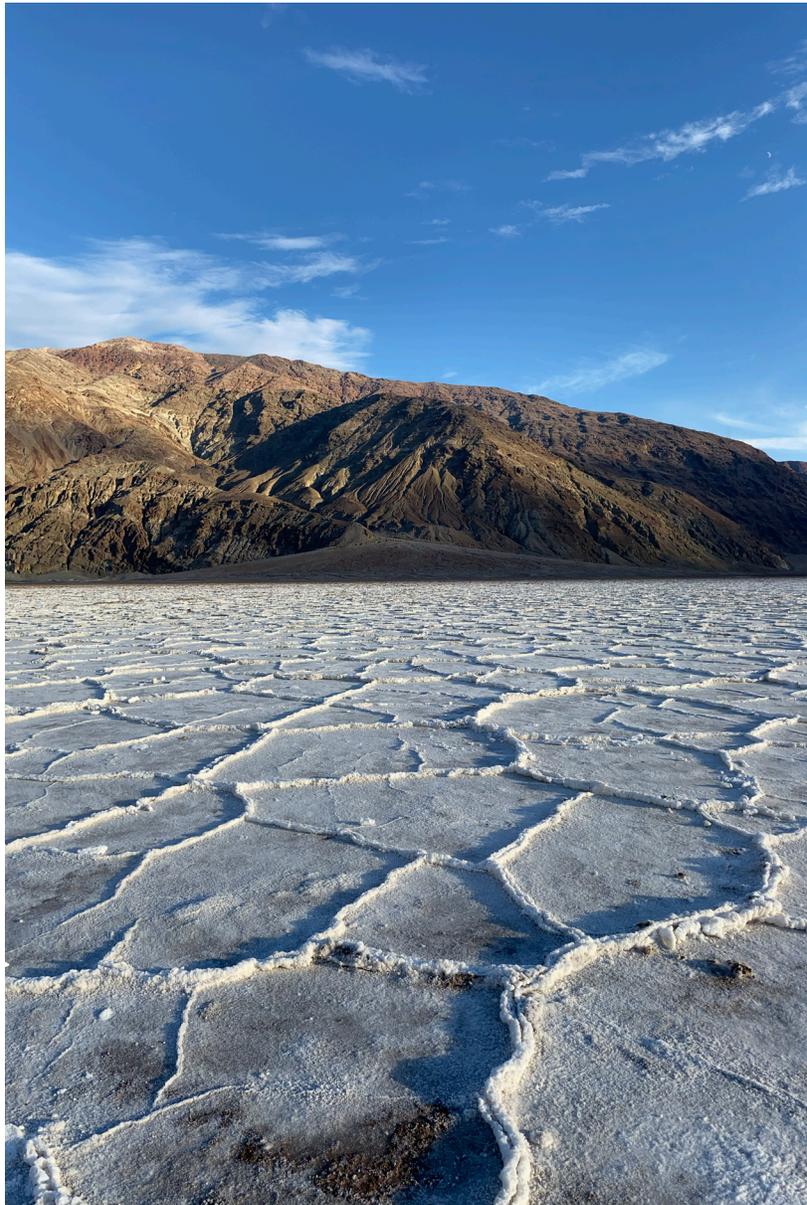


THE COLORADO COLLEGE GEOLOGY DEPARTMENT



2019-2020

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**Cover Photo: Modern evaporite deposits at Badwater Basin,
Death Valley National Park, California.**

**Taken during GY445: Regional Studies in Geology
by Ben Lloyd**

The Precambrian Basement
2019-2020

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Greetings Everyone!

We hope you are all doing well and that you will enjoy the enclosed stories about your geology faculty and what our current students are up to (within the realm of geology!).

We have several new faculty this year. Dr. Sarah Schanz is our new tenure-track geomorphologist replacing Eric Leonard. Sarah has a PhD from the University of Washington (2018) and her BS from Western Washington University (2011). She studies strath terraces and has changed a century of thinking about how rivers develop in relationship to bedrock. She is already fitting in well with the Block Plan with rumors of getting vans stuck in the snow in October and of an icy cold river project. Dr. Solomon Seyum joins us for a year as the department's first Riley Fellow, part of the college's program with the Consortium for Diversity. He team-taught a senior class with Christine traveling cross-country to his home region in Southern California and will be teaching courses in economic geology for non-majors and structural geology with Christine this spring, while working on publishing papers related to fracture mechanics, and work he did on oil migration in Denmark. Emily Pope, alumna from 2004, is in her second year as a visitor teaching a full array of classes with a major course on geofluids. Her research investigates the geologic and biologic evolution of Earth resulting from the exchange of fluids among the mantle, lithosphere, hydrosphere and atmosphere. As I write this, the department is also in the midst of selecting candidates for campus interviews for the position to replace Jeff Noblett.

The department had two major celebrations last year. Every ten years or so, Geology gets to host the Roberts Lecture, which invites a prestigious scientist to campus for public lectures and interaction with students. Our turn came up last May and we pioneered a new format, by creating a four-person symposium around the topic of: Beyond Climate Change: The Earth in the Anthropocene. Dr David Montgomery delivered a keynote address on Soil and the Fate of Civilizations: New Motivation to Bring our Soils Back to Life. Then Provost Alan Townsend, Dr. Dawn Wright, and Dr. Michelle Koppes took us deeper into current thinking about soil recovery, oceans, and glaciers in a panel discussion. It was an unusually uplifting experience as all four speakers focused on steps we can be taking now. Then last October, the department hosted a celebration of the careers of Eric Leonard and Jeff Noblett for their 38th and 40th years of teaching at CC, respectively. Eric retired last May and Jeff will retire this coming May, so the timing of the party split the difference. We had a gorgeous Colorado morning for a field trip where faculty unveiled new thinking about old Colorado formations, followed by a fabulous seminar where six of our alums from across the decades presented their current work and thinking- all were spectacular. Finally, over one hundred folks showed up for the open bar and dinner and to hear Paul Myrow roast Eric and Jeff, with cogent remarks from a number of family and alums. Both Eric and Jeff were thrilled with the celebration and grateful to all who contributed.

Our students again benefitted tremendously from the Witter Family Fund for Internships in Geology. Nine students received funding for internships this year. Their experiences were quite varied, including work for: LEAFF Environmental Consulting (co-owned by Claire Renault, class of 1984); the Denver Museum of Natural Sciences (they took three of our students for different length projects); the USGS and Neptune Company (with Aaron Bandler, class of 2011) both requested students again; two students worked at Lamont-Doherty Earth Observatory (connected to Columbia University); and one worked with the State of Alaska Division

of Geological and Geophysical Surveys (with Karri Sicard, class of 2007). You can read more about their stories within this issue. Please let me know if you have positions in geological fields (during summers or as blocks during the academic year) that might be appropriate for student interns or if you know people who would like to mentor young students. We really appreciate all you can do for our students.

Best wishes,

Jeff Noblett, Geology Department Chair



Clark "Dry" Lake after a night of rain, Borrego Springs, CA. Photo by Ben Lloyd

PAUL MYROW

(Sedimentology/Stratigraphy)



lots of travel to far-flung places. This last summer I went to Inner Mongolia for field work, and then Wales for a week and a half to work on a book on the Cambrian of the Himalaya that I am writing with my colleague Nigel Hughes. I followed that with a vacation trip to Ar-

gentina, and then on to Italy for two weeks to teach an Agouron Institute field course aimed at Oligocene and Miocene strata. This year I published a number of articles, including one book chapter, on Himalayan geology. One journal article concerns the geology of Pakistan and stratigraphic correlations to the rest of the Himalaya, even though I have never been to Pakistan (hmmm...sounds fishy). My ex-senior-thesis advisee from 2018, Everett Smith, along with a graduate student at the University of Texas, Austin, and I published a paper in the *Journal of Sedimentary Research* based on Everett's thesis work. He conducted a series of experiments over two months in which he set up turbidity currents with superimposed waves. It is a really interesting paper about the dynamics of sediment transport under combined (hyperpycnal) flows.

