Vertical streamline integration of U-series disequilibria in basalts

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Building on recent efforts to create more broadly accessible and flexible computing tools for forward modeling of basalt geochemistry, this project presents a two-dimensional integration and computing tool for time-dependent melting calculations of basalt generation by partial melting. This work aims to deliver a Python coding solution for a streamline integration routine that simulates simplified triangular corner flow in a decompression melting regime, after the solutions of Asimow et al. [2001] and McKenzie and Bickle [1998]; the model thus neglects 2D velocity solutions for mantle convection but conserves mass within each streamline. The model calculates the U-series isotope disequilibria ($(^{230}Th/^{238}U)$, $(^{226}Ra/^{230}Th)$, and $(^{231}Pa/^{235}U)$ activity ratios) generated in the integrated, aggregated partial melts during 1) time-dependent melting with either chemical equilibrium (porous flow) or disequilibrium transport mechanisms [after Elkins and Spiegelman, 2019; Spiegelman, 2000; Spiegelman and Elliott, 1993], and 2) subsequent disequilibrium transport and radioactive decay following melt segregation, as each melt portion travels laterally along the base of the lithosphere towards the mid-ocean ridge axis. The model includes the capability for lithospheric truncation of the melt regime, using methods similar to Asimow et al. [2001], but preserves the transport time between the final melting depth and the top of the simulated regime. Future efforts are expected to address omission of melts generated at the far corners of the melt regime, which may not efficiently segregate and join the aggregated liquid at the ridge axis; and integration of this model code with other ongoing efforts (e.g., the full *pyUsercalc* code, and combined two-lithology melting scenarios).

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