Pore size distribution measurements in low porosity argillaceous rocks

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The role of interlayer pores and other small pores with regard to anion migration in clay rocks is still an unresolved item. In particular, their accessibility to anions as a function of the pore solution composition has to be clarified [1]. In order to better understand the diffusion behaviour of anions in clay rocks, information on the pore size distribution is needed. Different methods for measuring the pore size and its distribution are known, each of them having their advantages and disadvantages. In this study different methods were compared to measure the pore size distribution in argillaceous rocks.

Two different indurated clay rocks originating from Switzerland were used: Opalinus Clay and Helvetic Marl [1]. Opalinus Clay has a bulk dry density of 2.4 kg dm^{-3}, a total porosity of 15% and a clay content (illite, kaolinite and chlorite) of 70%. The Helvetic Marl has a bulk dry density of ca. 2.6 kg dm^{-3}, a total porosity of 3% and a clay content (illite and chlorite) of 20%. Earlier studies showed that the transport relevant porosity in clay rocks is mainly located in the clay phase of the samples.

Four different methods were applied to measure the pore size distribution: NMR [2] [3], NMR-cryoporometry [4], mercury intrusion [5] and CO_2 adsorption [6]. Because each method is based on a different physical principle, it is not unexpected that the pore size distribution measured by different methods give different results. In this paper we discuss these differences and evaluate which method is the most suitable one for argillaceous rocks.

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