

The petrological evolution of island arc structure: Amphibole-rich Ultramafic Rock from the Nishidohira Formation of the Abukuma belt

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Introduction

Amphibole is assumed to have played an essential role in the development of island arc volcanic rocks (Davidson., 2007 Geology). However, it is difficult to directly investigate the role of amphibole crystallization in arc volcanic rocks. Amphibole-rich ultramafic to mafic rocks are rarely exposed at the surface, but occur frequently in association with arc-related crustal rocks (e.g., Itano et al., 2021 Lithos) as well as lower crust to the uppermost mantle sequence of the ophiolites (Ishiwatari et al., 1985 Jour. Petrol.: Ozawa et al., 2015 Island Arc).

In this study, we examined olivine-pyroxene hornblendite to hornblendite (amphibole-rich ultramafic rocks hereafter) from the Nishidohira Formation of the Abukuma belt. Amphibole-rich ultramafic rocks from the Nishidohira are composed of amphibole, clinopyroxene, olivine, and biotite, with a small amount of orthopyroxene and opaque minerals (sulfide/ ilmenite). Olivine, clinopyroxene, biotite, orthopyroxene, and opaque minerals are included in coarse-grained poikilitic amphibole. Orthopyroxene is partly replaced by talc. Zircon obtained from amphibole-rich ultramafic rock is 100 to 200 μm in size

Amphibole has chemical zoning, which is reflected in the different colors of dark brown, light brown and green. Dark brown amphibole is high in TiO_2 and tends to be scarce in light brown to green amphiboles. Chondrite-normalized trace element patterns of amphiboles are rich in light rare earth elements and are depleted by heavy rare earth elements. Dark brown amphibole and light brown amphibole have similar patterns, whereas the light rare earth elements in light brown amphibole are slightly higher than dark brown amphibole. The trace element patterns of dark brown and light brown amphiboles suggest that they crystallized from the same magma. Green amphibole has lower REE contents than other amphiboles.

Keywords: Amphibole-rich Ultramafic Rock