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**The Department of Geosciences**

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**Geosciences** is housed  
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# GEOscape

## 2022



GEOSCIENCES  
COLORADO STATE UNIVERSITY

# A Message from Department Chair Rick Aster

Dear Friends of Geosciences,

Our campus returned to full throttle this year as we resumed a fully in-person campus experience with record CSU enrollments. National and international in-person professional meetings, much delayed field work, and other research also restarted. We are establishing and reestablishing the personal and professional connections with geosciences peers, advisors, students, staff, and many others who make our Earth Science culture and community so rewarding, meaningful, and impactful. Following heroic teaching adaptations, including online classes, hybrid structures, and much more, our faculty were largely able to return to classrooms and field sites by this fall. I also specially thank our department staff - Patti Uman, Kailarae Lilly, and Angela Sharpe - for the sustained and exceptional efforts that keep our department running on an even keel. This transition to quasi-normalcy has been especially significant for our junior colleagues and students as they build formative networks of professional mentors, collaborators, and mentees around the department, on campus, amongst prospective employers, and in the wider world, including with many of you in our extended CSU community.

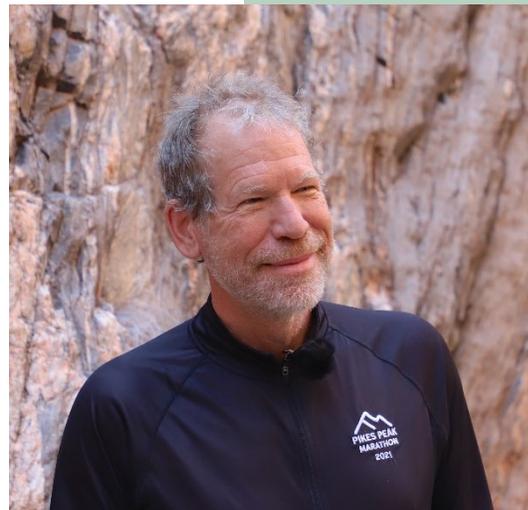
Congratulations to two outstanding faculty colleagues who were promoted this year - Sean Bryan (Master Instructor) and Derek Schutt (Full Professor). We saw the retirement of Sally Sutton and departure of Sven Egenhoff, two long-time colleagues, and are well along in hiring faculty successors in the general fields of petrology and sedimentary geology. I'm very pleased to note that we will be officially welcoming geologist/geochemist Lauren Harrison (currently in a Mendenhall Postdoc at the USGS) to our department next summer. In the meantime, Lauren is working closely with other faculty here to lay the foundations of a new Petrological Laboratory that will bring state-of-the-art isotope mass spectrometry capabilities spanning much of the periodic table to our department and campus next year and beyond. This transformative new laboratory was spearheaded by distinguished Faculty Emeritus Malcom McCallum, whose influence is readily apparent in today's department. As I write this, we are also arranging interviews to hire a second new faculty colleague in sedimentary geology in 2023.

John Hayes retired after a highly impactful tenure as dean, and we welcomed Alonso Aguirre as the new dean of Warner College of Natural Resources this summer. Among his impressive academic credentials, Alonso has two degrees from WCNR (M.S. and Ph.D.) and is a Warner College Distinguished Alumnus. Alonso hit the ground running this fall semester and we are already working from the department and across the college to realize new and ongoing opportunities.

I hope that you all are doing well, and that we will hear from many of you this coming year. As always, if you are visiting Fort Collins please stop by the department and say hello!



Rick Aster, Ph.D.  
Geosciences Department Chair



#### In This Issue:

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GEOScape is the annual newsletter produced for alums and friends of the Department of Geosciences at Colorado State University. We appreciate your continued support and welcome your thoughts.

This year's edition was compiled, edited, and designed in-house by the Department of Geosciences Administrative Assistant II, Kailarae Lilly.

On the cover:  
Peaks in Rocky Mountain National Park seen from near the summit of Round Mountain.  
Photo by Rick Aster

# A Message from WCNR Dean A. Alonso Aguirre

Greetings Department of Geosciences Alums and Friends,

I'm thrilled to be the new dean of Warner College of Natural Resources and am rapidly getting up to speed on the college and its programs to continue our momentum in positive directions.

Engaging with fellow Warner alums (I earned my M.S. and Ph.D. from Warner College in the Department of Fish, Wildlife, and Conservation Biology) is one of my favorite activities as I love to learn about all the great ways you've been putting your experiences here to good use. I'm committed to being well-connected to our alum network and hope we can engage with one another soon.

In my opinion, there has never been a better, more exciting time to work in management and conservation of natural resources and addressing complex environmental issues, including climate change and biodiversity loss. This requires truly transdisciplinary collaborations and integrating science and policy. Specifically, innovations and technological advancements in geoscience are vitally important to local and global efforts for reducing the carbon footprint and implementing processes and techniques that restore, protect, and conserve our natural resources.

As a college we are taking this academic year to refresh our strategic plan, find new ways to engage collaboration throughout the college and university, and grow and strengthen our partnerships with important stakeholders outside the university. I'm working to foster even more transdisciplinary work in the college through targeted internal grant initiatives and elevate this important research concept across the university. We are launching new communications tools and events to stay connected to all our communities.

The Department of Geosciences is poised to solve key environmental issues, using the most sophisticated tools to improve predictions of the Earth systems and climate patterns, locate natural resources for optimal extraction (but not over exploitation), and protect the environment with green and sustainable geoscientific knowledge. I trust you will enjoy GEOScape this year. It reflects the tremendous record of all the wonderful progress the department continues to make, and is a true demonstration of the impacts and productivity of this stellar faculty throughout a wide variety of geosciences disciplines.

There hasn't been a more exciting time to be a Warner Ram!



A handwritten signature in black ink, appearing to read "A. Alonso Aguirre". The signature is stylized and includes a large, sweeping flourish.

With best wishes of success!

A. Alonso Aguirre DVM, Ph.D.

Dean, Warner College of Natural Resources



# Department News

# WCNR Distinguished Alumna

## Congratulations to Cindy Williams (B.S., Geology, '89; M.S., Geology, '92) 2022 Warner College of Natural Resources Distinguished Alumna

Geosciences congratulates alumna Cindy Williams for her selection as the 2022 Honor Alumna of the Warner College of Natural Resources. Cindy is a highly accomplished economic geologist and resources industry executive, serving in vice presidential roles with Colorado-headquartered Newmont Corporation, the world's largest gold corporation from 1992-2013, where she led global exploration, development, technical services, innovation, and other programs, and where she served as the highest ranking female employee. Cindy lives in the Salida, Colorado area where she is a leader in regional conservation, recreation, fire preparedness, and other community-wide efforts. These include co-leading Envision Chaffee County, whose work encompasses 1,500 community members and 80 organizations. Her exceptional leadership was recently recognized by the Salida Chamber of Commerce/Heart of the Rockies with a Woman of the Year award. Cindy also serves on the Warner College Dean's Council. She was honored at this October's CSU Distinguished Alumni Awards Ceremony at the Lory Student Center Theater, which was also attended by members of her family and by her M.S. advisor and distinguished Faculty Emeritus Tommy B. Thompson. Congratulations, Cindy!



Left: Cindy Williams and adviser Tommy B. Thompson at this year's CSU Distinguished Alumni Awards

Below: Cindy accepting her Distinguished Alumna Award with Executive Director of the CSU Alumni Association, Kristi Bohlender

## New Petrological Facilities Coming Soon and a Special Thanks to Malcolm McCallum

We are pleased to announce that long-time department professor ('62 – '95) and distinguished Faculty Emeritus Malcolm McCallum generously engaged with us this year to spur a major laboratory initiative in the geosciences department. This effort, also supported by the Warner College of Natural Resources and the Colorado State University Office of the Vice President for Research, will support major new instrumentation including cutting-edge mass spectrometry. These capabilities will be coupled with a clean laboratory managed by incoming faculty colleague Lauren Harrison, starting August 2023, to facilitate the analysis of low-level samples at high precision in a wide variety of applications. The laboratory will specifically advance department research and training programs in petrology, economic geology, geochronology, mineralogy, sedimentology, and many other areas of geosciences. Expect to hear more on this transformative development soon!



# Drilling to Bedrock

As part of the expanding hydrogeological observatory at CSU Mountain Campus, geosciences faculty and students collaborated this fall with other WCNR colleagues on an exploratory drilling project to further investigate the valley sedimentary deposits and depth to bedrock. The project, led by Mike Ronayne, was funded by the Warner College Dean's Office through a generous anonymous donation to advance research and education at Mountain Campus. Drilling and well installation was conducted over a 4-day period in September 2022 using a drilling company that specializes in sonic drilling/casing advance, a method that allows for continuous core sampling while maintaining a deep hydrological borehole through unconsolidated, saturated coarse sediment. Remarkably, the team

Geosciences graduate student Billy Stansfield removes excess sediment from a core box



Core boxes with samples from the entire 214-ft. sequence are being preserved for future research and education



Graduate students Isabella Ulate and Camilla Warden inspecting core samples

logged over 65 meters (214 feet) of alluvial sediment before hitting Precambrian Hogue's Peak granite bedrock. Detailed logs were completed and continuous sampling of the sediments during drilling documented grain sizes that range from silt and clay to sand, gravel and cobble. The wide range of grain sizes indicate diverse environments where fine-grained laminated sediments were deposited by low velocity channel overbank flows and ponded water conditions, with the sand, gravel, and rounded cobble-sized sediments being transported by higher discharges and deposited in glacial outwash channels. The valley's thick alluvial sediment, dominated by porous sandy material, holds a large quantity of mobile groundwater. Preliminary estimates of local groundwater storage exceed 3 million cubic meters, a volume that is substantially higher than the total monthly streamflow during base flow periods at Mountain Campus (e.g., August – October). These results provide new insights into the depositional history of the valley, the mountain watershed hydrologic budget, and the important role of groundwater in sustaining streamflow throughout the year. Hydrogeology Ph.D. candidate Kristen Cognac (pictured to the left) was the lead field geologist in charge of logging and was joined by fellow geosciences graduate students Billy Stansfield, Isabella Ulate, and Camilla Warden. CSU staff at the Mountain Campus also supported the drilling and are currently providing storage space for the drill core that was collected.

# At the CSU Mountain Campus



Sonic drilling rig with grad students Camilla, Isabella, and Billy in foreground



Grad student Kristen Cognac transfers a sample into the core box

This Mountain Campus drilling project and hydrogeological infrastructure initiative involves multiple faculty from the geosciences department (Mike Ronayne, Sara Rathburn, Jeremy Rugenstein, Dan McGrath, Bill Sanford, Sean Gallen, and Dennis Harry) and research staff and faculty from the Department of Ecosystem Science and Sustainability (Kira Puntenney-Desmond, Stephanie Kampf, and Steven Fassnacht). Two department graduate students recently completed M.S. thesis focused on the geology and water resources near Mountain Campus: Jens Christoph Suhr (M.S., Spring 2022, co-advised by Sara and Dan) studied post-glacial alluvial dynamics, and Valerie Doebley (M.S., Summer 2022, advised by Mike) studied hydrogeologic controls on groundwater-surface interaction. This was also the first year in the department's history that a segment of our capstone field course (Geosciences Field Camp) was taught at Mountain Campus. Led by Dan McGrath and Jeremy Rugenstein, students investigated the valley geology, interpreted water chemistry, and conducted shallow geophysical surveys. The new deep monitoring well, along with preserved core samples, will be utilized in future offerings of Field Camp.

# Dinosaur Paleontology

In June, students from a variety of majors, including many from the Warner College of Natural Resources, joined geosciences Affiliate Professor Joe Sertich and a field team from the Denver Museum of Nature & Science for this year's Dinosaur Paleontology Field Camp, an expedition to the dinosaur-rich badlands of northwestern New Mexico. This field course was integrated into a multi-year project exploring the rich badlands of the region for fossils and geologic data from dinosaur ecosystems that thrived along a swampy coast of an inland sea 75 million years ago. Nothing could have prepared them for the amazing trove of fossils they discovered.



