Postseismic fluid discharge chemically recorded in altered pseudotachylyte discovered from an ancient megasplay fault

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Megasplay fault blanching from plate boundaries at subduction zones are thought to be important source of earthquakes generating tsunami. In this study, we performed structural and geochemical analyses on a fossilized Megasplay fault (the Nobeoka Thrust of the Shimanto accretionary complex) to understand fluid-rock interaction and how the splay fault plays a role of fluid flow in the seismogenic zone.
Nobeoka Thrust is a low-angle thrust which subdivides the Shimanto belt in Kyushu into the northern (Cretaceous and Tertiary) and the southern (Tertiary) subbelts, and is an exhumed analogue of an ancient megasplay fault. The hanging wall and the footwall of the Nobeoka Thrust show difference in lithology and metamorphic grade, and their maximum burial temperature is estimated from vitrinite reflectance analysis to be 320~330˚C and 250~270˚C, respectively.
As a result of structural observation, the principal slip zone (PSZ) of the Nobeoka thrust is composed of foliated cataclasite originated from sandstone-shale mélange including thin (~1.5 mm thick) pseudotachylyte layer. Major and trace element composition analysis and EPMA element mapping revealed that the pseudotachylyte within the PSZ is enriched in Li and Cs, as well as slip zone of a minor fault in the footwall. Li- and Cs-enrichment in pseudotachylyte is interpreted as a result of fluid-rock interaction just after faulting (postseismic stage) because such an anomaly is only formed by large fluid/rock ratio (R > 512 to 24 at 250 to 350 degrees C) under the existence of Li- and Cs-enriched fluid.
X-ray diffraction analysis showed that the pseudotachylyte was devitrified to form palygorskite and muscovite, similar to the pseudotachylyte founded in minor shear zone of the hanging wall (Okamoto et al., 2006). The amount of fluid reacted with pseudotachylyte is estimated to be 4.8 $\times 10^{0}$ to 1.64 $\times 10^{4}$ m^{3}, based on empirical relationships among fault thickness, displacement and fault length.

Keywords: fluid-rock interaction, pseudotachylyte, megasplay fault

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