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Along-strike variations in the timing and magnitude of exhumation in the eastern Peruvian Andes

Sarah Falkowski[1], Todd Ehlers[1], Nadine McQuarrie[2], Victoria Buford Parks[2], Chloë Glover[2], and José Cárdenas[3]

[1]Department of Geosciences, Universität Tübingen, Tübingen, Germany (sarah.falkowski@uni-tuebingen.de)
[2]Department of Geology and Environmental Science, University of Pittsburgh, Pittsburgh, USA
[3]Faculty of Engineering Geology, Mining and Metallurgy, Universidad Nacional San Antonio Abad del Cusco, Cusco, Peru

The spatio-temporal history and control of uplift and incision of the eastern flank of the Central Andean Plateau margin is a point of controversial discussion. For example, ca. 4 Ma incision has been suggested for canyons in Bolivia and South Peru (>1250 km apart) and could be interpreted as either tectonically or climatically driven.

To evaluate the sensitivity of cooling ages to climatic and/or tectonic driven erosional exhumation, we build upon previous work and contribute new low-temperature thermochronometer data from three, up to 190-km-long transects from the eastern Andean Plateau to the Subandean Zone in southeastern Peru. The transects extend from the plateau down the San Gabán, Marcapata, and Tres Cruces valleys and include both valley bottom and interfluve samples. This is different from previous work and allows for an evaluation of age-elevation relationships along and across strike.

We present new thermochronometer dates from 46 apatite (U-Th)/He (age range ~1–41 Ma), 23 zircon (U-Th)/He (~4–284 Ma), 21 apatite fission-track (~3–63 Ma), and 11 zircon fission-track (~14–37 Ma) bedrock samples, as well as thermal models. All samples are interpreted in the context of sample elevation and neighboring structures.

We discuss the Miocene–Pliocene exhumation history of the Eastern Cordillera, including differences in the exhumation magnitude between the transects that are ca. 50–100 km away from each other. Based on age-elevation and age-distance relationships of the different thermochronometers and thermal models, we find that causes of exhumation and canyon incision cannot be as clearly identified and separated in time as previously suggested. However, plateau incision in the latest Miocene or later is consistent with climate enhanced incision and needed to explain the relationship between apatite (U-Th)/He and higher-temperature thermochronometer ages. Future work will integrate thermo-kinematic and erosion models to help gain further insight into the deformation history of the area.