

Dissolution characteristics of altered tuffaceous rocks under high CO₂ pressure: Implications for the site selection of CO₂ geological storage.

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Basaltic aquifers have drawn attention as candidates for CO₂ geological storage due to their enormous CO₂ storage capacity and their potential for geochemical trapping compared to sedimentary aquifers. On the other hand, the potential of the intermediate and felsic volcanic rocks and tuffs have not been examined heartily. We, therefore, conducted CO₂-water-rock interaction experiments to elucidate the dissolution characteristics and geochemical trapping potential of three different altered andesitic to rhyolitic tuffaceous rocks (Tsugawa, Ushikiri and Daijima tuffaceous rock) comparing with fresh mid-ocean ridge basalt. All three tuffaceous rocks were taken from "Green Tuff Region" of northern and central Japan.

The interaction experiments were performed under 1 MPa CO₂ pressure and at 50 °C. The reaction time was up to 56 days. As a result, basalt showed high acid neutralization potential (solubility trapping potential) and rapid dissolution of silicate minerals. Two of the tuffaceous rocks (Ushikiri and Daijima) showed relatively high solubility trapping potential mainly due to the dissolution of carbonate minerals in the andesitic Ushikiri tuffaceous rock and the ion-exchange reaction with zeolite minerals in the rhyolitic Daijima tuffaceous rock. In addition, the Ushikiri tuffaceous rock also has relatively high mineral trapping potential nearly comparable to basaltic rock, due to the rapid dissolution of Mg- and Ca-bearing silicate minerals. Our experiment results strongly indicates that regions of porous and andesitic tuffaceous rock will be a promising CO₂ geologic storage formations.