

Pε Basement

THE COLORADO COLLEGE GEOLOGY DEPARTMENT



**2023-2024
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Cover photo:
A remote camping spot in Ruby Mountains, Nevada
GY316 Field Analysis of Geological Structures
Block 3, 2023-2024

Taken by Mingxi Hu

The Precambrian Basement
2023-2024

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Greetings from the Geology Department!! It has been another great year, and we have much to be proud of! Christine Siddoway, who shepherded us through the last three years as chair of the department, has stepped down and headed off to be on sabbatical. She did such a great job and is now resting up...well, not exactly...she's still going like a bat out of hell but is recharging her batteries for when she returns. Much thanks to her for the remarkable amount of energy that she put into chairing the department!

The big news this year is an addition to our family, specifically, Sarah Schanz's family. Arthur was born on April 25th, and he is a real cutie! There are rumors that Trevor and Sarah are now fighting over whether Arthur will be a geomorphologist or glaciologist, but there is still time for him to decide for himself!

Our two most recent hires are quickly becoming established members (and future leaders!) of the department. Sarah had a successful 3rd year review (as we expected), and then had a half year sabbatical and maternity leave. She is now finishing off research papers and returning to her normal teaching schedule, which the students will no doubt be happy to hear. Michelle Gevedon is undergoing her 3rd year review this year. Time flies! She has pulled off a remarkable feat of submitting a \$1.2+ million instrumentation grant to the National Science Foundation (NSF) for a research-grade field emission scanning electron microscope. Writing a grant of this magnitude is an enormous and ambitious effort (many months of work), and it is rare for a small liberal arts faculty member to pull this off, particularly in the first three years of one's career. Both Sarah and Michelle have had a wonderful start to their career, and we are excited for their futures.

As mentioned above, Christine Siddoway is on sabbatical but working as hard as ever. She is continuing her Antarctica work, including long sessions collecting geochronological data at the Laser-Chron Center at the University of Arizona. By now, they have probably set aside an office just for her! Henry Fricke continues to be his exceptional self, teaching great classes, inspiring students, and working on a wide range of exciting Mesozoic to Cenozoic Earth history problems. Oh yeah...and resting up for when I hand the Chair's job back over to him in a few years!

For the second year in a row, we have been privileged to have Tyler Grambling as a full-time visiting faculty member. We suspect that he will receive an offer for a tenure-track job soon, and if so, part of us may be secretly relieved since he has better class reviews than the permanent faculty! Tyler has brought an injection of intellectual excitement to the department because his broad background has allowed all of us to find things to discuss, and work on, with him. We are also excited to say that Tyler's wife Nadine will be teaching a class for us this spring.

The last two years brought an end of an era and new one to the fore. After decades, our colleague and friend Steve Weaver has finally hung up his spurs in 2022. We owe Steve a great debt for having been our Technical Director through a lot of changes. His expertise in computers, equipment, research instruments, photography, etcetera has served us well since the 1990's. His big shoes were ably filled (in February 2023) by our new Technical Director Elizabeth Erickson, who comes to us as a newly minted Ph.D. from University of California, Santa Barbara. She is a dynamo with a penchant for organization, and she is whipping the department facilities, and all of us(!), into shape. Under her leadership, the department has completely revamped our facilities in the Tutt Science Center, which will shortly have a fully functional mineral separation facility (no small feat). We look forward to working with her for the years to come!

We keep in touch with our recently retired colleagues, particularly Eric Leonard who has kept an office in the department. He is still working on geologic problems, publishing papers, and keeping active in his field. Jeff Noblett stops by the office on occasion, and he appears to be enjoying his retirement. A few health problems slowed him down for a bit, but he is now in fine fettle and is fully capable of keeping up with his grandkids!

Finally, the most important person in our department — the one who keeps it all running — Mandy Sulfrian. Year after year she has managed to keep our mangy group of faculty on the straight and narrow, which is no easy feat. If there is a better Administrative Assistant at this college, it would be news to us! She is not just leader of our department, but a leader amongst the staff across the college. This is a banner year for Mandy because it is her 20th at Colorado College. Feel free to congratulate her for this achievement!

This last year the department graduated 13 majors. The seniors had to suffer through a Regional Geology class in Hawaii, but somehow made it through unscathed! [I wish I had gone to CC]. The senior class completed a wide array of original research and did a fine job presenting their research at Geology Day; it was one of the best collection of talks in recent memory. Students also presented their work at both regional and national geological meetings. We are grateful that our Buster Student Research Scholarships and the Brian Hannigan Fund also supported students this last year; we are deeply grateful for this support.

Department faculty continued their work on a variety of research projects. Funded research projects took faculty and students to locations around the world. Four members of the department conducted research funded by National Science Foundation grants, and many had students involved in the work. The department also had an active speaker series, with many great talks. Well, that's about it. Please remember that we are always pleased to hear from alumni, and when you come through town, be sure to stop by the Department and say hello.



Beartooth Butte in Wyoming Photo by Mingxi Hu



PAUL MYROW
(Sedimentology/Stratigraphy)

Another great year in the Geology Department at Colorado College. After returning to Colorado from my sabbatical in May 2022, I have returned to duty, teaching classes, and doing research. I am in the final year (extended) of an NSF grant with my colleague Nigel Hughes (UC-Riverside) and CC alumnus Blair Schoene (Princeton) aimed at the geology of the ancient continent Sibumasu, which includes parts of Myanmar, Thailand, and southwest China. Late fall in 2022, I helped organize and run a research conference and associated field trip in Thailand associated with our UNESCO International Geoscience Program project “Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamic”. My colleagues and I ran a multi-day field excursion on Tarutao Island, a global Geopark. It was fun to be back in Asia after a Covid-induced hiatus. This past December I also took a trip to Cambodia to look at rocks that have barely been studied. We are going to date ash beds in a pile of rocks mapped as “Cambrian to Silurian”. If, as we suspect, they are Cambrian, then this will be the first report of verifiable Cambrian rocks in the country.

Over the last year I have traveled to Payson Arizona five times to work with Bob Gaines, a Pomona College professor, on the Tapeats Sandstone, a Cambrian Formation like the Sawatch Sandstone of the Colorado Springs area. Gaines and I have a paper in review with the Proceedings of the National Academy of Sciences based on this work, in which we propose that animals colonized freshwater environments on land >70 m.y. earlier than presently accepted.

I published two papers with a group of CC students and colleagues at Yale, Washington University, IUP, Nanjing University, and a Welsh national museum. The second author on both

papers is my ex-thesis-student Michael Hasson, who is presently completing a Ph.D. at Stanford. Two other CC students (George Fowlkes and Gerry Ramirez) are also on the papers. One of these is in the journal *Geology*. I also had two publications in 2022, and one paper in press, with recent alumnus Mingxi Hu, who is presently our paraprofessional. These publications came out of our work on Devonian rocks in Wyoming and Montana, including Hu’s senior thesis. One paper also has an ex-thesis-student Woody Fischer (CC ’00) from Caltech as a co-author. Hu is the first author on the paper that is in press with the *Geological Society of America Bulletin*, a significant achievement for a young scholar.

A paper was published with another of my past thesis students, Anne Hakim, who graduated in 2015, as well as a Chinese researcher, Jitao Chen, who had three short stints as a postdoctoral fellow with me at CC ~8 years ago. I also published a paper on ancient reefs in China with Chen in 2023. Finally, I have one paper published and another in press with a colleague from UC Riverside and one from University of Bonn, Germany based on trilobite specimens that I collected with my Historical Geology class from the Pennsylvanian Minturn Formation of central Colorado. Finally, it was a great pleasure to give a talk at an SEPM Research Symposium in Houston, TX co-organized by Jon Rotzien (CC ’07). It was great to see that Jon is thriving in the petroleum industry.

On the home front, all is well. Natalia and I are enjoying life, including lots of travel. I expanded my family of cars when I purchased a 1965 Plymouth Barracuda. It has been fully restored ~20 year ago, and it is beautiful. I have continued my learning of Spanish, albeit slowly. That’s about all for now. Please keep in touch!



Sarah Schanz
(Geomorphology)

Happy New Year! It's been a couple years since the last PCB, and there is just so much to share!

Research in 2022 started off strong with a week-long field excursion to the Oregon Cascade Range to investigate how bedrock rivers meander (a phenomenon mostly studied in alluvial channels). Together with collaborators from Indiana University, Zhilin Shi '23, Piper Kent '23, and I crawled, waded, and dug our way across the Smith River. Highlights include inventive techniques to sample from the base of a too-narrow pit (see picture) and dating the oldest terrace along the Oregon Coast Range; over the next year, we'll gather more geochronologic data to investigate how sediment supply and terrace meandering evolved over the late Pleistocene. We followed up this field work with a trip to Bloomington, Indiana, where we were joined by Luca Espinosa (EV '23). We used the Indiana supercomputers to simulate bedrock river evolution, while also checking out local bedrock rivers and limestone caves.



Zhilin Shi ('23), showing how to extract sand samples from narrow soil pits.

Working on a completely different timescale of 10s rather than 100,000s of years, Piper Kent '23 and John Byers '23 helped collect another year of data on Mesa Creek in Sondermann Park to add to the dataset we gathered in 2022 with Fiona Swope '22 and Ren Carroll '22. We documented an increase in grain size and vegetation since 1938, which has completely altered the geomorphic behavior of Mesa Creek – our findings were presented to the Colorado Springs Department of Parks, Recreation, and Cultural Services in a technical report – and we are continuing to monitor the creek as it responds to construction of Centennial Boulevard. Luckily, the Rototap we use for analysis has been moved to a quieter section of Tutt Science Building, so we are no longer disrupting every classroom in Palmer with our work!

GY320 Landscape Processes & Evolution (aka Geomorphology) returned to the Sangre de Cristo range in fall 2022 to investigate the legacy of glaciation on rivers. Building on the North Crestone Creek dataset from 2021, we hiked up South Crestone Creek to measure discharge and grain size. Our equipment tried to foil us; after lugging them up 1300 ft elevation gain, the flowmeters stopped working and our GPS units couldn't get a robust signal! Luckily, we MacGyvered a velocity meter (orange peels and phone timers) and ended up with a good dataset documenting the stream's ongoing efforts to break down glacial debris.



GY320 attended the 2022 Geological Society of America Annual Meeting in Denver, CO.

