QUEST-Northwest Mapping: BC Geological Survey Dease Lake Geoscience Project (NTS 104J, 104I), Northern British Columbia

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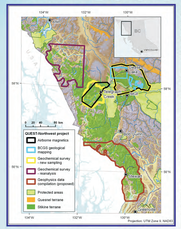
Introduction



Geoscience BC's QUEST-Northwest Project is a multidisciplinary, integrated project designed to help focus mineral exploration in a highly prospective area of northwestern BC.

The project's main activities include: two airborne magnetic surveys flown at line spacing of 250 m, bedrock geological mapping and a geochemical program. Collectively these programs will provide detailed, high quality geoscience data that is intended to assist metallic mineral exploration in this area of highly prospective geology.

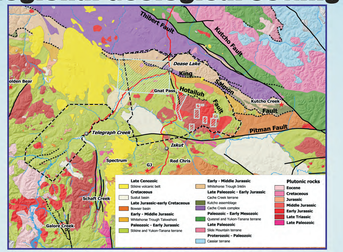
The QUEST-Northwest Dease Lake Geoscience project is a partnership between Geoscience BC and the BC Geological Survey and is the focus of this poster.

Dease Lake Geoscience Project

This past summer, the B.C. Geological Survey completed four field-based geology studies located within a 70 kilometres radius of the Dease Lake community. They consist of:

- Bedrock regional mapping of 104J/08, and /07E.
- The magmatic evolution and mineral potential of the Triassic-Jurassic Hotailuh batholith and its surrounding volcano-sedimentary rocks.
- The age, emplacement and molybdenum mineralization of the Snow Peak pluton.
- The deposition environments, age and lithogeochemical signature of Mesozoic arc volcanism.

Regional Geological Setting

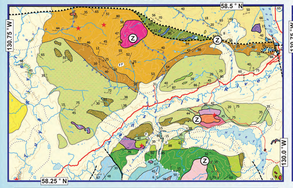


The Dease Lake study area is situated within the Stikine terrane, an extensive subduction-generated island arc magmatic system responsible for recurring calc-alkaline and/or alkaline plutonic events and associated Cu-Au mineralization, mainly during Late Triassic and Early Jurassic time. Prospective Mesozoic volcanic rocks exposed around the margins of the Bowser Basin (brown) form an arcuate belt containing porphyry deposits that include KSM, Galore and Shaft creek deposits to the west, and the Kemess deposits to the east. The Dease Lake study area is located at the apex of this arcuate belt, immediately north of the Red Chris Cu-Au porphyry deposit and adjacent to the Hotailuh batholith, a large composite intrusive complex similar in age to the intrusions hosting porphyry mineralization at the Galore and Shaft Creek deposits.

Part I: Regional Bedrock Mapping 104J/08, /07E

The Dease Lake map area straddles the early Middle Jurassic thrust-imbricated boundary between the Cache Creek and Stikine terranes. North of the King Salmon fault (KSF), the Cache Creek terrane consists of oceanic basalt, siliciclastic rocks and limestone of Carboniferous to Early Jurassic age. The terrane is overlain by Jurassic clastic sediments of the Inklin Formation comprising the southeastern extent of the Whitehorse Trough.

South of the KSF, the Stikine terrane comprises three overlapping island arc successions, which span 200 m.y. from Devonian to Middle Jurassic and include Stikine, Stuhini and Hazelton volcanic and sedimentary rocks. Their genetically related plutonic rocks include the Devono-Carboniferous Forrest Kerr, the Late Triassic Stikine and Copper Mountain, the Early Jurassic Texas Creek and the Middle Jurassic Three Sisters plutonic suites.



Total Field Magnetics

The total field airborne magnetic data reflects lithology and structural grain of the Stuhini Group, plutonic rocks and the ultramafic/mafic intrusions that straddle the Tanzilla River ~ 30km southwest of Dease Lake. This unit has some of the highest magnetic susceptibility measurements in the map area and a mean value of 92.6±43 x10-3 S.I. units.