2022 Dino Field Camp students, left to right: Noalani Benedict, Adam Rang, Kayla Grant, Hayley Young, Kaidan Capossere, Eli Crocker, Alex Polich

Left to right: Emily Tashea, William Eager, and Madeline Ferguson mid-excavation



Students started the course with lectures on the history of discovery in northwestern New Mexico, field safety and logistics, and a crash course in fossil identification. A behind-the-scenes tour of the labs and collections at the Denver Museum of Nature & Science exposed them to the journey of a fossil after field collection, from the delicate cleaning process to the long-term storage and research conducted by scientists and students. The real test, however, was in the field. During two sessions, seven days each, students learned about public lands uses and Wilderness Area protections from the Bureau of Land Management, learned how to search for and excavate fossils, and practiced field observations and data collection. They weathered intense heat, sandstorms that blocked out the sun, and drenching rains, all in the pursuit of dinosaur fossils and the evidence of a lost world.



# Field Course



Students proudly displaying their sandstone encased Pentaceratops skull loaded onto the trailer

Among the amazing finds of the season were numerous turtles, dinosaur teeth, fossil plants, and microfossils. Students helped unravel the geologic story behind the burial and preservation of a partial skull and skeleton of a juvenile tyrannosaur, likely the rare *Bistahieversor*, an ancestor of *Tyrannosaurus rex* from rocks 9 million years older than the famed predator. The most spectacular find was the complete skull of the horned dinosaur *Pentaceratops*, the most complete ever collected in more than 100 years of paleontological exploration, and among the best horned dinosaur skulls ever found on the Colorado Plateau. In only 4 days of digging students helped extract a 3,800-pound block of sandstone from the badlands and load it onto a trailer. The skull has already been fully cleaned and awaits research, perhaps by some of the same students that liberated it from its ancient sandy tomb.



Complete skull of the horned dinosaur *Pentaceratops*, being carefully set free at the DMNS



Students help remove the fossil skeleton of a tyrannosaur from the beautiful badlands of northwestern New Mexico. Photo by Joe Sertich

# Undergraduate Capstone

Our undergraduate capstone course, the intense five-week-long Field Camp, returned to the traditional timing in the first half of the summer break in 2022 with 25 students. Two major changes were planned compared to previous years: the first week was to be held at CSU's Mountain Campus, supported generously by WCNR, and the five weeks of camp were to be broken up by two short breaks during which students could return to their homes in Fort Collins or elsewhere in Colorado, to regain energy and enthusiasm. However, it turned out that some improvisations to the schedule were needed during the five weeks.



Group picture during the inaugural Mountain Campus Week

The first week did take place at Mountain Campus as planned. The students shared the campus and meals with the larger group of students from other departments at WCNR who were there for the Natural Resources Ecology and Measurements course. They also experienced the community-building ropes course. Professors McGrath and Rugenstein led the group through geophysical (ground-penetrating radar and seismic refraction surveys) and geochemical (stable isotopes, hydrochemical) measurements and interpretation of the subsurface geology and hydrogeology of the sediment-filled glacial valley at the Mountain Campus.

After a two-day break in Fort Collins, the next two weeks were to be based out of the Indian Springs Ranch campground near Cañon City, with quaternary sedimentology and landform development during week one and sedimentology projects in and around Grape Creek during week two. These plans had to change, however, as there was a COVID-19 outbreak at the Mountain Campus. Four of our group reported symptoms and positive tests on return to Fort Collins. Everyone was required to isolate at home to let the outbreak subside. With rapid work, Sean Gallen improvised, successfully delivering five days of replacement online exercises and meetings, covering broadly the same topics as would have been covered in the field.



Field Camp students collect a seismic refraction survey in the snow



Students enjoy the sun while interpreting their geophysical observations

# Geology Summer Field Course

The following sedimentology module was to have been given by Chris Cassle, a Ph.D. student and long-time oil geologist, but he fell ill with COVID-19 a couple of days before he was scheduled to join the group, causing need for further rapid improvisation. The departure of the group to Cañon City was delayed by two days as Nikki Seymour, recent Ph.D. graduate of the department, flew in from California to lead the group on a project involving mapping of complexly fault-dissected strata in the area. Unfortunately, after arrival in Colorado, Nikki was informed of her own COVID-19 infection. It was too late to improvise further, or for her to return to California, so she led and taught the students while maintaining social distancing in the field and at the campground. The last two weeks of the course were more stable, without the COVID-19 induced scrambling. The group traveled first to South Fork for a week led by Professor Ridley, being introduced to volcanic rocks, mapping at a larger scale, and identifying hydrothermal assemblages in the Summer Coon volcano north of Del Norte. The final push was a week camped at Eureka in the Animas Valley, upstream from Silverton, doing mapping work with Professor Singleton in the classic project area at Lime Creek.



Group at Eureka Campsite, northeast of Silverton



Group selfie at Molas Lake, south of Silverton

Through all of this, the students maintained their hard work, good spirits, and upbeat energy. Next year will be easier, we hope!

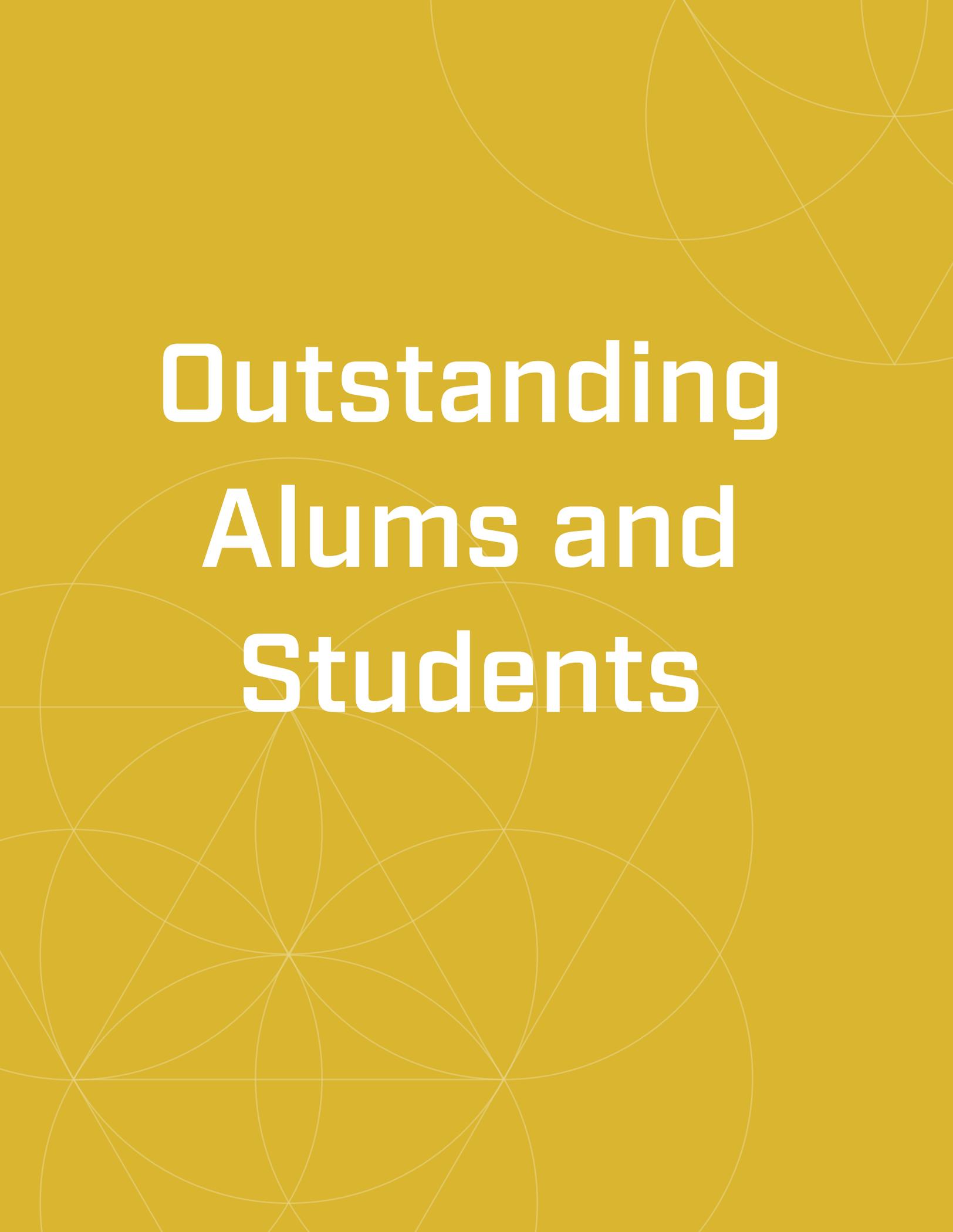
The Field Camp instructors offer special thanks to the following people, without whom this phenomenal capstone experience would not have been possible:

Head TA Emily Perman

TAs Siânin Spaur, Pat Ronnau, Luis Carlos Escobar Arenas, Elisa McGhee, Ethan Costello, Cole Sitar, Cece Hurtado, Lucas Zeller, and Randall Bonnell

CSU Alum Kirstin Brown for logistical help, and providing the group with a drinking water source at Silverton

CSU Mountain Campus staff for facilitating our group's first-ever week at the Mountain Campus



# **Outstanding Alums and Students**



Flowers at Roaring Creek, within the 2020 Cameron Peak Fire burn scar. Photo by Sara Rathburn

## Sarah Dunn, current M.S. student

Sarah Dunn is a graduate student working with Professor Sara Rathburn. She completed her B.A. in geology - environmental studies at Whitman College, spent one year working in outdoor science education, then two years working at the USGS in Washington State. She came to CSU to research post-fire sediment attenuation in beaver ponds. Sarah spent the summer completing fieldwork for her master's thesis. The 2020 fire season, when two of Colorado's largest fires occurred, generated concern about post-fire sediment erosion and transport to rivers. Excess sediment and burned material delivered to rivers after wildfires impair water quality and degrade aquatic habitat. Treating water after fires remains difficult and costly. After the 2020 fires, beaver ponds were observed to retain post-fire sediment and reduce delivery to the Cache la Poudre River, a critical water supply for thousands of Front Range citizens. The controls on post-fire sediment attenuation in beaver ponds has not been systematically analyzed, however, so Sarah identified beaver ponds spanning a range of conditions to quantify post-fire sediment volumes and characteristics.



Sarah Dunn and her field assistant Jana Stich (ESS major) collecting a sediment core from an active beaver pond in the 2020 Cameron Peak burn area

Over the summer, Sarah and her field assistant sampled 48 ponds (23 burned and 25 unburned) and collected 78 sediment cores. The ponds represented a mix of those positioned on- vs off-channel, and ponds actively maintained by beavers vs. currently abandoned. Her fieldwork was both academically interesting and physically demanding; Sarah became adept at wading in beaver ponds, using a pack raft to probe sediment depths in the deeper ponds, and maneuvering through dense forests carrying heavy cores sticking out of her pack! At each pond, Sarah surveyed the pond, probed sediment depths, and collected multiple sediment cores. Back in the lab, she extruded the cores, described the stratigraphy, and sampled for grain size analysis and total organic carbon. Her preliminary results show that beaver ponds in burned watersheds exhibit very high sedimentation rates, suggesting that ponds effectively capture sediment, keeping it from entering downstream waters. Additionally, both pre- and post-fire sediment stored in ponds contain high concentrations of organic matter, which indicates that beaver ponds remain an important carbon sink following fire.