The datasets built by GY320 inspired further work in the region, and Michelle Gevedon and I just had a Keck project funded to investigate the sources and transport of dust near Crestone, CO. Michelle will use forensic geology techniques to match the geochemistry of sand in the San Luis Valley with bedrock in North and South Crestone Creeks, while I'll be examining how the rocks physically break down in rock tumblers and in the field. We're looking forward to carrying out this work in summer 2024 with 10 rising sophomores! (and if you know any students who are interested, please encourage them to apply at keckgeology.org)

In June 2022, I joined an ongoing project investigating the effect of mentorship on the persistence of undergraduate women in geoscience. This is a completely different style of research than I am used to (requiring an IRB and all new training to work with human subjects), but so rewarding. My main role is to help organize and support student participant workshops that focus on building mentorship networks and creating unique pathways to a geoscience career. I travelled to College Station, TX; Atlanta, GA; and Fort Collins, CO, for workshops and we are working on more workshops in the Los Angeles and Washington, DC, regions.

In other new avenues, I became the Communications Coordinator for the Quaternary Geology & Geomorphology division of GSA, which means I lead social media efforts, update the website, and write and publish our newsletters (including re-learning InDesign, last used in my days as high school newspaper illustrator). If you are interested in surface processes in the last 1.8 Ma, I highly recommend following us on social media: @GSAQGG for Facebook and @qgg_gsa for Instagram.

I fulfilled a personal dream to visit Iceland in June 2022, and was ecstatic to see waterfalls (and river terraces) in person that I'd only read about in papers! We missed any active eruptions, unfortunately, but still had a blast exploring the unique geology.

If you've paid attention to the dates, you may have noted a lack of activity in 2023...and that can't be blamed on my spring 2023 sabbatical. Joyously, in April 2023, we welcomed baby boy Arthur! He's an absolute thrill to spend time with and is just about to start crawling and wreaking havoc on our house.



Photographing the Selfoss waterfall and 6 ky river terraces that may have formed due to a series of jökulhlaup floods!



Christine Siddoway
(Structural Geology)

I finished my “term” as Chair of Geology last July, passing the (figurative) sceptre to Paul Myrow. The culminating successes, at the conclusion of the three years, were the hirings

of Elizabeth Erickson as Technical Director, and Tyler Grambling as visiting assistant professor; both have plunged in wholeheartedly to their new roles and are making enormous contributions. And throughout the time it was a pleasure and privilege to work with Mandy, due to her deep knowledge of the functioning of CC, true heart of gold, and fun sense of mischief. Thanks, Mandy, you’re our #1!

I’m very grateful to now be on sabbatical during ’23-’24, so that I can devote myself to the colossal geochron and thermochron datasets that are accruing from work on West Antarctica bedrock geology and landscape evolution. The two NSF grants that support this are entering their final year, so it’s time to synthesize, address data gaps, and write! It’s extremely motivating that both projects center upon the region undergoing the most rapid ice sheet retreat, and to be investigating rock clasts transported to sea by icebergs! (That aspect, I wrote about in the 2022 PCB newsletter.) CC undergrads have contributed mightily to the acquisition of “multichron” data over the past three years: in part as conventional theses, but also in a somewhat pioneering fashion as students who enrolled in “CUREs,” or course-based undergraduate research experiences. A genuine aim of the CURE approach is to attract students from groups who’re not typically aware of or not finding access points to Earth Sciences or polar research. (Spelling this out: Students regularly make individual choices about course selection, but research opportunities usually are privileged opportunities offered

by discerning faculty who selected top-performing students from courses.). The adventurous students who chose to join research in the context of a class traveled to University of Arizona to use instrumentation in the Arizona Laserchron Center and Arizona Radiogenic Helium Lab, gaining new skills and a basis of understanding of West Antarctica’s geological and ice sheet history. Colleagues in the ALC and ARHL have been supreme partners on the CURE offerings, joining forces three times (two CC courses, and another at UA, over three years). Together, the CUREs served students >60% from groups underrepresented in STEM; and possibly those will feel encouraged to pursue more opportunities in earth or cryosphere sciences in years to come.

One more newsworthy item about past students whose thesis research centered on Antarctica, by way of the NSF ROSETTA-Ice project (2017 to 2021): Four of them completed graduate degrees last year, in 2023! In the PhD category are Matt Tankersley ’18 and Gina Jozef ’18, and coming up strong with MSc degrees are Alec Lockett ’17 and Skye Keeshin ’18. Sam Elkind ’16 just preceded them, with MSc in Computer Science in 2021. Kudos to you all!

Recreationally, hiking with dogs on our local trails often devolves into bushwhacking up to extreme terrain that exposes some new Tava sandstone exposure or another. There continue to be so many puzzles, it can be hard to banish from my mind. But there’s continual progress – thanks to new collaborations with CU colleagues, the age of 660 Ma is securely established for the local ‘oddity’ of the sandstone dikes in our area. That signifies that they formed during a Snowball Earth event, and may be North America’s only ‘inboard’ sediment record from that time. What’s more, a load of evidence now combines to show that the sandstone formed and dikes intruded in conditions of overpressure beneath the ice sheet. The faithful, strong Labradors Pearl and Bessie have done their part on Tava field discoveries, and Pearl, especially (R.I.P.) would have approved of the hydraulics.



Henry Fricke
(Geochemistry)

Hello Everyone!
It has been a long time since my last update, and with the parapros standing outside my door it's high time I get

back into the swing of writing them.

I'll start by saying that the last couple of years have flown by, with lots of changes, some tweaks, and many things staying the same. In the realm of teaching, the last two years have seen a mix of old and new. On one hand, it has been great to get back into the classroom, and it has been particularly great to get back to teaching and learning on the outcrop. On the other hand, ongoing health concerns have made it a challenge to plan extended stays away from campus, and camping out with classes is something I haven't done in over four years (this is a strange thing for me to write and I imagine it is a strange thing for many of you to read!). As a compromise I've been taking advantage of the Baca campus to teach a central Colorado-focused CC100, which is our new version of FYE. Teaching first-years remains one of my very favorite things to do, and I still remember meeting so many of you during your very first blocks at CC. Other teaching highlights include developing a version of introductory geology (GY150 as opposed to GY140) that has a hazards & resources focus (again with a central Colorado focus), co-leading a Regional Studies trip to the Island of Hawaii with Michelle (so much basalt...) and finally developing a soils-focused version of Geochemistry that I am truly excited about (it only took me 23 years...).

On the research side of things, I have remained engaged in the study of terrestrial environments & ecosystems of the late Cretaceous through early Eocene. New and ongoing collaborations are focused on: i) dietary behavior of theropod dinosaurs (did tyrannosaurs eat spawning fish ala Grizzly bears?? I think so!), ii) the three-di-

mensional structure of ancient forests (e.g. openvs closed-canopy), iii) dietary changes in (small!) mammals immediately after the K-Pg extinction event, and iv) identifying and describing the Paleocene-Eocene Thermal Maximum in the San Juan Basin. Much of the heavy lifting (i.e. grant and manuscript writing) is done by undergraduates, graduate students and other colleagues who suffer the wrath of my Red Pen, as I still struggle to find and dedicate time to writing manuscripts of my own (although I continue to give presentations as AGU, GSA etc.). I still hold out hope that I'll someday be able to focus more on writing, with Eric providing a fine example of how research productivity can spike after retirement (go Eric!).

Away from CC, Erin and I are officially empty-nesters (except for the dog and cat). Eli is about to graduate from Colby College (anyone have job for a Political Science major with an interest in law?? we do not want him coming back to the nest...), while Annaliese is finishing up her second year at Williams College where she is focusing on Environmental Studies, Spanish and volleyball (BTW she could also use a summer job). Erin and I find ourselves doing a lot more traveling, whether it is to see the kids, or other family, or other parts of the world both near (e.g. Crested Butte, Cuchara, Denver, Santa Fe) and far (e.g. Sicily, Denmark, Spain). All of this naturally gets us thinking about next steps, but this will be the topic of some later PCB update; in the meantime I hope all of you are happy and well, and I looking forward to seeing you the next time our paths cross! Take care, Henry



Michelle Gevedon
(Geochronology, Crustal Formation, Ore formation with skarns, Igneous Petrology)

Kia Ora! (Hello! in Te Rao Maōri, the language

of the Māori people). We kicked off 2023 with 6 weeks of fieldwork in the Nelson, Marlborough and Tasman regions of Aotearoa New Zealand for an NSF grant funded following our last PCB publication in last 2022. The fieldwork was exciting and took us through the densely vegetated sub-tropical regions of the northern most portions of the Aotearoa New Zealand's southern island. Along with collaborators from the University of Texas at Austin and the University of South Carolina we climbed Dun Mountain (the type locality for dunnite!), explored the northern exposure of the Alpine fault (the tectonic boundary between the Pacific Plate and the Australian plate), hired fishing boats to take us to remote bays in the Tasman Bay and on Rangitoto ki te Tonga/ D'Urville Island. Some of this fieldwork involved relying on the types of plants growing to determine what geologic unit we were in, swimming to outcrops, visiting important Māori quarries and geological locations, and working in the company of exotic and beautiful birds! The Dun Mountain Ophiolite and associated mélanges in these regions of New Zealand host a some-what-rare rock type—rodingite—which form via metasomatism during serpentinization. The Roding River, included in our study, is also the type locality for rodingites. Because minerals commonly found in serpentinites are generally poorly suited for geochronology and to serve as fluid-source proxies, our research group is using rodingites to understanding the timing, fluid sources and tectonic history of serpentinization and obduction of the Dun Mountain Ophiolite belt. (Not to worry, fun and relaxation was also had when husband Steve showed up at the end of fieldwork just in time to take in some (geological) sights, including an overnighter on a ship in Milford Sound, a stay on an alpaca

farm, sheep shearing lessons, and a visit to the Tongariro Crossing.) Several CC students are involved in this quest to better understand the globally significant process of serpentinization. During this process we have learned to use the CC Chemistry and Biochemistry Department's newly acquired Raman spectroscope, and students will travel to UT Austin this summer to measure oxygen, strontium, calcium stable isotope ratios, as well as measure U-Pb ratios in rodingite garnet for geochronology!

In teaching news, this year's Block 5 GY310 (Petrology and Origins of Earth's Crust) class had an exciting overlap with PY357 Astrophysics – through NASA's educational loan program GY310 spent time investigating lunar samples acquired through the Apollo sample return missions – we got to directly study moon rocks! The mineralogy and petrology of the moon is interesting because although there are limited mineral phases, the lack of volatiles makes for very clean and pristine mineral phases without alteration—They are BEAUTIFUL! And they are excellent subjects for studying the mineralogical and textural evidence of fractional crystallization processes! The astrophysicists taught the petrologists about stellar nucleosynthesis and how planets form; the petrologists taught the astrophysicists how to interpret minerals and textures in thin section with the goal of understanding that mineralogy is the manifestation of the chemical composition of the moon. It was great fun!

