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<https://fourcornersgeologicalsociety.org>



DECEMBER 2021 NEWSLETTER

FOUR CORNERS GEOLOGICAL SOCIETY

DECEMBER MEETING

SPEAKER: Dr. Ron Hill, Chief Scientist, EOG

TITLE: *The Unconventional Bakken Petroleum System: What Geochemistry Indicates about Petroleum System Processes*

DATE: Thursday, December 9th

TIME & 5:00 - 6:30 pm Social, FLC Geology Student Poster Session, Drinks and Lots of Various Small Plates!

LOCATION Vallecito Room, Student Union Building Fort Lewis College
6:30 pm - 7:30 pm. Speaker, followed by raffle
ZOOM meeting will start at 6:30 pm.

ZOOM LINK: [Click Here for Zoom Meeting Link or https://fortlewis.zoom.us/j/92708946952](https://fortlewis.zoom.us/j/92708946952)

COVID: Meeting is at FLC: Per Fort Lewis Policy, **VACCINATION IS REQUIRED TO ATTEND IN PERSON.** If you are not vaccinated, please use the Zoom option.

COST: \$20/person. Please RSVP by Tuesday, Dec. 7th at noon if possible. PLEASE go to the website to pay and register: <https://fourcornersgeologicalsociety.org/event> Or you can email Jon Harvey at jeharvey@fortlewis.edu Up to 20 (Wow!) students will be sponsored by Mr. Chuck Baltzer. To sign up, contact Dr. Harvey.



Map of Meeting Location



Our Speaker:

Dr. Ron Hill

Chief Geochemist, EOG Resources

Ron earned a BS in Geology from Michigan State University in 1986, a MS in Geochemistry from Colorado School of Mines in the Department of Chemistry and Geochemistry in 1989, and a PhD in Geology in the Department of Earth and Space Science from UCLA in 1994. He was a post-doctoral researcher at Chevron before joining Exxon Production Research Company in 1996. He has spent 27+ years in industry related positions and is currently Chief Geochemist at EOG Resources in Denver, Colorado.



Zoom Link is: (click)

<https://fortlewis.zoom.us/j/92708946952>

A HUGE THANK YOU
GOES OUT TO **CHUCK**
BALTZER FOR
SPONSORING 20
STUDENT DINNERS
THIS MONTH!



Four Corners Geological Society, P.O. Box 1501, Durango, CO 81302
www.fourcornersgeologicalsociety.org

Abstract and Poster Titles:

The Unconventional Bakken Petroleum System:

What Geochemistry Indicates about Petroleum System Processes

The Bakken Formation has been the target of intense petroleum exploration activity over the last fifteen years, and is widely considered an unconventional resource or a 'tight oil play'. The 'tight oil play' designation has evolved in part because the Bakken Formation, a world class source rock, is the drilling target. However, the primary reservoir objective within the Bakken formation is not an organic-rich shale, but rather the middle Bakken siltstone and carbonate, deposited between two world-class source rocks, the upper and lower Bakken. In general, the middle Bakken has porosity values less than 15%, permeability values in the microdarcy range, and is unconventional in the sense that although water saturations increase down dip, there is not a clearly defined down dip water leg, and updip water is present. The Bakken is the source rock for oils reservoired within the middle Bakken. The oils in the middle Bakken show evidence of migration. The middle Bakken thins toward the basin margins, suggesting stratigraphic trapping is important for petroleum accumulation, and overpressure within the overlying Lodgepole, Bakken and underlying Three Forks suggests a seal is present within the Lodgepole. From a petroleum system perspective, evaluation of the source rock, reservoir, trap, seal, and associated processes is critical for risking each element of the petroleum system and was key in understanding the unconventional Bakken petroleum system.

STUDENT POSTERS:

The following posters will be presented during the happy hour and a half at the upcoming meeting:

Brooks Bartlett – Exploration of Fluorite Occurrence within the Allard stock in the La Plata Mining District, Colorado, U.S.A.

