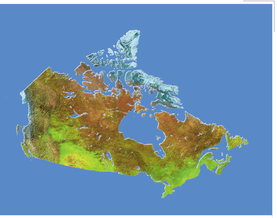
Ultramafic rock occurrences in the Dawson Range and their implications for the crustal structure of Yukon-Tanana terrane, Yukon (parts of NTS 115I, J and K)

Alex Zagorevski, Jim Ryan, Charlie Roots, and Nathan Hayward

Geological Survey of Canada



Introduction

The Yukon-Tanana terrane is a large composite pericratonic terrane that is most extensive in Yukon. It preserves a complex Devonian to Cretaceous geological history that includes several episodes of magmatism and tectonism. In general, the major magmatic episodes are Devono-Mississippian and Permian. In the northern Stevenson Ridge area, the Yukon Tanana terrane is characterized by pre-Devonian metasedimentary rocks of the Snowcap Assemblage, Mississippian metaplutonic rocks of the Simpson Range Suite, Mississippian metavolcanic rocks of the Finlayson assemblage, and metavolcanic (Klondike schist) and metaplutonic (Sulphur Creek suite) rocks of the Permian Klondike assemblage. Numerous new and previously recognized ultramafic bodies occur throughout the Stevenson Ridge area. These include clinopyroxenite and hornblendite and metamorphosed orthopyroxenite, harzburgite and dunite that are herein divided into four broad suites.

Triassic cumulate rocks

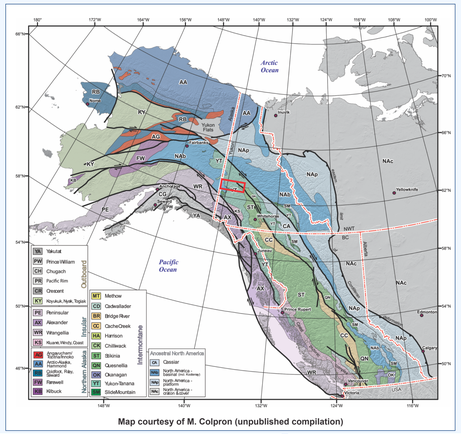
The first suite of ultramafic rocks comprises predominantly cumulate clinopyroxenite, hornblende clinopyroxenite, hornblendite, hornblende-pyroxene±plagioclase pegmatite, gabbro, diorite and tonalite that intruded into the Mississippian Simpson Range suite throughout the northeastern part of the study area.

Hornblendite, gabbro, diorite and tonalite appear to be produced by fluid infiltration of pyroxenite and partial melt production. Pyroxene Mountain diorite and hornblendite yielded ca. 220 Ma U/Pb titanite and 220.6 ± 1.6 Ma Ar/Ar ages respectively (Ryan and Villeneuve, unpublished data) indicating that these rocks are Late Triassic. Hence, these rocks represent the magmatic axis of the Late Triassic Stikinia/ Quesnellia arc.

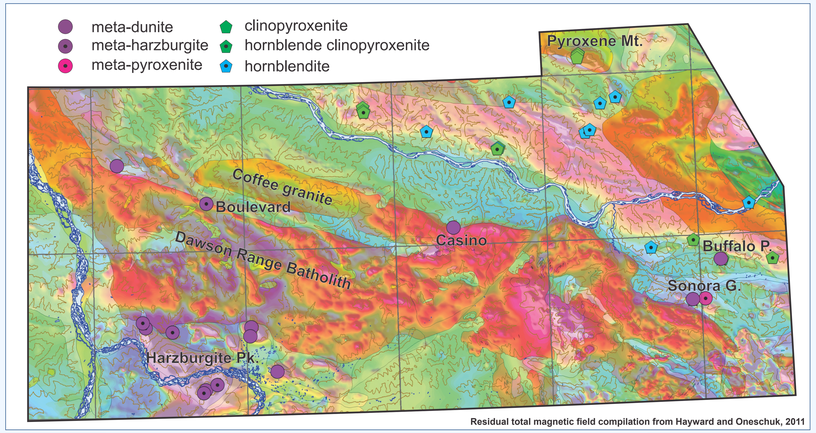
Buffalo Pitts peridotite

Buffalo Pitts Peridotite comprises a small body of harzburgite, troctolite, skarn and garnet amphibolite that were structurally emplaced into the metasedimentary rocks of the Snowcap Assemblage north of Sonora Gulch (Canil et al., 2003). A recent forest fire exposed new outcrops adjacent to the peridotite that contain banded pyroxenite. The peridotite contains spinel rimmed by plagioclase suggesting rapid decompression from spinel through plagioclase stability fields suggesting very rapid exhumation (Canil et al., 2003)

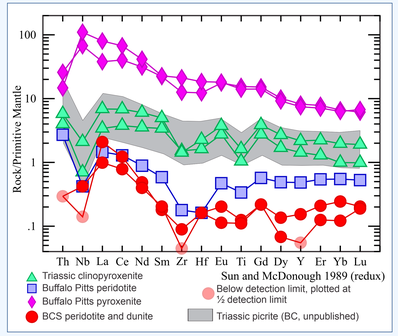
Mineralogy, geochemical characteristics and structural association led Canil et al. (2003) to suggest that the Buffalo Pitts peridotite originated as a piece of continental lithospheric mantle that was exhumed during Permian (Johnston et al., 2007) continental rifting.



