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シャツキー海台、オリ山塊のマグマ組成と層序
Magma variety and stratigraphy of Ori Massif, Shatsky Rise

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In order to examine magma genesis and evolution of large igneous provinces (LIPs), Integrated Ocean Drilling Program Expedition 324 cored ~470 m of igneous basement at four holes on Shatsky Rise, located ~1500 km east of Japan. The four basement holes are distributed on three volcanic massifs of Shatsky Rise (they are called Tamu, Ori, and Shirshov massifs from southwest to northeast); two holes on Ori Massif (Hole U1349A and U1350A) and one each hole on Shirshov (Hole U1346A) and Tamu (Hole U1347A) massifs. Geochemistry of ~130 fresh glass samples from the basement holes has indicated that Shatsky magmas are divided into three groups (Shimizu et al., AGU 2010 Fall Meeting Abstract U51A-0019); normal, low-Ti, and high-Nb (K) groups. Chemical compositions of the normal group are similar to those of normal mid-ocean ridge basalt (N-MORB), but slightly enriched (e.g., higher La/Yb than N-MORB). The fresh glasses and fresh whole rocks (LOI <1 wt %) of the normal group show an obvious chemical trend, which can be explained by a fractional crystallization of three phenocryst phases (olivine, plagioclase and augite) under low pressure (<<200 MPa) and nearly dry (water, 0.2-0.6 wt %) conditions. The crystallization temperatures are estimated to be 1130-1210 degree C. The low-Ti group has slightly lower Ti, Fe, Mn, V, Sr and Zr concentrations at the same MgO. The high-Nb basalts are characterized by their distinctly higher concentrations of incompatible trace elements (e.g., K, Nb, REEs) than the normal basalts, indicating that they were likely affected by enriched components. Examinations of the rock chemistry show that the three groups are simply discriminated by Nb/Ti ratio; normal group has low Nb/Ti (less than 0.00058), low-Ti group has middle Nb/Ti (0.00058-0.00071), high-Nb has high Nb/Ti (more than 0.00071). The discrimination method has strong merit that can be applied to altered rocks because both Ti and Nb are highly resistant to alteration processes.

The longest basement section (~173 m) among the Expedition 324 holes was recovered from Hole U1350A on flank site of Ori Massif. All three geochemical groups are present in the hole. On the basis of the basement morphology, the thick section is divided into three units; pillow and massive flows (unit II), hyaloclastite and breccias (unit III), and pillow lavas set in a matrix intercalated micritic limestone (unit IV). Unit II is subdivided into three subunits; upper massive-flow dominant unit IIa, transitional unit IIb, and lower pillow dominant unit IIc. The Nb/Ti of ~100 basement basalts (fresh glasses, lava flows and breccias) indicates that the normal group is the most abundant and occupies 64% of Hole 1350A. The high-Nb group is the second abundant (28%) and constitutes middle portion of unit IIa and most part of unit IIb. The low-Ti group (8% of the basement section) often appears adjacent to the high-Nb, implying that the origins of the two groups are closely related. One important note is that unit IIb consists only high-Nb and low-Ti groups (normal group basalt is absent). The geochemical examination shows that about 1/3 of the basement section is composed of non-normal basalts (high-Nb and low-Ti groups), which may indicate that the involvement of enriched components are important factors to discuss magma genesis of Shatsky Rise.
Keywords: Large Igneous Province, Integrated Ocean Drilling Program, plume, plate, oceanic plateau, magma