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Magma variety and its origin for Shatsky Rise

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Shatsky Rise, a large oceanic plateau in the northwest Pacific, consists of thick (>22 km) basaltic crust with various geochemical compositions. Geochemistry of fresh glass and whole rock samples from one site (Site 1213) of Ocean Drilling Program (ODP) and five sites (Sites U1346 to U1350) of Integrated Ocean Drilling Program (IODP) indicates that mainly four magma types exist on the plateau; namely normal, low-Ti, high-Nb, and U1349 types. The normal type is the most abundant in volume and appears all three large edifices of the plateau; Tamu (Sites 1213 and U1347), Ori (Site U1350), and Shirshov (Site U1346) massifs that are aligned from southwest to northeast. Composition of the normal type is a relatively uniform and similar to normal mid-ocean ridge basalt (N-MORB) composition, but slight relative enrichment in the more incompatible elements. The low-Ti type, which is present in one stratigraphic unit at Site U1347 and the upper stratigraphic units at Site 1350, is distinguished from the normal type basalt by slightly lower Ti, Fe, and Mn contents at a given MgO. The high-Nb type is found in the upper stratigraphic units at Site 1350 and one fresh glass from Site U1348 (on Tamu Massif), and the composition is characterized by distinctively high contents in incompatible trace elements such as K, Nb, and La. All basalts at Site U1349 (on Ori Massif) are composed of more primitive and distinctly depleted compositions compared with the others, and they are defined as an independent U1349 type. Examination of stratigraphic and geographical distributions of the magma types clarifies that about 1/3 of lava units are composed of non-normal type basalts (the high-Nb, low-Ti, and U1349 type basalts). The normal type basalts constitute most lava units of Tamu Massif but the non-normal type basalts are voluminous in Ori Massif, implying that geochemical compositions may have become heterogeneous with time. We will mainly focus on origin and evolution of the normal type magmas on Shatsky Rise.

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Keywords: Integrated Ocean Drilling Program, Expedition 324, Large Igneous Province, Oceanic Plateau, Plume