

Vertical slip rate estimated from young lacustrine sediment core samples across the Kamishiro fault, Itoigawa-Shizuoka Tectonic Line, central Japan

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We conducted drilling survey to re-examine a rate of the vertical deformation on the Kamishiro fault, northern part of the Itoigawa-Shizuoka tectonic line active fault system, central Japan. Exacted two cores, obtained on the hanging wall of the Kamishiro fault, consist of paleo-lacustrine sediments (alternation of sand-mud and sand-gravel layers). In the KMS-1 core, closer to the fault trace, extracted strata shallower than a depth of 3.2 m from the surface are horizontally laminated. The core extracted from depths from 3.20 m to 16.20 m exposes inclined strata with apparent dips of 20° to 30°, whereas upstanding strata were recovered from the core depth of 16.20 m to 28.60 m. We encountered horizontally laminated sand and mud layers again deeper than the sharp boundary at a depth of 28.65 m. In the KMS-2 core, farther from the fault trace, sediments shallower than a depth of 4.20 m are horizontally laminated. At depths from 4.20 m to 38.30 m, inclined strata with dips of 20 to 30 degree was extracted, whereas upstanding strata were recovered with shear planes at depths of 38.30 to 42.17 m. Across the sharp boundary at the core depth of 42.17 m, sand and mud layers return to be horizontally laminated.

We interpret that the sudden lithofacies change from overlying inclined strata to underlying horizontally-laminated strata, commonly shown in the both cores, is penetrating the Kamishiro fault. This interpretation is supported by ¹⁴C ages of the two cores. Thus, ¹⁴C age is younger (ca. 16,000 yr BP in the KMS-1 core, ca. 24,000 yr BP in the KMS-2 core) just below the horizon shown by the sharp boundary than that above the boundary (ca. 30,000 yr BP in the KMS-1 core, older than 50,000 yr BP in the KMS-2 core). On the basis of altitude of facies boundaries and over fifty radiocarbon ages, cumulative vertical displacements are 12–14 m at 9,000 yr BP, 16–17 m at 11,000 yr BP, ≥41 m at 21,000–24,000 yr BP, respectively. These vertical separations and ages indicate that average rates of vertical displacement in the study area are 1.2–1.4 mm/yr during the past 10 ka, and higher than 1.6 mm/yr during the past 25 to 30 ka, respectively. It implies that a coseismic vertical slip of 0.3–0.5 m at the 2014 earthquake released a strain accumulated during the past 210 to 420 years.

Keywords: Itoigawa-Shizuoka Tectonic Line, Kamishiro fault, vertical slip rate, sediment core, radiocarbon dating