MOYIE-PURCELL MAGMATISM AS SEEN FROM AMPHIBOLITES WITHIN THE SOUTHERN PRIEST RIVER COMPLEX

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PROJECT OVERVIEW & LOCATION

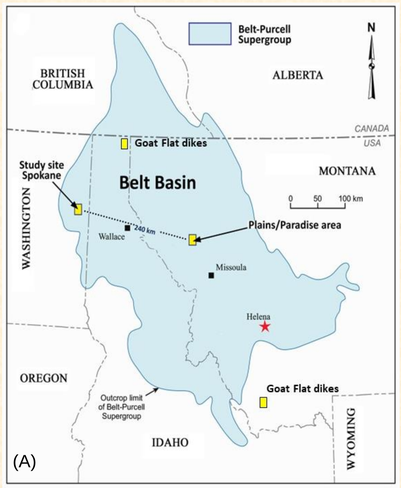
PURPOSE

- to study the field relations of a concordant amphibolite body (Figure 1) within the Hauser Lake gneiss of the southern Priest River complex (PRC), northeast Washington
- to compare the mineralogic and chemical characteristics to other amphibolites within the southern PRC
- to test the potential correlation to "Moyie-Purcell" mafic magmatism within the Prichard Formation of the Mesoproterozoic Belt Supergroup (1.47 – 1.48 Ga)

LOCATION

- the study area is located in the eastern Spokane Valley, near the western edge of exposed rocks of the Belt Purcell Supergroup within the southern PRC (Figure 2A & B)

Figure 1: study outcrop of amphibolite within Hauser Lake Gneiss.



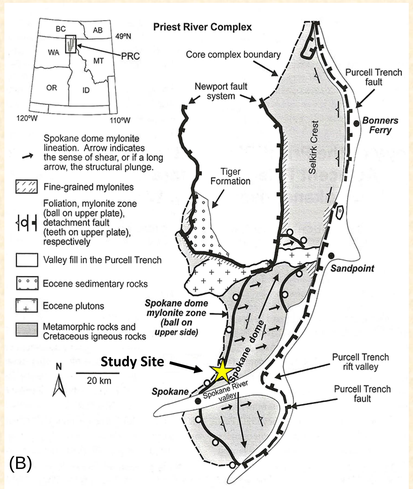


Figure 2: (A) study site location and potential Moyie magmatism correlation sites, modified after Lonn et al., 2020, (B) geologic map of the Priest River complex, modified after Doughty et al., 2016.

REGIONAL GEOLOGY

The study site occurs within the culmination (Spokane Dome) of the southern PRC, an Eocene-aged Cordilleran metamorphic core complex. The bedrock geology consists of upper amphibolite facies rocks of the Hauser Lake gneiss (a paragneiss). The Hauser Lake gneiss protolith has been interpreted to be the Prichard Formation of the lower portion of the Mesoproterozoic Belt-Purcell Supergroup (Doughty and Chamberlain, 2008). The Prichard Formation (Aldridge equivalent in southern B.C.) represents a thick sequence of quartz-rich sands and silts (Figure 3) indicative of deeper-water deposition during the early Belt sequence. Within the Prichard Formation are numerous mafic igneous sills and flows (Moyie-Purcell) that were emplaced during mid-Proterozoic rifting of Laurentia and the early development of the Belt Basin. Numerous amphibolite bodies occur within the Hauser Lake gneiss such as the one of this study and are potential Moyie-Purcell equivalents.

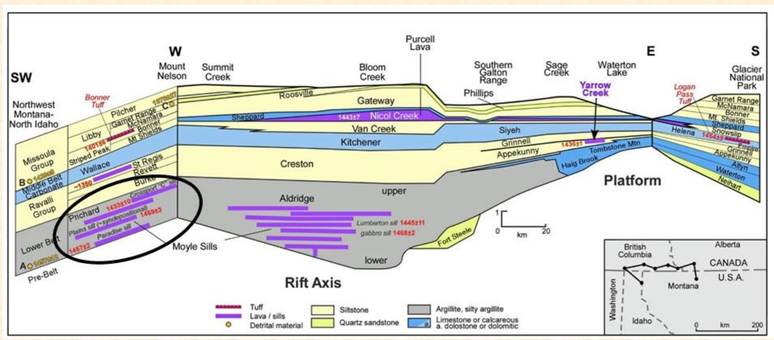


Figure 3: stratigraphic sections of the Belt-Purcell Supergroup modified from Pana and others, 2018.

