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Joint evolution of hydraulic transport parameters during limestone dissolution

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CO_2-brine-rock chemical reactions change the transport parameters (saturated and relative permeability of the wetting and non-wetting fluid, porosity, diffusion coefficient, pore size distribution) of reservoir rocks for geological CO_2 storage by dissolution and precipitation processes that modify the pore space geometry. These changes can affect the storage capacity and injectivity of the formation. The knowledge of these transport parameters and how they evolve in time is also vital also for accurate modelling of CO_2 storage and multi-phase flow simulations.

Most published studies for reservoir rocks concentrate on the changes of porosity and saturated liquid permeability, but hardly any data is available on the other parameters, and even less on their evolution during interaction with CO_2.

In the present laboratory experiments the joint evolution of all relevant transport parameters of sedimentary reservoir rocks upon reaction with CO_2 is being investigated. After determination of initial saturated and relative permeability of the wetting and non-wetting fluid, porosity, diffusion coefficient, and pore size distribution, the rock sample is attacked by permeation with dissolved CO_2. After partial dissolution, the suite of transport parameters is measured again. Several dissolution-characterization cycles are performed on each sample in order to study the evolution and interaction of the different parameters. Moreover, the modulus of elasticity and the electrical resistivity of the samples are measured before and after the different dissolution stages in order to evaluate the changes in geophysical properties.

In this poster preliminary results from these laboratory experiments will be presented.