And as if writing about visiting two type localities wasn't enough, summer 2024 brought a long-awaited (read: pandemic-delayed) visit to the blueschist type locality on the beautiful isle of Syros, Greece in the Aegean Sea. Technically, we visited for a good friend's wedding, meeting up with many other friends along the way for an amazing trip eating every treat that Greece had to offer. But, we definitely squeezed in a quick visit to Syros including the famous Kini and Azolimnos beaches to finally see the blueschist outcrops I've been working on for the past few years – partner Steve has had enough petrology on his vacations this year, and I have promised to subject him to fewer rocks in the

2024-2025 school year. Αγτίο! (Farwell in Greek!)



Tyler Grambling
(Visiting Professor/
Structural Geology/
Tectonics)
Hi Everyone!

I'm thrilled to be in the department for another year while wading into thesis projects and teaching upper divisions! It's been a wonder-

ful year so far. I kicked it off with a successful Natural Hazards course. I followed that up with Field Analysis of Geologic Structures with a great group of juniors and seniors who didn't mind spending a few snowy November nights in the Ruby Mountains of NE Nevada to map spectacular mylonites. I'm gearing up to teach Investigating Earth as a Physical System with Sarah in Block 5 and Rock Deformation and Structure of Mountains in Block 8.

Beyond the classroom, I've been busy working with Lachlan McCallum ('25) to better understand the strain history of the Ruby-Humboldt detachment for his thesis project and helping Pierce Hayton ('24) translate his Summer '23 Keck project into his thesis. I was also honored to convene a GSA session this past Fall honoring the career of my PhD advisor, Micah Jessup. The session was successful enough that myself and a few other close collaborators of Micah's are developing a complementary thematic collection for Journal of the Geological Society of London. I was excited to finally submit a pandemic side project using stable isotopes in aqueous sulfate to decipher the sulfur cycle in cordilleran orogens to Chemical Geology.

I'm looking forward to seeing what the spring semester brings and spending more time outside!



Students exploring the Mollie Kathleen Gold Mine, CO
GY203: Natural Hazard
Block 1 2023-2024



Elizabeth Erickson
(Technical Director)
Hello! For most of you, I will be an unfamiliar face as the department's new Technical Director, or "the new Steve Weaver" as I am often introduced.

Having only started at the beginning of February 2023, I am somewhat still in the chaos stage of familiarizing myself with the campus, the department, and our numerous lab spaces and instruments, all while taking on projects. Fortunately, my undergraduate degree in Geology at Cornell College has already prepared me for life on the block schedule!



So far I have been working on reimagining how to better integrate the research needs of our newest faculty, Michelle and Sarah, into the various lab spaces. We are making big changes in Tutt Science to create a full mineral separation lab optimized for crushing rocks and condensing different mineral separates for geochemical and geochronological analyses. This excitingly includes some new instruments in the department that can separate mineral concentrations through density and electromagnetic susceptibility. Additionally, we are reorganizing spaces in Tutt Science and Palmer Hall to better facilitate instrument use in courses for more hands-on stu-

dent learning opportunities! As an obsessively organized person, I am also taking stock and reorganizing each one of our spaces to create more accessible systems with lots of labels and laminated signs. No nook or cranny will be safe from my meddling (perhaps to some chagrin!).



Outside of the department, I moved here from California where I recently finished my doctoral program at UC Santa Barbara. My current research focuses on the timing and evolution of Precambrian through early Paleozoic magmatism



in the Transantarctic Mountains of Antarctica using geochemical and geochronological techniques. However, my broad background also includes experience in the Oil and Gas Industry as both a field geologist and manager in charge of the training and safety of the field geologists, in the

Agricultural Experimentation Industry creating a methodology for aerial-scale quantification of evapotranspiration rates in corn crops, and several academic research opportunities in marine invertebrate paleontology and paleoecology. My passion for learning new things and figuring out how to unbreak instruments is what drew me to the Geology department at Colorado College.

I am also a Colorado native, and I am so excited to be back in my favorite mountainous playground! No matter the season, COS promises many adventures as I explore the trails, sights,

and eateries. I look forward to some explorations accompanied by my kitten, Boots, who is leash-trained and often seen peeking out of his backpack while riding around on my motorcycle. His curiosity has already led to several jaunts around the department while he seeks out napping places, belly scratches, and mischief.



ing companies. But otherwise, we work on our house and enjoy having him home year round for the first time in 45 years!

Hope all is well with you. Give a holler when you're in Colorado Springs or on campus. I'd love to see you and catch up!

Please come say hello whenever you are in the department! I will gladly give a tour through the changing lab spaces



Mandy Sulfrin
(Administrative Assistant)

It's been a busy year in the Precambrian Basement of Palmer Hall – time flies and another year is beginning! Hard to believe. We've had such a big cold snap,

as much of the country, and the wind is the worst. Can't wait for springtime!

Charlie and I had some travels here and there this year. I went to Texas twice to spend time with my sisters – one time I drove and the other time I flew. I prefer driving! We went camping in South Dakota in July to camp with our son and his family. It was so beautiful in the Black Hills and we enjoyed all the sights! Then we went to Maine to our property in September. The leaves hadn't changed yet so I think next time will be early October. Charlie retired in July, although he says he's unemployed and I say he's retired. He's been looking for some contracting work, especially writing 43-101 Technical Reports for min-



Picture of me and grandson, Grayson, at a CC hockey game



Eric Leonard
(Geomorphology)

OK, now I'm more than four years into this retirement gig! Enough time that I've missed an entire generation of CC students. I think that now Mingxi is my only former student still on campus. Well, no, actually.

Prof. Mike Tabor in Education and Registrar Phil Apodaca were also students of mine.

Anyway, since it has been some time since I last wrote an update for the PCB I'll try to catch you up. As it did to almost everyone else, COVID disrupted a lot of our plans, especially for retirement travel. We've finally outgrown our COVID anxiety and in the last year have taken a spring trip to Greece (to observe and celebrate Orthodox Easter on Hydra and to hike and dine our way through the Pindos Mountains in the northern part of the country), and a winter trip to England for an intense ten days of immersion in the London theatre scene. Great to be back travelling again -- and yes, I did get COVID on returning from Greece. We've also taken a couple of road trips out to northern California, my old home turf, as well as to Oklahoma(!) to visit the Bob Dylan and Woody Guthrie Centers. The next big planned trip, a year from now, will have me as the faulty leader on a CC alumni trip to the Antarctic Peninsula.



Retired though I am, I haven't stopped working on research on glaciation and paleoclimate. This past year, along with alums Alex Robertson, Ed

Crawford, and Ben Mackall I published papers on the results of our glacial chronology, modeling, and paleoclimate work from the Santa Fe Range in New Mexico and in the Wyoming Medicine Bows. The next paper, a synthesis of our glacial modeling work along the entire crest of the US Rockies and a comparison with climate model output, currently has ten CC alums as co-authors. That will be a record for me.

Beyond continuing research and now-restarted travel, I've spent time transcribing a huge stack of (about 1000) World War II letters my parents sent to each other when he was in the South Pacific and putting them together as a book for the family. Interesting to get to know my parents as a young couple.

Lisa, also retired, is being even less successful at retirement than I am – in the sense that she keeps herself even busier than I do. I can't get her to slow down. Julia is still in Washington, DC and just bought a co-op apartment. Ack, our daughter a home owner! Susan moved to San Francisco in late 2022. Her apartment is on Alamo Square (you know that famous photo with the "painted ladies" Victorian homes in the foreground and the downtown skyline in back), about a mile and a half from the house I grew up in. She loves it there (especially the great food!) and has become, like her father, a die-hard 49er fan.



Eric geologizing in northern Greece



Jeff Noblett
(Igneous & Metamorphic Petrology)

Greetings,
I continue to enjoy retirement. Certainly, the grandkids provide the annual highlights.

This year our vacation trip with them involved piling them into a minivan to spend a week in northern New Mexico that included a dawn balloon ride, hike around the Albuquerque volcanoes (horned toads and snake provided comic relief from discussion of spatter cone development), and a lovely walk down the Bandelier National Monument trail to the Upper Falls and cross-section of a maar (though I needed knee shots and a fancy knee brace to take the kids down one of my favorite trails (when I got maudlin over my knees and likelihood this was my last hike here, my granddaughters immediately volunteered to clear the trail and take me down in a wheelchair in the future)). We are hoping to take them to Hawaii this summer and have already assigned a PBS video on Kilauea for homework. I still enjoy reading current articles on volcanoes and the new wealth of techniques used to study them. In other moments, I read philosophical works, new ideas on education, and devour older British mysteries. I continue to practice drawing with pencils, creating black and white sketches of landscapes (mountains work well, water is harder). In September, my siblings came out to Colorado for an early (by three months) celebration of my 70th birthday and two days poking around the fabulous Denver Gem and Mineral show.

It is wonderful hearing about the new developments and directions in the department. I really appreciate Christine's efforts to sustain and grow the Noblett-Witter internships and hope students will continue to benefit from these for years to come. It's a delight to hear how well our students are doing.

I strongly recommend that any of you who are interested in how the Block Plan was created, and its sometimes tortuous progress over fifty years read Professor Susan Ashley's "The Block Plan: An Unrehearsed Educational Venture". She is an extraordinary writer who has captured the promise and challenges of one of the great educational experiments of which you all were a part! Check the CC Bookstore for copies. I finish with existential ponderings (think Jean Paul-Sartre's No Exit play) in this sign found at the end of the street on which Jenny and I live:



I continue to wish you all well in your endeavors.

Obituaries

Worth Freeman '47 1920 — 2015



Four Generations of Freedmans sitting on their stoop with Worth Freeman '47 holding his great granddaughter.

Worth Freedman '47, lived a full life and passed in 2015. Worth joined the marines in 1941, then left to get a degree in geology at Colorado College. Through his work as an exploration geologist, he was able to support and raise a loving family in Arvada, CO, where he could pursue a passion in gardening. The department thanks Worth for his service, and sends warm wishes to the entire Freedman clan.

