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IODP Exp. 315, Site C0002B より採取した付加体中泥岩の破壊および浸透率特性
Failure and permeability properties of accretionary mud samples cored at Site C0002 of the IODP Expedition 315

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Very low frequency earthquakes have recently been found in the accretionary prism along the Nankai Trough (Ito and Obara, 2006), which has been ascribed to slow-slip faulting along out-of-sequence thrusts (OSTs). Thus faulting along the OSTs presumably varies from slow slips to seismic ruptures. What controls such difference in seismic faulting along the OSTs? Both intrinsic and extrinsic factors are likely responsible; intrinsic factors include material and physical properties of sediments (e.g., clay-mineral contents and permeability), while extrinsic factors include physical conditions (e.g., pressure, pore-water pressure and temperature). We will here discuss on pore-water diffusivity possibly affecting the duration time for stress drop after failure.

We have conducted triaxial compression experiments and permeability measurements to investigate what factors affect styles of brittle failure in accretionary sediments. We used mud samples cored from c.a. 1000 mbsf at site C0002 of the IODP Expedition 315 (#51R06 and #65R02). At room temperature, we first measured the permeability of the specimens of two samples with 20 mm in diameter and 40 mm in length, then deformed them at a constant axial displacement rate of either 1 micron/sec and 10 micron/sec, and at in situ confining and pore-water pressures, i.e. at the confining pressure Pc of 36 MPa and the pore-water pressure Pp of 28 MPa for the sample #51R06 (944 mbsf), while at Pc of 38 MPa and Pp of 29 MPa for the sample #65R02 (1049 mbsf).

Permeability measurements revealed that sample #51R06 is less permeable (k ˜ 10^{-20} m^2) than the sample #65R02 (k ˜ 10^{-19} m^2). Both samples showed a continuous porosity reduction during the deformation, implying a continuous compaction. However, the duration time required for stress drop after failure of the sample #51R06 was almost 10 times longer than that of the sample #65R02. Because the less permeable sample requires more time for pore water to diffuse throughout the sample, it also requires more time for pore-water pressure to stabilize after failure. Thus the duration time required for stress drop after failure is possibly affected by pore-water diffusivity. We will also discuss on mineral compositions and microstructures of the two samples which are relevant to the difference in their failure and permeability properties.

Keywords: post-failure curve, permeability, diffusivity