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Eocene extensional exhumation of basement and arc rocks along southwesternmost Peru, Central Andes.

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The overthickened crust of the current Central Andes is commonly viewed as the result of tectonic shortening. However, in the present-day terrestrial forearc and arc of southwesternmost Peru, crustal thickness increases from 30 km along the coastline to >60 km below the active arc, whereas the upper crust exhibits little to no evidence of crustal shortening and, in constrast, many extensional features. How (and when) crustal overthickness was acquired in this region is thus little understood. Because crustal overthickening often results in extensional collapse and/or significant erosion, here we address this issue through a regional-scale study of exhumation using fission-track thermochronology.

The limited fission-track data previously available in the area suggested that exhumation began during the Mesozoic. In this study, we present new apatite and zircon fission-track data obtained along the current terrestrial forearc of southwesternmost Peru. This relatively restricted area presents the interest of providing extensive outcrops of Precambrian to Ordovician basement and Early Jurassic to Late Cretaceous arc plutons. In order to compare the chronology of exhumation of these units, we performed extensive sampling for fission-track dating, as well as structural mapping.

Our results indicate that the basement rocks and Jurassic plutons that crop out in the Arequipa region, where the crust is now >50 km-thick, experienced a rapid cooling through the 240-110°C temperature range between ∼65 and ∼35 Ma. This period of rapid exhumation coincided in time with the accumulation of terrestrial forearc deposits (the Lower Moquegua Group), that exhibit many syn-sedimentary extensional features and are bounded by conspicuous normal faults, specifically along the region where intense activity of the main arc between ∼90 and ∼60 Ma had led to voluminous magma emplacement. This close succession of (1) intense magmatic activity and (2) regional-scale exhumation associated with extensional basins leads us to propose that arc magmatism between ∼90 and ∼60 Ma was productive enough to significantly thicken the crust, resulting in its subsequent extensional collapse between ∼60 and ∼35 Ma.