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Nothing recent about the oldest subduction zone on Earth: Thermochronometry of the Peruvian forearc region

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The ocean-continent convergence zone of western South America is the oldest active subduction zone on Earth. Despite the presence of large-scale fault zones and frequent large-magnitude earthquakes in the forearc region, exhumation rates have been suggested to be extremely slow since at least the Oligocene. Andean mountain building only began ∼50 Ma, although subduction is occurring since the Early Paleozoic. This is explained by different geodynamic, tectonic and/or climate feedbacks. Furthermore, large variations in the timing of onset and magnitude of deformation exist along strike of the Andes.
In this study, we applied thermochronometry to investigate the exhumation history of the northern limb of the Arica Bend in the Peruvian forearc. This region is thought to have developed in response to varying amounts of shortening in the Eo-Oligocene. Previous thermochronometric studies suggested block tilting and trench-parallel extension induced minor amounts of exhumation in response to trench parallel shortening and oroclinal bending. The majority of extension during orocline formation has been accommodated elsewhere, distal from the forearc region. Long- and short-term exhumation rates in the Coastal and Western Cordilleras have been very slow (∼0.1 km/Myr) based on previous thermochronometry and cosmogenic nuclide analyses. However, large scatter in the thermochronometric data, particularly in the U-Th/He data, left significant uncertainties in the interpretations of exhumation histories.
We complement previous tectonic studies of the region by presenting 30 new, multi-dated thermochronometric bedrock samples from a large latitudinal transect (∼14–18°S) in the Peruvian forearc region. The latitudinal transects are augmented by coast-perpendicular elevation transects. Although the apatite and zircon U-Th/He single-grain ages show some scatter, the additional apatite fission-track ages and lengths measurements from the same samples help to evaluate the overall dataset and allow for more detailed exhumation histories over the past 100 Myr. Utilizing previous and new apatite and zircon U-Th/He and fission-track data in latitudinal and elevation transects, and new exhumation histories from 1D thermal models, we interpret the ∼17–250 Ma range in data in the context of the tectonic and climatic history of the Andean forearc.