



APRIL 2021



SPEAKERS: FLC GRADUATING SENIORS

TITLES:

Nathanael Hunter

Testing hypotheses on the origin and structural controls of the East Great Salt Lake fault in northern Utah using structural modeling

Gregory A. Palese

Characterizing the valley-blocking Elk Creek rock avalanche Needle Mountains, Colorado

Austin W. Peterson

An investigation of metallogenesis and mineral assemblages of the east Dunmore vein, Uncompahgre mining district, Ouray county, Colorado

Diego Schutz

Constraints on conditions of mineralization in the quartz-hübnerite breccia pipe of the western Dunmore vein system, Silver Gulch, Colorado

DATE: Thursday, April 29, 2021

SCHEDULE:

5:30 PM - people accumulate on Zoom

6:00 PM - welcome, and kick off first talk.

4 student talks - each talk will be ~15 minutes

~ 7:30 PM - meeting wrap-up

LOCATION: Your own home!

This is a Zoom meeting hosted by FLC.

LINK TO MEETING-

COST: Free but please renew your membership for 2022.
(June 1st to May 31st is our calendar year)

APRIL 2021

Officers of the Society

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Abstracts

Nathanael Hunter

Testing hypotheses on the origin and structural controls of the East Great Salt Lake fault in northern Utah using structural modeling

ABSTRACT

Previous results from seismic interpretation on the East Great Salt Lake fault suggest that it formed initially as a Sevier thrust fault, which was later reactivated by listric normal faulting. This hypothesis was tested by relating the rollover geometry of the horizontal stratigraphic layers in the hanging wall to the listric normal fault shape of the East Great Salt Lake fault.

To constrain the listric fault geometry of the East Great Salt Lake fault, restoration of bedding in the hanging wall thru structural modeling was used. This process was done on StructureSolver to interpret seismic lines, restore rollover beds, and test viable fault shapes. After bedding was restored, the interpreted listric normal fault shape became steeper than before restoration at depths between 4 to 6 km below the surface.

Despite the change in fault shape, the Sevier thrust fault still merged with the East Great Salt Lake fault. Thus, my interpretations support the idea that reactivation of the East Great Salt Lake fault developed via reactivation of an older thrust fault.



I am a current undergraduate student attending Fort Lewis College in Durango, Colorado. I am from Farmington, New Mexico and I spend a lot of time hiking, kayaking, and fishing at Vallecito Reservoir. Pursuing a career in geology has been a passion of mine since I was a teenager and I hope to continue my education after I graduate.



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Diego Schutz

Constraints on conditions of mineralization in the quartz-hübnerite breccia pipe of the western Dunmore vein system, Silver Gulch, Colorado

ABSTRACT

The Dunmore system contains mineralized breccia chimneys and veins in a zone that trends ≈ 3 kilometers east-west in Silver Gulch, Colorado. This system has been poorly studied but represents a well exposed snapshot of mineral deposition analogous to Red Mountain breccia pipes and Silverton style veins. In this investigation, field and petrographic studies were combined with fluid inclusion analyses to unravel the fluid evolution, constrain temperatures, and estimate pressures of mineralization in the western Dunmore system. The results are novel and provide additional constraints of breccia chimney formation conditions in the region.



Field surveys were used to interpret textural and spatial relationships of the quartz-hübnerite zone and to collect samples for use in petrographic and fluid inclusions analyses. Petrographic analyses revealed the tungsten-breccia zone contains three dominant quartz generations: (1) Euhedral quartz with no growth zones (5 to 10 millimeters); (2) anhedral quartz with hübnerite (1 to 2 millimeters); and (3) euhedral quartz with growth zoning (4 to 6 millimeters).

Fluid inclusions within the first quartz generation represent high temperatures ($\approx 300^{\circ}\text{C}$) but are highly deformed from rapid pressure and temperature fluctuations and instability. Inclusions in the quartz-hübnerite generation are not preserved suggesting a transition from higher to lower temperatures. Late vuggy euhedral quartz with growth zoning hosts fluid inclusions with homogenization temperatures between $\approx 240^{\circ}$ to 250° C. Pressure estimations based off topographic differences and paleosurface assumptions suggest system formation at $\approx 1,400$ -meter depths at ≈ 60 bars of pressure.

