Geochemical constraint on the origin of albite-bearing black fault rocks in 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., 2005; Meneghini et al., 2010). The BFRs contain crystalline microlayers characterized by the presence of fine-grained albitic plagioclase (Meneghini et al., 2010). Previously Yamaguchi et al. (2014) showed that the trace element characteristics of BFRs are consistent with the occurrence of fluid-rock interactions at >350 deg. C. Here we present further trace element and isotope analyses on the same samples, and re-examine the data in detail. Plagioclase abundances (albite + anorthite) calculated from major element compositions are distinctly higher in BFRs than in host rocks and cataclasites. Distinctly high Sr concentrations and low 87Sr/86Sr ratios observed in BFRs are well correlated with the plagioclase abundances. 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. 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 combined with comminution induced high-temperature fluid-rock interactions at >350 deg. C to produce the unique geochemical characteristics observed for BFRs.
Refs: Meneghini et al. (2010) GSA Bull., 122, 1280-1297; Rowe et al. (2005) Geology, 33, 937-940; Yamaguchi et al. (2014) Earth Planet Space, 66:58.

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