My field season in Inner Mongolia was spent working with Tianran Zhang (former paraprofessional and now a graduate student at Dartmouth) and CC student Mingxi Hu. My work with Tianran and others on the Mesoproterozoic there resulted in a paper that is nearly in press (through two rounds of review). I am also nearly finished with another project that examines the Cambrian through Mississippian rocks in the Dinosaur National Monument region (doesn't every-

body go to Dinosaur to study the Paleozoic?). My student Michael Hasson (present paraprofessional) and I returned to the Monument and did work in an adjacent site (Cross Mt., WY). Michael went to both Yale and the University of Chicago to work with paleontologists on the fossils. We are ready to complete a manuscript, which will include our assertion that Devonian limestone deposits do in fact exist in this region, where no Devonian rocks have been mapped to date.

This year I also was successful in garnering an NSF grant with my colleague Nigel Hughes (UC-Riverside) and CC alumnus Blair Schoene (Princeton) that totals ~\$670,000 for research in southeast Asia. We will work for the next three years in Myanmar, Thailand, and southwest China, primarily on Cambrian rocks, looking at the paleontology, sedimentology, and geochronology of rocks that made up a continental mass called Sibumasu. I continued work on our International Geoscience Program (IGCP668), entitled "Equatorial Gondwanan History and Early Palaeozoic Evolutionary Dynamic", which concerns these same rocks. We had one international symposium in Thailand last year and are hosting our second in Myanmar in January, 2020.

My student Fai Chanchai is working on a geochemistry project that is a continuation of work summarized in one of my 2018 papers on the Ordovician–Silurian boundary interval in northern India. She is analyzing samples from this section and a coeval succession in Nevada, comparing their record of magnetic susceptibility and mercury content. The latter is considered a proxy for emissions of gasses from large igneous provinces. The idea is that eruptions from a large igneous province could have been responsible for altering the Earth's climate, including the late Ordovician glaciation.

On the personal front, I am in the last stages of yet another CD of my music, which I hope to have out by the summer. This com-

ing spring (2020) I am taking a half-year unpaid leave to teach at Yale (February) and Caltech (April and May), so if any of you are in the area, please let me know; I would love to meet up with you!

Sarah Schanz

(Geomorphology)



Hello! I am beyond thrilled (and a bit nervous) to be writing in the PCB for the first time – there's so much to live up to!

As you can expect with starting a new job and learning the Block system, this year has been quite busy! I moved here from Indiana in June with my husband and dog, and spent most of the summer exploring and getting used to the idea of easy access to spectacular outdoors. Oliver, the dog, has turned into a rock hound with an eye for bare rock and cliff edges. Trevor, the husband, is splitting his time between here and work in New Mexico at Los Alamos National Lab, and as a geologist/glaciologist is enjoying exploring the landscape.

We are both excited to be back in a landscape with a rich geologic and geomorphic history, which I got an introduction to while co-teaching Physical Geology in Block 1 with Paul. What an introduction to teaching on the Block! I've been practicing my run through of the local section with any and all visiting family/friends, who very politely nod along.

I am still working with students and collaborators at Indiana University. In March, I tagged along with a research team to Taiwan, where we visiting several rivers that had been impacted by Typhoon Morakot

– in some cases, hundreds of feet of rock had fallen from the hillslopes and deeply buried the rivers. I left with plenty of questions, including the interplay of short weather events on erosion and long-term impacts to the landscape, and I hope to pick my way through these over the next several years.

I continued to remotely advise an undergraduate student from Indiana, and this year she successfully presented her research work at GSA in Phoenix! Kendall calculated where river channels begin in different landscapes using a variety of lidar and geospatial datasets in ArcGIS and MATLAB. This tested work done in the early '90s that was impactful but also limited by technology and field sites. Kendall's initial work shows that lidar, and midwestern landscapes, contradict earlier work. We are currently working to design more direct comparisons with landscapes in Oregon – this would be a great project for a CC student!

The Rockies are proving fruitful for the modeling work I started last year, and I'm excited to get out this summer to start field testing the theoretical work I've been doing. Fingers crossed that I've adjusted to hiking at high elevations by then!

JEFF NOBLETT

(Igneous Petrology)

Greetings,
This is rather a poignant year, working through my fortieth and final year of teaching.



I have taught some of my favorite classes including the two-block First-Year Experience that blends geological, environmental, philosophical, and social issues related to geology- great way to start a liberal arts education here; as well as

the Earth as a Chemical system that places mineralogy in the context of igneous, sedimentary and metamorphic aspects of the local field area; and ending with the same class I started with forty years ago of Igneous Petrology (hopefully not the exact same class!). I have one thesis student, Robin Hilderman, who did a Witter Family Internship with the USGS collecting U-Pb age data and analyzing whole-rock geochemistry. She is turning that into a thesis that will provide new dates for the timing of the transition between the Conejos volcanic field (related to subduction of the Farallon plate under the San Juans) and the Hinsdale basalt (related to the opening of the Rio Grande Rift) as well as trace element analyses of the Hinsdale to characterize better the change in geochemistry between the two units.

I feel like I'm shelving an old friend as I finish each lecture this year knowing it's the last time I will share that information with students. I'm still going over my notes before each class hoping that this time, I will get the presentations just right and everyone will have perfect comprehension and that the labs will elucidate the notes and... Each day carries its own feeling of joys- one more day done well- one more aspect of my career completed nicely- the students are as passionate as ever and eager to learn. I remind myself that it's not that I won't see any of these field sites again, just that I won't be sharing questions and answers with students; but free to wander in the field to my heart's content and hope that I may yet understand some of this geology.

In fact, one of my goals upon retirement is to learn to draw- with special emphasis on landscapes. I love the nineteenth century pen and ink drawings in texts, before photography was commonplace. Perhaps I will finally see that key piece of the rocks or bump in the hill that changes my understanding of the geology. Perhaps as my

wife approaches her retirement in a few years, we will be sitting together on a hill in Iceland-or Costa Rica- sketching volcanic terrains and find a group of geology students pulling up to study the region.

The October celebration for Eric and my careers was fabulous and I thank all of you who were able to come and the many of you who sent notes. We couldn't have asked for a more perfect day for a field trip or for sharing all sorts of new ideas on the local geology. Our six alumni speakers in the afternoon were uniformly amazing in their presentations and are engaged in really interesting work. Wonderful to see some of the work our students have gone on to do! I appreciated all the comments from former (not old!) students at the dinner- some fond memories and some "what were we thinking" memories.

Best wishes to you all,
Jeff

EMILY POPE

(High-Temperature Geochemistry)



Oh my, what a busy year it has been here in Colorado. I have learned that teaching on the block plan does not leave a lot of time for reflection – there is always another big project looming around the corner. My biggest accomplishments this past year have been designing or adapting three new courses for the Geology Department: in block 8 of 2019, I taught Geofluids – a course that investigates the role that fluids, mainly water and CO₂, play in nearly every major geologic process from surface to mantle. The course also provides a solid serving of geochemical thermodynamics, and we spent quite a bit of time learning about why geochemical processes are taking place,

not just what processes take place. It wasn't all math and chemistry, though: there was time to go exploring and find one of Colorado's kimberlites! Big fun.



