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The usage of biotite as an exploration vector in igneous systems, as exemplified for the 1.54 Ga Salmi batholith, Russian Karelia.

ALICE BÄCKSTRÖM[1], MR. THOMAS ZACK[2] AND KRISTER SUNDBLAD[3]

[1]University of Gothenburg

[2]Department of Earth Sciences, University of Gothenburg

[3]St. Petersburg State University

Presenting Author: gusalicba@student.gu.se

Biotite is one of the primary ferromagnesian phases in magmatic systems and its crystal lattice allows for several cation substitutions depending on the bulk rock composition of the magma from which it crystallizes. There are a large number of studies using biotite chemistry for studying magmatic evolution and petrogenesis. Furthermore, a number of studies note biotite's chemistry to be an indicator of metal enrichment. Still, the connection to mineral exploration using biotite as a pathfinder-mineral deserves more attention.

The aim of this study was to evaluate the use of biotite chemistry as an exploration vector in igneous systems. Major- and trace elements of biotite within the Salmi rapakivi batholith in Russian Karelia were analysed by LA-ICP-MS/MS. The study focuses on biotite grains from samples exemplifying different degrees of fractionation within the batholith.

The Russian Karelian rapakivi granites are connected to greisen mineralization enriched in a number of metals including Sn, Zn, Li, W and In. According to experimental studies, biotite is thought to control the formation of possible In-enrichments in granites. The results from this study do not support the suggested model and no In enrichments are recorded within the biotite chemistry in connection to a higher degree of fractionation in the granite body. However, the fractionation trend within the batholith is well-mirrored within the biotite chemistry with an almost 1:1 relationship between Rb/Ba values for biotite and bulk rock data. Additionally, enrichments of other important critical metals such as Li, Sn and W are clearly observable within biotite as the degree of differentiation increases within the granite.

The results from this study suggest that major- and trace element concentrations of biotite analysed with LA-ICP-MS/MS can serve as an important tool in exploration. The method is cheap, time efficient, does not require advanced sample preparation compared to bulk analysis and still yields comparable results. Furthermore, biotite trace element analysis can be combined with in-situ Rb-Sr dating, adding important age constrains to exploration vectors. Finally, biotite geochemical fingerprinting can also be extended to usages in provenance characterizations to give crucial information about source regions.