Sarah Dunn with sediment cores collected in inactive beaver ponds along Roaring Creek within the 2020 Cameron Peak burn area

Overall, this research has valuable implications for understanding the controls on post-fire sediment attenuation in beaver ponds to enhance watershed resilience to fires. Further, it has management implications for source water protection by simulating beaver structures in rivers to mitigate post-fire sediment transport downstream.

This year, Sarah received numerous awards including the American Water Resource Association's Herbert Memorial Scholarship, the Hill Memorial Fellowship and Class of '73 Scholarship from Warner College of Natural Resources, the GSA Continental Scientific Drilling Division Student Research Grant, a GSA Science Communication Internship, and a student award from the Colorado Water Center. In her free time, Sarah enjoys dancing, pottery, spending time outdoors, and volunteering as a coach for a girls' running program. Sarah plans to defend her M.S. thesis in the spring and hopes to return to the public sector to continue working on rivers and communicating important scientific findings to the public.

## Luis Carlos Escobar Arenas, current M.S. student



Luis Carlos at GSA 2022 On To the Future in Denver. From left to right: Luis Carlos, Ana María Pérez Hincapié (Ph.D. student at the CSU Department of Geosciences), Estefanía Salgado (mentor from UT Austin) and César Bucheli (attendee from Missouri State).

Luis Carlos Escobar Arenas joined the geosciences department in fall of 2021. He is a first generation Latino LGBTQIA+ student from Colombia. Given his intersectional identities, he is passionate about increasing representation from historically underrepresented communities in geosciences (within the department and beyond). In his short time here at CSU, Luis Carlos has received four research grants from GSA, AAPG, SEPM, and RMAG, as well as the WCNR Thomas A. and Anne L. Shepherd Diversity Scholarship. He has also participated in the Society of Exploration Geophysics/Chevron Student Leadership Symposium before presenting his research at IMAGE2022. In October, he participated in the GSA On To the Future program. He is part of the Chile Slope Systems research group, co-led by Professors Lisa Stright (CSU), Steve Hubbard (U. of Calgary), and Brian Romans (Virginia Tech). His research project combines coding with outcrop statistics to predict near- and inter-wellbore stacking patterns of deep-water channels. Currently he is looking for a Ph.D. opportunity upon completion of his M.S. degree at CSU.



Gibraltar Lakes, upper St. Vrain basin, Front Range, Colorado. Photo by Rick Aster

# Exceptional Undergraduates

## Eli Crocker (current undergraduate student and WCNR Student Ambassador)

We're pleased to have Eli Crocker serving as Warner College student ambassador in the John and Dolores Goodier Student Success Center this year. Warner Ambassadors assist with college communications, tours, events, and much more. The Student Success Center honors John (geology, '59) and Dolores (occupational therapy, '58) Goodier for their exceptional contributions to CSU. Thank you for representing our college and department, Eli!



Eli Crocker, a Warner College Student Ambassador and junior geology major, is passionate about making Warner a good environment for everyone. They work with the SSC front desk and events team, helping both prospective and current students who have any questions about the college. They also help plan and host a variety of events.

## Student Representatives

Thanks to this year's Undergraduate Representative Claire Pickerel and Graduate Representative Cece Hurtado! Our student representatives are integral to the smooth operation of our department, serving as a critical line of communication between the students and faculty/staff and keeping our department engaged and informed in student goings-on throughout the semester.

## Student Office Employees

The Department of Geosciences would like to extend thanks to our three amazing student employees this year: Meaghan Pascual (geology, graduating 2024), Annabelle Williamson (agricultural biology, graduating 2025), and Mason O'Brien (biological science, graduating 2026).



Geology Club members at the 2022 Denver Mineral, Fossil, Gem, & Jewelry Show

## Geosciences Club

The Geosciences Club aims to build community among geoscience undergraduates and expose them to the many different fields of study and professions available to them. Every year the GeoClub invites a variety of different speakers from various fields, backgrounds, and points in their careers to present and answer questions. This has built a network of department alums and other professionals bringing advice, connections, and opportunities to club members. The club hosted its first GeoClub homecoming this fall and hopes to continue supporting the undergraduate community in the geosciences department.

# Geosciences Graduate Student Organization



Visiting and current geosciences graduate students gather with faculty and staff during our recruiting weekend event this February



The fall 2022 Geo Community Meeting, arranged and hosted by the GSO, had approximately 70 attendees including undergraduate and graduate level students, faculty, staff, and friends of the department

The Geosciences Graduate Student Organization has been active since its formation in the spring of 2021. With a mission to represent and connect geoscience graduate students at CSU, the GeoGSO has spearheaded several department initiatives over the past year, including graduate student participation in faculty hiring, improved resources and peer mentoring for incoming students, and the establishment of a Graduate Application Assistance Program (GAAP). The GeoGSO applied for and was awarded funding to collaborate with the Assistant Dean for Diversity and Inclusion, Rickey Frierson, Ph.D. to establish G.E.O.D.E., a customized training series that encourages DEI efforts and education within the department. GeoGSO members have also worked with faculty and staff to host various department events including a recurring coffee hour, annual community meeting, and the upcoming first-annual chili cookoff! They look forward to future opportunities to connect, engage, and advocate for geosciences graduate students.



The first G.E.O.D.E. training, created and moderated by Rickey Frierson

## Herb Saperstone, M.S., '86



First video project in Rocky Mountain National Park (Horseshoe Park), 1986

From the time I graduated high school, I knew geology was my path. I received my B.S. in geology from the University of Vermont in 1978 and promptly moved to Colorado, which at the time seemed like a geologist's dream. Young and hungry for work, I seized on new opportunities offered by the area's growing energy sector. I was first employed with Arco Coal doing field hydrogeology in the Powder River Basin. I then joined the USGS in Lakewood, rotating between branches: first Coal, then Oil and Gas, and ultimately landing in the Tech Reports Unit (editing maps and verifying geologic nomenclature among other duties). Sprinkled in were some classes at Colorado School of Mines and a few short courses offered by the USGS. I was indeed ready for my next adventure in geology.

Arriving in Fort Collins as a first-year graduate student in the then Department of Earth Resources, I was quick to select my thesis topic. It was ambitious, heavily weighted towards stratigraphy, sedimentology, and basin evolution. I had help from a number of mentors and advisors. USGS colleagues Frank Ethridge and new faculty member Eric Erslev guided me through the process. But it wasn't easy. My research took me to Montana for three long field seasons. I was still working part-time for the USGS in Lakewood, and during my 2nd year of grad school, my wife Jessica and I welcomed our first child. Two years later, diploma in hand, 1986 proved to be a down year for hiring. The price of oil had plummeted and the outlook for future jobs was bleak. And then as if the proverbial 'net' had appeared below me, I learned a new skill, and the arc of my professional life took a surprising turn.

Rocky Mountain National Park, through one of its non-profit associations, offered a five-day class in documentary film making. It sounded intriguing! Videography, scriptwriting, and editing were taught by a Denver news team, and I was one of just two students participating in that week-long intensive. In the field again, I felt at home, but traded in my Brunton compass and notebook for a bulky video camera, battery belt and heavy tripod. I trained my lens on the recent story of the Lawn Lake Flood and the new alluvial fan that formed in Horseshoe Park.

# An Unexpected Career of Geoscience, Public Education, & Storytelling

I discovered that I loved writing for the camera, decoding scientific research for a general audience, and got hooked on video editing as a way to polish ‘my story.’ For those who remember faculty member Larry Burns, he recommended I contact recent department graduates Mike Hobbs and Steve Savig, who were looking for a writer to script a new series of educational earth science videos. In that moment my first post-grad career was launched. Ten years later, I had produced over 25 titles in earth, space, and environmental science topics for middle school students.

In 1996, that job ended, and my career swung briefly back to geology as I taught a few semesters of Physical Geology at Front Range Community College. In the following decades, I continued my path in educational media, eventually taking over the management of Poudre School District’s educational access TV station. There I found my passion for creating educational science TV programs for kids. I helped co-create the 15-year-long “Everyday Science” TV show featuring CSU physics teacher Brian Jones. We also developed a kid-friendly TV version of the Colorado Climate Center’s CocoRahs citizen science initiative. Science education through the technology of cable TV (and later streaming media on the web) had become my new focus.

Fast forward to 2022 and we just celebrated our 40th year living in Fort Collins. I retired from Poudre School District in 2016 but not from creating video. I continue, part-time, producing media content for the city’s Communication Team. Although I work on diverse local topics that span virtually all segments of the community, my favorite productions are natural resource-centered stories. When not behind the camera, I also volunteer as a naturalist for Larimer County and regularly design and lead field-based geology programs for the county’s open spaces such as Horsetooth Mountain, Devils Backbone and Red Mountain. In this way, I’ve returned to my early career days in the field, but now, share my knowledge and love for local geology with others. And when I can, I continue to produce video stories about our natural world, just as I learned to do so many years ago in Rocky Mountain National Park. I am so grateful for all my mentors and teachers who directly or indirectly led me to this wonderful career blending geology and media. I can’t wait to see what lies ahead.



Scouting the next scene for a Larimer County Department of Natural Resources video, 2021

## Hunter Santiago, B.S., '18

Hello! My name is Hunter, and I am a proud alumnus of the Colorado State University Department of Geosciences. I graduated in December of 2018 with a Bachelor of Science in geology (environmental geology concentration).

The knowledge foundation that I built during my undergraduate studies at CSU has been extremely valuable to me in my professional career. No matter what position I have been in, I have always felt well prepared for everything that has come my way. I routinely rely on the knowledge that I gained at CSU, and employers have remarked that my understanding of concepts in geochemistry, hydrogeology, geomorphology, field geology, and other areas has been high compared to other applicants. This is a direct result of my studies at CSU and the guidance and instruction I received from the great team of professors in the department.

My first position after graduation was at a local geotechnical engineering firm. In that role, I gained valuable experience conducting field work and managing subcontractors. After some time there I had an opportunity to move to Washington to join a small environmental consulting firm with big dreams. Working for a small firm allowed me to wear many hats and learn quickly on the job. Tasks at that position involved Phase I Environmental Site Assessment (ESA) research, Phase II ESA field work, underground storage tank (UST) removals, ex-situ and in-situ remediation oversight including dig and haul projects and bioremediation projects, representative figure creation using AutoCAD, report writing, project management, and business development. In May of 2022 I accepted a job in Sales and Application Support for a world-leading provider of non-destructive geophysical solutions. We provide complete solutions of sensors and software within ground penetrating radar (GPR), geo-electrical (Resistivity/IP) and electromagnetic surveys (TEM), and near-surface seismics. I am enjoying my time in this technical sales role as it allows me to balance field geology/geophysics with business development and sales.

At each step in my journey thus far, I have relied on the education I received at CSU and I am very grateful for all the professors, teaching assistants, and classmates that helped me out along the way!



Hunter Santiago, environmental geology B.S., '18, at Gullfoss waterfall near Reykjavik, Iceland

## Aleks Novak, Ph.D., '19

I chose CSU over other universities to pursue a Ph.D. for several reasons. I was confident that I would get the necessary resources and training to succeed in my future career, and I valued an active outdoor lifestyle, meaning that I would be most fulfilled living close to some of my passions (mountains and snowboarding) while accomplishing a huge professional milestone. I found a great advisor match for my research interests in sedimentology and stratigraphy at the department, supported by a consistent track record of student employment post-graduation. Almost every class that I took at CSU had a hands-on field/lab component. As a graduate student I also had an opportunity to sharpen my field geology and leadership skills through assisting in teaching the summer geology field camp and working as a TA for Sedimentology and Stratigraphy seminars. Another thing that made the department so instrumental in mine and my peers' success was the continuous effort that faculty put towards building and maintaining relationships with the industry. As an example, these connections provided us access to the software that was being used by most potential employers, allowing us to expand our skillset and thereby putting students like me in an advantageous position on the job market.