Sam Brown – A review of the formation of the Mitchell Lakes, La Plata County, Colorado

Tom Calligas – Constraining the origin of a Climactichnites found in float at Electra Lake and possible implications for the Ignacio Formation, SW Colorado, USA

Lyle Denny – Modelling the prehistoric Elk Creek Rock Avalanche

Andy Hoffstatter – Using repeat LiDAR scanning to map sources of debris flows following the 416 fire near Durango, CO

Jack Tingwall – Channel Complexity on the Dolores River: Measuring side channel length for different discharges to show available habitat for threatened fish species

Matt Wanda – Mineralization of the Two Kids Mine, Ouray, CO





NEWS FROM THE FOUNDATION

After the Annual Meeting of The Four Corners Geological Foundation on November 18, the Board decided to donate **\$1000** to a fund managed by the Geosciences Department at Fort Lewis College that supports undergraduate research expenses. We know how hard the students work so we are most pleased to help!

MEMBERS:

If you missed the November meeting and would like to view the talk online, here is the link. It was a wonderful presentation by Dr. Joel Pederson of Utah State University titled "The Lateral Retreat and Quaternary Evolution of the Book Cliffs, Central Utah".

[LINK TO NOVEMBER TALK](#)



GEO QUESTION OF THE MONTH!

Courtesy of Dr. Vince Matthews

*What is the highest Peak on
North America's Great Divide?*

(see answer Page 8)



