# Authors comment

# Simulating permeability reduction by clay mineral nanopores in a tight sandstone by combining µXCT and FIB-SEM imaging

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The authors thank the referees for their time spent reviewing our manuscript. We appreciate the referees' comments and suggestions and agree with all the referees' statements. The corrections and suggested changes have been incorporated in the revised manuscript. The modified or added sentences can easily be found in the version where line numbers of the modifications are indicated in our specific responses provided in the table below.

| | Anonymous referee #2: | Authors' reply: |
|---|---|---|
| 1. | Line 104, list the brand, type and accuracy of the differential pressure transducer. | We listed the brand, type and accuracy of the equipment we have used from line 108-111. |
| 2. | Line 111, MIP should be replaced by MICP. | We replaced the term "MIP" by "MICP" throughout the text. |
| 3. | Line 128, add more details of the machine learning segmentation used in this study | Following the referees' suggestion, we added a section about the machine learning (line 185-191). We explain how the algorithm classifies pixel/voxel using the random forest classifier. |
| 4. | Line 156, how did the authors calculate the error bound? | The error bound is one of the mandatory settings for the solver. Since every calculated permeability is a result of an iterative differential equation process, the "true" value for permeability can only be approximated. A low error bound value of 0.05 often requires a simulation time of days to reach the specified stopping criterion. We added a description in the manuscript from line 164-167. |
| 5. | Line 258, modify the absolute | We changed the format of the permeability to mD. |

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| | permeability format. | |
| 6. | The unit of the permeability should be consistent for the whole paper | We made sure that the permeability format is consistent in the manuscript. |
| 7. | Additional question: Is this method applicable for shale? | Thank you for asking. Since the structure of shales is very different compared to sandstones, the method might be applicable depending on the pore throat characteristics. In shales, the dominating pore structure can be either fractured or porous while organic matter may play a role too (Tiwari et al. 2013, Grathoff et al. 2016). That is why an investigation of the method using mudrocks might be the most natural next step to climb. In the porous case, the method might be applicable when the pores are large enough while in the other cases the modelled clay mineral content might have no or only a minor effect on the permeability calculations. Further studies are necessary to gain knowledge about the effect of clay modelling on permeability in shales when our method should be applied. Of course, this is a very promising topic, and the method should be benchmarked on these structures as well. We added two sentences about the possible applicability in other types of rocks from line 351-354. |

**References:**

P. Tiwari, M. Deo, C.L. Lin, J.D. Miller,
Characterization of oil shale pore structure before and after pyrolysis by using X-ray micro CT, Fuel, Volume 107, doi: 10.1016/j.fuel.2013.01.006, 2013

Grathoff, G. H., Peltz, M., Enzmann, F., and Kaufhold, S.: Porosity and permeability determination of organic-rich Posidonia shales based on 3-D analyses by FIB-SEM microscopy, Solid Earth, 7, 1145–1156, https://doi.org/10.5194/se-7-1145-2016, 2016.