

A study on reaction characteristics of Green Tuff rocks for selecting optimal CO₂ storage locations in Japan

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Following the enactment of the Paris Agreement in 2015, many countries have set "2050 Carbon Neutrality" as a short-term goal. To achieve carbon neutrality, the utilization of negative emission technologies (NETs) that remove and store CO₂ from the atmosphere, as well as efforts to reduce GHGs emissions, are essential. This research focuses on CCS (Carbon Capture and Storage) technology among NETs, specifically discussing the possibility of CO₂ underground storage in Green Tuff region. In Japan, Green Tuff rock (altered tuffaceous rock) is widely distributed from the coastal areas of the Sea of Japan to Hokkaido. These rocks exhibit significant variations in chemical and mineral composition depending on its formation period, region, and degree of alteration. Due to its high content of Ca and Mg, and high porosity, some Green Tuff rocks are considered to have a high CO₂ mineral trapping potential. This research aims to reveal their reaction characteristics through reaction experiments. The final goal is to select optimal locations for CO₂ storage in Green Tuff region based on multiple indicators such as CO₂ fixation capacity, permeability, and porosity.

We collected samples from some locations within the Green Tuff region. After pulverization, the rock samples were subjected to a reaction experiment for up to 14 days under conditions of 3 MPa CO₂ partial pressure and 150°C. After a certain period, the solid and liquid phase was analyzed by using XRD, TC, and ICP-OES.

The carbon fixation capacity was calculated based on the experimental results and compared with the chemical and mineral composition of each sample. As a result, the rock samples from the Shikaribetsu-gawa formation, which contain a large amount of Mg and Ca, showed the highest carbon fixation capacity. Furthermore, it was found that the rocks with a low degree of alteration and that still contain pyroxene and plagioclase showed a high reactivity. These characteristics are important indicators when selecting rock types that can sequester CO₂ as minerals.

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