



## **Experimental investigation of CO<sub>2</sub>-brine-rock interactions at simulated *in-situ* conditions**

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Geological sequestration of carbon dioxide (CO<sub>2</sub>) in deep formations (e.g. saline aquifers, oil and gas reservoirs and coalbeds) is one of the most promising options for reducing concentration of this anthropogenic greenhouse gas in the atmosphere. CO<sub>2</sub> injected into the rock formations can be trapped by several mechanisms including structural and stratigraphic trapping, capillary CO<sub>2</sub> trapping, dissolution trapping and mineral trapping. During dissolution trapping, CO<sub>2</sub> dissolves in the formation brine and sinks in the reservoir as the CO<sub>2</sub>-enriched brine has an increased density. In comparison, in mineral trapping, CO<sub>2</sub> is bound by precipitating new carbonate minerals. The latter two mechanisms depend on the temperature, pressure, and the mineralogy of the reservoir rock and the chemical composition of the brine.

This study discusses laboratory scale alterations of Ordovician and Silurian shale rocks from potential CO<sub>2</sub> sequestration site B1 in the Baltic Basin. In the reported experiment, rocks submerged in brine in specially constructed reactors were subjected to CO<sub>2</sub> pressure of 30-35 MPa for 30-45 days at temperature of 80 °C. Shale samples were analyzed in terms of mineral composition and mesopore surface area and volume, before and after experiments, by means of X-ray diffraction and N<sub>2</sub> low-pressure adsorption, respectively, for possible CO<sub>2</sub> induced changes. Comparison of mineral composition before and after experiments demonstrated subtle mineral changes. The most conspicuous was a release of Fe in the form of Fe-oxyhydroxides, most probably related to the decomposition of Fe-bearing minerals like pyrite, chlorite and, less frequently, ankerite. With regard to porosity, interestingly, the most significant increase in mesopore surface area and mesopore volume was observed in samples with the largest drop of chlorite amount. The less significant mineral changes were associated with formation of kaolinite related to breakdown of feldspars and dissolution of carbonate minerals represented by calcite, dolomite, and ankerite. In the analyzed samples, no new carbonate minerals were formed during the experiments. An increase of carbonates was recorded only in three out of 13 samples. However, concentration of carbonates in these three samples is too low to conclude CO<sub>2</sub> mineral trapping in new carbonate phases.

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