTAIN VOLCANIC SUITE

- **mutP** Peninsula Mountain undivided: ocean arc? volcanics and associated sediments.
- **mutPc** Volcanic conglomerate: white and green, cobbles may be altered to massive epidote or partially digested by reaction with the matrix. Includes heterolithic tuffite of massive to thin bedded character.
- **mutPr** Pyritic, banded and spherulitic rhyolite flows, breccia and domes (?): generally rusty or yellow, resistant blocky to rounded outcrops. Aphyric, or with sparse, fine to medium-grained feldspar.
- **mutPv1** Pyroxene-phyric andesite and basalt: includes dark green, fine grained, massive greenstone with sparse clasts and phenocrysts; green, tabular feldspar porphyry; and pillowed to massive basalt flows, black tuff with maroon, green, grey and black lapilli and coarse ash matrix containing conspicuous pyroxene-crystals.
- **mutPv2** Heterolithic feldspar-phyric pyroclastic rocks: distinctive medium-grained, green, grey or maroon tabular feldspar (20%) porphyry and poorly bedded tuffs with hornblende (2%, rarely 10%) and rare pyroxene.
- **mutPp** Pillow basalt and pillow breccia: pyroxene-feldspar phyric, occurring with well-bedded tan or massive black chert.

PALEOZOIC TO UPPERMOST TRIASSIC

- **Ptc** Conglomerate: mainly clast-supported, comprised primarily of dynamically recrystallized mica schist and structurally underlying altered intrusive rock clasts.

MISSISSIPPIAN TO TRIASSIC

CACHE CREEK COMPLEX

- **PJs** Wacke and sparse interbedded chert: mainly tan or olive green weathering, dark grey on fresh surfaces; fine to coarse-grained, locally conglomeratic.
- **CP** Cache Creek complex undivided: a deep water, oceanic assemblage recording ocean basin closure and obduction. Sparse microfossil evidence from nearby areas suggests an age of Mississippian through Upper Triassic in the Atlin area. Rocks are typically highly sheared with lensoid and fault bounded units. Thus the stratigraphic order is largely unknown.
- **CPac** Sedimentary rocks: primarily rusty argillite and chert and highly sheared, medium to fine-grained, grey-green volcanic wacke and mudstone; broken formation. Localized zones of black cataclasite, lenses of diorite, ultramafite and sheared basalt.
- **CPH** Limestone: grey to tan or white weathering, grey to black on fresh surface. Massive, rarely bedded, locally traversed by dissolution pockets or irregular bands of hackley, tan to grey chert.
- **CPK** Chert: light grey to tan or black, generally massive, forms highly fractured, angular outcrops. Locally well bedded on scale of 2 to 10 cm with 0.5 to 4 cm argillite or rarely medium-grained wacke interbeds. Ribbons may be boudined, or have significant argillaceous component.
- **CPN** Volcanic rocks: massive, green to grey or brown weathering, fine-grained basalt flows and breccia. Characteristic dark green ("mint green") on fresh surface.
- **CPu** Ultramafic rocks: (1) Harzburgite: light to dark brown or red weathering, dark purple brown to black on fresh surface; typically forms unfoliated, medium to coarse-grained domains within a fine-grained, foliated matrix of sheared, recrystallized harzburgite or serpentinite; and (2) Serpentinite: green to rusty brown weathering, greenish black to purple on fresh surface; slickensided surfaces are light to medium green, polished, and contain fibrous mineral aggregates.

METASEDIMENTARY AND METAVOLCANIC SUITES

DEVONIAN TO TRIASSIC? BOUNDARY RANGES METAMORPHIC SUITE

- **DtB** Boundary Ranges metamorphosed arc strata with loose ties to Stikine Assemblage (undivided): mainly chlorite-actinolite schists and biotite (garnet), muscovite (± garnet) and pyroxene schists with a variable chlorite component. Carbonate, quartzite and felsic intrusive(?) rocks occur locally.
  - **DtBa** Chlorite actinolite schists: green and white banded plagioclase and quartz 50+% combined; minor biotite, rare garnet (abundance of biotite layers increase towards unit DtBb) chlorite fine grained; actinolite dark green, acicular, 1 - 30 mm, commonly outline a distinct lineation, actinolite < chlorite in abundance.
  - **DtBb** Biotite-plagioclase-quartz schists: rusty, well foliated, medium to fine grained, normally biotite < plagioclase < quartz; biotite layers < 10 cm thick are common; sparse garnet porhpyroblasts, 1 - 30 mm; muscovite and actinolite may be subequal to biotite in some layers; dark grey, compact.
  - **DtBc** Pelitic, chlorite-muscvovite-biotite±garnet schist: commonly graphitic with retrograde garnets. Protoliths may be argillaceous wacke with minor felsic pyroclasts and carbonate.
  - Marble.
  - **DtBp** Altered pyroxene-phyric volcanic flows, pyroxene gabbro, pyroxenite.

