

Evaluating the mobilization of cations from aquifer rocks exposed to high CO₂ levels

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Abstract:

Capture of CO₂ from point sources such as coal-fired power plants and storage deep in the subsurface is being explored as means to reduce anthropogenic CO₂ in the atmosphere, especially in the Gulf Coast Region. Characterization of subsurface settings can maximize assurance that CO₂ will be retained in the injection zone for long periods of time; however, the consequences of error resulting in leakage needs to be considered prior to implementation. This project undertakes a first laboratory investigation of the extent to which the accidental movement of CO₂ into a shallow aquifer could mobilize major and minor cations bound to the aquifer host rock and threaten groundwater quality. Ten core samples representative of major aquifers in Texas were placed in deionized water and bubbled with CO₂. Results showed elevated major cation (Ca, K, Mg, Na, Si) concentrations, such as carbonate samples with higher concentrations of Ca and Mg and clastic samples with higher Na and Si. Elevations in minor elements were more case sensitive, but most samples had elevated concentrations of As, Mn, P, Sr, and U. However, these elements were also elevated to some degree in the control, which consisted of samples being bubbled with Ar gas. The elevation of these minor cations is significant as expected indicators of CO₂ in future studies. Fe, which is an important constituent in the deep subsurface, only showed elevated concentrations in one sample where reductants were available. The results from this study are not meant to be extrapolated to an entire aquifer, as there is still some uncertainty about why there are elevated concentrations of minor cations in the control run.

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