

Dear Authors,

Please address the remaining comments after the second round of reviews. I look forward to receiving the final version of the paper soon.

With kind regards,
Florian Fuisseis

Dear Editor and Reviewers,

We would like to thank you for your further suggestions and comments, which are valuable and have further helped to improve our manuscript.

Below, you will find our point-by-point responses to the second round of reviews. We believe that we are now able to address all the concerns raised.

Best regards

Ref. 3 - Beaudoin, Nicolas

Dear author

Thank you for giving me the opportunity to give my feeling about this revised ms.

Dear Nicolas Beaudoin,

Thank you for your valuable suggestions, which have helped to improve our manuscript. We have welcomed your feedback and made our best to respond to your requests satisfactorily.

Best regards

I have a few remarks:

- there is quite a bit of the litterature that the authors don't refer to. I know the ms is presented as a workflow, yet results could be compare to other studies that have similar questions and approaches. This includes, on the top of my head: the review paper by Regnet (MPG, 2019), the various experimental works by Baud and/or Heap, and the recent paper by Vincent (GSL, 2024) that try to link petrophysics of carbonate rocks to diagenesis, could be included in your introduction/discussion.

Thank you for the suggested papers. They are indeed very helpful in providing a comprehensive scientific background for the manuscript. We have addressed them and specifically Baud et al., 2017; Regnet et al., 2019 and Vincent et al., 2025 in the introduction and added to the reference list.

- Also, I think the authors needs to reshape the tables to respect the format of SE, and I am not quite sure that fig. 6-9 are the best representation of the data (because the data is shown as bar graphs, which is not ideal for ready and understanding the trends, imposed by the sorting of the sample on the x-axis).

The tables have been formatted according to the Journal guidelines. Regarding Figures 6 to 9, as discussed in the previous review round, the samples were collected from a varying range of fault zones with different features, kinematics, and dimensional properties (e.g., length, displacement, width of individual structural domains). Therefore, we did not consider a fixed distance of each sample from the main slip surfaces. Consequently, representation via bars is the only way to present the results. Moreover, the depicted trend should be interpreted qualitatively as general pattern representing the evolution of each parameter with distance from the fault zone, as illustrated by the synoptic 3D representation of the main structural domains assessed for the studied fault zones (Figure 4). However, these qualitative trends are robustly and quantitatively confirmed and explained in the discussion section, where individual parameters are plotted as a function of porosity values.

- I also think the last sentence of the conclusion is very obvious (and already implied in the mention of the "in engineering geology, where understanding fluid dynamics is crucial"). So it could be removed.

We agree with the referee and have removed the last sentence from the Conclusion chapter.

Ref. 2 - Anonymous

I have reviewed again the revised version of the manuscript and the author's responses to comments. Although some of the main points of criticism were not addressed fully (or probably could not be addressed at this point due to time restrictions).

Once again, thank you for your time in reviewing our manuscript and for your valuable suggestions, which have greatly contributed to its improvement. We have carefully considered your feedback and have done our best to address your requests satisfactorily.

Best regards.

- I would at least expect more discussion on the use and implications of their protocol for fractured/faulted carbonates as potential sites for CO₂ storage, geothermal energy, H/C recovery, etc. (as they agreed to emphasise in their response letter) in order to enhance their research outcome impact

We have added specific sentences at the end of the conclusions to discuss the implications of the manuscript findings with potential implications for CO₂ storage or geothermal applications in carbonate rocks.

- Despite that, the authors did a good job in reforming the abstract, which now stands better in presenting the aim of this study and the research outcome. I still believe that few field outcrop images should be added in the supplementary material section (as a Figure), so the reader can have a better insight on the different subdomains that were sampled (HR, FHR, CFB and FCFB).

Thank you for your appreciation of the abstract editing. The suggested figures have been included in the supplementary material.

- It is still unclear, at least to me, why the trend of permeability k exhibits only slight differences between the host rocks and fault zones (see Fig. 12a and b between HR-AFZ and CFB-FCFB), since the porosity in fault zone domains is much higher, and as authors mention, the HR displays stiff rounded pores, vugs and microfractures, while the fault zone domains have a well-connected pore network and higher density of fractures; that is why they display a better poro-perm relationship. This can be discussed better in the discussion part.

We would like to acknowledge the reviewer for this request of clarification. Clarifying statements have been addressed as a comment to Figure 12.

- Some minor comments/suggestions: (in version with marked changes on)
Line 19: add (Ionian zone) after the Senonian and Vigla formations in the abstract. Readers might not be familiar with the stratigraphy of the area.

The proposed change has been made. We also slightly modified the text to remove double spacing and correct any misspellings.

- Line 80: you may add Clews, (1989) article for the piggy-back thrusting also, as a more appropriate reference for that, since Robertson and Dixon is a very general article for your statement.

We agree with the referee and have added the suggested reference to the manuscript.