Crustal growth of the southern Izu-Ogasawara (Bonin) arc inferred from a seismic velocity structure

Narumi Takahashi[1]; Yuka Kaiho[2]; Takeshi Sato[1]; Gou Fujie[2]; Shuichi Kodaira[1]; Yoshiyuki Tatsumi[1]; Yoshiyuki Kaneda[3]

[1] IFREE, JAMSTEC; [2] JAMSTEC; [3] JAMSTEC,IFREE

Crustal growth of the Izu-Ogasawara (Bonin)-Mariana (IBM) arc has been developing since Eocene time. Since the IBM arc with andesitic 6 km/s-layer is typical oceanic island arc, which was formed from the basaltic oceanic crust, the crustal growth process would accompany with removing the heavy crustal components. And, this process might be affected by the tectonic events with changes of crustal environments. IBM arc has experienced the crustal growth, a backarc opening and the current rifting for 50 Ma. The crustal change by these tectonic events is possibly recorded on the seismic velocity structures of the crust and the upper mantle. In short, these velocity structural variations obtained would indicate the degree of the crustal growth. The southern Izu-Ogasawara arc-backarc system consists of three arcs, which are the oldest oceanic arc formed in Eocene time, the older Miocene arc and current arc. We carried out high dense active seismic experiments with ocean bottom seismographs (OBSs) and an airgun array with large volume capacity is to understand the degree of the crustal growth among three arcs. Our seismic main line runs across the oldest Eocene arc (the Ogasawara ridge), the Ogasawara trough, the current active arc, the Nishinoshima trough and the old Miocene arc. The current preliminary seismic structure indicates that above arcs have respectively structural characteristics. The arcs has commonly crustal thickness of 20-25 km. Two troughs also have thick crustal thickness rather than typical oceanic crust. Although three arcs have andesitic middle crust with P-wave velocities of 6 km/s, these are still basaltic and not fully matured arcs. Comparing among the velocity structures of three arcs, the uniqueness of the Eocene arc structure is remarkable. The lower crust occupies a half of the entire of the arc crust and the upper crust is thicker than other two arcs. The current arc and the Miocene arc have relative thick middle crust and their structures are similar to that of the northern Izu arc. Low mantle velocities are also one of common characteristics of the arc crust. Significant velocity variations of the lower crusts are also observed, the P-wave velocity of the lower crust of the eastern current arc is slower than that of the western part. It might be suggested that these structural characteristics indicate the degree of crustal growth. In this presentation, we apply one crustal growth modeling constructed by petrologic studies for the obtained seismic structure and discuss the scenario and the stage of the crustal growth process in the southern Izu-Ogasawara arc.