

Partially melting of fault rock and wide high stress-strain zone in active plate boundary thrusts: The Okitsu Mélange in the Shimanto accretionary complex

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Deep part of the accretionary prism is characterized by underplating unit of large-scale duplex structure. Some ancient seismogenic faults were found along the roof thrusts, which is lying above the duplex structure in the Shimanto accretionary complex (Ikesawa et al., 2003, Mukoyoshi et al., 2006, etc.), but not along the plate boundary décollement of the floor thrust. This study find a outcrop of the floor thrust at the Okitsu Mélange, Shimanto accretionary complex. This study describes detailed structure of the seismogenic plate boundary fault and estimates paleostress condition using a calcite twin piezometer. The Okitsu Mélange is composed of black shales, pillow basalt, chert, and boudinage sandstones. The Okitsu Mélange is characterized by duplex structure with thrust sheets of oceanic floor stratigraphy, and the rock suffers high temperatures from 240 to 270° C based on the vitrinite reflectance (Sakaguchi, 1996). This temperature is correspond to thermal condition with the present Nankai seismogenic zone (Hyndman, 1995).

The floor thrust is a boundary between the Okitsu Mélange and the under thrusting Nakamura Formation. The fault zone has the fault core with approximately 15 m in thickness and strikes N17°E and dips 79°W. The fault core can be divided into two brittle fracture zones, the ultra cataclasite, and the cataclasite zones. The ultra cataclasite zone is characterized by high sheared deformation and many quartz and calcite veins. The cataclasite zone is characterized by alternate layers of dark color fault rocks and boudinage sandstone blocks. Some quartz clasts within the cataclasite zone have flow texture due to melting under the SEM-EDS observation. This implies that some clasts within the cataclasite zone reaches the temperature over 1730°C with seismic frictional slip of the fault.

The 24 calcite veins were sampled from the Okitsu Mélange and the Nakamura Formation. In the result, the highest twin density of 152 / mm was confirmed in the fault core of the floor thrust. In other fault zones, sudden decay of the calcite twin density with distance less than several ten meters from the fault core were reported. Such localized high twin calcite twin density around fault zone is explained by stress concentration with rupture propagation of the fault. Wide high twin density zone over 150/ mm with 250 m in thickness was found at the Okitsu Mélange side from the fault core. This value of the calcite twin density is much higher than 50 to 70/ mm obtained at the Nakamura Formation. The rock around floor thrust may have been suffered high stress-strain at wide region more than 250m.

Keywords: subduction zone, plate boundary fault, floor thrust, Shimanto accretionary complex, fault rock, calcite