

Geochemistry and zircon U-Pb ages of mafic rocks in the Mikabu and Sorachi-Yezo belts: Comparison with the Shatsky Rise

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Large igneous provinces (LIPs) are large volcanic edifices on the Earth, such as oceanic plateaus and continental traps. It is commonly believed that LIPs are formed by large-scale magmatism caused by the upwelling of unusually hot mantle plume from the deep mantle (e.g., Coffin and Eldholm, 1994). Therefore, the genesis and formation mechanisms of LIPs is crucial to understand the dynamics of the Earth's interior and episodic global events. Recent studies have revealed that the fragments of accreted oceanic plateaus are preserved in orogenic belts as ophiolites and accretionary complexes (e.g., Kerr et al., 2000; Ichiyama et al., 2014). The investigation of accreted oceanic plateaus will help to enhance our understanding of LIPs.

The Mikabu belt in SW Japan and Sorachi-Yezo belt in central Hokkaido, North Japan contain large accreted fragments of a paleo-oceanic plateau (Kimura et al., 1994). Recently, Ichiyama et al. (2014) proposed that the Mikabu and Sorachi-Yezo picrites with highly magnesian olivine phenocrysts (up to Fo₉₄) were produced by an unusually hot mantle plume. They also suggested that these picrites are derived from the Late Jurassic oceanic plateau (hereafter named "Mikabu-Sorachi plateau") formed on the Izanagi plate, which was possibly produced together with the Shatsky Rise at the Pacific-Izanagi-Farallon triple junction in the Pacific Ocean. However, the geochronological and geochemical comparison between the Mikabu-Sorachi and Shatsky Rise has been poorly constrained.

The Mikabu and Sorachi-Yezo mafic rocks are geochemically divided into depleted (D)-type and enriched (E)-type in the same manner as the picrites. The D-type is depleted in light rare earth elements (LREE), whereas the E-type is relatively enriched in LREE. These types were produced by higher degrees of partial melting (30-50%) than MORB. The U-Pb zircon analyses of gabbroic rocks in both belts yield the weighted mean ²⁰⁶Pb/²³⁸U zircon ages of 153.1-146.3 Ma for the Mikabu rocks and 146.2 and 137.6 Ma for the Sorachi-Yezo rocks.

A wide geochemical variety of basalts were recovered from the Shatsky Rise during the IODP Expedition 324 (Expedition 324 Scientists, 2010; Sano et al., 2012). The U1349-type and Normal-type basalts of the Shatsky Rise are closely similar in geochemical composition to the Mikabu-Sorachi D-type and E-type rocks, respectively. The radiometric ages of the Shatsky Rise basalts show 144.6-133.9 Ma (Mahoney et al., 2005; Geldmacher et al., 2014). The magnetic anomaly lineations of the Shatsky Rise exhibit that the formation of the rise started at M21 (about 147 Ma). The zircon U-Pb ages of the Mikabu-Sorachi mafic rocks are almost coeval with the formation ages of the Shatsky Rise. However, the older radiometric ages than 147 Ma are shown in this study. Recently, Sawada et al. (2019) also report the zircon U-Pb age of 154.6 Ma for the Mikabu metabasite from the Toba area.

The magnetic anomaly lineation of M29 (about 157 Ma) drawn at the southwest of the Shatsky Rise implies that the triple junction was already present at 157 Ma. The Mikabu-Sorachi plateau was produced on the Izanagi plate before the Shatsky Rise at the triple junction. The igneous rocks in the Mikabu-Sorachi belt possibly record the information on initiation mechanisms of the triple junction and

initial stages of LIPs formation in the paleo-Pacific Ocean.

Keywords: Mikabu belt, Sorachi-Yezo belt, Shatsky Rise, zircon U-Pb age, Large igneous provinces (LIPs), mantle plume