Evaluating the Origin of Garnet, Cordierite, and Biotite in Granitic Rocks: a Case Study from the South Mountain Batholith, Nova Scotia[1]

S. Erdmann[2], R. A. Jamieson[2] and M. A. MacDonald

Evaluating the origin of garnet, cordierite, and biotite in granites provides important insight into closed- and open-system magma evolution. We present field, textural, major- and trace-element mineral chemical, and Sr-Nd whole-rock isotopic data on garnet-, cordierite-, and biotite-rich zones from the peraluminous South Mountain Batholith. We infer that: (1) garnet-rich zones of decimeter to meter size with ≤30 vol. % large, subhedral garnet with abundant inclusions of detrital country-rock monazite represent partially assimilated metapelitic country rocks, where garnet is the incongruent product of biotite-dehydration melting; (2) cordierite-rich zones tens of meters to kilometers in dimension, with ≤5 vol. % large, subhedral to euhedral, zoned cordierite, formed by crystallization from relatively evolved magmas and subsequent crystal accumulation; (3) biotite-rich zones with large, subhedral to euhedral biotite with abundant euhedral apatite inclusions, making up ≤80 vol. % (centimeter-scale) or ≤25 vol. % (kilometer-scale) of the rocks, formed dominantly by fractional crystallization throughout the chemical evolution of the batholith. Our results suggest that for garnet and cordierite, a combination of textural and mineral chemical characterization is probably sufficient to determine their origin in granites. However, for biotite and other readily equilibrated minerals, evaluating both mineral and rock textures and major-element, trace-element, and isotopic compositions is essential.

[1] *In* Journal of Petrology, v. 50, no. 8, p. 1477-1503.
[2] Dalhousie University, Department of Earth Sciences, Halifax, NS B3H 3J5.