



Characterization of transport parameters during limestone dissolution experiments

Linda Luquot (1), Tobias Rötting (2), Diosenia Casalnuovo (2), and Jesus Carrera (1)

(1) IDAEA, CSIC, Barcelona, Spain , (2) Hydrogeology group, UPC, Barcelona, Spain

CO₂ sequestration in deep geological formation is considered an option to reduce CO₂ emissions in the atmosphere. After injection the CO₂ will slowly dissolve into the pore water producing low pH fluids with a high capacity for dissolving carbonates. Limestone rock dissolution induces geometrical parameters changes such as porosity, pore size distribution, or tortuosity which may consequently modify transport properties (permeability, diffusion coefficient). Characterizing these changes is essential for modelling flow and CO₂ transport during and after the CO₂ injection. Indeed, these changes can affect the storage capacity and injectivity of the formation.

Very few published studies evaluate the transport properties changes (porosity, permeability, pore size distribution, diffusion coefficient) due to fluid-rock interactions. Here we report experimental results from the injection of acidic fluid into limestone core samples of 25.4 mm diameter, 12.5 mm length. Experiments were realized at room temperature. Before and after each acidic rock attack, we measure the sample porosity, the diffusion coefficient and the pore size distribution. During percolation experiments, the permeability changes are recorded and chemical samples taken to evaluate calcite dissolution. Several dissolution-characterization cycles are performed on each sample in order to study the evolution and relation of the different parameters.

These experiments show that far from the well injection site (i.e. intermediate pH solution (4-5)), dissolution processes are characterized by slow mass transfers. We measure a permeability decrease during the different experiments. Nevertheless, we observed a porosity increase in the sample inlet with higher pore diameters. In the opposite, we measured smaller pore sizes near the core sample outlets. These results indicate that some fine particles move from the sample inlet towards the outlet. Due to the low fluid acidity, these fine particles are not dissolved inside the samples and are transported inside. Consequently, these particles can locally clog the porous space and decrease the permeability. Such processes can decrease the CO₂ storage capacity and pore volume accessibility.