Map courtesy of M. Colpron (unpublished compilation)



Residual total magnetic field compilation from Hayward and Oneschuk, 2011



Geochemistry

Representative samples of Triassic pyroxenite, Buffalo Pitts pyroxenite and harzburgite, and BCS harzburgite and dunite were analyzed at Activation Laboratories (Ancaster, ON). Triassic cumulate rocks have trace element characteristic of arc settings. The Buffalo Pitts sample has very similar trace element characteristics to the data of Canil et al. (2003). The high Al_2O_3 concentration, is similar to mantle peridotites from preoceanic or continental rift settings. The pyroxenite exhibits distinctly different trace element profiles and is highly aluminous (Al_2O_3 >10wt%) and may be unrelated to the peridotite. BCS harzburgite and dunite are depleted in Al_2O_3 (<1.1wt%), HREE and Th. Our limited geochemical data suggest that the origin of the BCS ultramafic rocks is distinct from the Buffalo Pitts peridotite.

YTT structure

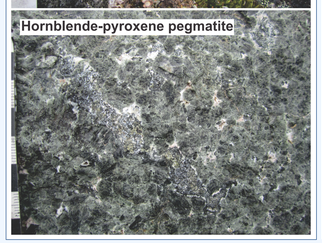
The ultramafic rocks in the Stevenson Ridge area help define the crustal structure of this portion of the Yukon Tanana terrane. The Triassic cumulate rocks appear to be restricted to Mississippian Simpson Range suite and siliciclastic rocks in the northeast part of the study area, where they form the roots to the Late Triassic calc-alkaline Lewes River/Stuhini Arc. The southernmost extent of these rocks, combined with lithological and geophysical contrasts, defines the Yukon River lineament. The Yukon River lineament is interpreted as a crustal scale fault that was reactivated in Late Triassic/Earliest Jurassic accommodating the late Triassic magmatic contrast across it. The Yukon River lineament is closely coincident with the structure that accommodated emplacement of the Buffalo Pitts peridotite.

The BCS lineament is defined by a discontinuous belt of ultramafic rocks that are structurally juxtaposed with metavolcanic and metaplutonic rocks of the Klondike assemblage. The juxtaposition of crust and mantle requires a crustal-scale fault. The northern boundary of the hornblende-phyric Cretaceous Dawson Range batholith closely coincides with this fault, but also appears to cut it. This suggests that the most voluminous pulse of Cretaceous magmatism and associated mineralization may have utilized the BCS lineament.

The Harzburgite Peak "ophiolite" represents an allochthonous sheet of unrelated subcontinental lithospheric mantle and ophiolitic crustal rocks. In contrast to the steep Yukon River and BCS lineaments, the Harzburgite Peak "ophiolite" was emplaced along a shallowly dipping structure.

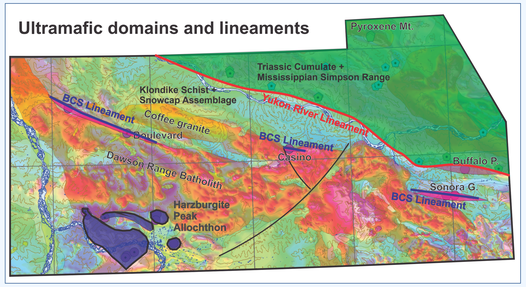
This is a contribution to the Geomapping for Energy and Minerals Program - Multiple Metals Northwest Cordillera Project.

Triassic ultramafic cumulate rocks



Buffalo Pitts peridotite and pyroxenite

Ultramafic domains and lineaments



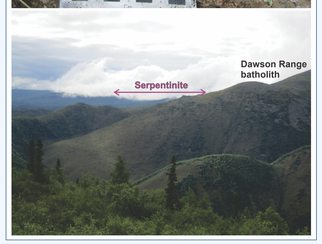
Ultramafics along Boulevard-Casino-Sonora (BCS) lineament

A series of ultramafic slivers outcrop along the northern boundary of the hornblende-porphyritic Cretaceous Dawson Range batholith. These structurally-bound slivers comprise harzburgite (near Boulevard), dunite (north of Casino) and pyroxenite/dunite (north of Sonora Gulch) where they are juxtaposed with volcanic and plutonic rocks of the Klondike assemblage and metasedimentary rocks of the Snowcap assemblage. The BCS ultramafic rocks appear to occupy the same structural position and may represent a single, dismembered ultramafic belt that was intruded by Jurassic and Cretaceous plutons and displaced by post-Cretaceous faults.

Harzburgite Peak

Harzburgite Peak ultramafic rocks comprise a shallow dipping, imbricated (?) allochthonous sheet that was thrust over deformed metavolcanic and metasedimetary rocks. The ultramafic rocks include dunite, harzburgite and spinel lherzolite. Murphy et al. (2011) obtained c. 0.7 to 3.2 Ga ages from the primary igneous sulphides, suggesting that the ultramafic rocks are remnants of ancient continental lithospheric mantle.

BCS peridotite and dunite



Harzburgite Peak

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