
The petrogenesis of REE-enriched granite dykes in the northeastern Cobequid Highlands, Nova Scotia

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Granitoid rocks enriched in incompatible elements have been the focus of ongoing exploration for rare earth elements (REEs). High concentrations of REEs were discovered in 2010 at the contact zone between two Late Devonian to Early Carboniferous felsic igneous units in the Debert Lake area, northeastern Cobequid Highlands, Nova Scotia. REE concentrations range from 100-2000 ppm within the REE-mineralized occurrences. The main rock types present in the Debert Lake area include granitic rocks of the Hart Lake-Byers Lake pluton, felsic volcanic and volcanoclastic rocks of the Byers Brook Formation, and late diorite bodies and diabase dykes. REE mineralization is associated with a coarse-grained and pegmatitic arfvedsonite-bearing granitoid that is elevated in incompatible elements compared to the rest of the Hart Lake-Byers Lake pluton. REE mineralization occurs in late granitic dykes that cross cut all other rock types in the area and range from 1–50 cm wide. Less common are 1–25 cm wide segregated pods within the arfvedsonite-bearing granitoid. In order to study the relationship between the Hart Lake-Byers Lake pluton, the REE-enriched granitoids and the REE-mineralized dykes and pods, 22 samples were selected for petrographic study of differences in mineralogy and texture. Appropriate samples are being analyzed using an electron microprobe (EMP) for geochemical trends recorded by amphibole. U-Pb zircon age dating will be conducted to determine the timing of emplacement of the HFSE-REE-enriched dykes compared to the Hart Lake-Byers Lake pluton. Petrographic studies show a change in amphibole composition based on color of pleochroism between each granitoid phase. Amphiboles within the incompatible-enriched granitoids consistently show dark-blue or black to greenish-brown pleochroism, indicative of arfvedsonite, compared to green to yellow pleochroism in the Hart Lake-Byers Lake granite. This evidence is consistent with EMP results on amphiboles which show higher sodium and iron content within the REE-enriched granitoids compared to the Hart Lake-Byers Lake pluton.