Surrounding breccia dikes and pipes represent a volatile-rich magmatic system with intense brecciation. The quartz-tungsten zone in the west Dunmore system shows minor brecciation representing a later transitional stage from a mesothermal magmatic system into a cooling epithermal stage of mineralization.

Breccia pipes are commonly important mineralized components found with numerous types of economic mineral deposits. This study contributes to the developing genetic model of the Dunmore system along with other breccia pipe occurrences in the northern San Juan Mountains. The Dunmore system illustrates a complex evolution of fluids and gases and the developments of different but spatially related mineralized bodies in breccia systems.



My name is Diego Schutz and I am a senior geology student here at Fort Lewis College. I am looking forward to graduating this spring after I finish up with field camp. After school I am excited to stay in Durango working for Metallic Minerals exploration in the La Plata Mountains. I was born in Elko, Nevada and moved to Colorado when I turned 6. I am a huge hockey fan and love the Colorado Avalanche.

APRIL 2021

Austin W. Peterson

An investigation of metallogenesis and mineral assemblages of the east Dunmore vein, Uncompahgre mining district, Ouray county, Colorado

ABSTRACT

The Dunmore system is a steeply dipping mineralized zone that trends east-west for ~3.2 km. The system is the only site in the San Juan Mountains where Red Mountain-style breccia chimneys are spatially and temporally related to the Silverton-style epithermal deposits. Although the breccia pipes were previously studied, no detailed work was done on the vein deposits. The purpose of this project was to better understand the mineralized veins of the East Dunmore system (EDS) and assess the economic potential for precious metals.

This investigation: 1) documents the distribution and field relationships of the veins; 2) constrains their mineral assemblages and paragenesis; and 3) assess the economic potential for gold and silver.

A field survey combined with petrographic studies revealed that there are four main stages of mineralization in the veins: 1) early massive quartz; 2) carbonate + hübnerite; 3) late stage microbrecciation dominated by quartz and muscovite; and 4) a medium grained quartz and sulfide generation. Mineralization overall is dominated by the assemblages of pyrite + sphalerite + galena + chalcopyrite ± tetrahedrite-tennantite.



Assays on seven mineralized samples reveal that gold concentrations vary from <0.001 opt to 0.054 opt and silver concentrations vary from 0.74 opt to 12.24 opt. Most of the precious metals are contained in chalcopyrite, galena, and tetrahedrite-tennantite.

The results reveal that the vein in the Dunmore system involved several different stages with stage 1 having the greatest concentrations of precious metal mineralization. The association of veins with microbreccia and related alteration is similar to the WDS breccia pipes and could hint at some sort of spatial and temporal relationship. The economic potential for the Au and Ag in the EDS is low, but the high concentration of base metal minerals could hold promise in the future.

I am from Durango, Colorado. I am interested in mining and exploration in the minerals industry. My hobbies include placer gold mining and rock hounding in and around the San Juan Mountains.

My favorite mineral is rhodochrosite.

APRIL 2021

Gregory A. Palese

Characterizing the valley-blocking Elk Creek rock avalanche Needle Mountains, Colorado

ABSTRACT



Rock avalanches are high-magnitude and low-frequency mass movement events. Within the Elk Creek valley in the Needle Mountains of southwestern Colorado, a well-preserved example of a large, valley-blocking, rock avalanche is exposed on the floor of a glacial valley. This site, though a great example of a rock avalanche, was not previously studied in any detail. My research focused on the size, characteristics, and timing of the Elk Creek rock avalanche as well as the impact this event had on the Elk Creek drainage.

The morphologic features of the Elk Creek event were defined using field studies, aerial LiDAR from USGS 3DEP, and GIS analyses. To constrain the age of the event, previous studies on the glacial history of the area and relative events from field observations were used.

The Elk Creek avalanche contains an estimated 13.8 to 24.7 million cubic meters of rock deposited in a single catastrophic event. LiDAR elevation data, planar laminated sediments, and Elk Creek's elevation profile confirm that this slide blocked Elk Creek creating a natural dam, causing the formation of one or more lakes. Over some time the lakes filled with sediment from upstream until the lake overtopped the dam and eventually carved a channel through. After the creation of a channel through the rock avalanche deposit, fill terraces downstream suggest enough sediment was flushed downstream to cause aggradation of the creek. The creek then re-incised through this material leaving behind these terraces.

