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Fluid-rock interaction at temperatures from diagenesis to seismogenesis: The Nankai accretionary complex (Japan)

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Subduction processes are known to play a key role in global geochemical cycling and convergent margin dynamics. Especially the role of fluids in earthquake nucleation and fault activation is long been known. As one of the key players, pore pressure may strongly enhanced when parts of a fault seal by precipitation of authigenic phases from a deep-seated, supersaturated fluid. At present one of the major aims in subduction factory research is to better understand the mechanisms and quantify the transfer of geochemical tracers from the subducted slab to the overlying lithosphere (forearc), hydrosphere (seepage), or atmosphere (arc magmatism). Earlier studies relied on the mobilization of large ion lithophile elements relative to high field strength and rare earth elements, enrichments in water-soluble elements being mobilized, as well as on ratios of key trace elements (e.g., B, Ba, Th, Nb) and isotopic ratios (e.g., 10Be/9Be; 232Th/230Th; 206Pb/204Pb, d11B).

Here, we report results of geotechnical tests under PT conditions approaching those of the upper seismogenic zone (up to 150°C and 70 MPa effective normal stress) to characterize devolatilization, cementation, and isotope fractionation in marine sediments. Pore fluids as well as muds of the main lithologies in the Nankai Trough subduction zone are continuously sampled during progressive loading during the experiment, and generally show profound enrichments in the fluids and leaching in the sediment. Clay mineral-rich sediments show profound freshening of some elements (e.g., Ba, Th) at low T (20°C), which is overprinted by T-driven mobilization at elevated T (tests at 100°C and 150°C). The tephra-rich turbidites do not show the element depletion. De-

spite low-T freshening in places, volatile elements, HFSEs and REEs are generally mobilized during the experiments. The results have several repercussions on earlier interpretations, such as the use of HFSE enrichment in magmas as a proxy for sediment consumption. B isotopes show significantly lower d11B values in the heated tests in both the fluids and solids, and B depletion in the sediment.