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Onset of Carnegie Ridge subduction from low-temperature thermochronology

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Cenozoic growth of the Andes has been strongly influenced by subduction dynamics, inherited crustal heterogeneities, and the superposed effects of climate. Subduction of the Carnegie Ridge in Ecuador has impacted late Cenozoic magmatism and tectonic activity, including the formation of a crustal sliver escaping northward. However, the relationship between ridge subduction and topographic growth has remained unclear. We present new thermochronological data from the Western Cordillera of Ecuador to (1) pinpoint the timing of ridge subduction, and (2) evaluate the role of ridge subduction in prompting growth of the Ecuadorian Andes. Time-temperature inverse modeling of our results shows two phases of cooling separated by tectonic quiescence. The first cooling phase immediately post-dates magmatism in the Western Cordillera, and hence we attribute it to magmatic cooling. The second cooling phase starts at ~6-5 Ma. This we associate with onset of enhanced exhumation at this time in the Western Cordillera, synchronous with the last cooling phase in the Eastern Cordillera. Based on our thermal modeling and thermochronological age patterns along geological cross-sections we propose that recent crustal shortening and rock uplift triggered exhumation of Western Ecuadorian Andes starting at ~6-5 Ma. We suggest that the onset of Carnegie Ridge subduction in the latest Miocene increased the coupling at the subduction interface and promoted shortening and regional rock uplift in the northern Andes. Overall, our new thermochronological results highlight the pivotal role of bathymetric anomalies in distinct upper-plate deformation processes at non-collisional convergent plate margins.