# Insight into the experimental study on $CO_2$-water-olivine interactions

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Anthropogenic $CO_2$ emission into atmosphere with relation to global change becomes the main challenge issue in the 21st century. One of the effective solutions for reducing $CO_2$ emission is carbon capture and storage (CCS). However, the storage mechanism has not been thoroughly understood because of scarce research and experiments conducted. Our study explored the reactive mechanisms of $CO_2$-olivine-water interactions. All the experiments were performed for 1000 hours at a temperature of 150□ and a pressure of 150 bar, respectively.

It's very critical for us to understand the different influencing factors in such $CO_2$-olivine-water systems. We tried to use multiple characterization techniques including TEM-EDS, SEM-EDS, XRD, ICP-MS, to figure out the contribution of intrinsic capability of $CO_2$, pressure/temperature, and the role of clay mineral in natural olivine. (i) High temperature and pressure could accelerate the decomposition of the original forsterite during $CO_2$/$N_2$-forsterite-water interaction. A reactive transitional zone was formed on the surface to enhance $H^+$ entering into the silicate framework for the reaction; (ii) We found the formed amorphous silica could be a passivating layer that mitigated the interaction, while clay materials could help facilitating ionic exchange between olivine and the surrounding solution, and the role of clays would favor magnesite formation. Our findings provide insights into the reaction mechanisms of $CO_2$-olivine-water interaction process in natural ultrabasic rocks with related to $CO_2$ sequestration.

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