Grand Junction Geological Society

http://www.gjgs.org/

This Month's Presentation

Andres Aslan

Colorado Mesa University

will present a talk entitled

The Detrital Mineral Dating Revolution: New Insights on Cenozoic Landscape Evolution of Western Colorado

Meeting Time and Location

March 26, 2025

Joint meeting with the CMU Geology Students

6:30 p.m.

Saccomanno Lecture Hall (Room 141) in the Wubben Science Building at Colorado Mesa University

Zoom Details

Andres Aslan is inviting you to a scheduled Zoom meeting.

Topic: My Meeting

Time: Mar 26, 2025 06:00 PM Mountain Time (US and Canada)

Join Zoom Meeting

https://coloradomesa.zoom.us/j/93927977145

Meeting ID: 939 2797 7145

Important Announcements

This month's meeting is a week later than usual because CMU is on Spring Break on our usual day and the building will be locked.

As always, the Zoom meeting will open a half-hour before the regular meeting to give people who can't attend in person time to log in.

Abstract

The Detrital Mineral Dating Revolution: New Insights on Cenozoic Landscape Evolution of Western Colorado

Detrital-mineral dating continues to revolutionize studies of geologic history and landscape evolution. Detrital sanidine (DS) $^{40}Ar/^{39}Ar$ geochronology provides incredibly precise maximum depositional ages of Cenozoic terrestrial sediments as well as aids in the identification of volcanic centers that produced the sanidine grains during explosive volcanic events (think Yellowstone). Detrital zircon (DZ) U-Pb geochronology produces maximum depositional ages that are generally less precise than those of sanidine but because of the durability of zircon, dates using this mineral are invaluable for studying sedimentary deposits where sanidine is not preserved. Zircon dates also provide important information on the provenance of detrital zircon grains, which are typically eroded from felsic intrusive rocks or deposited as tephra associated with explosive volcanism.

This presentation uses several examples of detrital-mineral dating to illustrate the significance of this technique. These case studies, representing Quaternary to Paleogene examples, include: *1) Integration of the upper Green River across the eastern Uinta Mountains.* Detrital sanidine dates for Quaternary Green River terraces near Peru Bench, WY and Browns Park, CO extend back to ca. 2 Ma and terrace maximum depositional ages (MDAs) increase systematically with increasing terrace height above the modern river. Field relations and the new DS dates indicate that the upper Green River integrated with the ancestral Colorado River some time after 8 Ma, and integration was probably complete by ca. 2 Ma, which may have accelerated exhumation of the Canyonlands region. *2) A Late Miocene ancestral Colorado River.* Grand Mesa basalt flows overlie DS- and DZ-dated ca. 11 Ma river deposits (elev. ~3000 m) of an ancestral Colorado River system that flowed across western Colorado towards the Colorado Plateau. . *3) A Middle Miocene paleo-river that flowed along the crest of the Uncompahgre Plateau.* Columbine Pass river gravels (elev. ~2800 m) are present atop the Uncompahgre Plateau, and produced a DS MDA of ca. 16 Ma. The river gravels are dominated by clasts of San Juan volcanic rocks. These observations suggest that the Columbine Pass paleo-river flowed northwest away from the San Juan volcanic field (SJVF) along the crest of the Uncompahgre Plateau. The presence of an ancient river flowing within a bedrock valley at this location suggests that the Uncompahgre Plateau remained a significant topographic barrier to west-flowing rivers of western Colorado up until the middle Miocene. Areas located east of the plateau may have been represented by internally drained basins similar to the landscapes of the Laramide Orogeny. *4) Origination of west-flowing river systems in the Gunnison basin during the Oligocene.* DS- and DZ-dating show the presence of ca. 30-29 Ma ancestral Gunnison River and associated tributary gravels at Poverty Mesa and Black Mesa near the Black Canyon. The river gravels are present at the crest of the Gunnison uplift (elev. ~2900 m) and mark the transition from north-directed flow into the Piceance Basin to west-directed flow across the Laramide Gunnison uplift.

Note: This is a lengthy abstract. The remainder of the abstract will be on the following page.

Bio

Andres Aslan received degrees from Brown University (B.S.) and the University of Colorado (M.S., Ph.D.). He is a Professor of Geosciences at Colorado Mesa University where he has taught since 1999. His research focuses on landscape evolution in the Southern Rocky Mountains and Colorado Plateau, and the origins of its major river systems.

Abstract, continued

5) DS- and DZ-dating of Late Eocene Telluride Conglomerate deposits and implications for post-Laramide uplift of the Sawatch Range and formation of the Rocky Mountain Erosion Surface. Telluride Conglomerate deposits that crop out at Cimarron Ridge (elev. ~3100 m) along the northern margin of the SJVF differ markedly from the Telluride deposits in the type area of Telluride, CO – the Cimarron Ridge Telluride is brown (not red), sand rich, and contains volcanic clasts. DS and DZ MDAs for the Telluride Conglomerate are ca. 35-34 Ma. Moreover, the DS and DZ grains in the Cimarron Ridge Telluride Conglomerate deposits record the evolution of calderas (Grizzly Peak, Mt Aetna, Mt Princeton) and probable uplift of the Sawatch Range. *6) Late Eocene (and maybe into the Miocene?) sedimentation in the southern Piceance Basin associated with end-Laramide and post-Laramide(?) uplift.* The Goodenough unit discovered by CMU professor Rex Cole beneath Grand Mesa basalt flows is a complex stratigraphic unit that overlies the Eocene Green River Formation and accumulated at a time when the Piceance Basin was still the primary depocenter in western Colorado. DS and DZ dates indicate that the Goodenough could be as old as ca. 42 Ma and a tephra bed (elev. 3340 m) at the top of an outcrop capped by Grand Mesa basalt is ca. 34 Ma, which suggests that the Goodenough unit is a Late Eocene fluvial deposit that is broadly correlative with the Duschesne River Formation of the northern Uinta Basin. However, there is one location where uppermost Goodenough sediment produced a DS MDA of ca. 13 Ma, which suggests that this sequence of poorly exposed deposits likely represents more than one stratigraphic unit.

In summary, the new detrital-mineral dates record the evolution of western Colorado from 1) Laramide closed-basin drainages (e.g., Eocene Green River lakes, Uinta and Goodenough deposits) to 2) Late Eocene to Early Oligocene re-direction of rivers across southern highlands (e.g., the Gunnison uplift) of the Piceance Basin in response to magmatism in the Sawatch Range and West Elk Mountains, to 3) Late Miocene integration of the ancestral upper Colorado River with Colorado Plateau depocenters and/or rivers draining the Colorado Plateau. The Cenozoic evolution of western Colorado has been dramatically impacted by episodes of post-Laramide uplift, magmatism, and erosion-driven topographic inversions that continue into the present.