

2023

# GEOscape

Department of Geosciences Annual Newsletter



GEOSCIENCES  
COLORADO STATE UNIVERSITY





PhD student Lucas Zeller takes in the view of Khumbu Glacier and Nuptse during fieldwork in Nepal  
Photo by Dan McGrath



## A Note from the Department Head

### RICK ASTER

Dear Friends,

January 2024 will mark a full decade of serving as your Geosciences Department Head. This will be my last Academic Year in this role so, if you'll indulge me, I'll take a more retrospective viewpoint than usual in this annual message.

The past 10 years encompasses transformative, and continuous, efforts to advance and sustain Geosciences at CSU. Our overall faculty numbers increased from 11.5 to 16 (with two additional hires expected this academic year). The seven new faculty hires during this period, and professional growth and accomplishments of continuing faculty have brought unprecedented breadth and depth to the department, including in volcanology, geochemistry, petrology, paleoclimatology, glaciology, critical zone geosciences, geophysics, hydrogeology, geomorphology, structural geology, geospatial modeling, and more. Eight department faculty have been promoted (two of them twice) and/or received tenure as of today. Our proportion of Ph.D. candidates doubled, from approximately 25% to 50% of the graduate student population. We have benefited tremendously from our exceptional office staff, who continue to keep our complex operational train moving forward and on the tracks every single day. We renewed our Geosciences Advisory Council and reinstituted its bi-yearly meetings and activities, including advancing major new scholarships



for our summer Field Camp students. We broadly advanced and expanded our development and communication efforts, re-establishing precious connections with far-flung alums. We secured a major multi-faceted commitment from donors, the university, and the college to bring state-of-the art petrological, geochemical, and other laboratory capabilities to the department. We grew our introductory Geology lecture and lab courses so that they now encompass about 1/6 of all Warner college credit-hours. We extensively renovated and updated more than half of our research, student, and office spaces.

We have, of course, dealt with significant challenges along the way. The greatest of these by far was navigating and overcoming unprecedented disruptions as the COVID-19 pandemic evolved across the university and the world. You can perhaps imagine the many high-impact decisions and pivots that this necessitated at a large university. I wish to most prominently highlight my everlasting appreciation for successfully flipping every one of our 2020 classes to on-line teaching during spring break of that year, and for maintaining our educational core mission throughout and across this crisis. This extraordinary effort included successfully teaching in-person capstone Field Camp courses across two pandemic summers.

After two five-year terms (and a bit more), I will be stepping down as the Geosciences Department Head in August of 2024, going on sabbatical during the next Academic Year, and returning to the department as a professor in fall of 2025. I want to express my heartfelt gratitude to faculty, staff, friends, administrators, alumni, and to my wife Jan and extended family, for their invaluable support. I have found this decade-long journey to be fulfilling, fascinating, and, hopefully others will agree, highly and positively impactful. I believe that our Geosciences foundation is both sound and offers tremendous future opportunities for my successor and for the department. The college, under Alonso Aguirre's able leadership, has recently initiated a nationwide search for the next Department Head, and I have full confidence that we will be welcoming an outstanding new colleague next year to help lead CSU Geosciences to ever-greater achievements.

Wishing you all the best, and with my sincere thanks.

Rick Aster  
Department Head

## A Note from the Dean

### ALONSO AGUIRRE

Hello and welcome to another exciting issue of GEOscape!

It has been another highly productive and impactful year in Warner College's Department of Geosciences and as you'll see, the faculty and students have contributed fantastic updates in this year's issue. The research, teaching, and engagement the Department saw over the past year was tremendous and there are many exciting developments to come in the new year.

This has been a year of reflection at Warner College as we released our new strategic plan, New Heights of Impact. The Geosciences department was highly engaged in vetting and shaping our new vision, prioritizing our dedication to the Land Grant Mission, and enhancing experiential education and our international leadership. Geosciences is integral to our efforts to embrace transdisciplinary approaches to solve earth sciences and natural resource challenges.

In particular, the Department's long-standing emphasis on experiential education through field and lab courses and its quintessential summer field camp are fantastic examples to build upon as we evolve our ability to provide students with high impact experiences leading to jobs or graduate school opportunities. The entire Geosciences community continues to support these efforts and address the modern challenges of long-term field courses, supported with the scholarships the Geosciences Advisory Council has established. That support is so critical to ensure students can get the important field training that will set them apart in their early years of their career. Thank you all for your generous support of our students.

Finally, I'd like to acknowledge Dr. Rick Aster for his phenomenal role as Department Head over the past decade. Under his leadership the department has grown and evolved positively in innumerable ways and despite challenges over the years, including the pandemic, we are in a better place for his efforts. From the capital improvements he has driven, to the strides he's made with philanthropy, to the academic and research innovations he's implemented; the department has grown its impacts tremendously. We are so glad he will return to the faculty following his sabbatical. His institutional knowledge will be invaluable to our new department leadership.

I look forward to engaging with you all as we proceed with selecting the Department's new leader. Rick has certainly set them up for success!

Thank you all for your continued support and interest in the Geosciences Department and Warner College. Best wishes in the new year.



A. Alonso Aguirre, Dean  
Warner College of Natural Resources



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## On the cover

Fort Collins sunrise from Lory State Park  
taken by Rick Aster

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



WARNER COLLEGE  
OF NATURAL RESOURCES  
COLORADO STATE UNIVERSITY





Tia Tarka and Haakon Nordrum get up close and personal with an exposure of tourmaline pegmatite near Glen Haven on the Fall Geology of the Rocky Mountains [Geol 401] field trip in September. Photo by Jerry Magloughlin



The background of the entire page is a solid olive green color. Overlaid on this background is a geometric pattern of thin, light green lines. These lines form a series of overlapping triangles that create a 3D effect, resembling a stack of pyramids or a series of interlocking diamond shapes. The pattern is centered and covers most of the page area.

# STUDENT HIGHLIGHTS

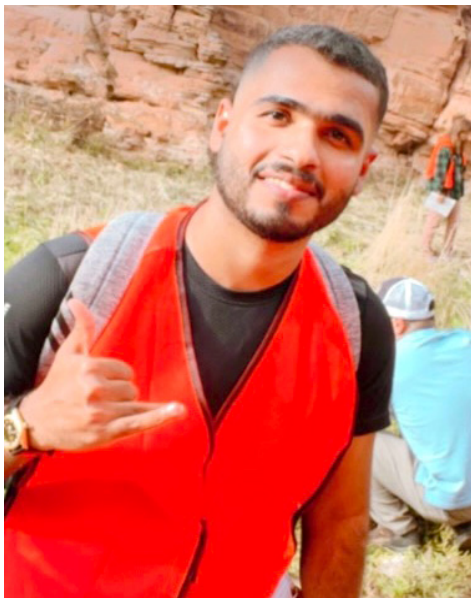
Our students experience a comprehensive learning environment of knowledge-gathering, research, outreach, and career-mentoring.





GEO154 students measuring strike and dip of the Niobrara Group at Coyote Ridge Natural Area during a spring 2023 field trip.  
Photo by Sara Rathburn





### Mahnad Al-souti

During my time at Colorado State University (CSU), I have had the privilege of pursuing a major in geology with a concentration in geophysics. This field has ignited my passion for understanding the Earth's dynamic processes and exploring the mysteries beneath its surface. CSU's exceptional academic programs and dedicated faculty have provided me with a solid foundation in geology and geophysics, equipping me with the necessary knowledge and skills to excel in my chosen field. As the head of the Omani Students organization at CSU, I have been fortunate to lead a vibrant community of Omani students on campus. Through this role, I have had the opportunity to foster a sense of belonging and support among Omani students, organizing various events and activities that celebrate our culture and promote cross-cultural understanding. CSU's inclusive and diverse environment has been instrumental in nurturing such initiatives, allowing students from different backgrounds to come together and thrive.

Throughout my academic journey at CSU, I have strived for excellence and achieved notable accomplishments. I have consistently maintained a high GPA, demonstrating my commitment to academic excellence. Additionally, I have actively

participated in research projects, contributing to the advancement of geophysics as a discipline. These experiences have not only enhanced my knowledge but also allowed me to develop critical thinking, problem-solving, and teamwork skills that are vital in the field of geology.

Furthermore, CSU's exceptional support services and resources have played a significant role in my personal and professional development. The university's career services have provided me with guidance and opportunities to network with industry professionals, helping me gain valuable insights into the geology and geophysics sectors. The state-of-the-art laboratories and fieldwork opportunities have further enriched my learning experience, allowing me to apply theoretical knowledge to real-world scenarios.

In conclusion, my time at CSU has been nothing short of extraordinary. The university's commitment to academic excellence, diverse community, and robust support systems have profoundly impacted my growth as a student and future geoscientist. I am immensely grateful for the opportunities and experiences that CSU has provided me.

### Madeline Ferguson

While preparing to graduate in December 2023, I have been reflecting on my time at Colorado State University and the path I took to get here. Although I have always known I wanted to be a geologist, financial circumstances were a significant barrier to my ability to attend college. After high school, it took me a few years of working full-time and attending school part-time before I came to a place where I could prioritize finishing my degree. When I re-enrolled at Front Range Community College full-time in Fall 2020, I put more effort into my classes than I ever had before. It took three semesters at community college before I was able to apply to CSU, but my hard work paid off, and I was thrilled when I was notified that I was accepted into the Warner College Geology Program.

I started at CSU in the Spring Semester of 2022. During this time, COVID-19 restrictions were still being enforced and I had just gone through a personal loss that was still affecting me. At the beginning of the semester, I had a "get in, get through, and get out" mindset. I wasn't expecting to make close friendships with my classmates because I feared that I was going to be the oldest student in the program. I was very surprised when I showed up





## UNDERGRADUATE STUDENT HIGHLIGHTS

to my first geology class and sat down next to a Navy veteran in his 30's and his iconic service dog Gator. As I got to know the other geology majors, I realized that my experience was far from unique. Many of my peers, younger and older alike, had also experienced setbacks and ended up on a non-traditional educational track.

This realization encouraged me to let my guard down and become more involved within the Warner College and the Geology Department, and I began to thrive. I became more outspoken in class, took leadership roles during group projects, and earned high marks in all of my classes. With the encouragement of my advisors and professors, I applied for scholarships through CSU and was awarded the Smith Scholarship for Geosciences.

I have had many incredible field experiences during my time at CSU. The first was attending Paleontology Field Camp in northwestern New Mexico for 10 days in the summer of 2022. This experience ignited my passion for field work and solidified my love of geology and the desert. A few months later, I went on a four-day trip to the Book Cliffs in eastern Utah. These experiences prepared me for the rigorous weekly field trips I would later participate in during Geologic Field Methods.

I attended Geology Field Camp during the Summer Semester of 2023, and while it was the most challenging academic experience of my life, it was also the most rewarding. For five weeks, I got to do geology every day, and live with my classmates, who became my close friends, all while exploring areas of Colorado I had never been to.

I feel now that I will be leaving CSU with much more than a bachelor's degree in Geology. Through CSU I have developed many advantageous professional relationships, been able to work as a graduate level teaching assistant, and developed critical skills that I will use for the rest of my career as a geologist. I have also forged lifelong friendships, and have memories that I will cherish. After graduation, I plan to attend graduate school to further study structural geology. While I am excited for my next steps, I will always remember CSU as the place where I found my calling.



### Kajsa Holland-Goon

My name is Kajsa Holland-Goon and I am a 4th year senior graduating in May with my concentration in geophysics. My time at CSU has far exceeded my expectations and it has played a huge role in finding my passions within geology. When I first applied and committed to CSU I was planning on studying Wildlife Biology and I quickly switched to geology due to the emphasis on mathematics and physics and my curiosity of understanding how the Earth works drew me in. My first year set me up for success instantly with Jeremy Rugenstein and Sara Rathburn teaching the new student seminar and Sean Gallen in Geology 150. I realized I had found my passion right away and I looked forward to class every day feeling so much support from these professors. I remember calling my mom regularly that year as I learned more and more about geology I just kept getting more excited.

In the middle of my sophomore year, I decided I wanted the opportunity to study abroad and looked online for programs. I ended up doing the SIT Geosciences in the Himalaya that summer for 7 weeks where I met incredible geologists from across the world, as well as other geology students from universities in the US and Nepal. It was an incredible experience to understand how geology I learned in Colorado applies everywhere and the projects I did in classes were teaching me important skills. It was also refreshing to meet other people who shared my passion and begin to talk about what they wanted to do with their degrees.

Although I loved my major and the department, I had a very difficult Junior year Fall semester for a variety of reasons personal and academic and felt at my lowest. I wasn't enjoying my classes much and I was having health problems among other things. After winter break, doing cycling team camp with the CSU team and getting ready for some classes I had been looking forward to began the new semester. Instantly, I was happier, glad I had pushed through, and excited for the future. Dan McGrath's Remote Sensing of the Earth Systems was one of my favorite classes I had taken and I decided to reach out about possibly doing my honors thesis with him which I am beginning this year. Structural geology was another favorite as I prepared for field camp and the support I got from John Singleton always inspired me to do my best.

