

Comparison of the fault zones of the fault activity terminated until the Early Pleistocene and the active fault

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In the active fault surveys without younger sedimentary layers, it is desired that the new method is developed to assess the fault activity using the fault rocks in the basement rocks. To achieve this, it is important to understand the characteristic features of the fault zones not only active faults, but also the faults terminated their activity recently. We studied the fault zone of the Median Tectonic Line (MTL) in Yoshino, Nara, and compare its results with those of active faults.

The MTL is the active fault in the west of the central part of the Kii peninsula, in which the fault activity is terminated recently in the east. In this eastern area, Okada and Togo (2000) show the fault which terminated its activity until 300 ka in the active fault maps. Sangawa and Okada (1977) reported an exposure of fault zone that makes a border of the Early Pleistocene Shobudani Formation and the Cretaceous Izumi Group, and that is covered by the Middle Pleistocene Gojo Formation unconformably. Based on the sedimentary ages of their formation, the MTL in this area is terminated until 1 to 1.2 Ma. The fault exposure reported by Sangawa and Okada (1977) is covered by concrete presently, we studied the fault exposure 13 km east away from the previous exposure.

In this exposure, the fault gouge zone with ca. 1 m thickness strikes E-W. The Izumi formation is in the northern side of the fault zone, in which no exposure in the southern side. The Izumi Formation in this exposure is mainly mudstone. Bedding plane is subhorizontal in the host rock, in which foliation is subvertical in cataclasite near the fault gouge. Composite planar fabric in foliated cataclasite indicates the uplift of the southern side.

The powder X-ray diffraction and X-ray fluorescence analyses were performed using the samples from this fault exposure. The results of the powder X-ray diffraction analysis shows disappearance of mica and formation of chlorite in the foliated cataclasite close to the fault gouge, and decomposition of plagioclase and formation of calcite in foliated cataclasite and fault gouge. The altered minerals indicate a remarkable alteration in foliated cataclasite rather than fault gouge. Smectite is not detected in fault gouge and cataclasite.

The results of the X-ray fluorescence analysis show the increase of TiO₂, Al₂O₃, MgO, K₂O and P₂O₅ toward the fault gouge and the decrease of CaO, Na₂O and MnO in foliated cataclasite and fault gouge. The decrease is especially in foliated cataclasite rather than fault gouge.

The studied feature is compared by that of the active faults. In the active fault zone, the latest fault gouge is characterized by the formation of smectite and concentration of Mn. Smectite is the mineral formed under lower temperature. Mn deposits under the oxidized condition. These are consistent with recent near-surface condition of the active fault zone. The studied fault zone would be displaced in the deeper part because its activity has been terminated and present surface exposure should be exhumed from 1 to 1.2 Ma to present. Mn is difficult to concentrate in the deeper reduction condition.

Keywords: Early Pleistocene, fault zone, active fault