Geochemistry of the 1066 Ma Little Hatchet rapakivi granite – gabbro pluton, New Mexico, USA

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The Little Hatchet Mountains in Hidalgo County, New Mexico host one of the southern-most exposures of Proterozoic basement rocks in southwestern United States. Mapping in the southern Little Hatchet Mountains has revealed relatively unaltered outcrops of hornblende granite, rapakivi-textured biotite granite, and gabbro comingled with the rapakivi granite that form a 5 by 4 km pluton. The rapakivi granite is dated at 1066±5 Ma (LA-MC-ICP/MS, U-Pb on zircon), which suggest affinity of the pluton to the southern Laurentian ~1.1 Ga bimodal magmatism.

Geochemically the Little Hatchet granites are A-type, subalkaline, metaluminous to peraluminous, and save for minor differences, similar to the coeval (~1.08 Ga) K-series granites of the Pikes Peak Batholith in southern Colorado and the Enchanted Rock Batholith granites of the central Llano Uplift region in central Texas. The Nd isotope composition (ID-TIMS, whole-rock) of the granites (εNd_i = +0.5 and +1.1) is more radiogenic than that of the surrounding country rock ($\varepsilon Nd_{@1066\ Ma}$ = -0.8), which combined with the geochemical evidence suggests a similar lower crustal origin to the Little Hatchet granites as envisaged for the K-series of the Pikes Peak Batholith and the Enchanted Rock Batholith granites. The Nd isotope composition of the gabbro overlaps with those of the granites, but is marginally more juvenile (εNd_i = +0.9 to +1.5), which allows for an upper mantle origin, but interaction with the granitic magma may have affected the isotope composition of the mafic magma.

In situ oxygen (SIMS) and Hf (LA-MC-ICP/MS) isotope analysis of zircon from the rapakivi granite reveals a juvenile isotope signature ($\delta^{18}O$ = 3.9±0.7 ‰, 2σ, n=39; εHf_i = +3.5±2.4, 2σ, n=21) comparable to the juvenile Nd isotope composition. The relatively low $\delta^{18}O$ values may reflect granite source enrichment by recycled oceanic crust.