Bryce Canyon: Rob Lander



"PREZ SEZ" by David Schiowitz

December 2021

Happy Holidays FCGS members,

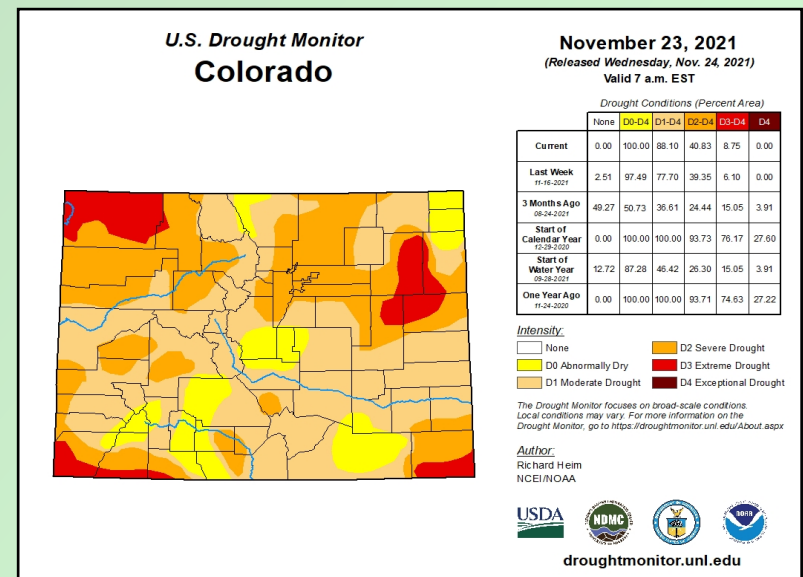
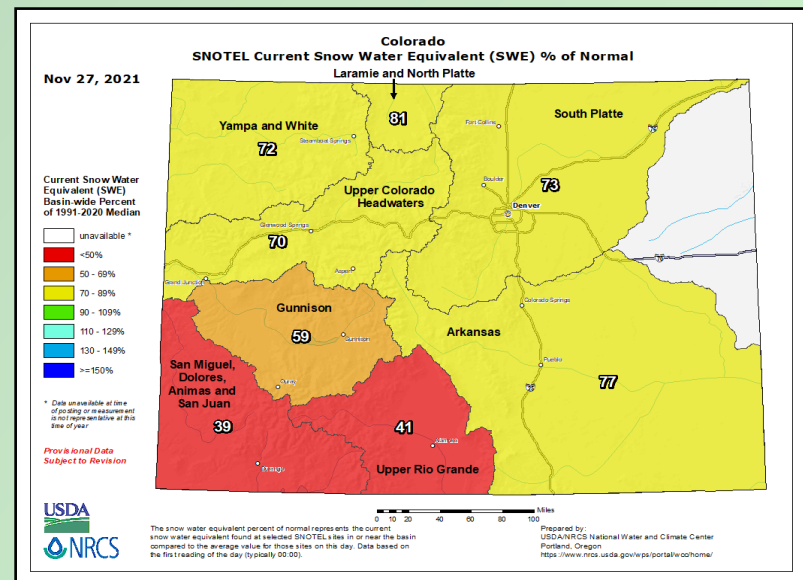
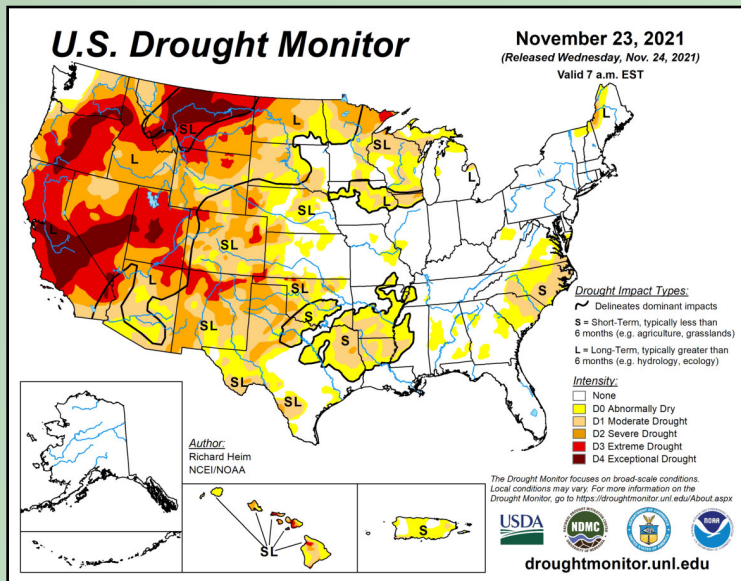
It's that time of year again when the days are short, the mornings are cold, and the anticipation of snow is in the air. Thank you to everyone that was able to participate in last month's meeting. We had an excellent talk by Dr. Joel Pederson (Utah State University) about the landscape evolution in the Book Cliffs of Utah.

For our next meeting, Thursday, December 9th, we have a talk by (Dr. Ron Hill, Chief Geochemist, EOG in Golden). It promises to be a fascinating talk and we also have poster presentations by FLC Senior Geology majors. I hope to see you there.

For this month's letter I'd like to show the current state of our snowpack (dismal) and the drought conditions (bad), which have led to low reservoir levels across the west. There is still plenty of winter left for snow to accumulate and change the current course of dry weather, but the following maps and graphs provide a good summary of current conditions across the west and in Colorado.

