Localized chemical changes of the fault gouges at the Awano-Tabiki outcrop of the Median Tectonic Line in Matsusaka-city, Mie Prefecture

Yuta Yamada[1], Chisaki Inaoi[2], *Tomoyuki Ohtani[1], Jun Kameda[2], Norio Shigematsu[3], Satoru Kojima[1]

1.Gifu University, 2.Hokkaido University, 3.National Institute of Advanced Industrial Science and Technology

The Median Tectonic Line (MTL) is the longest onshore fault in Japan, and it is accompanied by long deformation history and large fault zones. As the MTL has long history, the records of faultings at variable depth of the crust are expected to be well preserved. In this study, we analyzed the chemical and mineral compositions at a large outcrop exposed at Tabiki-Awano, Matsusaka-city, Mie Prefecture to understand the chemical change of the fault in the crust using the X-ray fluorescence analysis (XRF) and the powder X-ray diffraction analysis (XRD). For the XRD, the mineral assemblage analysis was performed by RockJock (Eberl, 2003).
At the Awano-Tabiki outcrop, the MTL juxtaposes the Sambagawa metamorphic rocks to the south (the footwall) against sedimentary rocks corresponding to the Izumi Group to the north (the hanging wall). The Sambagawa metamorphic rocks are variably damaged to the south by faulting with the dextral sense of shear for the distance about 20 m from the lithological boundary (Shigematsu *et al.*, 2015). Two slip zones comprising fault gouges distribute along the lithological boundary and a few meters beneath the boundary in the footwall. As the latter exhibits sharp distribution, this would be the principal slip zone. The principal slip zone consists of the foliated black gouge, gray gouge and unfoliated black gouge. As the gray gouge exhibits sharp boundaries and continuous distribution, this is expected to be the latest slip zone.
The results of the XRF show the increases of CaO, MgO, Fe_2O_3, Ignition Loss and the decrease of SiO_2 in the gray gouge. The contents of Na_2O, Al_2O_3, CaO, MnO, MgO, Fe_2O_3 are different between the both sides of the principal slip zone. No remarkable change of chemical composition is detected except the principal slip zone and rock fragments. The results of RockJock show the difference of the clay mineral contents between the both side of the principal slip zone and the distinct increases of smectite and dolomite in the principal slip zone. No remarkable change of the mineral assemblage is detected except the principal slip zone and rock fragments.
To discuss the chemical change in the principal slip zone, we examine the possibility that the decrease of SiO_2 is a relative change due to the increases of the CaO, MgO and Fe_2O_3 as carbonate minerals. The increases of Ca, Mg and Fe from the host rock are defined as three different variables. The relative decrease of SiO_2 is calculated from these variables, and they are calculated by the least square method. The result of the calculation shows that the chemical change of the principal slip zone is explained by the addition of carbonate minerals to the adjacent fault rock in the footwall side.
Although the thickness of the fault zone is large, the distinct changes of chemical compositions and mineral assemblages concentrate only in the principal slip zone. Oohashi et al. (2015) reported that the frictional coefficient is drastically decreased in the slip zone with > 30 wt% of smectite. The principal slip zone is estimated to be very weak due to the formation of smectite.

Eberl (2003) USGS Open-File Rep., 2003-78.
Oohashi *et al.* (2015) *Jour. Geophys. Res.*, 120, 1572–1586.
Shigematsu *et al.* (2015) JpGU abstrasts, SCG57-21.

Keywords: localized chemical changes, fault gouges, Median Tectonic Line