The Elk Creek rock avalanche serves as a demonstrative example of extreme post-glacial hillslope failure with long-lasting impacts on the landscape. The insights of that failure have value as an analog of geologic hazards that may face areas experiencing rapid deglaciation.



Gregory is a senior undergraduate geology major, GIS certificate, and music minor at Fort Lewis College. He is originally from Lakewood Colorado, is an Eagle Scout, enjoys playing piano and singing, and his favorite mineral is Tourmaline



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PREZ SEZ



Jon Harvey on 2019 hike / train fieldtrip

Greetings FCGS!

We are nearing the end of another year of FCGS talks. Not quite done, though! As is tradition, on Apr 29th we will host four Senior Fort Lewis College Geology Students as speakers. They have been hard at work for two+ semesters to define a project, perform background research, and then collect and analyze data to help them test their hypothesis(es). This 'senior thesis' serves as the capstone of our Geology major at Fort Lewis, and a big part of it is the

communication of their results to the public. What better public than the Four Corners Geological Society? We have made a habit of having these students present to FCGS at the end of the academic year, because 1) the topics are often of interest to the society members, and 2) your feedback for the students really helps them improve their science, their communication, and their confidence in public speaking. I hope we can achieve those same goals via Zoom.

So, please attend via Zoom on Apr 29 to hear about the awesome work these students have done, on a variety of topics, mostly focused in the Four Corners region. More about the specific topics to be covered can be found in the Newsletter. I will likely not be able to host/attend the meeting due the impending arrival of our 2nd child (any day now!), but Dr. David Gonzales, who corralled this particular cohort of students through their theses, will be hosting.

After this April meeting, we will have our final meeting of the speaker season in May, the details of which can be found in this newsletter. I hope to be back in attendance for that meeting. And while we're hoping, let's also look forward to getting back into the business of field trips and picnics and seeing each other IN PERSON soon!

Thank you all for being active members of the FCGS over this challenging year.

-Jon Harvey

FCGS SOCIETY NEWS

According to our bylaws, we elect new officers in May. Our elections cycle and calendar year is June 1st to May 31st.

Next month we will send out ballots, most likely using Google Survey/Voting link, as we have done in the past. **Keep an eye out for that Ballot!**

All positions are open except President-Elect. If you would like to volunteer to work for the Society as an officer, please contact Jon Harvey at jeharvey@fortlewis.edu or [this link](#).

It's quite rewarding to volunteer to help with the geological society and we hope you will consider it.

Only paid-up members can vote. Unfortunately quite a few of our long-time members did not renew last year and we would like to know why. What could we do or could have done differently? You will have a note on the email that comes with this newsletter if you did not renew in 2020-21. Dues for 2021-22 are due on the 1st of May.

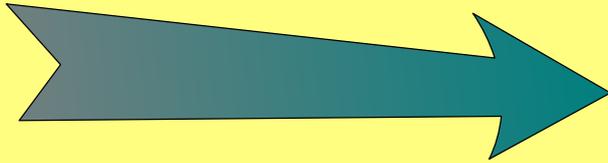
VOTE!!
(and volunteer)

CATCH THE NEW SPEAKER MUGS!

can you spot the rock hammer and geologist?



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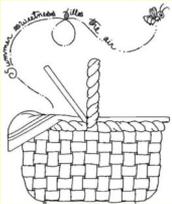


Meeting Zoom Link:

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

UP THIS MONTH: FLC STUDENT PRESENTATIONS.
THE MOST FUN MEETING OF THE YEAR!

Four Corners Annual Picnic is ON!



We have reserved the Junction Creek Picnic Pavilion on 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 tstaatz@gmail.com [LINK](#).



Links to Past Meeting Talks:

If you missed out on any meetings this year, Jon Harvey has come to the rescue with the following links to the recorded talks.