I was a bit nervous going into field camp as most of my main friends in the department were not going to be there. However,



## UNDERGRADUATE STUDENT HIGHLIGHTS

I quickly made friends with people I had known for years but never truly got to know. Field camp brought us together in a way no other experience had. This past summer was one of my favorite experiences ever, exploring Colorado, improving my mapping skills, and creating connections that would mean so much to me. I finished with winning the 2023 Field Camp Award.

I'm starting my final year at CSU with optimism and excitement for the future. Along with my time spent in the Geology department, I have worked as an Admissions Ambassador giving campus tours since May of 2021 as well as being a grader in the department and Geologic Resources Inventory intern for one year. I compete with the Nordic Ski team and Cycling teams on campus, and I am a peer mentor within the Honors College teaching an intro to college class for the past three years. I am the former vice president of Warner College Council and member of geology club. CSU has given me so many opportunities to find my interests and try new things. The professors, grad students, and my peers have all been incredibly supportive and inspiring in my undergraduate journey. This department means the world to me and has pushed me to look forwards to applying to graduate school within the next few years.

### Adam Walsh

Adam Walsh (he/him) is a senior geology major in the Geosciences Department, pursuing his second bachelor's degree. Before studying geology, Adam earned an M.S. in Public Communication & Technology (2018), and a B.A. in Journalism & Technical Communication (2012), both from CSU, and worked professionally as a freelance multimedia producer and marketing specialist. In the Spring of 2018, Adam worked as an instructional coordinator for Semester at Sea, traveling to eleven different countries, and sparking a passion for the natural sciences. This interest in studying the natural sciences eventually drove Adam back to CSU and the Geosciences Department in the Fall of 2020.

Since joining the Geosciences Department as an undergraduate student, Adam has served as the Vice President of the Geosciences Club (2021-2022) and joined CSU's chapter of AAPG. Adam has also enjoyed opportunities to conduct fieldwork and gain lab experience as a member of the GeoPAST Group led by Professor Jeremy Rugenstein. From October 2021 to September 2022, Adam completed an independent study with Dr. Rugenstein studying atmospheric sources of water in northern Colorado using stable isotopes from precipitation and stream samples and he is currently preparing the final report to submit for publication.

In the Spring of 2023, Adam took a sabbatical to again for work for Semester at Sea, after which, he returned to CSU to work for research scientist, Dr. Kerstin Braun, analyzing speleothem samples using the IRMS and gas bench in the Stable Isotope Lab at CSU's EcoCore Analytical Facility.

This Fall, Adam has resumed his time as a full-time student and works for Professor Jerry Magloughlin as an Undergraduate Teaching Assistant for the Mineralogy course, and Professor Jeremy Rugenstein as a grader for Sedimentary Petrology and Geochemistry course. For the 2023-2024 academic year, Adam is serving as the Undergraduate Student Representative for the department, where he is looking forward to sharing a student perspective with faculty and departmental leadership. Adam is anticipating graduating in the Fall of 2024, where he will likely pursue graduate school.

In his free time, Adam enjoys hiking and camping in the local natural areas and parks with his spouse, Marianna, and traveling as much as possible.



The Department of Geosciences would like to share our deepest gratitude for this year's Undergraduate Student Representative Adam Walsh and Graduate Student Representative Anna Marshall. 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. We thank our representatives for keeping our department engaged and informed in student goings-on throughout the semester!





## Anna Marshall, M.S. Program

As a fluvial geomorphologist, I study the interactions between the physical shapes of rivers, how they move and store water, sediment, and wood, and the landforms they create. Rivers are deceptively simple systems. Nearly every river I have searched for answers in has been shallow enough to wade across. Yet, getting to know a river reveals that its depth and width do not quantify how much it can teach us.

My premature fascination with flowing water began early, spending much of my childhood submerging myself or various objects in any water I came across. With age, I have graduated from analyzing which flow paths transported my leaf boats to geomorphic changes across entire fluvial systems. Needless to say, water's ability to shape and re-shape the landscape has been of life-long interest. Rivers are the veins of the Earth, and as I increasingly understand their intricacies, I am motivated to better understand the natural processes acting on these systems, alterations to river corridors caused by natural and human disturbances, and how those alterations constrain river science and management going forward.

I joined the Department of Geosciences at CSU in 2019 for an M.S. working with Dr. Ellen Wohl to explore how complex mountain channels influence hyporheic exchange, a key driver of ecosystem processes in many streams.

I fell in love with rivers of the Rocky Mountains conducting fieldwork in a tributary to the Poudre River near Pingree Park. Partway through my master's research in 2020, the Cameron Peak Fire burned through my field study, opening countless new research questions on the geomorphic response of rivers following disturbances. I had far too many questions to stop there and started my PhD in Fall 2021 working with Ellen to study the interactions between secondary channel and island formation, wood in rivers, and physical complexity along a river in Northern Montana.

As I start to wrap-up my time as a graduate student at CSU, I have begun to reflect on the many experiences being a part of the Department of Geosciences has provided me. The same things that first drew me to the department are what have kept me here for five years and two degrees- its strong legacy of surface processes and water research, a location that serves as a natural learning laboratory, and a commitment to building a strong and inclusive future for the geosciences discipline. I have been fortunate to have incredible mentorship from Ellen and support to always follow curiosities and explore new ideas. My PhD has taken me to every corner of the United States, up and down the Rocky Mountains, and across the world to Colombia, Italy, and Japan. More importantly, these opportunities have opened countless doors to network and work with a diverse range of collaborators and apply my research across disciplines and in management contexts. I will carry the skills and connections I've built at CSU with me wherever I go, and much like a river, allow them to branch and rejoin, with time.







Ricky Garza and department Geosciences Advisory Committee Member Chris Lidstone [M.S. '81]

### Ricky Garza Giron, Ph.D.

I am a postdoctoral researcher in the Department of Geosciences at CSU, where I focus on icequake studies at the grounding lines of the Ross Ice Shelf (RIS) in Antarctica, as well as research in volcano seismology under the guidance of Prof. Rick Aster. I am originally from Mexico, where I earned my undergraduate degree in Geophysics Engineering from the National Autonomous University of Mexico (UNAM). I later received my Ph.D. in Seismology from the University of California, Santa Cruz (UCSC), where I also served as a postdoctoral researcher.

My main research interests span three areas: the mechanics and behavior of icequakes in large ice masses, understanding the dynamics of volcanoes before, during, and after eruptions,

and using seismology to understand the repeatability and nucleation of megathrust earthquakes. At CSU, my work aims to improve our understanding of the mechanics of the grounding lines at the RIS, which are critical for both ice shelf stability and global sea-level rise predictions.

I am excited to be a part of this department, and I look forward to collaborating with a multidisciplinary team of researchers and engaging with enthusiastic students from diverse backgrounds who are passionate about geophysics.



### Matthew Lurtz, Ph.D.

I am a National Science Foundation Postdoctoral Fellow (2023-2025) and am hosted by Drs. Mike Ronayne at CSU and Alfredo Huete at the University of Technology Sydney. I received my PhD at CSU in the Civil and Environmental Engineering department under Dr. Ryan Morrison. My work examines river-aquifer connections with human-built systems, including multiscale impacts of agricultural practices on riparian water use.

My proposed work focuses on issues related to scale in groundwater dependent ecosystems. I am working with Dr. Mike Ronayne and the Warner College of Natural Resources at CSU given the long history of expertise in researching flow and transport through connected groundwater-surface water systems. We will conduct our investigation using hypothesis testing, field and remote based vegetation sampling, advanced statistics, and customized numerical modeling. Output from this work will be used to enlighten current groundwater models used in water management routines.





### Joel Leonard, Ph.D.

I'm a postdoc in the department interested in all things landscape evolution. After getting my Ph.D. from Arizona State University in December, 2022, I started my postdoc here working with Dr. Jeremy Caves Rugenstein and Dr. Sean Gallen. While I mostly work remotely, I have had the opportunity to visit in person on several occasions. Each time I meet so many wonderful people, all doing really high quality science, making my experience here really rewarding.

For my postdoc research, I am working to quantify feedbacks among tectonics, climate, topography, erosion, and chemical weathering during mountain building. To do so, we are developing a landscape evolution model that combines all these components to investigate how they interact. I am also continuing previous research that involves attempting to isolate the relative influences of tectonic, climate, and lithology on erosion and topography of the north-central Andes. Through these efforts, my goal is to better understand how mountain ranges evolve, how this evolution impacts climate, and how Earth surface responds to interactions between climate and tectonic processes.



Northern Colorado Moose  
Photo by Jerry Magloughlin





GEOL 154 students measuring strike and dip of the Dakota Group during a spring 2023 field trip  
Photo by Sara Rathburn



# Geosciences Field Camp Experience

Summer field camp (GEOL 436) began in late May, right after the conclusion of the GSA Rocky Mountain section meeting at CSU. Sean Gallen led the first week, which took place in Cañon City, Colorado. Students mapped surface deposits and modeled paleo-floods in Grape Creek. The weather cooperated, making for a very pleasant week in the field and camping at Indian Springs Ranch Campground. The 28 students worked extremely hard and produced exceptional maps and reports, and they finished excited for the second week.

The second week was also based in Cañon City and was split between bedrock mapping and stratigraphic analysis of spectacularly exposed Pennsylvanian to Upper Cretaceous strata. John Singleton led the mapping project, and department affiliate Howard Feldman (formerly at ExxonMobil) joined the group for the stratigraphy project, where his expertise in facies and siliciclastic systems provided significant insight into the exposures.

In week three, Bill Sanford and PhD candidate Randall Bonnell led a project in which students took on the role of consultants with the goal of quantifying groundwater storage in the aquifer below CSU's Mountain Campus. Students got wet in the South Fork of the Cache la Poudre River and measured stream velocity and cross-sectional area to estimate discharge. They observed a sediment core containing the glacial sediments that comprise the aquifer and measured the water quality of the aquifer at wells. To piece together their observations, students performed ground-penetrating radar surveys to map out the extent of the aquifer and estimate its volume.

Week four was a larger-scale mapping exercise in the core of the eroded Summer Coon stratovolcano near Del Norte, led by John Ridley. Students gained experience identifying and interpreting hydrothermal alteration and a wide range of volcanic and intrusive rocks. It was a week of almost perfect mapping weather - sunny and not too hot.

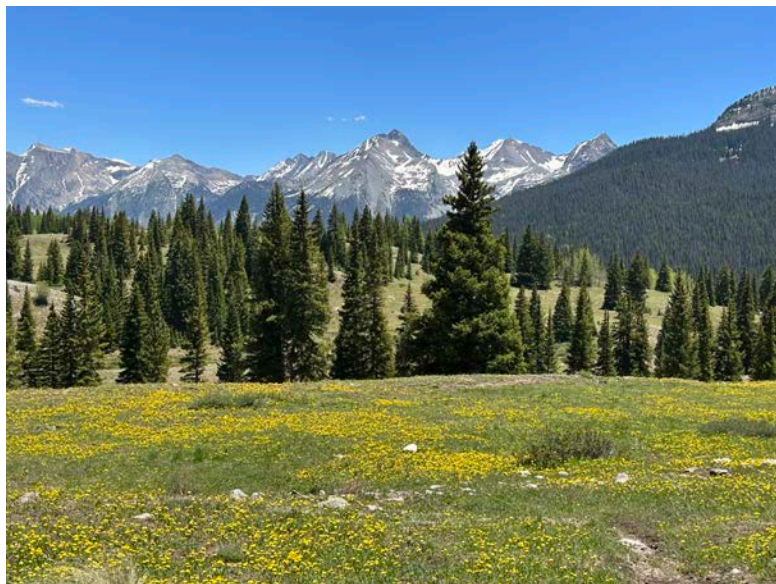
John Singleton led week five of field camp, which once again focused on bedrock mapping and structural geology near





## FIELD CAMP

Lime Creek and Molas Pass (south of Silverton, Colorado). Students mapped in beautiful areas that preserve multiple episodes of Proterozoic and Phanerozoic deformation. The weather was perfect, and the students maintained an excellent attitude all the way to the end, despite a formidable population of mosquitos at the Chris Park campground.







“Velocity Orange Fun” at the CSU Mountain Campus. Students performed velocity measurements of the stream by measuring the amount of time it takes an orange to travel a specific distance. Students reported that following the experiment, the orange met an untimely end, but was ultimately delicious.

From Left: Bill Stanford, Victoria Arnold, Meaghan Pascual, Noah Dayton, Devin Clary, Hannah Yakimisky, Madeline Ferguson, Brad Streets, Andrew Ruatti, Ann McDonald, Mitchell Mannino. In river: Rockwell “Rocko” Fillweber, and Kajsa Holland-Goon.

Photo taken during Week 3 of the 2023 Geology Summer Field Camp at the CSU Mountain Campus



# CSU Geosciences Club

by Geo Club President Adam Rang

The CSU Geosciences Club aims to build community within the Geosciences Department by connecting undergraduate students who are interested in the study of geology. The Geosciences Club meetings aim to broaden members' academic interests by presenting perspectives that may not be available within a classroom environment.

A major aspect of the club's meetings is dedicated to guest speakers, field trips, networking within the department, and creating a space for members to share a common interest in geology.

The CSU Geosciences Club is largely focused on geology but is not major specific and openly welcomes members of other majors.

