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Experimental study of CO2 capture and storage possibility on drilling core samples from Hungary

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The concentration of CO2 in the atmosphere has increased significantly since the industrial revolution. To reduce the CO2 level, a new area of research has been created, which has a clear goal to find geological formations below the surface where a long-term and safe storage of CO2 can be guaranteed [1]. These reservoirs are found in salt domes, depleted hydrocarbon fields, non-economical coal beds, deep saline aquifers and mafic or ultramafic rocks [2].
The sedimentary system in the Pannonian Basin contains several sub-basins, which are potential storage places, namely porous sandstone bodies with regional coverage by low permeability pelitic rocks [3]. Our main aim is to carry out a series of experiments on couples of potential reservoir and cap rocks from drilling cores drilled for hydrocarbon exploration.
As the first step, drilling core samples have been selected from the Jászság Basin by using the databases of the hydrocarbon exploration because several deep wells had been drilled in the Pannonian Basin. Hence, we could choose the most promising area by evaluation of the well-logs, containing the borehole-geophysical results, the carbonate-content and the petrographic description of the stratigraphic cross-section.
In the studied area there are 4 major formations (2 storage and 2 cap rock formations) that are potentially available for future CO2 storage. To decide what core sample to use in the experiments, we need to take into consideration all these data collected from the well-logs.
In the presented work we show the results of our preliminary petrographical and geochemical analyses. We have studied petrographic thin sections to describe the the original mineral compositions, whereas scanning electron microscopic images were also taken from the natural surfaces of the rocks to directly study the original pore and surface morphology We were able to identify minerals such as plagioclase, orthoclase, calcite, clay minerals, micas, and pyrite.
After identifying original mineral compositions pore and surface morphology we have treated the sandstone and monomineralic calcite samples with supercritical CO2 in batch reactors at pressures and temperatures similar to realistic reservoir conditions to model the expected chemical processes.
We have decided to focus on the behavior of the calcite because 1) it is the most abundant constituent in our sandstone samples, furthermore it is the most reactive mineral component, because already during short runs calcites produce variable solution and precipitation phenomena. We have analyzed the reaction products (rocks and mineral phases, fluid components) using scanning electron microscope and inductively coupled plasma - mass spectrometry, respectively.

We expect that our results will contribute to the selection of geological formations suitable for safe, long-term storage of industrial CO2.