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Correlation stress history with mineral composition at small brittle faults in the borehole core penetrating the MTL

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The Median Tectonic Line (MTL), the largest on-land fault in Japan, has a long history of displacement, and the fault rocks deformed under variable conditions exist. The analysis of internal structure of the MTL, therefore, helps to improve our understandings of variable fault behavior depend on the physical conditions.

AIST drilled a borehole penetrating the MTL for predicting the Tonankai-Nankai Earthquake at Iitaka-Ako, Matsuzaka, Mie prefecture. The drilling length is 600m. It crosses MTL at the depth of 473.9m. Hangingwall of the MTL consists of the Ryoke-derived tonalitic mylonite and footwall of the MTL consists of fractured rocks derived from the Sambagawa metamorphic rocks.

The hangingwall has gone through the three kinds of stress pattern after the mylonitization. These are stresses which caused normal faultings, North-South compressive stress and East-West compressive stress (present stress pattern) in turn with time (Shigematsu et al., 2010).

In addition, based on the analysis of deformation structure and alteration minerals, prehnite was formed before the stresses which caused normal faultings and laumontite had been formed since the stresses which caused normal faultings until the present stress pattern and then has decomposed later on in the hangingwall (Fujimoto et al., 2010).

Here we will more precisely reconstruct the history of the condition of deformation and alteration in the hangingwall by especially advancing the analysis of the alteration minerals in Fujimoto et al. (2010).

We collected the fault material on the slip surfaces of the about 250 small brittle faults whose stress histories are already analyzed in the borehole core. And we analyzed mineral composition of those samples by X-ray diffraction.

We recognized the following characteristics
(a) The mineral composition is different between slip surface and wall rock though the mineral assemblage is almost same.
(b) Mineral composition of the slip surfaces reflect hydrothermal alteration controlled by the meso scale fracture systems.
(c) The stress history does not precisely correspond to the mineral composition on each slip surface. The mineral composition on slip surface may have been affected by later stage hydrothermal alteration.

We inferred the following correlations between stress history and mineral composition.
(A) Quartz is dominant on the slip surfaces formed under the stresses which caused normal faultings.
(B) Calcite is dominant and laumontite is present on the slip surfaces formed under the North-South compressive stress.
(C) Both quartz and calcite are dominant and laumontite is scarce on the slip surfaces formed under the East-West compressive stress (present stress pattern).

Mode of occurrences of minerals on the slip surface should be studied for father understanding.

Keywords: Median Tectonic Line, Fault, Borehole core, Stress history, Fault material, Mineral composition