Happy and Snowy Holidays,

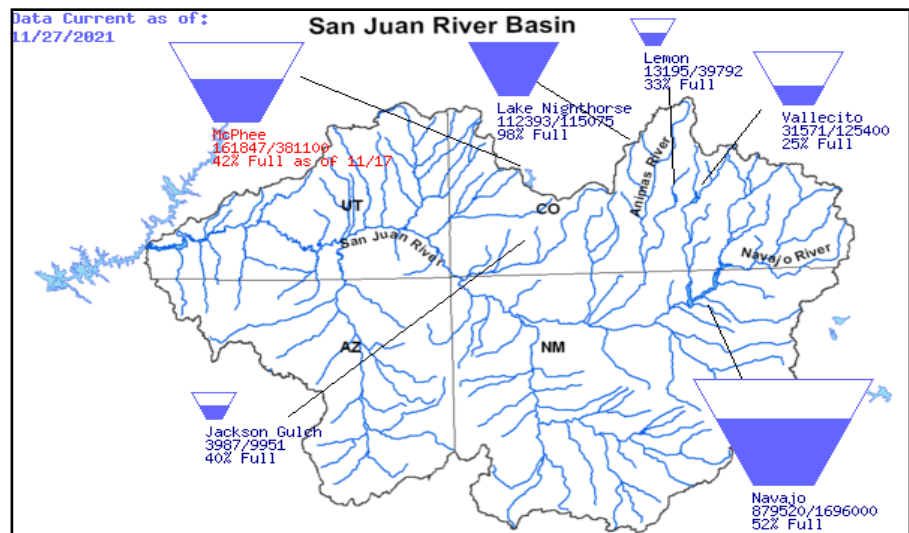
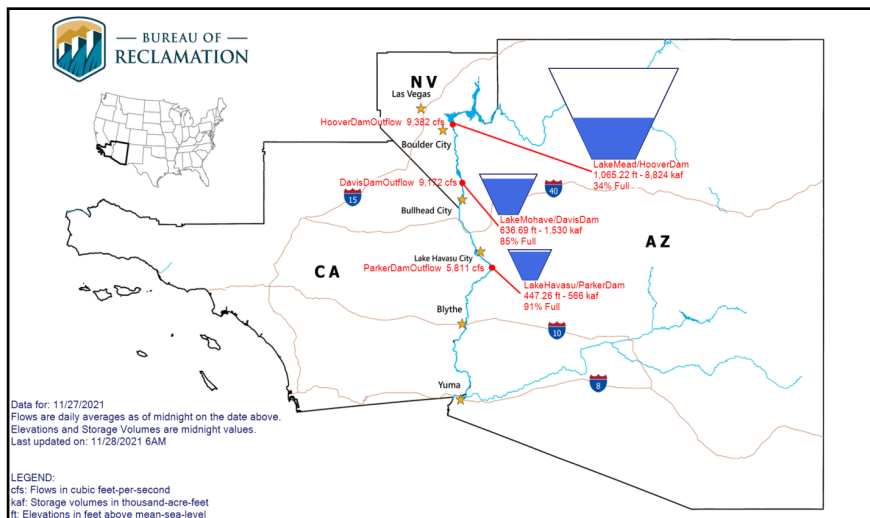
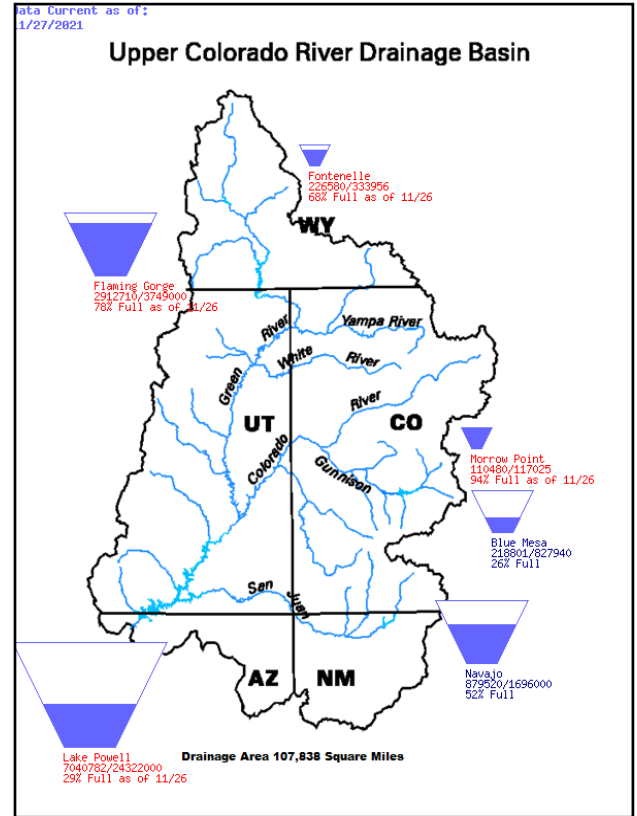
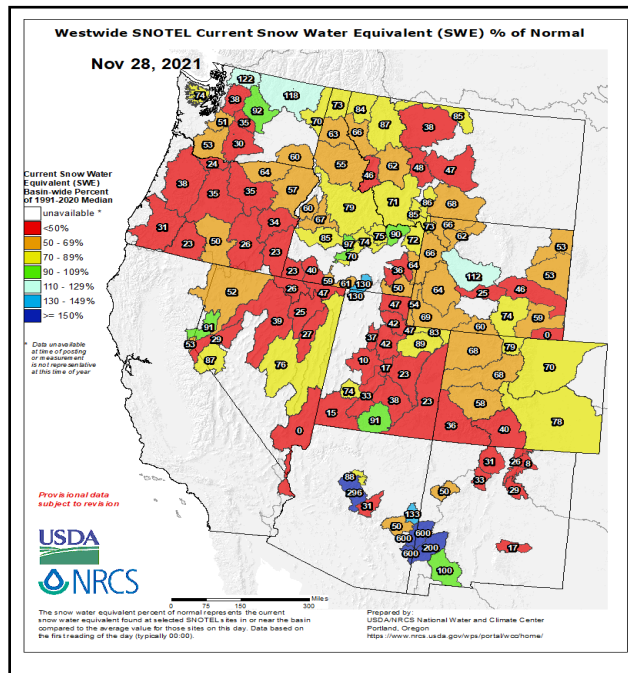
David