Metamorphic Petrology, 2019

Block 1 this year was Metamorphic Petrology – oh what an adventure, and in Block 5 I co-taught a new GY100 class with Riley Scholar (and my husband) Solomon Seyum on Mineral and Energy Resources of the Earth. I had a great group of eight students to work with in my first run of MetPet – we had some solid adventures in the southern Sangre de Cristo Mountains of New Mexico (off-roading, getting lost, rock-hounding, mapping, hot spring soaking), and a fair amount of time dedicated to developing or renewing a love of petrographic analysis. Solomon and I were thrilled to have 16 students in our earth resources class – comments from students suggest that there is large a desire at CC for earth science classes for those who don't have time for a full lab course, as well as a class that explores the issues of mining and fossil fuel extraction from multiple viewpoints: why we do it, how we do it, what would happen if we stopped, and how we can make it better for everyone. I hope that this is a course that lasts in some form, even after Solomon and I have moved on to the next adventure.

Somehow, there has been some time for research in the year as well. During the summer, I spent two weeks in Europe: first

packing up some of my research collection of Archean Greenlandic rocks from the University of Copenhagen to ship back to CC, and then to attend the Goldschmidt Meeting (the premiere international geochemistry conference) in Barcelona. I also spent a good portion of the summer working with student researchers: Helen Carter and I went down to the Picuris Mountains in New Mexico to collect tourmaline-bearing metapelite and amphibolite samples. Our goal is to test a relatively new Ca- and Ti-in-tourmaline geothermometer, by comparing it to more traditional garnet-biotite thermometric techniques in an area that has a fairly well constrained metamorphic history: all three aluminosilicate minerals (kyanite, andalusite and sillimanite) are present in the rocks in this region, which puts pretty strong limits on pressure and temperature conditions during metamorphism. Jess Hebert is helping me continue my research on the relationship between the physical parameters that determine how much water is subducted in a subduction zone, and the chemical characteristics of the overriding arc lavas. She has been working extensively with the geochemical database my MSc student from the University of Copenhagen, Marie Traun, built last year, as well as collecting some of her own hydrogen isotope data on samples from three representative arcs: the Tonga-Kermadec Arc in the South Pacific, the Central American Volcanic Arc, and the Andean Arc in Chile.



Emily, Solomon, and Iris in the Grand Canyon

Solomon, Iris and I did manage to get some of our own adventures in, too – it has been

fun being back in the US. Iris experienced her first big camping trip this summer, when we backpacked to Havasupai in the Grand Canyon. She loved the water and the camping – not so much the 12 mile hike. Although, as she was carried for most of it, her traveling companions were not the most sympathetic!

HENRY FRICKE
(Geochemistry)



Hello Everyone! If you remember from last year, I spent less of my update talking about myself, and instead waxed poetic about Eric and his impending retirement. As you all probably know, we

have another veteran of 39 years – Jeff Noblett - retiring from the department, and once again I'd like to dedicate some of this space to him.

When I look back at the 19 years I have known Jeff, the first thing I'll say is that my eyes were opened at the Eric & Jeff Fest this past fall. The stories I was told by alums about Basement Reiki and other goings on in the department in the 80s and 90s were a revelation to me, with none of them matching the pleated pants, sweater vests and neatly organized files that I typically associate with Jeff. I'm bummed that I missed out on all that. But I am glad that I had Jeff here to mentor me during my first few years on campus, and that I had him as a role model ever since.

Jeff took me on my first tour of Front Range field stops, beginning at the Garden of the Gods and ranging the whole way up to Loveland and Estes Park. At the time I wondered how he could remember all of the stops, and all of the stuff to talk about at all

of the stops, and what minerals were in the thin sections that came from the stops. Then he gave me a copy of his geologic history of Garden of the Gods, and I got it; he knows because the geology of this place is his passion. This was reaffirmed almost a decade later when Jeff developed – and I quickly stole - what I consider to be his magnum opus: "The Origin of the Pikes Peak Batholith and Magmatism in the Crust – a Project in Igneous Petrology". All majors have been completing some version of this project for the last ten years in 'Earth as a Chemical System', and I love it because it provides a reminder that Pikes Peak and environs is not just beautiful, it has a petrologic backstory that is both complex yet accessible.

Although Jeff helped me grow to become a more Colorado-centric geologist & teacher, he played an even more pivotal role in helping introduce me to the side of academic jobs that no one tells you about when you are in graduate school – administration. I am pretty sure that Jeff has either been Chair of the department, or an Associate Dean of the College, ever since I arrived at CC and I've watched as he has lead job searches, explained budgets, conducted meetings, and I've enjoyed the benefit of his amazing patience, especially during the moments when mine has evaporated. In fact I should use this opportunity to issue a blanket apology for all of my yelling over the years. As I've gained experience at CC I've have been asked to serve on various all-college committees and to serve as Chair of GY and Director of EV, I'm always asking myself WWJD; it's never a bad place to start.

Lastly I want to say thanks for Jeff for always being supportive of me in my life outside of the department and the college. Whether it was asking (yet again) to skip a Regional Studies block so I could stick around to help Erin with the kids, or discussing emergency leave to take care of aging parents, Jeff has

encouraged me to keep my job in perspective and to never lose sight of the importance of family.

Speaking of family, my oldest has graduated from high school, and will be heading off to the 'other CC' (Colby College) later this year. He has eclipsed me in height (6'6"), forcing me to look up for the first time in my life. Annaliese is all-volleyball all the time, and can now drive herself to/from practices. I don't know what to do with all the extra time that I have in my days now, but basically all is well. I hope the same is true for you, and as always please don't hesitate to stop by the department if you are in town to say hello!

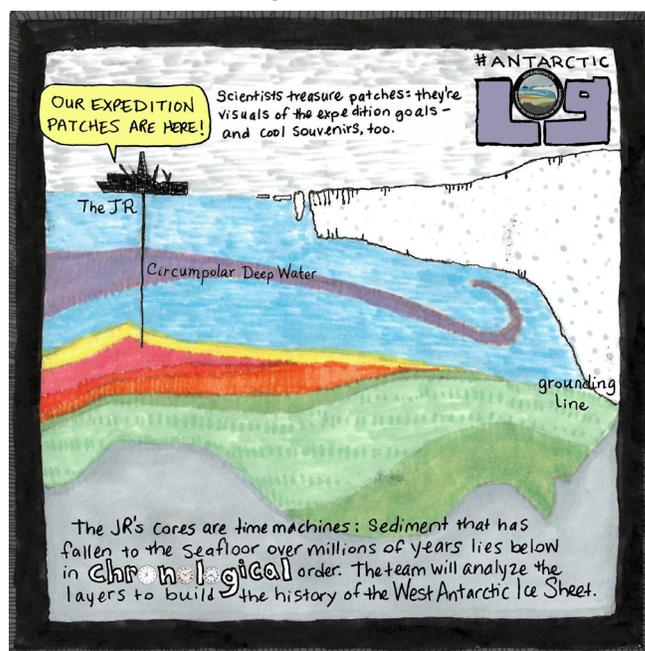
CHRISTINE SIDDOWAY (Structure)

Greetings, everybody! Last year, when I wrote, I was about to set sail on IODP's storied vessel, "Joides Resolution," (also known as the JR) for a drilling project off-shore the 'doomsday glacier' sector of Antarctica: the Amundsen Sea. The expedition was full of surprises. For instance, I was designated as a 'sedimentologist' --one of 12 on the core description team—which should strike you as funny, since I am a structural and metamorphic geologist. Also, we did not at any point even get a glimpse of Antarctica – there were so many icebergs in the region, the JR could not even approach the continental shelf, where we had expected to drill. Instead, we cored into a sedimentary drift at great depth, >4200m below sea level.