PERMIAN WANN RIVER GNEISS

- **Pw** Wann River gneiss: well layered hornblende gneiss of dioritic to granodioritic composition, 20 - 40% hornblende with lesser biotite. Layered on a millimetre to decimetre scale.

METASEDIMENTARY AND METAVOLCANIC SUITES (continued)

PROTEROZOIC TO ?DEVONIAN NISLING ASSEMBLAGE

- **BDs** Florence Range metamorphic suite (undivided): mainly pelitic and semipelitic rocks with carbonate, amphibolite, quartzite and minor calcsilicate and graphite-bearing semipelitic rocks. Metapelites in layers 0.1 to 30 m thick may contain sillimanite and pseudomorphed kyanite. Amphibolite is spatially associated with carbonate in 0.1 to 20 m thick layers.
  - **BDsq** Impure meta-quartzites: quartz-rich biotite schists texturally indistinguishable from DtBb typically < 10% biotite and < 20% feldspar.
  - Marble: carbonate layers up to several hundred metres thick, medium-grained; resistant, white, yellow, orange and tan-weathering (thicknesses may be exaggerated for presentation).

INTRUSIVE ROCKS

EOCENE

SLOKO PLUTONIC SUITE (c. 54-58 Ma)

- **EEsr** Granite/granitic dikes and sills: white weathering, grey on fresh surface; aphanitic to sparsely feldspar, quartz and rarely pyroxene-phyric. Often with very pronounced flow banding.
- **EEsg** Non-foliated granite, biotite leucogranite and quartz monzonite.
- **EEsdi** Biotite-hornblende quartz diorite.
- **EEsy** Hornblende syenite to quartz monzonite: orange weathering and fresh; variable medium to coarse grain size.

LATE (+/- MIDDLE) CRETACEOUS TO TERTIARY

COAST INTRUSIONS (INCLUDES MIDDLE CRETACEOUS WHITEHORSE PLUTONIC SUITE)

- **ETqa** K-feldspar porphyry and alaskite: salmon to flesh coloured, with smokey quartz. May locally be a late phase of LKg1.
- **LKg1** Granite: pink to grey, non-foliated, medium to coarse-grained; zoned K-feldspar 40 - 45% with 1 - 5% K-feldspar megacrysts up to 5 cm long; plagioclase 10 - 40%; quartz 40%; biotite as euhedral booklets, 2-5%; sparse hornblende; chilled contacts; x = xenolite-rich zones.
- **LKgp** Peraluminous granite: border phase to LKg1 contains up to 5% (generally 1 - 3%) pink, euhedral garnet up to 3 mm diameter.
- **LKgh** As LKg1 but contains hornblende in amounts subequal to, or greater than, biotite.
- **LKg2** Similar to LKg1 but lacking the textural and compositional variations.
- **LKg3** Biotite-hornblende granodiorite: medium grained with coarse K-feldspar and hornblende (up to 1 cm). Biotite more abundant than hornblende (< 15% combined). Crosscut by epidote veinlets and may locally contain up to 2% disseminated pyrite.
- **LKd** Hornblende-biotite diorite: orange-weathering, olive-brown to greasy-grey fresh, medium to coarse-grained - generally occurring as a border phase.
- **LKgd, LKhgd, LKg** Varitextured granodiorite: fine to medium-grained locally containing abundant biotite and hornblende-rich xenoliths. Labeled LKhgd where hornblende-rich. Other compositional variants include granite (LKg).
- **LKgdt** Hornblende granodiorite to tonalite: fine to medium-grained having subhedral plagioclase and hornblende with interstitial quartz and K-feldspar. Evenly distributed patches of finely intergrown acicular hornblende and plagioclase (0.5 - 2 cm in diameter) are characteristic.
- **LKqm** Quartz monzonite: homogeneous, light grey to pink or orange weathering, chilled margins, locally K-feldspar porphyritic; biotite, hornblende, and magnetite total 10 to 25%; < 15% quartz.

WINDY-TABLE INTRUSIVE SUITE (c. 70-85 Ma)

- **LKWp** Coarse quartz-feldspar-porphyry: orange weathering, extensively clay-altered, locally silicified, grey green fresh. Phenocrysts are: K-feldspar (20 - 25%), albite (to oligoclase, 50 - 60%), quartz (5 - 25%), accessory biotite, hornblende; traces of apatite, and zircon.
- **LKWqd** Quartz diorite to diorite.
- **LKqs** Orange weathering porphyritic quartz syenite to alkali granite: zoned K-feldspars 1 - 2 cm with plagioclase cores (± rims). Holocrystalline K-feldspar > quartz matrix; lacks mafic minerals.

CRETACEOUS

- **Kd** Altered and/or tectonized diorite: dark green fresh and red when weathered; elongate, locally foliated or brittly deformed bodies. In places extensively crosscut by quartz and chlorite veinlets.

