Geochemical results on the CO_2 georeactor sequestration tests at the Ogachi hot dry rock site, NE Japan

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Field Experiments

Field experiments of CO_2 sequestration into the Ogachi HDR have been examined for 4 years by our group. There are two injection/production wells (OGC-1 and 2), two major feed zones at depth of 700m and 1100m, where their temperatures are 170 and 210°C, respectively. CO_2 dissolved water (river water with dry ice) was directly injected into OGC-2 with tracers. Water samples are collected at the depth of ca. 800m by a sampler and monitored for their chemical and isotopic compositions. Dissolution or precipitation rates of calcite were determined by using a new technique of "*in situ* analyses" at the depth.

Results

The CO_2 and tracer concentrations decrease with the elapsed time. The injected CO_2 water is diluted with the reservoir fluid with 3 days and most CO_2 in them might be deposited as calcite by interaction with granitic rocks. The "in situ analyses" show that calcite precipitation was observed within 2 day after the injection. This supports the view that most of CO_2 injected might be fixed as carbonate.

Biological fractionations of quadruple sulfur isotopes in a stratified lake

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Quadruple sulfur isotope system ($^{32}S/^{33}S/^{34}S/^{36}S$) is a potential new tracer not only for photochemically-induced non-mass-dependent reactions, but also for mass-dependent processes including biogeochemical reactions [1]. We have studied quadruple sulfur isotope ratios of sulfate and sulfide in a small monomictic lake Fukami-ike, central Japan, having a maximum depth of 8.0 m. The lake is eutrophic and is stratified from March to October, when green and purple sulfur bacteria (anaerobic photosynthesizer) are active at oxic-anoxic boundary layer, and sulfate reducing bacteria produces hydrogen sulfide accumulated in an anoxic hypolimnion [2]. In August, systematic changes of $\delta^{34}S$ as well as $\Delta^{33}S$ and $\Delta^{36}S$ values was observed both for sulfate and sulfide in anoxic hypolimnion. Simple calculation assuming Rayleigh process yielded fractionation factors for $^{34}S/^{32}S$ (α-34) of 0.980, and mass dependent exponents λ-33 and -36 of 0.505 and 1.93, respectively. The results are consistent with sulfate reduction within a water column of the lake. Moreover, seasonal variation of $\Delta^{36}S/\Delta^{33}S$ relationship demonstrated that ^{33}S and ^{36}S signatures are potential indicators not only for microbial sulfate reduction but also for different sulfur metabolisms or cycles.

[1] Johnston *et al*. (2007) *GCA* **71**, 3929-3947. [2] Yagi (1996) *Water Ressources Research* **30**, 1823-1832.