Aleks Novak, geosciences Ph.D., '19

While still a Ph.D. student, I had an opportunity to attend a reservoir modeling short course organized by ExxonMobil for students across northwestern universities. The company then invited me to intern with one of the Houston-based asset teams focused on development and production of oil fields offshore Sakhalin Island. After completing the summer internship, I was offered a full-time position upon graduation. I have been a geoscientist with ExxonMobil for almost three years now. I've had opportunities to learn a lot about other disciplines besides geoscience that are involved in oil and gas field development and production cycles, such as reservoir simulation and surveillance, well design and completion, drilling, data acquisition and processing, and more. With the robust training that I received at CSU through classwork and research, I was able to quickly adapt to an integrator role at ExxonMobil: characterize and communicate subsurface uncertainties, collaborate across functions, develop business acumen, and add value. I'm excited to be a part of the ever-evolving energy industry and I look forward to one day applying my subsurface interpretation skills to a role within the growing low carbon solutions initiative.

Outside of the geoscientist role, I'm active in the diversity, equity and inclusion space within the company. I feel like my time as an international student at CSU greatly contributed to developing my passion for helping people of diverse backgrounds to feel heard and valued, and be comfortable being their authentic selves. I believe creating psychological safety in our work environments, whether it is a university or a corporation, is key to having a productive, rewarding, and joyful career.

My advice to current and prospective CSU students that are looking for exciting and fulfilling careers in the industry is to be proactive and curious. Participate in professional organizations and student chapters, look for opportunities to learn, don't be afraid to take on challenges and new responsibilities, and be sure to ask for feedback along the way. Lastly, show support and care to your teammates and build strong lifelong relationships.



# Faculty and Staff



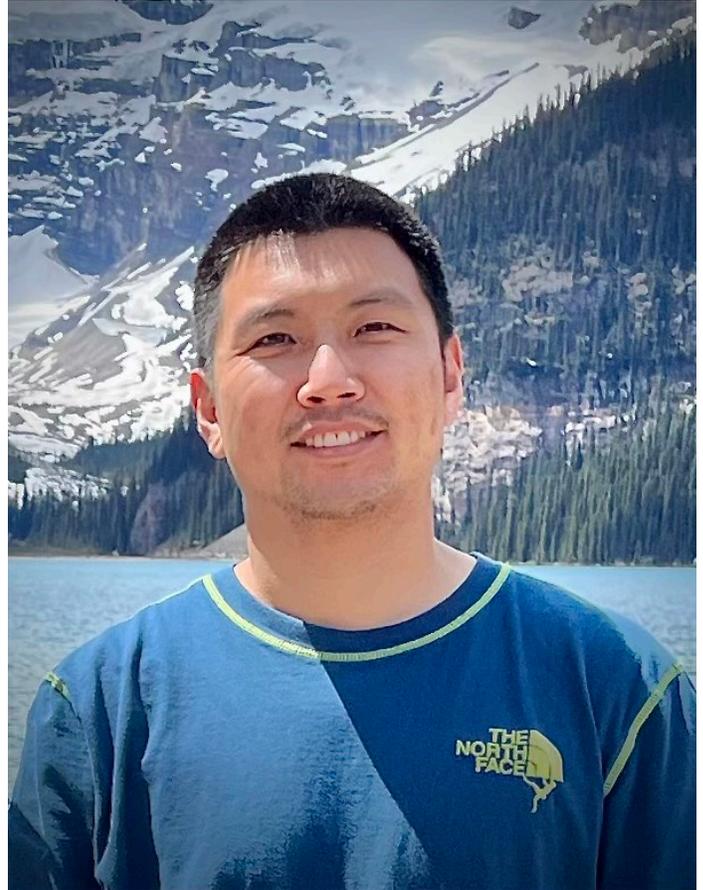
Autumn trail at Crosier Mountain, Front Range, Colorado. Photo by Rick Aster

# Welcome to New Staff Member Pengfei Hou

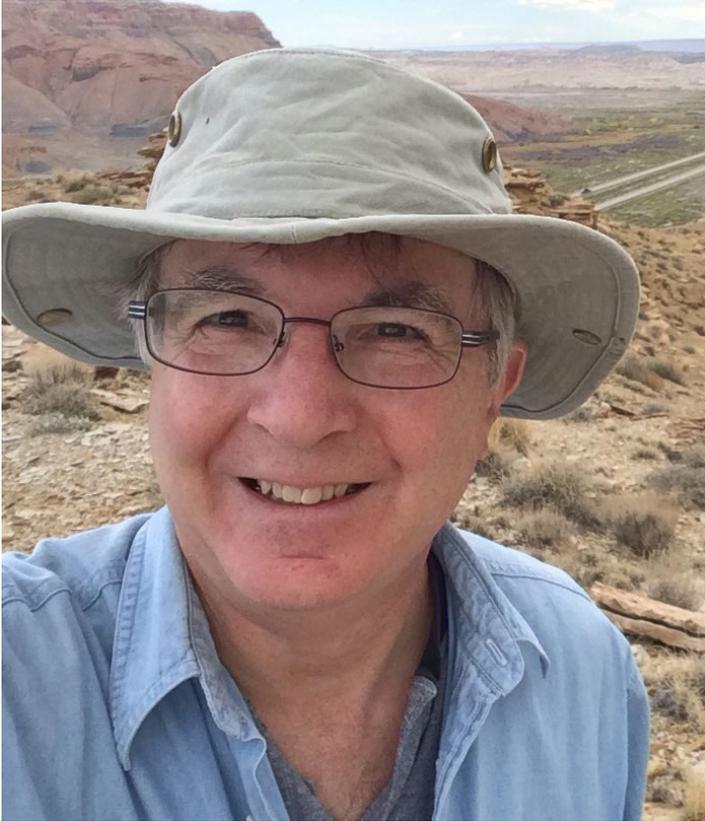
I am delighted to be part of the Department of Geosciences as a visiting instructor teaching Sedimentology and Stratigraphy. After getting my Ph.D. from the Colorado School of Mines in 2020, I have been working as a research and teaching faculty there, as well as teaching geology at Aims Community College in Greeley. CSU is a new environment for me, and I've received a lot of help from the faculty and staff. I really enjoy working with a group of experts in various disciplines of geosciences, and the many passionate students.

My interest and background in geosciences have three aspects: geo-data science, deep water sedimentology and stratigraphy, and paleontology/biostratigraphy. In the past two years I have been working on rebuilding and updating the Sedimentary Analogs Database at Colorado School of Mines with my Ph.D. advisor Leslie Wood (CSU Ph.D., '92). Sedimentary analogs from outcrops and the subsurface have been crucial for petroleum exploration and development, and will be equally crucial for carbon storage and sequestration. One of my particular interests in geo-data science is applying complexity science in sedimentology to understand signal propagation and the level of uncertainty in sedimentary analyses. I am currently building algorithms to calculate the degree of complexity in submarine fan systems.

Sedimentology and Stratigraphy is one of the essential courses for partial paradigm shift, in sedimentary geology in the past 20 years, but little is reflected in undergraduate-level education. I think it is important and beneficial for students to at least be exposed to the new ideas. Therefore, I am rebuilding the course completely with the newest materials available. Meanwhile, I am training the students to develop practical skills in making critical observations and interpreting sedimentary data through hand samples, outcrops, photo panels, subsurface, and other datasets through exercises, labs, and fieldwork. For my course materials, I keep everything transparent by providing references for all images and figures so that students can check the source papers, books, and websites. I also give them bonus credits for finding my typos and mistakes. Professors Lisa Stright, Howard Feldman, Jerry Magloughlin, Sara Rathburn, and John Singleton have been particularly helpful with tips for teaching and working in the department.



## and Affiliate Faculty Howard Feldman



I am very pleased to be offered an affiliate faculty position by the department, allowing me to return to academia after a 26-year-long detour at Exxon. I had a very fulfilling career at Exxon where I learned a lot about stratigraphy, facies analysis, and basin evolution, and I am now looking forward to passing on some of my knowledge to the next generation of geologists.

I have several goals in the coming years. The first is to complete a new introductory book on clastic facies which will be published by SEPM (Society of Sedimentary Geology). I am also working on an update to our workbook on sequence stratigraphy (you can see the current version here: <https://sedimentary-geology-store.com/catalog/book/sequence-stratigraphy-siliciclastic-systems>), and I am starting a research program into what types of fluvial systems are likely to get preserved in the stratigraphic record with a detailed investigation of the fluvial deposits in the Morrison Formation in Utah. It appears the distribution of river types (meandering, braided, etc.) that are found today may not be representative of what is preserved in the ancient record. I am also organizing an SEPM research conference on parasequences which is tentatively planned for October 2023.

I am very excited to be involved in teaching at the department. Jerry Magloughlin and I led the Geology of the Rocky Mountain Region fall field trip to the Book Cliffs in western Colorado and eastern Utah. Despite the heat we had a successful and fun trip, studying both detailed facies models of Cretaceous beach systems and large-scale stratigraphic architecture of fluvial to coastal deposits. I am currently helping out with Sedimentology and Stratigraphy, taught by Pengfei Hou.

Lastly, I am active in SEPM helping to guide it through some tough times with declining membership.



The Book Cliffs in Utah, with thick gray Mancos Shale capped by the coastal sandstones of the Castlegate Formation. Photo by Howard Feldman

# Introducing Lauren Harrison

I am delighted to be joining the Department of Geosciences at CSU in the fall of 2023 as a new assistant professor. My research centers on investigation of the composition, dynamics, and volcanic products of mantle plumes using geology, petrology, geochemistry, and geochronology. Mantle plumes provide a powerful window into mantle composition spatially and temporally, but they also provide the heat necessary for long-lived crustal magmatic systems. One such location is the Yellowstone Plateau Volcanic Field, where a plume has provided heat for a crustal magmatic reservoir and hydrothermal system that exhibits some of the most varied, spectacular, and unique volcanic and thermal features on our planet. Yellowstone hydrothermal explosions are some of the largest in the world, with craters up to 2 km in diameter! My recent work has focused on precise and accurate ways to date prehistoric explosion craters with the goal of understanding how they are primed and triggered, how much energy is involved, and calculation of the recurrence interval for quantification of the hazard.

My research on Hawai'i leverages the more direct connection between mantle-derived basalts with the composition and locations of deep Earth heterogeneities to study mantle composition and dynamics over geologic time. Recent advances in mantle seismic tomography confirm the deep source of some mantle plumes (including Hawai'i), and have imaged deep mantle anomalies (i.e., the large-low shear velocity provinces, LLSVP). The shape, size, and composition of LLSVP are currently hotly debated: do thermochemical effects cause deep mantle seismic anomalies? What are the sources, ages, and origins of that heterogeneous material and how has it survived mantle stirring and convection? Study of Hawaiian basalts along the Northwest Hawaiian Ridge (~47 Ma to the Hawaiian Islands, <6 Ma) provides the perfect laboratory to study those questions!

I am excited to have the opportunity to complement the research breadth and faculty expertise at Colorado State University, as well as to work with and teach a new generation of geoscientists. Getting out into the field with students are some of my best geological memories during my career and I can't wait to enjoy the sunshine, as well as the occasional lashing rains that come with working outside. The transformative Petrology Lab at CSU will provide many cutting-edge tools for a wide breadth of research and teaching goals within the department, and contributing to building such an analytical facility is an effort I feel very lucky to be involved with. I'm greatly looking forward to meeting you all soon!



