Emplacement and faulting of basaltic rocks of Benten Island, Mineoka Belt

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According to the book titled as Story of Friction by Norimune Soda (1971; Iwanami-Shinsho), Leonardo da Vinci knew that the harder material does not erode the softer one, but vice versa. This concept might be applied to the natural faulting. Another saying is that the hanging wall is more strongly damaged than the foot wall. This might be owing to upward fluid migration.

We have been studying the geology of the ophiolitic rocks and their emplacement processes and associated deformation from various areas. Among these, we found several interesting deformation stages and modes in the basaltic rocks of the Benten Island, Mineoka Harbor, Boso Peninsula. They are published in Takahashi, Ogawa, Hirano and Ohta (2004, London Spec. Pub.); Ogawa and Takahashi (2004, Tectonophysics). In this island, three different kinds of basaltic rocks are distributed with fault contact. Dolerite dikes (D) occupy the main part, red pillow basalt (R) is on the west, and black pillow basalt (B) on the north. All are of tholeiitic major chemistry with slightly different signatures of trace and RE elements (Hirano et al., 2004; London Spec. Pub.; Ogawa, Kurosawa et al., in preparation). Ages of the basaltic rocks are mostly of Eocene (ca. 40 MaBP) with considerable younger exception of 20 MaBP alkali basalt (Hirano et al., 2004; London Spec. Pub.).

Those basaltic rocks are products of mid-oceanic ridge, back-arc basin or initial stage of island arc, but back-arc setting is most plausible. Each body has much complicatedly deformed with vein minerals, prehnite, calcite, and various zeolites as hydrothermal activities, some along faults or fractures. The fault planes or zones in between these three types of rocks are well exposed. By means of stage and geometrical analysis, the following processes are obtained. First fractures and faults in strike-slip regime occur with mineral veining, and the stretching veins suggest hybrid/extension shears. Second, strong cataclastic deformation occur, some with and some without mineral veining. This stage might be strong enough to bring those types of rocks together, and the third stage of deformation might be responsible for the present fault zone formation in which ophiolitic rocks and other pelagic to terrigeneous sedimentary rocks become in fault contact together with shear zones or gouge on the occasion of the final emplacement of the ophiolitic rocks to land. The fault zones remove again into Riedel shear fashion. The details of faultings must be critically discussed by consideration of the recent triaxial test results by Yasufumi Ohta (2004, PhD, Univ. Tsukuba).