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Quantifying the spatial distribution of rapid exhumation from glacial detritus, St. Elias Range (Alaska)

D. Grabowski, E. Enkelmann, and T. A. Ehlers
Department of Geosciences, Universität Tübingen, Germany, (david.grabowski@student.uni-tuebingen.de)

We present a provenance analysis, zircon (U-Th)/He thermochronometer cooling ages, and petrologic characterization of exhumation processes active under the Malaspina Glacier, St. Elias Range, Alaska. The collision of the Yakutat Terrane with North America formed the St. Elias Range in southeast Alaska. This region is subject to active faulting, high seismicity, and intense glacial erosion. Recent thermochronology studies document rapid rock exhumation at the Yakutat corner where strike-slip deformation transitions to convergence. Published detrital zircon fission track ages from sand samples of the Seward – Malaspina Glacier yielded a young age population of 2 Ma, suggesting a region of rapid exhumation somewhere in the glacier drainage basin. However, the glaciers cover the area and prevent direct observation and sampling, thereby inhibiting detailed bedrock exhumation studies of the Yakutat corner region.
We investigate the lithologies of the bedrock at the Yakutat corner to quantify patterns of rock exhumation using clasts collected from the toe of the Malaspina Glacier. Seven different locations 50 km around the glacier were sampled and lithologies characterized by point counting in the field. In total, 1998 clasts were analyzed. We identified six main lithological groups that are assignable to specific geological units. Most of the detritus is gneiss and granulite (26%), micashist and phyllite (26%), and granite (11%) and are typical lithologies of the Chugach Terrane located at the southern margin of the North American plate. Mafic rocks of amphibolite, gabbro, and basalts (21%), and metapelite, sandstone, quartzite and breccia (14%) were also present and are typical for the colliding Yakutat Terrane. Two percent of the clasts are tightly foliated and mylonitic. These clasts are inferred to originate from the Contact Fault, an old suture zone that has been reactivated during Yakutat Terrane collision.
Individual clasts from each sample locality and from all lithological groups were measured for zircon (U-Th)/He thermochronometer cooling ages. Furthermore, thin sections of 80 clasts were analyzed for petrographic characterization of the lithological groups. The zircon and titanite grains of 50 clasts have been separated and prepared for U-Th/He dating, degassed for He, and await final measurement of U-Th concentrations. We will report a comparison of these cooling ages with published bedrock and detrital low-temperature thermochronometer ages from neighboring areas. These cooling ages and their associated lithologies will allow identification of the spatial distribution of exhumation and the different magnitudes of exhumation between the two plates (Chugach vs. Yakutat).