

Deformation of a major out-of-sequence thrust located at seismogenic depth

Shinya Okamoto[1]; Gaku Kimura[2]

[1] Earth and Planetary Sci., Tokyo Univ; [2] Earth and Planetary Science . Inst., Univ. of Tokyo (Jamstec, IFREE)

Recent geophysical researches suggest that a splay fault is bifurcated from the plate boundary decollement in the upper part of seismogenic zone in the Nankai Trough (Park et al., 2002). It implies that large earthquake in the subduction zone occurs along the splay fault. The purpose of this study is to reveal the interaction between evolution of splay fault and occurrence of large earthquake in the subduction zone.

Therefore, we have investigated the Nobeoka thrust and its shear zone which is a good on-land analogue of the splay fault.

The Nobeoka Thrust cuts the hanging-wall and foot-wall foliations and partly cuts across geologic belts different in their age (Cretaceous/Tertiary). There is about 70 degrees temperature gap between the hanging- and foot-walls. It means the Nobeoka Thrust was activated after the establishment of paleo-thermal structure. Therefore, the Nobeoka thrust is regarded as an out-of-sequence thrust.

The shear-zone related to the Nobeoka Thrust is thicker than 100m from hanging-wall to foot-wall. The foot-wall is composed of shale-dominated chaotic rocks of melange. A systematic structure like Y-P-R asymmetric fabric is recognized. The sense of shear estimated from asymmetric Y-P-R fabric suggests top-to-the SSE-ward slip, which is the same as that of the Nobeoka Thrust.

Fault core of the Nobeoka Thrust is consisted of cataclastic deformation zone about 20cm in thickness. It divides the melange in foot-wall and phyllite in hanging-wall.

We observed deformation structures in hanging-wall of the Nobeoka thrust expected to record the deformation from deep to shallow. Quartz grains are plastically deformed, and the plastic deformation-related shear strain increases with approaching the fault core of the Nobeoka thrust. Many brittle shear fractures are overlapped on the plastic deformation in the hanging wall, which have similar shear direction to that of the Nobeoka thrust. Micro-fabric analysis documents that frictional melting (pseudotachylyte) took place on the fault surface (Okamoto et al., this meeting). Moreover, preceding asymmetric cracks surrounding the pseudotachylyte are developed. The cracks are connected with implosion breccia forming a mantle of the pseudotachylyte. These fabrics suggest that the rupture propagation preceding slip was related to hydro-fracturing due to super-lithostatic fluid pressure.

Consequently, the Nobeoka thrust records the deformation from plastic to brittle regime with seismic slip.