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Solid Earth Discussions

Interactive comment on "Porosity and permeability determinations of organic rich Posidonia shales based on 3D analyses by FIB-SEM microscopy" *by* Georg H. Grathoff et al.

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Dear Anonymous Referee #1, Thank you for the very constructive critique. We would like to respond to the 3 points that the referee explicitly pointed out: 1. needed further discussion about our assumed permeabilities, 2. needed comparison with other published data on the Posidonia shale and 3. Needed more detail about the image and data processing. In detail: 1. Assumed permeability of the organic matter needs further discussion Absolutely right, in the newly submitted manuscript we added a section to the discussion, where we discuss the variation of permeability in organic matter. The results of the GeoDict calculations depend strongly on the assumed permeability of the organic matter. As shown in our work and by others (e.g. Curtis et al. (2012), Rexer

et al. (2014), Klaver et al. (2016)) the organic matter porosity depends strongly on the maturity of the shale and on the type of the organic matter. Therefore, organic matter permeability should differ with increasing maturity. We did not use different permeability coefficients for the two samples in order to be able to compare the differences in the calculated permeability with changes in the pore space. We are aware that the assumed K = 1e-21 m^2 is very likely different from the true K-value. A next step - and this needs to be addressed in the paper as well - is to perform ultra-high resolution (<=5 nm pixel size) FIB-SEM on OM particles in order to determine 3D pore network structures in the smallest a transport relevant regime. This data can then be used to calculate permeability coefficients for the OM in order to improve the initial model presented in this study. 2. Comparison with other studies of the Posidonia Shale We agree that it would be a good idea to summarize recent studies on the Posidonia shale. Therefore we added a table comparing our values to those of others. Interestingly, during the time of the review, new studies have been published by Klaver et al. (2016) and Mathia et al. (2016) that offer interesting data that we were able to include in our discussion.

3. Methodology on image and data processing We have improved the methods section, addressing all comments and added some information where we needed further explanations.

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