Reassessment of Triassic and Jurassic Volcanic Strata in the Dease Lake Region, Northern British Columbia

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ABSTRACT

Detailed stratigraphy and sedimentology, petrography, detrital zircon geochronology, and whole rock geochemistry of volcanic strata mapped as the Triassic Stuhini and Tsaybahe Groups in the Dease Lake area indicate that these rocks actually belong to the middle Jurassic Hazelton Group.

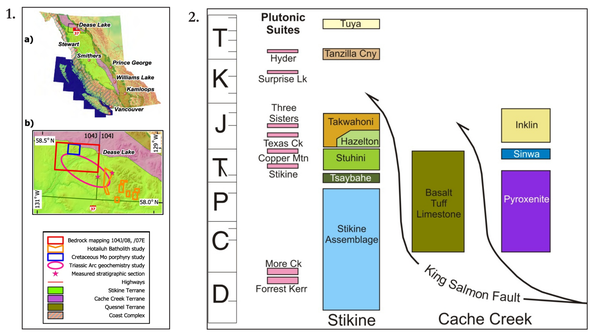
This project focuses on two well-exposed stratigraphic sections including a reference section north of the Cake Hill pluton first described by Anderson (1980, 1983), and a second section on the north flank of Thenatlodi Mountain. The reference section was originally interpreted to be the Late Triassic Stuhini Group in thrust contact with the Late Triassic Cake Hill pluton. Subsequent work suggested that these strata were correlative with the informal Middle Triassic Tsaybahe Group. The detrital zircon analysis of this section indicates that these strata are much younger than originally interpreted, and are correlative with the Early to Middle Jurassic Hazelton Group. This indicates that the Hotailuh thrust fault does not exist and that the entire section is an upright stratigraphic sequence of Middle Jurassic strata unconformably overlying the Cake Hill pluton. Stratigraphic similarities between these strata and those exposed on Thenatlodi Mountain suggest that the Hazelton Group is much more widespread than previously interpreted in this region.

Whole rock geochemical analysis, including major and trace analysis, is in progress on volcanogenic rocks from the measured sections and regional collections. The objective is to compare and contrast the geochemical character of rocks now recognized to be Early to Middle Jurassic in age with those mapped as the Stuhini and Tsaybahe groups.

PURPOSE

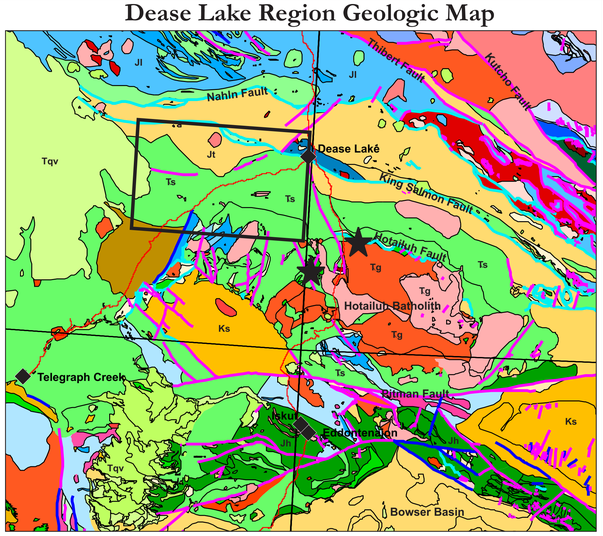
This project was originally designed to compare and contrast the Late Triassic Stuhini and the Middle Triassic Tsaybahe Groups due to their significant overlap in lithology and uncertain age assignment. Lithostratigraphic features, detrital zircon geochronology, petrography, and volcanic geochemistry were examined to provide insight into the age, stratigraphic relationships, and tectonic evolution of this part of the Stikine terrane. However, geochronologic results indicate that the strata correlate with the Jurassic Hazelton Group. Definitive lithologic characteristics identified through this project will be used as a reference for comparison to the younger Stuhini assemblage to determine if the Jurassic Hazelton Group is more widespread in the Dease Lake region than originally interpreted.

LOCATION



(1.) Location of the QUEST-Northwest mapping – British Columbia Geological Survey Dease Lake Geoscience Project on the (a) BC terrane map (after Massey et al., 2005); (b) detailed view of map areas at Dease Lake. **(2).** Schematic stratigraphic, plutonic and structural relationships for Stikine and Cache Creek terrane rocks within the map area.

