4-10 - UNRAVELING THE TECTONIC EVOLUTION OF THE ANDEAN HINTERLAND (ARGENTINA AND CHILE, 30°S) USING MULTI-SAMPLE THERMAL HISTORY MODELS

Sunday, September 22, 2024

10:25 AM - 10:40 AM

212B (Anaheim Convention Center)

Abstract

The Andean hinterland of Chile and Argentina defines a region of voluminous magmatism, polyphase deformation, and high topography above a long-lived subduction zone. Construction of this high-elevation domain has been variably attributed to isostatic uplift during crustal thickening induced by internal hinterland shortening, underthrusting during growth of the external thrust belt, or lower crustal flow. Alternatively, uplift may be related to dynamic processes associated with lithospheric foundering or flat-slab subduction. This study integrates geo/thermochronological, structural, magmatic, and sedimentological datasets to reconstruct hinterland evolution and evaluate potential drivers of exhumation. Our thermal history modeling approach implements a new time-depth extension to HeFTy 2 software, which enables simultaneous inversion of multiple samples along a structural or topographic profile. This extension addresses transient effects such as isotherm deflection and the transition from geothermal to atmospheric gradients and permits changes in the relative position among samples (folding, tilting) within user-defined constraints. Single- and multi-sample modeling results based on published apatite (U-Th)/He and fission track data (AHe, AFT) along the western Andean hinterland confirm late Eocene (~30–40 Ma) cooling below at least ~120ºC, whereas thermal histories derived from new AHe, AFT, and zircon He analyses from the eastern hinterland resolve Mesozoic cooling below ~80–160ºC, followed by protracted residence at ~60–80ºC and rapid exhumational cooling in the early Miocene. Multi-sample models further require ~10º eastward tilting of eastern sample locations, compatible with hinterland uplift via underthrusting and development of a crustal-scale fault-bend fold that was geometrically and kinematically linked to shortening in the external (eastern) thrust belt. Results underscore the enhanced resolution of multi-sample thermal history models in testing structural hypotheses and deciphering the timing, magnitude, and mechanisms of exhumational cooling during changing geodynamic conditions.

Geological Society of America Abstracts with Programs. Vol. 56, No. 5, 2024
doi: 10.1130/abs/2024AM-402137

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