None of us really expected to see much rock material in the cores from that site, but they turned out to be full of ice rafted debris from past deglaciation events. Turns out that I was the sole petrologist on board, and it fell to me to reliably distinguish clasts of granite or gneiss from pebbles of sandstone (for 12 hours a day, 7 days a week, for 9 weeks). I was in heaven! Rather than write more words about this, let me offer some graphic-art glimpses of IODP379, provided by team mate/artist Karen Romano Young:

1. Our expedition goals:



The Crew!

2. A creative explanation of how I will use rock pebbles and clasts for my current NSF project, ICI-Hot

Once upon a time in the deep past...
 'Twas millions of years ago that pebbles rose to form MARIE BYRD LAND, a mountainous region on the coast of the Amundsen Sea. 'Twas just three days ago that the JOIDES RESOLUTION drilled these pebble-sized pebbles from the seabed.

What happened between?
 will be revealed—as in the tale of the Princess and the pea—by something small that might seem insignificant.

Granite starts molten and solidifies. As it emerges from the bedrock, minerals in it—ZIRCON and apatite—change in a way that makes them as reliable as clocks in marking a point in TIME. Testing the pebbles will tell Christine the time the glacier covering Marie Byrd Land began to slide and how fast it slid: **DATE AND RATE!**

THESE ROCKS SEEM LIKE OLD FRIENDS I MADE WHEN I EXPLORED MARIE BYRD LAND'S MOUNTAIN TOPS.

Christine's project, called ICI-Hot, involves finding the data the **rock clocks** stopped.

#ANTARCTIC LOG #102

Now...
 Christine can't wait to verify IF the pebbles came from Marie Byrd Land and **WHEN** the glacier began grinding those mountains and dragging debris seaward. The answers will let her draw a map through **SPACE** and **TIME** and ground-truth it with rock that has crossed both dimensions.

① Was it 5 million years ago?
 Did elevation from below—heat from a magma chamber—push MBL up like a hot fist under **SLIME**?
 MBL = Marie Byrd Land
 SLIME = ice
 The elevated land is colder, causing ice caps, and eventually glaciers, to form.
 (This happened to the Yellowstone Plateau, domed 9,000 feet high.)

② Was it 14 million years ago?
 Did a glacier weigh down the land like a tablecloth full of **SLIME**? When the glacier moved off, did the land stop sagging and rebound?
 (This is still happening to New England, rebounding from a glacier that covered the region 12,000 years ago.)

WITH CORES, WE CAN GET AT THE ROCK THAT WAS CARRIED OFF BY THE GLACIER. THAT WILL GIVE US THE ANSWER: WHICH SCENARIO HAPPENED TO MARIE BYRD LAND?

• KAREN ROMANO YOUNG • THE JR • 2019 •

to good structural geology problems in the Rockies. The Tavakaiv quartzite (Neoproterozoic) has been brought in to conversations about the origins of The Great Unconformity, and in future is providing some new opportunities for collaboration with esteemed Emeritus Professor Eric Leonard!

Solomon Seyum (Structure)

Greetings! I am happy to announce that I will continue teaching and scholarship in the Geology Department as a Riley Scholar-in-Residence next year. What does that mean? is a fair question considering it is the first time that the Geology Department has had a Riley Scholar since the inception of the position title at Colorado College in 1988. And, it's a fair question because this is probably the first time that you're hearing from me.



3. A conceptual model for the origins of ice rafted debris.

#ANTARCTIC LOG #100

1. It begins with **SNOW** falling in the mountains.
2. It's so **COLD** the snow never melts, just compresses, turning to **ICE**, forming a glacier. So immense peaks are buried and the land **SINKS**.
3. In time the ice flows, forced by gravity and **PRESSURE**. It streams down frozen rivers, moving toward sea.
4. The streaming glacier grinds into the bedrock. The flowing ice grinds the rocky crumble into the fragments it carries below. As the ice reaches the sea, it extends, the frozen fresh water floating atop the warmer salt water. **ice-rafted debris (IRD)** *Little...*
5. ... Warm water churning up to the sea surface lifts the ice shelf and starts a thaw.

6. The ice shelf receives ice flowing in from the glacier and releases **Calves**—icebergs that break off and mooove away on their Antarctic odyssey.

The last time the **WAIS** collapsed, there were no people to observe. Now we're in a new **warming** trend. Because of **human activity**, glaciers are retreating at an accelerated pace. Enter the **JOIDES RESOLUTION**, into the space between the glaciers and bergs, to drill down into the hard evidence left by the glaciers as they drove debris seaward.

Expedition #379 scientists examining **80** cores found evidence that the ice sheet retreated further inland than today, and that more ice was lost.

THE AMOUNT OF ICE-RAFTED DEBRIS IN SOME OF THE PERIODS OF TIME REPRESENTED IN OUR 750 METERS OF CORE SHOWS THE CONSEQUENCE OF WARMING AND GLACIER RETREAT. IT'S A BIG CONCERN ABOUT THE POTENTIALLY HUGE IMPACT FOR LOTS OF REGIONS ON THE PLANET IN THE EVENT OF A COLLAPSE.

Johann Klages, sedimentologist

• KAREN ROMANO YOUNG • THE JR • 2019 •

In other news: Last year, I mentored 8 thes- is or research projects (an all-time annual record for me), several of whom contributed to Ross Ice Shelf region research, and others

A Riley Scholar is a one-year, visiting faculty member of an academic department at Colorado College. I am one of four Riley Scholars this year. The expectation is to teach half-time (3 blocks) and conduct research during the rest of the academic year. It is a hire to explicitly increase diversity of perspective among faculty on campus by including statistically underrepresented cultural experiences in their rank. My inclusion in Geology at CC appears to be well-received by students in the department and in my classes. In one instance, a student proclaimed their approval upon first sight! The position is part of a larger diversity initiative known as the Consortium for Faculty Diversity, hosted by Gettysburg College. It is a consortium of 50+ liberal arts colleges in the United States. Colorado College's investment in Riley Scholar positions demonstrates their active participa-

tion in that nation-wide endeavor.

In some instances, a Riley Scholar position can be extended for an additional year if the scholar would like to increase their teaching and scholarship experience at CC... and if the host department is happy with their contributions and would like to keep you around!

Okay, but who am I? is also a reasonable question.

Professionally, I am a structural geologist. I use field data and rock fracture mechanics to explain phenomena that I'm interested in, such as tectonic processes, physical methods for extracting resources, engineering geology challenges, earthquake mechanics, mass wasting, and volcanism. I arrived at Colorado College in August 2018 as a one-block visiting Assistant Professor to team-teach the 200-level course, Earth as a Physical System, with Paul Myrow in block 1. For much of the remaining academic year, I invested time in preparing for my eventual teaching role in the department as a Riley Scholar, shadowing Paul's, Christine's, Jeff's, and Eric's classes. I was also a guest lecturer in Henry's class this year.

This year started off as well as I could have imagined. Jonny Norwine, a student who took the Earth as a Physical System course with me and Paul a year prior, opted to embark on an engineering geology independent research study with me. We investigated mechanisms for the development of subsidence and sinkholes in Northeast Colorado Springs due to the collapse of abandoned coal mine tunnels in the Laramie Formation. Jonny used Python to code and visualize physical models that he constrained with geologic and rock mechanics data. The results of his preliminary work were presented at the Midstates Consortium for undergraduate research in Chicago, IL, in November.

