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Evolutionary processes of initial arc magma yield from hot subduction zone reference from the Oman Ophiolite

KUSANO, Yuki[1*] ; UMINO, Susumu[1] ; KITAMURA, Keitaro[1] ; ADACHI, Yoshiko[2] ; SHINJO, Ryuichi[3] ; MIYASHITA, Sumio[2]

[1]Kanazawa University, [2]Niigata University, [3]University of Ryukyus

Tethys ophiolite zone consisted of fragments of Jurassic to Cretaceous oceanic crusts is considered to be produced on forearc setting (e.g. Dilek and Furnes, 2009). However, it is questioned that do initial arc always develop a long-survived subduction zone as explained by evolution processes of the Izu-Ogasawara-Mariana arc (e.g. Stern, 2004). We present volcanic, magmatic and tectonic evolutionary process of short-lived juvenile arc from the northern Oman ophiolite.

The Oman ophiolite belonging to the Tethys ophiolite zone is one of the best places to investigate magmatic and volcanic developing processes of an infant arc. The Ophiolite had formed on a spreading axis and followed by subduction stage magmatism at approximately 100 Ma. Latest U-Pb age of zircon in plutonic bodies shows that there is only 0.5 m.y. time gap between the spreading and subduction stages (Riuox et al., 2014). Based on the radiolarian fossil age, the initial subduction volcanism ceased $<$2 m.y. after the ridge stage (Agui et al., 2014), therefore, it seems to record short-spanned island arc magmatism.

The subduction stage volcanic rocks extending 1100 m thick consist of the lower arc tholeiite (LV2) and upper boninite (UV2). Pahoehoe and sheet flows are dominate in the LV2, while 50 m thick pyroclastic rocks are partly distributed upward. Since the upper part consists mainly of sheet flows and pyroclastic rocks with intervening some pelagic sedimentary layers, the LV2 volcano was developed quickly at the beginning and the volcanism became explosive and intermittently later. The UV2 magma intrudes into lower plutonic and extrusive sequences and erupted as pyroclastic fall and lava flows through fissure vents. The UV2 is overlying the LV2 with interbedded sedimentary layer and distributed $>$350 km along the Oman Ophiolite. Geochemically it is suggested that the LV2 magma is generated by wet partial melting containing hydrous fluids while the UV2 magma is generated by accretion of sedimentary melt. Estimated degree of melting in the LV2 and UV2 indicates that both are explained by remelting of the residual mantle after the spreading magmatism and the difference of magma was controlled by involved fluid compositions rather than progressive source depletion. The boninite magma genesis is well supported by ~1400 ℃ mantle potential temperature calculated from primary magma composition of glass inclusion in boninite Cr-spinel (Kitamura et al., 2014).

Keywords: Initial arc, Hot subduction zone, Boninite, Oman Ophiolite