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Role of phase changes on the pattern of upper mantle flow beneath mid-oceanic ridges

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The seismic discontinuity at 410 km depth is widely accepted to result from the Olivine-Spinel phase transition in the upper mantle. Most of previous works have focused on the interaction of Olivine-Spinel phase transition with a cold descending slab or a hot up welling plume. Less attention has been paid to the effect of the phase transition on the passive flow resulting from plate motion.
Here, plane-strain thermo-mechanical finite element model experiments are used to investigate the role of exothermic phase change at 410 km depth on the pattern of passive upper mantle flow beneath mid-oceanic ridges. Consequences of upper mantle viscosity structure, dehydration strengthening, depth dependent thermal expansivity, variation in Clapeyron slope, magnitude of density jump, and the thickness of layer with exothermic phase change on the pattern of passive flow and depth of upwelling are explored. The results are tested for varying spreading rate. Further modeling investigated the variation in the pattern of upper mantle flow, when two exothermic phase changes with two different thicknesses have been considered at 410 and 520 km depths.