The following are words from his son, Frank Freeman:

When he was 19 years old, he was the oldest of 3 kids and his father had recently passed. In the spring of 1941 [age 21] knowing that a war was looming over the horizon, he joined the United States Marine Corps and sent most of his pay home to his mother to help support her and his younger brother and sister.

He found himself on Guadalcanal for 72 days and fought through the fiercest battles one could imagine. They were without supplies for the most part and at one point were nearly starving to death,

all had malaria and they were down to 15 rounds of ammo per man.

Neither he nor any other marines there had no concept of living through the ordeal at that point. Admiral Bull Halsey heard of their plight and sent supply ships in to finally reinforce them.

In his older age I asked my father, when he realized that he might actually survive at least for the time being, what he thought he would do with his life if he made it through the rest of the war.

He replied: "I knew exactly what I wanted to do. I wanted to get married, have a family, become an oilman and have a big garden I could work in without anybody shooting at me."

And that is just what he did. He received his Master's Degree in Geology from Colorado College and went on to become the Exploration Manager for Phillips Petroleum. After 28 years he left Phillips to become a partner in a small independent firm. He helped put two major fields on the map in Texas during his tenure at Phillips, and completed several smaller wells in North Dakota as an independent and partner.

We grew up at the city limits of Arvada and with 1/3 of an acre, he had the biggest garden in the neighborhood.

He faced the end of his life with courage, bolstered by two sons, four grandkids and one great granddaughter, all of whom loved and respected him dearly.

I believe Colorado College helped him to achieve his goal in life, and it might be nice to know that Colorado College helps change lives in a very positive way.

Thank you for that.

Sincerely,

Frank Freeman

David Byer Nash 1948 — 2023

David Byer Nash, a distinguished alumnus of Colorado College, passed away on February 19, 2023, at the age of 74. After graduating from Colorado College in 1970, David went to Ann Arbor, Michigan and earned a Ph.D. from the University of Michigan. He joined the faculty of the Department of Geology at the University of Cincinnati in 1978. He founded the University's CV Theis Groundwater Observatory, later renamed the Theis Environmental Monitoring and Modeling Site (TEMMS), situated along the Great Miami River. This research facility is dedicated to monitoring both the river and the adjacent aquifer, aiming to detect and assess potential threats to the environment and public health. Over the years, he became a revered figure and eventually retired as Professor Emeritus in 2015.

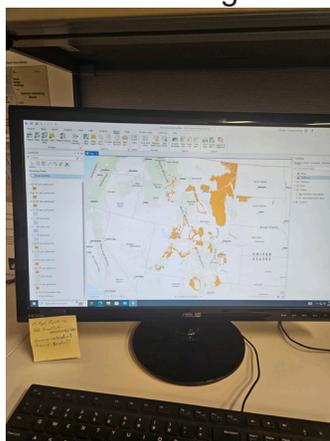
During his retirement, he took pleasure in leisurely activities, such as reading on the porch, refining his grilling skills, and constructing robots. David was preceded in death by his parents Leonard K. and Ava Byer Nash. He is survived by his loving wife Ruth Anne Van Loon; his devoted sons, Nathan Nash and daughter-in-law Andrea Evans of Chicago, and Samuel Nash of Cincinnati; his cherished sister Vivian Nash and brother-in-law Jeffrey Sklar of Brookline, MA; his adored nephew Aaron Sklar and niece Shana Sklar and their families; and cousins and in-laws who greatly loved him.

Summer Student Research 2023



Hello! My name is Charlie Hite (she/her), and I'm a geology major graduating May 2025. I am delighted to share a brief account of my experience as a Noblett-Witter intern last summer at the Denver Museum of Nature and Science:

I worked with Curator of Geology, James Hagadorn, on many tasks ranging from organizing specimen collections to paleogeographic mapping and even spending a week in North Dakota digging up dinosaurs! My big summer project was working on the museum's long-term project of making paleoenvironmental maps focused on Colorado and the surrounding states for the past 550 million years. I think of these maps as Google Satellite-view just many millions of years ago! While there are paleoenvironmental maps available, they don't have clear sources for their interpretations and frequently require purchase. Accessibility can be a limiting factor in many scientific disciplines, and with this project, we hope to provide a model for data accessibility and transparency. Along with my fellow CC intern and friend, Grace King '23, we



used ArcGIS Pro to make these maps by starting with just the sedimentary outcrops that will later be used to interpret the paleoenvironment. I have taken several GIS classes at CC, and it's a skill I want to pursue in not only my senior thesis project with CC Professor Michelle Gevedon, but also a future career in geosciences!

I was also able to work on many other projects within the Earth Sciences Division while at the DMNS. One such project was a week-long field trip to Marmarth, North Dakota with the Paleontology team July 2nd-8th! I went with all the other CC geology interns as well as other undergraduate interns from around the country. We had a blast spending the days covered in dirt and nerding out about rocks. In addition to the fossil bones we found, I enjoyed spotting the living creatures such as many toads, snakes, and even a pair of owls! Additionally, I had the opportunity to collect aquatic fossils and dinosaur bones from the Hell Creek Formation which contains the dinosaur inhabitants of the Western U.S. right before the extinction event. I became close friends with everyone there, and the trip reminded me how incredible the geologic community is.

Another project I worked on was organizing a recently donated collection of conodonts with Grace King. Conodonts are an extinct group of eel-like vertebrates that lived roughly 500 mya-200 mya. Due to their abundance around the world, conodonts are extremely useful in dating rocks. Only their tiny teeth are preserved in the fossil record which meant Grace and I spent a lot of time looking through microscopes at them, and whenever we had extra time during the day we organized the collection.

One of my favorite things about the internship were the community engagement opportunities. One such opportunity was the annual DMNS Member's Night where I set up an amber viewing station. I loved being able to teach the kids and adults alike about science. It was particularly great to see how excited the kids were to be using the microscope themselves to find the ancient bugs trapped inside the amber. Another community engagement event I did was Science

on the Spot which gave Grace King and I the chance to present our paleoenvironmental GIS maps. Museum patrons were excited to hear about what we did behind the scenes as geology interns, and I enjoyed practicing my ability to relate scientific concepts to a general audience. I think my biggest career takeaway from the internship was getting to practice my GIS mapping skills and expand my network of mentors. My biggest personal takeaway is undoubtedly all the friends I made and memories of the times we laughed until we cried.

I want to give a huge thank you to the Noblett and Witter families for this opportunity!

- Charlie Hite



This summer, I interned at the Minnesota Geological Survey (MGS) and worked with drill cutting sets from a recently discovered ancient meteor crater located in Dakota county, MN.

The goals of my work this summer were to pho-

tograph the drill cutting samples, make detailed descriptions of the sample sets from both inside and outside the crater, to decode the stratigraphy from within the crater sets, and to use a pXRF to test the elemental compositions of each sample set. In order to learn more about Minnesota geology, my work started with descriptions and analysis of the sample sets outside of the crater. Each of these cuttings sets had a depth of around

1,000 feet and were organized into envelopes of 5 foot intervals. Once I finished descriptions of the cutting sets from outside of the crater I started to work on the cutting sets from inside of the crater. These sample sets were shorter than the previous sets - only reaching a depth of around 700 feet - and the stratigraphy was more difficult to decipher due to the mixing and reorganization of the formations upon impact.

Some of my most interesting finds during this process included medium-coarse shocked quartz sand grains, overturned bedding, and obsidian fragments located in a 5-foot quaternary interval. Once my descriptions were complete I learned how to use the pXRF and with the help of my supervisor, Julia Steenberg and her colleagues at the Wisconsin Geological Survey, we developed a method for testing the fine-grained material from the crater sets. We used our method to “zap” both the crater cutting sets and the cutting sets from outside of the crater. I was able to finish sampling each cutting set, but my internship unfortunately ended before the analysis of the pXRF data began so I will be updated as analysis occurs. I learned so much during this experience, but one of the most valuable things I learned was what working in a geological survey is like. I am typically not exposed to geology-related jobs outside of academic

and museum settings, so working with MGS made me gain a deeper understanding of their work and it inspired me to pursue a similar career path in my future.

- Lucy Rogers

Dave Freedman '14

Hello PCB!

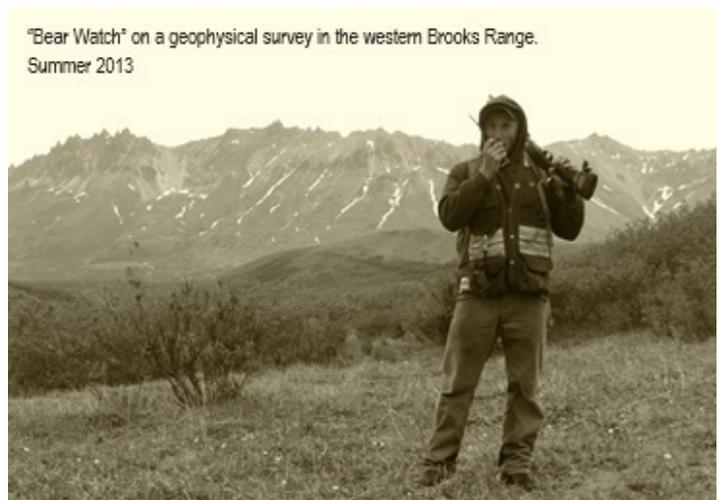
Thanks for the opportunity to tell a bit of my story in front of this great community.

If you work in mining or find yourself in Salt Lake City or northern Quebec please reach out, I am always eager to make (or refresh) a CC connection!

The story of my geology career really starts in block 2 of my sophomore year.

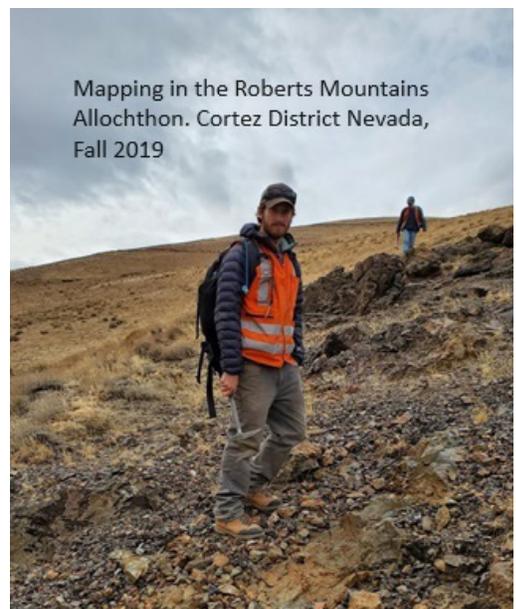
I had just been convinced to take a geology course, GY140, by an Alaskan CC'er who told me that the course was basically a camping trip but with hammers, very few showers, and no cell service.