EARLY CRETACEOUS

- **EKg** Peraluminous biotite granite, medium grained with euhedral garnet (up to 5%) ± minor muscovite.
- **EKt1** Foliated tonalite.
- **EKt2** Tonalite, weakly to non-foliated.

MIDDLE JURASSIC

FOURTH OF JULY PLUTONIC SUITE (c. 165 to 172 Ma)

- **MJTg** Undivided granitic batholith.
- **MJTg1** Biotite-hornblende granite: pink weathering, medium to light grey, equigranular, medium-grained with 5 to 15% brown biotite and pyroxene-cored hornblende in subequal amounts. Locally quartz monzonitic.
- **MJTg2** Hornblende granite and quartz monzonite: medium-grained and holocrystalline with pyroxene-cored hornblende (5 to 25%) that is dark green to black and typically subhedral in habit.
- **MJTg3** Biotite granite to alkali feldspar granite and alaskite: medium to coarsely crystalline, light grey to pink fresh, pink weathering; range from 1 to > 20% biotite ± accessory hornblende. K-feldspar from 50 to ~100% of total feldspar.
- **MJTg4** K-feldspar megacrystic granite: characterized by the presence of large (1 to 4 cm) K-feldspar megacrysts, in a medium-grained, biotite to pyroxene-cored hornblende-rich matrix. Megacrysts are commonly zoned, from light grey cores to pink rims, and may form "cumulate" layers with > 50% megacrysts.
- **MJTgd** Border phases, granite to diorite: this unit is a diverse assemblage ranging from lamprophyre and diorite to alaskite in composition, including the following: (1) fine-to medium-crystalline, dark grey, biotite hornblende granodiorite; (2) medium-grained hornblende biotite granodiorite; (3) dark grey, medium-grained, pyroxene glomeroporphyritic hornblende granodiorite or diorite; (4) medium-grained biotite-hornblende granite (coarse-grained equivalent is described above). Several phases may be present in a single outcrop; xenolith-rich horizons are common.

EARLY JURASSIC

- **EJh** Hornblendite (c. 187 Ma): black, coarse hornblende (95%) to medium-grained hornblende diorite; may include "dioritized" host rock veined by epidote and feldspar; resistant, weathers black.

AISHIHIK PLUTONIC SUITE

- **EJAgd** Hornblende biotite granodiorite (c. 187 Ma): light green-grey, feldspar porphyroblastic, strongly foliated; altered, chlorite (12%) and epidote (2%). Early epidote may be partly of magmatic origin.

LATE TRIASSIC

STIKINE PLUTONIC SUITE

- **Ltgd** K-feldspar megacrystic hornblende granodiorite: white, pink or tan, weakly to moderately foliated, conspicuous K-feldspar megacrysts up to 4 cm contain concentric zones of plagioclase and hornblende inclusions.

MID TO LATE TRIASSIC

- **Lthg** Variably foliated hornblende-rich gabbro: strongly foliated to unfoliated hornblende diorite to gabbro reduced to a chlorite schist in severely deformed zones . Polyphase, syntectonic intrusion is indicated with high variability of both the plagioclase content and degree of foliation in outcrop scale (may in part be equivalent to Pw).

MESOZOIC

- **Mgd** Granodiorite: dynamically recrystallized and brecciated felsic intrusive rocks primarily confined to the Llewellyn Fault zone, probably equivalent to Ltgd possibly equivalent to Mtgd

EARLY MESOZOIC?

- **EMft** Foliated tonalite: white and green on fresh surfaces and slabby, dark grey weathering; hornblende (20%, altered to actinolite); biotite (10% in clots); quartz (20% as ribbons); medium grained plagioclase (and sparse K-feldspar (?), 50% combined)

MISSISSIPPIAN TO TRIASSIC?

- **Mtgd** Altered and deformed felsic intrusive: typically altered and or affected by weak to strong dynamic recrystallization and local silicification. Compositionally variable to leucogranite and quartz diorite.

GRAHAM CREEK IGNEOUS SUITE (undivided as MtG)

- **MtGg** Altered hornblende gabbro and pillow basalt: black, dark green or brown weathering, generally medium grained but may be variable on an outcrop scale. Extensively crosscut by minor faults with cm to dm offset, chloritized. Basalt may occur as well developed pillows or as pillow breccia.
- **MtGu** Variably serpentinized ultramafic tectonites: serpentinite with minor crysotile veining is juxtaposed with bright orange, hackley weathering, quartz-calcite-mariposite-altered harzburgite. Strongly sheared pyroxenite may represent cumulates. Occurs as slivers along the Nahlin fault.

DEVONO-MISSISSIPPIAN

- **DMB** Bighorn Creek orthogneiss: tan to white-weathering, foliated plagioclase porphyry orthogneiss.

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Digitally restructured NAD 27 transverse Mercator projection, shifted to best match NAD 83 datum. Universal Transverse Mercator Grid Zone 8.

Approximate magnetic declination (1983) near centre of map is 28°35' (or 508 mils) decreasing 6.6' per year.