Seismic images of the Eocene, Oligocene and current arc crust in the Izu-Bonin intra-oceanic arc

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JAMSTEC has carried out intensive active source seismic surveys to widely cover the Izu-Bonin intra-oceanic arc since 2004. According to a tectonic history of the Izu-Bonin arc, an initial arc crust formed at the Eocene age has been preserved at the fore-arc region along the Bonin ridge. Although the Oligocene arc is an issue of a debate, it is proposed that the Oligocene arc may be situated beneath the rear-arc and/or at slightly east of the current volcanic front. In this study, we show along arc seismic images at the current volcanic front and rear-arc to discuss a crustal evolution from a presumable Oligocene arc to the current arc. In addition to that, we present a preliminary result of a seismic image of along the Bonin ridge, which is proposed as the Eocene arc. The seismic image along the volcanic front, i.e., the current arc, provides a seismological constraints on crustal growth,1) crust having felsic to intermediate composition (Vp of 6-6.8 km/s) has been predominantly generated beneath basaltic volcanic centers along the volcanic front, 2) the bulk compositions of the crust does not changed from the thin Bonin arc crust to the thick Izu arc crust, but represent more mafic (basaltic) than an average composition of typical continental crusts, 3) this suggests a process to return mafic to ultramafic lower crustal components to the mantle is required for an arc crust to evolve into a continental crust. We found, along rear-arc profile, that a volume of the felsic to intermediate composition curst shows 50-80 km scale variation. Comparing along arc structural variation patterns (e.g., average seismic velocity and volume of the felsic to intermediate component crust) between the current arc and rear arc shows well correlation. This observation strongly supports an idea indicating that the rear arc crust has been separated from the volcanic front in the Oligocene age. A remarkable difference between the volcanic front and rear arc is, however, observed in the thinner parts of the felsic to intermediate component crust. A volume ratio of a cruatal component having over 7 km/s (mafic to ultra-mafic composition) between the basalt volcanoes in the present-day arc shows significantly larger than that in the Oligocene arc. A process to predominantly increase such a high velocity crustal component between the basalt volcanoes may be required during the evolution process from the Oligocene arc to the current arc.