This year we had a group attend the Gem and Mineral Show, we put on the first ever Geosciences Club Interest Night, and we are looking forward to our kimberlite field trip, the Graduate Student Panel, and the fall department Chili Cook-Off!



The Geosciences Club hosted the Graduate Student Panel which gave students an opportunity to discuss post-graduation options.



Geosciences Club members armed with their laptops and chargers for Minecraft Night





# Geosciences Graduate Student Organization

by Shayla Triantafillou



Victoria Arnold and John Kemper, winners of the 2022 Geosciences Chili Cook Off!

Formed in the spring of 2021, the Geosciences Graduate Student Organization (GeoGSO) has remained active throughout 2023.

Continuing the mission to represent and connect geosciences graduate students at CSU, the GeoGSO has maintained many department initiatives over the past year. We have continued graduate student participation in the faculty hiring process, created and distributed resources for new graduate students, run our annual peer mentoring for incoming graduate students, and started our second year of the Graduate Application Assistance Program (GAAP).

New GeoGSO initiatives this year include participating in a mentoring program for undergraduates in the department and establishing a recurring graduate student and faculty forum every semester.

Members of the GeoGSO have worked with faculty and staff to host department events including a coffee hour twice a month, an annual community meeting, and the upcoming third annual chili cookoff.



The 2022 Geosciences Chili Cook Off, hosted at Wolverine Publick Farms in Old Town Fort Collins



# The Nix Kimberlites

In the fall semester, our Geoscience students took a (one-in-a-lifetime!) field trip to view the Nix kimberlites led by Howard Coopersmith, who, in the mid-seventies, discovered many of the kimberlites we examined on this trip while he was a Malcolm McCallum student. Along for the fun were Ed Warner, assistant professor Lauren Harrison, grad student Victoria Arnold, and many of the undergraduate Geosciences Club members.

One of the most stunning facts about the Nix kimberlites in this location is that three of the pipes, located less than a few kilometers apart, exhibit very different outcrop character—including not one, but two kimberlites that form outcrop! The trip started with the (astounding) cliffy kimberlite outcrop, moved to the (more typical) deeply eroded kimberlite, and culminated with examination of a magmatic-type kimberlite that exhibited a suite of mantle minerals. There was fresh, green olivine (not serpentinized), chromium-rich diopside, and gorgeous pyrope garnets, along with minor amounts of orthopyroxene, ilmenite, phlogopite, and carbonates. The Nix kimberlites are also unique in that they are associated with major faults that may have exerted structural control on emplacement, and have been found to contain the most chromium rich garnets documented not just amongst the State Line kimberlites, but among global kimberlites.

We are very thankful for the Moen and Uthmann families who allowed access to the kimberlites on their ranch, as well as coming along to see what all those funny rocks were about. Along with Ed, it was incredible to have Howard arrange this trip, and to discuss kimberlite formation in Northern Colorado!







“I’m a geologist, why would I ever want to retire? I’ve got the best job in the world!”

Howard Coopersmith





Connor Mertz modeling the latest in Field Fashion for a rainy day, along Little Beaver Creek in Colorado, where he is studying river response after wildfire.  
Photo by Ellen Wohl







# **GEOSCIENCES ALUMNI**

Our alumni are contributing to geosciences work and research all over the world.



# Learning How to Learn

David Heath, M.S. '20

My name is David Heath, and I graduated from Colorado State University's Master of Science in Geosciences program in 2020. My time at CSU gave me the tools and training to have both a successful experience in graduate school, as well as a successful career following my formal education.

My desire to concentrate in seismology stemmed from my early experiences with my advisor Derek Schutt. His sincere encouragement and supportive role as my advisor gave me confidence in my own ability to have a successful educational and research experience in graduate school. That encouragement included not just advice and research topics, but extended to taking on other challenges such as coordinating our summer 2018 field season in the remote Northwest Territories of Canada. These experiences combined to give me immersive participation in the field of seismology, as well as practical knowledge to solve challenging problems.

I was also presented with the opportunity to attend several research conferences, as well as technical workshops. Those included conferences of the Seismological Society of America, American Geophysical Union (AGU), Incorporated Research Institutions for Seismology, and technical meetings such as the Lamont-Doherty Student Seismology Workshop. I was further encouraged to participate in a summer internship with the U.S. Geological Survey, which opened several professional doors for me, and led to my first first-author publication.

During my time at CSU, I was also encouraged to pursue other activities of interest, which included the Voices for Science program (sponsored by AGU). Through Voices for Science, I was given science communication training to impact policy decisions at a national level. I interacted with legislative branch staff, as well as hosted a visit with Colorado's second district representative, Rep. Joe Neguse, to the Warner College, where he met with students and toured our facilities. Another program I was encouraged to participate in was the Apply-to-Sail program, hosted by the National Science Foundation on the research vessel Sikuliaq. There, we sailed for three weeks out of Seward, Alaska, deploying seismometers in the Gulf of Alaska. These experiences were foundational for my development as both a scientist and science communicator, and helped exercise my ambition to seek new challenges.

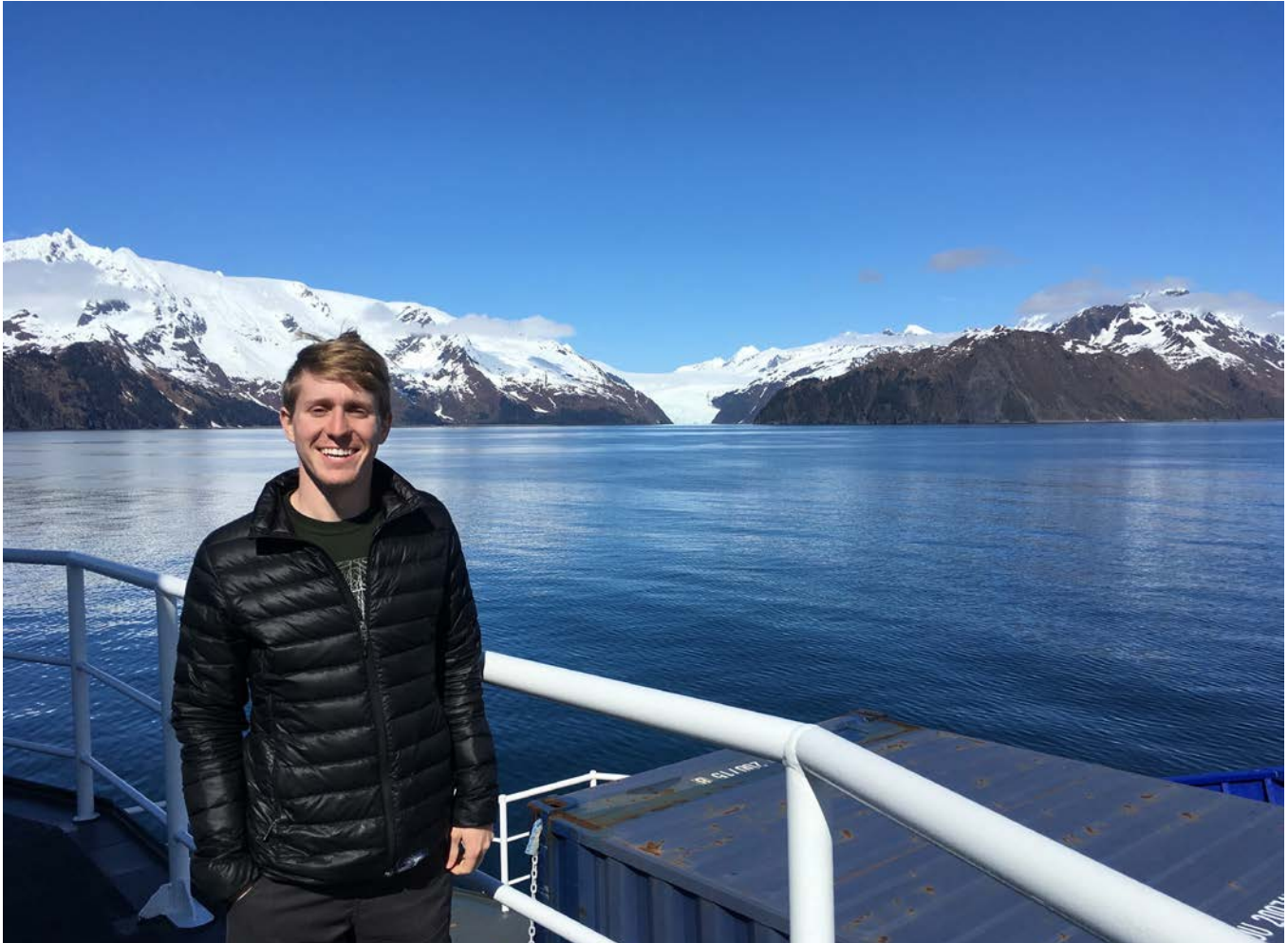
While I knew that attending CSU would give me the proper training for a career in seismology, I didn't realize it would also prepare me for a career in an unexpected industry – space. While searching for post-graduate employment, I was presented with an opportunity to join The Aerospace Corporation, an independent, nonprofit corporation dedicated to solving difficult problems of national importance in space. Although the field of study was a complete switch from my time at CSU, I recognized that the foundational mathematics and programming skills I had developed in my studies were well-aligned with the research being performed at The Aerospace Corporation. Three years into my job I have found that CSU prepared me far better than expected as both a scientist and a problem-solver. I was given the skills to think critically, ask questions, and devise solutions to challenging problems.

My choice to attend CSU was driven by the university's international recognition as a top-notch research institution, with friendly and knowledgeable professors, and the incredible location on the front range of Colorado. My advice to those thinking about taking on an unfamiliar challenge is to consider your resiliency, training, and adaptability – all skills that CSU helps to





develop. And don't underestimate the value of your education to give you skills in areas you may not be immediately familiar with. Your training in school is often about learning how to learn. That includes learning how to seek answers, form appropriate questions, and devise experimentation. Those foundational skills will carry you far in your education and professional career.



David Heath at the end of a 21-day research cruise aboard the R/V *Sikuliaq* in October 2018 to deploy ocean bottom seismographs in support of the Alaska Amphibious Community Seismic Experiment (AACSE) while a graduate student at CSU



Noah Dayton & Kajsa Holland-Goon at Field Camp,  
outside of Silverton, CO.  
Photo by Madeline Ferguson







John Singleton, Sara Rathburn and the GEOL 201:  
Field Geology of the Front Range class at Red  
Mountain Open Space





# **Emeritus News**

Warner College honors Malcolm McCallum



# Malcolm McCallum Receives 2023 Warner College Emeritus Faculty Award

We were delighted as department faculty member (1962 – 1995) Malcolm (Mac) McCallum received the Warner College Emeritus Faculty Award this spring. This is the college's highest honor offered to an emeritus faculty member and recognized his outstanding and ongoing career as a mentor, teacher, friend, and internationally renowned geologist. Malcolm's impacts across the decades continue to loom large within the Geosciences Department, as well as with the national, and international geology community.

Malcolm was additionally celebrated and toasted (including, notably, by former advisee Ed Warner) this October in an international gathering of over 40 friends, former students, business associates, and college and department representatives, including Dean Alonso Aguirre, Department Head Rick Aster, and faculty Lauren Harrison and Jerry Magloughlin, in Old Town Fort Collins.



A toast for Malcolm McCallum, recipient of the Warner College Emeritus Faculty Award.

Malcolm McCallum's former advisee Ed Warner honors Malcolm at the Old Town celebration.





# GPAL Instrumentation Initiative Update

Mac was also pivotal in elevating and realizing the dream of new state-of-the-art petrographic equipment in the department, including a foundational cutting-edge JEOL Field Emission microprobe and new mass spectrometry capabilities. We have initiated instrument purchases and have ongoing discussions with state-of-the-art manufacturers, have begun essential laboratory renovations, and are engaging across the faculty and with our larger community to build a world-class laboratory and academic environment for both research and for the teaching and training of 21st century geoscientists.

