Geological setting of the Granite Mountain batholith, south-central British Columbia

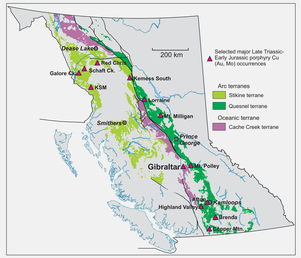
Paul Schiarizza

Thanks to Wes Harman for assistance in 2013. Additional assistance provided by Lori Kennedy and Adrian Hickin

Thanks to Mark Ralph for assistance in 2014. Additional assistance provided by Lori Kennedy

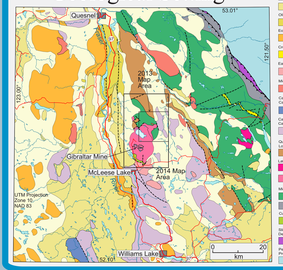
For More Information
Paul.Schiarizza@gov.bc.ca
604-660-2628

Overview

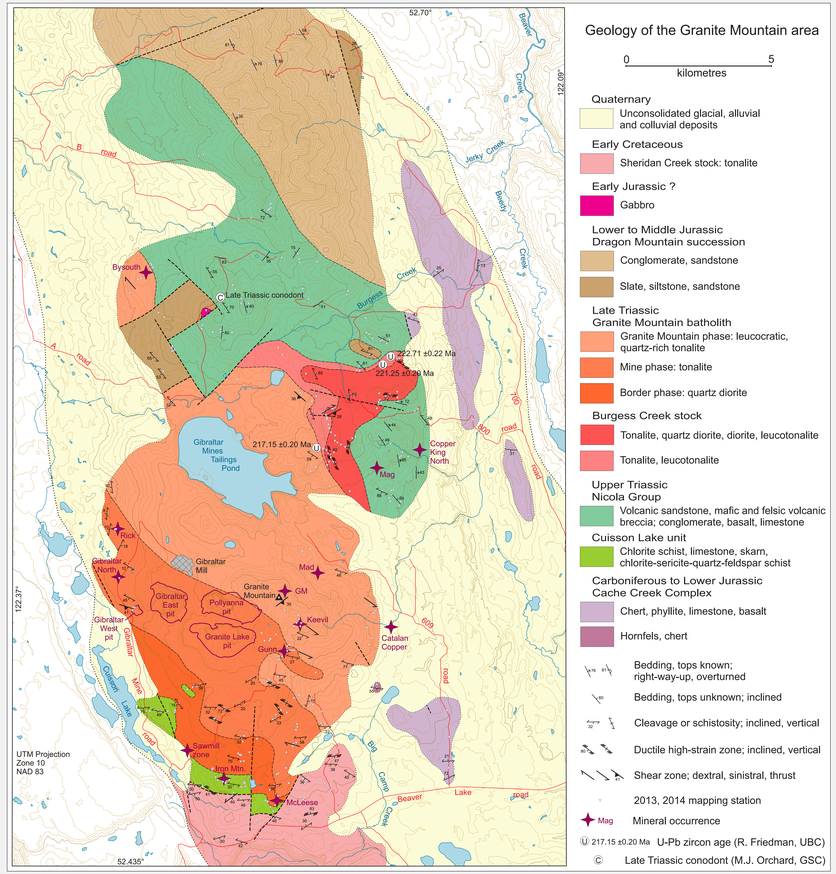


- *The Granite Mountain project, initiated in 2013 and continued in 2014, was implemented to clarify the geological setting, terrane affinity, and structural history of the Granite Mountain batholith (Late Triassic), which hosts the Gibraltar porphyry Cu-Mo deposit.*
- *This project builds on the work of Ash et al. (1999), who challenged the long-held view that the Granite Mountain batholith was part of Cache Creek terrane. Instead, Ash et al. proposed that the batholith is part of Quesnel terrane, and that it was juxtaposed against Cache Creek rocks along post-Triassic faults.*
- *Main conclusion: The Granite Mountain batholith is part of Quesnel terrane. It, and associated rocks of the Nicola Group (Upper Triassic), Burgess Creek stock (Late Triassic), and Dragon Mountain succession (Lower-Middle Jurassic) form a panel of Quesnel terrane rocks that is faulted against Cache Creek terrane to the east, south and west.*

Geological Setting



Geology of the Granite Mountain area, based on 2013 and 2014 fieldwork



Geology of the Granite Mountain area

0 5 kilometres

Quaternary
- Unconsolidated glacial, alluvial and colluvial deposits

Early Cretaceous
- Sheridan Creek stock: tonalite

Early Jurassic ?
- Gabbro

Lower to Middle Jurassic Dragon Mountain succession
- Conglomerate, sandstone
- Slate, siltstone, sandstone

Late Triassic Granite Mountain batholith
- Granite Mountain phase: leucocratic, quartz-rich tonalite
- Mine phase: tonalite
- Border phase: quartz diorite

Burgess Creek stock
- Tonalite, quartz diorite, diorite, leucotonalite
- Tonalite, leucotonalite

Upper Triassic Nicola Group
- Volcanic sandstone, mafic and felsic volcanic breccia; conglomerate, basalt, limestone

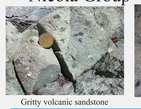
Cuisson Lake unit
- Chlorite schist, limestone, skarn, chlorite-sericite-quartz-feldspar schist

Carboniferous to Lower Jurassic Cache Creek Complex
- Chert, phyllite, limestone, basalt
- Hornfels, chert

- Bedding, tops known; right-way-up, overturned
- Bedding, tops unknown; inclined
- Cleavage or schistosity; inclined, vertical
- Ductile high-strain zone; inclined, vertical
- Shear zone; dextral, sinistral, thrust
- 2013, 2014 mapping station
- Mag — Mineral occurrence
- Ⓤ 217.15 ±0.20 Ma — U-Pb zircon age (R. Friedman, UBC)
- Ⓒ — Late Triassic conodont (M.J. Orchard, GSC)

