Chemical characteristics and source of the fluid involved in the black fault rocks in the Kodiak accretionary complex

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Fluids in subduction zone are believed to play an essential role in triggering the earthquakes and inducing dynamic weakening of the earthquake faults. Recent geochemical studies have revealed that trace element and isotope characteristics recorded on the fault rocks are useful for evaluating fluid-rock interactions in fault zones during the past earthquakes. In this paper, we discuss the nature of the fluid involved in the fault zone in the Kodiak accretionary complex, which is regarded as a paleo-plate-boundary decollement at seismogenic depth (Rowe et al., 2005). It has been shown that ultrafine-grained black fault rocks in this locality exhibit clear depletions in Rb and Cs and enrichment in Sr relative to host rocks, consistent with the occurrence of coseismic fluid-rock interactions at the temperatures higher than 350 ˚C (Yamaguchi et al., 2014).

The distinct Sr enrichment in the black fault rocks is associated with a decrease in 87Sr/86Sr ratio, suggesting the involvement of fluids of external origin that has low 87Sr/86Sr ratios. The estimated 87Sr/86Sr for the end-component fluid is too low to be derived from sediments, but consistent with altered oceanic basalts. This suggests that the fluids were derived from underlying subducted oceanic crust. The black fault rocks are also characterized by slight enrichments in Li, which contrasts with distinct Li depletion observed in fault rocks that have experienced high-temperature fluid-rock interactions at shallower depths (Ishikawa et al., 2008; Hamada et al., 2011). The observed Li enrichment implies the involvement of Li-rich fluids in the Kodiak fault zone. The temperature and source required for the Kodiak fluids will be discussed based on the trace element and Li isotope characteristics.

References: Yamaguchi et al. (2014) Earth, Planets and Space, 66, 58; Rowe et al. (2005) Geology, 33, 937–940; Ishikawa et al. (2008) Nature Geoscience, 1, 679–683; Hamada et al. (2011) Journal of Geophysical Research, 116, B01302.

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