



FCGS Newsletter

P.O. Box 1501 | Durango | CO 81302 | www.fourcornersgeologicalsociety.org

May 2021

SPEAKER: Mr. Erik Hulm, TeoGeo Consulting

TITLE: *Seeing the Forest for the Trees Across North America's Cordilleran Foreland Megasequence*

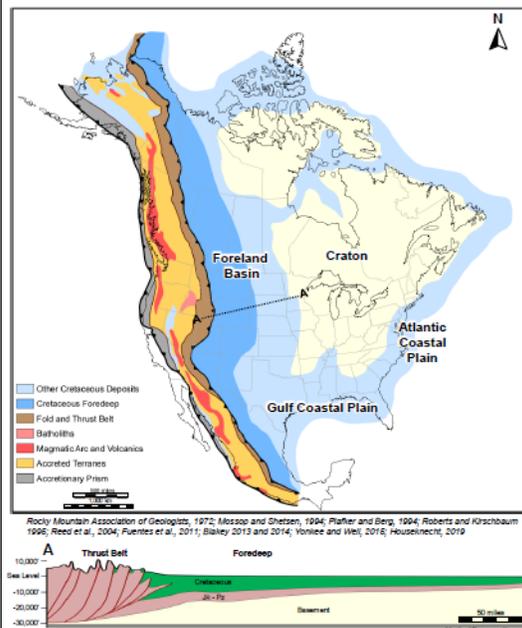
DATE: May 13, 2021

TIME: Please login to meeting a little before 5:30. From 5:30 - 6:00 attendees will be in a chat room for virtual socializing. Bring your beverage of choice!
6:00 - 6:15 back to meeting for Society business announcements and introductory remarks.
6:15 - 7:15 talk & Q&A.

LOCATION: Your own home! This is a Zoom meeting hosted by FLC.
- ZOOM LINK -

COST: Free but please renew your membership!
<https://fourcornersgeologicalsociety.org/membership/>

Late Cretaceous (L Campanian) Contiguous Foreland Basin



- Foreland basin formed in the late Jurassic during the Sevier Orogeny
- Represents a continuation of convergent tectonics along North America's western margin that began in the Triassic
- Combination of tectonic loading and global sea level maximum resulted in continuous basin and seaway connecting the Gulf of Mexico with the Arctic Ocean in late Cretaceous

May 2021

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ABSTRACT

The North American Cordilleran foreland basin once formed a contiguous succession of sedimentary rocks that extended from the Gulf of Mexico to the Arctic Ocean. Much has been published on the structural character and evolution of the Cordilleran but little on the full breadth of the foreland sedimentary fill and hydrocarbon endowment. This is largely due to post-Cretaceous structural modification and fragmentation of the foreland and confusion related to variations in stratigraphic nomenclature. This paper is an attempt to reconstruct the continental scale of the foreland basin megasequence and demonstrate the continuity and reach of the basin fill and related petroleum systems.

The Cordilleran foreland basin formed during the Sevier orogeny in Late Jurassic through Early Cretaceous time. The combination of tectonic loading and a global sea level maximum resulted in a continuous basin and seaway that extended across North America. Toward the end of the Cretaceous a change in plate motion resulted in significant tectonic modification of the foreland into many 10's of discrete basins that have experienced varying degrees of uplift, erosion, subsidence and burial. Evidence for the continuity of the Cretaceous foreland fill is represented by numerous transgressive and regressive units that extend for 100's to 1000's of miles across North America. Stacked reservoir and source intervals are present across the foreland megasequence making it one of the most productive and diverse petroleum provinces in the world. To date over 25 billion bbls of oil and 200 Tcf of gas have been produced. Current production across the megasequence

is over 4 mmbopd and 14 bcfgpd with upwards of 200 billion bbls of oil and gas equivalent reserves yet to be produced.

The megasequence continues to be a focus of significant activity and investment. Since the early 2000's oil production has grown significantly through development of heavy and tight oil resources across North America. Oil sands development in Canada through surface mining and in-situ steam recovery account for most of the heavy oil production increase. Tight oil developments, enabled through multi-stage fracture stimulation of horizontal wellbores, began at scale around 2010 and have since spread across the US and Canada. In addition, future potential is being realized in Alaska through successful exploration of the Nanushuk topset play and exploration and appraisal of additional tight oil reservoirs throughout the Rocky Mountain region.

Continued success in exploration and development will rely on pushing the boundaries of what is known and employing new approaches, methods and concepts. This can be facilitated by looking at the megasequence through a larger lens in order to see through local barriers that hinder deeper interrogation of analogues and the transfer of knowledge and best practices.

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BIOGRAPHY

Erik Hulm

Geologist/Manager

Erik Hulm is a geologist and manager with over 20 years of experience working complex exploration, appraisal, and development projects around the world. He earned his bachelor's degree in earth science at the University of South Dakota and a master's in geology at the University of Alaska Fairbanks. He began his career with BP Alaska in 1998 as a geologist evaluating exploration potential across Alaska's North Slope. During his career at BP, he held a variety of technical and leadership roles with projects in Alaska, Gulf of Mexico, Turkey, Columbia, Algeria, Russia, Egypt, Lebanon, Greenland, Ireland, and the UK. Since leaving BP in 2018 Erik has worked as a geoscience consultant and is currently a Senior Project Manager at the Rocky Mountain Biological Laboratory in Crested Butte, Colorado.



