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Low T thermochronology in andean basement backstop at 33.5°S validate controversial, west-vergent, West Andean Thrust (WAT) model

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At 33.5°S, the Andes are narrow and simple, with a basement backbone to the east, reaching 6km asl (named the Frontal Cordillera, hereafter FC), and fold and thrust belts affecting Meso-Cenozoic sedimentary and volcanic rocks to the west. The overall topography follows the same pattern, with an orogenic prism tapering toward the west and marked by the emergence of a recently identified active thrust at its western front (the San Ramón Fault). Following this discovery, a controversy arose about the geometry and vergence of the crustal-scale thrust stack responsible for relief building, and correlatively for the formation of andean foreland basins east and west of these reliefs. East-vergent "classical" views predict eastward propagation of the deformation and a late <10Ma uplift of the FC basement. On the contrary, recently proposed west-vergent model imply a protracted uplift of the FC since 20-25Ma, with this basement culmination acting as a backstop for westward propagation of a shallower fold and thrust belt to the west. Determining the exhumation history of the FC is thus essential. With this objective we provide new (U-Th)/He dating results on apatites and zircons from granitoids of the FC core, in Argentina. We first interpret these results as a pseudo-vertical thermochronological section, which implies continuous and ongoing exhumation at least from ∼17Ma (from apatites), and probably older than 20 Ma considering the youngest, reset zircon ages from the lowermost (initially deepest) samples. This is at odds with predictions of all published east-vergent models. Then, we test the consistency of this thermochronological record with the proposed west-vergent tectonic model using a thermo-kinematic numerical modeling. Accordingly, a kinematic model with primarily west-vergent thrusting initiating by ∼20-26Ma, and continuous since that time, can satisfactorily reproduce the apatite and zircon (U-Th)/He ages. Our thermo-kinematic modeling also allows to assess the proportion of under versus over-thrusting at crustal-scale. The range of possible overthrusting rates appears to be between 40 and 90% of the total shortening rates, a value particularly high compared to other examples such as Taiwan or the Himalayas. This implies limited underthrusting, and restricted flexure, of the footwall andean marginal block to the west. These results confirm the validity of the west-vergent West Andean Thrust (WAT) model, and call for a new framework to interpret foreland basin and source history. They imply that westward fold-thrust belt propagation at crustal-scale is the primary driving mechanism for andean mountain building at this latitude.