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Early exhumation of the Frontal Cordillera (southern Central Andes at ~33.5°S) and implications for Andean mountain-building

Robin Lacassin[1], Magali Riesner[1,2], Martine Simoes[1], Tania Habel[1], Audrey Margirier[3], and Daniel Carrizo[4]

[1]Université de Paris, Institut de physique du globe de Paris, CNRS, Paris, France (lacassin@ipgp.fr)
[2]CEA, DAM, DIF, F- 91297, Arpajon, France
[3]Universität Potsdam, Institut für Geowissenschaften, Potsdam, Germany
[4]Advanced Mining Technology Center, University de Chile, Santiago, Chile

The Andes are the modern active example of a Cordilleran-type orogen, with mountain-building and crustal thickening within the upper plate of a subduction zone. Despite numerous studies of this emblematic mountain range, several primary traits of this orogeny remain unresolved or poorly documented. The timing of uplift and deformation of the Frontal Cordillera basement culmination of the Southern Central Andes is such an example, even though this structural unit appears as a first-order topographic and geological feature. Constraining this timing and in particular the onset of uplift is a key point in the ongoing debate about the initial vergence of the crustal-scale thrusts at the start of the Cenozoic Andean orogeny. To solve for this, new apatite and zircon (U-Th)/He ages from granitoids of the Frontal Cordillera at ~33.5°S are provided here. These data, interpreted as an age-elevation thermochronological profile, imply continuous exhumation initiating well before ~12–14 Ma, and at most by ~22 Ma when considering the youngest zircon grain from the lowermost sample (Riesner et al. 2019). The inverse modeling of the thermochronological data using QTQt software confirms these conclusions and point to a continuous cooling rate since onset of cooling. The minimum age of exhumation onset is then refined to ~20 Ma by combining these results with data on sedimentary provenance from the nearby basins. Such continuous exhumation since ~20 Ma needs to have been sustained by tectonic uplift on an underlying crustal-scale thrust ramp. Such early exhumation and associated uplift of the Frontal Cordillera question the classically proposed east-vergent models of the Andes at this latitude. Additionally, this study provides further support to recent views on Andean mountain-building proposing that the Andes-Altiplano orogenic system grew firstly over west-vergent basement structures before shifting to dominantly east-vergent thrusts.
Riesner M. et al. 2019, Scientific Reports, DOI: 10.1038/s41598-019-44320-1