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Zircon U-Pb ages of the Mikabu ophiolitic belt, Southwest Japan: Implications for the origin of the Shatsky Rise

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There have been debates about how oceanic plateaus formed. Drilling approaches are vital to obtaining the genetic information of oceanic plateaus, but thick volcanic piles beyond the ability of drilling technique make difficult to investigate the evolutionary history of oceanic plateaus. Plume-type ophiolites originate from oceanic plateaus emplaced on orogenic belts (Dilek and Furnes, 2011), and their extensive exposures can give us good opportunities for understanding the genesis of oceanic plateaus.
The Mikabu Belt is distributed from Kanto Mountains to western Shikoku in the Outer Zone of Southwest Japan and forms an ophiolitic mélange composed mainly of mafic volcanic and plutonic rocks and ultramafic cumulates associated with Late Jurassic to Early Cretaceous radiolarian fossils. The Mikabu volcanic rocks are composed of hyaloclastite and pillow lava and are sometimes Mg-rich in composition. The picrites with highly magnesian olivine phenocrysts (up to Fo93) indicate that they were produced by a hot mantle plume (Ichiyama et al., 2014). Ichiyama et al. (2014) regarded the Mikabu Belt as a plume-type ophiolite and suggested that they are derived from a Late Jurassic oceanic plateau formed on Izanagi Plate, which was possibly produced together with the Shatsky Rise in the Late Jurassic Pacific Ocean.
The Mikabu Belt is poor in geochronological data, and the only hornblende K-Ar ages of 142-153 Ma and 199 Ma are reported from picritic dikes (Ozawa et al., 1997). We carried out zircon U-Pb dating for gabbroic rocks in the Mikabu Belt to constrain the origin of the Mikabu ophiolitic rocks and the relationship with the Shatsky Rise. The weighted mean zircon U-Pb ages from three samples were 146.3±5.4 Ma, 147.1±4.8 Ma, and 153.1±3.6 Ma. These zircon U-Pb ages are close to the younger hornblende K-Ar ages and assure that the igneous rocks in the Mikabu Belt formed around 145-150 Ma.
The magnetic lineation of the Shatsky Rise indicates that the rise formed from M21 (147 Ma) to M1 (124 Ma), and especially, the TAMU massif, which is the largest edifice located in the southernmost margin, formed between M21 and M19 (145 Ma) (Sagaer, 2005). Basaltic lavas recovered from the TAMU massif also yield the Ar-Ar plateau ages of about 144 Ma (Geldmacher et al., 2014; Mahoney et al., 2005). The geochronologic consistency between the Mikabu Belt and the Shatsky Rise strongly supports that they formed synchronously at the triple junction of the Pacific, Izanagi, and Farallon plates. Although it has been controversial whether the formation of the Shatsky Rise was caused by a hot mantle plume or not, the presence of the Mg-rich picritic rocks in the Mikabu Bet implies that the Shatsky Rise is derived from a mantle plume in the Late Jurassic Pacific Ocean.