Colorado Scientific Society

The objective of the Society is to promote the knowledge and understanding of Earth science, and its application to human needs

CSS Newsletter, February 2021

Mechanical stratigraphy and layer-bound normal faulting: Understanding the evolution and development of normal faults in the Upper Cretaceous Niobrara Formation, Wattenberg Field, Colorado

Kyle Bracken, Geologist, Occidental Petroleum

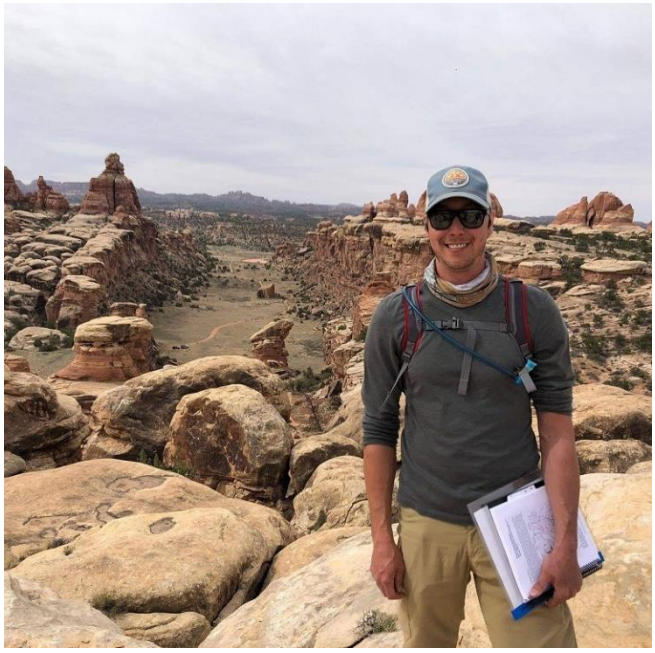
7:00 p.m., Thursday, Feb. 18, 2021

Join our Zoom meetings after 6:45 Mountain Time, with short social time before our
Meeting and Program begin at 7:00
Link to Join CSS February Zoom Meeting:

Click to Join CSS Zoom Meeting
from PC, Mac, Linux, iOS or Android

See also our website:
https://coloscisoc.org/

And our facebook page:
https://www.facebook.com/groups/511533159044226



Tonight's meeting link is,
https://mines.zoom.us/j/92414104109?pwd=cm1BajlkTUtEQ0V0TmwrQmswYnJSUT09
Password for meeting, if needed: **184468**

Mechanical stratigraphy and layer-bound normal faulting: Understanding the evolution and development of normal faults in the Upper Cretaceous Niobrara Formation, Wattenberg Field, Colorado

Kyle Bracken, Geologist, Occidental Petroleum

Abstract: The Upper Cretaceous section of the Denver Basin is littered with small-scale normal faults. Much of the previous work on this fault system has focused on the 3-D distribution of the faults and their relationship to other pre-existing tectonic features. This research focuses on the timing and propagation history of the faults and how that relates to the mechanically layered nature of the Niobrara Formation. 3-D seismic and well log interpretation reveal a complex, segmented fault system that is divided into two discrete tiers: an upper tier located in the Upper Pierre Shale, and a lower tier centered over the Niobrara Formation. Growth strata in the Lower Pierre Shale above grabens in the Niobrara Formation indicate that the faults were active during the deposition of the Pierre Shale and thus pre-date the formation of the upper tier of faults. 3-D analysis of fault plane geometry and throw show that fault segments are laterally well-connected near the top of the Niobrara Formation, forming linear arrays of linked grabens. Below, faults are less connected and show evidence of both lateral and vertical segmentation. In cross-section, fault planes are observed to change dip angle as they pass through rock layers with differing mechanical properties; refracting from ~55° in the more competent layers down to ~35° in the less competent layers. Field examples of normal faults that cut mechanically layered rock help better understand these geometries and provide reasonable inferences to their development and propagation history. In summary, it is argued that the mechanically layered nature of the Niobrara and Carlile formations is responsible for many of the fault characteristics described and provides valuable insight into the evolution of the fault system.

Speaker's Bio: Kyle Bracken earned a B.S. in Geoscience from the University of Iowa in 2010 and began working as a mud logger (well site geologist) for Columbine Logging in Colorado the following year. In 2012 he joined Anadarko Petroleum (Denver) as an Operations Geologist. Over the span of his career with Anadarko, and now Occidental Petroleum, Kyle has geosteered over 300 horizontal wells across the Rockies Region including projects in the Powder River, Sand Wash, Washakie, Green River, and Denver basins. More recently he has specialized in seismic interpretation, well planning, and structure mapping in support of Occidental's drilling programs across the Rockies. Kyle has a passion for the outdoors and enjoys taking in Colorado's beautiful geology while fly fishing and mountain biking.

