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The role of sediments in the mechanics of the subduction plate interface – Chugach accretionary prism Alaska

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The subduction interface is a shear zone that defines the boundary between two convergent tectonic plates, the subducting slab and its overriding upper plate. The rheological and seismic behavior of the plate interface is a function of interacting physicochemical processes such as metamorphic grade and mineral dehydration reactions. Here we study the role of initial oceanic crustal composition in controlling these low-grade (prehnite-pumpellyite facies) conditions, and investigating the potential links between composition, deformational styles and modes of fault slip along subduction megathrusts. Our study area is located on the Kenai Peninsula in southern Alaska where the Jurassic-Cretaceous Chugach accretionary complex is preserved. This complex comprises underplated slices of basaltic oceanic crust and sedimentary material. We compare two field sites at similar metamorphic temperatures that each represent an interface shear zone: a basalt dominated section and a sediment-rich section. Raman spectroscopy to determine graphite crystallinity and deformation temperatures, combined with detrital zircon dating (U-Pb) are examined as function of structural depth and provide constraints on the metamorphic conditions and timing of underplating, and the peak temperature reached in underplated slices. Observations from field work and drone imaging shows that the sediment-rich interface shear zone includes a chert-argillite mélange zone of up to 15-m thick. Within this mélange, greywacke blocks occur and are surrounded by brittle-deformed and heavily veined basalt and/or greywacke slabs. The basalt dominated section includes several localized duplex faults. The fault planes are much narrower fault surfaces (< 5 cm thicknesses) and are decorated by highly orientated laths of chlorite. Microstructural observations will allow us to decipher the microphysical deformation mechanisms. Comparing the deformation structures and mechanisms at these two sites provides new insights into the compositional control on the rheology of the subduction interface.