Solid Earth Discuss.,
https://doi.org/10.5194/se-2019-56-RC2, 2019

Solid Earth
Discussions
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Interactive comment on "Late Miocene thrusting in the North Alpine foreland: Driven by a deep-seated process and shaped by the local mechanical stratigraphy" *by* Samuel Mock et al.

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Received and published: 12 April 2019

Dear Editor, I have reviewed the paper of Mock et al. on the Late Miocene tectonic history in the Miocene. The paper presents some new age-data from the Swiss part of the Molasse and these data are then discussed in a general tectonic framework of the Alps. The main problem of the present paper is that there is a general confusion between regional and local geology. The Author jump continuosly from the Central Alps tp the entire chain, so that is difficoult to understand what they mean. I would suggest to use a strict nomenclature (Central Alps Molasse, Eastern Alps Molasse and so on). If the Authors want to keep a broader view on the general problem of the Molasse Basin in

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the Alps, then they need to clearly describe similarities and differences between Central and Eastern Alps, in particular if these could play a significant role in their model. I have nothing against the proposed tectonic interpretation, but I would find difficult to extend the tectonic effect of the ECM to the East, where the structure of the Alps is different. This point should somehow be discussed. Furthermore, the present data are mostly localized and would not support an interpretation on the general evolution of the Molasse. See my further comments on the specific paragraphs.

Regards, Nicola Levi

In general, I find the abstract a little complex to understand. Line 9-11 I don't really understand what the Authors want to state with this sentence. I don't understand "vertically directed tectonics" but then they state that they have back-thrusting, that would rather fit into the normal accretion processes. I think this needs to be explained a bit better. 15-17 This sentence is a bit long and complex. I would split into separate sentences.

General comment on the introduction. The geological background is after the introduction, thus the reader is loaded with information that are not easy to understand. Some of these information could be shifted to the geologic introduction. As discussed above, this chapter is focused on the Central Alps, but there is little on the evolution of the Eastern Alps, which is also part of the study area.

Page 2 Line 8 I would add also the interesting studies of Hinsch (I think is on Acta Geologica Carpatica) on recent basin tilting and erosion, which could provide also some constrains for the current study.

Page 2 Lines 11 From this point on the Authors refer to the Northern Alpine foreland in Switzerland, whereas before they were considering the entire basin. Maybe a different nomenclature would help the reader understanding these differences.

Page 2 Line 20 There are many papers on that topic also in other sectors of the Alps

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(Hinsch, 2013; Beidinger and Decker, 2014 and so on).

Page 2 Line 32 I don't understand what the Authors mean with "change of thrust tectonics". Do they mean change of tectonic regime?

Page 3 Line 10 In which sector of the Molasse?

Page 3 Line 15-20 As comment as above.

Page 4 Geologic Background If this is the introduction of the study area, then the Authors should described also the Eastern Alps, as at page 3 (line 23) they state that the study area extends from Geneva to Salzburg. This point would need some corrections here and there in the entire paragraph. The nomenclature, the relationships and so is all limited to the Central alps.

Page 4 line 23 I don't understand if the Authors are talking about the Molasse Basin in the Central Alps or in general, as in the references there are some papers on other sectors and they state the study area extends also in the Eastern Alps. This should be better specified. See also point above.

Page 5 line 21 Also here there a little of misleading information, as the Authors talk about Molasse Basin, but actually describe only the basin in the Central Alps. This paragraph need more space and figures, such as stratigraphic columns, correlations and so on. I would also point out the characteristics of the substrate of the Molasse, as this might play also a role in the development of the compressional structures.

Page 8 4-2 Late Miocene shortening estimates in this paragraph there is a little confusion between data from the Central Alps and from the Eastern Alps.

Page 8 line 15 This part is a little confusing. The Authors stop their estimation of shortening in the area of Salzburg, but further to the East the shortening is significant, tens of km! Furthermore, I don't understand how they extrapolated a less than 1km of shortening in the area of Salzburg. They should explain this part better. Is this shortening estimated just from map data? Is there any balanced section available?

This needs to be explained. Check also the paper of Hinsch that contains data in this area.

Page 9 line 5 what is the meaning of a syn-tectonic strike-slip fault? Any fault is syn-tectonic by definition. Explain better.

Page 9 line 13-16 Instead of strain release pattern I would rather use something like change of structural style and thrust-spacing. The term strain partitioning refers to a very specific condition.

Page 9 line 15-18 I understand the meaning of this sentence, but is a little complicated. Maybe I would suggest to explain better what the Authors want to state.

Page 9 line 20 If the Authors want to use the term “strain partitioning”, they need to bring some more evidences supporting that. Different thrust spacing with the same tectonic directions can be generated by many tectonic processes.

Page 9 24 Why re-activated. Please explain better.

Page 9 29 I would make clear that this is valied for the Subalpine Molasse in the Central Alps, as in the Eastern Alps the tectonic framework is completely different.

Page 10 line 5 Actually the Easternmost part of the Molasse is described also by Hinsch 2013 and Beidinger and Decker 2014.

Part 10 line 15-22 I find this part a little weak. There should be a more comprehensive discussion on the tectonic of the entire frontal part of the Alps, or otherwise to limit the model only to the Central Alps, leaving the rest out. For example, in that time-span there a lot of syn-thrusting strike slip faulting in the frontal part of the Eastern Alps that should be considered (See Peresson and Decker 1997 and many others). There are also other large tectonic elements in the game, that could play a role in the deformation of the Molasse.

Page 11 line 18. As far as I remember Hinsch describes laterally varying structures

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and timing in the eastern part of Eastern Alps. This data needs to be discussed in the present paper.

Comments on the figures. Fig. 1 As in the text there is are many comments on the ECM, I would put them on the map. I would also include the major tectonic elements, such as the various tectonic windows and other elements that could play a role. The tectonic section shows the structure of the Central Alps, but how about the rest of the Molasse Basin? I would add a section also further to the East, where the deformation in the Molasse happened in a completely different tectonic framework.

Fig. 2 It took me 10 minutes to understand why the SW-NE striking thrust-faults look E-W oriented. Please, rotate the map with North oriented vertically.

Fig. 5 I would extend this picture further to the East, and add more details on the major tectonic elements here, to show what is going on at the Eastern end of the Molasse. Furthermore, how was that shortening estimated? This is not clear in the text and apparently does not fully agree with some of the data published.

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