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A brittle (normal?) shear zone cored in Site C0002 of Nankai Trough Seismogenic Zone Experiment (IODP Expedition 348)

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Integrated Ocean Discovery Program (IODP) Expedition 348, which belongs to the Nankai Trough Seismogenic Zone Experiment, conducted riser-drilling to make deeper an existing hole at Site C0002, up to 3058.5 meters below seafloor (mbsf). This site is located 80 km SE of the Kii Peninsula (Japan) in the Kumano forearc basin, in turn situated on top of the Nankai accretionary prism. Cuttings (875.5-3058.5 mbsf) and cores (2163.0–2217.5 mbsf) were collected in the upper Miocene to Pliocene turbiditic silty claystone with few intercalations of sandstone which characterize the accretionary prism lithological units.

A remarkably preserved fault zone has been cored around 2205 mbsf (core section Hole C0002P-348-5R-4). It is characterized by 34 cm of fault breccia, in which an anastomosed cataclastic foliation is present. The rocks of the damaged zone are formed by silty claystone with an incipient scaly fabric and scarce levels of sandstones.

Extra-large thin sections were made along the whole core section. In the brittle shear zone, they reveal a catalogue of deformation structures characteristic of a high structural level. In particular, almond-type structures and arrays of microfaults cutting the stratification are the most common structures and outline the cataclastic foliation. The occurrence of calcite veins in the recovered cores is limited to this fault zone, which is indicative of its role as fluid path, accompanied by carbonate cementation. Generally fault veins have lower δ^{18}O values than carbonate cements in the sedimentary matrix, consistent with veins forming at higher temperatures and/or from a fluid more strongly depleted in ^{18}O. A continuum of the relationships between calcite veins and cataclastic deformation is observed, from veins that precipitated early in the fault history, with calcite grains broken during subsequent deformation, to late veins which seal the almond-type structures within the claystones. The geometry of the calcite grains within the veins and the relationship between the veins and the wall rock indicate that the mechanism that actuate during the vein formation is that of crack-seal. It took place along variable growth planes inside the vein and the wall rock (localized and delocalized stretching veins, respectively), which result in asymmetric syntaxial veins.

All the observed microfaults produced lengthening of the markers. Together with the mesoscopic criteria (according to the visual core descriptions made onboard), this would indicate that, in its present-day position, this brittle shear zone is associated with a normal fault. Nevertheless, it is not discarded that it could be an early thrust rotated after its development.

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