The origin of ria coasts in the Kinki, Chugoku, and Shikoku regions

*Yukitoshi Fukahata[1], Yutaro Mori[2]

1. Disaster Prevention Research Institute, Kyoto University, 2. Graduate School of Science, Kyoto University

In the last JpGU (Mori & Fukahata, 2021), based on the dislocation model for plate subduction, we have shown that subduction of a slab along a trench axis with a bend results in subsidence around the bend, and that subduction of a slab with a ridge results in coupled deformation: subsidence just above the ridge and uplift in the adjacent areas. Such theoretical prediction is consistent with observed topography.

When an oceanic plate subducts into the mantle, the iso-depth contours are usually nearly parallel to the trench axis, but the Philippine Sea slab is an exception. The Philippine Sea slab has large undulation, which is larger as the subduction proceeds. Based on such characteristic deformation, Fukahata (2019, PEPS) argued that large undulation of the Philippine Sea slab is considered to have been caused by E-W compression since 3 Ma.

In western Japan, the paleo Setouchi low-land area extends until the east of the Nobi plain in the Pliocene. In the area, non-marine sediments deposited, which means that this low-land area was separated from the Pacific Ocean by the outer-arc range.

As mentioned above, the stress regime in Japan has drastically changed to strong E-W compression since 3 Ma. Because of that, topography in western Japan has been developed as follows.

In the inner zone of the Kinki regions, block-fault mountains, such as the Suzuka and the Ikoma Mountains, have formed due to active reverse fault movements. In the outer zone, because of the development of the undulation of the Philippine Sea plate, the relief of topography becomes larger: uplift of the Kii and Shikoku Mountains have accelerated, while the Kii Strait was opened and the subsidence of the Bungo Channel and Ise Bay have occurred, which results in the formation of ria coasts in the Shima Peninsula, Anan, and Uwajima. Wakasa Bay and Hiroshima Bay both locate above the extension of the ridges of the Philippine Sea slab; because of that, considerable subsidence have occurred in these bays.

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