Faculty - Rick Aster, Sean Bryan, Sean Gallen, Judy Hannah, Dennis Harry, Jerry Magloughlin, Dan McGrath, Sara Rathburn, John Ridley, Mike Ronayne, Jeremy Rugenstein, Bill Sanford, Derek Schutt, John Singleton, Lisa Stright, Ellen Wohl

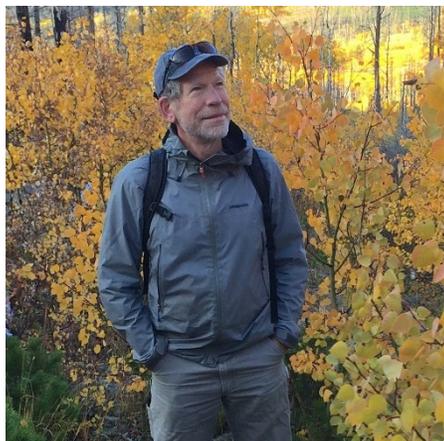
Joint Appointment Faculty - Wolfgang Bangerth, Lee MacDonald

Emeritus Faculty - Frank Ethridge, Eric Erslev, Sally Sutton, Tommy Thompson

Staff - James Chappell, Pengfei Hou, Ronald Karpilo Jr., Katie KellerLynn, Joel Leonard, Kailarae Lilly, Stephanie O'Meara, Joe Sertich, Angela Sharpe, Trista Thornberry-Ehrlich, Patti Uman

Affiliates - Patrick Ball, Kerstin Braun, Jonathan Caine, Joel Cubley, Sven Egenhoff, Howard Feldman, Jonathan Friedman, Svetoslav Georgiev, James Hagadorn, Øyvind Hammer, Lauren Harrison, Ed Harvey, Kenneth S. Hughes, Patrick Keys, Chris Lidstone, John Lisle, Hans Peter Marshall, Scott McCoy, Samuel Mukasa, Snorre Olaussen, Frank J. Pazzaglia, Robert Porritt, Kaleb Scarberry, Dan Scott, Roger Steininger, Robert Stollar, Edward Warner, Thad Wasklewicz

# Annual Faculty Updates



**Rick Aster**

This was an especially satisfying year for seeing a number of long-term efforts published with a number of students and other collaborators. This included a seismological study of the astounding 15 January 2022 Hunga Tonga eruption and its dramatic effects on the atmosphere, oceans, and solid Earth – it made our planet ring like a bell at frequencies near 2.7 and 4.4 Millihertz, caused a global tsunami, and was audible thousands of miles away. I co-authored two studies covering shear wave anisotropy, crustal, and sedimentary structures across Antarctica that integrated more than 15 years of hard-won seismic observations from very remote places, as well as a paper with Derek Schutt and CSU student Andrew Bolton (M.S., '21) describing seismic anisotropy and mantle flow from our project in the Mackenzie Mountains of Canada. I was an organizer with Adam Ringler and Rob Anthony (Ph.D., '16), both now at the USGS, of a 143-page Reviews of Geophysics piece spanning global seismology. Additional papers presently in review include studies in high-frequency snow and firn seismology, flexure and fracture in ice shelves, and long-term geodetic changes at the active Erebus Volcano in Antarctica. M.S. student Erika Jaski completed her degree and thesis in August, analyzing dense network data from Erebus in a detailed study of seismic activity from its convecting and erupting phonolitic lava lake. This year I am completing my 3-year term as Board Chair of the Incorporated Research Institutions for Seismology after four years on the Board. This has included overseeing IRIS' NSF-funded major seismological instrumentation, data, and educational programs, as well as continuous effort to shepherd a successful 501 (c) (3) corporate merger of IRIS with the UNAVCO geodetic

consortium to create the 175-institution EarthScope Consortium in early 2023 to guide future US and global academic community geophysical efforts. Finally, I was honored in December of 2021 to become a Fellow of the AGU and to learn that I would become a 2022 Fellow of AAAS.



**Sean Bryan**

The 2021/2022 academic year inched back toward some form of normalcy with almost all of our introductory courses and labs back in-person. Of course, there were hiccups, masks, COVID-19 quarantines for students and TAs, etc., but it was nice to be back in-person full time. As usual, I was very impressed by and grateful to our TAs over the last year (Valerie Doebley, Ellie Driscoll, Johanna Eidmann, Omar Ghamedi, John Kemper, Alex Marr, Mickey Means-Brous, Wyatt Reis, Patrick Ronnau, and Kemi Taiwo) who make our introductory laboratories run. Our challenge as we move forward is to incorporate the lessons learned and resources that were developed over the past couple years to take advantage of the best aspects of online and in-person modalities, while maintaining flexibility and accessibility. Another highlight of the last year was the launch of a new undergraduate minor for Warner College, titled "Diversity and Inclusion in Natural Resources." Over the past couple years, I have had the pleasure of working on the development of the minor along with Diversity Director Rickey Frierson and a group of faculty in Warner College, including Sara Bombaci, Gillian Bowser, Dominique David-Chavez, and Anna Lavoie. This minor embraces human diversity and inclusion in natural resource fields through exploration of how complex aspects of diversity serve to shape natural resources and our environment in our modern

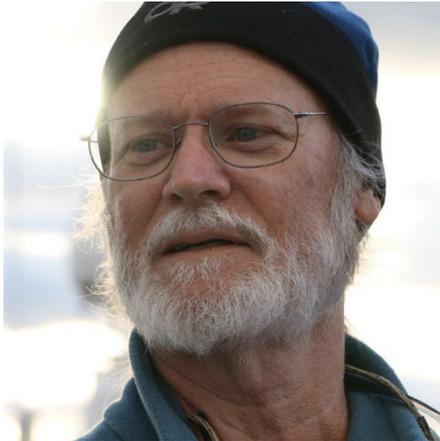
era. We taught the foundational course (NR 140) for the first time during spring semester 2022.



**Sean Gallen**

This year was fairly eventful and exciting. I traveled to Puerto Rico, Italy, and southern Colorado for fieldwork, visited Brazil as a keynote speaker at a conference, and went to Switzerland for a Ph.D. defense. Three of my Ph.D. students, Johanna Eidmann (CSU), Eyal Marder (CSU), and Katie Scheide (ETH-Zurich, my pre-CSU home), defended their dissertations. I had a large NSF project funded to study rock-type controls on landscape evolution in Puerto Rico, and I published several papers as a coauthor. My research group expanded. Cece Hurtado, Abby Axness, and Ana María Pérez Hincapié joined my existing graduate students, Omar Ghamedi and Emily Perman (co-advised by John Singleton). Ana María, Omar, and I did fieldwork this summer in Calabria to advance my NSF-CAREER project and collected a bunch of samples that are being processed. Cece, Emily, myself, and CSU undergraduate Shea Slonkosky visited the Sangre de Cristo Mountains in August for fieldwork related to Cece's project studying relationships between tectonically active faults and climate. I've also been engaged in service with Subduction Zones in 4 Dimensions (SZ4D) and the Center for Land-Surface Hazards (CLaSH), two community science efforts to establish new venues for studying natural hazards through the NSF and domestic and international partners. In the spring I taught a seminar on the mechanics of mountain building, and this fall I am teaching Physical Geology for Scientists and Engineers, Critical Zone Science, and a seminar on the active tectonics of the Sangre de Cristo Mountains. I also taught a week of the summer field course. Sadly, my week

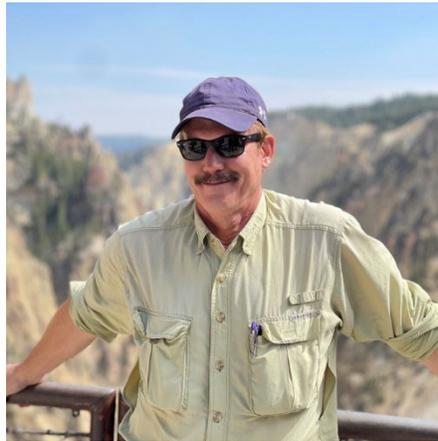
went online due to COVID-related concerns, but we spent the week doing hands-on activities to teach the students how to use geomorphology and geophysics to identify active faults and assess earthquake hazards. Finally, I participated in an Early Career workshop to improve networking and broaden diversity in Critical Zone Science. I found the experience rewarding and hope to continue these community-building activities.



**Dennis Harry**

My 2021/2022 teaching included classes on Applied Geophysics in the fall and Plate Tectonics in the spring. As has been our recent practice, Derek Schutt and I collaborated to offer complementary geodynamics seminars, with him leading a seminar on lithosphere rheology and strength in the fall and me leading a seminar on opening of the Rio Grande Rift in the spring. This seminar topic complements the next phase of my research and graduate teaching program, as I wrap up my work on the northwestern Australian continental margin and begin a new project focused on the Rio Grande Rift. I am excited that the work my group is doing regarding the Rio Grande Rift tectonomagmatic evolution complements that of department colleagues Professors Sanford, Ronayne, Gallen, and Rugenstein, who are each investigating aspects of water resource management and landscape evolution in the Rio Grande Rift and River system. New M.S. student Alanna Maher will be building her thesis project from this emergent Rio Grande Rift collaboration. Ph.D. student Micah Mayle continues to work on geodynamic models of rift systems, focusing on sources of syn-rift magmas and why the magmatic character of continental rifts varies so much from rift to rift. Micah completed coding of two significant geodynamic modeling software packages this year and will be presenting the results at the annual GSA and AGU meetings in Fall 2022. Outside of CSU I have been busy

working with the geosciences community on two major initiatives. The first is an effort I am co-leading to build a new NSF initiative, which we are calling Rift2Ridge. Rift2Ridge will take the place of the expired GeoPRISMS and RIDGES programs and is envisioned as a 10-year initiative designed to encourage a cross-disciplinary process-oriented approach to understanding extensional systems, from incipient rifting through to the evolution of mature seafloor spreading ridge. I am also co-leading an effort to build an industry/government/academia partnership that will be charged with archiving the vast wealth of petroleum industry seismic and borehole data that is in danger of becoming lost due to storage cost vs. data value mismatches. Our group welcomes contact with Rams who have interest in helping get such an archive established! It was a busy, exciting, and fun year, as my students and I continue to balance new and ongoing solid Earth classes and research projects with new and ongoing near-surface and hydrogeophysics classes and projects. The 2021/2022 year was especially exciting in this regard, as it has created new collaborations and opportunities in both arenas.



**Jerry Magloughlin**

As usual, this past year flew by. As usual, I taught what remains our only online course, Introductory Physical Geology, spring and summer semesters. Spring break gave me a terrific opportunity for some new video and photos for my courses, in both Death Valley and the Grand Canyon. Death Valley was very windy so there was a significant dust storm—not the best situation for camera equipment—but the Grand Canyon was breathtaking as ever. Never gets old. Summer seemed especially quiet around campus, and as usual I got out several times for lightning photography, including one night back in June where the little thunderstorms were everywhere and just kept coming one after

another. I also did a nice tour through the central U.S., visiting interesting geology in South Dakota (a perpetually flowing gas-charged artesian well on the grounds of the state capital) and the beautiful Missouri capitol building (excellent fossiliferous limestones). Partly owing to knee problems, I missed out on any field work this summer. Fall semester has been exceptionally busy. Besides two sections of our online Physical Geology course, and the usual Mineralogy and Optical Mineralogy courses, I volunteered to help Howard Feldman with the GEOL 401 fall field trip to the Book Cliffs of Utah. Very interesting, and also hot! Over 100 degrees every day, but nonetheless a very good trip. Always happy to hear from alums; feel free to send an email or contact me on LinkedIn.