Structure

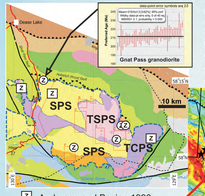
The King Salmon fault is the dominant structure in the area, oriented ~ E-W it marks the boundary between Cache Creek and Stikine terranes. The trace of the fault is marked by a number of small listwanite and/or serpentinite- altered ultramafic bodies. Rocks to the north of the KSF are penetratively foliated and have undergone extensive metamorphic recrystallization. In contrast, penetrative fabrics are only sporadically developed in Mesozoic units to the south and the rocks have not been metamorphically recrystallized.

Folding

D_{1a} folding and penetrative deformation in the Paleozoic rocks is thought to pre-date deposition of Mesozoic units.

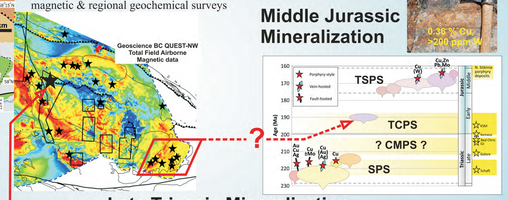
Two main phases of folding affect Jurassic rocks of the Takwahoni Formation. The first phase produced folds trending roughly east (Middle Jurassic amalgamation of Cache Creek and Stikine terranes). Second phase folds trend ~north and manifest themselves in map-scale deflects of bedding and stratigraphic contacts with fold wavelengths of 100's of m to several kms.

Part II: Magmatic evolution and mineral potential of the Triassic-Jurassic Hotailuh batholith



Objectives

- Refine temporal magmatic and geochemical evolution of the batholith
- Link magmatism and mineralization
- Provide geological base to interpret airborne magnetic & regional geochemical surveys



Z Anderson and Bevier, 1990
Z This study

Intrusive Rocks

TSPS — Middle Jurassic: Undivided plutonic rocks; Three Sisters potassic phase; Three Sisters central felsic phase; Three Sisters mafic phase
TCPS — Early Jurassic: McBride River pluton; Late Triassic: Beggerlay Creek pluton; Cake Hill pluton
SPS — Grat Lakes ultramafics

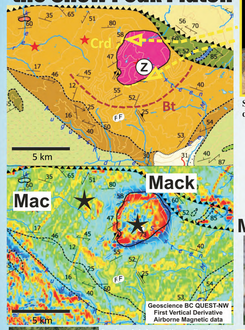
TSPS Three Sisters Plutonic Suite
TCPS Texas Creek Plutonic Suite
CMPS Copper Mountain Plutonic Suite
SPS Stikine Plutonic Suite

Middle Jurassic Mineralization

Late Triassic Mineralization

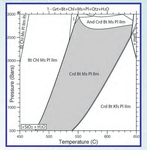
Gnat Pass
Indicated reserve 30.4 Mt grading 0.38 % Cu (non-NI 43-101 compliant)

Part III: Age, Emplacement & Mineralization of the Snow Peak Pluton

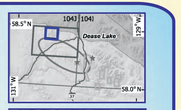


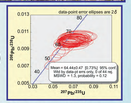
Spotted cordierite hornfels developed in Takwahoni sediments.

Snow Peak hornblende-biotite quartz monzodiorite (fov 3mm).



Equilibrium phase diagram for cordierite-bearing hornfels shows assemblage of Crd+Bt+Ms+Pl+Ilm is stable below ~2.75 kbar between 500-650°C. Implying emplacement depth of < 10km.





U-Pb Concordia plot for LA-ICPMS U-Pb data from the Snow Peak pluton.

Mack Mo±Au, W prospect

Mineralization comprises coarse-grained (1-7mm) molybdenite and pyrite crystals, which are disseminated along steeply-dipping WNW-trending fractures or narrow quartz veins.

In the vicinity of Snow Peak, the Takwahoni Formation hosts a voluminous network of dikes and sills of plagioclase porphyry. They range from tens of cm to metres thick and predate intrusion of the SPP.

