Geophysical Research Abstracts
Vol. 21, EGU2019-8534, 2019
EGU General Assembly 2019

Exhumation rate and tectonic histories of the Central Andes (18-36°S)

Nadja Franziska Stalder (1), Frédéric Herman (1), Maria Giuditta Fellin (2), Isabelle Coutand (3), Peter W. Reiners (4), and German Aguilar (5)

(1) Institute of Earth Surface Dynamics, University of Lausanne, Lausanne, Switzerland, (2) Department of Earth Sciences, ETH Zurich, Zurich, Switzerland, (3) Department of Earth Sciences, Dalhousie University, Halifax, Canada, (4) Department of Geosciences, University of Arizona, Tucson, USA, (5) Advanced Mining Technology Center, Facultad de Ciencias Fisicas y Matematicas, Universidad de Chile, Santiago, Chile

The Earth's topography is shaped by tectonic and climatic conditions which influence surface processes via rock uplift, erosion, and deposition. Although early numerical and analogue models provide the theoretical background of the role of erosion on the tectonic evolution of a mountain belt, evidences of feedbacks rather than circumstantial coincidences between topography, climate, and tectonics are challenging to observe in field studies. Here, we use the Central Andes (18-36°S) as a natural laboratory to study possible interactions between these processes. We start by modelling the exhumation rate history in the Central Andes for the last 80 Ma by inverting low-temperature thermochronometric ages compiled from literature (699 ages) and new data (240 ages). The modeled exhumation rates are then compared to the deformation and climatic histories derived from regional sedimentary deposits. Our findings show that before 22 Ma, exhumation rates north of 32°S are lower than 0.15 km/Ma. This is consistent with low shortening rates and low topography in this region. Pulses with slightly higher rates occur only locally in distinct zones in the Western Cordillera. These are probably controlled by regional fault activities during the first major orogenic phase in the Eocene. Exhumation in the Eastern Cordillera started around 26 Ma and subsequently affected the Interandean (∼18 Ma) and the Subandean zones (∼12 Ma), most likely reflecting the migration of the deformation front to the east. Exhumation rates in these zones increase during the Miocene from ca. 0.15 to 0.3 km/Ma, probably due to the combination of growing topography, higher shortening rates, and intensified precipitation along the eastern deformation front linked to the uplift of the Eastern Cordillera. South of 32°S, exhumation rates in the Principal Cordillera increase from 0.15 km/Ma at 12 Ma to more than 1.2 km/Ma since 2 Ma. This recent increase in erosion is associated with increased precipitation and glaciation, and a feedback with isostatic rock-uplift and active tectonics. Our study shows that the respective influences of climate and deformation on exhumation cannot be decoupled in the northern Central Andes, whereas in the southern part exhumation rates are largely influenced by Pleistocene glacial erosion and intensified precipitation. Furthermore, late Miocene exhumation rates of the semi-arid to arid eastern Andean slope north of 32°S and the Principal Cordillera south of 32°S are similar, although shortening rates are significantly higher in the north than in the south. This highlights the importance of climate on exhumation in active mountain belts.