

## Enhanced Weathering of Daikonjima Island Basalts for Carbon Dioxide Removal

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### 【研究の目的と内容】

Daikonjima Island, located in the Shimane Peninsula, is underlain by Quaternary mafic basalts that are particularly well suited for enhanced weathering and carbon sequestration studies. These basalts weather rapidly due to their high content of reactive silicate minerals such as olivine and plagioclase, which transform into stable carbonate minerals during chemical weathering and permanently remove CO<sub>2</sub> from the atmosphere. Daikonjima's geological age combined with its limited surface disturbance, provides an excellent natural setting to evaluate basalt reactivity and long-term CO<sub>2</sub> uptake potential. The island's proximity to Nakaumi Lake and its extensive surrounding agricultural land allow assessment of both geochemical processes and agricultural co-benefits, including soil fertility improvement.

The proposed project focuses on assessing the CO<sub>2</sub> uptake potential and environmental benefits of these basalts within an agriculturally active setting. It involves detailed mineralogical and geochemical characterization of Daikonjima basalts to model their carbon sequestration capacity. Laboratory experiments will examine the effects of grain size and weathering conditions on reaction rates, followed by controlled field trials within agricultural settings. By integrating geology, climate science, and agriculture, this project aims to position Daikonjima as a model site for scalable, island-based enhanced weathering strategies that simultaneously support climate mitigation and sustainable soil productivity.

### 【研究の成果(本研究によって得られた知見、成果、論文、学会発表、外部資金への応募見込み等)】

The project successfully identified and subdivided Daikonjima Island into five geochemically distinct areas based on detailed petrogeochemical analyses. It comprehensively evaluated the enhanced weathering potential of Quaternary basalts from Daikonjima through integrated mineralogical, geochemical, and experimental investigations. The basalts are olivine-rich (15–35 modal %) and exhibit Mg-rich compositions (MgO: 8.2–12.4 wt%; CaO: 9.1–11.8 wt%), with iron-rich forsteritic olivine (Fo<sub>72</sub>–Fo<sub>85</sub>), indicating high reactivity and strong potential for CO<sub>2</sub> sequestration. Petrographic features and trace element signatures confirm a tholeiitic oceanic island basalt affinity and rapid initial olivine dissolution, further supporting their suitability for enhanced weathering applications. A manuscript detailing these findings is currently in preparation and the outcomes will be presented at an upcoming conference in summer. In parallel, a related pilot study on comparable samples from India was published in 2025 (Thanooja et al., 2025, Hydrological processes). These research results form a strong foundation for external funding applications, including JST LOTUS and bilateral research programs, and demonstrate significant potential for scalable carbon removal and agricultural soil enhancement.