"Okay" I said, "seems up my alley". My background up until this point, which included formational experiences swamping canoes in northern Ontario and clearing trail with a crosscut saw (or 'misery whip') in the Idaho wilderness, had led me to appreciate the unpredictable nature of long trips in inhospitable places. During that trip (or maybe another one, but I can't remember) we had dug pits and slept in cold sand during the heat of the day, licked weathering dinosaur bones, and emptied our water jugs after someone had dropped dilute HCl in their eye thinking it was visine. I knew I wanted more.



True to my own style, I dropped the entirety of my first semester courseload for which I had deliberated and carefully allocated my points in favor of whatever geology was available. First was Invertebrate Paleontology, where Paul Myrow lectured as we dug the vans out of axle deep mud near Truth or Consequences, NM. Then two blocks of Rocky Mountains Geology taught by a rotating cast of passionate, colorful professors including Henry Fricke and Christine Siddoway. In the heart of the winter I went up Cheyenne Canyon with Christine (along with labradors Bessie and Pearl) to hear about some strange sandstones and a research project. I was hooked.

The rest of my time at CC I stayed busy both in the classroom and in extracurricular geology work. After I took my first economic geology course with visiting professor Christian Schrader, I started to flesh out an interest in mining and especially mineral exploration. Though a second-degree CC connection through Christine Siddoway with Betsy Friedlander (CC '2007) I landed a seasonal job in northern Alaska carrying geophysical wire and collecting sediment samples and mosquito bites at Teck's Red Dog Mine. I then fell in love with the Basin and Range thanks to Charlie Sulfrian (CC '1973) who introduced me to Winnemucca Nevada and the joys of old mining districts. The whole thing was driven home by a raucous Regional Studies block in California and western Nevada.



Flash forward to 2018 and I had just finished a master's program at the University of Nevada Reno to study in the newly expanded Center for Research in Economic Geology (CREG). My masters work was a study of a tilted block which exposed about 10 kilometers of stratigraphy from an acid Eocene pluton up to the Eocene paleosurface. The range was riddled with widely varied mineral deposit styles running from intrusion hosted gold through distal disseminated (then all the rage in Nevada following the discovery of the Long Canyon Carlin Gold deposit).

After graduation I applied a bit of my master's work to hunt for distal disseminated gold in eastern Nevada and eventually ended up with Barrick Gold, one of the largest companies in the industry, in the Fourmile district near Cortez. There I was part (and then the final survivor) of an exploration group looking for deep, high-grade Carlin orebodies. I especially enjoyed this work because during this time there was a revolution in the understanding of Carlin deposits resulting in a new focus on hot, breccia-pipe hosted high grade plumbing systems beneath the enormous orebodies that had been mined since the 60s. It was a stimulating time when new ideas were quick to get traction and funding. After COVID hit I left Nevada for an odd job on the Cook Inlet in Alaska, working on an atypical massive sulfide deposit. Mostly I was attracted by a promised escape from lockdown into a camp within view of two glaciers and an active volcano (Mount Iliamna). When inevitably the snows came and vaccines were rolled out I moved on again, in the fall of 2020, to KoBold Metals where I work today. Currently I run a nickel exploration project in Quebec's Ungava Peninsula.



KoBold's prospecting crew in Ungava Quebec. Summer 2023. Dave is second from left.

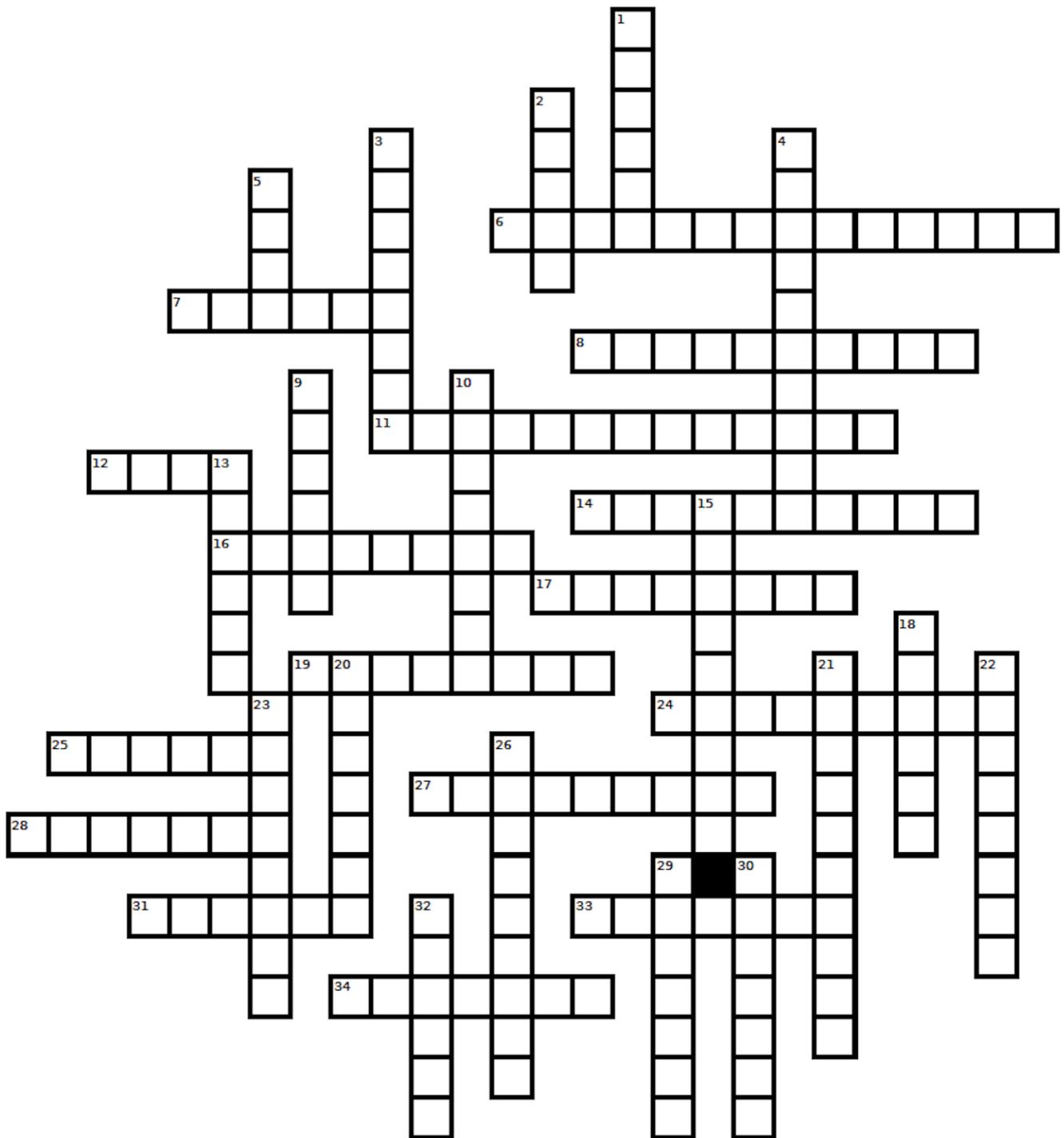
The thing I enjoy most about working in exploration is that a broad knowledge base and diverse skill-sets are emphasized more than a specific narrow focus. In any week I am fortunate enough to use a combination of hydrothermal, structural, igneous, stratigraphic, sedimentological, geochemical, and geophysical geology, among other methods. In addition, I appreciate being able to see such a variety of places on our rocky planet. My personal favorite is the arctic.

My experience at CC and since has taught me several things:

1. It isn't what you know, it's what you can learn.
2. Utilize your connections to CC and beyond.
3. Do what you enjoy.
4. "Never Say Whoa"

Dave Freedman '14
dfreedman1241@gmail.com

Minerals!



ACROSS

- 6) A major component of the hard tissues in the human body, such as bones and teeth
- 7) Lead ore and it is very dense
- 8) Cross-stone, often in metamorphic rocks
- 11) Manganese carbonate; rose-red color
- 12) the softest mineral on the Mohs scale
- 14) The primary source of zinc
- 16) A common group of dark-colored minerals often found in igneous rocks, known for their role in the formation of lunar basalts
- 17) The lead in pencils is not actually lead
- 19) Named after a French geologist, de Dolomieu, who first described the mineral
- 24) Has the same chemical formula as calcite
- 25) Table Salt
- 27) A greenish-blue variety of microcline feldspar, often used as a gemstone, especially in jewelry
- 28) CaCO_3
- 31) Fool's gold
- 33) Deep blue; often associated with malachite
- 34) Blue to bluish green; used as a refractory mineral

Answers on page 37

DOWN

- 1) Yellow and brittle; distinctive odor when scratched
- 2) Hexagonal Crystals
- 3) The primary ore of mercury and has been used for centuries as a source of pigment, especially in red paints
- 4) Seafood buffet or shrimp poops, just above the Great Unconformity in Manitou Springs, CO
- 5) This gemstone is known for its iridescence, often called "play of color"
- 9) A black variety of tourmaline
- 10) Second hardest mineral
- 13) A metal and mineral that has been used by humans for thousands of years, it is an excellent conductor of electricity
- 15) Anhydrous calcium sulfate
- 18) Often mistaken for ruby or sapphire
- 20) Green mineral in mafic igneous rocks
- 21) Dark mineral commonly found in igneous rock 60° and 120° cleavage angles
- 22) The red streak left by this mineral when scratched on a surface is where its name comes from, as "haima" is Greek for blood
- 23) This form of gypsum can be transparent, and its name comes from the Greek word for the Moon, reflecting its moon-like glow
- 26) Rich green mineral often associated with copper deposits
- 29) Copper oxide mineral
- 30) Black mica
- 32) Conchoidal fracture, a common mineral in granite

Geology Day

April 8th, 2023, Tutt Science Lecture Hall

Student Presentations

Emory Pollatsek '23 "Understanding fault-fluid interaction through stable isotope analysis of tourmaline-coated brittle faults of the West Antarctic Rift System"

Zhilin Shi '23 "How does Lithology Influence the Migration and Meander Stability of Meandering Bedrock Rivers"

Cade Quigley '23 "The Seismic Record of Wind in Alaska"

Grace King '23 "Assessing Wildfire Regimes and Floral Recovery After the K-Pg in Corral Bluffs, CO"

Clay Rodriguez Gould '23 "Facilitating the green transition: an analysis of carbon market opportunities & limitations"

Katya Nicolayevsky '24 "Tracking Paleoenvironmental Associations in Vertebrate Microfos-

sil Bonebeds in the Upper Cretaceous (Campanian) Judith River Formation, Montana"

Jack-Henry Kent '23 "Meandering Bedrock Rive Bedforms"

Lucy Rogers '25 "Tiny Modification Features on Fossil Bones from Vertebrate Microfossil Bonebeds in the Upper Cretaceous (Campanian) Judith River Formation, Montana"

Cade Quigley '23 "Glacial sliding on volcanic bedrock: effect of rock surface roughness on ice-on-rock friction and healing"

GY315 class - "Past, Present, and Future of the Rampart Range Fault: A Blessing and a Curse?"

