Authigenic clay minerals in lacustrine sediments containing paleoenvironmental information have impacts on sediment porosity and permeability, and may affect reservoir pressurization. In East Africa's rift and volcanic lakes, crystallization mechanisms and diagenetic reaction pathways in alkaline siliceous fluids remain unclear.

Here we test the role of CO_3^{-2} and other ions in promoting Ca-exchange from interlayers of Al-rich smectite in sodium carbonate brines. Enhanced cation exchange in such saline environments may play a role in the eventual precipitation of Mg-rich smectite, a key indicator of saline and alkaline paleoenvironments.

Clay Minerals Society standard SWy-2 was Ca-saturated with $CaCl_2$, washed, and exposed to high and moderate carbonate solutions based on reported concentrations from Lake Magadi, Kenya. Cation exchange (i.e. release of Ca from the clay sites) was monitored by using a pH meter and atomic absorption spectrophotometry. Experimental reactants and products were analyzed by XRD and XRF.

XRF analysis of experimental products revealed excess Ca in the solid phase; XRD identified calcite. Atomic absorption showed that Ca^{2+} concentration was <0.1ppm in the moderate brine, rising to 1.6 ppm after exposure to Ca-saturated clays. In the most concentrated brine, initial concentration of 1.8 ppm rose to 3.2 ppm. In both cases, significant amounts of Ca^{2+} released by the clays were precipitated as calcite.

Potential explanations for the Ca-exchange are either Na^+ displaces Ca^{2+} from the clay surface or the Ca^{2+} is pulled off by CO_3^{2-}. Much of the Ca^{2+} precipitates as calcite in either case, but significant amounts remain in solution. Post-experimental Ca^{2+} in the most concentrated brine was double that of the moderate brine suggesting more cation exchange due to higher CO_3^{2-} concentration levels, alternatively the higher Na^+ could have played a role. Future experiments will attempt to test these multiple working hypothesis and work with other fluid compositions.

These results provide insight into a key step in clay mineral diagenesis and crystallization in alkaline siliceous fluids. On-going work will continue with analysis of promoting precipitation of Mg-rich clays as well as a low to no carbonate brine solution to expose to the Ca-saturated smectite.