

Reconstructing post-Jurassic overburden in Central Europe: New insights from mudstone compaction and thermal history analyses of the Franconian Alb, SE Germany

Response to reviewer's comments

Reviewer Prof. Dr. Hilmar von Eynatten:

Simon Freitag and co-authors use petrographic and petrophysical properties and organic maturation data of Lower and Middle Jurassic mudstones from outcrops and drillcores of the Franconian Alb to estimate thicknesses of the post-Jurassic regional overburden. The paper is overall well written, methods and calibrations appear sound to me (though I'm not an expert in petrophysical properties), and the results constitute a significant and highly relevant contribution for the understanding of the Mesozoic evolution of the area. I recommend minor revisions only. The authors may consider separating chapter 3 into 'Results' (largely sections 3.1 to 3.4) and 'Discussion' (largely 3.5 and 3.6, could then be a new chapter 4).

When comparing the results to those by von Eynatten et al. (2021) in section 3.5, please consider that their modeling leading to 3-4 km burial refers to Early Triassic (Bundsandstein) strata (their figure 10). Including about 600-800 m of Middle Triassic (Muschelkalk) and Late Triassic (Keuper) strata significantly reduces the contrast between the two studies. Moreover, the study area is located towards the eastern/southern margin of the domal uplift proposed by von Eynatten et al. (2021) with likely less uplift/exhumation, as already emphasized in section 3.6. Given that the thermal anomalies mentioned are mainly local (as already stated by Freitag et al.) and an elevated heat flow of 80-85 mWm⁻² still requires removal of 2.5-3 km of post-Early Triassic overburden (von Eynatten et al. 2021), I guess the contrast between the two studies remains within the uncertainties of the individual methods, implying that there is no need to call for increased heat flows or geothermal gradients.

Some parts appear over-referenced (and in this respect redundant in the Introduction and Methods parts, e.g. lines 125-126, 127-129, 133-134, 188-190). Please consider reducing to two or three major references as examples (e.g., ...) or being more specific regarding information and respective references.

Authors response

The authors thank the reviewer Prof. Dr. Hilmar von Eynatten for the constructive comments that helped in improving the content and quality of our manuscript. As recommended, we separated chapter 3 into 'Results' and 'Discussion', which contributed to a better structured and therefore more comprehensible manuscript. Reducing the amount of references in the over-referenced sections additionally increased the clarity of this manuscript. All the comments on the text have been addressed and reported in the table below.

Responses to comments on the text

Reviewer #2 comments	Authors answers
Lines 80-82: sentence should be reformulated.	Lines 81-83: Sentence was reformulated.

Line 101: the Cretaceous strata are even more related to the parallel structure further south, not labelled in figure 1 but abbreviated as ‘DF’ in the inset (Bayrischer Pfahl?, not explained in caption). This should be clarified for readers not familiar with the regional geology.	Lines 99-104: This information was added to the sentence and figure 1 including caption modified.
Line 281: it remains unclear whether these are 41 individual samples or 41 measurements on ca. 10 samples (please note that in the heading for table 1 and in the text (line 157) the numbers summing up to 41 (in case of GSC) are declared as measurements per sample). The same holds for line 222: 72 samples (or measurements per sample?) for bulk density and porosity. This should be consistent and clear for the readers without checking the Appendix.	Line 281: Yes, there must have happened a mistake. We changed the heading of table 1 and it should now be clear that the numbers are equal to the number of samples, which had been analysed (one measurement per sample).
Line 286: these terms should be used in figure 4a as well (i.e. avoid clayshale, mudshale, siltshale, they are rather unusual).	Line 286: Figure 4 changed accordingly.
Line 314: quartz, pyrite, ...	Line 314: Text modified.
Line 331: ... (2018) suggests vertical effective stresses ... and roughly equates to 700-2000 m true vertical depth.	Lines 331-32: Text changed accordingly.
Line 440: just for consistency, lower limit is 800 m in Fig.9, caption to Fig. 9 and in the text (line 450).	Line 440: Text changed accordingly.
Line 472: not fully clear how the 1.1 km are deduced.	Lines 471-472: Text modified so that the origin of the 1.1 km should be clear now.
Line 490: von Eynatten et al. ...	Line 490: Text changed accordingly.
Line 645: though correct for German name rules, ‘von ...’ is usually listed under ‘v’ in the reference lists of international journals. The same holds for ‘Le Bayon et al.’, etc. I guess.	Line 827: Order in references changed accordingly.