**Dan McGrath**

It's been a great year for my research group! We've published papers examining glacial lakes in Alaska using the Landsat satellite record and Google Earth Engine (Rick et al., 2022, The Cryosphere), spatially distributed glacier mass balance estimates through the integration of radar, geodetic, and in situ datasets (Zeller et al., 2022, J. Glaciology), distributed snow depth and density through the integration of ground-penetrating radar (GPR) and Structure from Motion derived snow depths (McGrath et al., 2022, Frontiers in Remote Sensing), and the impacts of wildfires on seasonal snowpacks in the western U.S. (Kampf et al., 2022, PNAS). The latter attracted substantial media coverage including stories in the Washington Post, High Country News, and National Public Radio. Our field work has included a time-series of snow surveys in the Cameron Peak burn area led by M.S. student Wyatt Reis, geodetic surveys of Arapaho Glacier, GPR surveys on Middle Teton Glacier, and a glacier snowline survey in Alaska led by Ph.D. student Lucas Zeller and colleagues at USGS. On the teaching front, I offered The Blue Planet: Geology of our Environment as well

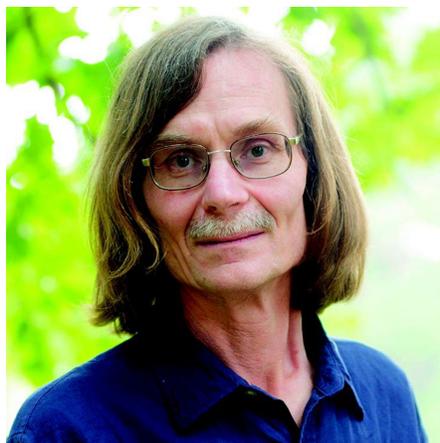
as Glacial Geology in the fall, and Remote Sensing of the Earth System last spring. We had a great field trip to Rocky Mountain National Park to see the spectacular glacial landforms with my Glacial Geology class in September. In May, I coled the first week of field camp at the CSU Mountain Campus with Jeremy Rugenstein. Despite some inclement weather at times, the students did an amazing job collecting and analyzing hydrochemistry and geophysical datasets! In late September Bri Rick defended her Ph.D. titled "Cryo-Geohazards in a Warming Climate" and started a postdoc at the USGS Alaska Climate Adaptation Science Center. Lastly, I'm excited to be starting two new projects in the coming year: an NSF-funded project studying modern glacier change in the Tetons and a NASA-funded project focused on evaluating the use of L-band radar to measure snow water equivalent from satellite platforms.



**Sara Rathburn**

Spring 2022 marked my return from sabbatical. I realized I missed teaching and interacting with my graduate students but appreciated the time to think, finish up a few manuscripts, exercise, and spend more time with family and friends provided by the sabbatical. In January my M.S. student Jens Christoph Suhr submitted his M.S. thesis to the graduate school and was then hired by a consulting firm in the Pacific NW. My Ph.D. student John Kemper published two papers in early 2022 and defended his dissertation in the summer. He is now doing post-doctoral research with Ellen Wohl. Celeste Wieting (Ph.D.) worked hard all spring and submitted her first manuscript days before delivering a healthy baby boy in May! My M.S. student Sarah Dunn wrote numerous proposals in the spring and received a grant from AWRA and a GSA student research grant. In Spring 2022, I taught Historical Geology and was thrilled to see the student's smiles emerge as the mask mandate was lifted. During the summer, I helped Sarah and her field assistant

with field work quantifying post-fire sediment deposition in active and inactive beaver ponds. Wading in beaver ponds is a unique form of sloggng and a good way to lose your shoe! This fall I am busy teaching Exploring Geosciences, a freshman seminar that includes an overnight trip to the Mountain Campus, Field Geology of the Colorado Front Range with three weekend field trips, and my graduate level Field Geomorphology class, again more field trips. I'll be at GSA in October where I will give a talk on my Iceland research. Say hi if you see me, or send an email any time with an update. I always enjoy hearing from our alums.



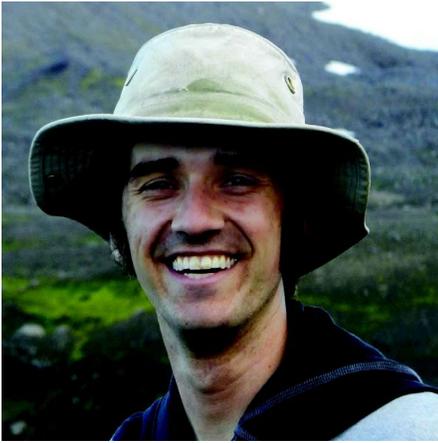
**John Ridley**

This has been a busy year for me with teaching and committee work. With the exit of two faculty members in the department, I stepped up to head our Summer Field Camp. The course was more intensive this year. We added a section at the CSU Mountain Campus and re-structured the overall schedule to make it more manageable for the students. Despite quite a few setbacks (including a lot of COVID-19 and a stolen catalytic converter) we successfully completed all five weeks, thanks largely to the resilience and motivation of our students. In addition, I taught Structural Geology on behalf of John Singleton, who was on sabbatical, and Field Methods. I also chaired a successful search committee for our new petrology faculty member, replaced Sally Sutton on the University Curriculum Committee, and graduated two M.S. students, Jake McCane and Tracey Cotterell. I will turn my focus now on completing the second edition of my Ore Deposit Geology textbook and continuing my regular teaching schedule.



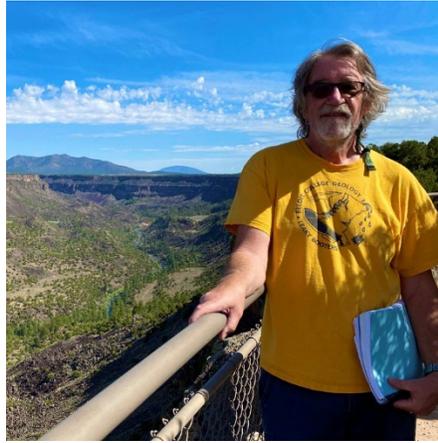
**Mike Ronayne**

My group continued our Colorado research projects this year, including studies of groundwater/surface water interaction in mountain watersheds (M.S. graduate Valerie Doebley), the influence of pumping and heterogeneous aquifer architecture on recharge dynamics in the Denver Basin (Ph.D. candidate Kristen Cognac), and the impact of beaver dams on groundwater recharge along Front Range alluvial channels (B.S. graduate Isabela Arauz). Valerie, Kristen, and Isabela presented this research at the GSA annual conference and the AGU Hydrology Days conference. Other recent research activity involved a collaborative project with engineering colleagues to evaluate machine learning methods for forecasting groundwater contaminant plume behavior at remediation sites. This fall we welcomed new M.S. student Billy Stansfield, a UCONN graduate with prior experience in the environmental consulting industry. Billy and I will be working on long-term groundwater availability trends in high-elevation basins of the central Andes, Peru. We are eagerly anticipating our first fieldwork trip to southern Peru over the winter break. I taught my graduate level groundwater modeling and geostatistics courses this year, and I also continued to teach a section of our introductory geology course for non-majors. Along with Sean Bryan and other geosciences colleagues, I am working on the development of new sustainability content for our intro courses, an initiative supported by the CSU School of Global Environmental Sustainability. See also a description of our drilling project at Mountain Campus elsewhere in this issue.



**Jeremy Rugenstein**

This past year has been one of transition as my first two M.S. students at CSU—Siânin Spaur and Ellie Driscoll—successfully defended their theses. Siânin’s work formed the basis for an NSF paleoclimate grant I received in collaboration with Maria Rugenstein (CSU Atmospheric Sciences) to understand how the water cycle in northern New Mexico will change with warming. As part of Ellie’s thesis, she helped develop an online database of terrestrial stable isotope data spanning the globe (the PATCH Lab), which is now hosted by CSU’s Geospatial Centroid. This fall I have three new students — Thu Bui (Ph.D.), Gaby Sanchez Ortiz (M.S.), and Isabella Ulate (M.S.). Thu will be following up on Siânin’s thesis and continuing our work in New Mexico. Gaby and I did field work this past summer in Croatia and Bosnia, collecting samples for stable isotope analysis to constrain the Miocene elevation of the Dinarides, and Isabella will be working to constrain water chemistry and source dynamics of our new ultra-deep well at the Mountain Campus. This fall, I’ve also started teaching GEOL 366 (Sedimentary Petrology and Geochemistry), taking over this required class from Sally. In the spring I will be teaching a new class in the department, Global Biogeochemical Cycles Through Time, which will focus on how elemental cycles have evolved over Earth history. Lastly, in conjunction with Kelly Wrighton’s research group in Soil and Crop Sciences, we have now set up and are operating an Ion Chromatograph that permits us to precisely measure the chemistry of freshwaters.



**Bill Sanford**

For this past year, I was the leader of a multidisciplinary research team from the Departments of Geosciences, Watershed Science, Geography (remote sensing), Civil Engineering, and Atmospheric Sciences which received a seed grant from the Colorado Water Center. The project is to study the role of drainage from high elevation wetlands in maintaining late season stream discharge in snowmelt-dominated headwater streams. I have recently hired two undergraduate students and one graduate student to work with data from this project. The wetland project grew out of the M.S. research of Nick Chohan. In addition, I am part of a team of scientists from WCNR, led by Mike Ronayne, studying the hydrogeology of the Mountain Campus. Recently, a well was drilled to bedrock which will be used for multiple purposes, including determining the time since recharge of the groundwater using stable isotopes,  $^{14}\text{C}$ -Carbon, and noble gasses. I am hopeful that both projects will lead to additional funding. Camilla Warden, my new M.S. student, is the GTA for Hydrogeology. We are working with Dennis Harry on continuing the use of temporal gravity surveys quantify groundwater storage changes due to seasonal variations of water levels in a basin, and potentially using the method to see if the mass change due to the injection of water into a confined aquifer during managed aquifer recharge can be observed in the gravity data. In March, I was the session chair in the GSA Rocky Mountain/Cordillera Section joint meeting in Las Vegas. I didn’t come home rich, but was able to visit both Death Valley and Lake Mead to see the effects of the drought on water resources. In addition to research, I taught my normal courses Hydrogeology and Environmental Geology and added a special topics course on Groundwater/Surface Water Interactions. I am serving as the chair of the search committee for the new sedimentary

geologist for the department. The committee has now reviewed over 176 applications for the position, and we are confident an excellent scientist will be hired. Overall, I am looking forward to the upcoming year.



**Derek Schutt**

Teaching last year went well. In the spring, I taught The Solid Earth to a class of about 25. I tried something called Standards Based Grading, where I give students multiple attempts to show they met each learning objective in the course. The students quite liked it, as they could miss the learning objectives early on in class but still had a chance to show mastery and get a high grade. I found that most students showed mastery on every learning objective at the end of the class, and I gave more As than normal, because students had more time to master the objectives. I plan to use this method in all of my classes eventually. In the fall I taught Global Seismology and a seminar on Mantle Velocity Variations and Mantle Plumes. Both were successful, and they were great courses for preparing graduate students and advanced undergraduates (who are always welcome in my graduate-level classes) for research. From a research perspective, postdoc Paddy Ball and I continued our NSF-funded work on the temperature of the lithosphere. We mapped geotherms to xenolith equilibration pressures and temperatures and compared this to temperatures derived from seismic waves to infer temperature change over time. We have also looked at the compositional causes of mantle velocity variations among 300+ xenoliths, and Paddy is currently finishing off mantle Pn tomography under the Mackenzie Mountains, in addition to pursuing multiple other research objectives. I presented our research at the Goldschmidt Meeting in Honolulu, where it was well received. I also presented preliminary results of surface wave tomography in the Mackenzie Mountains at meetings in Nanaimo, BC, and virtually in Pittsburgh, PA.

In 2021-2022 I published papers on topics including a cause for the high elevations in the western U.S., surface-wave tomography of the northern Canadian Cordillera, and shear wave splitting in the Mackenzie Mountains. I'm particularly proud of the shear wave splitting paper, as it was led by M.S. student Andrew Bolton. Current Ph.D. student Aziz Bankher has just started the first of his research projects on Saudi Arabia, in which he will perform Pn tomography of the region. I would also like to welcome M.S. student Tomalika Biswas from Bangladesh and Ph.D. student Sharif Sanusi from Nigeria, who are starting their programs with me this year.



