Study on fault activity evaluation method (A new attempt to understand fault activities) No.2
- Injection experiment using a SIMFIP probe at Shionohira Fault and southern fault-

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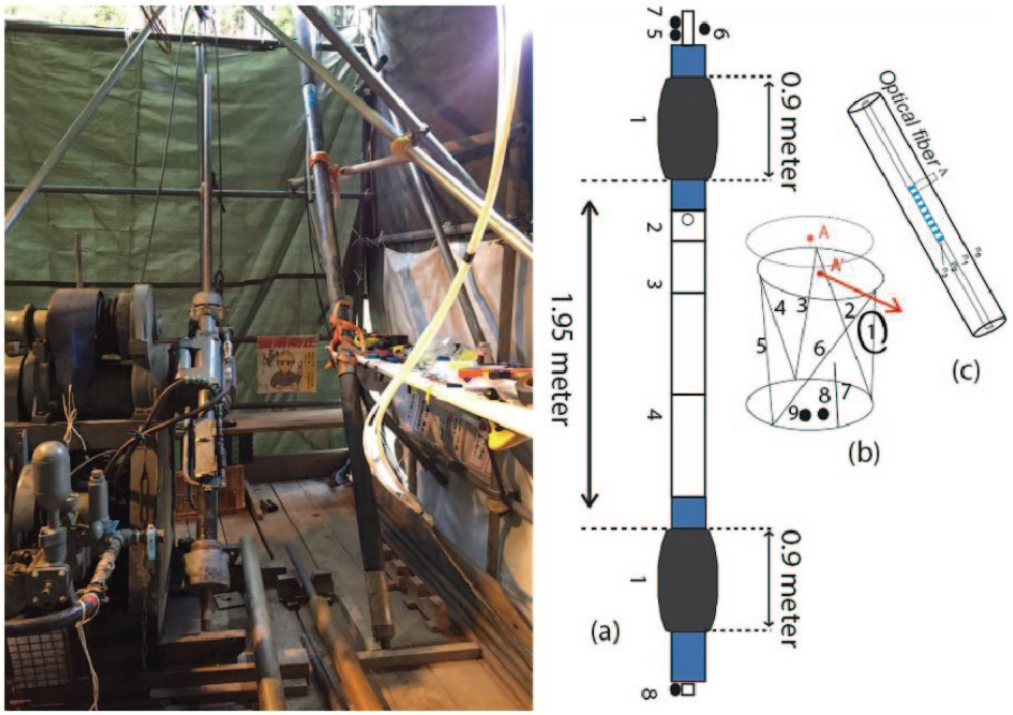
The Shionohira fault caused the April 11, 2011 Fukushima-ken Hamadori Earthquake of Mw 6.7 which occurred one month after the Tohoku-Oki earthquake of Mw 9.0. Co-seismic surface ruptures trending NNW-SSE allowed to estimate a normal slip faulting with a 2 m maximum displacement. The causes of fault activation might be related to changes in the stress state following the Tohoku-Oki earthquake. The key question is to understand why some fault segments were activated and ruptured the land surface while others remained inactive although being very close and aligned on the same fault zone, which is of importance in better assessing the risk of seismic activation of faults in Japan. This might be related to slight differences in properties between active and inactive segments. This might be related to slight differences in properties between active and inactive segments. Recent laboratory measurements on core sampled across the rupture zone show that there are differences in friction coefficients and smectite and clay mineral contents between segments (Aoki, et. al., 2016, Seshimo, et. al., 2016). These differences may condition the frictional rate and state stability of the fault. In this project, frictional stability and hydraulic permeability of the Shionohira fault are explored in situ from SIMFIP probing of borehole intervals intersecting the fault at depths of about 10-to-30m.

Surface earthquake fault caused the earthquake of April 11, 2011 coincides with the west trace of Itozawa fault (Tsutsumi and Toda, 2012). Imaizumi et. al. (2018) identified the lineament as an active fault from Wakigawa of Yamadama-machi to Obuki of Sekimoto-machi, Kitaibaraki city. No surface rupture was idenfied in this region. This study refers to the part of the fault with surface rupture as an active segment and that without surface rupture as an inactive segment.

At the Shionohira site, vertical borehole of 30 m depth was drilled and test intervals were decided based on core observations, borehole TV and caliper logging data as follows. Test 1 between depths of 7.0 and 11.5m isolated with upper and lower packers and pressurized was conducted above the recently activated fault zone in the unfaulted sandstone layers. Test 2 between depths of 12.8 and 17.3m was conducted across the recently activated fault zone.

At the Minakami-kita site, inclined borehole of 50 degrees from surface with 30 m length was drilled and fracture zones were detected at 20.40 to 23.10 m. In-situ injection experiment using a SIMFIP probe is under going, comparison results will be presented at the conference.

Keywords: SIMFIP method, active fault, Sionohira Fault, Fukushima-ken Hamadori Earthquake, fracture zone charactarizaton, injection test



-SIMFIP probe used in Minakami-Kita tests – Left is a photo of the drill rig with the assembled SIMFIP probe set on the right -
(a) SIMFIP plan (1 packers, 2 injection sub, 3 SIMFIP cage, 4 extension subs, 5 Inclinometer, 6 Accelerometer, 7 Top pressure, 8 Bottom pressure)
(b) Principles of the sensor which is a deforming cage in 6 different directions + 1 reference (7) + 1 interval pressure (8)
(c) We build all our sensors using Bragg gages all connected on the same optical fiber.

