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Morphology of the pore space in claystones – evidence from BIB/FIB ion beam sectioning and cryo-SEM observations

G. Desbois[1], J. L. Urai[1], and P. A. Kukla[2]
[1]Geologie – Endogene Dynamik, RWTH Aachen University, Lochnerstr. 4–20, 52062 Aachen, Germany
[2]Geological Institute, RWTH Aachen University, Wüllnerstr. 2, 2062 Aachen, Germany

Abstract. The morphology of pore space has a strong effect on mechanical and transport properties of mudrocks and clay-rich fault gouge, but its characterization has been mostly indirect. We report on a study of Boom clay from a proposed disposal site of radioactive waste (Mol site, Belgium) using high resolution SEM at cryogenic temperature, with ion beam cutting to prepare smooth, damage free surfaces. Pores commonly have crack-like tips, preferred orientation parallel to bedding and power law size distribution. We define a number of pore types depending on shape and location in the microstructure: large jagged pores in strain shadows of clastic grains, high aspect ratio pores between similarly oriented phyllosilicate grains and crescent-shaped pores in saddle reefs of folded phyllosilicates. 3-D reconstruction by serial sectioning shows 3-D connectivity of the pore space. These findings call for reinterpretation of traditional pore size distributions calculated from mercury Injection experiments, explain slaking of clays by successive wetting and drying and provide the basis for microstructure-based models of transport in clays.

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