In block 4, I team-taught Regional Studies in Geology with Christine Siddoway and with Warren Dickinson of Victoria University of Wellington, New Zealand, including 11 students from NZ. The trip began in San Bernardino and Salton Sea, CA, and ended in Flagstaff, AZ. It was an incredible journey with people who will remain close colleagues and friends. A snowball fight in the Mojave Desert on Thanksgiving while students and paraprofs prepared a deep-fried Tur-chicken feast (amazingly delicious), with so many tasty sides, was one of the highlights of the trip for me.



Swiss Geologists, Warren Dickinson and Christine Siddoway

I don't think there are many people who can say this, but I team-taught a course with my spouse this year. It was the first time either of us witnessed the other giving a lecture,

which was an interesting experience for us. Emily Pope and I developed a geology course for non-Geology majors with the aim of building student intuition about the processes for exploring and extracting Earth's resources and how individual, corporate, and community choices impact environmental, cultural, economic, and political dynamics. The title of the course is Mineral and Energy Resources of the Earth. We had 16 students from various departments ranging from Freshmen to Senior status. Except for rearranging dates of local geology excursions due to snowstorms, the course was an overall success, ending with great independent student research reports on topics of their choosing.

In the remaining academic year, I will team-teach Structural Geology with Christine Siddoway and solo-teach Physical Geology (Intro to geology) this summer. I will also pursue at least three research projects with students. Senior, Julian Lopez, will analyze veins and pressure solution seams in outcrop, hand samples, and thin section building upon research from my 2015 Stanford University PhD thesis. Junior, Charlie Robinson, will build upon my postdoctoral research at the Technical University of Denmark by describing the distribution of fractures in chalk from the North Sea and in Denmark to explain their impact on the flow of groundwater, oil, and gas through reservoirs. And Sophomore, Cade Quigley, will help me explore a new research endeavor of explaining the opening and propagation mechanics of the Rio Grande Rift.

Emily, our daughter, Iris, and I invest much of our free time visiting friends and family across the country and abroad. This academic year, we visited the Grand Canyon and Los Angeles. We are also planning visits to Denmark and Germany in the spring.

Eric Leonard
(Geomorphology, emeritus)



OK – an update from me now that I am retired!

I taught my last block (at least so far) during block 8 last April and May – an Intro class that took me back to lots of old haunts and was capped off by a (rainy) mapping project in Colorado Monument. I will miss those hikes down Monument Canyon. Also during that final block -- Christine and I organized and chaired a Roberts Symposium that brought together four internationally recognized scholars for two days of presentations and discussions on "Beyond Climate Change – the Earth in the Anthropocene". Elsewhere in this version of the PCB there is a fuller discussion of the symposium.

Retirement has taken me afield several times in the past six months. First, in June I led an alumni hiking/geology trip to the Scottish Isles, visiting several classic geologic and archaeological sites, drying off in some very nice hotels with Scottish ales, but only a single nip of Scotch. Lisa served as yoga instructor on the trip. Then in July I returned to the British Isles, this time to Ireland for the INQUA (In-

ternational Union for Quaternary Research) congress in Dublin and for several days touring the west coast. Finally, in November, Lisa and I did an off-season pilgrimage along a portion of the Camino de Santiago – covering the final 120 km of the Camino Portuguese into Santiago. Off-season things were quiet, the trail uncrowded, the weather cool and (luckily) mostly dry. It was a great time to take the walk. I've also taken a couple of meandering car & hiking trips – one from Boston to Colorado via northern Ontario and the UP of Michigan, another to the Phoenix GSA and back through canyon country.

I haven't abandoned geology though and I am still working on several projects. We returned to the Spruce Creek rock glacier to complete our "30-year" – actually 34 – re-survey. It was quite an adventure as the road in was blocked short of the normal trailhead by avalanche debris and rockfall had made our uppermost survey station much less accessible and scarier. Thanks to Paul Longnecker, Sam Bower, and Julian Lopez from braving that survey job. I am also continuing work and manuscript writing on several glacial chronology and modeling projects (two manuscripts currently in review, two nearly ready to submit). I love that stuff and see myself continuing working on it for many years.

Many of you came to the Jeff-Eric Fest in October – about 70 of you attended accompanied by about 30 spouses/partners. It was a really great weekend. Thanks to all of you who were able to come and to the Department for sponsoring and organizing the event. Elsewhere in this PCB there is a fuller description of the event and a link to a page on the Department website with photographs, etc.

Lisa is torn between really liking her job and heading out to interesting places with her now-retired husband. We'll see how that

plays out. Julia and Susan (brace yourselves) are about to turn 30 and 25 respectively. Julia is still in DC, with a new job, Susan in Boston with both a new job and a new apartment.

STEVE WEAVER

(Technical Director)

It has been another great year as Geo Tech Director supporting faculty and students in many class and research endeavors and, as of January 2020, I am proud to announce I have reached the milestone of 25 years of service to the department and Colorado College! It was so great to see a lot of you Geo alums from over my years at CC at the Eric and Jeff Fest retirement Bash in October.



As usual, Student and faculty field and lab-based activity remains high with the analytical facilities getting lots of use. It really is always very gratifying to see the quality of research our students continually produce. As our current EDS-XRF spectrometer is reaching the end of its life I am looking forward to the possible acquisition in the coming year of a new XRF instrument.

I also continue to be active with my creative passion of landscape and nature photography with my usual annual summer trip to Wyoming and Montana and a Winter break trip to Death Valley and the Mojave National Preserve. As always you can check out my work at my website: www.stephen-weaver.com, and follow me on Facebook (@StephenWeaverPhotography.EarthSystemsImaging), and Instagram (weaveresi).

MANDY SULFRIAN

(Administrative Assistant)

Well, it's happened again – another year has flown by and we're in the spring semester, hoping for more snow.

We have two new para-profs – Michael Hasson '19 and Ben Lloyd '19.

They've been a huge help with all the logistics! Skye Keeshin '18 returned to paraprof during 1st block this year. He was a great help with the GY212 class taught by Christine Siddoway and visiting professor Mariana Esteves. Thanks Skye for your help! Lille Haecker '19 also returned to help out in the paraprofing world. Lille worked during 2nd block with Emily Pope '04 for the Physical Geology class. Thanks, Lille, for doing another bang up job!

Charlie & I took a vacation to Scottsdale, AZ, in January. We love the desert! We met some of my family there, had lunch with old friends, and hiked. It was a fun trip!

Hope all's well with you and yours! Do stop by and visit if you're here – it's fun to hear what you're doing and how everything is going.

Mandy



Obituary

Sarah Andrews

The following obituary was shared with members of the American Association of State Geologists (AASG).

