Development of an experimental method for determining chemico-osmotic, hydraulic and diffusion properties of rocks

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Precise characterization and modeling of groundwater flow systems are necessary for performance assessments of radioactive waste disposal. Excess fluid pressures induced by chemical osmosis in natural formations may have a significant influence on groundwater systems in a geological time scale. Examinations of the possibility and duration times require characterization of the chemico-osmotic, hydraulic and diffusion properties of representative formation media under field conditions. To develop a laboratory apparatus for chemical osmosis experiments that simulates in-situ conditions, typical lithostatic and background pore pressures, a fundamental concept of the chemical osmosis experiment using a closed fluid circuit system was revisited. Analytical solutions that simulate coupled processes in the experiment were developed. In preliminary experiments at atmospheric pressure a chemical osmosis experiment using the closed system was demonstrated. Using the analytical solutions, the chemico-osmotic, hydraulic and diffusion properties of a sedimentary rock were estimated. Based on preliminary examinations, an experimental system capable of loading the confining and pore pressures on the sample was thus developed.