

Solid Earth Discuss., author comment AC2
<https://doi.org/10.5194/se-2021-46-AC2>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC2

Amir Kalifi et al.

Author comment on "Chronology of thrust propagation from an updated tectono-sedimentary framework of the Miocene molasse (western Alps)" by Amir Kalifi et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-46-AC2>, 2021

Dear editor,

Here follow our responses to the review by Fritz Schlunegger (RC2) of our manuscript submitted to Solid Earth.

Reviews are listed in black - italic while our answers are in blue - bold text.

Referee comment on "Chronology of thrust propagation from an updated tectonosedimentary framework of the Miocene molasse (western Alps)" by Amir Kalifi et al., Solid

Earth Discuss., <https://doi.org/10.5194/se-2021-46-RC2>, 2021

Dear Authors, dear Editor

It is usually a significant challenge to intergrate various sources of data into a comprehensive and conclusive framework. This paper is an excellent example of how this can be achieved. I congratulate the authors for their work, which I enjoyed reading. This has been very well done!

Thank you

The material is presented in such a way that the reader can follow the way of how the authors reach their conclusions, and why. The readers are given access to a wealth of material that has been integrated in this manuscript. Therefore, from a scientific point of view, this work is very solid, reproducible and should be published.

What has not been fully clear to me is the separation of previously published data (in the authors' Sedimentology paper) and their original contribution presented in this work. In this regard, chapter 3 (Materials and Methods) should be more specific and clear.

The sedimentology paper (Kalifi et al., 2020) aim was the description and interpretation of the facies and how they evolve in space and time. For this, sedimentological sections 4, 5, 13, 16 and 22 were presented in details, together with 57 Strontium ages which were published without stable isotopes results. In this paper we present 30 more sedimentological sections and ad 72 new Strontium ages to calibrate the log sections, together with biostratigraphy and magnetostratigraphy age constraints. Some sequence stratigraphy interpretations thus slightly evolved.

We modified the chapter 3 as follow:

Lines 208-217: "Sedimentological and stratigraphical analyses were conducted from 35 well-outcropping sections of the Miocene Molasse deposits (sections 4, 5, 13, 16, 22 are detailed in Kalifi et al., 2020), and from partially preserved sections (<40m) outcropping in adjacent localities. Sedimentary successions, up to 1050 m-thick, were logged at the decimeter (dm) to meter (m) scale resolution in the field. Using the combined analyses of textural characteristics, clastic and biogenic components, bed thickness, bed organization and geometry, sedimentary structures and paleocurrent measurements, 25 facies grouped into 11 facies associations (FA) were previously defined by Kalifi et al. (2020). Building on these results and using the same methodology, depositional sequences were identified based on facies associations evolution and the main stratigraphical surfaces (Embry, 1993, 1995). Depositional sequences were identified, using Posamentier and Allen (1999) methodology on spontaneous potential (SP) and gamma-ray logs (GR) data from 28 well-logs located in the Bas-Dauphiné basin."

Line 226: "To the 57 samples published by Kalifi et al. (2020) we ad 72 new samples (Table S1)."

In table S1 samples published in Kalifi et al. (2020) are now denoted by asterisks (*).

It is true that chronological data for the Burdigalian is sparse for the Molasse deposits. However, the authors might have a look at the magnetostratigraphic work done at the Univ. Bern c. 25 years ago where some terrestrial sections of Burdigalian age have been calibrated through magnetostratigraphy and mammal biostratigraphy (Schlunegger et al., 1996, Eclogae Geol. Helv., Kempf et al., 1997, Int. J. Earth Sci.; Strunck and Matter, 2002, Eclogae Geol. Helv.). Therefore, the first sentences of the Abstract need to be tuned town. I understand that the authors refer to the Western part of the NAFB and the Alpine orogen, because it is not true that the chronological records are poor for the Swiss, German and Austrian segments of the NAFB (perhaps see also Hülscher et al., 2019, Front. Earth Sci.)

The first sentence of the abstract has been modified as follows:

"After more than a century of research, the chronology of the deformation of the external part of the western Alpine belt (France) is still controversial for the Miocene epoch"

As a final, but not mandatory aspect, I think it would be worth while placing the sedimentary history of the western part of the NAFB into a broader context, if possible. In particular, following Berger (2005; Int. J. Earth Sci.) and Ford and Lickorish (2004; Geol. Soc. London Spec. Publ.), the pre 20 Ma sediments in the western part of the NAFB are characterized by gypsiferous marls, freshwater carbonates and paleosoils, suggesting a sedimentary environment that is indicative for a basin margin which opened towards the Swiss, German and Austrian Molasse basin that was the depositional sink at that time. After 20 Ma and particularly after 18 Ma, the situation changed as the dispersal direction became reversed and as sediment was routed from the Eastern Alps and the Bohemian massif through the German and Swiss Molasse basins and finally to the French part of the NAFB, which started to take the role as a depositional sink. Interestingly, this is the time when active deformation at the orogen front started, as documented in this work, while thrust front activity came to a halt in the Austrian basin.

Another paper, which is in review in Geol Soc Sp. Pub., is dedicated to the paleogeographical evolution of the western alpine foreland basin. However, we do agree that we can briefly compare the timing of the tectonic phases from our results with those of the neighbouring molassic basins (Swiss and the Rhodanian). A new paragraph (5.3) was integrated and is called "5.3:

Comparison of deformation phases affecting the Miocene molasses in western Alps".

Please also note the supplement to this reply for our answers about the more specific comments and corrections suggested : "se-2021-46-RC2-detailed-response"

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2021-46/se-2021-46-AC2-supplement.pdf>