Collisional structure of the Izu-Bonin arc beneath the eastern flank of the Kanto Mountains

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Since the middle Miocene, the Izu-Bonin arc (IBA) has been colliding to the Honshu Island, Japan, forming the complex crustal structure in central Japan, called the Izu Collision Zone (ICZ). Following the collision, some crustal units of the IBA, such as the Tanzawa Mountains (TM) and the Izu peninsula (IP), accreted onto the Honshu crust, and several active faults including the Tonoki-Aikawa Tectonic Line (TATL) and the Kodu-Matsuda Fault (KMF) were formed in and around the ICZ. In 2003, an intensive seismic expedition was conducted across the eastern part of the ICZ (Sato et al., 2005). The N-S seismic line of 130-km length is crossing the TATL and the KMF in its middle and southern part. Crustal structure from CMP reflection method using this data set was reported by Sato et al. (2005). Arai et al. (2007) applied this data to integrated analysis of refraction/wide-angle reflection method, revealing the seismic velocity structure associated with the collision and subduction beneath the eastern part of the ICZ. By Comparing this velocity structure with that of Kodaira et al. (2007), which was conducted along the intra-oceanic IBA volcanic front, we revealed the relationship between the Tanzawa block and the PSP, and the IBA crust. Furthermore, hypocenter relocation was performed using refraction velocity model to examine whether the seismic activity is affected by the arc-arc collision. Finally, we propose the collision model of the Honshu arc and the IBA beneath the eastern part of the ICZ.

We have revealed the following things from refraction analysis and relocated hypocenters.
1:shallower structure -from refraction tomography-
(1)The KM is composed of Paleozoic to Mesozoic accretionary prisms with high velocity of 4.0-5.5 km/s represented by Sanbagawa Metamorphic Belt, the Chichibu belt and the Shimanto belt. (2)The TM consists of Miocene volcanic, volcaniclastic rocks and Neogene intrusive rocks represented by tonalites, which have relatively low velocity of 3.5-5.0 km/s. (3)The TATL is interpreted as the northern edge of the low velocity unit of the TM.

2:deep structure -from forward ray tracing and relocated hypocenter distribution-
(1)Clear reflectors R0-R3 exist beneath the KM in a depth range of 6-20km. R2, a northward dipping reflector with rather high angle, was imaged at a depth of 12-18 km, which is interpreted to be the deep extension of the TATL from its geometry. These relectors are estimated to have velocity contrasts of 0.2-0.3 km/s from amplitude analysis. (2)Another reflector of R3 in a depth range of 15-18 km is found to merge to the dipping reflector of R2. A wedge-like geometry formed by R2 and R3 is interpreted to be boundary between the KM in the Honshu arc and the TM in the IBA. (3)The estimated velocity for the Tanzawa block and the uppermost part of the PSP from the amplitude analysis was 6.0-6.4 km/s and 7.2 km/s, respectively. These values correspond to those of upper part of the middle crust and the lower crust beneath the intraoceanic IBA volcanic front (Kodaira et al., 2007). (4)A reflector R6 is located within the PSP. We can not determine whether it is a boundary within the lower crust of the IBA or Moho. (5)From the relocated hypocenter distribution, we found the seismicity is remarkably different between the northern and southern side of the TATL. In the Honshu crust north of the TATL, hundreds of hypocenters are distributed up to a depth of about 25 km, most of which are concentrated around the reflectors R1-R3. (6)In contrast, almost all of the earthquakes south of the TATL occurred within the PSP, that is the lower crust of the IBA. The Tanzawa massif with a relatively low velocity is characterized by low seismicity, but it is also noticed that the some activities are found in its peripherals, probably related to the collision of the IBA and the Honshu arc.