

Rare earth element of carbonate minerals in sedimentary rocks around Tono uranium deposit, central Japan

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1. Purpose

A retardation effect (an effect to retard migration of a radioactive element in the underground) by mineral adsorption has been studied a lot by a conventional natural analogue study, but a few studies of retardation effect by mineral incorporation has been studied. It is expected that mineral incorporation could be a long-term retardation effect.

Therefore, in this study, carbonate mineral incorporation is considered, because carbonate mineral is one of the most ubiquitous authigenic mineral in the sedimentary rocks.

In addition, the rare-earth elements are used as chemically analogue elements to radioactive elements such as Am and Cm don't occur in natural environment.

2. Experimental method

Samples of sedimentary rocks were collected from drilling cores. Major element compositions of sample were analyzed by XRF (X-ray fluorescence analysis). Minerals were identified by XRD (X-ray diffraction analysis). Carbonate minerals were dissolved by 1M acetic acid method for fractionation, and the solution analyzed by ICP-MS (Inductively coupled plasma mass spectrometry), ICP-AES (Inductively coupled plasma atomic emission spectrometry), and AA (Atomic absorption spectrometry).

3. Result and discussion

C1 chondrite-normalized REE pattern of the carbonate show the W-type tetrad effects.

M-type tetrad effects can occur in the REE pattern of granitic rocks, while the W-type effects, the counterpart of fraction occur in the groundwater by water-rock interactions in the Tono area (Takahashi et al., 2002). The REE pattern of sedimentary rocks shows W-type tetrad effect by REE provided from groundwater (Takahashi et al., 2002). Therefore, it is thought that the rare-earth element is incorporated into carbonate from the groundwater, resulting to W-type tetrad effect of carbonate as well as the groundwater.

In particular the light rare-earth element concentration in carbonate is high, compared to that of bulk rock. Because light rare-earth element in a rare-earth element is chemically analogue to radioactive element such as Am and Cm, it is likely that a carbonate mineral is easily to incorporate these especially.

Therefore, it is expected that a carbonate mineral incorporation can retard long-term migration of radioactive elements such as Am, Cm.