A 2D double-porosity ridge model constrained by observations

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Purpose of this study

The purpose of this study is to build a 2D double-porosity model to simulate channelized melt migration beneath mid-ocean ridges. We will show that the observed fine-scale channel networks can be integrated in one geodynamic model constrained by geochemical and geophysical observations.

Preview of results

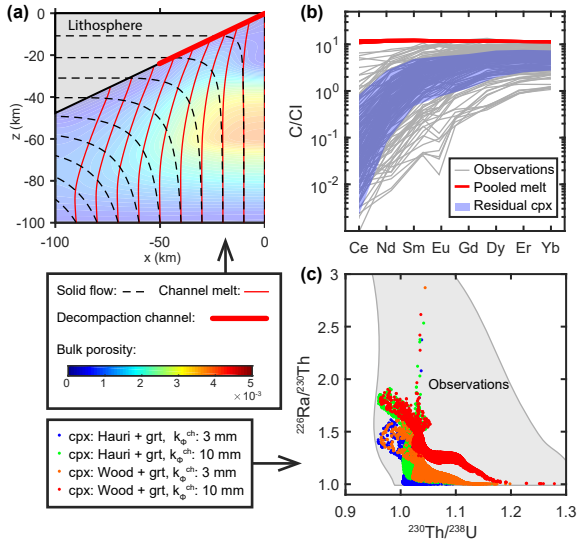

Figure 1 (a) An example of ridge model. (b) Predicted REE patterns in pooled melt and residual diopside. (c) Predicted ($^{230}Th/^{238}U$) and ($^{226}Ra/^{230}Th$) in fractions of extracted melts.

The fine-scale channel networks are treated as a continuum to model the melt extraction and melt transport. The distribution of porosity depends on the rate of melt extraction and the permeability in the peridotite matrix while the melt velocity in the channel is controlled by dunite permeability. The predicted porosity distribution and melt transport rate have consequences on REE patterns in residual peridotites and pooled melt, and U series activity ratios in fractions of extracted melts. This study provides a platform to reconcile independent observations and for studying melting and melt migration in a heterogeneous mantle. For example, depleted REE patterns in residual diopside and high ($^{226}Ra/^{230}Th$) ratio would be produced by channelized melt migration starting from 60 km depth (Fig.1).