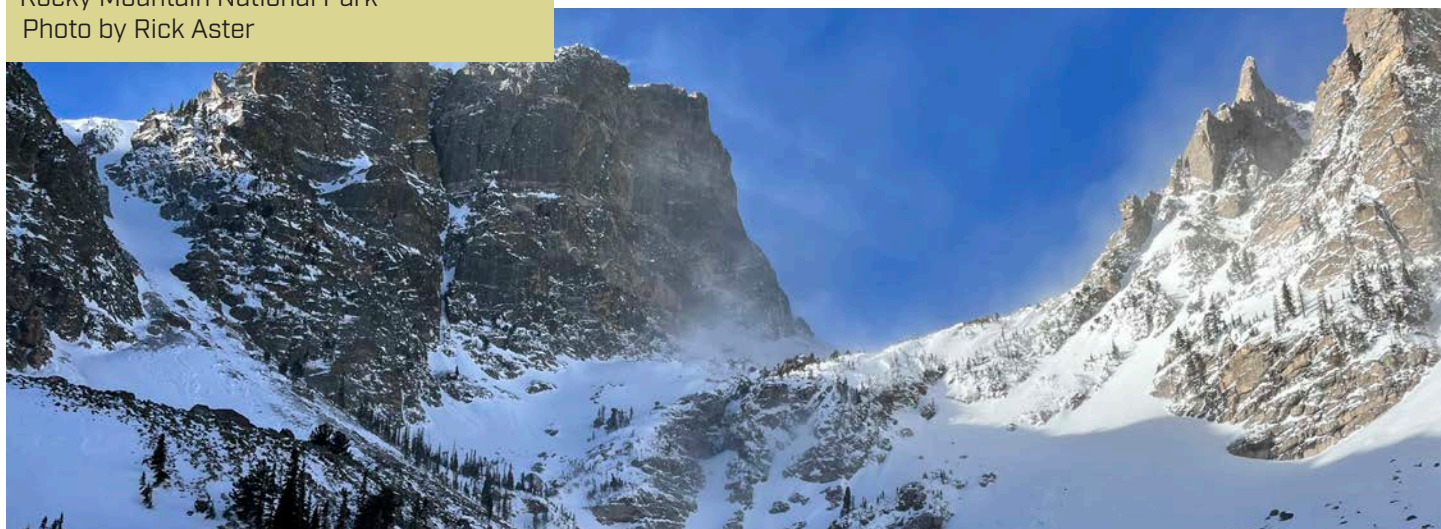
These historical multi-laboratory efforts are being pursued under the umbrella of our Geosciences Petrology Advancement Laboratories (GPAL) initiative introduced in last year's GEOScape and are a pivotal step towards realizing a truly world-class department in petrology and related science and education. While we have made outstanding progress towards fully funding this effort as of the end of this year, we have continued needs to raise funds to complete the initial build-out of this multi-million-dollar project.

*If you are interested in learning more about the many ways in which you can support this historic effort, please contact Department Head Rick Aster ([rick.aster@colostate.edu](mailto:rick.aster@colostate.edu)) and or Interim Managing Director of Development Danielle Young ([M.Danielle.Young@colostate.edu](mailto:M.Danielle.Young@colostate.edu)).*



JEOL Field Emission Electron Probe Microanalyzer  
Photo used with permission by JEOL Ltd.

A blustery winter day at Emerald Lake,  
Rocky Mountain National Park  
Photo by Rick Aster





# **FACULTY and STAFF**

Our faculty and staff explore the wide world of geosciences.



## FACULTY AND STAFF



**Rick Aster,**  
Department Head, Professor

Early this year I completed a multiyear commitment as board chair of the Incorporated Research Institutions for Seismology (IRIS). This service culminated in a corporate merger with our sister UNAVCO geodetic consortium to form a new community consortium of over 150 universities and other partners, the EarthScope Consortium. The US geophysical research and education community, and the NSF-funded facilities that it operates are in great hands going forward with this organization and its new leadership and board! Completion of this epic effort created a few new opportunities for me to pursue some continuing and new research directions. I am mentoring and advising postdoc Ricky Garza-Giron (who began this January) with funding from two NSF projects, and a Ph.D. student Elisa McGhee, who are both working in Antarctic seismology. The seismology of Antarctica's globally important ice shelves -- they restrict the flow of Earth's largest glaciers to the sea, for one thing -- continues to be a priority, and our extensive data collected during 2014 – 2017 continue to provide important scientific discoveries. Elisa is studying on the seismology of ocean swell interactions with the Ross Ice Shelf (RIS; Earth's largest), and Ricky

is working on tidally induced fracture and icequake seismology on the RIS. In another RIS study, Doug Wiens (Washington University), I, and other colleagues discovered using seismic and GNSS (GPS) data that the entire ice shelf (an area comparable to France) undergoes sudden accelerations driven by forces that are propagated seismically from inland Antarctic ice streams hundreds of kilometers distant. Ricky is additionally collaborating with me and our larger multi-university research group studying seismic signals from the actively degassing, and convecting, and erupting phonolitic lava lake of Erebus Volcano on Ross Island, Antarctica, continuing work by Erika Jaski (M.S., 2022). In collaboration with Adam Ringler and former advisee Rob Anthony (Ph.D., 2016), both at the U.S. Geological Survey, and we initiated a comprehensive study of the global seismic wavefield excited by the cumulative effect of ocean waves using global seismographs that have been continuously recording since the 1980's. This work resulted in new quantitative estimates of the mechanical work done on coastal regions by ocean waves across the whole Earth as well as at individual ocean basin scales. These analyses show that seismic energy generated by global ocean waves widely responds to El Nino and other climate factors and provides a complementary proxy to assess ocean storminess along with oceanographic and meteorological studies of our oceans and climate. Finally, Derek Schutt and I, along with Canadian collaborators, are working on a next-generation proposal to NSF to further investigate the unusual plate boundary and orogenic system of the Mackenzie Mountains in Yukon and Northwest Territories. This project is proposed to include joint seismic and magnetotelluric deep imaging, with instruments to be installed via multiple

rivers that extend into the cordilleran interior. Finally, as I complete my final year as Department Head, I am planning a 2024-25 sabbatical, which will be partially supported by a recently awarded Gordon Moore Distinguished Scholar award to pursue new research with colleagues at the Caltech Seismological Laboratory, and a Harry Hess visiting professor award to be in residence at Princeton University.



**Sean Bryan,**  
Master Instructor

The 2022/2023 academic year saw strong enrollment in our introductory-level courses, with about 1100 students taking GEOL 120/121. I can't thank our graduate teaching assistants (Abby Axness, Tomalika Biswas, Thu Bui, Luis Carlos Escobar Arenas, Aaron Katz, Gaby Sanchez Ortiz, Ana María Pérez-Hincapié, Wyatt Reis, Pat Ronnau, Sherif Sanusi, William Stansfield, and Isabella Ulate) and undergraduate learning assistants (Usama Al Hashmi, Zöe Bauerschmidt, Roanan Gallaher, Ally Loyd, and Holly McCrory) enough for all of their efforts contributing to the teaching of these courses.

We continue to adapt and evolve these courses to meet the changing needs of



our students and to provide them with a foundation exploring the relevant and dynamic nature of the geosciences. With these goals in mind, together with Sean Gallen, Dan McGrath, Mike Ronayne, and Lisa Stright, we applied for a curriculum development grant from the School of Sustainability to incorporate more sustainability-focused content into our introductory-level courses. With this funding, we developed six new modules that can be incorporated into any of our 100-level courses. These modules focused on Mineral Resources, Energy Resources, Water Resources, Flooding, Glaciers and Sea Level, and Mass Movement Hazards. These modules provide our introductory students with an understanding of how geosciences interacts with economic, environmental, and political factors in addressing societal challenges. Diversity, Equity, and Inclusion in the Geosciences continued to be a focus of my efforts this year. In the fall, I helped co-teach NR 140 Diversity and Inclusion in the Natural Resources, which is the foundational course for the WCNR Minor in Diversity and Inclusion in the Natural Resources. And in the spring, I lead a group of faculty, undergraduate and graduate students, in a seminar revisiting the Unlearning Racism in the Geosciences (URGE) initiative, which initially ran in Spring 2021. We brought another cohort through the URGE curriculum, revisited the policy proposals created by our group in 2021, and explored ways that our department could become more inclusive.



**Sean Gallen**  
Assistant Professor

I conducted fieldwork in Puerto Rico, southern Italy, and Colorado this year. The Puerto Rico fieldwork was spearheaded by PhD student Abby Axness and supported by PhD student Ana María Pérez-Hincapié. We visited over two dozen sites, collecting geomorphic measurements to determine what's causing differences in mountain relief among rock types on the sub-tropical island. Ana and PhD student Omar Ghamedi led a successful field campaign to southern Italy in June. They traversed most of the "toe of the boot" in search of uplifted fossil beaches that we're using to understand the uplift history of the region over the last million years or so. Three CSU undergraduate students, Maggie Windingstad, Emily Hofer, and Nathan Weaver, joined us to collect data and are working on research projects this academic year. Two MS students defended their theses. Emily Perman (co-advised with John Singleton) finished her project on neotectonic lineaments in the Atacama Desert, Chile, in the spring, and Cece Hurtado defended her thesis on the influence of glaciers on mountain building and fault activity in the Sangre de Cristo Mountains, CO. Beyond all that excitement, I had a full teaching

load with Introductory Physical Geology for Scientists and Engineers (GEOL 150), Critical Zone Science (GEOL 415), Tectonic Geomorphology (GEO 571), and field camp (GEOL 436), along with two reading seminars. I also taught a graduate summer field school with colleagues at CSU's Mountain Campus, the Center for Land Surface Hazards (CLaSH). This class trained a diverse group of students from throughout the US and internationally on how to generate high-resolution data of the earth's surface and use it to quantify earth surface hazards. I maintained my involvement in CLaSH and subduction zones in four dimensions (SZ4D), two large community-led efforts to study natural hazards from various perspectives. I also published several papers (mostly student-led), including publications in *Geology*, *Nature Geoscience*, and *Science*. In the upcoming year, I look forward to working with my graduate and undergraduate students, teaching and conducting research as I prepare for my sabbatical next academic year.



Sean Gallen's students in Southern Italy.  
Photo by Sean Gallen





**Lauren Harrison**  
Assistant Professor

This has been a year of incredible growth and transition as I've moved from a position at the U.S. Geological Survey to a faculty position at Colorado State University in August 2023. I'm certainly happy to be joining such a wonderful group of world-class researchers and engaged students! This past year, I co-authored three papers, including one that was published as the feature article in *Nature Reviews in Earth and Environment*. This work reviewed how isotope geochemistry has been used to understand the composition and dynamics of the Earth, along with identifying new research directions for the future. Two other studies examined the eruptive duration of a shield volcano east of the Lassen Volcanic Center in California and how drought affects geyser eruptions of the largest active geyser in the world, Steamboat, in Yellowstone National Park. Two other first-author papers are currently in review on the isotope geochemistry of postshield lavas from the Northwest Hawaiian Ridge and the connection between Yellowstone hydrothermal travertine and changes in climate. I greatly enjoyed volcanic field trips in New Zealand as a part

of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) conference, where I also presented research into the geology and geochronology of hydrothermal explosions within the Yellowstone Plateau Volcanic Field. Three other conference presentations at GSA Cordilleran and Rocky Mountain Section Meetings rounded out the meeting calendar, along with co-convening a session focused on the ecology, paleoclimate and volcanology of Mono Lake, CA. For the field season, I assisted Ph.D. student Karissa Cordova (University of Texas Arlington) with the collection of hydrothermal explosion optically stimulated luminescence (OSL) dating samples, mounted a campaign on skis up Mt. Shasta (California) to collect more of the most recent lava flows, and participated in a U.S. Geological Survey field trip to the Long Valley Caldera led by the great trio Wes Hildreth, Judy Fierstein, and Andrew Calvert. A trip to the University of British Columbia rounded out the summer, where we analyzed lavas erupted during the 2022 Mauna Loa eruption (the first since 1984!) and kicked off the second portion of student Serena Formenti's Ph.D. which will leverage the geochemistry of a drillcore from Lana'i to investigate the composition of a "Loa-type" Hawaiian volcano over time and test key hypotheses about the structure of the Hawaiian mantle plume. Planning for the new CSU Geosciences Petrology Advancement Laboratory (GPAL) has been active for the past six months as we work with Facilities and partners to renovate key spaces in preparation for new analytical labs and instrumentation. That work continues to gain momentum into the Fall, along with the new academic year.

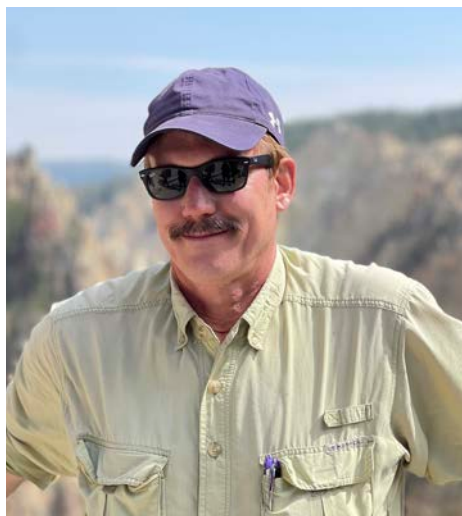


**Dennis Harry,**  
Edward M. Warner Geosciences  
Chair, Professor

My time during the 2022/2023 academic year was devoted primarily to teaching my classes and seminars, advising graduate and undergraduate students working in my lab, and moving the NSF Rift2Ridge initiative forward. My classes included Plate Tectonics and Subsurface Mapping during the 2022/2023 year, with Applied Geophysics underway during the current semester. I was excited to participate in the lively discussions in the reading seminars Derek Schutt and I take turns teaching each semester, which this year focused on physical and chemical interactions between the lithosphere and deeper mantle. My Ph.D. student Micah Mayle passed his Qualifying Exam and published the first of his dissertation papers in *Journal of Geophysical Research* describing a numerical method to evaluate melt production during continental rifting. Micah's final two dissertation papers are in preparation and focus on melt production during opening of the West Antarctic Rift System. Former Ph.D. student Sumant Jha's final paper on subsidence in the western Ross Sea in West Antarctica was also published in 2022 in *Geochemistry, Geophysics*,



and Geosystems. New M.S. student Jorge Espinoza began in Fall 2023 and will be continuing Micah's and Sumant's work but with a focus on the Rio Grande Rift in Colorado and New Mexico. Three undergraduate students are now working in my lab conducting various seismic mapping and numerical modeling studies that complement the work of Micah and Jorge. The results of our work in West Antarctica and the Rio Grande Rift were reported by my students and I in eight abstracts presented at various American Geophysical Union, Geological Society of America, and European Geophysical Union meetings. A substantial amount of my time was devoted to organizing the Rift2Ridge organization. Rift2Ridge is an emerging national organization supported by NSF that is designed to coordinate and focus the American science communities investigations of continental rifts, rifted margins, and ocean ridge systems. The Rift2Ridge organization continues to grow, and I anticipate continuing to play a leadership role as that organization becomes established. The coming year will be busy. In addition to my Rift2Ridge activities, Micah is expected to graduate this summer. Jorge will undertake his field work this spring and summer, collecting new gravity data in the northern part of the Rio Grande Rift. The three undergraduate students working with me should finish their research projects in the spring, which we expect will lead to a publication describing the results of their seismic mapping project. Overall, 2022/2023 was a productive year with Micah's work beginning to emerge in the science literature and my group's work on the Rio Grande Rift getting fully underway. My students and I look forward to continuing this work in 2023/2024.



