Latest on the Characterization of Pore Size Distribution

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ABSTRACT

I show that SEM imaging detects only a fraction (~30%) of the total porosity of mudrocks, neglecting the significant amount of pores below the resolution of SEM. Furthermore, I show that oven drying, which is a prerequisite for most characterization methods, leads to a shrinkage of 50-70% in the sub_35 nm clay pores, and a shrinkage of 15-30% in the pore space visible in SEM images (>35nm) (See Figs. 1 and 2). Finally, contrary to the understanding in the literature, I show that the application of stress on mudrocks leads to a simultaneous compression of sub_35nm clay pores and visible SEM pores. I use conventional SEM to image milled oven-dried samples, and cryo-SEM to image milled wet samples. The ion-milling of wet samples was made possible using a recently-developed cryo polisher. These results will have a significant influence on materials characterization given that the majority of characterization methods require materials to be dried, which alters the microstructure.

CLICK ON IMAGE FOR LARGER VIEW

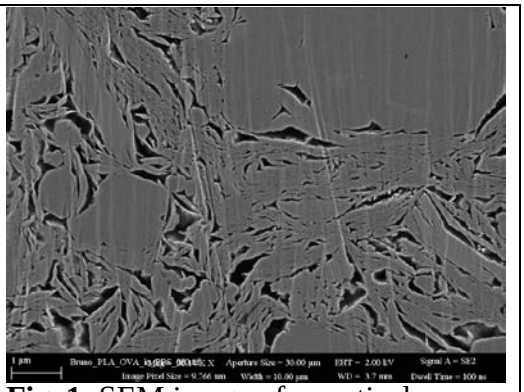


Fig. 1: SEM image of a vertical section of a Resedimented Gulf of Mexico (RGOM) sample at 1 MPa. The image shows clay particles and pore space. The sample was oven dried and ion milled prior to imaging. The image was segmented to separate the pore space and particles for further analysis.

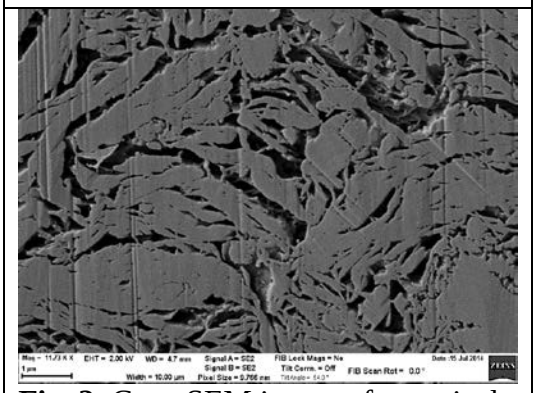
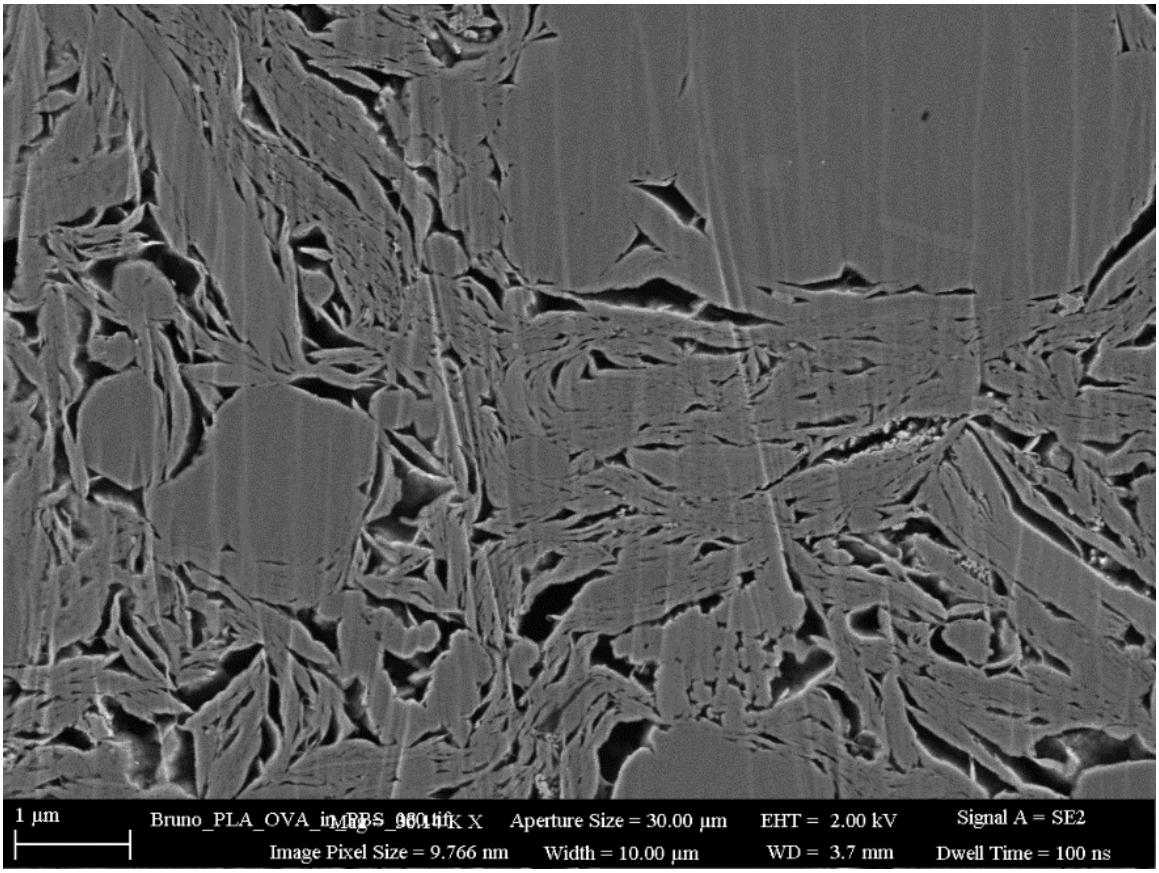


