6-2 - CENOZOIC SLIP ALONG THE SOUTHERN SIERRA NEVADA RANGE FRONT NORMAL FAULT, CALIFORNIA: A LONG-LIVED STABLE WESTERN BOUNDARY OF THE BASIN AND RANGE

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Abstract

The topographic development of the Sierra Nevada, CA has been the topic of research for more than 100 years, yet disagreement remains as to whether 1) the Sierra Nevada records uplift in the late Mesozoic followed by no change or a decrease in elevation throughout the Cenozoic vs 2) uplift in the late Mesozoic followed by a decrease in elevation during the middle Cenozoic, and a second pulse of uplift in the late Cenozoic. The second pulse of uplift in the late Cenozoic is linked to late Cenozoic normal slip along the southern Sierra Nevada (SSN) range front normal fault (SSNF). To test this fault slip hypothesis, we report apatite (U-Th/He) (AHe) results from samples in the footwall of the SSNF collected along three vertical transects (from north to south, RV, MW, and MU) up the eastern escarpment of the SSN. Here, exposed bedrock fault planes and associated joints yield nearly identical strike-dip values of ~356°-69°NE. At the RV transect, 14 AHe samples record an elevation invariant mean age of 17.8 ± 5.3 Ma over a vertical distance of 802 m. At MW, 14 samples collected over a vertical distance of 1043 m yield an elevation invariant mean age of 26.6 ± 5.0 Ma. At MU, 8 samples record an elevation invariant mean age of 12.7 ± 3.7 Ma over a vertical distance of 501 m and 5 higher elevation samples record an elevation invariant mean age of 26.5 ± 3.3 Ma. At MU, the lowest elevation sample yielded an AFT age of 50 Ma and mean track length of 13.1 microns. Preliminary HeFTy modeling of the AHe and AFT ages from this sample yield accelerated cooling at ~22 Ma and ~10 Ma. Preliminary modeling (Pecube + landscape evolution) of the MU AHe results, elevation, and a prominent knickpoint yield an increase in fault slip rate at ~1-2 Ma. We interpret the elevation invariant ages and modeling results as indicating three periods—late Oligocene, middle Miocene, and Pliocene—of cooling and exhumation in the footwall of the SSNF due to normal fault slip. Our results are the first to document late Oligocene to Pliocene cooling and normal slip along the SSNF. Miocene and Pliocene age normal fault slip along the SSNF is contemporaneous with normal slip along range bounding faults across the Basin and Range, including the adjacent Inyo and White Mountains. Combined, these data indicate that since the late Oligocene the SSN defined the stable western limit of the Basin and Range.

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Author

Jeffrey Lee
Colorado School of Mines Geophysics. Green Center Rm 283

Daniel Stockli
University of Texas at Austin

Ann Blythe
Occidental College

Matthew Fox
University College London