Development of new rock deformation apparatus with solid confining medium designed to reproduce the Pc-Pp-T condition of the base of the seismogenic zone

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At subduction plate boundaries and inland active faults, most of large earthquakes (Mw >7) occur at the base of the seismogenic zone with a depth of about 10–25 km. The PT conditions of these areas are corresponding to lithostatic pressures ranging 300–800 MPa and temperatures ranging 200–400 degC. In addition, seismological observations indicate that the pore fluid pressure is nearly lithostatic, meaning 300–800 MPa. The presence of high pore fluid pressure has a key role to control the rock rheology, because the frictional strength of the fault is a function of the effective pressure and physico-chemical properties of fluids changes exponentially under high pressure. However, most of rock friction experiments are conducted under pressure lower than 200 MPa. Therefore, understanding of fault rheology at the base of the seismogenic zone is limited by extrapolations of low PT experiments and experiments using analog materials. We recently built two new solid pressure medium apparatuses at Kochi Core Center and Tohoku University. They are capable to increase the confining pressure, the pore pressure and the temperature up to 2 GPa, 1 GPa and 1200 degC, respectively. These apparatuses can reproduce the in-situ or even deeper P-Pp-T conditions of the seismogenic zone. In this presentation, we will report basic performances, calibration data of the apparatuses and initial experimental results.

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