Consideration of Formation factor of Trench-parallel fore-arc ridge

*Shohei Iwama[3,1], Ryoya Ikuta[2], Yuto Iwase[4]

1. Graduate school of Integrated Science and Technology, 2. Faculty of Science, Shizuoka University, 3. Kokusai Kogyo Co., Ltd., 4. Kawasaki Geological Engineering Co. Ltd.

This study revealed a nature of trench-parallel fore-arc ridge (TPFR). TPFR is a trench parallel rise of elevation and gravity existing in between trench and volcanic front, which is a general feature of fore-arc. Bassett and Watts (2015) suggested that TPFR corresponds to the down-dip limit of inter-plate earthquakes. Iwase (2017 JPGU) found a positive correlation between the TPFR’s free air anomaly and the age of the subducting slab. He suggested that the TPFR is caused by inter-plate interaction which reflects the rigidity of the subducting slab. But, Iwama (2018 JPGU) revisited the relationship between the free air anomaly and the slab age with more data to find that the slab age and the TPFR do not necessarily correlate each other. This suggested that the Iwase (2017)’s relationship would be artifacts due to a shortage of the data.

We considered the origin of the TPFRs from the view point of slab and fore-arc parameters. We studied the circum-Pacific subduction zones and the Jawa, the Puerto-Rico, the South-Sandwich trenches. The considered parameters are; sea floor age from National Oceanic and Atmospheric Administration (NOAA), topography from Global Bathymetric Chart of Ocean (GEBCO), slab angle calculating from slab-depth Slab1.0 from United States Geological Survey. We compared the gravity anomaly peak of TPFR with these parameters.
As a result, we found no correlation between slab age and the peak gravity value of the TPFR. However, when dividing the subduction zones by its slab age with interval of 10 Ma, we found a clear linearity between TPFR gravity and its elevation for each age range. The gradient of the gravity against the elevation is explained by pure increase of the land mass beneath the TPFR. This suggests that the TPFR is formed by lifting by the rigidity of the subducted slab. Furthermore, we found a good positive correlation between the slab age and the intercept of the TPFR gravity against the TPFR elevation. This means that when comparing the TPFR gravity at the sea level, the peak gravity is larger with older slab. This means that older slab pushes up the fore arc more than the younger slab. We concluded that rigidity of the subducting slab is not reflected by the TPFR height, but reflected by holding TPFR up.

Keywords: forearc structure, TPFR, rigidity of slab