Interplay of mantle temperature, composition and upwelling, and lithosphere extension during continental breakup

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Basaltic magmatism associated with continental breakup provides fundamental insights into mantle and tectonic processes associated with the Wilson Cycle. The roles of plumes, source fertility, continental insulation, and edge-driven convection in generating breakup-related magmatism remain controversial because magmatism is controlled by a complex relationship between mantle temperature, composition, upwelling rate and lithosphere thickness. To constrain the relative importance of these variables during continental rifting/breakup, we employ our forward melting model, REEBOX PRO [1], which simulates adiabatic decompression melting during passive and active upwelling of a lithologically heterogeneous source using experimentally-constrained thermodynamic expressions for melting. The model has been expanded to include new parameterizations for the melting behavior of harzburgite, hydrous peridotite, and three types of pyroxenite, and now allows for scenarios involving incomplete melt pooling. Mean upwelling rates are calculated from the net buoyancy of the source, which is constrained using the thermodynamic model Perple_X [2]. REEBOX PRO outputs include the trace element and isotopic compositions of pooled melts, and igneous crustal thickness. We apply the model to several different rifted margins, as well as the nascent Afar rift, where the lithosphere is known to modulate magmatism. These results will be compared and contrasted with recent results for the North Atlantic Igneous Province [1].

[1] Brown & Lesher (2014), *Nature Geoscience* **7**, 824-828 [2] Connolly (2005), *Earth and Planetary Science Letters* **236**, 524-541