

Relationships between spacing and growth or linkage of normal faults in the Miyako Island, South Ryukyu arc, Japan

*Sumire Maeda¹, Makoto Otsubo¹, Daisuke Asahina¹, Yuki Furuno¹

1. Research Institute of Earthquake and Volcano Geology, Geological Survey of Japan/AIST

Estimating interaction and linkage of faults is one of the most important issues to evaluate the long-term activity of future earthquakes. For the long-term evaluation of the major active fault zones, Headquarters for Earthquake Research Promotion (e.g., HERP, 2010) uses so-called 5-km gap threshold (Matsuda, 1990) to group and segment the fault traces. However, the fault size may change in the future, so it is necessary to introduce a multilateral index that can evaluate temporal and spatial evolution of faults.

Fault spacing, the horizontal distance between neighboring faults, has been related to stress reduction around faults (e.g., Soliva et al., 2006; Fossen and Rotevatn, 2016). Soliva et al. (2006) investigated the relationship between the fault spacing and the stress reduction area for a series of faults. Their studies show that the fault spacing is linearly related to the mechanical layer thickness. In the evolution process of normal fault, it is assumed that randomly distributed faults start to propagate and couple at the beginning, and the fault spacing becomes regularly distributed. Therefore, it may be possible to estimate the thickness of the mechanical layer in which the faults exist from the regular spacing of the saturated faults.

In this study, we investigated the normal faults in the Miyako Island, South Ryukyu arc, Japan in order to examine the possibility of fault linkage based on the fault spacing and the Coulomb shear stress perturbation. We found that the Miyako Island has three fault groups with different types of strikes, and these fault spacings are almost regularly distributed. The layer thickness of the NW-SE strike fault group can be estimated about 3,500 m based on the faults spacing. This results imply that the fault group extends only to the upper end of the seismogenic zone (3-17 km; HERP, 2012). In addition, the thickness of this fault group is close to the thickness of the Ryukyu Group and Shimajiri Group of the Miyako Island. Large-scale faults beneath the Miyako Island may be branched in the shallow soft-sedimentary rocks.