Experimental study of the CO_2 saturated water – clay system at 70-180 bars and 80-100 °C

E. SENDULA[12*], M. PÁLES[1], I. KOVÁCS[2], B. UDVARDI[2], P. KÓNYA[2], A. BESNYI[2], Á. FREILER[2], B. PÉTER SZABÓ[3], CS. KIRÁLY, E. SZÉKELY[3], CS. SZABÓ[1] AND GY. FALUS[2]

[1]Lithosphere Fluid Research Lab, Institute of Geography and Earth Sciences, Eötvös University, Budapest, Pázmány Péter sétány 1/C., Hungary 1117, (*correspondence: sendulaeszter1990@gmail.com, http://lrg.elte.hu)

[2]Geological and Geophysical Institute of Hungary, Budapest, XIV. Stefánia út 14., Hungary 1143

[3]Budapest University of Technology and Economics, Budapest, Műegyetem rkp. 3., Hungary 1111

Caprock integrity is one of the most important factors regarding the long-term safe underground storage of CO_2 in saline aquifers. As a result of geochemical reactions among the caprock mineralogy and CO_2 saturated pore water, the physical properties of caprock such as porosity, permeability and tortuosity may change, which could affect its sealing capacity. Due to the commonly high clay mineral content of caprocks, the reactivity of these minerals should be well-studied in CO_2 saturated reservoir conditions.

The main aim of the present study is filling the gap of experimental results in order to understand better the geochemical behavior of CO_2 – brine – clay mineral system. For this reason, 1-2 weeks long laboratory experiments and geochemical modeling were carried out under reservoir conditions (70-180 bars and 85-100 °C) using international illite (IMt-1), kaolinite (KGa-1b) and Na-montmorillonite (SWy-2) standards. The resulting solid phases were examined by ATR-FTIR and XRD, whereas the fluid compositions were measured by ICP-AES. For comparison, control samples were also studied the same way as the CO_2-exposed samples.

The experimental results indicate rapid and total dissolution of carbonates, initially present in the samples, and slight increase in the amount of smectite in the CO_2-treated samples. Furthermore, the experienced shift of initial d001 spacing by about 1 Å in smectites (XRD) could be the result of both Ca-exchange and/or CO_2 incorporation into the interlayer.