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Upcoming CSS meetings:

March 25: Marieke Deschene (USGS) "**North and Middle Park, CO**"

April 15: Teresa Schwartz (CSM) "**Fluvial deposits of the Raton Basin: Implications for paleotopography and paleoclimate"**

May 13: (speaker to be confirmed; tentatively, a talk about the Yellowstone hotspot and monitoring Old Faithful geyser)

You can read more about all CSS programs on our website, **https://coloscisoc.org/ .**

Recent CSS presentations are recorded on Zoom. Follow the links on the website for each presentation to see abstracts, biographies of the speakers and video recordings of our meetings. [Note: Please ignore the "Transcript". It is wrong too often. Just listen to the video!]

Future Colorado Scientific Society Meetings and Field Trips

Our meetings will be virtual until further notice because of the COVID-19 pandemic.
We hope to resume meeting at The Colorado School of Mines, Berthoud Hall, once in-person public meetings are allowed to take place on campus.

Other organizations' upcoming meetings:

Sun., Feb. 21, 1:00 p.m. "Timing of the uplift of Pikes Peak and the demise of Lake Florissant", by Ned Sterne. A Zoom presentation for the Florissant Scientific Society; all are welcome to attend. An abstract of the talk is posted at https://florissantscientificsociety.co.education/events/ . See also, https://www.facebook.com/FlorissantScientificSociety/.

Please pay your dues for 2021 to CSS! You may pay dues online, or print out a pdf of the membership form and mail it to us with a check. Continuing your membership in CSS will enable us to continue all our ongoing programs, including our field trips, virtual meetings, Student Research Grants, and more.

See **https://coloscisoc.org/join-donate/** for the online link to our membership & dues form. Regular CSS dues are $25; Corresponding Membership (outside of the Front Range area) $10; Student Membership (any level) $5; Life Membership, $395. Send your membership payment, if not done online through PayPal, to Colorado Scientific Society P.O. Box 150495 Lakewood, CO 80215-0495.
Thank you!

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The Colorado Scientific Society slate of officers and councilors for 2021, presented and approved by "virtual show of hands" at our Annual Meeting, is:

President, Bruce Trudgill, Colorado School of Mines

President-elect, Ned Sterne, consulting geologist

Past-president, Jim Paces, U.S. Geological Survey

Secretary, Lisa Fisher, Escalante Mines, Inc. (incumbent)

Treasurer, Don Sweetkind, U.S. Geological Survey (incumbent)

Councilors: 2019-2021: Linda Barton Cronoble (incumbent)
2019-2021: Yvette Kuiper, Colorado School of Mines (incumbent)
2020-2022: Joe Sertich, Denver Museum of Nature & Science (incumbent)
2020-2022: Warren Day, U.S. Geological Survey (incumbent)
2021-2023: Lew Kleinhans, independent geologist
2021-2023: Karen Berry, Director, Colorado Geological Survey

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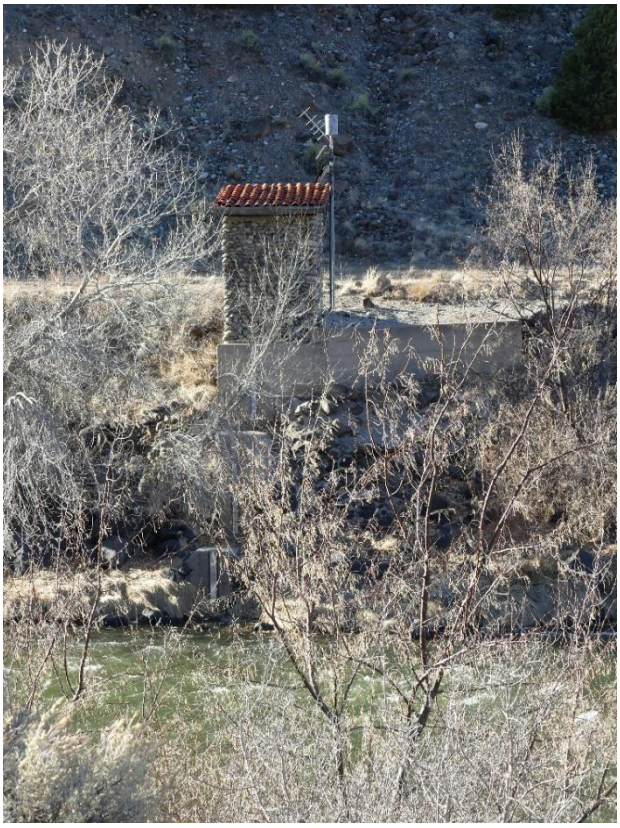
Where's that rock? – January

