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Exhuming Metamorphic Rocks:

Constraints from Cooling of the Chugach Metamorphic Complex, southern Alaska

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Exhumation mechanisms for metamorphic rocks include (a) erosion, (b) extension, (c) extrusion by channel flow, simple or pure shear, and - recently suggested - (d) slab extraction. Distinguishing in a particular case of a metamorphic complex between the different exhumation mechanisms is a much discussed subject in modern geodynamics. In order to add to this discussion, we adopt an interdisciplinary approach combining detailed petrological and structural field work with several geochronological and thermochronological systems.

The Chugach Metamorphic Complex of southern Alaska is a ∼600 km long and 10-30 km wide zone of upper amphibolite-facies metamorphic rocks. It lies in the outermost tectonic belt of the North American Cordillera, which is a vast and complex Phanerozoic orogen formed from the oblique collision of the Pacific, Kula and Farallon oceanic plates and the North American continent. The Chugach Complex developed in the Eocene in a Cretaceous to Paleocene accretionary prism while the Kula and Pacific plates were obliquely colliding with North America. We conducted detailed field work, U-Pb and ^{40}Ar-^{39}Ar geochronology and compiled all other geochronological data from the region in order to construct cooling histories for the whole metamorphic complex. These cooling histories vary along strike: The western and central parts of the Chugach Metamorphic Complex, where the metamorphic complex is wide, show very fast cooling to below ∼300°C between 54-45 Ma, shortly after peak metamorphism, and then slowly cool to surface temperatures over the remaining 45 Ma. In contrast, the south-eastern part, where the metamorphic complex is very narrow, slowly and steadily cooled between 51-5 Ma only to increase its cooling rate in the last few Ma before present. Whether and how these cooling rates can be directly linked with exhumation rates and why they differ so grossly between the wide and the narrow parts of the complex is the current focus of our work.