

Mineralogical characteristics of dawsonite as a footprint of supercritical CO₂ : possible natural analogue of leakage

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An option storing CO₂ in a saline aquifer is recently considered to be vital for successful deployment of CO₂ sequestration in many countries including Japan. We carried out a study of desk-top CO₂ storage, taking the underground geology beneath the Tokyo Bay area as a model storage site. Geochemical transport modeling by using TOUGHREACT simulator showed an interesting behavior of dawsonite, a Na-Al hydrous carbonate. The mineral was extensively formed throughout the CO₂ plume in the early stage of plume migration. However, the mineral began to dissolve with time, accompanied by a change in chemistry of formation water in the plume. Finally, its distribution became very limited to the top thin layer at the boundary of the reservoir and the seal formations in which supercritical CO₂ persists for a long period. The change in the distribution of dawsonite suggests an important role of geochemical interaction between CO₂ and rocks of the reservoir as well as those above it (including seal formation) to remediate the effect of injected CO₂ as a voluminous acidic fluid.

An interesting occurrence of dawsonite-bearing carbonate assemblages is found in the Cretaceous Izumi Group, SW Japan. The Izumi Group is known to be a classical dawsonite locality in Japan (Aikawa et al., 1972). In the new outcrops, dawsonite occurs together with calcite, and other carbonates. The mode of occurrence of dawsonite together with the other carbonates probably indicates an invasion and remediation of CO₂ by the host sedimentary strata, and can be an important natural analogue to understand a process of leakage from (micro) fractured seal formation and that of chemical remediation by sedimentary strata of storage complex and above.

Keywords: geological CO₂ storage, geochemical trapping, natural analogue, dawsonite, supercritical CO₂