Characteristics and mass transfer of fault gouges in the latest slip plane of the Atera fault zone, central Japan

Tomoyuki Ohtani[1]; Kouichirou Morikawa[2]; Satoru Kojima[1]

[1] Dept. of Civil Eng., Gifu Univ.; [2] Civil Engineering ,Gifu Univ.

http://www1.gifu-u.ac.jp/~tmohtani/

Deformation structure, mineral assemblage and whole rock chemistry of the fault zone that the age of the latest earthquake is restricted are examined to clarify the relationship between the latest slip plane and mass transfer of the fault zone in the basement rock. Although the rupture history of the faults that displace the Quaternary has been studied by the trenching survey, the large inland earthquakes were occurred recently in the unstudied active faults such as the Noto Hanto Earthquake and the Niigataken Chuetsu-oki Earthquake in 2007. To understand the rupture history of the inland active fault, it is better to evaluate the faults not only in the Quaternary but also in the basement rocks. We select the Atera fault, central Japan for this study. Fault gouges in the Atera fault are developed in basement rocks and these probably ruptured during the recent earthquakes. These fault gouges give an opportunity to clarify the relationship between the latest slip plane and mass transfer.

The two studied outcrops are located at Tase (outcrop A) and Ogo (outcrop B) in Nakatsugawa city, Gifu prefecture. The fault zone at outcrop A includes the fault gouge between the Cretaceous granite and Quaternary sediments. The fault gouge zone is 10 cm in thickness. The fault gouge is composed of several different gouges with different colors. These gouges are parallel to the fault gouge zone. The pale yellow fault gouge zones are widely distributed and contain a few granite blocks less than several centimeters in diameter. Their distribution is discontinuous. Brown fault gouge zones often intrude into pale yellow fault gouge. They contain the blocks of pale yellow fault gouge. One of them is distributed straightly and continuously. Black fault gouge zones are straight and discontinuous. These evidences suggest that one of the brown fault gouge zones is the possible latest slip plane.

The fault zone at outcrop B is developed in the Nohi rhyolite, which is covered by a conglomerate layer. Two fault gouge zones are distributed in the fault zone. One of them is an intrusion vein, and the other is the rupture zone of the earthquakes.

Mineral assemblage of the fault gouges is determined by powder X-ray diffraction method (XRD). At outcrop A, smectite is identified from fault gouge samples except the black gouges. Conversely, muscovite and chlorite are detected from black gouges. At outcrop B, plagioclase is disappeared in the fault zone.

Whole rock chemistry of the fault gouges is determined by X-ray fluorescence analysis (XRF). This analysis was performed in the Tono Geoscience Center, the Japan Atomic Energy Agency with the cooperation of Mr. Kazuhiko Kakamu using the Rigaku SYSTEM 3270. In outcrop A, the MnO content in the pale yellow and black fault gouges are similar to that in the host rock. Conversely, that in the brown fault gouge is remarkably increased. In outcrop B, the increase of the MnO content is also recognized in the fault gouge.

These results suggest that the fault gouge ruptured during the recent large earthquake and manganese has been precipitated there. Minerals with manganese are not detected by the powder X-ray diffraction. This suggests that the Mn content is low or the mineral with manganese is amorphous. The Mn oxide and hydroxide is precipitated under the surface oxidic condition. Therefore, the fault gouges was ruptured under the surface oxidic condition, and manganese has been precipitated from the groundwater. This result shows that the fault gouges ruptured recently contain the minerals precipitated under the surface condition. In the fault zone of the basement rocks, the fault activity would be evaluated from the point of view of mass transfer.