Geophysical Research Abstracts
Vol. 17, EGU2015-551, 2015
EGU General Assembly 2015

Spatial and temporal development of exhumation at the St. Elias syntaxis in the Yakutat-North American subduction-collision zone, SE Alaska

Sarah Falkowski (1), Eva Enkelmann (2), Jörg Pfänder (3), Kerstin Drost (1), Konstanze Stübner (1), and Todd Ehlers (1)

(1) Department of Geosciences, University of Tuebingen, Tuebingen, Germany, (2) Department of Geology, University of Cincinnati, Cincinnati, USA, (3) Department of Geology, TU Bergakademie Freiberg, Freiberg, Germany

Since the Mesozoic, the western North American margin has been built by the subduction-collision of several terranes. Currently, the 15–30 km thick, wedge-shaped oceanic plateau of the Yakutat microplate collides obliquely with North America at the bend of the southern Alaskan margin forming the Chugach-St. Elias Mountains. Glaciation of this orogen started 6–5 Ma and efficient glacial erosion has been reported over different timescales. Particularly rapid and deep exhumation occurs at the St. Elias syntaxis, where the plate boundary bends and the tectonic regime transitions from transpression to convergence and flat-slab subduction. This region comprises the highest topography and is almost completely covered by the Seward-Malaspina and Hubbard-Valerie glacial systems. Very young detrital zircon fission-track exhumation ages (<5 Ma, closure temperature of 250±40 °C) from glacial outwash sand led to speculations about the underlying geodynamic mechanisms and comparisons to processes occurring at the Himalayan syntaxes.

The comparison of bedrock and detrital thermochronology shows that the youngest cooling ages, and hence the highest exhumation rates, only occur in low-elevation, ice-covered valleys in the St. Elias syntaxis area. We now further investigate this area concerning its spatial and temporal development. Zircon fission-track age distributions derived from 46 glacio-fluvial sand samples confine the area of rapid and deep exhumation on the resolution of catchments to an ~4800 km̂2 area on the North American Plate around the St. Elias syntaxis. To overcome the shortcoming of a decreased resolution of the provenance signal of sand, we present 22 new crystallization ages of cobble-sized detritus from the Seward-Malaspina Glacier. Zircon U-Th/He ages of the cobbles demonstrate that they originate from below the ice and their provenance is analyzed based on their petrographic information and zircon U/Pb data (30.8±0.8 to 277.1±7 Ma, 2σ). Furthermore, we gained 29 new cooling ages of multiple thermochronometers from the cobbles of the Seward-Malaspina and Hubbard-Valerie Glaciers (hornblende and biotite 40Ar/39Ar, zircon and apatite U-Th/He, apatite fission-track) that reveal different cooling histories for the rocks within the syntaxis. For most cobbles, we can determine the provenance within the glacial catchments of the syntaxis area. The results support previous conclusions of a larger part of the syntaxis being affected by rapid, deep exhumation because several terranes contributed cobbles with young cooling signals. Unlike at the Himalayan syntaxes, the higher-temperature 40Ar/39Ar cooling ages (~300–500 °C) are not very young but mostly only a few Myr younger than the corresponding crystallization age. This represents cooling after Eocene ridge subduction, which formed the Chugach Metamorphic Complex.

This study reveals the longer regional tectonic history, such as various subduction processes and collision of the Yakutat microplate. It also shows that detrital material yields information on exhumation and provenance of otherwise inaccessible parts of a catchment.