PREZ SEZ

Greetings Society Members!

Thank you for attending last month's event with Fort Lewis College Geology student presenters. I know they appreciated having an audience to speak to during a time when live audiences are hard to come by!



I hope you will join us on Thursday, May 13 for the last speaker event for the September - May FCGS speaker year. We will hear from Erik Hulm (TeoGeo Consulting), who will help us to 'see the forest through the trees' when looking at the North American Cordilleran Foreland Megasequence. I am excited to learn more about this all-important stack of strata and rich hydrocarbon resource that drapes a good chunk of North America.

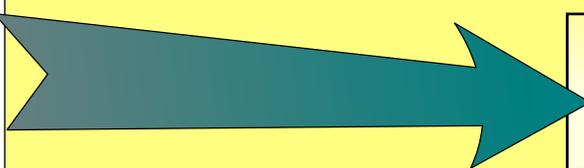
Prior to that meeting, we will announce FCGS officers for the coming year. Active members - please vote with the online ballot. We will send you a separate email with that information. Anyone interested in helping to plan field trips or working on the newsletter - please get in touch with an officer ASAP!

I look forward to seeing many of you IN PERSON later this summer for the FCGS picnic. Look elsewhere in this newsletter for more about it. Hopefully that will kick off a speaker year of in-person gatherings like we know and love from years prior, along with field trips and other activities for society members to enjoy.

In the meantime, join us on Thursday, enjoy the change of seasons, and hope for rain!

-Jon

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May Meeting Zoom Link:

<https://fortlewis.zoom.us/j/91248378486>

Four Corners Annual Picnic is ON!

Awesome volunteer Tom Staatz has reserved the Junction Creek Picnic Pavilion for the last Sunday in August. (August 29th).



Calling all people who have Or can bring shade canopies! We would like to be able to ensure social distancing for our more cautious older members, (and a major support arm of the society). Please keep that in mind and let us know if you can help.

This will our first in-person gathering since CoVid.



A raffle will be run. We will let you know the format because potluck food is probably not the best idea. We will figure out something safe and appropriate. Any and all ideas and volunteers are appreciated. Contact Tom Staatz at tstaat@tstate.com or this [LINK](#).

FCGS Foundation News



The Four Corners Geological Foundation has just awarded its annual research grants to three master's degree candidates who are working on theses in our Four Corners states. We hope you'll help us to fund this increase over our usual two grants by donating generously to your Foundation!

Hannah Cothren, at Utah State University, will prepare a geologic map of the Naomi Peak Quadrangle to be published by the Utah Geological Survey. She'll also date its Cambrian formations and compare those results with recent dates from the Grand Canyon that could revise the age of the Neoproterozoic/Cambrian boundary.

Haley Thorson, at Colorado School of Mines, will study the structural segmentation and early movement history of the Pennsylvanian Eagle Evaporite Formation. Understanding these

evaporites is important because they still affect land stability in the area and water quality in the Colorado River.

Finally, April Phinney, at Utah State University, will use the luminescence (OSL) properties of fire-heated rocks, among other methods, to compare the intensities of recent and older wildfires in northern Arizona. This unusual approach may yield new tools for evaluating trends in wildfire intensity over time.

Unfortunately, we could not fund the remaining ten applicants but we wish them well. We appreciate the excellent quality of students entering our profession and the new information they provide. With any luck, we'll get some of our grantees to give talks in the future!

Congratulations to Hannah, Haley and April. You rock!!

Mary Gillam, President

May 2021

EVENTS AND TRAINING

The following listings are provided by Douglas Peters,
CO-AIPG

CEMS Mining Mini-Conference: Tue, May 11, 2021; 1:45 PM - 5:00 PM MDT

Speaker and presentation titles:- Jeff Graves, Colorado DMNR: "Where is all that water coming from? Chasing sources at the Nelson Tunnel"- Jim Harrington, Ensero Solutions: "The Use of Biological Treatment to Stabilize the Schwartzwalder Mine and Reduce Long Term Water Treatment Costs"- Dusty Earley, EA Engineering, Science, and Technology Inc. PBC: "Thermal and Hydrogeochemical Modelling of Arsenic Treatment in Mine Impacted Water and the Implications of Climate Change on Treatment Costs"- Kerry Guy, US EPA Region 8: "The Gladstone Treatment Plant: Challenges and Lessons Learned from Five-Years of Operation Treating MIW from the Gold King Mine"

Free event! To register, go to <https://register.gotowebinar.com/register/4665416267445321229>

Geomechanics for Managers and Supervisors by The Petroleum Technology Transfer Council (PTTC): Tue, May 11, 2021, 10:00 AM – Thu, May 13, 2021, 12:00 PM MDT

This PTTC online session will be presented via zoom during two lunch hour sessions on May 11 and 13, 2021. In addition to the live session, participants will receive recorded session, presentation deck, and 4 hour certificate of attendance.

