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The Gothic Dome: Kilometer-scale Miocene Exhumation in Colorado's Elk and West Elk Mountains

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Abstract Text:

The Colorado Rockies were initially raised during the Laramide Orogeny ca. 70-45 Ma. But consensus exists that the range experienced a second, post-Laramide episode of surface uplift; the timing and cause of that post-Laramide surface uplift event remains enigmatic. Low-temperature thermochronologic studies conducted by us and others using apatite (U-Th)/He (AHe), apatite fission track (AFT), and zircon (U-Th)/He (ZHe) techniques reveal that a dome of kilometer-scale exhumation occurred in Colorado's Elk and West Elk mountains between ca. 18-6 Ma. We call this feature the "Gothic Dome" because it is centered on Gothic Mountain, near the town of Crested Butte. We suggest the ~100-km-diameter Gothic Dome likely experienced Miocene surface uplift, which triggered the dome-shaped exhumation pattern documented by the low-temperature thermochronometry. The exhumation magnitude exceeds 4 km in the center of the dome (as revealed by a 16 Ma ZHe date on an Oligocene pluton) and diminishes toward its perimeter. This diminution of exhumation magnitude toward the perimeter is revealed by progressively older AHe, AFT, and ZHe dates in all directions away from Gothic Mountain. AHe dates for samples that lie outside the perimeter are Laramide-age or older, further documenting the dome-shaped nature of this Miocene exhumation event and illustrating the low magnitude of Miocene to recent exhumation outside the dome's perimeter. Outcrops of ca. 11 Ma basalt surround the Gothic Dome to the north, west, and south, requiring that Miocene exhumation outside the dome's perimeter was minimal. A suite of alkaline, low-volume, felsic plutons and ultramafic lamprophyres intruded the Gothic Dome between ca. 18-12 Ma. This alkalic magmatism began either immediately prior to or contemporaneous with the onset of Gothic Dome exhumation, hinting that the same root cause might be responsible for both. Workers elsewhere, including Tibet, the Altiplano, and California's Sierra Nevada mountains, have attributed small-volume alkalic magmatism, surface uplift, and exhumation to the activity of lithospheric drips. We offer that Miocene activity of such a drip beneath Colorado's Elk and West Elk

mountains is an appealing mechanism to explain the near simultaneity of those same phenomena here.

Plain-Language Summary:
When and how the Colorado Rockies were uplifted to their present height remains unknown. We present data on the range's erosion history that provides one clue to help solve that mystery

Session Selection:
EP031. Reconstructing mountain belts tectonics and climate

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Abstract Title:
The Gothic Dome: Kilometer-scale Miocene Exhumation in Colorado's Elk and West Elk Mountains

Requested Presentation Type:
Assigned by Program Committee (oral, eLightning or poster discussion session)

Previously Published?:
No

Abstract Payment:
Paid (agu-fm21-1002048-6776-1766-3576-1911)

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