OUTCROP DESCRIPTION

The amphibolite occurs within a large outcrop (100-150 m) of foliated and lineated Hauser Lake gneiss dipping 48 degrees to the west (Figures 1,4-10). The HLG consists of alternating quartzofeldspathic-rich and biotite-rich bands with abundant sillimanite and rare garnet. The tabular concordant amphibolite body has a total thickness of 17.7 m. Its western contact contains a 3 m thick garnet-rich border phase with 1-2 cm almandine garnets. The main portion of the amphibolite is coarse-grained, granoblastic with a mineral assemblage of amp+plag+pyx+qtz and minor amounts of bt+ap+zrc. The amphibolite also contains sporadic veinlets of plag+qtz. Structurally below the amphibolite is a 44.8 m thick body of coarse-grained white quartzite separated by 21.3 m of Hauser Lake gneiss. The quartzite contains variable amounts of feldspar with trace garnet and biotite.

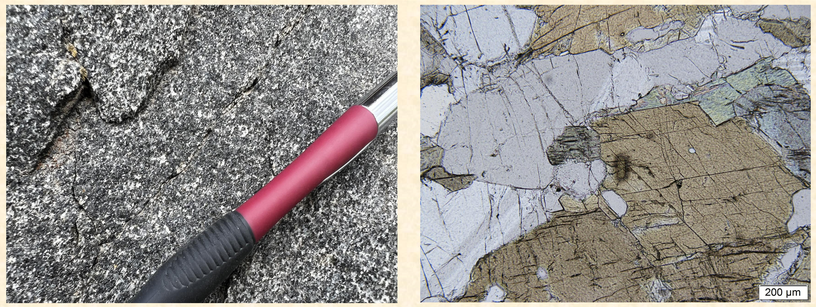


Figure 4 (left) & 5 (right): close-up and photomicrograph of amphibolite (ppl) which contains a monazite inclusion exhibiting a pleochroic halo within hornblende.

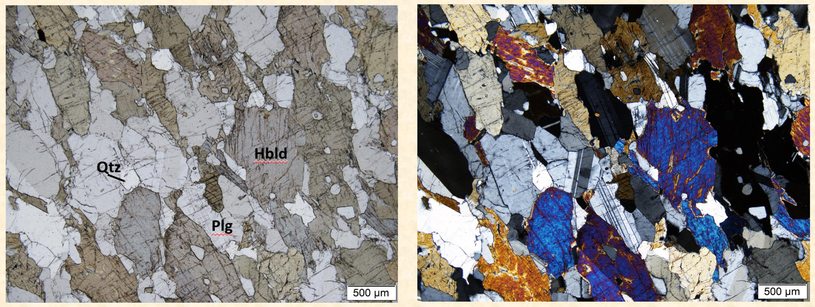


Figure 6 (left, ppl) & 7 (right, xpl): photomicrographs of amphibolite with hornblende, plagioclase, and quartz.

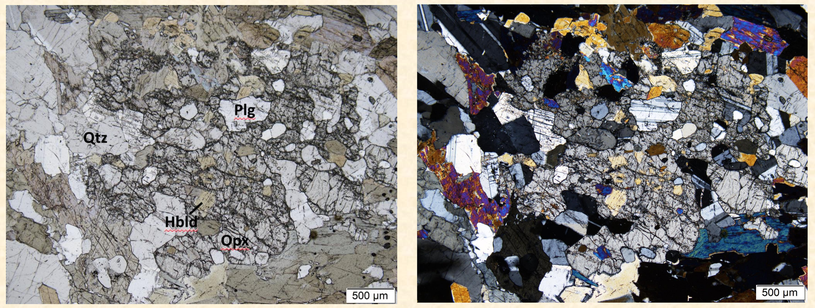


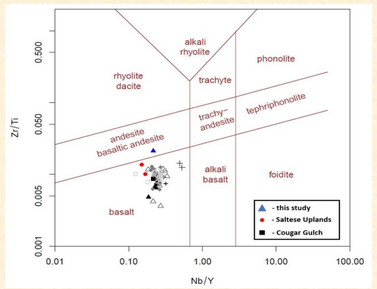
Figure 8 (left, ppl) & 9 (right, xpl): amphibolite with possible orthopyroxene (opx) and hornblende (hbld) inclusions, surrounded by plagioclase (plg), quartz (qtz), and hornblende (hbld).

