

Isotopic compositions of carbonate veins along the Nobeoka Thrust: implication for fluid conduit system of a mega-splay fault

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The Nobeoka Thrust in Kyushu, Japan is a large ancient fossilized out-of-sequence thrust (OOST) exhumed from seismogenic depth of accretionary prism and thought to be an on-land analogue of mega-splay fault seen in many subduction zones. Recent studies have revealed the general features of the thrust: 1) Widely distributed damage zone was formed due to repeated shear and extensional cracking. Moreover, large amount of syn-deformational fluid influx was suggested by mineral veins (Kondo et al., 2005), 2) Pseudotachylyte-bearing subsidiary faults and evidence of thermal pressurization were discovered in the hanging wall damage zone (Okamoto et al., 2006), 3) P- and S- wave velocity and density contrast between hanging wall and footwall can explain the seismic reflection pattern of mega-splay fault in modern Nankai Trough (Tsuji et al., 2006). These features are thought to be the nature of fluid-saturated faulting in subduction zones.

Despite evidence of fluid-saturated faulting, hydrological and geochemical work on the Nobeoka Thrust has not been well performed so far. In this study, we analyzed carbon and oxygen isotopic compositions of syn-tectonic carbonate veins and tried to reconstruct the fluid flow system around the thrust.

The results are as follows: 1) Delta-13C values of all the syn-tectonic veins range -6 to -12 permil (PDB), and delta-18O values of the veins range +15 to +20 permil (SMOW). Reconstructed isotopic compositions of source fluid using fluid inclusion geothermometry have delta-13C values of -4 to -9 permil (PDB) and delta-18O values of +7 to +15 permil (SMOW). These values are much higher than that of the Mugi Melange, and maybe reflecting the difference in the generation (dehydration) depth of source fluid. 2) Fault core of the Nobeoka Thrust do not seem to have been act as a fluid barrier because there is small difference in isotopic compositions between hanging wall and footwall. 3) Carbonate matrix of implosion breccia accompanying pseudotachylyte has obviously heaviest delta-13C and delta-18O values. Therefore fluid flow accompanying pseudotachylyte generation seems to have been occurred non-equilibriumly compared to other fractures.

Although these isotopic results are tentative, we could draw the general framework of fluid conduit system along the Nobeoka Thrust. Geochemical analysis of mineral veins should be useful to reveal the fluid flow system of modern mega-splay fault when we reached there.