**John Singleton**

I spent the first six months of 2022 on sabbatical in Chile with my family. We lived in Viña del Mar, where my three kids went to school, and I did research in collaboration with two Chilean professors and their students. My main research project in Chile focuses on reconstructing the polyphase deformation history recorded in spectacular coastal exposures of a Jurassic plutonic complex near 32.5°S. This research builds upon some of our previous research on deformation and magmatism in the Jurassic-Cretaceous arc in northern Chile. I did make it back to Colorado to teach week 5 of Field Camp this summer (the Lime Creek project). The students did a great job, and I really enjoyed the week! This fall I have focused on our research project in the Sangre de Cristo range in southern Colorado. M.S. student Cole Sitar is completing his thesis, which focuses on reverse faults that were heterogeneously reactivated as brittle-plastic extensional shear zones during the early development of the Rio Grande rift. Ph.D. student Omar Ghamedi is investigating the complex low-temperature cooling history of the Sangre de Cristos, and undergraduate student

Sammy Malavarca has continued her research on the highly variable metamorphism of Pennsylvanian strata along the western flank of the range.



**Lisa Stright**

The academic year of 2021-2022 I was on sabbatical following my recent tenure and promotion to associate professor. During my sabbatical, I translated more than a decade of sedimentologic measured sections from our Patagonia fieldwork into an SQL database. This database is now being used as a foundation for research by students in our consortium and has also been deployed to our affiliate consortium members. This fall, I am back from sabbatical and teaching Geologic Natural Resources. This course has 80 undergraduate students comprised of 65% freshmen, with the remaining students a mix of sophomores, juniors, and seniors. The majority of the students in the class are construction management or business majors, but with a broad range of majors beyond that. We are currently in the first year of Phase 4 of Chile Slope Systems (CSS) with four years confirmed. We will be heading into the field again to lead an affiliate field trip in February after a two-year hiatus. In Fall 2021, I admitted two M.S. students: Luis Carlos Escobar Arenas and Patrick Ronnau. Luis Carlos joined us this fall from Columbia and is working on a near-wellbore modeling project to predict channel connectivity from 1D machine learning results generated by my previous student, Noah Vento (now at ExxonMobil) using an early version of this database. Pat joined us following his joint undergraduate degrees in Petroleum Engineering and Geology with a concentration in Geophysics from the University of Kansas. Pat is tackling the difficult problem of propagating interpreted facies and facies associations that exist in less than 10% of the measured sections

in the database to the remaining database and learning about the difference between sedimentologist interpreted data and the classes generated by machine learning.



**Ellen Wohl**

This past academic year presented fewer COVID-19-related challenges for teaching and field work. Emily Iskin, Anna Marshall, and Mickey Means-Brous were all able to successfully complete field work. Emily examined floodplain heterogeneity in Illinois, Oregon, Montana, and Colorado and has now collected more sediment cores than she ever thought possible. Anna worked on the Swan River in Montana, persevering despite flooding followed by fire, and uncountable hordes of mosquitoes as a constant. (She was far more tolerant of the mosquitoes than I was.) Mickey started in relatively calm conditions at Little Beaver Creek, a tributary of the South Fork Poudre River that burned during the 2020 Cameron Peak Fire. I thought all the geomorphic drama had occurred in the summer of 2021 when the watershed had a series of impressive floods. However, a major debris flow and flood occurred in July 2022, far exceeding anything that happened the previous summer. That's why we do field work... Mickey is examining the geomorphic context for how trout in the stream respond to all the fluvial rockin' and rollin'. Ph.D. students Sarah Hinshaw and Rich Knox finished their degrees in May 2022. Sarah is now with Headwaters Corporation and Rich is teaching at West Point. We added new M.S. students Aaron Katz and Shayla Triantafyllou to the research group. I'm continuing to work at Little Beaver Creek, where all the in-channel logjams have migrated to the floodplain. I am daring them to stay put for a while and I intend to watch them carefully over the next few years.

# GRI: An Annual Update of a

For 23 years, the Department of Geosciences and the National Park Service (NPS) have worked together to inventory the geologic resources (features and processes) of the National Park System. The Geologic Resources Inventory (GRI) provides park managers with geologic map data and information to make science-informed resource management decisions. Starting in 1999, the team was supported by Judy Hannah as principal investigator (PI). In June 2022, Derek Schutt became the team's PI.

At present, the GRI team consists of a combination of CSU research associates and interns (11 people, many of whom received or are in the process of receiving degrees from CSU) and NPS staff and cooperators (six people). CSU team members are Michael Barthelmes (M.C.M.M., '22), Jim Chappell (B.S., '97), Lucas Chappell (graduating 2024), Thom Curdts, Ron Karpilo, Katie KellerLynn, Stephanie O'Meara (B.S., '92; M.S., '97), Derek Schutt, Shea Slonkosky (graduating 2023), Trista Thornberry-Ehrlich (M.S., '01), and James Winter (B.S., '15).

Currently, the GRI team is in the process of hiring three additional CSU research associates to assist in writing and/or editing reports for 73 parks (of the original 272 parks selected for inclusion in the inventory); 14 of these reports are already in progress.

In the past year, the team completed GRI reports and posters for nine parks: (1) Buffalo National River (Arkansas), (2) Chattahoochee River National Recreation Area (Georgia), (3) Klondike Gold Rush National Historical Park (Alaska), (4) Little River Canyon National Preserve (Alabama), (5) Ocmulgee Mounds National Historical Park (Georgia), (6) Organ Pipe Cactus National Monument (Arizona), (7) Pictured Rocks National Lakeshore (Michigan), (8) Pinnacles National Park (California), and (9) Tallgrass Prairie National Preserve (Kansas).

The year's completed reports are distinctive for containing chapters on "Geologic Heritage," exploring and illustrating significant geologic features, landforms, and landscapes that characterize the United States and are preserved for the full range of values that society places on them (e.g., scientific, aesthetic, cultural, ecosystemic, educational, recreational, and economic), and "Guidance for Resource Management," providing specific options and resources for management and planning. Moreover, with an established report format in the hands of experienced writers, the reports are easier to read with a narrative style that connects human stories and geologic resources. In addition, with an established style guide, which as of 2022 includes elements of Indigenous style, all reports are edited consistently.



# Long-Lasting CSU-NPS Collaboration



With respect to geologic maps and GIS data, the team completed new products for eight parks: (1) Canyon de Chelly National Monument (Arizona), (2) Cedar Breaks National Monument (Utah), (3) Devils Postpile National Monument (California), (4) Guadalupe Mountains National Park (Texas), (5) Missouri National Recreational River (South Dakota and Nebraska), (6) Natchez Trace Parkway (Alabama, Mississippi, and Tennessee), (7) Pinnacles National Park (California), and (8) Wrangell-St. Elias National Park & Preserve (Alaska). In addition, the team completed and released for use eight out of ten maps of the GRI GIS product for Arches National Park (Utah).

Because software technology and geologic interpretations evolve, the team also updated geologic map products for 36 parks, including projects with one map, for example, Whitman Mission National Historic Site (Washington); two maps, for instance, Florissant Fossil Beds National Monument (Colorado); eight maps for Richmond National Battlefield Park (Virginia); 15 maps for Sequoia & Kings Canyon National Parks (California); 20 maps for Buffalo National River (Arkansas); and 39 maps for Mammoth Cave National Park (Kentucky). All told, the year's statistics for new and updated map products account for 158 maps for 43 parks.

As of October 2022, the team had completed GRI GIS products for 266 parks and GRI reports for 198 parks. All GRI products are publicly available and readily downloadable at <http://go.nps.gov/gripubs>.



View of Horsetooth Reservoir from Lory State Park. Photo by Rick Aster



# Department Awards and Supporters

# Your Gift's Impact

## Olivia Montoya

### Undergraduate Explorationist Scholarship

"I cannot express how grateful and honored I feel to have received the Warner College of Natural Resources Undergraduate Explorationist Scholarship. It has assisted me with my bookstore and technology needs that I may have otherwise not been able to afford myself. I was able to purchase my own textbooks, rather than rent, where I'll be able to refer to them in the future as my career and education advances. As an avid book collector, particularly books that are science related, I am excited to be adding to my collection. As many may know, university textbooks cost upwards of thousands of dollars over the years spent in undergrad, and I am grateful that I do not have to worry about these material costs thus far."

## Luis Carlos Escobar Arenas

### Thomas A. and Anne L. Shepherd Diversity Scholarship

"Thank you so much for your support through the Thomas A. and Anne L. Shepherd Diversity Scholarship! As a Latino, low-income, first-generation, queer student, this is a significant achievement that allows me to start answering some of the questions regarding subsurface geology. This is a challenging but interdisciplinary, vibrant and exciting topic. I arrived to the States less than a year ago, and I have been very pleased by the welcoming of my ideas. Your assistance directly relieves much of the burden of attending graduate school in the United States as an international student."

## Kajsa Holland-Goon

### Undergraduate Explorationist Scholarship

"I am incredibly grateful and honored to be the recipient of this scholarship. Having support like this shows me that my interests are worth working towards and there are people that believe in me and find value in what I want to do. Thank you so much for giving me the support I need and showing me that it is worth it to follow my dreams and everything I am doing is not for nothing. Sometimes college can be very difficult and I have to push myself to continue working hard but in times like this I am reminded that there are people who believe in me and understand why I am working down this fascinating but difficult path."

## Mickey Means-Brous

### Schumm Graduate Scholarship, West Denver Chapter-Trout Unlimited Scholarship, Hill Memorial Scholarship

"I was, fortunately, employed most of last year, but I didn't plan on my seasonal job ending early due to COVID-19 or being unemployed this past winter. The savings I thought were sufficient for starting grad school and moving to Fort Collins quickly dwindled just to keep a roof over my and my dog's head. Due to my family's financial status, I have supported myself almost entirely since I was sixteen, so I know how to manage my funds and live frugally, but this recent hardship did not leave enough to see this journey to fruition without added stress or taking out loans that would increase my debt affecting my financial success in my future."

## Andrew Ruatti

### Charles E. Beverly Memorial Scholarship

"I am grateful for your generosity in awarding me this scholarship. If I wasn't awarded this scholarship, I probably would've had to work another job during this coming up school year to help pay for tuition and books/supplies since majority of the money I make firefighting goes into my apartment. I am also grateful that the dedication that you guys put in so that students can afford to go to college and follow their dreams. Because of people like you, I can have the opportunity to get a good education at a place where I can focus my studies on something I feel like will get me a good career from."

## Juni Park

### McCallum Mineralogy and Petrology Graduate Scholarship

"I really appreciate your gift. My parents retired a few years ago, and they do not have sufficient earning capacity to support me. Your gift removed my parents' burden as well as mine. During the pandemic, the financial status in our lab has been not good. This scholarship makes me participate in the international research conference, where I can introduce my research and receive feedback from active researchers. That opportunity could be the most precious experience ever in the Ph.D. program. Thanks to the scholarship last year, I participated in the Goldschmidt conference last month. The conference is one of the biggest international geochemistry conferences."

