



## **The effects of carbon dioxide on the mineralogical and geochemical alterations of phyllosilicate minerals**

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This study aims to identify the geochemical and mineralogical effects of carbon dioxide stored in geological formations on subsurface environments in deep rock formations. A series of autoclave experiments were conducted to simulate the interactions in the scCO<sub>2</sub>-groundwater-phyllsilicate minerals reaction systems using a high pressure and high temperature cells at 50C and 100 bar. Kaolinite and montmorillonite were used as geological materials reactive in CO<sub>2</sub>-rich acidic environments, and groundwater sampled from a 800-depth well were applied as aqueous solutions. The dissolution characteristics of phyllosilicate minerals and their geochemical and mineralogical alternations after 30-days reactions were quantitatively examined by XRD, XRF, ICP-OES and SEM/EDX investigation. Throughout experimental processes, it was observed that the acidic environments induced by the dissolution of CO<sub>2</sub> resulted in the changes in pH and cation concentration in the aqueous phase, and, thereby, the mineral phase changes in composition and interlayer spacing. The experimental results clearly showed an enhanced dissolution of kaolinite and montmorillonite with the presence of CO<sub>2</sub>. They also suggested that geochemical processes such as dissolution/precipitation and cation exchange played major roles in physical and chemical changes in pore structure and groundwater in relevant formations and aquifers.