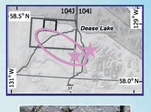
U-Pb Concordia plot for LA-ICPMS U-Pb data from a dike of plagioclase porphyry that cross-cuts foliated serpentinite in the HW of the KSF.

Mac Au, Ag, Zn, Pb, Cu showing

The Mac showing is located approximately 3 km west of Snow Peak pluton. Mineralization is quartz vein hosted and associated with easterly-trending quartz-feldspar porphyry (QFP) dike swarms which are common in the area. Pyrite, galena, chalcopyrite ± galena, sphalerite and tetrahedrite are reported to occur within quartz veins and as selvages in altered country rock.

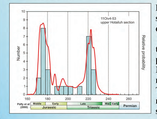
Part IV: Geochemistry, Age & Depositional Environment of Mesozoic Volcanism

View looking west across the trace of the reference section north of Cake Hill pluton. Gnat Pass and Highway 37 are visible in the background. Down-faulted pyroxene porphyritic breccia of unit 4 occupies foreground. Red stars show approximate location of detrital zircon sample sites.



Schematic stratigraphic column for sedimentary and volcanic rocks overlying Cake Hill pluton measured east of Gnat Pass.

Detrital zircon U-Pb



Detrital zircon populations for sample 11OIv4-53 collected from quartz-bearing tuff of horizon 2. Detrital zircon populations indicate the strata are much younger than previously realised. Here, Early to Middle Jurassic rocks nonconformably overly the Late Triassic Cake Hill Pluton in a north-dipping upright bedded section.

What's in it for you?

Procurement and integration of modern bedrock geological mapping, high quality airborne geophysical and multi-element regional geochemical data sets will lead to new discoveries and cost effective exploration particularly in areas of limited outcrop exposure like 104J/08 and /07E.

Summary

The BC Geological Survey's Dease Lake Geoscience Project is part of the new QUEST-Northwest Mapping initiative by Geoscience BC. The BCGS-DLGP was designed to investigate the stratigraphy, magmatic evolution and metallogeny along the Stikine Arch in the vicinity of Dease Lake and comprises the 4 field-based integrated research projects reported on here. The results of the bedrock mapping projects will be released as BC Geological Survey Open File Maps and a Geoscience BC publication.

Conclusions

Polydeformed phyllite, greenstone and Early Permian limestone of the Stikine assemblage are overlain by less deformed Early to Middle Triassic cherty sediments and crowded pyroxene porphyry basalt breccias that pass up section through a dominantly volcaniclastic sequence of the Late Triassic Stuhini Group and coarse sedimentary rocks of the Takwahoni Formation.

Peripheral to the Hotailuh batholith is significant magmatic-hydrothermal mineralization that is related to Late Triassic phases. Evaluation of mineral potential associated with the Early and Middle Jurassic phases is under realized and warranted.

Recognition that all pyroxene porphyritic basalts are not Middle or Late Triassic in age, but can comprise identical thick sections in the Jurassic requires careful mapping and age determinations.

Molybdenum mineralization at Snow Peak is associated with shallowly emplaced (<10km) Latest Cretaceous to Paleocene plutonism.

Preliminary Laser Ablation U-Pb zircon ages have identified some Late Jurassic and Early Cretaceous magmatic events not previously recognized in rocks of the Stikine arch.

The next step involves integration of the regional bedrock mapping with the QUEST-NW airborne magnetic and geochemical survey data sets and MINFILE BC to prioritize exploration sites in this highly prospective region.

More information

BC Ministry of Energy and Mines, Geological Fieldwork 2011 articles by
Part I: *Logan, Moynihan and Diakow,*
Part II: van Straaten, Logan and Diakow,
Part III: Moynihan and Logan,
PartIV: Iverson, Mahoney and Logan,
Available online as downloadable files at www.empr.gov.bc.ca/geology see *Publications Catalogue*