Fluid:rock interaction in Proterozoic pegmatites near Sudbury, Ontario: Relevance to rare-metal mineralization

RI Lorenzo, DJ Kontak

Mineral Exploration Research Centre, Harquail School of Earth Sciences, Laurentian University, Sudbury, Ontario

Rare-metal (RM) mineralization (Li, Sn, Ta, Nb, REE) in pegmatite settings (e.g., Tanco, MB; Strange Lake, LB; Thor Lake, NWT) is considered by many to involve the upgrading of an earlier magmatic stage proto-ore due to fluid:rock interaction. This project consists of documenting and sampling exceptional exposures of a pegmatite swarm intruding Proterozoic para- and orthogneiss close to Sudbury, Ontario, which record intense metasomatism without known RM mineralization. These pegmatites are being studied to better understand the progression of alteration processes in pegmatite settings. The UTM coordinates and extent of 50 pegmatites were documented and their features were recorded photographically for primary and secondary features (e.g., textures, mineralogical associations, alteration). A library for the pegmatite swarm is being generated to illustrate the extent of alteration and the regional variation of textures. Upon examination of the pegmatites, two main groups have been established: 1) those displaying internal zonation with a megacrystic quartz core, and 2) those lacking a quartz core. To assess the extent of contamination, or fluid:rock interaction in group 1 pegmatites, petrographic and SEM-EDS studies will be integrated with in situ $\delta^{18}O$ of quartz using SIMS. This data will also be used to assess the possible regional variation of $\delta^{18}O$ in the melt and possibly address the nature and source of the pegmatite swarm. In addition, one excellent locality (approximately 30 m by 3 m) was used for a more detailed study of primary and secondary features. This outcrop was mapped in detail to capture relevant information such as graphic texture, extent and nature of primary vs. secondary mica, albitization, and degree of hematization. The pegmatite alteration is related to two different fluid sources: 1) fluids exsolved from the quartz core, which is indicated by core-proximal hematization of K-feldspar and the occurrence of garnet and muscovite clusters aligned parallel to the core margins, and, 2) externally sourced fluids that migrated through fractures perpendicular to the pegmatite contacts, which is indicated by finger-shaped muscovite-quartz symplectiites and hematization of adjacent K-feldspar crystals. In addition to characterizing the chemistry and distribution of the texture of muscovite, K-feldspar, albite, and garnet, in situ $\delta^{18}O$ of quartz will be used to document the fluid evolution of the pegmatite and extent of fluid:rock interaction.