Mar 18:

<https://fortlewis.zoom.us/rec/play/ix6CyXlvHt8I2MqiyOdkWg5XQmmiSu5PazwHRatk7IRUjgH51IXPWsnasYhjXKn2giWigChGY0clLVnq.UXq0vdsWEFl8eJj>

Feb 18:

https://fortlewis.zoom.us/rec/play/KAmNmzw6BfUXCSOQiz7JEXT8OSVTPWYbZxv2x7uUMhIVUhepjEx3d7IRGBdPQEVS_RgFt7A-MFidCgE.QSzd2f1EM8h-YdX

Jan 28:

https://fortlewis.zoom.us/rec/play/zVrAAhVEaOr3xNYHUIF-MEMvO5xEOYJSIm2amIXuC7R1KMs3bGhAChvCsEraExHtvFJOxkdnL5uwLM.Sto_QZ6XrWHTCydr

Dec 10:

https://fortlewis.zoom.us/rec/play/EP2MUyU0DPNbe8FHIqjB2N5e1nEuipNb03fFafmjf-rex0xsdGufuZslhF7fMk88t_dEDeku5wDS8Zk.6vjN37v2GKnA64Hv

Nov 14: no recording

Oct 22:

<https://fortlewis.zoom.us/rec/play/bljaNLMpoGDJ7qJtQdxIQZLVgmomCg2vIW5y14re6K8MRWYtpBHWu2xbITf0zB375pN5HmVjdwHgLPz.iFGlitKgtfymIH>

Sep 17:

https://fortlewis.zoom.us/rec/play/VHZQDLY22hHsHgMclnvrky5gCGZ_JyH6HcjGnZgiMK5ACXh9sJiipnKHII5GKqXJd_j3BHJvfmS3nJqx.3S_dSpLICgr6Rs4S

Green River showing Island and Rainbow Park and the Island Park Fault, taken last June at sunset.

Photo by David Schiowitz



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WGA PRESENTS:

April 23rd, 2021

Dr. Patrick Druckenmiller

Title:

Nurseries of the North: Baby dinosaurs from the Prince Creek Formation (Upper Cretaceous), northern Alaska.

Abstract:

The Upper Cretaceous Prince Creek Formation of northern Alaska preserves the northernmost dinosaurs that lived on Earth. The fact they survived at ~80 degrees North is amazing in itself, but new discoveries along the Colville River reveal that at least seven different species of plant- and meat-eating dinosaurs also reproduced in the high Arctic. Paleontologist Patrick Druckenmiller discusses the paleogeographic and climatic setting at this time, the dinosaurs that inhabited this challenging environment, and the hard-won evidence for nesting. The implications for dinosaur migration are also presented.



Artistic rendering of a juvenile dromaeosaur 70 mya, Prince Creek Formation, Alaska. (Andrey Atuchin/Southern Methodist Univ.)

WGA Board is inviting you to a scheduled Zoom meeting.

Topic: April 23rd WGA Friday Lunch Speaker: Patrick Druckenmiller, Curator of Earth Science, University of Alaska Museum of the North
"Overview of Alaska Fossil Record"
Time: Apr 23, 2021 11:45 AM Mountain Time (US and Canada)

Join Zoom Meeting

[LINK](#)

Meeting ID: 882 3234 6550

Passcode: 030989

One tap mobile

+16699009128,,88232346550#,,,,*030989# US (San Jose)

+12532158782,,88232346550#,,,,*030989# US (Tacoma)

Dial by your location

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+1 253 215 8782 US (Tacoma)

+1 346 248 7799 US (Houston)

+1 646 558 8656 US (New York)

+1 301 715 8592 US (Washington DC)

+1 312 626 6799 US (Chicago)

Meeting ID: 882 3234 6550

Passcode: 030989

Find your local number: <https://us02web.zoom.us/j/88232346550>

Save the Date!

May 13th

**Erik Hulm,
TeoGeo Consulting**

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

**Possible Fall Field
Trips are in Our
Future**

August 29th:

**@ Junction Creek
Campground Picnic
Pavilion. FCGS Summer
Picnic.**



**Northward dipping limb of the Split Mountain Anticline from a beach on the Green River before entering Split Mountain.
Photo by David Schiowitz**



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 .