Sarah (Andrews) Brown, her husband, Damon, and their 25-year-old son, Duncan, tragically died on July 24, 2019, when their private plane crashed in Nebraska, on their way to their California home from an air show in Wisconsin. She was the award-winning author, pilot, artist, teacher, and professional geologist who brought the excitement of geology to the public through her mystery stories. She adeptly engaged geoscientist friends in her research, often rewarding them with veiled appearances in her books, sometimes with unfortunate outcomes. In her dozen books, geologists, paleontologists, biologists, accountants, and graduate students, among others, were murdered. Her chief alter

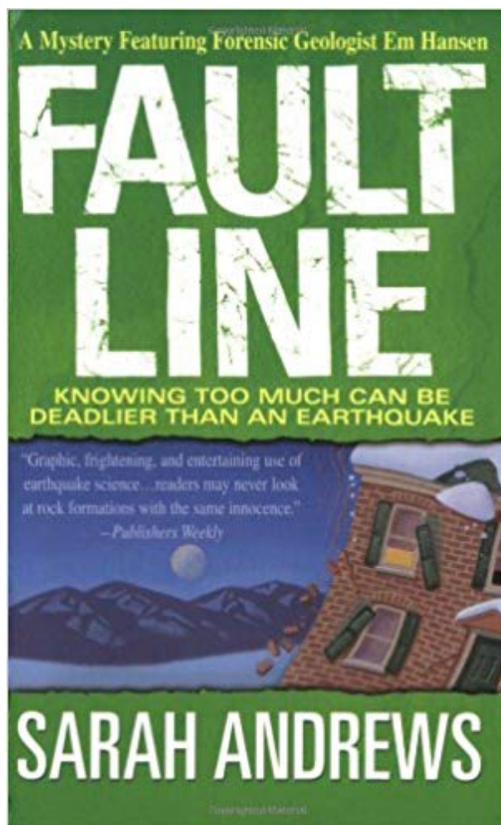


ego, petroleum geologist turned forensic geologist, Em Hansen, demonstrated that geological principles can be used not only to solve murders and scientific problems but also to address social concerns. She painted positive pictures of petroleum, mining, environmental, engineering, and research geologists in industry, the USGS, state geological surveys, and academia. Fascination with the Grand Canyon and dedication to her USGS mentor, Eddie McKee, Chief Naturalist at Grand Canyon National Park from 1929 to 1940, allowed Em Hansen to deftly tackle creationism while rafting down the canyon (in the book *Rock Bottom*).

Sarah's career gave her the background and contacts for research on her books. She earned her B.A. degree in geology at Colorado College. Her first geological job was with the U.S. Geological Survey, where she made contacts that later provided ideas for some of her books (including her yet-to-be-published biography of McKee). After earning her M.S. in Earth resources at Colorado State University, she became a petroleum geologist for Amoco and ANGUS Petroleum, which provided plots for *Tensleep*, *A Fall in Denver*, and *Only Flesh and Bones*.

Professional contacts also gave Sarah a long-lasting friendship with Lee Allison (later State Geologist of Utah, Kansas, and Arizona), who in 2016 also tragically passed away, and through whom other friendships developed with State Geologists and employees of the state geological surveys of Utah (*Bone Hunter*—with intrigue about collecting vertebrate fossils for sale; *Fault Line*—with questions about revealing information on hazards to the public), Nevada (*An Eye for Gold*—touching on fraud and endangered species), Pennsylvania (*Earth Colors*—using elements in pigments as poisons), Florida (*Killer Dust*—effects of African dust), and Colorado (*Dead Dry*—drought and water resources). A downturn in the petroleum industry gave Sarah the opportunity to leave the oil patch for the environmental consulting business in California (background for her book *Mother Nature*) and lecturing at Sonoma State University.

Sarah's engaging personality also urged academics and law-enforcement professionals to jump at the chance of helping her gather information for her books. Reading the acknowledgments in her books is a good way of discovering a network of helpful friends and colleagues. Sarah also acquired background for her books from her youth on the East Coast. She inherited some of her artistic talents from her grandmother and father, who were recognized oil painters. Her mother, an English and religion teacher, gave her confidence to tackle writing and topics for which geology and religion occasionally collide.



The National Science Foundation awarded Sarah an Artists and Writers Grant to conduct research at McMurdo Station and field stations in Antarctica for her book *In Cold Pursuit*, in which the protagonist is a female graduate student who proves that her professor isn't guilty of murdering a journalist.

Sarah was frequently invited to lecture on a wide range of topics, including geology, mystery writing, communicating science to the public, women in geology, how geologists think, the controversy between science and religion, and the life of Eddie McKee. A Fellow of the Geological Society of America, Sarah received several significant awards: the 2016 President's Medal of the Geological Society of America, the 2009 Louis T. Benezet Award from Colorado College, the 2006 Antarctic Service Medal, the 2003 Special Award of the Association of Engineering Geologists, the 2001 James T. Shea Award of the National Association of Geoscience Teachers, the 1999 Journalism Award of the American Association of Petroleum Geologists, and the 1997 Journalism Award of the Rocky Mountain Association of Geologists.

Roberts Symposium 2019 “Beyond Climate Change – the Earth in the Anthropocene”

The Roberts Symposium was hosted by the Geology Department last Spring. With generous funding provided by the Harold D. and Rhoda N. Roberts Memorial fund, the Department engaged four noted scholars over two nights of discussion, on April 30 - May 1, 2019. Eric Leonard and Christine Siddoway co-organized the Symposium and involved the invited scholars in classroom activities during their visit.

The Symposium kicked off with a keynote lecture by Professor David Montgomery of the University of Washington (geomorph students may remember that name) who spoke on the topic “Soil and the Fate of Civilizations: New Motivation to bring Our Soils Back to Life”. During the reception and book signing that followed the lecture, Professor Montgomery was besieged by students and neighbors of the College, who were stimulated by the examples of urban restoration provided in the talk. The following evening Professor Montgomery joined three other scholars for presentations and a panel discussion on the topic of “Earth Systems in the Anthropocene”. Dr. Dawn Wright, Chief Scientist of Earth Systems Research Institute (ESRI) spoke on the advances in geospatial tools that allow 3D mapping of the changing world ocean; Professor Michele Koppes, University of British Columbia, spoke on changes in the cryosphere (glaciers, permafrost, etc.) and their implications for annual water supplies and human existence; CC Provost Alan Townsend reflected on his experiences and beliefs as a scientist studying ecological change. Their presentations were followed by a very lively discussion with the audience.

In addition to their formal presentations, the off-campus scientists met with Geology and Environmental Science classes and with the CC Women in Science Group. Faculty from across the Natural Science Division engaged in vibrant conversation with the speakers over meals and suitable beverages, particularly enjoying the obvious synergy that developed between the speakers.



Dr. Dawn Wright speaks in the CC GIS Lab.



Dr. David Montgomery gives his presentation, “Soil and the Fate of Civilizations: New Motivation to bring Our Soils Back to Life”

Regionals Studies 2020



Regional Studies in Geology is a course in which students use the knowledge and skills that they have developed during their undergraduate education to perform an in-depth study of a given area. Members of the group included five Colorado College seniors, several recent graduates of the University of Victoria in New Zealand, three faculty, and three TAs. During the trip, dubbed “Coast to Continent,” students investigated the geologic features of the western United States by integrating analyses of structures, neotectonics, sedimentology, stratigraphy, and geochemistry.

On November 17th, 2019 the journey began as the Colorado College group drove from Colorado to California to meet the group from the University of Victoria. After sketching the San Andreas fault from the San Bernardino Overlook, the group enjoyed the first of many beautiful sunsets that the West Coast had to offer.

In the following days the group performed its first field mapping project in the Mecca Hills and Salton Trough areas of southern California, while staying in a spectacular field station in Anza-Borrego Desert State Park. Between days of mapping, the class hiked through desert canyons and visited the paleontology lab at the state park—Anza-Borrego was

once home to mammoths, sabertooth cats, and prehistoric camels! As the class continued across California, students were given time to hike and rock climb in Joshua Tree National Park. After the stop in Joshua Tree, the class continued to the Sweeney Granite Mountains Desert Research Center located in a remote corner of the East Mojave Desert. This stop coincided with Thanksgiving, so the class celebrated with a deep fried turkey and the traditional New Zealand dessert, pavlova.

As the trip progressed inland, the class spent a week in the Death Valley area, based out of the little town of Shoshone. After observing the spectacular structures, metamorphics, alluvial fans, and evaporites of the National Park, the class left California for the Grand Canyon. They made sure to stop in Las Vegas to try In-N-Out Burger and visit Red Rock Canyon. While the weather at the Grand Canyon was too snowy to hike below the rim, students learned and debated the different hypotheses regarding its formation. This was the last study area of the trip, and the class ended in Flagstaff on December 13th.