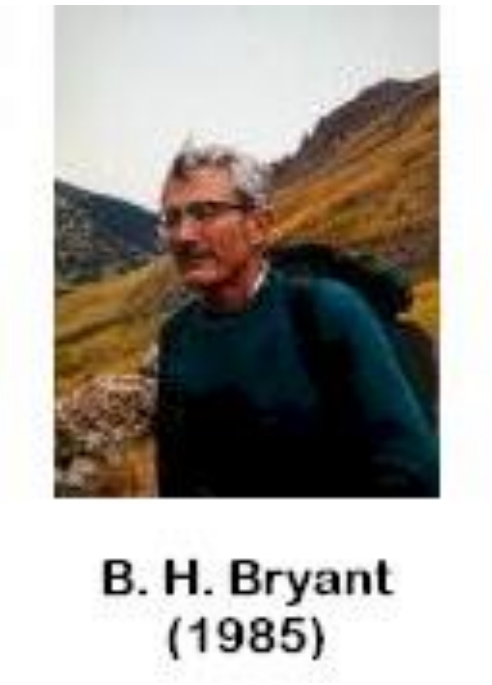
My Janruary WTR photo, of this butte (or call it a small mesa?) is located near the entrance to San Lorenzo Canyon, northwest of Socorro near Lemitar, New Mexico. Scott Minor was the first to write to me to correctly identify the site. Scott gave a very complete description: "*The feature is near the mouth of San Lorenzo Canyon along the west flank of the Rio Grande rift north of Socorro, NM. The tilted strata below the angular unconformity are about 7-10 Ma in age, whereas the overlying horizontal beds are about 0.5 Ma in age. It is the most spectacularly exposed angular unconformity I have seen!"* I subsequently received one other correct guess (I apologize—I haven't been able to relocate the email to say from whom—if you write me and remind me, I'll give you credit next issue!), and one or two incorrect guesses.

I myself visited the site, for the first time, at the end of December. You can drive to the butte, and San Lorenzo Canyon beyond it is a spectacular place for a hike!

Here is our February photo (a pair of them—two views of the same place). It's not a "rock", but it's earth science related. If you have your guess of what/where this is, please send it to Pete Modreski, at pmodreski@gmail.com.



Bruce Bryant, 9/25/1930 - 01/12/2021



B. H. Bryant
(1985)

We are sad to report that Bruce Bryant, retired USGS geologist, longtime CSS member, and past CSS President (1985), passed away on January 12. Bruce was much respected and loved by his many friends and colleagues.

Here is Bruce's obituary, from Legacy.com and the Denver Post, https://www.legacy.com/obituaries/denverpost/obituary.aspx?n=bruce-bryant&pid=197516072&fhid=16067

Bruce Bryant passed away January 12, 2021, in Boulder, Colorado. He was born in New York City, New York, grew up in Springfield, Vermont attended high school at Hotchkiss in Connecticut, and college at Dartmouth College in New Hampshire. He made his first trip west after graduating from college and fell in love with the west. He attended the University of Washington where he earned his Ph.D. in Geology. He met his wife Dolores Ann Becker (Sandy or San) at Mt Rainier and they settled in Golden, Colorado, and raised their family. Among Bruce's passions were mountains and the outdoors. He loved fieldwork, skiing, hiking, and instilled that passion for the outdoors in his 4 children. He was active in preserving open spaces and natural resources through the Clear Creek Conservancy and Plan Jeffco in its early days. In addition to the outdoors, he loved knowledge, learning, and travel. He read deeply and broadly and was always quick to bring out reference books at the dinner table. He had a long and productive career as a research geologist with the United States Geological Survey where he mapped in North Carolina, Kentucky, Colorado, Utah, and Arizona resulting in over 100 publications. After retiring he continued to go to the office and write and publish. His family and friends will remember him as a person of great integrity and intellect with a fine sense of humor. Bruce was preceded in death by his wife Sandy (2007) and is survived by his four children Lisa Bryant, Ross Bryant, Keith Bryant, and Mark Bryant, eight grandchildren Will Wells, Reed Bryant, Taylor Bryant, Alexander Bryant, Jesse Bryant, Bianca Bryant, Isabella Bryant, Jeremy Bryant and 4 great-grandchildren Mia Bryant-Lopez, Felipe Bryant-Lopez, Santiago Bryant-Lopez, and Julian Bryant. Memorial gifts can be made to the Colorado Open Lands 1546 Cole Blvd. #200 Lakewood, CO 80401 https://coloradoopenlands.org/or the Colorado Scientific Society Memorial Fund P.O. Box 150495 Lakewood, CO 80215-0495 https://coloscisoc.org. For online messages to the family visit www.murphyfuneraldirectors.com.