Northward motion of the Manazuru micro-plate revealed by strike-slip deformation along the Tanna fault observed by paleomagnetism

Haruo Kimura[1]; Hiroshi Sato[1]; Naoto Ishikawa[2]

[1] ERI, Univ. Tokyo; [2] Graduate School of Human and Environmental Studies, Kyoto Univ.

http://www.eri.u-tokyo.ac.jp/haruo/

The reason why many earth scientific phenomena in and around the Izu region are unsolved is owing to complexity in the arc-arc collision tectonics. To explain this complexity, existence of a micro-plate separated from the Philippine Sea plate (PHS), which is predicted to move to the north-northeast direction against the PHS, is assumed in the northeastern part of the Izu Peninsula. Actually, considering GPS data, the northeastern part of the peninsula is moving toward the north differentially from the other parts in the peninsula [Ishibashi and Itani, 2004]. If this northward motion of the northeastern block of the peninsula observed by geodesy is not a temporary phenomenon but a continuous phenomenon in the longer time scale, it is important to reveal this unique movement of the block for understanding the active tectonics of the collision between the Izu Peninsula and the Honshu arc. Therefore, in order to study the northward motion of the northeastern block of the peninsula as a micro-plate in the longer time scale, the author has aimed to reveal kinematics of the block by obtaining the velocity of movement of the block at its boundaries.

Along the western boundary of the block as a transform boundary, the author carried out paleomagnetic measurement around the N-S trending Tanna fault zone, and obtained the total strike-slip component of slip rate of fault including a broad strike-slip drag deformation along the fault in addition to the offset on the fault. Within 3 km from the Tanna fault, there is tectonic rotation large enough to be detected as rotation of paleomagnetic direction for the past 0.6 million years. Differential counter-clockwise rotations are found around the left-lateral strike-slip Tanna fault. We found a correlation between relative rotations and distances from the fault; the amount of vertical-axis rotation is larger for areas closer to the fault. We calculated the minimum value of strike-slip displacement by the drag deformation along the fault during the past about 0.6 million years. The obtained value is about 6.4-9.6 km. Because the offset on the fault during past 0.6 million years inferred from tectonic geomorphology [Kuno, 1936] is about 1 km, the total strike-slip displacement is more than about 7.4-10.6 km. The strike-slip component of the slip rate of the fault is greater than about 12.3-17.6 mm/yr.

The southern margin of block is the zone from the Higashi-Izu monogenetic volcanoes to the Izu-Oshima Island as a divergence boundary. Late Quaternary lateral extension along the Higashi-Izu monogenetic volcanoes is reported by Koyama and Umino [1991]. Koyama [1993] estimated the spreading velocity along the NNE-SSW direction, based on a relation between growth of thickness of dyke and intervals of dyke intrusion events. The obtained value is less than 17-20 mm/yr. At the Izu-Oshima Volcano, fissure eruption occurred in 1986 [Yamaoka et al., 1988]. An extensional rate in the NE-SW azimuth obtained from a physical model as inferred from the gravity and elevation changes [Okubo and Watanabe, 1988] and average intervals of major activities of the Izu-Oshima Volcano based on 14C dating for the volcanic products [Isshiki et al., 1981] is about 21-35 mm/yr. These values are concordant with the value observed along the Tanna fault by paleomagnetism and tectonic geomorphology.

Consequently, we can say that the northeastern part of the Izu Peninsula is moving toward the north-northeast at a velocity that is greater than about 12.3-17.6 mm/yr. This result is almost consistent with the GPS data by Ishibashi and Itani [2004].