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Crustal structure and growth of the Forearc region of Izu-Ogasawara arc

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JAMSTEC has carried out seismic surveys in the Izu-Ogasawara-Mariana region to clarify process for arc crustal growth to continent. We have already reported as follows. Much basaltic magmas are needed to make develop arc crust to current one and mafic arc materials are transformed into the mantle (Takahashi et al., 2007; 2008, Tasumi et al., 2008). There is crustal rifting and spreading between current volcanic front and the rear arc (Kodaira et al., 2009). Beneath the forearc region, there is thick arc crust with thickness of about 25 km and relative thin crust with that of about 10-15 km (Takahashi et al., 2011). Although arctic crusts were identified from magnetic anomalies map (Yamazaki and Yuasa, 1998), the real crustal structure with magnetic anomalies is not still shown yet. We carried out a seismic survey using R/V 'Kairei' of JAMSTEC to understand process of arc crusts beneath the forearc region.

The seismic line runs from the Shinkurose to the Ogasawara Trough through the Sumisu spur, the Daini Higashi Torishima knoll, and the Omachi seamount. Obtained profiling of the crustal structure along the forearc shows a variation of crustal thickness. The thick curst distributes around 32.5 degree N, the Sumisu spur, the Daini Higashi Torishima knoll, and the Omachi seamount. There is thin crust beneath the Shinkurose. The Omachi seamount has very thick lower crust the inside. The distribution pattern of the thick crusts is consistent with that of magnetic anomalies (Yamazaki and Yuasa, 1998). In the thick arc crusts with Vp of 6 km/s except the Omachi seamount, the velocity contours of 6 km./s and 7 km/s indicate convex and concave shape, respectively. It is known that the arc crusts on the volcanic front has thick layer with Vp of less than 6 km/s (Kodaira et al., 2007). This suggests that the arc crusts beneath the forearc region have much mafic materials rather than that along the volcanic front, and the result is consistent with past drilling studies (e.g., Taylor, 1992). Around the Shinkurose, thin and shallow crust is identified by this study and has high magnetic anomalies. This suggests that the crust beneath the Shinkurose is not in isostasy and that the entire of the thin crust is uplifted. It is possible that the signature of the Shinkurose is brought by the collision of the Izu-Ogasawara arc to the Honshu arc.

Keywords: Refraction survey, paleo-arc, crustal growth