HYDROTHERMAL ALTERATION AND ASSOCIATED MINERALIZATION WITHIN A POLYPHASE INTRUSIVE COMPLEX FROM THE SOUTH MOUNTAIN BATHOLITH

M.C. Corey
Nova Scotia Department of Mines and Energy
Halifax, Nova Scotia, B3J 2X1

The Big Indian Lake polyphase intrusion (BIPI) is a 18-20 km^2 hyperaluminous complex located within a granodiorite phase of the South Mountain Batholith (SMB). The BIPI complex is comprised of four mineralogically similar, but texturally variable, phases which display intimate spatial relationships and sharp irregular contacts. Field observations indicate that the textural variations observed may be due to multiple injections of a siliceous melt through a granodiorite carapace. The most abundant phase is a texturally variable two-mica monzogranite, which is intruded by small (< 500 m^2) bodies of quartz-feldspar porphyry and leucocratic microgranite. Early, post-magmatic fluid-rock interaction extensively modified the mineralogy of these phases resulting in a hyperaluminous mineral assemblage (garnet, cordierite, muscovite). Although observed in all phases, the metasomatic overprint is most intense and pervasive within the microgranite phase.

A later shear-related hydrothermal alteration period overprinted the earlier metasomatic assemblage modifying the mineralogy to produce a zone of high alumina alteration. This zone is characterized by andalusite, cordierite, spinel, apatite, pyrite and the first reported occurrence of sillimanite within the SMB. A third, and final, lower temperature alteration event characterized by intense hematization utilized the same structure and overprinted previous alteration assemblages.

Field and petrographic evidence suggest that the intense hydrothermal metasomatic effects observed are due to an evolving fluid phase which was associated with intrusion of the last phase (microgranite) of the BIPI complex. Repeated fluid-rock interaction resulted in extensive compositional and mineralogical modifications producing a more stable hyperaluminous mineral assemblage. The alteration types within the BIPI complex are very similar to those commonly observed in porphyry Cu-Mo deposits (e.g., Climax, Henderson).

Quartz-chlorite-tourmaline greisen veins and significant vein-type W-Cu-Mo and shear-related U-Cu mineralization are associated with the hydrothermal alteration. The recognition of such widespread and pervasive hydrothermal activity, in particular the high alumina alteration, has important petrogenetic and mineral exploration implications.