Spencer Shaw '23 "Geomorphologic Characterization of Fountain Creek: A Study of Planform Change and Channel Migration"

Matt Semel '23 "Is the Mojave Crustal Province the assimilation source of Proterozoic zircon grains in the Cretaceous Oasis Granite, Mojave Desert, California?"

Eugenie Haring '23 "Zircon U-Pb Ages and Hf Iso-

topes of the Black Canyon Gabbro: Insights into Magmatic Processes and Tectonic Implications of the Teutonia Batholith”

Jackson Kohn ‘23 “Determination of metal-PD-MA stability constants via spectrophotometric and potentiometric titrations”

Department Awards

Annual Awards

Presented at GeoDay 2023

Rocky Mountain Association of Geologists Award:

Cade Quigley ‘23

Association of Women Geoscientists:

Eugenie Haring ‘23

Grace King ‘23

Estwing outstanding senior geologist:

Zhilin Shi ‘23

RMAG McKenna Scholarship (for a junior previous year):

Mackenzie Boyd ‘25

Emma Revenaugh ‘24

Buster Scholarships:

Zhilin Shi ‘23

Jack Henry Kent ‘23

Eugenie Haring ‘23

Matt Semel ‘23

Gould Scholarship:

Annie Breyak ‘25

Emma Revenaugh ‘24

Putman Scholarship:

Baxter Waltermire ‘24

Jesus Lara Rivas ‘25

Charles Rhoads:

Jack-Henry Kent ‘23

Clayton Rodriguez Gould ‘23

Wold Family Fund:

Charlotte “Charlie” Hite ‘25

Hannigan:

Charlotte “Charlie” Hite ‘25

Creager:

Baxter Waltermire ‘24

Noblett-Witter Family Fund Internships: Summer 2023

Student	Organization	Sponsor
Eugenie Haring ‘23	U of Auckland School of Environment - Soil Tech Intern	Melanie Kah
Jackson Kohn ‘23	Zaytuna Farm - Permaculture Apprentice	Nadia Lawton (pursued directly)
Emma Revenaugh ‘24	U of MN Duluth, Large Lakes Observatory - Research Assistant	Ted Ozersky
Emory Polatsek ‘23	American Museum of Natural History - Invertebrate Paleontology Curation Intern	Bushra Hus-saini
Mahon Raghunath ‘25	American Museum of Natural History - Invertebrate Paleontology Curation Intern	Bushra Hus-saini
Grace King ‘23	Denver Museum Nature & Science - Museum Mix & Fossil Vertebrates Intern	James Hagadorn
Baxter Waltermire ‘24	Denver Museum Nature & Science - Museum Mix & Fossil Vertebrates Intern	James Hagadorn

Charlie Hite '25	Denver Museum Nature & Science - Museum Mix & Fossil Vertebrates Intern	James Hagadorn
Katya Nicolaevsky '24	Denver Museum Nature & Science - Museum Mix & Fossil Vertebrates Intern	James Hagadorn
Taylor Jenkins '25	Denver Museum Nature & Science - Museum Mix & Fossil Vertebrates Intern	James Hagadorn
Clay Rodriguez Gould '23	Hartree Partners, LP - Summer Mining Analyst	Matthew Rosales
Lucy Rogers '25	Minnesota Geological Survey - Junior Field Tech	Julia Steenberg
Zhilin Shi '23	Northwest Hydraulic Consultants - Fluvial Geomorphology Intern	Andrew Nelson

Visitor Seminar Series 2022-23 and 2023-24

Spring Semester 2022-23:

Block 5, February 1, 2023, Ana Vargo '84, Geologist, USDA Natural Resources Conservation Service, Curious about Geoscience in service of society? Come learn: "What an Engineering Geologist Does"

Block 6, March 16, 2023, Dr. Nick Sullivan, "Planetary Motions Recorded in the Deep Sea: Characterizing Milankovitch Cycles from Neogene strata in the Southern Ocean"

Block 7, April 4, 2023, Lexie Millikin '17, PhD Candidate Yale University, "Assessing the link between early Paleoproterozoic glaciation and the Great Oxidation Event with new Re-Os geochronology"

Block 8, May 10, 2023, Dr. Lizzy Trower, Assistant

Professor, CU Boulder, "A world in a grain of sand: Learning to read the geological record in ooids"

Fall Semester 2023-24:

Block 3, November 13, 2023, Dr. Rachel Havnarek, University of Idaho, "It's getting hot in here: how modern environments can help us understand ancient examples of climate change"

Block 4, December 18, 2023, Dr. Nadine Grambling, Brown Rock Deformation Lab, "Fabricating rock fabrics"

Recent Faculty Publications 2022-2024

Paul Myrow

Hu, M., Myrow, P.M., Fike, D.A., Di Pasquo, M., Zatoń, M., Fischer, W.W., and Coates, M., 2024, Depositional history of Devonian to lower Carboniferous (Tournaisian) strata, northern Wyoming and southern Montana, USA: Geological Society of America Bulletin, doi:10.1130/B36728.1.

Craddock, J., Paulsen, T., Da Silva Schmitt, R., Johnston, S.T., Myrow, P.M., and Hughes, N.C., 2023, The amalgamation of Gondwana: calcite twinning and finite strains from the early-late Paleozoic Buzios, Ross, Kurgikh and Gondwanide orogens: Geological Society, London, Special Publications, v. 531, p. 95-130, doi:10.1144/SP531-2022-165.

Myrow, P.M., Hasson, M., Taylor, J.F., Tarhan, L.G., Ramirez, G., Fowlkes, G., and Chen, J., 2023, Structural control of Cambrian paleotopography and patterns of transgression in western Laurentia: Geology, v. 51, p. 521-526, doi:10.1130/G51055.1.

Myrow, P.M., Hasson, M., Taylor, J.F., Tarhan, L., Fike, D.A., Ramirez, G., Fowlkes, G., Popov, L.E., Liu, H., and Chen, J., 2023, Revised Paleozoic depositional history of the central Rocky Mountains (Utah and Colorado): Sedimentary Geology, v. 449, p. 106373,

doi:10.1016/j.sedgeo.2023.106373.

S0016756821001266

Myrow, P.M., Hughes, N.C., and Singh, B.P., 2023, Ordovician strata of the Indian subcontinent, in *A Global Synthesis of the Ordovician System: Part 2*, T. Servais, D. A. T. Harper, B. Lefebvre, I. G. Percival, <https://doi.org/10.1144/SP533-2022-3>.

Wernette, S.J., Hughes, N.C., Myrow, P.M., and Sardud, A., 2023, Trilobites of Thailand's Cambrian–Ordovician Tarutao Group and their geological setting: *Papers in Palaeontology*, v. 9, p. e1516, doi:10.1002/spp2.1516.

Xin, H., Chen, J., Gao, B., Li, F., and Myrow, P.M., 2023, Spatio-temporal distribution of the Cambrian maceriate reefs across the North China Platform: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 614, p. 111429, doi:10.1016/j.palaeo.2023.111429.

Di Pasquo, M., Hu, M., Zatoń, M., and Myrow, P., 2022, Microspores, megaspores, palynofacies, and depositional history of the upper Givetian Maywood Formation, Northern Wyoming, USA: *Review of Palaeobotany and Palynology*, v. 299, p. 104604, doi:10.1016/j.revpalbo.2022.104604.

Hughes, N.C., Peng, S., Harper, D.A.T., Myrow, P.M., Phạm, N.K., Wernette, S.J., and Zhu, X., 2022, Cambrian and earliest Ordovician fauna and geology of the Sông Đà and adjacent terranes in Việt Nam (Vietnam): *Geological Magazine*, v. 159, p. 55–80, doi:10.1017/S0016756821000844.

Li, W., Chen, J., Hakim, A.J., and Myrow, P.M., 2022, Middle Ordovician mass transport deposits from western Inner Mongolia, China: Mechanisms and implications for basin evolution (A. Pontén, Ed.): *Sedimentology*, v. 69, p. 1301–1338, doi:10.1111/sed.12949.

Myrow, P.M., 2022, Book review: *Tectonics of the Indian Subcontinent* by A.K. Jain et al. *Geological Magazine* 159:819–820. <https://doi.org/10.1017/>

Zatoń, M., Hu, M., Di Pasquo, M., and Myrow, P.M., 2022, Adaptive function and phylogenetic significance of novel skeletal features of a new Devonian microconchid tubeworm (*Tentaculita*) from Wyoming, USA: *Journal of Paleontology*, v. 96, p. 112–126, doi:10.1017/jpa.2021.71.

Sarah Schanz

Burt, MA, Barnes, RT, Schanz, SA, Clinton, S and Fischer, EV, 2023. "Mentorship Builds Inclusivity and Belonging in the Geosciences" *AGU Eos*, 104, <https://doi.org/10.1029/2023EO230020>.

Schanz, S.A. and *Colee, A.P., 2022. Controls on earthflow formation in the Teanaway River basin, central Washington State, USA. *Earth Surface Dynamics*, 10(4), pp.761-774. <https://doi.org/10.5194/esurf-10-761-2022>

Christine Siddoway

Marschalek, J., Thomson, S., Hillenbrand, C.-D. Vermeesch, P., Siddoway, C. and 7 others, 2024, Geological Insights from the Newly Discovered Granite of Sif Island between Thwaites and Pine Island Glaciers, *Antarctic Science*, doi: 10.1017/S0954102023000287.