At some point as a manager of a subsurface field operation – whether it be a deepwater oil & gas field or an unconventional play, a complicated reservoir for a CO2 sequestration, or a salt solution mining project or even a geothermal well - geomechanics cannot be a simple, check-the-box exercise. In fact, understanding and predicting subsurface geomechanics issues may be the make-or-break effort for your entire operation.

This course, presented in two 90-minute sessions across the lunch hour, doesn't teach geomechanics procedures. Rather, this course provides the fundamentals required to specify a geomechanics program for a particular application, and to set realistic expectations of the results of a geomechanics evaluation, considering the reliability, quality and amount of the data.

To register or get more info, go to https://www.eventbrite.com/e/geomechanics-for-managers-and-supervisors-tickets-148927342691?aff=odeimcmailchimp&mc_cid=f957832aad&mc_eid=c8827b406b

MMSA May Meeting May 14, 2021; 1 pm Mountain Time; Zoom Webinar

“Critical Minerals (.er Penalty Elements) from Mine to Metal in the Copper Supply Chain”

Michael Moats, Professor of Metallurgical Engineering, Missouri University of Science and Technology

Save the Date!

Possible Fall Field Trips are in Our Future

August 29th:
@ Junction Creek
Campground Picnic
Pavilion. FCGS Summer Picnic.

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Description: In 2018, the United States identified thirty-five critical minerals due to concerns regarding supply risk and their importance to the nation's economy and defense. This presentation will examine the department and production potential of five "critical minerals" (selenium, tellurium, arsenic, antimony and bismuth) in the copper pyrometallurgical supply chain from mine to metal. Potential areas for future investigation and investment will be discussed to increase the recovery of these critical minerals from the existing copper supply chain.

Biography: Michael Moats is a Professor of Metallurgical Engineering at the Missouri University of Science and Technology. He is also the Director of the Thomas J. O'Keefe Institute for the Sustainable Supply of Strategic Minerals. Prof. Moats is an extractive metallurgist with over 100 publications in the fields of hydro- and electrometallurgy. In 2018, he received the AIME James Douglas Gold Medal "for his knowledge and contributions in the field of electrometallurgy". Dr. Moats serves as the project leader for AMIRA's P705D base metal electrowinning project, facilitator for an international consortium of eight copper refineries, and team leader for the surveying of copper electrorefineries for the triennial world Copper meetings.

Register in advance for this webinar:

https://us02web.zoom.us/webinar/register/WN_44HTiiZRTJOY_dWtNEa-yg

After registering, you will receive a confirmation email containing information about joining the webinar.

NGWA's Hydrogeology of States Webinar Series: Kansas: May 19, 2021; Online 2-3 p.m. ET

As hydrogeology varies widely across the United States — and as primary jurisdiction over groundwater development rests with the states — each is unique. This webinar series explores the issues encountered in each of the 50 states — one at a time.

The Oklahoma hydrogeology webinar, presented by James J. Butler Jr., Ph.D., Senior Scientist and Chief of the Geohydrology Section of the Kansas Geological Survey, will cover:—Major aquifers—Physical and geologic properties—Groundwater use and availability—Groundwater quality and contamination—Surface water/groundwater interactions—Groundwater management issues

Cost: On/before May 7 - NGWA member: \$29; Nonmember: \$49 Starting May 8 - NGWA member: \$39; Nonmember: \$59

To register, go to <https://www.ngwa.org/detail/event/2021/05/19/default-calendar/21may19web>

After registering for this event, you will receive a confirmation email acknowledging your registration that also contains instructions for accessing the event.

Fate of PFAS: From Groundwater to Tap Water Conference June 22-23, 2021

What have we learned about per- and polyfluoroalkyl substances from the past year? We're assessing the impacts to human health, discussing how legal and scientific perspectives on PFAS differ, and so much more during the Fate of PFAS: From Groundwater to Tap Water Conference. Registration is open for the conference, which will happen virtually June 22-23, 2021. A panel representing California, Colorado, New Hampshire, New Jersey, and Wisconsin will share how these states are addressing PFAS. Various speakers will address rapidly evolving knowledge about the environmental behavior, treatment and disposal, and health effects of different PFAS chemicals.

Early registration discounts are available if you sign up by May 21st. To register or get more info, go to <https://pheedloop.com/PFAS5010/site/registration/>



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:

***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)

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. <i>*Highest Degree, Type and Year:</i> _____ <i>*College / University:</i> _____
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. <i>*Highest Degree, Type and Year:</i> _____ <i>*College / University:</i> _____
Student Member	Free	Any undergraduate or graduate student majoring in geology at a college of acceptable academic standards. <i>*College / University:</i> _____ <i>*Year expected to graduate:</i> _____
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. <i>*Year emeritus status was awarded:</i> _____
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. <i>*Year honorarium was awarded:</i> _____

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 .