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TESTING INTERPRETATIONS OF THE DISPLACEMENT MAGNITUDE OF THE TETON FAULT AND UPLIFT OF THE TETON RANGE, WY WITH INTEGRATED FLEXURAL-KINEMATIC AND THERMAL MODELING

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Previous estimates of the maximum displacement ($D_{\max}$) on the Teton fault cover a wide range (2-9 km). Discrepancies also exist regarding the slip onset timing, which ranges from 2-13 Ma. To address this discrepancy, the exhumation history of the Teton Range is here investigated using forward flexural-kinematic and PECUBE thermal history models that can be compared with previously reported apatite fission track (AFT) and apatite (U-Th)/He (AHe) ages from Mount Moran, which has been hypothesized to represent the paleo-center of the Teton fault.

In this study, Move kinematic models that include flexural isostasy and erosion were constructed to test possible structural solutions for Teton fault evolution. Free parameters include fault dip angle, elastic thickness (T_e), depth of detachment (D_d) and magnitude ($D_{\max}$) and duration of slip. Flexural parameters and the fault subsurface geometry were constrained by comparing model results with the present-day wavelength of footwall uplift and structural configuration of the Jackson Hole basin. This led to identification of a reference model that includes a surface fault dip of 70°, T_e of 5 km, and D_d of 15 km. The modeled structural evolution is then used to create velocity fields for the thermal modeling code PECUBE, which can produce a 2D thermal history that includes predicted AFT and AHe ages, to be compared with the observed ages.

The flexural-kinematic models yield predictions of the footwall uplift contribution to total fault slip, which can then be compared to the range of $D_{\max}$ estimates. Using these model results, previous estimates for $D_{\max}$ (2-9 km) correspond to footwall uplifts of 0.7-2.4 km. For comparison, the modern footwall relief at Mount Moran (~1.8 km) and Grand Teton (~2.2 km) would yield modeled $D_{\max}$ estimates of 6-8 km, which is a minimum estimate, as these values do not account for an estimated ~2 km of overburden erosion. Thus, these model results indicate that the $D_{\max}$ for the Teton fault is likely >9 km. To produce the footwall uplift necessary to exhume reset AFT ages observed at the base of the Moran transect (~4.2 km), flexural-kinematic models require $D_{\max}$ estimates of 13-17 km. Preliminary results from PECUBE thermal history modeling and comparison with AFT and AHe data also yield $D_{\max}$ estimates of 13-17 km at Mount Moran, much higher than previous estimates.

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Geological Society of America *Abstracts with Programs*. Vol 52, No. 6
doi: 10.1130/abs/2020AM-356016

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