HAPPY HOLIDAYS!



PREZ SEZ, continued



December News

SAVE THE DATES!

January 20: David Gonzales,
Fort Lewis College

February 17: Chris Heine,
FTF Integrated Geoscience

March 31: Peter Vrolijk,
ExxonMobil retired

April 21: FLC student
presentations

May 19: TBD



November FCGS
Meeting @ FLC
(Jon Harvey)



Canyon de Chelly, Rachel Medina

JOB ANNOUNCEMENT:

COMPANY NAME: Red Willow Production Company

JOB TITLE: Geologist II

JOB CITY: Ignacio, CO

The closing date is 12/19/2021

Description: Performs detailed geological studies and incorporates relevant aspects of other disciplines to support operated and non-operated exploration and development activities for the purpose of maximizing hydrocarbon recovery and value. Responsible for routine assignments of moderate scope supervised by a senior Geologist who reviews both techniques and results.

Required Skills: A Bachelor's degree in Geoscience and four years applicable work experience; OR a Master's degree in Geoscience and two years applicable work experience is required. Must have strong computer-based data management and analysis skills. Must be willing to assist others, learn new skills, and participate in a productive team-oriented environment. Must have valid driver's license for state of residency and be insurable under RWPC's vehicle insurance policy. Must pass a pre-employment drug test and criminal history background check.

Position closes at 5:00 pm Mountain Standard Time on December 19, 2021.

Please apply online at <https://careers.southernnute.com/sugf>



Four Corners Geological Society, P.O. Box 1501, Durango, CO 81302
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GEO FUN FACTS for December



What is the highest Peak on North America's Great Divide?

CU Professor, Paul Weimer, caught me and his father Bob with this question, "What is the highest peak on the Continental Divide in Colorado?" We both answered, "Mount Elbert, of course."

