



## **Timing of early Andean uplift based on provenance analysis of Cenozoic sediments from southern Peru, northern Chile and adjacent Bolivia**

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The western margin of the South American continent is controlled by continuous subduction of the Nazca plate underneath the South American continent since Early Jurassic time. Crustal thickening started around Eocene time and has led to the present 70 km thick crust and elevations up to ~6500m. Generally, two major pulses of surface uplift are considered: a first episode during Oligocene to Early Miocene (Isacks 1988, *J Geophysical Res* 93) and a second one during Late Miocene (Schildgen et al. 2007, *Geology* 35). However, the processes that lead to crustal thickening are strongly debated and time constraints especially on the early uplift phases are relatively weak.

We focus our study on Cenozoic continental siliciclastic formations deposited in the Central Depression (between Western Cordillera and Coastal Cordillera) in southern Peru and northern Chile, as well as on similar deposits on the Altiplano in adjacent Bolivia (Corque syncline). Methods comprise heavy mineral geochemistry (amphibole, Fe-Ti oxide, garnet, tourmaline and rutile) as well as detrital zircon fission-track thermochronology and U/Pb dating using LA-SF-ICP-MS. The data are used to develop a model of sediment provenance and paleodrainage controlled by tectonics and magmatism in the uplifting Andean range.

The combination of field observations, stratigraphic and petrographic descriptions taken from the literature, and our geochemical, geochronological and thermochronological data indicates uplift induced a significant change in provenance at around 35 to 30 Ma. This age coincides with the onset of widespread deformation and a first peak in shortening rates in the Eastern Cordillera (c. 35 Ma) and the Altiplano region (c. 30 Ma) in the Central Andes (Elger et al. 2005, *Tectonics* 24). A lag time of about 10 Ma is observed between the initial range uplift and the onset of voluminous volcanic activity (~25 to 20 Ma). This suggests that magmatic addition is not a main driver for crustal thickening in this early stage of Andean uplift. The onset of major volcanism is characterized by voluminous plateau-forming ignimbrites in southern Peru and northernmost Chile and is documented in a second profound change in the provenance of detrital minerals.