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Reservoir Quality of Clastic and Carbonate Rocks:

Analysis, Modelling and Prediction

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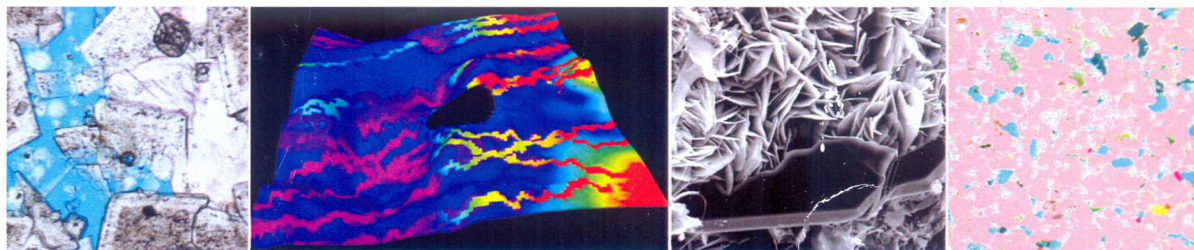
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Petrographical, Mineralogical Analysis and Reactive Modelling Of Potential CO₂ Storage and Cap Rock Lithologies from Hungary

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Since the first international agreement in 1997 (the Kyoto Protocol) the reduction of greenhouse gas emission has a key role in the European Union's energy and climate change policy. To mitigate the CO₂ emission, one potential mode is the CO₂ Capture and Storage.

In Hungary the most abundant potential storage formations are mostly saline aquifers of the Great Hungarian Plain (SE-Hungary), with sandstone reservoir and clayey caprock. The Neogene basin of the Great Hungarian Plain was subsided and then filled by a prograding delta system from NW and NE during the Late Miocene, mostly in the Pannonian time. The most potential storage rock was formed as a fine-grained sandy turbidite interlayered by thin argillaceous beds in the deepest part of the basin. It has relatively high porosity, depth and more than 1000 m thickness. Providing a regional coverage for the sandy turbidite, a 400-500 m thick argillaceous succession was formed in the slope environment. The composition, thickness and low permeability is expected to make it a suitable, leakage-safe caprock of the storage system. This succession is underlain by argillaceous rocks that were formed in the basin, far from sediment input and overlain by interfingering siltstone, sandstone and claystone succession formed in delta and shoreline environments and in the alluvial plain.

Core samples have been collected from the potential reservoir rock and its cap rock in the Great Hungarian Plain succession. The water compositions of the studied depth were known from well-log database. Using information, acquired from these archive documents, we have constructed input data for geochemical modelling in order to study the effect of CO₂ injection in the potential CO₂ storage environment.

From the potential reservoir rock samples (sandstone) thin sections were made to determine the mineral composition, pore distribution, pore geometry and grain size. To obtain more accurate mineral composition, petrographic observation and SEM analyzes have been carried out. The caprock samples, involved in the study, can be divided into mudstone and aleurolite samples. To determine the mineral composition of these samples, XRD, DTA, FTIR, SEM analysis has been carried out.

The main question in the CO₂ geological storage is geochemical behavior of the potential rock-pore water-CO₂ system hence the processes in the reservoir are playing in geological timescale. For this reasons, equilibrium geochemical models, using PHREEQC 3.0, were made for the reservoir rocks. The data used in the model are real pore water compositions from the studied area and an average modal composition based on petrographic microscope and SEM images. First of all, we were interested in the direction of the geochemical reactions during an injection process. To verify our results, we study rock samples from a natural CO₂ reservoir in same formation, too.



The preliminary results of the model made for the reservoir rock shows slight dissolution of plagioclase, K-feldspar, chlorite and strong dissolution of calcite. Furthermore intense dolomite, kaolinite and minor quartz precipitation is predicted. As new mineral phase dawsonite is appeared.