**Jerry Magloughlin**  
Associate Professor

Greetings to all. Spring semester I taught Microtectonics and our online Physical Geology course. The real challenge came in March when I had knee surgery after too many years of wear and tear from soccer, competitive tennis, and hiking in the mountains loaded down with rocks. For a change, I stayed close to home through the summer to continue physical therapy and especially to work on the McCallum Petrology Initiative, where we are working toward the unprecedented enhancement to our petrologic infrastructure, including the purchase of a state-of-the-art Electron Microprobe. This will be an amazing leap forward with an enormous variety of teaching and research applications across numerous geologic subdisciplines. We feel enormously lucky to be the beneficiaries of Malcolm McCallum's vision and understanding of the central role this instrument plays in petrology. We hope to see it installed by the latter half of 2024. This fall has been extra busy as I filled in at the last minute to lead our annual fall field trip, Geology 401, keeping the course close to home, given the short

planning window, through a series of day trips. My usual Mineralogy and Optical Mineralogy courses are in progress, along with the online Physical Geology course. I took the Mineralogy course to the enormous and growing Denver Mineral Show, where I was happy to meet up with a few alums, including Mariah Kuhr. I took a couple of days in October to travel down to western New Mexico to view the annular eclipse (my third central annular eclipse), where I got within ten feet of a very large, very full grown mountain lion. I am already planning on traveling to Texas for the total eclipse next year.

We truly enjoy hearing from our alumni, so feel free to email or call or stop by the department. It is always great to hear what those of you with recent (or not so recent) connections to the department are doing these days.



**Dan McGrath**  
Assistant Professor

The past year brought some exciting fieldwork opportunities for my research group, including the 2-week NASA SnowEx Campaign (>40 scientists from five countries) in Fairbanks, Alaska in March, a 3-week trip to the Sagarmatha (Mt. Everest) region



of Nepal to study glacial lakes and debris-covered glaciers in May, and two trips to Grand Teton National Park, where we conducted radar surveys to measure glacier thickness. In April, Wyatt Reis defended his M.S. thesis on aspect-dependent differences in post-fire snowpack processes and is now working as a Research Civil Engineer with the Cold Regions Research and Engineering Laboratory. We hosted the 2nd Annual Colorado Glaciology Workshop in early May at CSU – we had more than 40 glaciologists from across the state (and beyond) join for an exciting day of science updates and community building. In August, Ally Detre and Ash Khatiwada joined the research group. Ally will be working on a NASA-funded snow remote sensing project and Ash will be working on a NSF-funded project studying glacier mass balance in the Tetons. A couple research highlights from graduate students in my group include deriving snow permittivity and density from coupled radar and lidar observations (Bonnell et al., 2023) and a detailed examination of ice-dammed lake drainage frequency and magnitude in Alaska (Rick et al., 2023). On the teaching front, I taught GEOL440: Geodetic and Near-surface Geophysical Methods and GEOL554: Remote Sensing of the Earth System this past year – it's been exciting to see students apply the knowledge and skills from these courses in their research. Lastly, we'll be starting work on two new projects this year with colleagues in WCNR – a NSF-funded project looking at post-fire hydrogeomorphic change and recovery, and a Bureau of Reclamation project focused on improving snow water supply forecasts in wildfire-impacted basins in the western US.



**Sara Rathburn**  
Professor

In Spring 2023, my MS student Sarah Dunn defended her thesis on post-fire excess sediment accumulation in beaver ponds. Sarah accepted a job with the USGS Washington Water Science Center and moved to Tacoma, WA in the summer. Celeste Wieting, my PhD Student, is making good progress on another chapter of her dissertation quantifying invasive plant traits to numerically model erosion and deposition along Rio Grande in Big Bend National Park. An undergraduate geology major, Colby Carson, is completing independent research this semester helping Celeste process field based images of plants to calculate hydraulic roughness of various species as model input. I taught GEOL154 Historical Geology in the spring and used an open source textbook for the first time. The students were grateful for the money savings and seemed to enjoy the engaging and interactive format of the online book. This summer, new MS student Connor Mertz joined the Geomorphology Lab. Connor arrived on a Sunday night and was game to start field work Monday morning. His project is part of the Kawuneeche Valley Restoration Collaborative (KVRC) where

he will evaluate channel restoration potential of tributaries of the Colorado River in Rocky Mountain National Park. Connor collected a full suite of field data at one site, met many of the partners of the collaborative, saw lots of moose, elk and some evidence of beaver(!), and experienced the plethora of insects that emerge during a wet spring and summer. I also published the results of my research on afforestation and bank cohesion of Icelandic rivers with Celeste and John Kemper (former PhD student), and colleagues I met during my Fulbright in Iceland. This fall I am busy teaching GEOL192 Exploring Geosciences, co-teaching GEOL201 Field Geology of the Colorado Front Range with John Singleton, my graduate level GEOL662 Field Geomorphology class, and co-teaching GEOL601 Professional Development in the Geosciences with Jeremy Rugenstein. I'll travel to San Francisco with Celeste in December for the annual AGU meeting. If you are at the meeting, be sure to say "hi", or send an email and fill me in on your whereabouts.



Beaver dam under construction.  
Photo by Sara Rathburn





**John Ridley**

Malcolm McCallum Chair of  
Economic Geology, Associate  
Professor

Outside the usual classes and committee work, my main job this year was to finish the second edition of my book “Ore Deposit Geology” and present it to the publishers (I failed). The second edition is to be a major rewriting of the successful first edition that was published ten years ago. In addition to conceptual advances, consideration of new deposit discoveries, there has also been an evolution in which commodities are of sufficient economic interest to warrant coverage in a book. But will the new commodities remain of strong interest over the longer life span of a book? It has thus become a part of my job to keep an interest in technological developments that control use of mined mineral commodities. Will lithium be substituted in batteries, its boom market and boom in scientific work on its ores collapse, or will there be a price and demand buffer with substitution in some uses and it remain of at least of some interest?



**Michael Ronayne**

Associate Professor

In addition to my regular teaching of groundwater modeling and introductory environmental geology, I have been active on a few new research projects this year. Along with CSU collaborators from Forest and Rangeland Stewardship, grad student Billy Stansfield and I are studying changes in mountain water resources in southern Peru. For a representative basin in the central Andes, we are developing models to assess how environmental stressors including climate change and groundwater pumping are affecting groundwater-dependent ecosystems and the regional water budget. In January, we were hosted by our partners from Jorge Basadre National University in Tacna, Peru, which was a great adventure. Travel to our study area (basin floor > 14,500 feet above sea level) gave us a quick introduction to the challenge of collecting field data at high elevations! A new U.S. Army Corps-sponsored project involves the characterization of karst springsheds in the Ozark Plateau region of south central Missouri. Our project team recently completed a successful dye tracing experiment, during which we

were able to document the incredibly high groundwater velocities that occur in a karst aquifer. We plan to conduct numerical modeling to better understand how spatially variable groundwater recharge is routed to spring outlets. Also this year, I expanded my study of the Denver Basin Aquifer system by partnering with GEO colleague Jeremy Rugenstein to evaluate the applicability of water stable isotopes for quantifying mountain-block recharge into the basin aquifers. In September, we welcomed NSF postdoctoral fellow Dr. Matt Lurtz (see Matt's entry elsewhere in this issue). Matt is working on groundwater-dependent ecosystems in Colorado and Australia. We are excited to host Matt and benefit from his expertise in Bayesian statistical modeling!



**Jeremy Rugenstein**

Assistant Professor

During the past year, I have been ramping up activities related to several externally funded projects focused on understanding Cenozoic paleoclimate and Colorado hydrology. My PhD student (Thu Bui) and I have been using the stable isotopes of authigenic carbonates to constrain how precipitation and temperature changed



in the desert Southwest during the middle Miocene—a period when we think atmospheric CO<sub>2</sub> may have been as high as 800 ppm and similar to end-of-century estimates of atmospheric CO<sub>2</sub>. One of my MS students (Gaby Sanchez Ortiz) has been working to constrain the paleo-elevation of the Dinaride range in Croatia and Bosnia and has applied a very new technique—the measurement of the rarest stable isotope of oxygen (17-oxygen)—to estimate past elevations more precisely. Gaby will also transfer to working on a newly funded project to understand the past climate and elevation of the Altai Mountains in western Mongolia. This project is a large collaboration with colleagues at Lehigh University, University of California Irvine, George Mason University, and the Institute of Astronomy and Geophysics in Ulaanbaator. My other MS student (Isabella Ulate) has been busy sampling waters and installing precipitation gauges across the Front Range to understand how much water from the Front Range block recharges the Denver Basin Aquifer System. This project involves citizen scientists across Colorado, who agree to host a gauge and collect monthly samples for us. Lastly, I have developed a new graduate class about the stable isotopes of oxygen and hydrogen in waters, and this class has attracted more than 10 students across three departments. It's exciting to see growing interest in the use of stable isotopes across CSU.



**Bill Sanford**  
Associate Professor

I am continuing and developing my research project in the Senator Beck Basin in the Colorado San Juan Mountains. The main thrust of the research is to examine the potential effects of climate variability on the amount, timing, and phase of precipitation and how these changes influence groundwater recharge in high elevation, snowmelt dominated hydrologic systems. Nick Chohan, an MS student, is focusing on how this variability will affect wetland drainage, which can be a major hydrologic input to maintain late season streamflow following the main snowmelt period. I am working closely with collaborators from Watershed Science and Geography, and the Center for Snow and Avalanche Studies. In early February 2023, we organized and held a 1-day workshop in Silverton, CO, entitled “Snow Research Meets Water Resources Operations in the San Juans: Current State and Future Collaborations.” The meeting was held in a hybrid format and there were over 70 attendees.

In addition, I am convening a poster session at the Fall AGU meeting this year on “Groundwater in High-Elevation Headwater Systems: Potential Influence

of Climate Variability.” I taught one session of the Summer Geology Field Camp this year at the CSU Mountain Campus (MTC) with co-instructor Randall Bonnell, a PhD student working with Dan McGrath. The project was designed as a consultant-like investigation with the main goal of estimating the volume of water in the MTC glacial outwash valley and determine if it is viable to extract water for an imaginary water bottling plant. We used stream and well data, along with Ground Penetrating Radar (led by Randall) to image the subsurface sedimentary features and to estimate the depth to the water table. In addition, the students examined a core, collected during the drilling of the deep well, to visually see the glacial outwash that comprises the basin materials. Some of the work was cut short due to rain, thunder, lightning, and hail.



**Derek Schutt**  
Professor

Spring of 2023 was dominated by teaching my undergraduate class The Solid Earth, and a graduate class Geodynamics. I also attended a workshop in Whitehorse, Yukon Territory, where I presented our latest results on seismic velocity structure under the Mackenzie Mountains in the Northwest Territories. Later in the



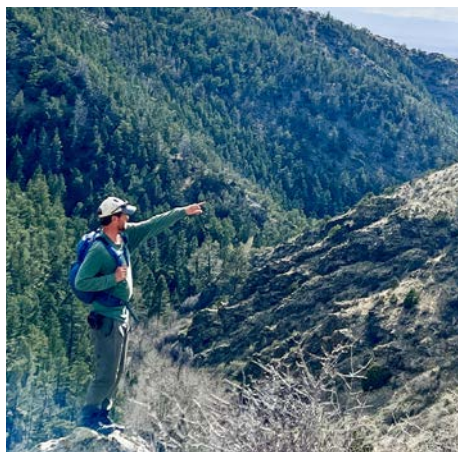
spring I also attended the European Geophysical Union meeting for the first time and met many new potential collaborators. Finally, I also went to the Carnegie Institution of Washington to collaborate with an international team working on how best to map seismic velocities in the mantle to temperature. It turns out the details are quite complicated!

In the summer, I started a yearlong sabbatical, and kicked it off with some work at the University of Bristol, UK. Here I have used a seismic phase called Pn, that travels just below the base of the crust, to begin to map out temperature variations in southern Europe. The rest of my sabbatical I will be at the University of Iceland, working with petrologists and geochemists to figure out the temperature of the Icelandic mantle plume.

