



EGUsphere, referee comment RC1
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Comment on egusphere-2022-62

Nemanja Krstekanic (Referee)

Referee comment on "Control of crustal strength, tectonic inheritance, and stretching/shortening rates on crustal deformation and basin reactivation: insights from laboratory models" by Benjamin Guillaume et al., EGU sphere,
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General comments

In this manuscript, the authors use crustal-scale analogue modelling to study a complex tectonic system in which indentation-driven and extrusion-driven deformation overlap in space and time and result in different coeval tectonic regimes. The topic of this research is very welcome as there is still a lack of knowledge on various controlling factors of such processes' interplay. The manuscript is well structured and written, scientifically very valid, with a clear description of the methodology, results, interpretations and conclusions. The title is informative and reflects the content of the manuscript, while the language is good. Taking all of that into account, I consider it a nice contribution to Solid Earth.

I have a few moderate to minor comments that I'll point out below. Also in the attached annotated pdf of the manuscript, I have smaller comments that I hope will help the authors clarify a few minor things in the text.

Specific comments

- Referencing existing publications is generally very good in the manuscript. However, I would suggest to slightly expand the comparison with existing studies of the complex interplay of different tectonic regimes, both in the Introduction when introducing the studied problem and in the Discussion when comparing to the novel results of this paper. Several relatively recent papers deal with indentation and extrusion or interplay

of different tectonic regimes, using both analogue modelling and field data. See also annotated pdf.

- Section 4.1: While I generally agree with the content of this section I think it is too long and can be shortened. Also, this section would apply more to the homogeneous system, while in all models in this study there is a rheological and/or structural heterogeneity, which, in my opinion, significantly influences the deformation. It is not only the distance to the model margins (i.e., indenter and extrusion-related pull). I think the limitation of the modelling setup (i.e., relatively low amount of total shortening) has an impact on the evolution of thrusting, as thrusts will form after a certain accumulation of shortening. I think it is not only the extension/shortening ratio but the total accumulation of strain that plays an important role. This issue should be discussed more in this section. Another factor that should be taken into account is the compressional wedge that forms close to the indenter. This wedge increases the vertical load in the model, therefore increasing the vertical stress, which significantly affects the distribution of stress and strain in the model. I think all these factors should be considered and better discussed in this section. So, my suggestion is to modify section 4.1 to make it more concise and focused, while discussing all factors that affect the tectonic regime(s) in the models.
- Orientation of strike-slip faults: I made several comments in the annotated pdf about the change of strike-slip fault orientation as this is one of the important results of this study. Please consider that some of them can be boundary effects, or that some of them are indentation-driven or extrusion-driven. This last terminological distinction can be considered, but it is just a suggestion, authors do not have to accept it. Anyway, I think a bit more discussion about what controls the strike-slip fault orientation is needed in section 4.2.
- Referring to figures should be stronger in the text. I suggest to authors to refer to figures more often. This will make the connection between the text and figures much stronger and will help readers to follow the text more easily.
- Figures are generally good and informative. However, I have a few suggestions on how to improve them:
 - Maybe it would be good to have an additional figure (maybe new Fig. 1) to accompany the problem statement and to illustrate the processes and some natural examples mentioned in the Introduction.
 - When a figure has more than one panel, I suggest putting a letter on each panel to make it clear which part of the figure authors refer to in the text (e.g., Fig. 3c).
 - Panels in figures 3, 4, 5, 8 and 13 are too small and it is difficult to read them. Try to make panels larger.
 - I understand why it is important to show plots of principal stretches because they are used to derive strain type. However, these plots are not necessary here and are not discussed in the text. They also take space that can be used to make other panels larger. I suggest moving principal stretches plots from figures 3, 4, 6, 7 and 9 to Supplementary Material and maybe combining figures 3 and 4 and also figures 6, 7 and 8. This will reduce the number of figures (which is already large), while no information will be lost.
 - Other smaller comments about figures I added in the annotated pdf.

Technical comment

- There are just a few typos and some technical errors I managed to see. I marked them in the annotated pdf. Otherwise, the text is technically very good.

I'm looking forward to these small corrections and the publication of this manuscript.

Please also note the supplement to this comment:

<https://egusphere.copernicus.org/preprints/2022/egusphere-2022-62/egusphere-2022-62-RC1-supplement.pdf>