

Trace element composition of chromian spinel in the Sanbagawa ultramafic rocks

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The Sanbagawa belt, which is distributed from the Kanto Mountains to the eastern part of Kyushu Island, is a Cretaceous high-pressure-type metamorphic terrane and records Cretaceous subduction zone tectonics. In the Higashi-Akaishi area, the central part of Shikoku Island, a large ultramafic body is exposed associated with metamorphic rocks (mafic gneiss, metagabbro, etc.), which experienced eclogite-facies metamorphism (e.g., Kugimiya and Takasu, 2002). Also, there are exotic rocks of ultramafic volcanic rocks in an ophiolitic belt (Mikabu belt) in the south of the Sanbagawa belt and serpentinite blocks in low-grade pelitic schist, as seen in the Fujiwara body. In this study, major- and Trace-element analyses of chromian spinel for the Sanbagawa ultramafic rocks were performed to reveal the origin of various ultramafic rocks in the Sanbagawa belt. Chromian spinel in the Higashi-Akaishi dunites and chromitite show high Cr# ($= \text{Cr} / [\text{Cr} + \text{Al}]$; >0.6) and low TiO_2 (<0.3 wt.%) content and are poor in Ga, Ti, and Ni in normalized elemental patterns. No positive anomaly in Ru is present in platinum-group element patterns. These results suggest that the Higashi-Akaishi dunites and chromitite formed as cumulates crystallized from the same parental magma, which is derived from the highly depleted mantle like boninite in an island arc setting. On the other hand, chromian spinel in the serpentinite in the Fujiwara body and picrite in the Mikabu belt show intermediate Cr# (0.4-0.6) and TiO_2 (0.4-1.7 wt.%) content relative to those of the Higashi-Akaishi body rocks. The trace element patterns show enrichment in Ga, Ti, and Ni and the platinum-group element patterns are characterized by a significant positive anomaly in Ru. These results suggest that the Fujiwara serpentinite and Mikabu picrite are derived from the intraplate magma produced by the upwelling of a large mantle plume, as proposed by the previous studies (Ichiyama, 2014). The metamorphic rocks associated with the Higashi-Akaishi body were formed in an oceanic island arc in the Early Jurassic (Aoki et al., 2019; 2020). The Higashi-Akaishi ultramafic rocks would have been parts of the lower crust of an Early Jurassic oceanic island arc on the Izanagi plate, whereas the Fujiwara serpentinite and Mikabu picrite are probably fragments of a Late Jurassic oceanic plateau. These results imply that all ultramafic rocks in the Sanbagawa metamorphic belt were brought through the subduction process of the Izanagi plate.

Keywords: Sanbagawa belt, ultramafic rocks, chromian spinel