Whereas Colorado's highest peak, Mount Elbert (14,440' AMSL) is the highest peak in the entire Rocky Mountains which extends from central New Mexico to northern British Columbia—Elbert is seven miles east of the Continental Divide, not on it. The highest peak on the Great Divide in Colorado is another of Colorado's 58 "Fourteeners"— Grays Peak. Indeed, Grays Peak (14,278' AMSL) and its sibling (Torreys Peak at three feet lower) are the highest points on the entire Continental Divide of North America, from The Bering Strait to southern Mexico. The USGS recognized this by labeling the area around the two peaks as "Continental Mountains."

- Vince Matthews

Big Thanks to Dr. Vince Matthews, retired Colorado State Geologist and Director, Colorado Geological Survey, for sending us this fun fact.

*Let's start a trend!
Send in Your GEO FUN FACT for next month to Tom Ann at talcgeo@gmail.com*



NEWS FROM AROUND THE REGION

RMAG December Luncheon
December 1, 2021; ONLINE ONLY

Ali Jaffri, Stratgraphix

"Beyond Red Beds: What Makes Sandstone-Hosted Copper Work?"

The "Redbed Type" model for sediment-hosted stratiform copper accumulations has been widely accepted for decades and serves as a template for greenfield copper exploration. The model assumes: 1) Redbeds are deposited in alluvial to fluvial environments, 2) Redbeds are associated with arid climates in rift basins, and 3) Redbeds are a primary source of copper. Recent sedimentological work on redbeds challenges this paradigm. We now understand that redbeds carry no depositional or climatic connotation. Furthermore, copper from classic "Redbed Type" mines is neither sourced nor hosted in redbeds. We propose a better predictor of copper occurrence is a combination of Cu-rich labile minerals, halite sourced brines to mobilize the minerals, and reductants that can be contained within sandstones of various depositional origins, not exclusively redbeds.

Free to RMAG members. Non-Member Online Talk Link = \$10.00.

To register, go to <https://www.rmag.org/index.php?src=events&srctype=detail&refno=195&category=RMAG%20Luncheons>

TCFD Alignment and Reporting: Paving the Path Forward to Net Zero
Wednesday, December 1; 1:00 pm – 2:00 pm EST

As companies face increasing pressures from investors and regulators to reduce greenhouse gas emissions, they often do not know where to begin and how to formulate a plan of action.

Learn how teams can use S&P Global analytics to create a baseline carbon footprint, conduct climate risk and scenario analyses, set targets, and communicate progress. Join us for a deep-dive with ESG experts to discuss organizational motivations and pressures, review case studies, and understand the powerful role reporting data plays on the path to net zero.

To get more info or to register, go to <https://pages.marketintelligence.spglobal.com/TCFD-Alignment-and-Reporting-Paving-the-Path-Forward-to-Net-Zero-Registration-December-2021.html>

Mining and Metallurgical Society of America 2021 ESG WEBINAR SERIES

#2 Social Issues – Social License to Operate

December 3, 2021; 1 pm MT

The MMSA QP Enhancement Committee is offering a series of webinars about ESG designed for the professionals working for mining companies and those involved in the preparation of studies and disclosure documents. The accepted standards of environmental stewardship, social license and governance of mineral endowments are constantly changing. QPs must know the issues of importance to society and be prepared to adapt and respond to changing societal norms. The series will also be of interest to the legal, financial, management and academic sectors of the industry.

Five webinars are planned:

1. ESG Panel of Experts Discussion – This Webinar was held October 1. The YouTube Recording is available at: <https://www.youtube.com/watch?v=fHJ4Xz4bWAs>.
2. Social issues – how to obtain and secure the "social license" to operate.
3. Environmental and permitting – meeting the standards demanded by governments.
4. Governance – making the right ESG decisions in the Board Room.
5. ESG 101 for Investors - summarizes the preceding four sessions.



The second Webinar is a Panel session and assembles experts in social issues. Over the course of 90 minutes the panel discussion will identify and introduce topics of importance which are faced by mining companies, mineral property developers and explorationists today.