# Department and College Scholarships and Awards

With sincere thanks to the generous donors who have made these scholarships and awards possible

## Undergraduate Students

Usama Al Hashmi: Geology Field Camp Scholarship

Emma DeLisa: Geology Field Camp Scholarship

Madeline Ferguson: Charles E. Beverly Memorial Scholarship, Michael Smith Scholars in Geosciences

Ben Fowler: Geology Field Camp Scholarship, Michael Smith Scholars in Geosciences, Steve and Gail Kloppel Scholarship in Geosciences, Oscar and Isabel Anderson Undergraduate Scholarship

Leo Harland: John and Dolores Goodier Scholarship in CNR, Ernest and Bernice Dice Scholarship, WCNR Student Success Scholarship, Geosciences Undergraduate Scholarship

Kajsa Holland-Goon: Undergraduate Explorationist Scholarship, Chris Lidstone & Kate Laudon Scholarship in Geosciences

Nathan Hollars: Geosciences Field Camp Scholarship

Ally Loyd: Chris Lidstone & Kate Laudon Scholarship in Geosciences, Roy G. and Ruth K. Coffin Scholarship, William D. Hatfield, Jr. Memorial Scholarship

Sammy Malavarca: Michael Smith Scholars in Geosciences, Geology Field Camp Scholarship

Olivia Montoya: Undergraduate Explorationist Scholarship

Adam Parol: David V. Harris Memorial Geology Scholarship, Michael Smith Scholars in Geosciences

Meaghan Pascual: Thomas A. and Anne L. Shepherd Diversity Scholarship

Kyle Piper: Geology Field Camp Scholarship

Andrew Ruatti: Charles E. Beverly Memorial Scholarship

Shea Slonkosky: Treckles Scholarship in Geosciences, Geology Field Camp Scholarship, Robert L. Stollar Scholarship in Hydrogeology

Julie Spawn: Katharine Compton Field Experience Scholarship, Geosciences Field Camp Scholarship

Nick Widler: Michael Smith Scholars in Geosciences

## Graduate Students

Victoria Arnold: Roger and LuAnne Steininger Fellowship, The McCallum Mineralogy and Petrology Graduate Scholarship

Sarah Dunn: Hill Memorial Fellowship, Class of '73 Scholars

Luis Carlos Escobar Arenas: Thomas A. and Anne L. Shepherd Diversity Scholarship

Emily Iskin: Ware Geosciences Fellowship, Hill Memorial Fellowship

Anna Marshall: Marie Morisawa Graduate Fellowship, Class of '73 Scholars

Mickey Means-Brous: Schumm Graduate Scholarship, West Denver Chapter - Trout Unlimited Scholarship, Hill Memorial Scholarship

Juni Park: McCallum Mineralogy and Petrology Graduate Scholarship

Wyatt Reis: Evelyn I. Clark Graduate Scholarship, WCNR Student Success Scholarship

Christophe Wakamya: Joby Adams Geosciences Graduate Scholarship, Thomas A. and Anne L. Shepherd Diversity Scholarship

Celeste Wieting: Lary Kent Burns Memorial Scholarship, Oscar and Isabel Anderson Graduate Fellowship, Chris Lidstone and Kate Laudon Graduate Fellowship in Geosciences

## Faculty and Staff

Rick Aster: Elected Fellow of the American Association for the Advancement of Science, 2022

Sean Gallen: Warner College Outstanding Publication Award, 2022

Dan McGrath: Warner College Outstanding Research Impact Award, 2022

John Singleton: AGU 2021 Editors' Citation for Excellence in Refereeing for Tectonics

Ellen Wohl: Association of American Geographers Geomorphology Distinguished Lecture; American Geophysical Union Hydrologic Sciences Award

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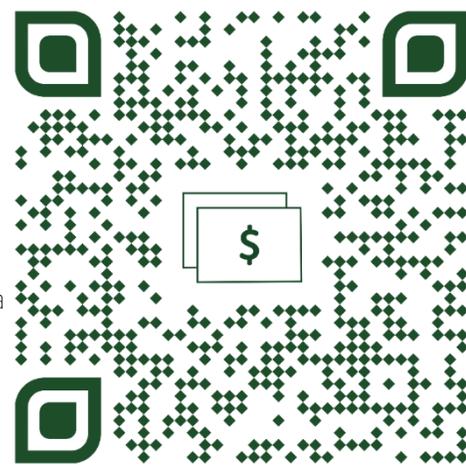
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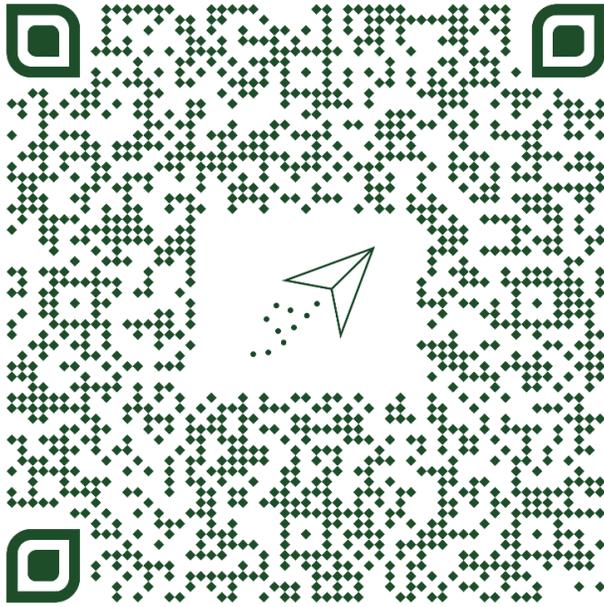


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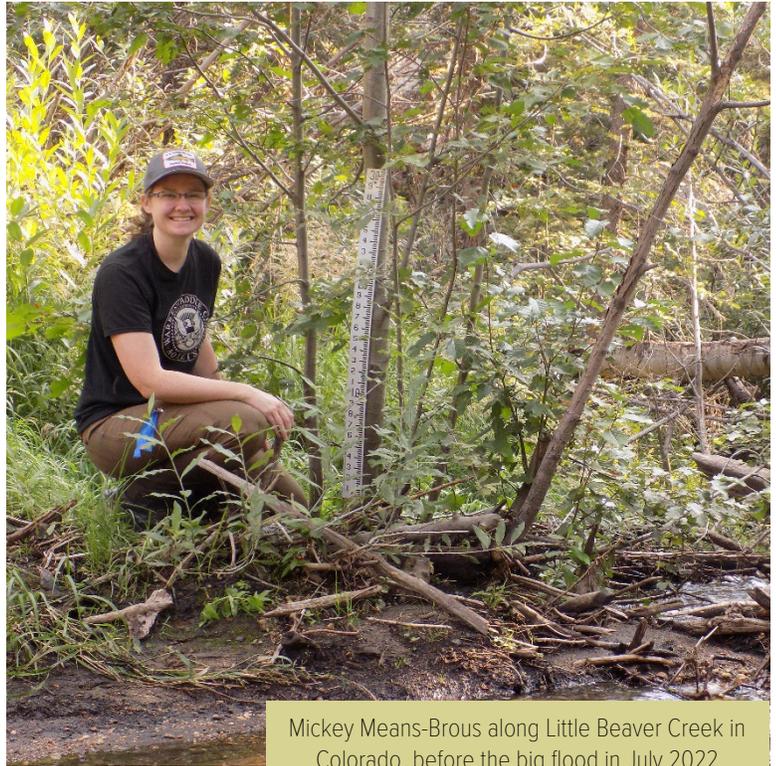
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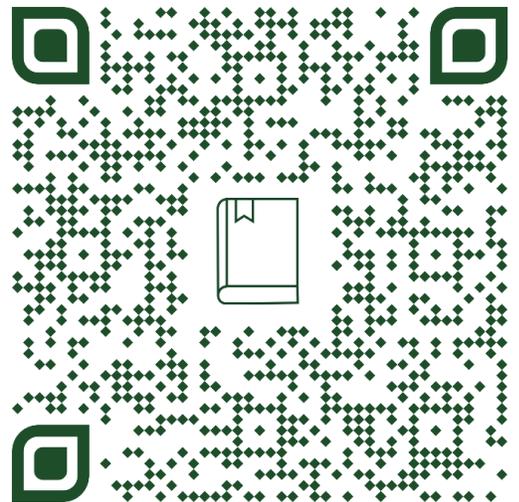


Mickey Means-Brous along Little Beaver Creek in Colorado, before the big flood in July 2022



Historical and Analytical Geology class  
on top of the Dakota Group

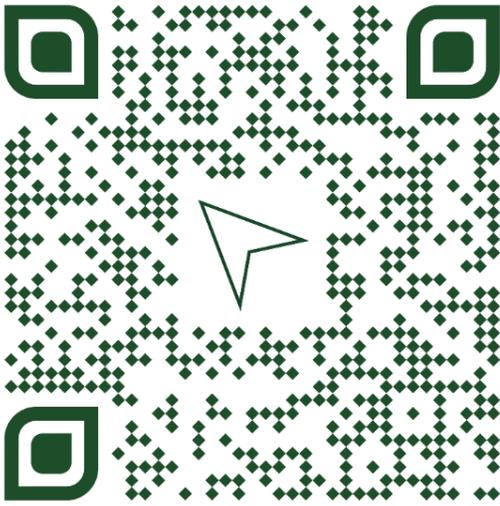
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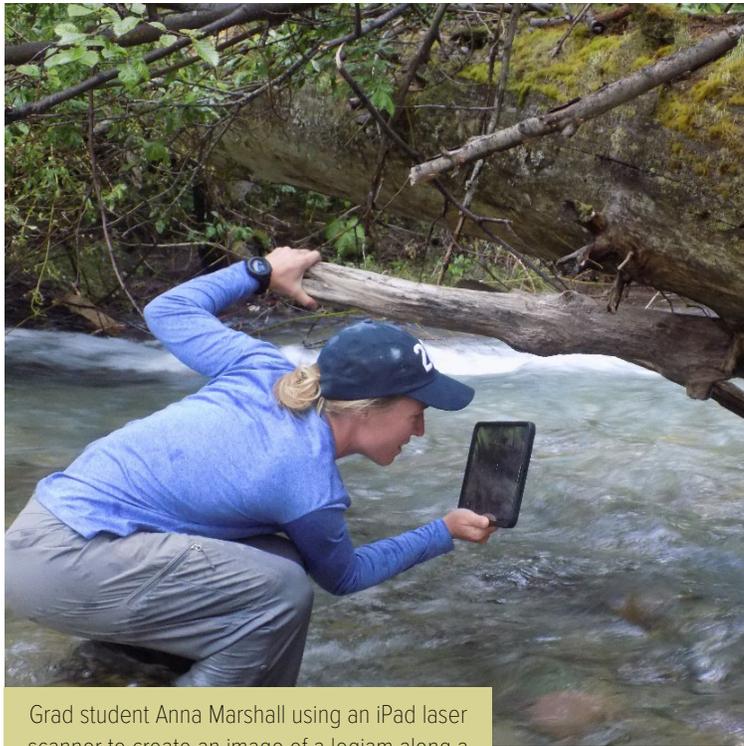
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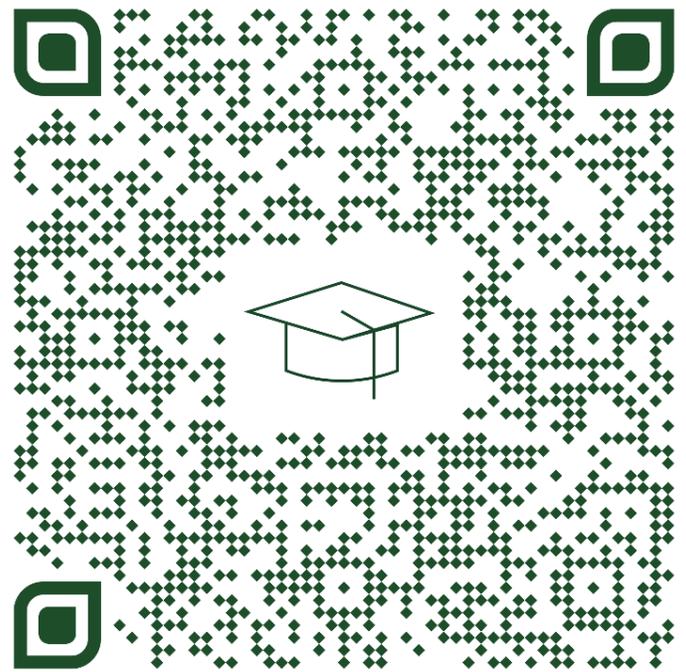


Howard Feldman describing the stratigraphy in eastern Utah, while everyone tries not to melt (it was 103 degrees)



Grad student Anna Marshall using an iPad laser scanner to create an image of a logjam along a tributary of the Swan River in Montana

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