

Fingerprinting thermal, hydraulic, and tectonic activity via REE phosphate compositional evolution: Mt. Monadnock region, New Hampshire, USA

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We are investigating REE phosphate compositional evolution, and possible correlations with sediment source, pluton proximity, and structural level, in the 15'x15' Monadnock Mountain Quadrangle. Chemical variation is examined independent of and prior to U-Th-total Pb EPMA age determination to avoid temporal biasing in assignment of compositional domains.

Examination of Ce/Y and Th/U variation in monazite allows 1) modeling of monazite growth relative to the mass fraction of garnet grown along a single monazite Ce/Y vector; 2) *T*-bracketed monazite growth at xenotime saturation; 3) Th/U-based discrimination of hydrothermal vs. migmatic monazite growth sequences. Additionally, LREE (La-Sm) show decoupled La/Ce, Sm/Nd, and LREE/Th trends between "typical" metamorphic monazite with restricted compositional variation ((La/Ce)_N ~1.4-1.5, Sm/Nd ~0.15-0.18, La/Th ~5-7), monazite from samples proximal to ~400 Ma plutons (dispersed La/Ce, increased Sm/Nd, decreased LREE/Th), and actinide-poor monazite cores (La/Th ~10-200, La/Ce < 1.2) found only in samples below the Chesham Pond thrust fault.

Xenotime inclusions in garnet cores tend to higher Dy/Yb and Sm/Nd ratios than does matrix xenotime, though the overall compositional variability in xenotime inclusions in garnet may be much greater than that displayed by matrix xenotime. Multiple growth domains in matrix xenotime are common, and are most clearly delimited by Yb variation.

Compositionally-delimited monazite growth events correlate with 1) New Hampshire series plutonism between 410-400 Ma; 2) regional low-P metamorphism between 380-355 Ma. Sample RX-186, 200 m from the 354 Ma Fitzwilliam Granite, records a monazite growth event at 349±8 Ma (wtd. avg. ± 1 s.e.). Two upper plate samples proximal to the Brennan Hill thrust fault (BHTF) record monazite growth events of 297±7 Ma (RX-186) and 295±3 Ma (2D). Furthermore, BHTF hanging wall sample 2A2 was contemporaneously ~40°C hotter (660±30°C) than footwall sample 2D (620±30°C) at 360±6 Ma. This constrains movement on the BHTF to after ~360 Ma; the monazite growth events recorded in RX-186 and 2D imply BHTF movement may have been as late as ~300 Ma.