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The Seismic Velocity and Permeability Properties of Pulverized Rocks

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In recent years, ‘pulverized rocks’ have been studied and described on various active traces of the San Andreas Fault. These rocks appear to have been shattered in situ, have very fine grain size, but do not appear to have been subjected to significant shear strain. How these rocks were created is currently not fully understood. Recent theories include pulverized rock genesis by dynamic rupture propagation on bi-material interfaces in fault zones with different seismic velocities across the fault or the slip zone. In such cases, there is an incompatibility along the propagating rupture tip that can produce ‘wrinkle-like’ pulses and strong dynamic weakening. Rupture associated with wrinkle-like pulses may form asymmetric damage structures and shattered "pulverized rocks" on the high velocity side.

We sampled pulverized rocks from two faults zones; the San Andreas Fault in California, as well as an outcrop of the Arima-Takatsuki fault in Kobe, Japan. Using special techniques, core samples were collected in three orthogonal directions relative to fault strike and slip direction, and at various distances from the fault core. We present the first quantitative experimental data on the seismic velocities of such pulverized rocks at various effective pressures, as well as permeability measurements and detailed TEM observations on microstructures. Detailed seismic velocity data can be used as input into existing seismological models, to help test current models on the origin of pulverized rocks.