TITLE: Mining SLO Depends on Embracing the Mine of the Future

Mining's Social License to Operate (SLO) has been heavily challenged over the last few decades, from NIMBYism to outrage over accidents or mistakes. While Mining has done much to clean up its act, especially as it relates to the safety of mines and their workers, negative perceptions remain. Now Mining faces a cataclysmic shift in how it can and will operate given the confluence of Climate / decarbonization, Digital, Automation, Globalization, and ESG. There is no aspect of mining that will remain untouched by the next decade of changes.

The industry's response needs to include quickly adapting to these shifts and proactively embracing the Mine of the Future to regain the trust of a world dependent on mining for the building blocks of not just decarbonization but everything that humans need for life as we know it. From mining in sensitive environmental regions, digging deeper and deep sea mining, to respect for communities, indigenous heritage and diversity of its workforce, Mining has to raise the bar to build its SLO, do things differently, and reach outside typical comfort zones. This session will explore how to build Mining's SLO by overcoming its reluctance to adopt and scale new ways of operating.

To register for this free webinar, go to https://us02web.zoom.us/webinar/register/WN_OPp6H8o-T-mkJ5Wz8cblq

Denver Region Exploration Geologists Society December Meeting

Mon., Dec. 6, 2021; 6:30 pm, Presentation at 7 pm

In-person at Colorado School of Mines, Berthoud Hall Room 241, Golden, CO and on Zoom

Paul G. Spry, Department of Geological and Atmospheric Sciences, Iowa State University

"THE GEOLOGY AND MINERALOGY OF PROTEROZOIC METAMORPHOSED MASSIVE SULFIDE AND GOLD MINERALIZATION IN THE DAWSON-EL PLOMO-GREEN MOUNTAIN TREND, CAÑON CITY, COLORADO"

Zoom link: <https://us06web.zoom.us/j/89376910222?pwd=V05iU2xZWlBYVVRGQTZONjYveWR4UT09>

Meeting ID: 893 7691 0222

Passcode: 395781

MiT Talk: Grant Writing for Geoscientists

December 9, 2021; 12 pm-1 pm (MST)

Rocky Mountain Members in Transition (MiT) is a joint effort of members of AAPG, SPE, WOGA, COGA, DWLS, and RMAG in the Rocky Mountain region to help association members in the midst of a career transition.

Webinars are free and open to all.

Presentation by Susan Nash, AAPG

The goal of this presentation is to identify opportunities to obtain funding or participate in a funded grant or federally funded contract that was awarded based on a response to a Call for Proposals.

To register or get more info, go to <https://aapg.zoom.us/meeting/register/tJEoc--hrTkuGdWBLIzUbyjFQAb6PAjVGxqg>

2022 Rocky Mountain Geo-Conference Call for Papers

Deadline December 10, 2021

Planning is underway for the next Rocky Mountain Geo-Conference, to be held November 4, 2022 in Westminster. The



conference is co-sponsored by CAGE, AEG Mile High Chapter, ASCE, and the ASCE Geo-Institute. This is historically a very well-attended and informative one-day regional conference. You are invited to submit an abstract on a geotechnical or geological project or case study in the Rocky Mountain Region to be considered for presentation at the conference and publication in an ASCE Geotechnical Practice Publication.

The email for abstract submissions is in the Call for Papers (<https://aegmilehigh.us9.list-manage.com/track/click?u=7cdecaeb033c45216c38110ff&id=b09b09b4a1&e=3d917d4f01>), and the abstract deadline is December 10, 2021.

MiT Talk: Mining Brines - A Unique Approach to Traditional Exploration and Production
December 16, 2021; 12 pm-1 pm (MST)

Rocky Mountain Members in Transition (MiT) is a joint effort of members of AAPG, SPE, WOGA, COGA, DWLS, and RMAG in the Rocky Mountain region to help association members in the midst of a career transition.

Webinars are free and open to all.

