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From plateaus and paleoclimate to fluids on faults: Carbonate clumped isotope thermometry in continental tectonics

Reconstructing the thermal history of minerals and fluids in continental environments is a cornerstone of tectonics research. Clumped isotope thermometry constrains the temperature and isotopic composition of carbonates and the fluids from which they grew in both surface and subsurface environments, providing important tests of geodynamic, structural, topographic and basin evolution models. This talk will examine how this approach can shed light on problems in continental tectonics, focusing on paleoaltimetry, geothermal and structural geology applications. Paleoaltimetry is inherently difficult, and the precision in carbonate growth temperature estimates is at the limit of what is useful for quantitative paleoelevation reconstruction. A closer look at lake and soil carbonates highlights the need to understand the context and formation processes of paleoenvironmental proxies in such reconstructions. The shallow crust is important as host to economic resources and records of tectonics and climate, and clumped isotope thermometry is one of the few proxies that can access this critical zone with sensitivity to temperature alone. Examples from the San Andreas and an active geothermal system in Nevada show how clumped isotope geochemistry of fault-hosted cements can give new insight into fluid-fault interactions from the outcrop to plate-bounding fault scale.