Cox, S.C., Smith Lyttle, B., Elkind, S., Siddoway, C., Morin, P., Capponi, G., Abu-Alam, T. and 22 others including Lexie Millikin and Tristan White, 2023, A continent-wide detailed geological map dataset of Antarctica, *Nature Scientific Data*, 10, 250, doi: 10.1038/s41597-023-02152-9.

Flowers, R. M., Ketchum, R.A., Macdonald, FA., Siddoway, C.S., and Havranek, R., 2022, Existing thermochronologic data do not constrain Snowball glacial erosion below the Great Unconformities, *Proceedings of the National Academy of Science*, v. 119 (38), doi: 10.1073/pnas.220845111.

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Tyler Grambling

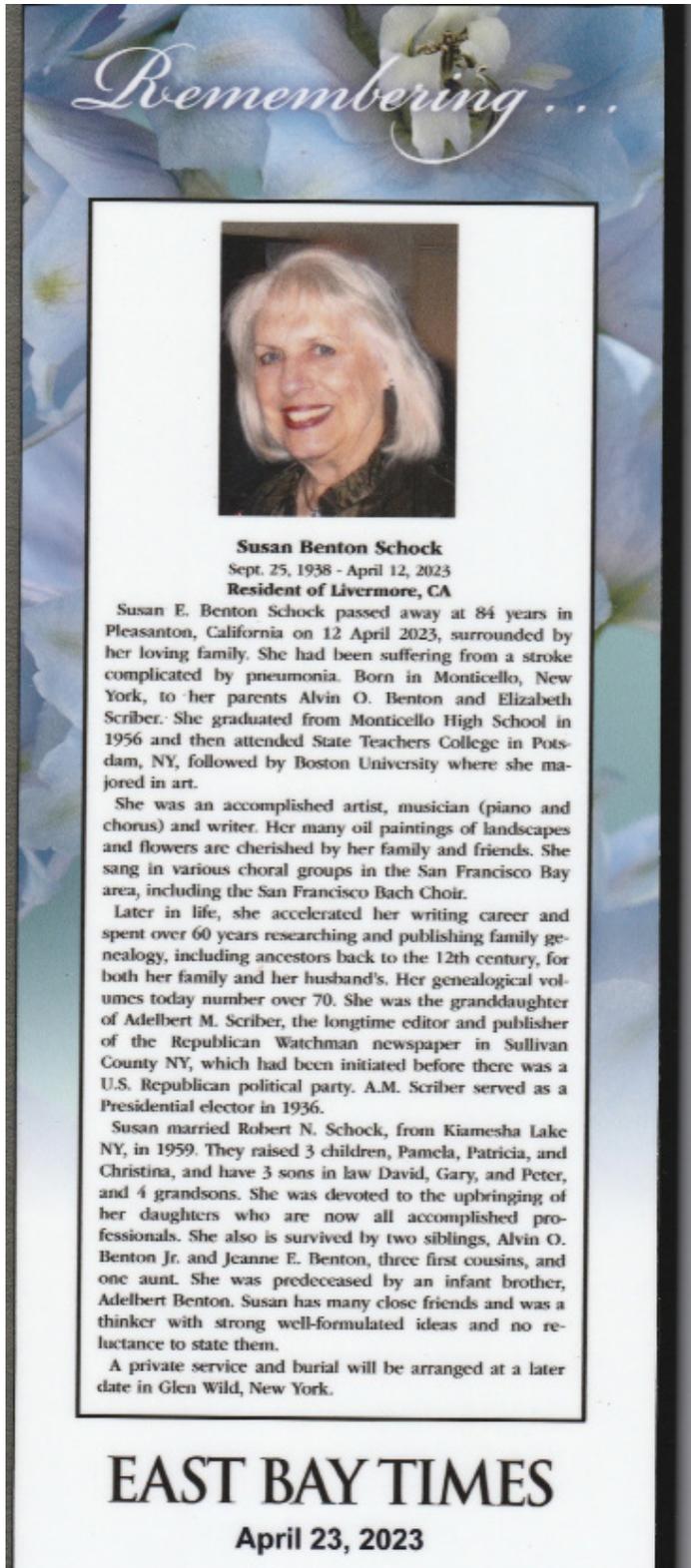
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Thanks to all the awesome alumni who have sent updates this year! We sure do appreciate it. You can always send us updates at precambrianbsmt@coloradocollege.edu

Bob Schock, 1961



Remembering...

Susan Benton Schock
Sept. 25, 1938 - April 12, 2023
Resident of Livermore, CA

Susan E. Benton Schock passed away at 84 years in Pleasanton, California on 12 April 2023, surrounded by her loving family. She had been suffering from a stroke complicated by pneumonia. Born in Monticello, New York, to her parents Alvin O. Benton and Elizabeth Scriber. She graduated from Monticello High School in 1956 and then attended State Teachers College in Potsdam, NY, followed by Boston University where she majored in art.

She was an accomplished artist, musician (piano and chorus) and writer. Her many oil paintings of landscapes and flowers are cherished by her family and friends. She sang in various choral groups in the San Francisco Bay area, including the San Francisco Bach Choir.

Later in life, she accelerated her writing career and spent over 60 years researching and publishing family genealogy, including ancestors back to the 12th century, for both her family and her husband's. Her genealogical volumes today number over 70. She was the granddaughter of Adelbert M. Scriber, the longtime editor and publisher of the Republican Watchman newspaper in Sullivan County NY, which had been initiated before there was a U.S. Republican political party. A.M. Scriber served as a Presidential elector in 1936.

Susan married Robert N. Schock, from Kiamesha Lake NY, in 1959. They raised 3 children, Pamela, Patricia, and Christina, and have 3 sons in law David, Gary, and Peter, and 4 grandsons. She was devoted to the upbringing of her daughters who are now all accomplished professionals. She also is survived by two siblings, Alvin O. Benton Jr. and Jeanne E. Benton, three first cousins, and one aunt. She was predeceased by an infant brother, Adelbert Benton. Susan has many close friends and was a thinker with strong well-formulated ideas and no reluctance to state them.

A private service and burial will be arranged at a later date in Glen Wild, New York.

EAST BAY TIMES
April 23, 2023

Ann Hooker Clarke, 1972

No other news other than that I am enjoying teaching food, agricultural, and environmental law as well as persuasive legal writing at the Monterey College of Law located on California's Central Coast. In discussing various toxic tort cases, such as the talc and ovarian cancer litigation, or Superfund sites in California, such as the New Idria Mercury Mine, I show a picture of the mineral at issue, talc and mercury, respectively, in the lectures. The topic is serious of course but teaching is fun.

Charlie Sulfrian, 1973



This past summer(2022), Alum Charlie Sulfrian '73 and Professor Michelle Gevedon had a grand 'ol time digging for Amazonite and Smoky Quartz in the Colorado mountains

Thomas Ewing, 1975

A few things have happened for me – it has been a while since I communicated with the CC Geology department. I am still consulting in San Antonio in oil & gas and some groundwater projects, also researching and writing on various aspects of regional geology.

I have had the honor of receiving few awards in the last 5 years: AAPG - Honorary Membership in 2021, AAPG - Berg Research Award in 2023 (to be awarded in August), and the GCAGS (Gulf Coast Association of Geological Societies) - D.R. Boyd Medal for Excellence in Gulf Coast Geology in 2018.

I am also directing a couple of German choirs in San Antonio.

David Williams, 1987

In October 2023, the University of Washington Press published *Spirit Whales and Sloth Tales: Fossils of Washington State*. I was the co-author with Elizabeth Nesbitt, curator emerita at the Burke Museum in Seattle. The book includes 24 profiles of a unique plant, animal, or environment and covers the 500 million years of fossil history found in the state.

Meadow Koslen, 1996

is now teaching Earth and Space Science at Wakatipu High School in Queenstown, New Zealand trying to nurture future geologists, environmental scientists and a few astronomers as well. Drop me a line on mkoslenridd@wakatipu.school.nz if you are heading down under. I will be bringing a group of students to Aspen, Colorado next year as part of a sister city exchange program in January and hope to stop into CC if time allows.

Anna Phelps, 2010

Hi all! I love reading the Precambrian Basement every year and hearing what everyone is up to! I've been working as a Petroleum Geologist for the past 7+ years at SM Energy in Denver. I'm currently working on the Reservoir Characteri-

zation Team, making 3D geocellular models of the Permian basin. I also recently became the Technical Development Supervisor and manage college recruiting, the intern program, and the new hire program for SM Energy. I enjoy volunteering in the Denver geologic community, and I am currently serving on the Rocky Mountain Association of Geologists (RMAG) Board and the AAPG Rocky Mountain Section Board. I live in Evergreen with my husband and our two dogs and spend my free time mountain biking, hunting, doing CrossFit, and going up to Wyoming every chance I get! I hope everyone is well!

**Victoria “Vikki” Crystal, 2014**

Victoria “Vikki” Crystal has been very busy over the last several years. After receiving her master's degree in Geological Science from CU Boulder, Vikki spent a summer as a visiting instructor



at CC teaching Geology of the Pike's Peak Region. Vikki then moved to Omaha, Nebraska where she worked for the University of Nebraska Omaha as an adjunct instructor teaching Sedimentary Geology, Physical Geology, and Environmental Geology during the

pandemic. She adapted her teaching strategies for a virtual classroom and even designed some virtual field trips for her students!

Early in 2020, Vikki created a podcast called Ask A Scientist, where she asks scientists questions written by elementary and middle school students. Several CC alumni have been guests on the podcast!

Vikki is now a curator and museum specialist with the U.S. Geological Survey's Geological materials Repository (GMR). The GMR is a centralized repository for the USGS that houses scientific working collections in a warehouse facility within the Denver Federal Center. Vikki enjoys spending her days surrounded by ~80,000 square feet of rock storage and driving around forklifts full of literally a ton of rock!

Gabi Rossetto Harris, 2015

I successfully completed my dissertation in Geosciences at Penn State University with a focus on Eocene-Oligocene fossil floras in Argentine Patagonia, with two kids in tow, Ruby, 3 years, and Calvin, 10 months. Beginning in January 2024, I start an NSF Postdoctoral Research Fellowship in Biology, hosted between the Denver Museum of Nature & Science and the Field Museum (Chicago), to investigate the rainforest affinities of the Paleocene Castle Rock, Colorado flora.