Map units; their relationships and significance

Nicola Group


Gritty volcanic sandstone


Pyroxene-plagioclase porphyry


Mafic volcanic breccia

- Mainly gritty volcanic sandstone, with mafic and felsic volcanic breccia, conglomerate, limestone and basalt
- Lithologic correlation with Nicola Group (main stratigraphic element of Quesnel terrane) corroborated by Late Triassic conodonts from one limestone unit
- Intruded by Late Triassic Burgess Creek stock, which itself is cut by Granite Moutain batholith; so Granite Mountain batholith is linked to Quesnel terrane

Burgess Creek stock


Tonalite


Quartz diorite, leucotonalite, tonalite


High-strain zone

- Heterogeneous mixture of tonalite, quartz diorite, diorite and leucotonalite; new U-Pb zircon ages are Late Triassic, ~5 Ma older than Granite Mountain batholith
- Local high-strain zones affect some phases but are cut by others, so formed during construction of stock
- Intrudes Nicola Group, so is part of Quesnel terrane; is cut by Granite Moutain batholith, also Quesnel terrane

Granite Mountain batholith


Border phase


Mine phase

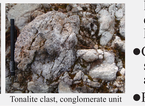

Granite Mountain phase

- Late Triassic; mainly tonalite; 3 main map units that become progressively more felsic from SW to NE
- External contacts not well-exposed, but cuts Burgess Creek stock to NE and(?) Cuisson Lake unit to the SW
- Variably developed south-dipping S1 foliation common in southern part, locally overprinted by younger structures. S1 congruent with S1 in Cuisson Lake unit and Early Cretaceous Sheridan Creek stock

Dragon Mountain succession


Slate-sandstone unit


Conglomerate unit


Tonalite clast, conglomerate unit

- Slate-sandstone unit: laminated slate/siltstone with local beds of quartz-rich sandstone and pebble conglomerate; overlies Nicola Group and(?) Granite Mountain batholith in central part of area
- Conglomerate unit: heterolithic conglomerate, local sandstone interbeds; forms northeast-younging panel above Nicola Group in north part of area
- Part of a Lower-Middle Jurassic intra-Quesnel basin

Cuisson Lake unit

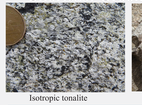

Chlorite schist


Platy limestone

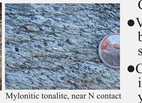

Skarn

- Chlorite schist, limestone, skarn; forms narrow belt along SW margin of Granite Mountain batholith
- Previously assigned to Cache Creek Complex, but herein correlated with Nicola Group because schist protolith seems to be mainly feldspathic volcaniclastic rocks
- South-dipping foliation, congruent with S1 in Granite Mountain batholith and Sheridan Creek stock, related to fault contact with Sheridan Creek stock

Sheridan Creek stock

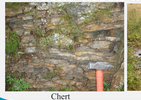

Isotropic tonalite


Foliated tonalite


Mylonitic tonalite, near N contact

- Early Cretaceous tonalite; apparently intrudes Cache Creek Complex to south
- Variably developed south-dipping S1 foliation, locally cut by younger high-strain zones, very similar to structural style of southern Granite Mountain batholith
- Contact with Cuisson Lake unit (Quesnel terrane) inferred to be south-dipping fault, mid-Cretaceous or younger, that formed at same time as S1 foliation

Cache Creek Complex


Chert

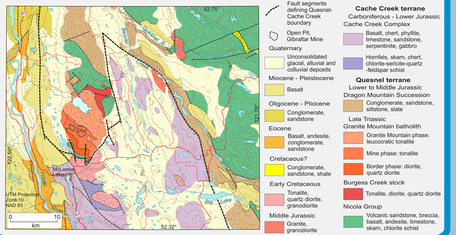

Limestone


Basalt

- Chert, basalt, limestone; typical Cache Creek, exposed in eastern part of area
- Cache Creek east of Quesnel is anomalous, and implies significant re-shuffling of terrane contact
- Contact inferred to be significant north-northwest trending fault, Middle Jurassic or younger, probably with more than 20 km of sinistral displacement

Main conclusions

- *The Late Triassic Granite Mountain batholith is part of Quesnel terrane, and is in a panel of Quesnel rocks faulted against Cache Creek terrane to the east, south and west. The batholith intrudes the slightly older Burgess Creek stock, which intrudes the Nicola Group.*
- *The southern boundary of the Quesnel panel is an east-striking fault that juxtaposes the Nicola-correlative(?) Cuisson Lake unit against the Early Cretaceous Sheridan Creek stock. South-dipping foliations in the Sheridan Creek stock, Cuisson Lake unit, and southern Granite Mountain batholith formed at the same time as this fault, which is inferred to be a south-dipping thrust or reverse fault.*
- *The eastern boundary of the Quesnel panel is an unexposed north-northeast striking fault that juxtaposes it against the Cache Creek Complex. Map-scale relationships suggest that this is a post-Early Jurassic sinistral fault with at least 20 km of displacement.*



Plutonic patterns, southern Quesnel terrane

- *Granite Mountain batholith conforms to well defined pattern of magmatism in southern Quesnel terrane, comprising parallel belts of calcalkaline or alkaline plutons that young from west to east*
- *Western Late Triassic calcalkaline belt includes Guichon Creek batholith (Highland Valley porphyry Cu-Mo deposits) and Granite Mountain batholith (Gibraltar porphyry Cu-Mo deposit); intervening area, largely covered, has potential for buried calcalkaline porphyry deposits*