Geochemical characteristics and origin of fluids involved in the genesis of plate-boundary fault rocks of the Kodiak accretionary complex

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The Pasagshak Point thrust in the Kodiak accretionary complex is considered to represent the paleo-plate-boundary décollement at seismogenic depths. The fault rocks in this thrust consist of cataclasites and ultrafine-grained black fault rocks (BFRs), and the latter makes up the principal shear zones (Rowe et al., Geology, 2005; Meneghini et al., GSA Bull., 2010). Yamaguchi et al. (EPS, 2014) showed that trace element characteristics of the BFRs are consistent with the occurrence of fluid-rock interactions at >350 deg. C, based on the geochemical modeling (Ishikawa et al., Nature Geosci., 2008). Here we present further trace element and isotope analyses on the same samples, and re-examine the data in detail.

The BFRs are characterized by clear enrichments in Na and Sr and depletions in B, K, As, Rb and Cs relative to the cataclasites. Normative Plagioclase abundances calculated from major element compositions are distinctly higher in BFRs than in cataclasites. Distinctly high Sr concentrations and low 87Sr/86Sr ratios observed in BFRs are well correlated with the normative plagioclase. This indicates that the petrogenesis of BFRs requires additions of Na and Sr derived from external sources, possibly migrating saline fluids. The 87Sr/86Sr ratio estimated for end-component fluid is as low as 0.705, strongly suggesting the involvement of fluids from basaltic source. B and Li isotope ratios of BFRs are also consistent with equilibration with basalt-derived fluids. Thus, it is likely that saline fluids largely derived from basaltic oceanic crust of the lower plate migrated through the plate boundary décollement, and frictional heating during earthquake(s) induced high-temperature fluid-rock interactions at >350 deg. C to produce the unique geochemical characteristics observed in BFRs.

Keywords: Fault rocks, Geochemistry, Subduction zones, Fluids

