Attenuation of seismic wave in water-saturated granite during triaxial deformation

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Rock microfracturing significantly affects attenuation of seismic wave as well as seismic velocity. In this study, seismic wave attenuation in fluid-saturated granite was estimated during triaxial deformation experiments, with particular attention focused on how microfracturing affects the attenuation.
Fine-grained Aji granite was used for experiments, with 40 mm long and 20 mm in diameter. Triaxial experiments were carried at a constant strain-rate of ~10^{-6} s^{-1} under confining pressure of 20 MPa and pore pressure of 10 MPa. During deformation, elastic wave was monitored by a pulse transmission method using both P and S wave transducers with a resonant frequency of 2 MHz. In the early stage of deformation, amplitudes of both P and S waves increase slightly due to closure of preexisting cracks and then decrease due to nucleation and growth of microcracks as the sample approaches failure, with agreement of changes in seismic velocity. Change in amplitude of shear wave tends to be larger than compressional wave, similar to those observed in fluid-saturated sandstone, suggesting that inter-crack fluid flow acts as a main source of energy dissipation. We use these wavelets to estimate attenuation (quality factor) using the spectral ratio method described by Toksoz et al. (1979); the results will be presented during the meeting.