Fig. 2: Cryo-SEM image of a vertical section of a Resedimented Gulf of Mexico (GOM) sample at 1 MPa. The image shows clay particles and pore space. The sample was frozen in liquid nitrogen, ion milled and imaged under cryo-conditions. The image was segmented to separate the pore space and particles for further analysis.



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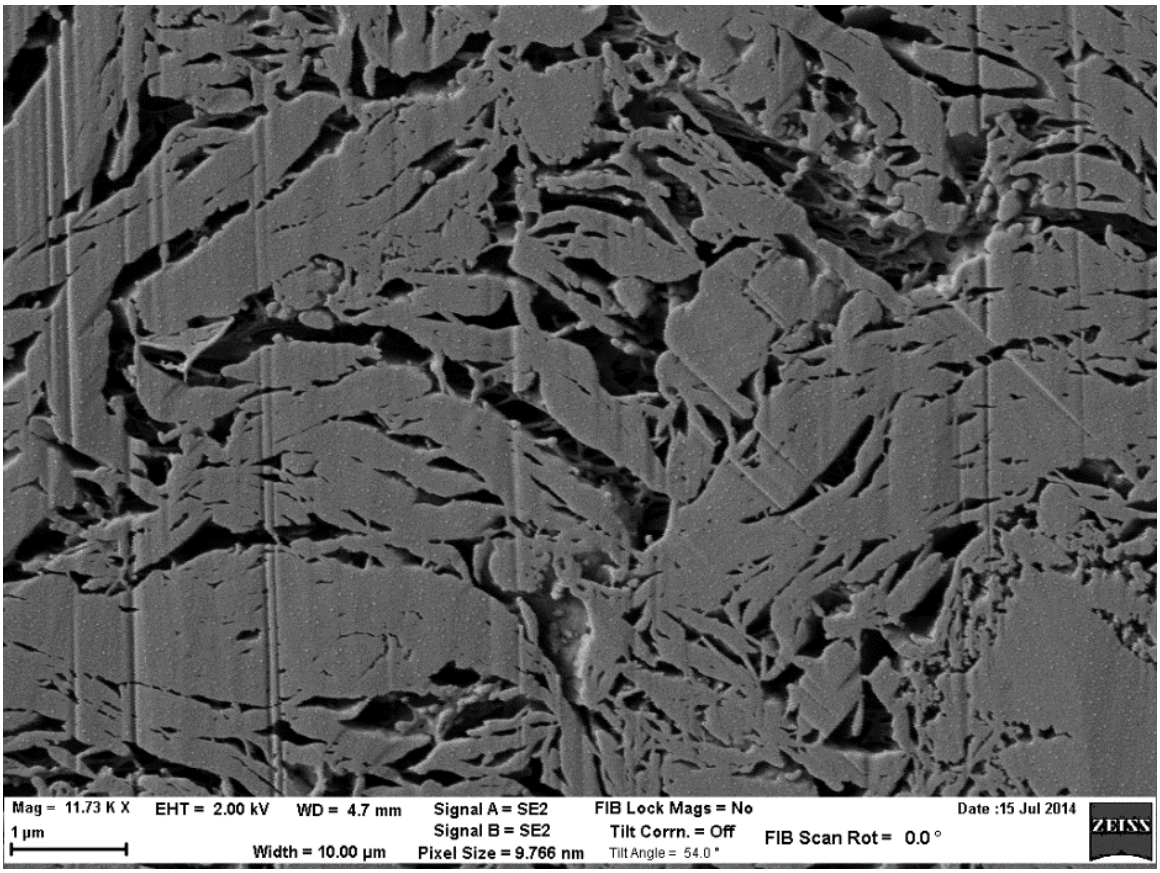

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