Grand Junction Geological Society

http://www.gjgs.org/

This Month's Presentation

Ned Sterne
Independent Geologist
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Will Speak On

"Deformation of the Rocky Mountain Erosion Surface and Its Effects on Landscape Evolution and Drainage Reorganization across Colorado: Carving the Black Canyon across the Cimarron Uplift and rerouting the ancestral Castle Rock and South Platte rivers around Pikes Dome."

The speaker will present in person although we will also have Zoom available.

Guests Are Always Welcome

Abstract and Speaker's Bio Are on The Next Page

Meeting Time and Location

Wednesday, November 15, 2023

Joint meeting with the CMU Geology Students

7:30

Saccomanno Lecture Hall
(Room 131 in the Wubben-Science Building)

Zoom Details

Andres Aslan is inviting you to a scheduled Zoom meeting.

Topic: GJGS Nov meeting

Time: Nov 15, 2023 07:00 PM Mountain Time (US and Canada)

Join Zoom Meeting

https://coloradomesa.zoom.us/j/93727970675

Meeting ID: 937 2797 0675

Important Announcements

It is time to select officers. If you would be interested in any position relating to the management of the organization, please let one of the current officers know.

Our thanks to Kathleen (Katy) Worrell for the new design of our announcements.

Abstract

The Rocky Mountain Erosion Surface (RMES) formed during the upper Eocene after Laramide contraction driven by flat-subduction of the Farallon Plate and before epeirogenic uplift, extension and volcanism associated with roll-back and foundering of the Farallon Plate.

Since the 1870's when Archibald R. Marvine, geologist extraordinaire with the Hayden Expedition, recognized the accordant summits of the Front Range were beveled by erosion, geologists have pondered the evolution of what we now call the RMES. The RMES is surface of variable relief. What caused that relief and when it developed have long been debated and will be the focus of this talk. Luminaries such as Thomas S. Lovering and Francis M. Van Tuyl explained the relief solely by erosion, with the oldest of 14 surfaces preserved at high elevations and the youngest at low elevations. In contrast, savants such as Arthur Lakes, Samuel Scudder and George H. Stone recognized relief on the RMES was also due to subsequent deformation by studying the extinct rivers that once flowed across it.

Our discussion will be framed by a structure map of the RMES across Colorado and parts of neighboring states that treats the surface as a composite unconformity formed during multiple erosion cycles spanning the upper Eocene to the basal Pleistocene. One insight from the RMES structure map is current topography reflects relief on the RMES, revealing that although the Ancestral Rocky Mountain and Laramide orogenies shaped the gross structure of Colorado, we inhabit a landscape dominated by later erosion and deformation. Understanding the 35 Myr evolution of the composite RMES requires knowing the age of deposits that rest upon it, and there are ongoing efforts to date many of these deposits for the first time using detrital zircon, detrital sanidine and cosmogenic techniques. Early results of those efforts indicate prior estimates for the age of the overlap deposits can be off by up to 15 Myr, which clearly revises our understanding of the RMES's evolution.

The most unambiguous way to demonstrate deformation of the RMES is by documenting drainage reversals of the ancient rivers that flowed on the RMES, and this technique will figure prominently in our discussions of the Cimarron and Pikes Dome uplifts described below. However, not all areas are graced by preserved overlap deposits and in those instances deformation of the RMES is best documented using low-temperature thermochronology (LTT) techniques in areas not impacted by thermal anomalies.

Deformation of the RMES manifests in a variety of forms including grabens, evaporite dissolution basins, laccoliths, basement uplifts, rift-flank uplifts, and extensive, low-relief piedmonts domes. Of these, we will focus on two examples.

The first example attributes the carving of Black Canyon by the antecedent Gunnison River to the rise of the northwest-trending Cimarron Uplift - a basement uplift. The uplift reversed westward flows of drainages depositing the Telluride Conglomerate, and confined the Uncompahgre River near Ouray to a structural low in the RMES between its southwestern flank and laccoliths uplifting the RMES centered to the west on Mount Wilson. Farther northwest, the western flank of the uplift is unconstrained due to an absence of overlap deposits; however, along its eastern flank, serial structure maps of the RMES, the base of ashfall tuffs and the base of Miocene basalts show the uplift deforming each of these levels. To the east, the Gunnison River follows a low in the RMES, but to the west at the Black Canyon it cuts into a high in the RMES as it encounters the flank of the Cimarron Uplift. LTT data are needed to better constrain the timing of the Cimarron Uplift.

The second example focuses on Pikes Dome, a post-Laramide uplift that extends from west of Pikes Peak into western Kansas - an extensive, low-relief piedmont dome. Since its initial rise in the latest Eocene, the dome diverted the southerly flows of the ancestral South Platte and now-extinct Castle Rock rivers first to the east into the now-extinct Hayden-Divide-Arikaree River, and finally with further localized doming around Pikes Peak proper, to the northeast into the current course of the South Platte River. Successive drainage reversals and course changes of the ancestral rivers will be used to constrain the structural evolution of Pikes Dome through time. LTT data and RMES structure across Pikes Peak proper will be used to show it is a 1000-meter local structural uplift rather than a monadnock. As is typical of many rivers across Colorado, both the current South Platte and Arkansas rivers now reside in structural lows in the RMES flanking piedmont domes.

Bio

Ned Sterne received a B.A. in geology from Harvard in 1979 having finished a solo undergraduate honors thesis on the Indus-Tsangpo Suture Zone of Ladakh, northern India. He completed an M.A. in geology in 1981 at Dartmouth resulting in the discovery of natural ammonium illites associated with exhalative Pb-Zn-Ag ore deposits in northern Alaska. He did Rocky Mountain and international petroleum exploration from 1981 to 2015. Since retiring in 2015, he has been studying the geology of Colorado. Ongoing projects include showing how stacked triangle zones have built the thrusted basement uplifts of Colorado, the palinspastic restoration of a cross section following I-70 across Colorado, and illustrating how deformation of the Rocky Mountain Erosion Surface has rerouted rivers across Colorado and parts of neighboring states during the Cenozoic. In 2022, he served as president of the Colorado Scientific Society. nedsterne@aol.com