Since the middle Miocene, the Izu-Bonin arc has been colliding from south with the Honshu arc in central Japan associated with subduction of the Philippine Sea plate. This process is responsible for forming a complex crustal structure called the Izu collision zone. In order to reveal the physical property of the subducted crust of the Izu-Bonin arc and its relation to seismicity in the lower crustal level, we carried out seismic tomography analyses incorporating active and passive source seismic data. The obtained P and S wave velocity models showed large lateral velocity variations associated with the collision/subduction processes of the Izu-Bonin arc. The middle/lower crust of the Izu-Bonin arc with P wave velocity of 6.5-7.0 km/s, within which intensive seismicity occurs, is subducted beneath the collision zone. These events form 10-km-thick seismicity zone dipping northward in the depth of 15-30 km. Vp/Vs ratio in this seismogenic zone showed an intermediate value, which agrees well with hornblende gabbro measured in dry condition. Other geophysical evidence such as distribution of intermediate-depth earthquakes and low frequency tremors, b value and resistivity structure also suggest lower water content and poor dehydration process in the subducted Izu-Bonin arc crust. We propose two hypotheses for physical causes of the remarkable seismicity: A fracture zone associated with the progress of the crustal delamination in the middle/lower crust and high-density cracks the Izu-Bonin arc crust originally contains. These two factors may contribute to generate microseismicity in the collision zone.