

Geochemistry of Alkali Feldspars, South Mountain Batholith, N.S.: Implications For Petrogenesis

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The geochemistry of granitoid rocks is a poor approximation of the bulk composition of the melt from which the constituent minerals crystallized. A multitude of processes (e.g., filter pressing, accumulation, adcumulate growth, subsolidus fluid interaction) may act singularly or collectively to modify the original bulk composition of the melt and crystals. One way to circumvent this problem is by direct analysis of mineral phases which have retained their primary, magmatic compositions. Assuming that melt-crystal evolution for a given element (K_D) remained constant during magmatic crystallization, then mineral chemistry should provide a more direct and reliable means of evaluating the geochemical evolution of magmatic systems.

Alkali feldspar (Kf) separates from the South Mountain Batholith, representing the most primitive to most evolved members, were analyzed for major and trace (Rb, Sr, Ba, Li, Ga, Pb, Cs, Nb, Mo, Zr, Th, U, W, Y, REE) elements to examine the geochemical evolution of the batholith. Results are summarized as follows: (1) bulk, magmatic compositions and calculated minimum temperatures (for 1 Kbar) for the major units are: granodiorites (grnd) Or₇₀₋₇₅, 650-725°C; monzogranites (mnzg), Or₅₈₋₆₅, 650-700°C; pegmatites, Or₆₈₋₇₈, 525-400°C; (2) there is a consistent trend of increasing phosphorous (wt.%) in Kf from

grnd (0.05-0.1) to mnzg (0.18-0.35), to pegs in mnzg (0.44-0.52) to large pegs (0.56-1.08); (3) all samples conform to single, well-defined trends on Rb vs. Sr and Rb vs. Ba plots suggesting a crystal chemical control and constant K_D 's; (4) Kf from grnds show large variations (ppm) in Sr (350-220), Ba (7000-3500), Eu/Eu* (4-13) and Σ REE (19-36), but similar Rb, Ga, Cs and Pb contents; (5) Kf from some mnzgs have more primitive chemistry than Kf from grnds, and significant chemical differences between mnzg suites occur (e.g., Halifax vs Harrietsfield suites); (6) Σ REE and Eu/Eu* decrease consistently from grnd to pegs, but Yb_N values remain very similar in grnd and mnzg; (7) Kf from pegs are chemically the most variable, reflecting primarily the degree of fraction of their parent melt.

Some important conclusions that provide constraints for petrogenesis of the batholith are: (1) grnds do not represent homogeneous parental melts; (2) grnds cannot be parental to all mnzgs; (3) some significant chemical differences between mnzg suites occur indicating multiple, co-existing melts; (4) P behaves as an incompatible element during fractionation with late-stage enrichment in pegs; (5) LREE's decrease systematically during fractionation mainly due to sequestering of LREE into accessory phases and Eu into feldspar; (6) trace element (Rb, Cs, Li, REE)

contents of pegmatitic Kfs are excellent indicators of degree of fractionation (and mineral potential).

In addition to the above, one of the more significant results of this study that will be demonstrated is that chemical differ-

ences between suites not readily apparent using whole rock chemistry is more obvious utilizing mineral chemistry. This is due mainly to the lack of dilution which occurs during whole rock analyses of granites which typically contain 30-45 vol.% quartz.