Alteration in the northern and south-central parts of the Atera fault zone

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Deformation structure and mineral assemblage in a fault gouge ruptured during the latest large earthquakes are examined to clarify the fault healing in the northern and south-central parts of the Atera fault, central Japan. The latest activity of the south-central part is the 1586 Tensho earthquake. A fault gouge in the Atera fault is revealed to be ruptured during the 1586 earthquake by a chronological study (Toda et al., 1994). The Hagiwara fault, in the northern part of the Atera fault, has a different history of rupturing from the south-central part of the Atera fault, and its latest event is 3300 years ago (Toda et al., 1996). These fault gouges give an opportunity to clarify the mineralization in the fault gouge after large earthquakes.

The studied outcrop, in the central part of the Atera fault, includes the fault gouge between the Cretaceous granite and Quaternary formations. The fault gouge zone is 10 cm in thickness. The fault gouge is composed of several clay layers with different colors. These layers are parallel to the fault gouge zone. The outcrop in the Hagiwara fault includes the fault gouge between the granite porphyry and sedimentary formation. The fault gouge zone is 5 to 30 cm in thickness, and exhibits foliation.

For the detailed observation of the fault gouges, oriented samples are collected from the outcrop. These samples are cut perpendicular to the fault plane and parallel to the lineation and are polished to observe deformation structures. In the south-central part, pale green fault gouge zones are widely distributed and contain a few granite blocks less than several centimeters in diameter. Pale orange, grayish brown and black fault gouge zones are less than 5 mm in thickness. Pale orange fault gouge zones contact with pale green fault gouges, and their boundaries are unclear. Grayish brown and black fault gouge zones are straight, and grayish brown fault gouge zones often intrude into pale green gouges. Pale green and pale orange fault gouges distribute discontinuously, suggesting that these are not the products by the latest coseismic rupturing. As the grayish brown and black gouge zones distribute continuously, these are deduced to be the possible latest coseismic rupture zone. In the northern part, four different colored fault gouges are distributed. Cross-cutting relationships are not recognized between these fault gouges.

Mineral assemblage of the fault gouge is determined by powder X-ray diffraction method (XRD). In the south-central part, Smectite is identified from fault gouge samples except the black gouges. Magnetite, mica and chlorite are detected from one sample of black gouges. These results suggest that magnetite, mica and chlorite were transported into the rupture zone during the 1586 earthquake or mineralized after the latest event and that smectite was dissolved or not involved in the rupture zone. In the northern part, mica and either chlorite or vermiculite are contained in the fault gouge. The difference of mineral assemblage between the northern and south-central parts may reflect the different history of faulting. These fluctuations of mineral assemblage during seismic cycle in fault zones would be important for fluid flow across fault zones.