Dease Lake Region Geologic Map



Legend

- Stratigraphic Sections
- QUEST-Northwest Map Area
- Towns
- Ks Cretaceous Skeena Group
- Jh Jurassic Hazelton Group
- Jl Jurassic Inklin Formation
- Js Jurassic Sediments
- Tg Triassic Intrusions (Hotailuh Batholith)
- Ts Triassic Stuhini Group

Angular volcanic breccia within Member 5. Note reaction rims on volcanic clasts, indicating elevated temperatures during deposition.

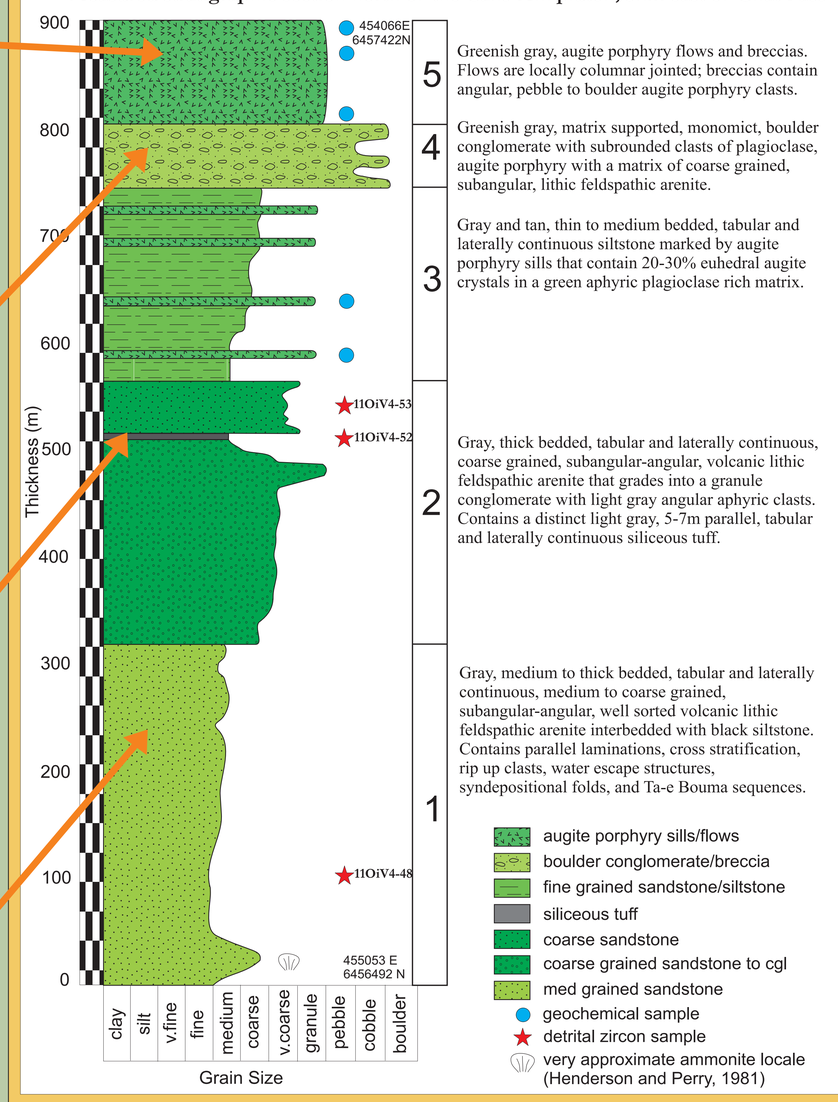
Monomict volcanic (augite porphyry) boulder conglomerate of Member 4.

Thin to medium bedded, medium to coarse grained volcanic lithic arenite with distinct light grey siliceous tuff interbeds of Member 2.

Soft sediment deformation and basal scour features common in the thin-bedded intervals of Member 1.

STRATIGRAPHY

Measured stratigraphic section north of the Cake Hill pluton, 5km east of Gnat Pass



5 — Greenish gray, augite porphyry flows and breccias. Flows are locally columnar jointed; breccias contain angular, pebble to boulder augite porphyry clasts.