Presentation by Thomas Smith, CEO, US Strategic Minerals Exploration, LLC

Summary:

At the recent COP26 meetings, it was evident that there is an ever-increasing global demand for economically viable carbon capture technology. Using nature's own design, our proprietary CCUS technology offers scalable solutions for owner/operators of CO₂-emitting facilities located near suitable sources of subsurface brines. These mineral-rich brines can be sourced from new or targeted brine exploration areas, or from a large inventory of existing mine sites and oil and gas production operations. It is our goal to advance the use of CCUS processing technology that, on a global scale, provides an ESG-compliant future for a "Sustainable Energy Industry."

To register or get more info, go to

<https://www.rmags.org/index.php?src=events&srctype=detail&refno=196&category=Members%20in%20Transition>

PC2 = Precambrian Colorado Update

"PC2 = Precambrian Colorado" is the brand of an initiative whose mission is to "Contribute to the geologic and economic geologic knowledge bases of Precambrian Colorado rocks, and to their relationship to those of correlative units outboard of Colorado". The vision is to bring together a series of field trips, topical sessions, and presentations at the upcoming GSA Connects annual meeting in Denver in October 2022, and at the subsequent GSA Rocky Mountain Section meeting in Fort Collins the following Spring (2023). DREGS and the Colorado Scientific Society are the current endorses/co-sponsors of the initiative. Anyone interested in this endeavor and/or with information or data bearing on the topic please reach out to Lew Kleinhans (lewis.oysterclub@gmail.com) and/or Lisa Fisher (lisa.fisher@alumni.mines.edu).



**Be of Good Cheer
and**

Toast to Snow and Field Trips in 2022!





FOUR CORNERS GEOLOGICAL SOCIETY

P.O. Box 1501, Durango, CO 81302

MEMBERSHIP RENEWAL or APPLICATION: June 1, 2021 to May 31, 2022



*Name: _____

*Address: _____ City: _____ State: _____ Zip: _____

*Email: _____ Phone: _____

*Employer: _____

Please Identify a Membership Category:

Active Member	\$25	Any person engaged in the practice or teaching of geology or who holds a Bachelor's Degree in geological science from a college of acceptable academic standards. Degree requirement may be waived if applicant has adequate professional experience. *Highest Degree, Type and Year: _____ *College / University: _____
Associate Member	\$25	Any person who is a graduate of a college of acceptable academic standards with major studies related to, or associated with, geology. Degree requirement may be waived if applicant has adequate professional experience. *Highest Degree, Type and Year: _____ *College / University: _____
Student Member	Free	Any undergraduate or graduate student majoring in geology at a college of acceptable academic standards. *College / University: _____ *Year expected to graduate: _____
Emeritus Member	Free	An Active Member of 65 years old or older who has been a member for 25 years including time spent in military service. *Year emeritus status was awarded: _____
Honorary Member	Free	An Active Member who has contributed distinguished service to the profession of geology and to the betterment of the FCGS. Determination is made by the FCGS Executive Committee. *Year honorarium was awarded: _____

Other Professional Interests:

** Required information for new members. Current Members, please update.*

Please either print, complete and return this form with your check for dues made payable to: "Four Corners Geological Society" and mail to the address above or go online to fourcornersgeologicalsociety.org.

Please donate to the Foundation to support student research. Make out your check to: "Four Corners Geological Foundation" and include it in the envelope with your dues.

*Please check your interests:

- ☐ Sedimentology & stratigraphy
- ☐ Structure & tectonics
- ☐ Mineralogy, petrology, geochemistry
- ☐ Igneous geology, volcanology
- ☐ Ore geology and hard rock mining
- ☐ Other mineral extraction
- ☐ Petroleum geology
- ☐ Geophysics
- ☐ Geological engineering
- ☐ Geomorphology
- ☐ Quaternary geology
- ☐ Hydrology & water resources
- ☐ Environmental geology
- ☐ Geography / GIS
- ☐ Other interest (see box)