I had four graduate students working with me in the spring. Abdalaziz is working on Pn tomography of Saudi Arabia, where he has a tremendous data set. Sherif is working on crustal thickness variations in Greenland, where he will apply this and Pn wave measurements to figure out the heat flux into the base of the glaciers here. This is important in that it is poorly known, and an essential input into models of glacial retreat and sea level rise. Tomalika is working on S-wave tomography of western Canada, in the hopes we can map out the boundary between the lithosphere and asthenosphere, which has implications for the formation of the Cordilleran-Craton boundary. Finally, Kivanc is working on shear wave splitting of southwestern Canada. This should tell us about the lithospheric evolution and asthenospheric flow in the area. I would also like to welcome Josh to our group. He just started in August and is already an active member of our research group.

This fall, I intend to work on calculating seismic wave velocity variations from the Pn phase in the North Atlantic, the Mackenzie Mountains, Anatolia, and use this to infer the temperature of the plates in these regions. From temperature, we can infer the strength of the lithosphere, which will explain why some regions deform and others don't. I also am working on inferring the velocity variations due to compositional changes among mantle xenoliths, in the hope we can use seismology to figure out how composition varies in the upper mantle.

What excites me the most, however, is our faculty-wide collaboration to design a new undergraduate curriculum. We have already made tremendous progress, and I think the undergraduates will love it.



**John Singleton**  
Associate Professor

2023 kicked off with fieldwork in central Chile, where I finished structural data collection in coastal exposures of a Jurassic plutonic complex that records multiple episodes of ductile and brittle deformation. I taught Structural Geology (GEOL 372) in the spring semester and helped organize the successful Geological Society of America Rocky

Mountain section meeting at CSU in May. I also co-led two field trips for the meeting (to Red Mountain Open Space and the Horsetooth Reservoir area), which were a lot of fun. This summer I taught two weeks of field camp (GEOL 436), including a mapping and stratigraphy-focused project in Cañon City and the usual Lime Creek mapping project near Silverton. This was the 8th time I have taught the Lime Creek project, but I am continuing to learn new things and am nowhere close to getting tired of the geology and scenery of this spectacular area.

Our research in the Sangre de Cristo Range in southern Colorado continues to yield exciting results. MS student Sammy Malavarca spent several weeks this summer mapping complexly deformed Pennsylvanian Minturn Formation in the footwall of a major thrust sheet in Great Sand Dunes National Park. Sammy's work in this area and other areas has demonstrated that much of the range underwent significant Oligocene magmatism, metamorphism, and heterogeneous penetrative deformation prior to the onset of regional extension in the Rio Grande rift. MS student Miriam Primus joined our Sangres research team this summer and will be looking at Laramide and Oligo-Miocene mylonites exposed along the western flank of the range. There is still plenty to learn!

This fall I taught Advanced Structural Geology (GEOL 572) and a seminar on the Proterozoic to Cenozoic tectonic development of the Rocky Mountain region, and I co-taught Field Geology of the Colorado Front Range (GEOL 201) with Sara Rathburn. Sammy and I were able to sneak in a few trips to the Sangre de Cristos for fieldwork, and at the GSA annual meeting in Pittsburgh I gave a presentation on discrete brittle-plastic shear zones in Arizona's metamorphic core complexes.



## FACULTY AND STAFF



**Lisa Stright**  
Associate Professor

**Teaching:** During the Fall of 2023, I am teaching GEOL124: Geologic Natural Resources and GEOL344: Stratigraphy and Sedimentology. It has been an honor to work with both our non-major general science students and our majors in these two classes. PhD student Omar Ghamedy is the lab instructor for sed/strat and I am grateful to my friends and colleagues (Dr. Brian Romans, Virginia Tech; Dr. Steve Hubbard, University of Calgary; and Dr. Amy Weislogel, West Virginia University) for openly sharing their curricular materials. I don't anticipate this to be a permanent teaching assignment, but I have enjoyed teaching the class and seeing this part of our curriculum. Last Spring I took a teaching sabbatical to reflect on how to translate my upper-level courses (Reservoir Characterization and Modeling, Petrophysics and Well Logging, Petroleum Geology) to topics that are more attractive and relevant

for students earlier in our curriculum. My goal in creating a new class is to focus on providing students with technical skills that they can put on their resumes and to teach students the critical role applied geology will play in the energy transition. In the Spring of 2024, I will teach a 300-level Geologic Subsurface Reservoirs course that will cover where reservoirs occur, how to evaluate reservoir presence and quality, and appraise reservoir potential. The class will focus on natural subsurface reservoirs that hold fossil fuels, water, and mineral brines; how reservoirs can be used for strategic storage of water, gas, or hydrogen and provide space to sequester CO<sub>2</sub>; and offer renewable energy options (e.g., geothermal). Additionally, I will be teaching 1-credit data analytics course where students will explore databases and data dashboards (Spotfire, PowerBI, Tableau) to teach students how to communicate with data.

**Research:** We are currently in the second year of phase 4 of Chile Slope Systems (CSS) with 4 confirmed (and 1 pending) sponsors. My co-PIs and I will be heading into the field in early March to lead an affiliate fieldtrip to look at the deepwater slope strata in the Cretaceous outcrops of Patagonia in southern Chile. In the Spring of 2023, Luis Carlos Escobar Arenas defended his MS on near wellbore modeling of deepwater channels. Luis Carlos joined the Quantitative Clastics Laboratory at the University of Texas Austin for a PhD. Pat Ronnau will finish in the Spring after completing an internship with ExxonMobil over the summer of 2023. 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**  
University Distinguished Professor

This has been a productive year for our group. Emily Iskin and Juli Scamardo successfully defended their PhD dissertations in the spring, and Mickey Means-Brous successfully defended her MS thesis. Emily is now a post-doc at Boise State University, Juli is a post-doc at the University of Vermont, and Mickey works for the environmental consulting firm Wolf Water Resources. Continuing students Aaron Katz, Anna Marshall, and Shayla Triantafillou had successful summer field seasons. Aaron is examining the ongoing sedimentation along the Poudre River associated with the 2020 Cameron Peak Fire and 2021 Black Hollow debris flow. He is collaborating with fish biologists to quantify loss of fish habitat and potential flows needed to re-mobilize the sediment. Anna continues to investigate the ways of water and wood, primarily at Montana's Swan River, but she also received a CUAHSI Pathfinder Grant and had a chance to examine water-logjam

interactions in the Butokama-betsu River in Hokkaido University's Experimental Forest in northern Japan. Shayla is working in multiple small, burned catchments in the 2020 Cameron Peak Fire area, examining potential sources of geomorphic



## FACULTY AND STAFF

resilience to the floods and debris flows that followed the fire. MS student Katie Larkin joined the group in Fall 2023 and will be monitoring the ability of post-assisted log structures to enhance geomorphic recovery in burned catchments in the 2020 fire area. (Yes, we're on fire now.)

I am on sabbatical for the 2023-24 academic year!!! (hysterical punctuation is warranted) I started by trying to set some kind of record for conference attendance: the Gordon Catchment Science Conference in Vermont (June), the International Conference of Fluvial Sedimentology in Italy (July), the National Stream Restoration Conference in Maryland (August), the Brazilian Symposium of Geomorphology in Brazil (August), Scientific Advances in River Restoration in England (August), and the Ecology and Civil Engineering Society meeting in Japan (September). Other people go clubbing, I go conferencing. I hope to eventually reconcile with my long-suffering legs and back, which are ready to petition Congress to legislate more humane airplane seats. (not to mention reconciling with long-suffering Naia the Cat)

The remainder of the sabbatical will mainly feature some writing assignments that I have committed to, including an AGU book on wildfires.



Advanced Structural Geology class collecting fault data at Horsetooth Reservoir.  
Photo by John Singleton





Phillip Kondracki and Colby Carlson check out the Niobrara Formation in Grape Creek, Colorado.  
Photo by Madeline Ferguson



# 2023 DEI Highlights

by Dan McGrath and the DEI Committee

It's been an active year for our Diversity, Equity, and Inclusion (DEI) Committee on numerous fronts. We organized two department G.E.O.D.E. trainings in the past year. In spring 2023, the workshop focused on inclusive syllabi, with a keynote from Dr. Lisa Dysleski in the College of Natural Sciences, and this fall, our training focused on developing a community-written field code of conduct. Our committee is working to incorporate all of the great ideas and feedback gathered during this event to draft a shared code for department field trips. Members of our department participated in a URGE



(Un)learning Racism in the Geosciences) seminar and developed a set of recommendations to advance DEI efforts in the department. Graduate students in the department developed GAAP this past year, a free mentorship program designed to assist prospective students, including those from under-represented and non-traditional academic backgrounds, navigate the graduate application process. The program was quite successful in its inaugural year and has been launched again this fall. We've also been meeting with geosciences contacts at local community colleges along the Front Range to establish more direct connections between our institutions and students. Lastly, we have a new department DEI website to share updates on our activities and related resources. Check it out at <https://warnercnr.colostate.edu/geosciences/diversity-equity-and-inclusion/>

# DEPARTMENT PUBLICATIONS

Using Google Scholar, we have set up a Web interface that automatically tracks Geosciences department publications. For a comprehensive and timely look at what the department-affiliated authors have been publishing, or for links to specific papers of any date, please visit: [warnercnr.colostate.edu/geosciences/geo-publications](http://warnercnr.colostate.edu/geosciences/geo-publications).





# GRI: Products for You and the National Park Service

The Geologic Resources Inventory (GRI) was established in 1998 by the National Park Service (NPS) to meet the NPS need for geologic mapping and related information. From the beginning, Colorado State University has been part of the GRI to ensure products are scientifically accurate and utilize the latest in GIS technology.

The target audience of the GRI is park resource managers, but GRI products—GIS data, GRI reports, geologic map posters, and graphics—are geologically relevant, interesting, and publicly available at <https://www.nps.gov/subjects/geology/geologic-resources-inventory-products.htm>. Consequently, everyone—including CSU alumni, faculty, staff, and students—can use these products for lectures, papers, trip planning, and courses such as Introduction to Geology-Parks and Monuments (GEOL 110) or Geology of Natural Resources (GEOL 124).



The GRI team primarily consists of CSU research associates from the Department of Geosciences and NPS staff from the Geologic Resources Division. Standing, left to right: Jason Kenworthy [NPS program lead], Derek Schutt [CSU PI], Trista Thornberry-Ehrlich [CSU, MS 2001], Jim Chappell [CSU, BS 1997], Stephanie O'Meara [CSU; BS 1992, MS 1997], Matt Harrington [CSU], Thom Curdts [CSU, MS 1993], Ron Karpilo [CSU], Tim Henderson [CSU], and James Winter [CSU, BS 2015]. Kneeling, left to right: Amanda Lanik [University of Alaska, Museum of the North], Sofia Shuler [NPS], Michael Barthelmes [CSU, MCOMM 2022], Katie KellerLynn [CSU], Cullen Scheland [NPS], Sharon Perrone [Natural Resources Conservation Service/NPS partner], and Suzanne McKetta [CSU, MA 2014]. Not pictured are Rebecca Port [NPS Report Team lead] and Eli Crocker [CSU intern].



## GIS Data

GRI GIS data (“digital geologic maps”) reproduce all aspects of traditional paper maps, including notes, legends, and cross sections. Bedrock, surficial, and special purpose (e.g., coastal or geologic hazard) maps may be used by the GRI to create GIS data to meet park needs. The GRI GIS data provide a consistent format for users to combine with other geospatial data to better understand the role geology plays in park ecosystems and landscapes. These data allow geologic information to be easily viewed and analyzed in conjunction with other types of resource management information. If new, more accurate geologic maps become available or if software advances require an update to the digital format, the GRI team updates the data. In addition, the team consistently updates its many custom tools and scripts for working in GIS.

## Brooks Range

A member of the Map Team who focuses on parks in Alaska, Ron Karpilo’s favorite GRI map project is the Brooks Range, which includes Cape Krusenstern National Monument, Gates of the Arctic National Park and Preserve, Kobuk Valley National Park, and Noatak National Preserve. Originally completed in 2017, Ron updated the project in 2023. Ron says, “My favorite part of the project was the sheer size of the map area. It spanned a significant portion of the Brooks Range and covered approximately 32,131 km<sup>2</sup> (102,406 mi<sup>2</sup>) which, if it were a state, would be the ninth largest in the US, ranking just behind Colorado.”



Index map of the Brooks Range GRI GIS project, compiled by Ron Karpilo.

## Dinosaur National Monument

Leading the Map Team, Stephanie O’Meara’s favorite GRI map project is Dinosaur National Monument. It was the first large project that she managed back in 1999–2000. In all, 17 quadrangle maps and a compiled park and vicinity map were part of the project. Stephanie says, “None of the 17 source maps were digital and thus I had to set up each map project to be digitized using the four interns at the time—Jenny Adams, Jerome Walker, Abbey Abley, and Eileen Ernenwein. While managing, performing data quality control, and compiling the maps, I learned quite a lot about the park’s geology: the east–west trending Split Mountain anticline and major faults, the extensiveness of the Oligocene Bishop Conglomerate on the flanks of the mountain range, and where the Cretaceous and Jurassic dinosaur fossil-bearing units are in the park.” In 2023, Stephanie managed the update of the GRI map project for the monument.

