# The effects of two-lithology mantle melting on U-series in basalts

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Melting in a lithologically heterogeneous mantle is expected to impact magma supply, crustal thickness, and magma transport. Oceanic basalts are products of mantle melting and thus potential indicators of such heterogeneity, but basalts record complex histories that can be difficult to uniquely interpret. Uranium-series isotopes are well-suited to fingerprinting diverse lithologies due to variations in 1) source mineralogy and U-Th-Pa-Ra partitioning, and 2) lithologic melt fertility and the series' particular sensitivity to melting rates. However, such interpretations to-date have been hampered by a lack of constraints on the melting behavior of mafic rocks under mantle conditions.

Recent, experimentally-based parameterizations for pyroxenite melting, and the application of those new calibrations to two-lithology melting calculations [Lambart et al., 2016, JGR, 10.1002/2015JB012762; Lambart, 2017, GPL, 10.7185/geochemlet.1728], constitute significant improvements to our predictions for pyroxenite melting. Here we use the outcomes of those parameterizations and of energy-constrained two-lithology melting calculations to produce a refined set of melt fractions and mineral modes during adiabatic melting. We tested the effects of melting upper mantle containing 10% pyroxenite for a range of mantle potential temperatures. In agreement with recent work [Lambart, 2017], we find that productivity variations for two-lithology melting regimes have a significant impact on resulting melt mixtures, with particular dependence on pyroxenite compositions and resulting solidus temperatures.

The resulting melt fractions and partition coefficients will next be used to determine U-series disequilibria for pyroxenite- and peridotite-derived partial melts and mixtures thereof. We will consider 1D, continuous numerical solutions for both dynamic melting and reactive porous flow scenarios, allowing both the degree of melting and the mineral/melt partition coefficients to vary non-linearly. We expect the resulting predicted basalt compositions to better approach the effects of heterogeneous mantle melting on U-series isotope disequilibria in basalts.