

Mineral characteristics of the plate-boundary fault at the Japan Trench

KAMEDA, Jun^{1*} ; SHIMIZU, Mayuko² ; UJIIE, Kohtaro³ ; HIROSE, Takehiro⁴ ; IKARI, Matt⁵ ; REMITTI, Francesca⁶ ; MORI, James⁷ ; CHESTER, Frederick⁸ ; KIMURA, Gaku²

¹Hokkaido University, ²University of Tokyo, ³Tsukuba University, ⁴JAMSTEC, ⁵University of Bremen, ⁶Universita di Modena, ⁷kyoto University, ⁸Texas A&M University

The rupture and slip of the 2011 Tohoku-oki earthquake (Mw9.0) propagated along the plate-boundary megathrust and caused a huge tsunami. In order to elucidate the physical mechanisms responsible for such unexpectedly large slip of the fault, the IODP Exp. 343, the Japan Trench Fast Drilling Project (JFAST) was carried out one year after the earthquake. It succeeded in recovery of material from the plate boundary shear zone. We have examined how mineralogical properties vary through a depth-section including the plate boundary fault rock.

At the drill site (C0019E) where the large fault slip (>50m) occurred, a plate boundary shear zone was identified around 820 mbsf. X-ray diffraction (XRD) analysis revealed that abundance of smectite is markedly higher within the fault (60-80 wt.%) than in the surrounding host rocks, suggesting the shear zone material had a low intrinsic friction coefficient. Laboratory experiments on these materials demonstrated very low frictional state under various sliding conditions (Ujiie et al., 2013; Ikari et al., submitted)

In comparison, we also examined the mineralogy of reference material recovered on the outer rise of the Japan Trench (Site 436) during DSDP Leg 56. XRD analyses on the continuous series of cores found a marked anomaly in smectite abundance in the topmost ~5m section in the pelagic clay layer. Such a mineralogical feature compares well to that observed in the JFAST cores, and the smectite-rich horizon in the incoming sediments is inferred to be the localized deformation zone (decollement) when it arrives at the Japan Trench.

Keywords: Japan Trench, smectite, pelagic clay, Tohoku-oki earthquake