

The acceleration episode of the back-arc rifting in the Izu-Bonin Arc possibly triggered by a remote earthquake in 2004

ARISA, Deasy^{1*} ; HEKI, Kosuke¹

¹Department of Natural History Sciences, Faculty of Science, Hokkaido University

The Izu-Ogasawara (Bonin)-Mariana Island arc lies along the convergent boundary between the subducting Pacific plate (PA) and the overriding Philippine Sea plate (PH) in the western Pacific. Nishimura (2011) found that the back-arc rifting goes on behind the Izu arc by studying the horizontal velocities of GNSS stations on the Izu Islands. Here we show that this rifting has accelerated in 2004 using GNSS data at stations such as Aogashima, Hachijojima, Mikurajima, Shikinejima, and Nijima (we excluded stations in the Miyake Island because of the volcanic deformation).

The back-arc rifting behind the Izu islands can be seen as the increasing distance between stations in the Izu Islands (they are located to the east of the rifting axis) and stations located in the stable part of PH, e.g. Minami- and Kita-Daito islands. We found that their movement showed clear acceleration around the third quarter of 2004. Such an accelerated eastward movement could be interpreted not only as the acceleration of the back-arc rifting, but also as the trenchward movement of the arc due to a slow slip episode at the PH-PA boundary.

We first rule out the second possibility by constraining the onset time of the acceleration episode, and by correlating it with other inter-plate earthquakes in the PH-PA boundary. There was an inter-plate earthquake occurred on May 29, 2004 (M6.5) at the PA-PH boundary just to the south of the Boso-oki triple junction. However, the time series clearly lacked the jump which should mark the onset of the eastward slow movement. Moreover, the additional velocity vectors do not converge to the epicenter, and the onset time that minimizes the post-fit residual is significantly later than May. We therefore conclude that the accelerated eastward movement started in 2004 was not due to the afterslip of the interplate earthquake in May.

We found that the onset time coincides with the occurrence of the September 5, 2004, Kii-Hanto-oki, September 5, 2004, earthquake (M7.4), which occurred in the PH slab subducting at the Nankai Trough off the Kii Peninsula. We found that the accelerated movement vectors of these islands are almost parallel with each other, and perpendicular to the rift axis. We hypothesize that the seismic wave radiated from the epicenter of this earthquake dynamically triggered the acceleration of the back arc opening in the Izu Arc.

Keywords: GPS, GNSS, Izu-Bonin Arc, time series, back-arc opening, acceleration