## Pinnacles National Monument

A member of the Map Team who originally hails from Northern California, Jim Chappell’s favorite GIS map project is Pinnacles National Monument. Jim says, “Unfortunately, I have never been to this park but have driven past it many, many times on Highway 101 as I was traveling from Northern to Southern California and back—in a way, retracing the journey the rocks of Pinnacles traveled along the San Andreas Fault to their present location.” Piecing together the GIS data—which comes in two different scales, a 1:100,000-scale dataset that gives some context of the local geology and contains fault, fold, and landslide features, and a 1:24,000-scale dataset that was derived from a master’s thesis providing good detail of the Pinnacles volcanic field—connected memories and hopes to visit the monument one day.



### Yellowstone National Monument

In 2020, the GRI team engaged in a GRI GIS project with a dual mission for Yellowstone National Park. The primary objective was to create a comprehensive geospatial database, offering a detailed inventory of the park's geologic features while helping park staff address specific resource management challenges. The team compiled 34 of the best available source maps from the US Geological Survey and the Montana Bureau of Mines and Geology. These maps encompassed scales from 1:24,000 to 1:125,000 and were created over a span of more than 50 years by many different authors. This compilation process posed a considerable challenge due to variations in quality, scale, and geologic interpretation. Despite these challenges, the project not only showcased the team's expertise in delivering an effective geospatial database for park management but also extended its impact.

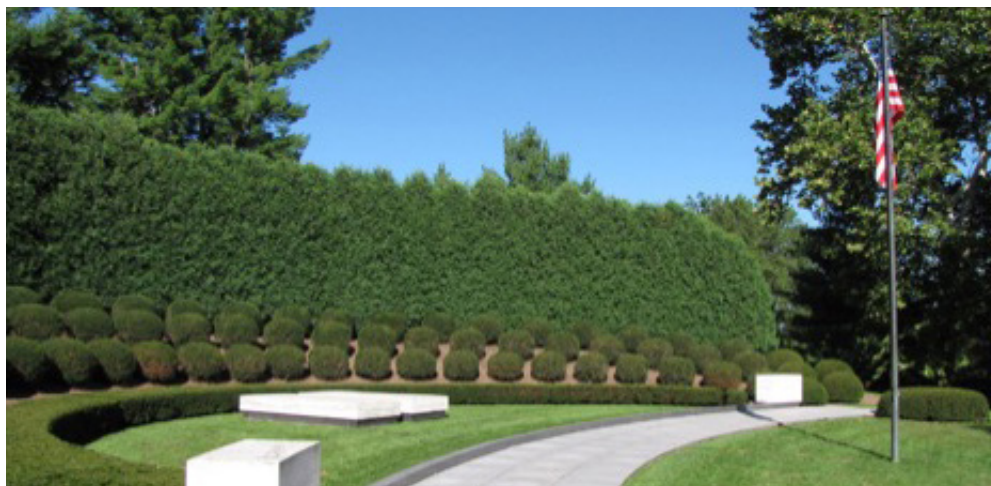
Simultaneously, the team provided another geospatial database to researchers at Montana State University, initiating efforts to address inconsistencies across map boundaries. This collaborative approach, involving diverse perspectives and expertise, is what makes this project James Winter's favorite. James says, "It underscores the power of teamwork and a shared commitment to advancing geospatial knowledge."

### GRI Reports

GRI reports are based on the most accurate, up-to-date geologic mapping known at the time of writing and compile and summarize park-specific geologic information and research. In some cases, GRI reports are the only place where geologic information has been compiled for a park unit. GRI reports are written with park management in mind and make connections among a park's geology and its purpose, significance, fundamental resources and values (many of which are geologic features and processes), and interpretive themes.

### Herbert Hoover National Historic Site

A member of the Report Team, Michael Barthelmes' favorite part of working on GRI reports is exploring the connections between park stories and geology, especially at NPS units that may not be thought of as "geology parks." The best example of this is Herbert Hoover National Historic Site in Iowa. At first glance this birthplace, final resting place, and presidential library are not exactly geologic highlights—the only exposed stone is the Vermont marble of the Hoovers' graves. But at a closer look, the history of Herbert and Lou Henry Hoover is rooted in geology. The Hoovers both graduated from Stanford University with degrees in geology, and Lou Henry was the first woman to do so. As accomplished linguists, they collaborated to translate *De Re Metallica* from Latin to English; their translation remains in print as the standard English version. Before entering public service, Herbert Hoover worked as a mining geologist in China and Australia and is the only US president to have been a professionally trained geologist. Michael says, "Finding and sharing these surprising geologic connections to park stories is absolutely the highlight of my work with the GRI."

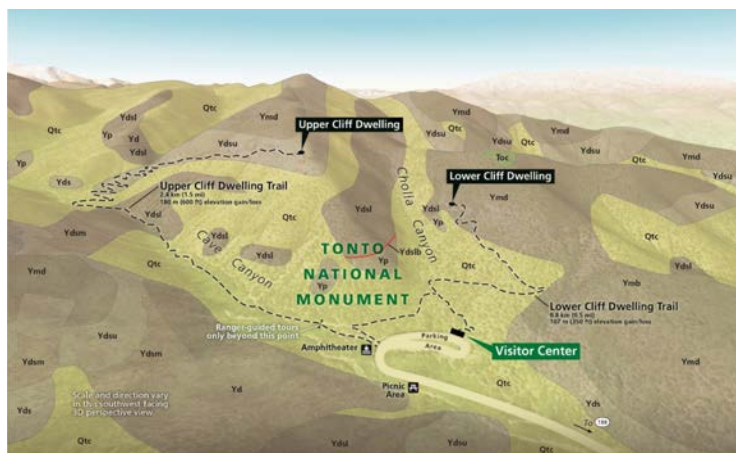


Grave site of Herbert Hoover and his wife, Lou. The grave markers are made from Vermont white marble. NPS photograph by Steve Lonergan.



## Graphics

Trista Thornberry-Ehrlich creates many of the graphics used in GRI reports. Regarding her favorite, some she finds aesthetically pleasing, others make her proud because of their use beyond the GRI; however, one graphic—geology draped over a 3D park map of Tonto National Monument—stands out. She says, “I liked the widespread collaboration that went into it, the fact that it uses our GRI GIS data in an interesting way, and it was really challenging to produce. It also just looks ‘NPS-y’ and yet wholly original at the same time.” Notably, since the 1950s, park managers, interpreters, and the park literature reported that both the Upper Cliff Dwelling and Lower Cliff Dwelling were in the Dripping Spring Quartzite (map unit Ydsu). However, along with geologic mapping by the Arizona Geological Survey, producing the graphic revealed that only the Upper Cliff Dwelling occurs in the quartzite. The Lower Cliff Dwelling occurs in the Mescal Limestone, dolomite (Ymdl). This change influences the interpretation and understanding of cave formation at the monument.

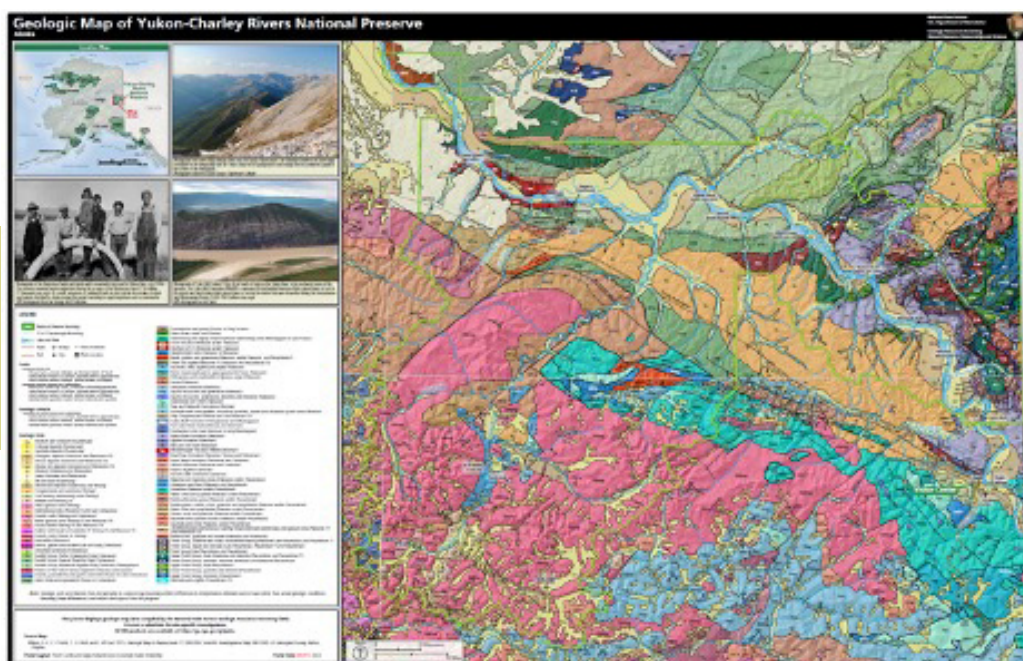


GRI graphic (figure 10) in the report about Tonto National Monument in Arizona, prepared by Trista Thornberry-Ehrlich.

## Geologic Map Posters

Leading the creation of geologic map posters, which are based on the GRI GIS data and are a companion to the GRI reports, Thom Curdts’ favorite GRI poster is of Yukon-Charley Rivers National Preserve. Thom says, “From an aesthetic perspective, it is beautiful to look at. The map elements are balanced, and the colors and patterns of the geologic units are varied, intricate, and draw me in visually. From a cartographic perspective, the complexity of the geology and the number of smaller geologic units were a challenge to label sufficiently while communicating the geologic information without having the layout become too cluttered.” In addition, Thom likes that the poster includes some photos that “breathe life” into the geology and geologic heritage, especially for the non-geologist.

Geologic map poster for Yukon-Charley Rivers National Preserve, Alaska, compiled by Thom Curdts and Kajsa Holland-Goon.





## Stratotype Inventory Project

The NPS stratotype inventory project (<https://www.nps.gov/subjects/geology/nps-stratotype-inventory.htm>) is a systematic effort to document the occurrence of stratotypes exposed within, partially within, and near NPS administrative boundaries. Some particularly recognizable examples (and their stratotype assignments) include the Paleoproterozoic Vishnu Schist (Vishnu Canyon in Grand Canyon National Park, Arizona), the Lower Cambrian Harpers Formation (Harpers Ferry National Historical Park, West Virginia), and the Late Cretaceous Whitney Granodiorite (Mount Whitney in Sequoia and Kings Canyon National Parks, California).

According to Tim Henderson, a principal investigator of the stratotype inventory project (as well as a GRI report writer), the stratotype inventory project “represents an important component of the GRI because these designations are vital to geologic heritage (‘geoheritage’), possessing important scientific, historic, educational, cultural, and aesthetic values.” To date, the NPS stratotype inventory has compiled more than 700 stratotypes distributed across the continental United States, Alaska, Hawaii, Guam, American Samoa, and the US Virgin Islands. The GRI is currently working toward producing both geospatial and non-geospatial products that encompass information about stratotypes throughout the National Park System to guide NPS decision making and promote conservation.



Serpentine Hot Springs in Bearing Land Bridge National Preserve, Alaska, is near the type locality of the Cretaceous Donatut Granite Complex. Photograph by Matt Harrington.



## The Department of Geosciences would like to thank Department Head Rick Aster for his continuous support and dedication, and wish him the best of luck on his future endeavors

"Rick, Thank you so much for your tremendous leadership, professionalism, and dedication to the department. Your door was always open and your constructive can-do attitude helped advance the department in so many ways. Best wishes in your future endeavors both in the department and beyond!"

**Dan McGrath**

"Thanks for your leadership and especially your support of the young faculty. There was no one better than you at helping guide me through CSU as I started, calming me down if I got frustrated, and generally lending an ear whenever I needed to ask for advice or help."

**Jeremy Rugenstein**

"Thank you for 10 years of dedicated, hard work for the Geosciences Department. I particularly appreciate your unfailing support and encouragement of students, faculty, and staff. We are a stronger, more cohesive department because of your leadership."

**Sara Rathburn**

"Rick, I have the highest respect for you and appreciate your support and encouragement through the years. You have given so much time and energy and patience steering this crazy department, through good times and bad. You always let me be myself and I always knew you had my back, and that is a rare and wonderful thing. Thank you for everything Rick, you're the best."

**Patti Uman**

"Rick, thank you for your outstanding leadership, mentorship, and consistent support of faculty, staff, and students. You have done a terrific job as Department Head!"

**John Singleton**

"Rick was great to work in the field with."

**Derek Schutt**

"Best of luck, Rick. Your life can only become more relaxed and enjoyable once you finish trying to herd cats!"

**Ellen Wohl**

"Rick, a huge thank you for juggling so many balls for so long; you're a master of multi-tasking. Our facilities, alumni relations, visibility, and development efforts, to name a few, have all taken major steps forward under your leadership."

