

The uppermost mantle section below a remnant proto-Philippine Sea island arc: Insights from the peridotite fragments from the Daito Ridge

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ABSTRACT

The Amami Plateau, Daito Ridge, and Oki-Daito Ridge of the northwestern Philippine Sea Plate are remnants of Mesozoic island arcs. We have newly recovered samples of peridotite and peridotite-derived minerals from the Daito Ridge. The peridotite samples are composed of serpentinized/altered olivines, orthopyroxene porphyroclasts, small clinopyroxenes, and spinels, indicating a harzburgitic origin. Chondrite- and primitive mantle-normalized trace-element patterns for clinopyroxenes are characterized by a steep positive slope from middle rare earth elements to heavy rare earth elements (HREEs) plus yttrium. The light rare earth elements (LREEs) and Sr and Zr contents of clinopyroxenes vary in abundance, and some crystals have high LREE/HREE ratios coupled with positive Sr and Zr anomalies. These petrological and geochemical characteristics are not consistent with the Daito peridotites being the residue of a single partial melting event including melt extraction expected for mid-ocean ridge mantle. Instead, the peridotite source must have been enriched with slab-derived components, which are associated with arc-related magma. Thus, it is concluded that the studied peridotite fragments belong to an exhumed mantle section of a remnant proto-Philippine Sea island arc.

Keywords: Philippine Sea Plate, Daito Ridge, remnant arc, peridotite, slab-derived components, melting model; New Advances in Subduction Zone Magma Genesis