

Solid Earth Discuss., referee comment RC2
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Comment on se-2021-150

Anonymous Referee #2

Referee comment on "The estimation of porosity in Japan Trench plate boundary using low-resolution X-ray computed tomography (XCT) images and laboratory measurements" by Hamed Amiri et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-150-RC2>, 2022

The authors have provided an interesting study using different methods to enhance the accuracy of the segmentation in CT images. The idea is very good but I think there are a few significant aspects which should be considered.

- The manuscript only talks about porosity and uses this as a reference for the CT segmentation. However, I think this is not enough. At least pore size distribution (PSD) measured by other lab techniques should be provided to compare with the PSD extracted from CT images. The author mentioned that there are many micropores and mesopores in the sample. The definition was not mentioned. I assume the author refers to the IUPAC classification, i.e. micropores < 2 nm and mesopores 2-50nm. The pixel size is 0.188mm, which is 3760 to over 100, 000 times larger than the pores. As the author mentioned, the grey value of one pixel is an average value of all the compositions. The compositions are very complicated. Even if a tiny change in the compositions will significantly change the average grey values. It is hard to believe the changes in grey value are caused by pores, which are 1/100, 000 of a pixel (although they might be many pores; this is not mentioned at all in this manuscript), not the mineral compositions.
- In clayey rocks, although the micropores and mesopores are the major components (in number or in frequency) in the pore system, they are not the major contributions to the total porosity. See Figure 2C in this paper:
<https://www.nature.com/articles/s41598-018-30153-x> This means that the total volume of the pores below the resolution might be even smaller than the errors you have shown in your data.
- The authors mentioned a few times that the best resolution of CT is 0.5 um, but this is not true. It can achieve 50 nm. For example: 1) [1016/j.marpetgeo.2016.02.008](https://doi.org/10.1016/j.marpetgeo.2016.02.008) 2) [10.1021/acs.energyfuels.0c03225](https://doi.org/10.1021/acs.energyfuels.0c03225) 3) <https://doi.org/10.1039/D0EE03651J>
- Many of basic concepts, for example, CT (line 90-110), segmentation (line125-134), do not needed to be detailed explain in this manuscripts. There are many papers talking about the details already. Proper citations are enough.

Therefore, the research itself is interesting, but the results and the conclusions are not reliable owing to the unreliable validation. I suggest pore size distribution measured by other lab techniques (e.g. nitrogen adsorption) should be provided to compare with the PSD extracted from CT images. Also, SEM images or TEM images can be provided as evidence for the locations and distributions of the pores.