During this month-long trip, students were exposed to a wide variety of lithologies including deposits from lacustrine and Snowball Earth environments, as well as highly fossiliferous units. They cemented their abilities to formulate hypotheses, interpret data, and propose simple models that lead to a deep understanding of a region’s geologic history. The trip would not have been possible without the enormous efforts and careful planning of the faculty and TAs, and the students are extremely grateful for the opportunity to attend such a special course.



Photos by Ben Lloyd

A Few Current Theses and Projects

For my thesis I am studying Miocene carbonate facies in the central Apennines for the purpose of analyzing the cross-bedding and

sequence stratigraphy. In doing so, I will discuss the paleoenvironmental interpretations, and respective processes, responsible for the formation of the cross-bedding and propose a new sequence stratigraphy interpretation.

-Hannah Runyon, '20

Myrow et al. (2018) showed that carbonate rock sections from the South Egan Range, Nevada and the Pin Formation, northern India record nearly identical carbon isotope profiles of the Ordovician–Silurian boundary. The two sections were deposited along the margins of two different supercontinents, and thus similar isotopic curves suggest that these sections record a global signature of oceanic isotopic composition, and that the two sections may be chronostratigraphically correlated to a high degree. The purpose of my study is to study magnetic susceptibility and mercury anomalies in Katian to lower Hirnantian (Ordovician–Silurian) rock units from Nevada and northern India. The magnetic susceptibility analysis will determine if there is a global signal in this parameter that could be used for correlation, and the mercury study will show whether there is a possible link between volcanism and climate change at the end of the Ordovician. Through this study, I hope to improve an understanding of the pre-Hirnantian (Boda event), earliest Hirnantian interval, and factors that led to mass extinction in the Late Ordovician.

-Fai Chanchai, '20

I did a detailed sedimentological and chemostratigraphic study of Mesoproterozoic strata in Inner Mongolia, China with Paul Myrow. This included field work in China during the summer of 2018 as well as multiple visits to David Fike's lab at Washington University St. Louis.

-Peter Mow, '20

I conducted LA-ICP-MS of U-Pb zircon geochemistry of the Conejos and Hinsdale Formation, collected new petrology of the Hinsdale Formation and compiled Early and Recent geochemistry of the three rock suits that comprise the San Juan volcanic field in order to determine if there is a temporal and spatial evolution of the volcanic rocks from the San Juan Mountains from trace element analysis. This study adds to the lacking geochronology using U-Pb analysis and better define rifting of the Rio Grande Rift.

-Robin Hilderman, '20

Summer Student Research

I participated in a 10 week internship with the USGS funded by the Witter Foundation which gave me many valuable experiences in performing geochemical dating methods, substantial material for a senior thesis and helped me understand what I want to do with my future career in geology. I am grateful and thankful for having gotten to work with Amy Gilmer, Kate Sounders and Leah Morgan on two projects and taken a six day trip in the field gathering samples with Kenzie Turner and Ren Thompson.

I conducted in-situ U-Pb zircon geochronology of igneous rocks from the San Juan Volcanic Field, specifically the Conejos and Hinsdale Formations. I prepared zircons by separating, picking, mounting, imaging on the SEM, and choose points of analysis for the LA-ICP-MS. I assist with imaging of thin sections of the Hinsdale Formation, which we used to determine where to do Electron MicroProbe analysis.

The other project I worked on was assisting with extracting data (specifically Ar-Ar dating) from published literature to populate a geochronology database to be included in the Intermountain West Project. To gain an initial understanding of what a robust database needs, I attended the 2019 Community for Data Integration Workshop in Boulder.

-Robin Hilderman, '20

Thanks to the Witter Family Fund, I got to spend 8 weeks this summer working as an Earth Sciences Intern at the Denver Museum of Nature and Science with Ada and Helen. Throughout the summer Helen and I used ArcGIS to attempt to generate a paleoelevation model of the Great Unconformity in the Grand Canyon. Other than that, I spent a lot of time cutting and powdering rocks, organizing the collections, and doing fieldwork throughout Colorado and North Dakota.

-Hannah Runyon, '20

This summer I spent time in the stable isotope lab at CU Boulder measuring clumped isotopes, in samples taken from the Pin formation of Northern India, to determine Upper-Ordovician paleoclimate temperatures and provide further data on the Boda event. I also prepared samples from the Pin formation, and a corresponding section in Nevada, for magnetic susceptibility testing to gain insights into the Ordovician-Silurian boundary.

-Parker Rehmus, '22

Kalsoum Abbasi '97

I arrived at Colorado College in the fall of 1993 with little knowledge of what to expect, but high expectations. Why CC? I wanted to get out of my home state of Washington—a lovely place that I now miss dearly, but 18-year-old me was ready for something new. I was intrigued by the Block Plan, and my mom really wanted her math- and science-obsessed daughter to have a liberal arts education. My dad, like all proper Asian immigrants, wanted a doctor in the family, and I had mollified him by mumbling something about a pre-med program (that I really did look into...!). But I knew I wanted to study geology, and I could tell CC was the place to do that. Field trips! Prime Colorado location! I wasn't sure why I was so drawn to earth science, but it seemed like a good mix of physics and chemistry—and sadly for my dad, biology was just not my favorite science.

I made sure to get Intro Geology on my schedule my first year, and spent two blocks with a visiting professor who took us to west Texas for our extended field trip. We went fossil hunting—something I had never done before—and I was hooked. All I found were some tiny crinoid stem fragments, but the fact that I could find and hold something so ancient was beyond amazing to me. And I loved learning about minerals, and plate tectonics, and strike and dip and all those basics you get in Intro. I remember when I got one of my exams back, the prof had written something like “I hope you stay in geology, because you are awesome at this!”. Why yes, I believe I will.

As I settled into my studies, I figured out that geochemistry was my strong suit. I was okay at identifying minerals, but damn if I couldn't memorize their formulas! While I LOVED my field classes, mapping and thinking in 3D weren't my strong suits. My interest in geochemistry led to a Keck Project in Cyprus, where my field partner and I attempted to map and differentiate a canyon wall of sheeted dikes associated with the Troodos Ophiolite using physical and chemical markers. While I loved all the rock prep and lab work, my samples were so chemically altered we couldn't make much of them. Fortunately, Bruce Loeffler and Jeff Noblett were gracious enough to guide me through the process of cobbling a bunch of bad data into a thesis project. This would not be my last experience with a questionable thesis project.

After graduation, I went back home with no real plan for the future. I figured that grad school was the answer, but I wasn't quite ready to commit. I came back to Colorado Springs in the fall of 1997 to visit my best friend, and stopped by Palmer Hall to say hi. I chatted with Paul Myrow, who mentioned that he had a research partner at MIT who might be able to use some lab help. Within a month I was in Cambridge, working with Sam Bowring in his geochronology lab. I spent the next two years as a glorified rock crusher with a few



We use snow course data to help predict water yields each winter. Occasionally, I get to go help collect reads (though not as often as I would like).

side benefits including: taking graduate courses at MIT to prep for grad school, working under the wing of the pre-eminent scientist in geochronology and isotope dating methods, and most importantly, reconnecting with Matt Reuer. Matt had been a paraprof my junior year, and is now my husband of 12 years. Sadly, Sam passed away last year but I will always be grateful for all that he did for me and all that he contributed to our understanding of earth history.

