An evaluation of alteration assemblages and fluid-inclusion chemistry in granitoid samples from the South Mountain Batholith, Nova Scotia, Canada: a tool for deciphering barren and mineralized zones

FERGUS TWEEDALE[1], JACOB HANLEY[1], DANIEL KONTAK[2], AND NEIL ROGERS[3]

1. Department of Geology, Saint Mary's University, Halifax, Nova Scotia B3H 3C3, Canada <fergus.tweedale@smu.ca> ¶ 2. Department of Earth Sciences, Laurentian University, Sudbury, Ontario P3E 2C6, Canada ¶ 3. Geological Survey of Canada, Ottawa, Ontario K1A 0E8, Canada

The Devonian South Mountain Batholith (SMB) of Nova Scotia is a large (~7300 km^2), contiguous granitoid intrusion that consists of 13 coalesced plutons of granodiorite to leucomonzogranite composition which host a variety of mineralized zones (e.g., Sn-Zn-Cu-Ag, Mo, Mn-Fe-P, U, and Cu-Ag). Given the hydrothermal nature of this mineralization, it is expected that the mineralizing fluids might manifest itself both petrographically, as alteration assemblages, and by the chemistry of secondary fluid inclusions in the granites on a scale equal to or larger than the mineralized centres. This study assesses the potential of using such information to decipher barren and mineralized areas. The novel research protocol includes: (1) detailed petrography of hundreds of archived samples that focuses on: (i) abundance and type of perthite, (ii) degree of chloritization of biotite, (iii) abundance of sericite, (iv) degree of saussuritization of plagioclase, (v) abundance of white mica, and (vi) abundance of secondary fluid inclusions in quartz; and (2) the chemistry of quartz-hosted fluid inclusions, based on SEM/EDS mound analysis from a sample suite representative of the entire batholith. The petrographic data and fluid chemistry was used to map the extent of alteration across the batholith, which indicates that fluid:rock interaction was batholith-wide and that its interaction generated Na-K-Ca-Cl-F rich fluids in addition to primary enrichment of Fe, Zn, and Cu. Specifically, two distinct fluid types are present, one Na-K-Cl and the other Na-Ca-Cl-F; this enrichment of F in one of the fluid populations is the first recognition of this phenomenon in granitic bodies on such a large scale. The occurrence of this F-rich fluid across the SMB, including its most primitive rocks (i.e., granodiorites), suggests its generation is part of the natural evolution of the system and consistent with the presence of topaz in both the most evolved phases and as an integral part mineralized greisens.

Atlantic Geology, 2015, Volume 51, Number 1
41st Colloquium & Annual General Meeting 2015
doi: 10.4138/atlgeol.2015.005