Along strike crustal variation in the northern Izu island arc and its implications for crustal evolution processes

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An accretion and collision of an island arc crust had been believed to play an important role for a generation of a continental crust. However, structural similarities between a continental crust and an intra-oceanic island arc had been unclear. Progresses of crustal scale marine seismic imaging in 1990s have provided important information for crustal evolution processes in an intra-island arc. One of the most exciting findings is 6 km/s-layer, which is a typical continental upper crust, at the northern Izu arc. This have been the first seismological evidence showing that the crust of the intra-oceanic arc already have a continental material. Another striking result is a wide-spread high velocity (Vp, higher than 7.2 km/s) lowermost crust, which is rarely observed in a typical continental crust, across the entire arc. This structure means that a delamination of the lowermost crust is a key process for generating a continental crust form an intra-oceanic arc crust. Following the northern Izu's seismic study, several intra-oceanic arcs have been investigated to compare those similarities and differences. For example, a result from the Aleutian arc suggested that the 6 km/s-layer is not always situated in an island arc.

In order to clarify a crustal variation of the intra-oceanic arc, Jamstec has started a multi-scale seismic imaging project focusing on the Izu-Bonin-Mariana (IBM) arc, which is a typical intra-oceanic arc, since 2002. In the summer of 2004, we acquired our first along arc wide-angle seismic data from Sagami-bay to the Torishima island just on the volcanic front. 102 OBSs were deployed with 5 km spacing on the 520 km long profile, and 12, 000 cu. inches air gun array was shot at every 100 m. Although, data qualities varied from an OBS to OBS probably depending on structures, we can trace first arrivals to nearly 200 km offset in a good quality data. Those long offsets arrivals are very effective to see a deeper part of the crust and uppermost mantle. We apply a first arrival refraction tomography, as the first step of the data process, to obtain an overall crustal variation. The preliminary results show that 1) crust is generally thinned toward south; i.e., 25 km thick beneath Ohshima and 15 km thick beneath Torishima, 2) a variation of thickness in the lower crust is more significant than that in middle crust, 3) a very low velocity (Vp, slower than 7.5 km/s) may exist at the northern part of the profile, beneath Miyake-jima and Hachijo-jima. We will further use later reflection arrivals to map the Moho and intra crustal interfaces in the next step of processing.