Characteristics of the latest slip zone in the near-surface fault zone of the Neodani Fault

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The activity assessment of the active faults basically needs younger sediments. To understand the fault activity in the area with no younger sediments, it is desired to develop the new method which assesses the fault activity from the fault rocks in the basement rocks. The purpose of this study is to clarify the characteristics of the near-surface latest slip plane in the basement rocks based on deformation structure, mineral assemblage and element composition using the active fault with a large displacement during an earthquake.

The study fault is the Neodani Fault ruptured in the 1891 Nobi earthquake. The studied sites are Neo-Nagamine and Hinata, Motosu City, central Japan where left lateral displacements of 3 m and 8 m were occurred in 1891, respectively. The basement rock in the area including the studied sites is the Jurassic mélange with mudstone matrix and blocks of chert, siliceous shale, sandstone and basalt. At the Neo-Nagamine site, black shale and siliceous shale are at the northeast and southwest sides of the latest slip plane, respectively. The fault zone consists of fault breccias and gouges originated from black shale and siliceous shale, and the latest slip plane is the fault gouge of black shale. At the Hinata site, basalt and mudstone are at the northeast and southwest sides of the latest slip plane, respectively. The fault zone consists of fault gouges of them. The latest slip plane shows pale-yellow color and its original rock is not clear from the field observation. These fault zones are covered by the Quaternary river sediments, and the gravels along the latest slip plane are rotated at both sites.

The block samples were collected from the both sites, and deformation structure is observed on the polished slabs. This observation reveals that the gravels are included in the latest slip plane in the basement rocks. These are rounded gravels with 2 mm diameter, and some of them are chert at the Neo-Nagamine site. These are a subrounded chert gravel with 5 cm diameter and a rounded sandstone one with 1 cm diameter at the Hinata site. They do not come from the neighboring fault rocks and intact rocks of the basement.

The powder X-ray diffraction (XRD) and the X-ray fluorescence analysis (XRF) were performed using the powder samples to clarify mineral assemblage and element composition of the fault rocks. Smectite is included in most of the fault gouges at both sites, and kaolinite is detected from the latest slip plane at the Hinata site. Distinctive element mobilization between the latest slip plane, fault rocks and intact rocks is not recognized from the result of XRF.

The gravels including the latest slip plane is considered to come not from the neighboring fault rocks and intact rocks but the river sediments above the basement fault rocks according to the occurrence. Kaolinite in the latest slip plane and no distinctive element mobilization support this idea because Kaolinite is a product of surface weathering. The diameter of gravels in the latest slip plane is larger at the Hinata site with a larger displacement during the 1891 earthquake. This indicates that the wider opening was occurred near the surface at the area with larger displacement. Ring shear experiments under the lower confined pressure by Scaringi et al. (2018) show that clay gouge is more dilated with larger displacement. This suggests that the latest slip plane is opened during the 1981 earthquake due to the dilation of the

slipped fault gouge at the deeper part. Therefore, when the gravels above the sediments are included in the latest slip plane in the basement rocks and the sedimentation age of the gravels is known, the age of the latest faulting is limited after the sedimentation age.

Keywords: latest slip zone, near-surface fault zone, Neodani Fault