Ben Justman, 2016

In 2019, I left my geologic mapping job and

moved home to Paonia, CO to found Peony Lane, a Natural Winery. I grow the highest elevation Pinot Noir in North America. All of my wines are Natural Wine's meaning that I procure sustainably grown grapes, ferment them with the wild yeast from my Pinot Noir Vineyard and take a hands off approach in the winemaking process. I ship wine all over the country. Order via PeonyLaneWine.com



Tristan White, 2018

Hi all! Time flies. Yada, yada. My wife Becki and I were recently married in July 2022 in Larkspur, Colorado. We met studying geology abroad at the University of Canterbury in 2017 and reconnected the following year since she grew up 20 minutes from Yale (thanks Paul!). I turned in my lab coat for a pickaxe in 2019 and haven't looked back since. We are approaching four years at the behemoth Morenci copper mine in Arizona where Becki works in modeling and I'm coordinating our drilling campaigns. Thanks to my newfound Covid-era hobby—genealogy—I've since learned I am the sixth generation of 'White' in the mining industry, so it's all quite fitting. We eventually plan on moving to the East Coast, but we'll be enjoying the mild, sunny winters until then! In other news, we honeymooned in Curacao, are headed to Hawaii this spring and are halfway through our quest of visiting all the National Parks. One must constantly travel to avoid going stir crazy in a tiny company town three hours outside of Tucson! Hopefully everyone is in good health and spirit. Very much looking forward to

attending our 5-year reunion this October!



Lille Haecker, 2019

Hi all!

I am currently completing the Impact MBA with a graduate certificate in carbon management



from CSU. I never would have thought how applicable my geology knowledge is in the sustainability space! Here is a picture of me presenting my

aluminum value-chain risk assessment project at a showcase in September 2023! I worked for Ball Aerospace this summer researching the different climate risks associated with their upstream supply chain. If anyone is interested in pursuing the Impact MBA or wants to talk about graduate school, please feel free to reach out: lille.w.haecker@gmail.com ;)

Grace King, 2023

After graduating in May 2023, I moved to Denver to work at the Denver Museum of Nature and Science in the earth sciences department as a Noblett-Witter Intern. I helped with many different projects, including making outcrop maps in GIS, participating in field work in North Dakota, and hanging out with other awesome interns,

including four other Witters. I am grateful that my internship has since been extended through the fall and into the spring. In December, I also had the opportunity to present my thesis at AGU in San Francisco and connect with many CC alums. Hope everyone is well!



Posing with the K-Pg boundary outside of Marmarth, ND with other summer 2023 DMNS Witter interns, clockwise from top: Charlie Hite '25, myself, Baxter Waltermire '24, Katya Nicolayevsky '24, and Taylor Jenkins '26.

Jackson Kohn 2023

Since graduation, I completed a Witter Family internship all the way down undah in New South Wales, Australia at the Permaculture Research Institute on Zaytuna Farm. I was there for a total of 12 weeks – the first two earning my Permaculture Design Certificate (PDC) and the following 10 working on the 66-acre farm. I worked under direct tutelage from Geoff Lawton, the foremost living authority on permaculture, and other knowledgeable workers on the farm.

During the working portion of my time on Zaytuna Farm, I became very circadian. Rising before the sun to manually turn compost, maintain the kitchen garden, and feed chickens, goats, hors-



es, and cows. In order to feed the goats, another worker and I would 'chop and drop' legume trees called ice cream bean with a chainsaw and then drag the leafy branches to the goats with the atv. Definitely a good way to get the blood pumping on

colder mornings when we had to climb into a nook of the tree to make a clean cut. One cool thing that I learned while cutting the ice cream bean branches was that a proportional amount of the tree's root would die and decompose, returning nutrients to the soil from beneath the ground as we cut the upper branches. And because we were working with legume trees in a subtropical climate, the pollards that we created would quickly spout new branches from the place where we made the cut.



I was also responsible for maintaining several productive food forests. Food forests mimic natural forests in the sense that they have canopy trees, understory plants, vines, and groundcover, but most of the plants are non-natives that Geoff selected because of their unique or productive properties. The

food forests were usually planted on contoured swales to increase their water-holding capacity and contained a huge diversity of fruit trees and supporting legumes (to fix nitrogen) and palms (to fix phosphate). Some of the fruits that are grown on the farm are mangos, bananas, guavas, Brazil cherries, loquats, jackfruits, mulberries, passion fruits, coffee, dragon fruit, lemons, oranges, and avocados. To maintain these food forests, we had to pollard legume trees to allow light to pass through to the productive fruit trees and apply a bit of compost to some of the more nutrient-intensive trees, like mango and avocado.



Zaytuna Farm is totally off-grid, so they use solar for electricity and rainwater catchment for drinking and irrigation water. The solar was not usually an issue thanks to the intense Australian sun, but the water was occasionally problematic due to the complexity of the kilometers-long piping system around the farm. Multiple times, there were huge leaks that led to over 120,000 liters of irrigation water being lost to the ultra-absorptive soil in various parts of the farm. This led to days of tracking down leaks, replacing damaged pipes, and lots of trial and error figuring out just how that much water escaped almost unnoticed. For one of the leaks, the entire 40,000-liter irrigation tank at the top of the property emptied overnight. We thought we fixed the leak and allowed the tank to fill (via solar pump from one of the 28 ponds on the property) and then opened all of the taps and proceeded

with our day as normal. The following day, we realized that the tank had emptied again! Luckily, one of my coworkers found the leak by mistake and figured out that one of the horses had stepped on the pipe after we had rotated them into a new paddock and one of the swales had absorbed all the water.

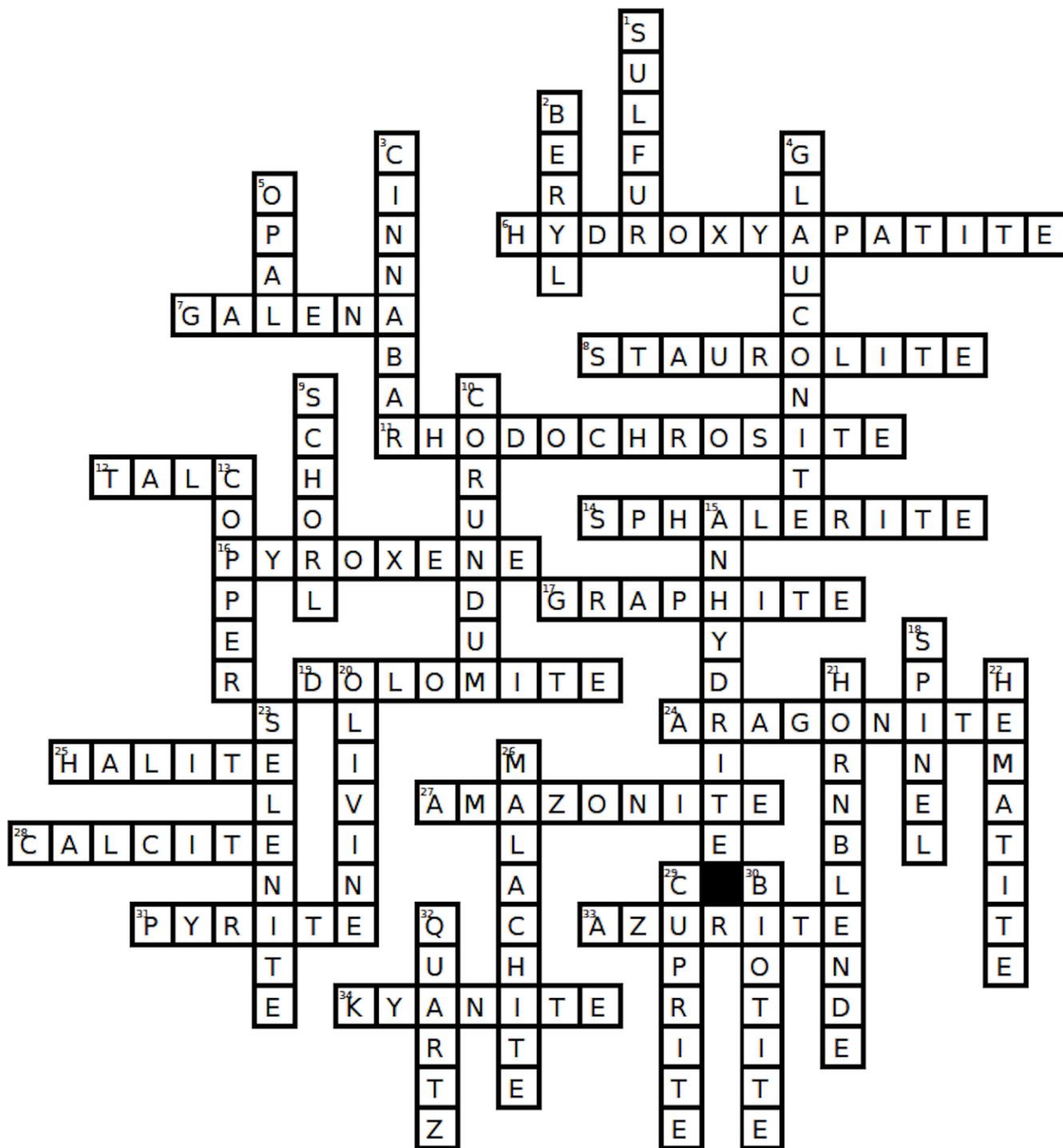


Other tasks around the farm included general construction of different buildings, cleaning gutters, planting new food forests, taking care of nursery plants, rotating seasonal vegetable crops in kitchen gardens, making compost, and ample amounts of shoveling manure. My time on the farm was extremely fulfilling and I feel like I learned a lot about what it means to be sustainable and how to employ an ethic of permaculture on a daily basis. I am extremely grateful for my experience and will look back on it fondly for the rest of my life. Here are some fun farm photos for my fellow geo-people!

Now that I'm back in the states, I'm going on a rock climbing nomadic road trip from the southeast across the south and then back up and over through the west. My plan is to find the climate where I want to be and then (hopefully) find a soil-based job in that location.



Minerals!



Dear Colorado College Geology Alum:

We hope you have enjoyed the 2023-24 edition of the Precambrian Basement, CC Geology's annual alumni newsletter. We would love to hear what you're up to, where you've been, and where you are now. Please fill out this form and return it to:

The Precambrian Basement
Colorado College
Geology Department
14 E. Cache La Poudre St.
Colorado Springs, CO 80903

OR: email us at precambrianbsmt@coloradocollege.edu

We love pictures!

Last Name _____ First

Name _____

Maiden Name or Nickname _____ Year of Graduation _____

Current Address (street) _____
et) _____

City _____ State _____ Zip-
code _____

Home Phone _____ Business Phone _____

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