# Fault Properties of the Shionohira Fault and its Southern Extension in Fukushima and Ibaraki Prefectures, Japan

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Co-seismic surface ruptures from Tabiuto-Nameishi to northeastern Ishizumi-Tsunaki in the Tabito-cho of Iwaki City, Fukushima Prefecture, caused by the Apr 11, 2011 Fukushima-ken Hamadori Earthquake (Mj7.0), were named the Shionohira Fault by Ishiyama et al. (2011) (hereinafter referred to as "the active segment of the 4.11 Earthquake") .
In previous studies of the 4.11 Earthquake, the Itozawa Fault consisting of some lineaments suspected as active faults was depicted (The Research Group for Active Faults of Japan, 2011). The Shionohira Fault nearly overlaps this lineament, but further extends southward from the southern end of the surface rupture. Moreover, it continues south to connect to a geological fault named the Kuruma Fault (Sugai et al., 1957) (hereinafter referred to as "the non-active segment of the 4.11 Earthquake").
The authors investigated these faults, focusing on the differences between active and non-active segments of the 4.11 Earthquake. This paper shows the results of boring surveys and properties of fault zones in boring core samples taken from both the active and non-active segments.
The study area is composed of a schist of Gozaisyo metamorphic rocks and overlaying Paleogene-Neogene sedimentary rocks, cut by the Shionohira Fault. In the active segment, studies of the fault outcrops and oriented boring surveys were carried out at Shionohira and Betto areas of Tabito-cho in Iwaki City. Vertical boring and inclined boring were conducted at Shionohira. The fault surface (N20W/75W) was found to have a 20-30 cm thick dark green gouge near the boundary between conglomerate and green schist in both core samples. Fault breccias were well developed around the fault gouge, especially thick in green schist at the footwall. An inclined boring was performed at Betto. The fault surface (N7W/80W) was found to have about 25 cm thick brown gouge in the fracture zone of the schist.
In the non-active segment, oriented boring surveys were carried out at Minakami-kita area (Fujigaoka, Sekimoto-cho, Kita-Ibaraki City). The lithology of the core sample was identified as top soil, Paleogene sedimentary rocks (mainly conglomerate), green schist and psammitic-pelitic schist, in descending order. Green schist was unconformably overlain by the conglomerate; however, the boundary was indistinct because of a fault shear. A fault surface (N4E/74W; core-depth 20.86m) with 2 cm thick blackish green gouge, and a fault surface (N1E/86W; core-depth 20.86m) with 11 cm thick grayish green and gray gouges were found. The former was in fault breccia of green schist, and the latter on the boundary between fault breccia of green schist and fault breccia of psammitic-pelitic schist. A thick fault breccia continued below the fault gouge in the footwall and partly contained cataclasite-like rocks.
The scale and properties of fault zones indicated that the Shionohira Fault and its southern extension possibly had moved before the deposition of Paleogene sedimentary rocks.
XRD analyses showed the fault gouge samples from the outcrops of Shionohira and Betto of the active segment to contain smectite with a small or non-detectable amount of chlorite. On the other hand, fault gouge samples from Minakami-kita contained chlorite with a small amount of illite and smectite. Thus, significant differences were recognized in clay minerals of fault gouge between active and non-active segments.
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