Geophysical Research Abstracts
Vol. 14, EGU2012-5511, 2012
EGU General Assembly 2012

Relief evolution above Patagonian slab window inferred from low-temperature thermochronology: subduction or climate?

B. Guillaume (1,2), C. Gautheron (3), T. Simon-Labric (4), J. Martinod (5), M. Roddaz (5), and E. Douville (6)

(1) Géosciences Rennes, UMR CNRS-6118, Rennes, France, (2) Laboratoire de Planétologie et Géodynamique, Université de Nantes, Nantes, France (benjamin.guillaume@univ-nantes.fr), (3) Interactions et Dynamique des Environnements de Surface, UMR CNRS-8148, Orsay, France , (4) Isterre, Universit\'e Grenoble 1, CNRS, Grenoble, France , (5) GET, UMR 5563 (CNRS-UPS-IRD-CNES), Toulouse, France, (6) LSCE/IPSL, UMR 8212 (CNRS-CEA-UVSQ), Gif sur Yvette, France

The formation and evolution of relief in subduction-related orogens result from a variety of processes acting at different scales of time and space. The interplay between tectonics and erosion (river incision, glacial erosion...) is generally the principal contributor to the relief development. However, Earth's surface topography is also shaped by mantle convection, the latter generally producing a low amplitude, long-wavelength deflection of the surface as a response to the distribution of density anomalies in the mantle. For regions where mantle dynamics may change rapidly, e.g. in subduction zones where slab windows form, the signal of dynamic topography may also be variable in time and space, and exert an important control on landscape evolution, but this issue has been poorly addressed so far.

Patagonian is one of the few regions on Earth where a slab window is currently developing. The arrival at trench of the Chile Ridge separating the Nazca and Antarctic plates at the latitude of 54°S ca. 16 Ma ago and the westward motion of South America led to the intermittent migration toward the north of the associated triple junction and the progressive enlargement of the Patagonian slab window, which is clearly identified on tomographic images as a low seismic velocity anomaly in the upper mantle. The contribution of slab-window-related dynamic topography in the topographic evolution of the Patagonian Cordillera has generally not been considered mainly because local flexural and isostatic adjustments due to tectonics and erosion obscure the dynamic topography signal. In particular, glaciations recorded by the oldest glacial till preserved in South America, played an important role in shaping the Andean landscape as early as ca. 5-7.4 Ma.

In this study, we combine low-temperature thermochronology apatite (U-Th)/He data and semi-analytical modeling of dynamic topography to investigate the role of slab window and climate on cooling/heating history and relief evolution in the Patagonian Cordillera. In particular, we discuss a new thermochronological dataset consisting in 22 samples divided into four elevation transects. Sampling sites were chosen at the same distance from the trench (250-300 km), on the leeward eastern side of the orogen, for latitudes ranging between 45°S and 48°S to detect a potential northward migration of the thermal signal associated with the northward migration of the slab window. We show that history of heating and cooling for this region of the southern Andes compares well with the time-evolution of slab window and that present-day latitudinal topographic variations cannot be explained by climate alone but require an additional support by dynamic topography.