THE GEOLOGICAL SOCIETY OF AMERICA®
CONNECTS 2022
9–12 October
Denver, Colorado, USA
& Online Everywhere

74-8 - WHAT WERE THE DRIVERS OF HINTERLAND EXHUMATION DURING FLAT-SLAB SUBDUCTION IN THE SOUTHERN CENTRAL ANDES? INSIGHTS FROM MULTI-SAMPLE THERMAL HISTORY MODELING USING HEFTY 2.0 AND FETKIN SOFTWARE

Monday, 10 October 2022

10:05 AM - 10:25 AM

601 (Colorado Convention Center)

Abstract

Flat-slab subduction is a cornerstone tectonic process, commonly linked to changes in convergent margin thermal structure, enhanced seismicity, and intraplate shortening and magmatism expressed hundreds of kilometers from the trench. Yet, the impacts of flat-slab subduction on hinterland evolution remain poorly understood. We leverage new thermochronological data from the Argentine Frontal Cordillera (a zone of high hinterland topography above the modern flat-slab segment at 29–33ºS) and novel thermal history modeling techniques to interrogate the influence of (1) increased plate coupling, elevated shortening, and structurally-driven exhumation along emergent or subsurface faults, and/or (2) dynamic uplift associated with slab flattening and inboard migration of the subduction hinge. New apatite and zircon (U-Th)/He data quantify hinterland cooling during Paleogene subduction and Neogene flattening of the Nazca oceanic plate. Our thermal history modeling approach implements a time-elevation extension to the 1D HeFTy thermal history modeling program that allows simultaneous inversion of multiple samples along a structural or topographic profile. This extension enables HeFTy to better approximate transient effects such as isotherm compression during rapid exhumation and the transition from geothermal to elevation gradients, and allows for change in the relative depth among samples (e.g., tilting, folding) during the history within user-defined constraints. Multi-sample modeling results from hinterland sample profiles spanning an along-strike distance of >400 km record rapid exhumational cooling coeval with middle Miocene flattening of the subducted slab, and point to structurally-driven exhumation: along an orogen-scale fault-bend fold anticline at 29–31°S, and emergent faults that exhume west-dipping hanging wall panels at ~31–33°S. We illustrate the resulting structural, topographic, and thermochronological relationships along two reconstructed 2D geological cross sections using thermokinematic modeling (FETKin software). This research demonstrates the utility of multi-sample thermal history modeling in refining the results obtained from single-sample modeling approaches, and evaluating the timing, rates, and drivers of exhumation during changes in subduction.

Geological Society of America Abstracts with Programs. Vol 54, No. 5, 2022
doi: 10.1130/abs/2022AM-381296

Author

M

Chelsea Mackaman-Lofland
University of Connecticut

Authors

K

Richard Ketcham
University of Texas at Austin

F

Julie Fosdick
University of Connecticut

H

Brian Horton
University of Texas

L

Ana Lossada
University of Buenos Aires

S

Daniel F. Stockli
Jackson School of Geosciences, University of Texas at Austin

View Related

Session

74: T1. Advances and Applications of Thermochronology in Tectonic, Magmatic, Basin, and Geomorphic Studies I

Scott Jess, *University of Toronto Mississauga, Mississauga, ON, Canada,* ***Kendra Murray***, *Idaho State University Geosciences, Pocatello, ID,* ***Gilby Jepson***, *Geosciences, University of Arizona, Tucson, AZ and* ***Alyssa Abbey***, *Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI*

Monday, 10 October 2022

8:00 AM - 12:00 PM

601 (Colorado Convention Center)