

Crustal reflector imaging around the late Eocene paleo arc in the fore-arc region of the Izu-Bonin island arc deduced from OBS wide-angle data

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The Izu-Bonin island arc is a typical oceanic island arc formed by subduction of the Pacific plate beneath the Philippine Sea plate. In the fore-arc region of this arc, two paleo arcs (early Eocene and late Eocene paleo arcs) run parallel to the volcanic front (Taylor, 1992). To understand the arc crust evolution and continental crust formation, the ultra-deep drilling to the middle crust of the Izu-Bonin arc has been proposed beneath the late Eocene paleo arc (IBM-4 site) (Tatsumi and Stern, 2006). Around this paleo arc (IBM-4 site), the multi-channel seismic reflection (MCS) and seismic refraction study using ocean bottom seismographs (OBSs) surveys were conducted, however, this area is too deep to image the crustal structure on the MCS profile. On the other hand, in OBSs, wide-angle reflection phases reflected from reflectors in the deep part of the crust are visible. For this study, using these phases recorded by OBSs and the pre-stack depth migration (PSDM), we image the seismic reflection profile in the whole crust around the late Eocene paleo arc (IBM-4 site) in the fore-arc region.

The dataset used in this study is 85 OBSs deployed 1 km interval along the survey line from the volcanic front, the late Eocene paleo arc to the early one in the fore-arc region off the east of Aoga-shima in 2008 (Yamashita et al., 2009). Using wide-angle reflection phases recorded for OBSs and PSDM, we have simulated a crustal image where the MCS profile can't be imaged in the fore-arc region. Moreover, we used the pseudo-seismic reflections simulated by applying the seismic interferometry (SI) to OBS data and PSDM to image the crustal structure in this region. Between the volcanic front and the late Eocene arc, the obvious reflector having the reflectivity is observed at a depth of about 13 km. The P-wave velocity beneath this reflector has about 7.7 km/s. From these results, this reflector corresponds to the Moho. Moreover, this reflectivity may show the interaction between the crust and the mantle in the tectonic stage of the rifting between the volcanic front and the late Eocene paleo arc. On the other hand, between the late Eocene arc and the early one, the obvious reflector corresponding to the Moho can't be observed. Along the survey line, others reflectors are observed below the basement. These reflectors may correspond to the top of the crust and/or reflectors in the upper and middle crust. Below the late Eocene paleo arc, there are some reflectors in the shallow part of the crust. However, the depth and the size of these reflectors can't be determined by this study.