**Jerry Magloughlin**



Photo by Derek Schutt



Dan McGrath prepares for a ground penetrating radar survey of Middle Teton Glacier, Wyoming  
Photo by Wyatt Reis





## DEPARTMENT HONORS, AWARDS AND SCHOLARSHIPS

### Undergraduate Students

**Pablo Aguedelo:** The Geology Field Camp Scholarship

**Brendan Auer:** The Geology Field Camp Scholarship

**Tucker Chapin:** The Geology Field Camp Scholarship

**Devin Clary:** The Geology Field Camp Scholarship

**Eli Crocker:** The Geology Field Camp Scholarship

**Noah Dayton:** The Geology Field Camp Scholarship

**Adam Edwards:** The Geology Field Camp Scholarship

**Madeline Ferguson:** Michael Smith Scholars in Geosciences, Chris Lidstone and Kate Laudon Scholarship in Geosciences

**Rocko Fillweber:** The Geology Field Camp Scholarship

**Emily Hofer:** John and Delores Goodier Scholarship in CNR, Chris Lidstone and Kate Laudon Scholarship in Geosciences

**Kajsa Holland-Goon:** Undergraduate Explorationist Scholarship, Chris Lidstone and Kate Laudon Scholarship in Geosciences, The Geology Field Camp Scholarship, Tobacco Root Geological Society Field Course Award

**Kyros Kasner:** The Geology Field Camp Scholarship

**Phillip Kondracki:** The Geology Field Camp Scholarship

**Cristina Lindenberg:** Michael Smith Scholars in Geosciences

**Palmer Littleton:** The Geology Field Camp Scholarship

**Mitchell Mannino:** The Geology Field Camp Scholarship

**Olivia Montoya:** Salonee Kharkar Memorial Scholarship, Thomas A. and Anne L. Shepard Diversity Scholarship

**Haakon Nordrum:** Steve and Gail Kloppel Scholarship in Geosciences

**Meaghan Pascual:** The Geology Field

Camp Scholarship

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

**Adam Rang:** The Geology Field Camp Scholarship

**Andrew Ruatti:** Chris Lidstone and Kate Laudon Scholarship in Geosciences

**Logan Seymour:** Undergraduate Explorationist Scholarship

**Brad Streets:** The Geology Field Camp Scholarship

**Hannah Yakimisky:** The Geology Field Camp Scholarship

### Graduate Students

**Victoria Arnold:** Roger and Luanne Steininger Fellowship

**Abigail Axness:** GSA Graduate Student Research Grant, Thomas A. and Anne L. Shepard Diversity Scholarship, Geological Society of America Donald R. Coates Geomorphology Student Research Award

**Thu Bui:** GSA Graduate Research Grant, EcoCore Method Development Grant, CO2Proxy Integration Project Grant, WCNr Class of '73 Scholarship

**Omar Ghamedi:** Geological Society of America Outstanding Structural Geology and Tectonics Division Student Award

**Aaron Katz:** Hill Memorial Scholarship, Ware Geosciences Fellowship, Colorado Riparian Association Award

**Sammy Malavarca:** Class of 73 Scholars Scholarship, Roger and Luanne Steininger Fellowship

**Anna Marshall:** Marie Morisawa Graduate Fellowship, AGU Horton Research Award, CUAHSI Pathfinder Fellowship

**Elisa McGhee:** Liniger Honor, Service and Commitment Scholarship, Office of the Vice President for Research Graduate Fellowship, Earthscope Distributed Acoustic Sensing Research Community Network Field Experience Travel Grant, CSU Graduate Student Council Conference Travel Grant,

Geodetic/Seismological Facility for the Advancement of Geosciences Workshop Travel Scholarship, American Meteorological Society Annual Meeting Travel Grant, Pat Tillman Foundation Scholarship

**Connor Mertz:** Warner Graduate Research Assistant Award

**Ana Perez:** Larry Kent Burns Scholarship

**Gaby Sanchez Ortiz:** GSA Graduate Student Research Grant

**William Stansfield:** Oscar and Isabel Anderson Graduate Fellowship, Chris Lidstone and Kate Laudon Scholarship in Geosciences

**Shayla Triantafillou:** Colorado Riparian Association Graduate Scholarship, Rocky Mountain Association of Geologists Bolyard Family Scholarship, American Water Resources Association, Richard A. Herbert Memorial Scholarship, Hill Memorial Fellowship, Schumm Graduate Scholarship

**Isabella Ulate:** Lipman Research Award

**Camilla Warden:** Robert L. Stollar Scholarship in Hydrogeology, Bohart Conservation Scholarship

**Celeste Wieting:** WCNr Student Success Scholarship

**Lucas Zeller:** Evelyn I. Clark Scholarship

### Faculty

**Rick Aster:** Harry Hess Distinguished Professorship (Fall 2024), Princeton University; Gordon Moore Distinguished Scholar (Spring 2025), Caltech

**Malcolm McCallum:** Warner College Distinguished Emeritus Award

**Derek Schutt:** Next Generation Visiting Researcher, University of Bristol. Fulbright NSF Arctic Research Fellowship

**Ellen Wohl:** Fellow of the British Society for Geomorphology



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Your gifts provide critical support to our students and programs and elevate the department's teaching, research, and outreach.

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Mike and Lou Steppe

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Bob L. Stollar

Tara Tafi

Tommy Thompson and Peggy Arps

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Thomas L. Woodzick

Thomas S. and Lois G. Woolsey

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American Chemical Society

American Endowment Foundation

American Geophysical Union

Brogdon Foundation

City of Fort Collins

Colorado Geological Survey

Colorado Open Lands

ExxonMobil Foundation

Gates Frontiers Fund

Geological Society of America

NASA

National Park Service

National Science Foundation

Society of Economic Geologists

Stillwater Sciences

Trout Unlimited - West Denver Chapter

University of Nevada

U.S. Forest Service

U.S. Geological Survey

The Virginia W. Hill Foundation

Walton Family Foundation

Wolf Water Resources

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### Mitchell Mannino

"Thank you so much for your contribution, my parents and I really appreciate you all taking the time to read through my application. I am really looking forward to field camp starting in the next couple of weeks! Again, thank you so much for your donation, I am extremely grateful for your gift!"

Field Camp Scholarship

### Devin Clary

"I am writing this in the hope all of you are well and with the intent to thank you for the scholarship money you have provided to me for geologic field camp 2023. The money will be used to pay for necessary food and equipment for the five-week course length. This money is absolutely critical for me and my colleagues to complete our geological degrees. With this in mind please accept my most heartfelt thank you from me and my fellow students for your financial support."

Field Camp Scholarship

### Tucker Chapin

"I cannot thank you enough for your generous support. I have been studying geology intensely for years now and I truly believe I have found my passion. However, my family and I are worried about the financial burden of field camp. I literally jumped with excitement when I received your email that I was accepted to receive your scholarship. With this I will be able to afford field camp and the gear I need to spend weeks in the field. I'm honored and floored. Thank you so much. I am eternally grateful."

Field Camp Scholarship

### Kajsa Holland-Goon

"Thank you so much for giving me the chance to save some money on this capstone opportunity within such an amazing major. I have been looking forward to field camp since my Freshman year and hadn't truly looked at the cost until this year and realized I had to figure something out. This scholarship is a big help for me to afford the program as an out of state student. Thank you for playing a role in making this crucial part of geology education a little bit more accessible."

Field Camp Scholarship

### Meaghan Pascual

"I would love to give the biggest thank you for gifting the Field Camp Scholarship! It truly is amazing to be gifted this gift and it really helps make it easier to attend field camp. I am truly grateful because being an out of state student, it is twice the amount for me to attend field camp than it is for in state students. I am very excited for field camp and for all the memories and knowledge that I will experience and learn. Thank you so much for investing in not only my field camp experience, but also my future as a geologist."

Field Camp Scholarship

### Brendan Auer

"I would like to extend my gratitude for the scholarship money awarded to me for the CSU Field Camp in 2023. This will be the last course of my undergraduate studies, and the money makes the transition between college and post-graduation significantly smoother. This money will be used for tuition, as well as to help offset the costs of food and gear that will be incurred in preparation for, and during the course. More specifically, it will allow me to get the proper gear needed to make for a successful field camp experience, without needing to take out significant loans for tuition and other expenses."

Field Camp Scholarship



### Palmer Littleton

"I would like to sincerely thank you for your donation to the scholarship fund. As a profound experience in a geologist's educational journey, it is important that all field camp participants are able to enjoy and learn from their experience without having to be worried about financial hardship. Your graciousness does just that. Again, I thank you and hope that you will continue to donate in order to help other students have a successful field camp experience."

Field Camp Scholarship

### Andrew Ruatti

"I would like to thank you for your generosity in funding the Katharine E Compton Scholarship that I received this summer for field camp at CSU. I am honored to receive this award, in which allows me to have enough funds to attend field camp this summer without taking out a loan. Due to your generosity, I will have the opportunity to participate in field camp in which will be an essential part of my path on becoming a geologist in the future. I am very excited for the opportunity to go to field camp the fun memories it will provide."

Katharine E Compton Scholarship

### Hannah Yakimisky

"I would like to thank you for granting me the Geology Field Camp Scholarship. It is an honor to receive this scholarship and have the opportunity to use this generous contribution to further my education. As an out-of-state student from California, attending Colorado State University has been one of the best choices I have made. The excellent Geology program has greatly impacted my learning; this upcoming summer, that experience will only further my understanding and abilities. As I advance my education and skills, this scholarship will allow me to continue through this program, and I am very thankful for this generous gift."

Field Camp Scholarship

### Eli Crocker

"Thank you so much for supporting my academic journey with your generosity. I greatly appreciate the gift that you have provided, not just to me, but to many other students as well. I will definitely be more secure financially because of your help this summer."

Field Camp Scholarship

### Pablo Agudelo

"I want to begin by thanking you, the donors, for considering me worthy of the scholarship. This scholarship has lifted a great amount of weight from my parents' shoulders who have been carrying me financially through college. As much as my parents are grateful for this, I am even more as you have alleviated and assisted in helping the most important people in my life. With this scholarship I'll be able to acquire gear and food for the camp to ensure I am rested and fed so I can properly succeed in this task."

Field Camp Scholarship

### Kyros Kasner

"I would like to extend my sincere gratitude for your contribution to this scholarship fund. The money that I will be receiving will greatly benefit me and my field camp experience. This scholarship provides a great financial relief for me, as I was concerned about having the necessary savings to feed myself and take care of my pet during the course."

Field Camp Scholarship



### Noah Dayton

"Thank you so so much for this scholarship! It will be incredibly helpful for my success this summer, and assists me greatly in affording my continued higher education and passion for geology. I will work diligently during field camp to honor this award."

Field Camp Scholarship

### Philip Kondracki

"Receiving this scholarship has not only provided financial assistance but has also instilled in me a sense of validation and encouragement. Knowing that there are individuals like you who believe in my potential and are willing to invest in my education has motivated me to strive for excellence in all aspects of my academic and personal life.

The financial burden of pursuing higher education can be daunting, but your generosity has alleviated a significant portion of that burden for me. This scholarship will help me cover travel fees, purchase necessary textbooks and supplies, and relieve some of the financial stress that often accompanies a college education. Thanks to your support, I can fully focus on my studies and make the most of the educational opportunities presented to me.

Beyond the financial aspect, your scholarship has provided me with more than just monetary aid. It has served as a reminder of the power of compassion and philanthropy. Your act of giving has inspired me to give back to my community and help others in need when I am in a position to do so. I promise to honor your generosity by working diligently to achieve my academic goals, being actively involved in extracurricular activities, and striving to make a positive impact on society.

I would be remiss if I did not acknowledge the tremendous impact this scholarship will have on my future. By easing the financial burden, you have opened up doors of opportunity for me. I am now able to focus solely on this upcoming summer's field studies without the stress of travel looming over me. Your investment in my education will undoubtedly contribute to my personal growth and enable me to make a meaningful contribution to society in the future.

Thank you once again for your generosity and belief in my abilities. Your support has made a significant difference in my life, and I am eternally grateful."

Field Camp Scholarship



Thanks to the generous donations made to the Field Camp Scholarship, many students were able to attend Field Camp in 2023



## THANK YOU FOR SUPPORTING CSU GEOSCIENCES

Your philanthropic support as a friend of the department is critical to our students and programs.

Kindly consider making a tax-deductible contribution to the Geosciences Department at:

<https://advancing.colostate.edu/GEOSCIENCES>

You may also contact us at:

**WCNR\_GEO\_Info@Mail.ColoState.EDU;**  
[970] 491-5661, or by reaching out to the Department  
Head at: **rick.aster@colostate.edu;** 970 491-7606.

Contributions by mail may be sent to Colorado State University Foundation, P.O., Box 1870, Fort Collins CO 80522-1870 (kindly specify that your contribution is for the Department of Geosciences).

We particularly like to highlight our *Geology Field Camp Scholarship*, *Tommy B. Thompson Economic Geology* fund, and the *Petrological and Materials Laboratory* fund; contributions to the *Geosciences General Fund* are also always most welcome.

Should you have other specific giving interests, please contact the department or Director of Development Danielle Young at [m.danielle.young@colostate.edu](mailto:m.danielle.young@colostate.edu).

*Thank you!*





## ADDITIONAL LINKS



Adam Rang measures the strike and dip of a fault found in a road cut outside of Silverton, Colorado.  
Photo by Madeline Ferguson

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Colorado State Flower (Rocky  
Mountain Columbine)  
Photo by Rick Aster







## COLORADO STATE UNIVERSITY

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