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Preliminary study of a potential CO_2 reservoir area in 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. Following the Directive 2009/31/EC we are experiencing a significant change in the Hungarian national activity. Since the harmonization procedure, which was completed in May 2012, the national regulation obligates the competent authority to collect and regularly update all geological complexes that are potential for CO_2 geological 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's succession. The water compositions of the studied depth were known from well-log database. Using the information, acquired from these archive documents, we have constructed input data for geochemical modeling in order to to study the effect of pCO_2 injection in the potential CO_2 storage environment.
From the potential reservoir rock samples (sandstone) thin sections were prepared to determine the mineral composition, pore distribution, pore geometry and grain size. The volume ratio of the minerals was calculated using pixel counter. To have 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.
To obtain a picture about the geochemical behavior of the potential CO_2 storage system, geochemical models were made for the reservoir rocks. For the equilibrium geochemical model, PHREEQC 3.0 was used applying LLNL database. The data used in the model are real pore water compositions from the studied area and an average mineral composition based on petrographic microscope and SEM images. In the model we considered the cation-anion ratio (<10%) and the partial pressure of CO_2. First of all, we were interested in the direction of the geochemical reactions during an injection process.

Present work is focused on the mineralogy of the most potential storage rock and its caprock, and their expectable geochemical reactions for the effect of $scCO_2$.