Abstract

[Project Information]

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In this study, potential sites for geological CO_2 storage in Japan were evaluated, with a specific focus on the Green Tuff region. Green Tuff refers to tuffaceous rocks formed through submarine hydrothermal activity during the formation of the Japan Sea, characterized by their green coloration resulting from hydrothermal alteration. Some of these rocks exhibit basaltic or andesitic compositions and are enriched in calcium and magnesium, making them favorable candidates for mineral carbonation via reactions with injected CO_2 to form stable carbonate minerals.

However, Green Tuff encompasses a broad range of lithologies that vary significantly in chemical and mineralogical composition depending on their age and the extent of alteration. Therefore, it is essential to elucidate how such compositional differences influence the CO_2 mineral trapping potential. To address this, Green Tuff rocks with diverse chemical and mineralogical characteristics were collected from several regions and subjected to CO_2–water–rock interaction experiments to identify the primary factors controlling their capacity for CO_2 mineral trapping.

Field investigations and sampling were conducted, followed by detailed petrographic and geochemical analyses. CO_2–water–rock reaction experiments were performed using both powdered and cube-shaped samples to assess parameters such as CO_2 fixation rates. The experimental results demonstrated that hydrothermal alteration, which defines “Green Tuff”, significantly reduces its capacity for mineral trapping of CO_2. Specifically, a lower degree of alteration and the preservation of primary rock-forming minerals such as plagioclase and pyroxene were found to be critical for CO_2 mineral fixation. In contrast, alteration minerals such as clay minerals and zeolites contributed minimally to CO_2 fixation.

Based on these findings, andesitic rock formations with low degrees of hydrothermal alteration—such as those found in the Shikaribetsugawa Formation in western Hokkaido and the Ushikiri and Jōzōji formations on the Shimane Peninsula—are identified as promising candidates for CO_2 storage sites within the Green Tuff region.

Reference: Yutato Takaya, Wako Kobayashi, Mitsuki Ogasawara, The effect of hydrothermal alteration of tuffaceous rock on CO_2 mineral trapping potential、Applied Geochemistry. (submitted)

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