Figure 10: study outcrop with west-dipping Hauser Lake gneiss (hlg), amphibolite (am), and quartzite (qtzite).

ACKNOWLEDGEMENTS

We would like to thank the Spokane Office of U.S. Geological Survey for use of their petrographic microscopes and for their help creating the photomicrographs. We also thank the Peter Hooper GeoAnalytical Lab for guidance in rock sample preparation and geochemical analysis. Marilyn Smith participated in sample collection and field assistance.

GEOCHEMISTRY



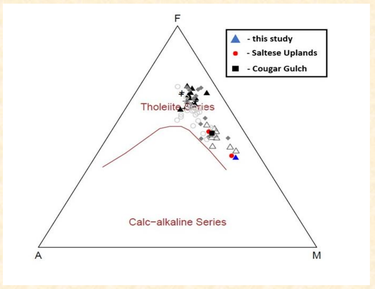
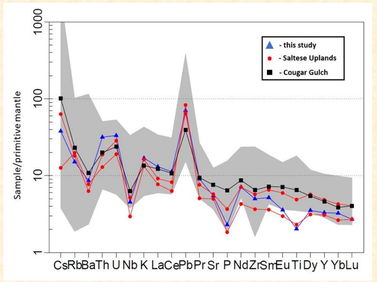


Figure 11 (left) & 12 (right): classification plot (left) and AFM plot (right) for southern PRC amphibolites (colored symbols) in comparison to mafic igneous rocks of the Plains, Paradise, and Goat Flat groups (gray symbols) from Rogers et al., 2016.



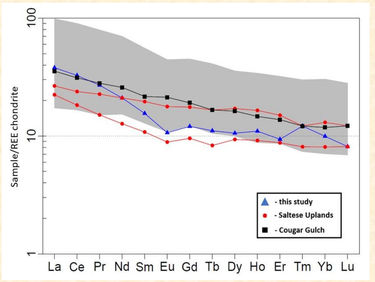


Figure 13 (left) & 14 (right): trace element (left, modified from Sun & McDonough, 1995) and REE (right, modified from McDonough & Sun, 1995) plots of southern PRC amphibolites with compositional ranges of the Plains, Paradise, and Goat Flat groups (gray shading) from Rogers et al., 2016.

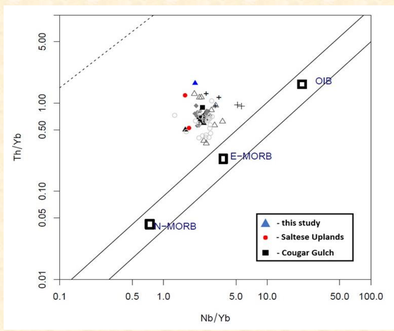


Figure 15: MORB-OIB array plot (modified from Pearce, 2008) of PRC amphibolites with compositional ranges of the Plains, Paradise, and Goat Flat groups (gray symbols) from Rogers et al., 2016. PRC samples strongly correlate to enriched mid-ocean ridge basalt with varying amounts of crustal contamination. Upper dashed line is the volcanic arc array.

CONCLUSIONS

The study examined a concordant amphibolite body in the southern Priest River complex. The project goal was to compare and correlate the study outcrop with other southern PRC amphibolites, and with known Proterozoic-aged mafic igneous units of the lower Belt Supergroup (Moyie sills). Study findings include:

- the amphibolite studied correlates to other amphibolites of the southern PRC
- the amphibolites are tholeiitic, basalt to basaltic andesite in composition with E-MORB affinities
- trace element and REE compositions correlate well with the mafic igneous sills of the Plains and Paradise groups of Moyie sill age (1.46–1.47 Ga)
- a third possible candidate for correlation are mafic dikes of the Goat Flat dike group of Rogers et al., 2016 (1.47 Ga, Chamberlain et al., 2000)

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