

## Fault gouge obtained from the Atera fault, Gifu Prefecture, Central Japan

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The Atera fault in central Japan extends about 35 km from Gifu to Nagano Prefectures, running in a generally NW-SE direction with a left-lateral strike-slip. The area studied, Miyawaki in Fukuoka Town, is located at the center of the fault. In the northwestern part of the study area, faults with cataclasite and fault gouge in the outcrops run NW-SE and consist of the general strike of the Atera fault. These faults are believed to have a Y-shear form within the Atera fault shear zone. In the southeastern part, the faults show an en-echelon pattern, and the relation of the faults and the major fault shear zone reveals an oblique direction with thrusting movement. The above information suggests these faults to be P-shear.

Fault gouge samples obtained from three locations in the southeastern area are described from the micrometer to the nanometer scale using transmission electron microscopy and high-resolution scanning electron microscopy. The microstructure in the fault gouge has a heterogeneous texture, characterized by domains of clayey mineral with strong dimensional-preferred orientation. These zones are similar to the shearing patterns seen in cases of R-shear and Y-shear.

The fault gouge matrix mainly consists of micrometer- to nanometer-scale particles with a quartz, plagioclase, K-feldspar, muscovite, laumontite, chlorite and smectite composition. Larger than micron-scale particles show angular shapes and crystal diffraction patterns. Particles smaller than some hundreds of nanometers in size are classified into two types: 1) angular particles with crystal and amorphous diffraction patterns, and 2) spherical particles that show only crystal diffraction patterns. The spherical particles appear to have partially dissolved in water during chemical weathering or hydrothermal alteration. The angular shapes of the amorphous particles are probably due to mechanochemical effects caused by shear stress during accompanying fault motion.