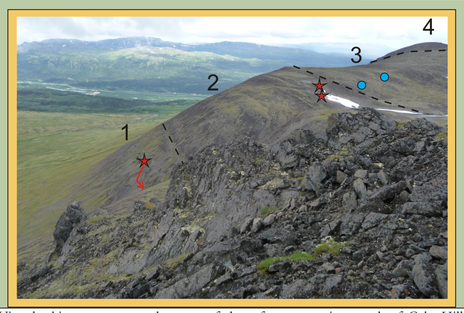
4 — Greenish gray, matrix supported, monomict, boulder conglomerate with subrounded clasts of plagioclase, augite porphyry with a matrix of coarse grained, subangular, lithic feldspathic arenite.

3 — Gray and tan, thin to medium bedded, tabular and laterally continuous siltstone marked by augite porphyry sills that contain 20-30% euhedral augite crystals in a green aphyric plagioclase rich matrix.

2 — Gray, thick bedded, tabular and laterally continuous, coarse grained, subangular-angular, volcanic lithic feldspathic arenite that grades into a granule conglomerate with light gray angular aphyric clasts. Contains a distinct light gray, 5-7m parallel, tabular and laterally continuous siliceous tuff.

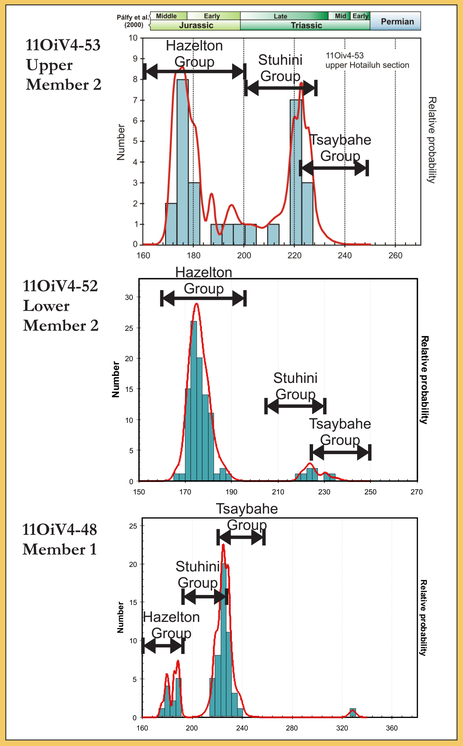
1 — Gray, medium to thick bedded, tabular and laterally continuous, medium to coarse grained, subangular-angular, well sorted volcanic lithic feldspathic arenite interbedded with black siltstone. Contains parallel laminations, cross stratification, rip up clasts, water escape structures, syndepositional folds, and Ta-e Bouma sequences.

- augite porphyry sills/flows
- boulder conglomerate/breccia
- fine grained sandstone/siltstone
- siliceous tuff
- coarse sandstone
- coarse grained sandstone to cgl
- med grained sandstone
- geochemical sample
- detrital zircon sample
- very approximate ammonite locale (Henderson and Perry, 1981)

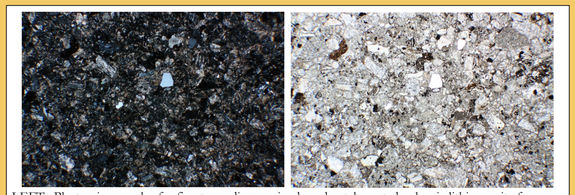


View looking west across the trace of the reference section north of Cake Hill pluton. Down-faulted pyroxene porphyritic breccia of member 4 occupies foreground. Red stars show approximate location of detrital zircon sample sites and blue circles show approximate location of geochemistry sample sites.

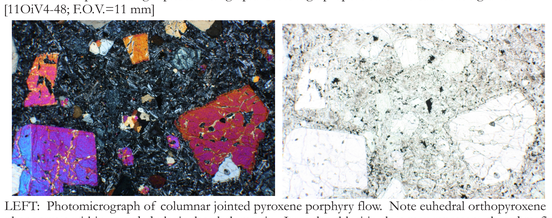
GEOCHRONOLOGY



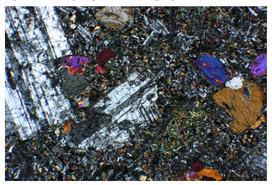
PETROLOGY



LEFT: Photomicrograph of a fine to medium grained moderately sorted volcanic lithic arenite from Member 1. Note strongly distinct alteration, with strongly sericitized plagioclase and calcite replacement. Note prominent unaltered volcanic quartz.
RIGHT: Plane polarized light photomicrograph. Note high proportion of volcanic lithic grains. [11OiV4-48; F.O.V.=11 mm]



