

## Comments:

**Line 70:** Is there an effect of other discontinuities (e.g. at 410 km) as well? Do you include phase changes in your models?

**Line 73:** What would be the effect of a free surface as boundary? Do you emplace the extracted melt at the top?

**Line 77:** What do you mean with “real temperature space”? Below the lithosphere?

**Line 81:** Do you also include latent heat? Do you think it would have a big effect on the results?

**Line 90:** It would be nice to see a sketch showing the parameters  $w$ ,  $T_o$  and  $T_c$  with varying geometries (maybe as zoom in Figure 2?)

**Line 90:** maybe replace “,” with “and” and add some words at the end: *Hence, we systematically explore parameters age of the oceanic lithosphere ( $\tau_o$ ) and age of the continental lithosphere ( $\tau_c$ ) describing the different lithospheric thicknesses.*

**Line 94:** Does this mean, that after melt extraction (depletion) it becomes more difficult to melt the residual? And if yes, how it is done? (see also comment **Line 114**)

**Line 94:** Is the mantle depletion not increased by melt extraction rather than melting? As long as melt is not extracted it would not deplete the material, right?

**Line 97:** How  $F$  (depletion) is updated after melt extraction? Is after melt extraction (e.g. 10%)  $F$  increased by 0.1 locally on the marker?

**Line 100-101:** How you exactly construct your mid-ocean ridge model? You changed the geodynamic setting by keeping boundary conditions? Do you have extension? Do you then check what is the amount of melt that could be extracted leaving behind depleted residuals? How long do you run these models? Is the depletion constant for one age? How it is exactly done? Please add some Details! Maybe add a sketch.

**Line 102:** Maybe change the sentence slightly:

*For the initial depletion profile at the base of the continental lithosphere, we have chosen to impose the same ridge depletion as in the oceanic side **and added additionally** a depleted lid (with  $F = 1$ ) **on the top on the continental part** (figure 2b).*

**Line 102:** You use the depletion profile for the sub-crustal continental lithosphere right?

**Line 104-105:** Is the thickness of the lid the crust thickness? Adjusted for models with different continental lithospheric thickness? The crust follows the 0.9 Tref? If it is the lithosphere, then maybe replace “to” with “that”. How the crust thickness changes with changing lithospheric thickness?

**Figure 2:** Can you label it? Where is the LAB (maybe isolines)? Where is crust and continent, the edge?

**Line 112:** Is the only difference between depleted and enriched peridotite the water content?

**Line 111-113:** Is the total melt averaged from the different laws?

**Line 114:** Do you emplace the melt somewhere after extraction? And do you deplete the material left behind after melt extraction? If yes, how? Is it dependent on the amount of extracted melt?

**Line 125:** Why it is important that the slope of the viscosity profile along adiabat remains the same?

**Table 1:** What is with phi used in equation 1, maybe list it as well?

In the table latent heat is mentioned, in which equation this parameter is included?

Are the values in front of the brackets always the reference values? If yes, please say this in the caption.

**Line 129:** Maybe add a small introduction in that paragraph.

**Figure 3:** Maybe add important values that you have changed for other models then it could be easier for the reader to compare the figures (e.g.  $E_a$  and viscosity) (**also for Figure 4**). Maybe describe also the meaning of the arrows. Maybe it would be also nice to see other plots than temperature, for example different rock types/depletion stages and how they are mixed with time.

**Line 141:** Why stresses induce the bump?

**Line 143-145:** What do you mean? You have to shift material below the base of the lithosphere to induce melting? Because you have to increase the temperature of lithospheric material to exceed the solidus curve?

**Line 154:** Maybe write: Figure 4b

**Figure 5a:** typo: Pa s

**Figure 6:** typo in (b): Pyroxenite/Total. First line: reference viscosity (typo?); Point is missing at the end of caption; Why  $z = 206$  km is used, please clarify;

**Lines: 191-193:** You define the amount of enrichment only the amount of pyroxenite melting, right? Or is the amount of melt considered as well? Do you track the chemistry of melt?

**Line 222:** why SSC = 48+40 Myr? Why +40?

**Line 249:** typo? from 15 % to 25 %?

**Line 278-280:** Which of your results are then realistic and which not? Is the EDC seen in your models sometimes just an artefact because of the metastable conditions at the beginning? Would it be then not better to start with a middle ocean ridge next to a continent to see the real evolution?

**Line 341-342:** Maybe the paper of Tobias Keller could be interesting: [Keller, T.](#) , Katz, R. F. and Hirschmann, M. M. (2017) Volatiles beneath mid-ocean ridges: deep melting, channelised transport, focusing, and metasomatism. *Earth and Planetary Science Letters*, 464, pp. 55-68. (doi:[10.1016/j.epsl.2017.02.006](https://doi.org/10.1016/j.epsl.2017.02.006)).

**Line 387:** I would add “low” (e.g. low  $E_a$  and/or low  $\eta_0$ )

**Line 83 and Line 220, 339:** maybe delete “,” before “;” in the citation

**Line 125:** typo: we slightly

**Line 206:** typo: Figure 7

**Line 260:** typo: H<sub>2</sub>O

**Line 284:** typo: many of our results

Maybe it is better to use always our and we instead of my and I: **Line: 287, 293, 303, 345, 352, 353, 368**

**Line 318:** typo: with a spacing

**Line 394:** typo: replace "." with ","