

Formation processes of arc crust revealed by seismic images along the volcanic front and back-arc seamount chains in the Izu arc

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The existence of a continental crust is believed to be a unique characteristic of the Earth, but the process by which it grows is not well understood. In order to investigate an evolution process of arc crust and mantle, JAMSTEC has been working on active seismic data acquired in the Izu-Bonin-Mariana work since 2003. Among several important findings from those data, seismic imaging along the volcanic front of the Izu-Bonin intra-oceanic arc shows structural variation to evolve from juvenile to mature crust, which provide new constraints on growth of continental crust: 1) crust of continental composition has been generated beneath basaltic volcanic centers in an intra-oceanic arc, 2) the bulk compositions of juvenile and mature arc crusts are the same, and 3) a process to return mafic to ultramafic components to the mantle is required for an arc crust to evolve into a continental crust. These new findings resolve a longstanding paradox in current understanding of the growth of continental crust in intra-oceanic arcs. One of the unique characters of the Izu arc is an existence of the back-arc seamount chains which are sub-parallel seamount chains situated at the western edge of the Izu arc. Although several ideas have been proposed to explain a formation process of the back-arc seamount chains on the basis of petrological, geochemical and geophysical studies, a structure of the entire crust has not been revealed. In order to image the along arc structure crossing the back-arc seamount chains, we newly acquired wide-angle seismic data as well as multi-channel seismic data in 2006. The data acquisition system used was the same system which was used for obtaining the structure along volcanic front (i.e., 100 OBSs are deployed with 5 km interval on the 500 km long profile, and the 200 L air-gun array was used as a controlled source). In this study we show the seismic structures crossing the back-arc seamount chains, and compare it with the structure of the volcanic front to examine the formation process of the back-arc seamount chains in the Izu arc.