Strength of serpentinite gouge at the dehydration

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Using a gas-medium, high-pressure and high-temperature deformation apparatus, the shear sliding tests on antigorite-serpentinite gouge at 0.12 micrometer/sec with heating the specimen at 10 deg.C/min to 800 deg.C under 80 MPa of the confining pressure condition were employed to elucidate its potential to trigger the earthquakes due to the abrupt high pore pressure generation. We prepared two fluid transporting conditions around the fault, drainage and undrainage conditions. The expulsed water could be confined to generate the pore pressure under the undrainage condition, produced by the pre-cut dense alumina spacers around the specimen. On the other hand, the water could be released into the large volume of vacuumed pore pressure line through the porous alumina spacers, i.e. the drainage condition.

Weakening of the shear strength of antigorite gouge started at 520 deg.C and became significantly at 590 deg.C under the undrainagae condition. On the other hand, under drainage condition, the strength indicated almost continuous increasing until the temperature became 590 deg.C. The shear strength was slightly reduced due to the expulsion of the constitution water, and recovered after the dehydroxylation reaction ended. The dehydroxylation reaction of the constitution water would proceed abruptly in shorter time and generate the abnormal pore pressure once the specimen attains the enough heat energy, possibly inducing the fault unstable. This experimental result strongly supports a thought that the dehydration of serpentinite in the process of the subduction could be a trigger of the intraslab earthquake.

XRD analysis on experimental product for the case of undrainage condition obtained forsterite, quartz and opal, meaning the released water solved the quartz and was solidified as opal. On the other hand, for the case of drainage condition, the products were forsterite and talc. Thus, the reactions under drainage and undrainage conditions became different. We at this joint meeting would like to present more detail result of the analysis, which will reveal what mechanism induced the different reactions relevant to the fluid transport environment of the fault.