Investigating fluid exchange between host granitic magma, enclaves and dykes in the South Mountain Batholith, Nova Scotia, Canada

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Recent studies have suggested that mafic enclaves within the (Late Devonian) South Mountain Batholith are mela-granitic restites formed in part from the melting of metasedimentary rocks. Detailed textural studies conducted in the Sambro Head area have revealed clear evidence of magma mixing between the host granite and a mafic dyke intrusion. Textural and micro-analytical studies also show resorption textures and Ba zoning in K-feldspar megacrysts, indicating significant temperature changes, supporting the hypothesis that hybridization has occurred. However, hybridization and fluid-alteration of the dyke makes determining the original composition extremely difficult. This study aims to investigate the fluid exchange reactions between the host granitic rock and the Sambro Head dyke using whole rock relationships as well as analyses of fluid-bearing phases. Whole-rock samples from the dyke, the mixing zone, and the adjacent peraluminous granites have been collected and analyzed. Whole-rock samples were prepared by grinding portions of each specific dyke section into a fine powder, followed by a fusion at ~1500°C for 50 minutes, creating small glasses. Preliminary whole rock Electron Probe Micro-Analyzer (EPMA) results show a strong decrease in Al_2O_3 and a general decrease in metal oxides when transitioning from the mixing zone of the dyke towards its center. The dyke's mineral assemblage consists of plagioclase + quartz + biotite + oxides, along with secondary chlorite + muscovite and a significant amount of apatite, much of which appears to be primary. The extensive chlorite + muscovite replacement of biotite indicates continued fluid exchange reactions prior to final crystallization of the dyke. EPMA maps and thin section data show that this replacement is fairly consistent in all samples from within the dyke, with slightly higher replacement of biotite occurring near the edges of the dyke. The biotite selvage adjacent to the mixing zone also suggests evidence of disequilibrium and fluid exchange between the dyke and the granitic host. Small groups of cordierite can be found in similar places, along the edge of the dyke. Results will be used to create a temperature profile using existing biotite, chlorite and apatite geothermometry methods. This investigation also aims to construct a petrochemical classification of the minerals that have remained unaltered throughout the various fluid-assisted reactions in the Sambro Head dyke and thus, define primary versus secondary textures. This will in turn help define which textures can be used to determine the origin of these dykes and mafic enclaves.

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