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Influence of Crustal Fluids on Faulting and Earthquakes

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Rocks under the natural crustal condition are porous to some degree. The pores are likely to contain fluids. Crustal fluids play the critical roles in faulting and earthquake generation processes. Physical properties such as elastic-wave velocities are also affected by pore fluids. A series of laboratory studies on the role of water in faulting and earthquake processes were carried out. Effects of chemical reactions between the geological materials and fluids on mechanical behavior are also important under the conditions of seismogenic zones. (1) Compressional and shear wave speeds are affected by the pore fluids(water, Ar gas, or without pore fluids). The seismic velocities under all conditions decreased linearly as temperature increased, but at different rates. (2) Microcrack activities are triggered by water infiltrated to the stressed rock specimen. In particular, they are observed at the front of the infiltrated water where gradient of water pressure is large or maximum. (3) Changes of crack shape are estimated based on the crack model and measured Vp Vs changes. As water infiltrated into the specimen, the aspect ratio of cracks becomes larger. This finally caused the coalescence of microcracks and macroscopic failure of the specimen. (4) Effects of chemical reaction on the mechanical behavior are observed in the deformation and friction experiments under high-pressure and high-temperature conditions in the presence of water.