

Dear Editor and Reviewer,

Thank you for the further suggestions to improve on the manuscript. We considered all comments and excluded the chapters on the rheological and geochemical implications. We still write about these (potential) implications shortly in the discussion, but we refer to detailed studies (when available) and clearly state the limitations of the model to constrain deep lithosphere processes. For the additional minor comments, please read our responses below. The comments of the referees are in *Italic*, our reply is in normal font. We have also added a marked-up manuscript version where all the changes in the text can be found.

Kind regards,

Eszter Békési and co-authors

REVIEWER #1

The revised manuscript of Bekesi et al. addressed almost all my previous comments and this will be an appropriate contribution in Solid Earth. My only remaining major comment addresses chapters 5.3-5.4 about the rheological and geochemical implications. After addressing this one point and considering a few minor comments, the manuscript will be ready for publication.

Major comment: Chapter 5.3-5.4: Rheological inferences and geochemical implications: In my opinion, these chapters are still not connected to the rest of the manuscript. The parameters and statements here are not discussed, the limitations behind the assumptions are not provided. As also pointed out by Nicolas Coltice, the thermal model is not particularly sensitive to temperature variations in the mantle and therefore, this model is not suitable for addressing the actual depth of xenoliths. The authors need to choose between two possibilities: they either provide a real discussion behind these topics, including the role of inherited structures in the crust, assumptions on grain size variations, and water content, etc. How realistic is it that the entire mantle is proposed to be described by a wet olivine rheology; what is the possible temperature variation and error within mantle depth in different models, etc. Or these sections should be kept out from this manuscript and could become an interesting independent paper.

Further comments:

1. Ln. 92: show the location of the “Mid-Hungarian Shear Zone” on one of the maps or in the cross-section.

We added the location of the Mid-Hungarian Shear Zone to Fig. 2.

2. Ln. 125-126: The paper by Faccenna et al. (2014) did not propose that the overriding plates prior to back-arc extension had an overthickened lithosphere. On the contrary, we assume

a thick crust and hot lithosphere, such as having a shallow LAB, the isotherm being much warmer than steady-state solutions.

We corrected the references on the overthickened lithosphere, and limited the assumption based on Faccenna et al. (2014) to the selection of the crustal thickness.

3. *Figures: it is not an ideal choice to plot the “temp. obs.” by grey dots on an already grey map*

Corrected.

4. *Figures: when showing continuous physical fields, including the stretching factors, with the chosen smooth color scales, please add iso-contour lines, otherwise, it is nearly impossible to read the values. This is already very well done in Fig. 9*

We added isolines to Fig.5, and indicated the temperature values both in Fig 5. and 6.

5. *Ln. 284: pre grid cell?*

Corrected.

6. *Fig. 6: Given the Range in the southeastern part of the model area is clearly affected by shallow-water circulation and related thermal effects in the porous limestones, I suggest you indicate the boundary of this unit. Furthermore, I suggest also indicating the area of the Rechnitz complex in Figs. 5-6, where the used approximation clearly does not work.*

We outlined the area of the Transdanubian Range built up by outcropping carbonate rocks, affected by shallow fluid flow in Fig. 6. For the Rechnitz core complex, the shallow part of the present-day model (<10 km) can be considered reliable, so we do not show its outline. In the text, we discuss about the validity of model parameters in the Rechnitz area, and we added its outline to Fig. 5, indicating that the prior and posterior stretching factors are not fully realistic in there.

7. *Chapter 5.1: Please also clearly write in this chapter about the fluid flow effects, particularly affecting the Range and the porous limestone reservoirs. Furthermore, you need to also write here that areas, such as the Rechnitz complex were likely affected by different upper and lower crustal stretching factors and the applied method is not suitable to account for such effects connected to metamorphic core complex formation and exhumation.*

We clearly list the most important model simplifications in section 5.1 in the revised ms. We added further discussion on the effects of fluid flow that is relevant to the shallow part of the model also in this chapter. We extended the discussion on the model simplifications and limitations in the peripheral parts of the basin, most importantly in the Rechnitz core complex.

8. *Chapter 5.3-5.4: Rheological inferences and geochemical implications. In my opinion, these chapters are still not connected to the rest of the manuscript. The parameters and statements here are not discussed, the limitations behind the assumptions are not provided.*

The authors need to choose between two possibilities: they either provide a real discussion behind these topics, including the role of inherited structures in the crust, assumptions on grain size and water content, etc. How realistic is it that the entire mantle is proposed to be described by a wet olivine rheology, etc. Or these sections should be kept out from this manuscript.

We excluded these sections from the revised ms., and only extended the previous section with a short discussion on the rheology based on Porkoláb et al. (2025). Additionally, we briefly mention the potential geochemical implications of the thermal model to constrain the depth of mantle xenoliths, clearly stating the limitations of the thermal model to constrain deep lithosphere processes.

9. *Ln. 521: the locations of Tihany, Szigliget, Fuzes-to, etc are not shown anywhere in the manuscript.*

We eliminated this section from the revised ms.