

Exhumation history of the Laramide Ranges using (U-Th)/He thermochronology

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The goal of our project is to document the distribution, timing, rate and amount exhumation of the Rocky Mountains in Wyoming, southern Montana and Utah using low-temperature (U-Th)/He thermochronology. Our study uses (U-Th)/He dating of apatite (AHe) from both petroleum well cuttings and surface samples. All of the wells in this study penetrate Precambrian basement rocks in the hanging walls of Laramide-age uplifts. Cuttings have been collected from at least one well through each of the Beartooth, Bighorn, Laramie, Granite, and Medicine Bow ranges, as well as the Uncompahgre uplift. Apatite separates were obtained for six samples from a well through the Wind River Range.

In the Wind River Range, thermal forward modeling of our AHe results together with previously-published apatite fission track (AFT) ages shows that at least two episodes of exhumation are required to match the subsurface data; one episode during the early Eocene and another during the late Miocene. It is impossible to match the AHe data without including an exhumation event in the Miocene. Modeling shows removal of approximately 4 km of material in the Eocene, and between 1 and 2 km in the Miocene.

Preliminary results from several samples from the Beartooth Range well show indications of Miocene exhumation, but there are currently insufficient data to recognize a ~50 Ma exhumation event that was documented by previous workers using AFT dating. Results for additional samples from this well are pending and should help clarify these preliminary data and allow for modeling. Sample preparation, mineral separations and apatite picking are ongoing for wells and surface samples from other ranges.