LEFT: Photomicrograph of columnar jointed pyroxene porphyry flow. Note euhedral orthopyroxene phenocrysts within crowded plagioclase lath matrix. Irregular chloritic clots may represent altered mafic xenocrysts. RIGHT: Plane polarized light photomicrograph. [11OiV4-59; F.O.V.=11 mm]

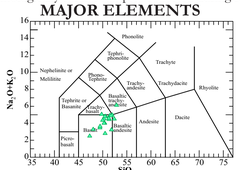


Photomicrograph of pyroxene porphyry from the Thenatlodi Mountain area, west of the measured stratigraphic section. Notice the similarity between the petrology of the preceding photomicrograph and the euhedral orthopyroxene phenocrysts within crowded plagioclase lath matrix shown here. The percentage of the coarse euhedral plagioclase phenocrysts shown here vary throughout the area. [11OiV4-39; F.O.V.=11 mm]

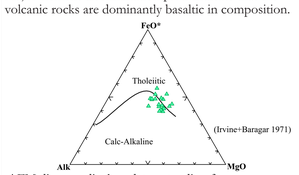
GEOCHEMISTRY

The stratigraphic section contained volcanic tuff, tuff breccia and pyroxene-phyric volcanic breccia intercalated with numerous pyroxene-phyric mafic sills. Geochemical samples include samples from the stratigraphic section, as well as lithologically similar samples collected during regional mapping.

MAJOR ELEMENTS

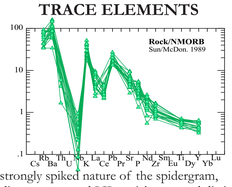


Major element discrimination plots indicate that the volcanic rocks are dominantly basaltic in composition.



AFM diagram displays data extending from more primitivetholeiitic mamgas to more evolved calc-alkaline magmas, a common overlap in island arc magmatic systems. Tight data cluster prohibits identification of clear tholeiitic or calc-alkaline trends.

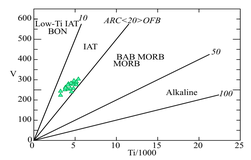
TRACE ELEMENTS

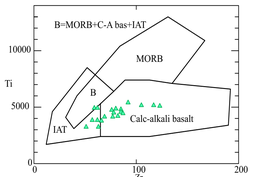


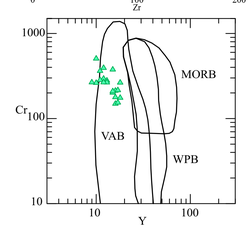
The strongly spiked nature of the spidergram, including pronounced LIL enrichment and distinct Nb trough suggest a subduction-related origin. The high LIL/HFS ratio is believed to result from LIL mobility within subduction-related fluids and retention of HFS in the source during partial melting.

TECTONIC DISCRIMINATION DIAGRAMS

Trace element tectonic discrimination diagrams. Note that each ratio examined suggests magma derivation in a volcanic island arc setting.







PRELIMINARY INTERPRETATIONS

Lithostratigraphy:
- the abundance of sedimentary structures, including synsedimentary folds, Bouma sequences, scour surfaces and rip-up clast horizons suggest relatively rapid gravity flow sedimentation in a subaqueous environment
- the stratigraphic section represents a coarsening upward succession that grades from thin to medium bedded clastic sedimentary rocks to coarse volcanic breccias. This succession may represent a shallowing upward depositional setting that culminates in subaerial exposure
- the presence of volcanic tuff (subaqueous?) and coarse volcanic breccias intercalated with compositionally identical sills argues for syndepositional volcanism

Petrology:
- the section is dominated by feldspathic volcanic lithic arenite intercalated with and overlain by orthopyroxene-phyric porphyritic monomict conglomerate, volcanic breccia and sills

Geochemistry:
- the section is dominated by compositionally homogeneous basalts with a thoellitic to calc-alkaline affinity.
- the strongly spiked trace element pattern with a high LIL/HFS element ratio suggests subduction related magmatism
- trace element distribution on tectonic discrimination diagrams suggest magmatism in an uncontaminated island arc setting

Geochronology:
- detrital zircon U/Pb spectra clearly demonstrates sediment derivation from a Jurassic source

MAIN CONCLUSION:
- these rocks are properly assigned to the Hazelton Group, suggesting a much broader distribution of Jurassic volcanic rocks in the area than previously assumed.

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