Style of fluid flow in and around an ancient out-of-sequence thrust

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To understand the characteristics of deformation of an out-of-sequence thrust (OST) and the style of fluid flow along it, we investigated the Nobeoka Tectonic Line, which has been interpreted as a deep OST (7-9 km), in the Shimanto accretionary complex. The footwalls adjacent to the NTL showed intense shear zones of several ten to hundred thick with well-developed Y-P-R composite planner fabrics and mineral veins. We regarded them as the NTL-related shear zone because their shear senses, strike, and dip of the Y-planes were well coincided with those of the NTL, and considered that the shear zones have experienced the seismogenic faulting along a plate-subduction zone. The shear zones showed a significant difference of not only thickness, varying from 100 to 300 m, but also lithology and mineral vein development along the strike. Relatively thick zone was composed of black shale with abundant elongated sandstone blocks, and was characterized by well-developed Y-P-R composite planner fabrics and numerous mineral veins incorporated within sandstone blocks forming the P-plane. In contract, thinner shear zone was composed of black shale with relatively low density of sandstone blocks, and was characterized by well-developed Y-P-R composite planner fabrics and some millimeter to centimeter thick liner veins along the Y-plane. We performed microscopic observations of mineral veins under optical microscope and scanning electron microscopy-cathodoluminescence, and revealed that fiberous crystals were precipitated within the microcracks, perpendicular to the P-plane, as veins in the sandstone blocks, in the thicker sandstone-dominat shear zone, while Y plane filled thick liner veins, network veins, injecting into black shale, were observed in the thinner shale-dominant shear zone. The former textures could indicate that pore fluid in and around the fault zone migrated via the microcracks, and the latter could lead that high-pressurized pore fluid flowed rapidly simultaneously with the development of Y-plane. Thus, lateral variation of thickness and lithology of the shear zones in deep part of OST might follow the difference of style of fluid escape.