After a couple of years I needed to get back to school, but had decided that a PhD geochronology thesis wasn't the right fit (I may have been just a bit intimidated by the intensity of my boyfriend and the other MIT grad students I worked with). I thought that a nice master's degree would do me just fine. Something environmental science-y sounded good but I didn't really know what I wanted to do. I was fortunate enough to be accepted to the engineering department at Tufts University, into a master's program specifically for students with undergraduate degrees in science. I was taken on by a MIT-grad professor who had interest in the fate and transport of contaminants in water. This happened to be a side interest of Sam's, so I was set to work on a chemical investigation of a local waterway, with Sam allowing me to do some analyses in his lab. It all came together great—until the funding fell apart toward the

end of my first year. Another professor whose main research focus was water quality modeling was looking for a student—so I went from being an environmental chemist to a modeler in the blink of an eye. I put together a little conductivity/temperature model for a local pond that sat at the bottom of a 4-lane highway and was inundated with road salt each winter. Fortunately, there was a lot of fun sampling work and I found that I enjoyed the modeling more than I thought I would. The real lessons for me, though, were stepping out of my comfort zone, learning quickly, and figuring out how to wrangle an academic thesis out of a less-than-ideal situation—all lessons I had learned at CC.



Matt and I in Kanazawa, Japan in 2018.

After grad school I had vague notions of doing water quality work or maybe stream restoration, but no real plan (are you sensing a theme here?). I found a job at a small consulting firm working on various local water quality projects and getting my feet wet in NEPA permitting support work. After Matt graduated, we moved to Princeton for his postdoc work, and I got a job at CDM—my first hire as an engineer! I continued with NEPA support and did some civil engineering work, mostly acting as resident engineer on construction projects. After two years, Matt was ready to find a job and saw a posting for Technical Director for the Environmental Studies program at CC. “Technical Director—like what Steve Weaver does?” “Yep.” “That sounds cool!” Matt was offered the job and was glad to get back to CC—he had loved his year there as paraprof. In the summer of 2004, we packed up our cars and a moving van and headed for Pikes Peak or bust.

I, however, did not have a job lined up (is anyone surprised?). I had decided that life as a civil engineering consultant was not for me so I moved back to Colorado Springs open to possibilities. I still felt the desire to do “something” with water, but what? At some point I swung by Palmer to say hello and, since I didn't have a full-time job yet, Paul offered to let me be para-prof for his Historical Geology class (hooking me up with work once again—thanks, Paul!). I spent a fun block in the field learning and helping out with a class that I never got to take as a student. I remember insisting that Paul drive the van with the trailer in an attempt to slow him down on our drive to Arizona (it didn't work).

Prior to my Block 8 job I had interviewed for a couple of positions with the Colorado Division of Water Resources. DWR is the agency tasked with administering water use in the state. Colorado has a VERY complex web of water rights, a priority system and a lot of rules and regulations, which I proceeded to learn by drinking from the fire hose. I spent a couple months reading well meters and then, with the benefit of my engineering degree, got a job keeping track of how much water users owed to the Arkansas River and its tributaries and making sure they made releases of water to pay it back. In much of Colorado, and especially the Arkansas River basin, alluvial well users who intercept river water when their water right is not in priority must replace their depletions, and I worked with these well users. I put my “learn quickly” skills to use and within a year or so went from being completely clueless—I really had no idea about Colorado water law when I started—to loving the complexity of the work our office did.

After four years with DWR, I took a job with Colorado Springs Utilities. While I enjoyed my work with the State, I didn't love my commute to Pueblo. So, in 2009 I began work in what is now known as Water Conveyance in Utilities' Resource and Demand Management department. Our team of five, which I now supervise, is responsible for accounting for, managing, and keeping records of water at our river diversions and the 25 reservoirs (a couple of which are about 100 miles from town, on the other side of the Continental Divide) that supply water to Colorado Springs. We are also responsible for staying in compliance with the water rights decrees we have, applying to court for new rights when we need to, and monitoring others' applications to make sure our rights aren't impacted by their proposed operations. Because we are part of a planning department, we also work on long-term demand planning and water supply projects, and many other things (reservoir rehab projects, water quality monitoring teams, state policy review, just to name a few). I love the diversity of work I get to do—operational, engineering, legal—and knowing that my team and I have a critical role in delivering this most important resource to our customers.



Block Break Adventures,
circa 2004

Until I started working at Colorado Springs Utilities, I had little understanding of where my drinking water came from—just like most of our customers. While public outreach is a small part of my job, I do media interviews a couple of times a year to talk about the state of our water supply, and once in a while I'll give a tour or talk to a community group. Over the past several years I've been able to lead tours as part of the CC Office of Sustainabil-

ity's Sense of Place trips, talking to students and staff about their water supply and giving them a hint of all that's involved in keeping the taps flowing now and into the future (while General Palmer found a beautiful location for his Newport in the Rockies, he did not think water supply through very well...). I've been thankful that I've had a few opportunities to work with CC students, staff and faculty in my current role, and am especially happy that CC makes an effort to educate its community about water resources.

Do I do anything related to geology anymore? You may recall that Pikes Peak granite is high in fluorine minerals in places. Part of my team's job when we're planning diversions and reservoir releases to treatment is to pick the right mix of local vs. imported water to keep fluoride levels below federal drinking water standards.

Matt left his job as EV Technical Director several years ago and now works installing and servicing mass spectrometry instruments for a private company. We live with too many cats about a mile east of campus. I run into geology folks every now and then around town, and was thrilled to attend Eric and Jeff's day of retirement activities last October. Despite the fact that my career path diverged from geology, I absolutely would not be where I am today without my time in Palmer Hall!



Getting lots of help carrying precious lake mud that I'd analyze for my senior thesis work, Svalbard, 2005

Caroline Alden, '07

I had the pleasure of speaking with CC alum Caroline Alden, class of 2007, about her exciting geologic career. Here are some of her stories!

Ben Lloyd (BL): Could you give us a quick summary of your path to CC, and how you became a Geo Major?

Caroline Alden (CA): I was born and raised in central Wisconsin and had a lot of exposure to the outdoors as a kid. When I was applying to colleges, I had a lot of interest in being outside and being in the mountains, and came out to visit CC. I was just struck by how sunny and beautiful it was—I was like, "Woah! I want to be here." To be near the mountains is so incredible, it's just crazy to visit and see Pike's Peak right there. I'm sure many people had a similar experience.

In 2013, I finished my PhD and moved to the west coast for a postdoc with Noah Diffenbaugh. He runs a climate dynamics laboratory, which is quite different from my previous work, and it was not as easy as I thought to merge these two different fields. Regardless, it was very interesting to get to interact with the people in his group and I made some lasting connections with people I still collaborate with. My work at that time focused on Amazon rainforest carbon fluxes. So, I was out in CA from 2014-2015, but then my personal life started to assert more influence on my next steps.

My then-boyfriend (now husband) lived back in Boulder, so I thought it would be nice to return to Colorado. I kept my eye out for positions in Boulder, and then this job popped up that focused on using atmospheric observations to look for methane leaks from oil and gas production. I had never done anything on that scale before, but it used the same toolkit as my previous research. I ended up getting that job in 2015 and joining what ended up being a very interesting project.

After I made the call to go to CC, I remember signing up for classes for the FYE. I'm not even sure I knew what Geology was at the time—I didn't have any kind of earth science in high school, but the Geology FYE course description mentioned field trips, so that piqued my interest. It seemed like a great—basically camping—introduction to college! That was my first block of geology, taught by Henry and Christine, and—I think this happens to a lot of Geo Majors—the rest is history! My plan had always been to go to med school; my dad and grandfather were doctors, and I always assumed I'd follow that path, but geology made me start to reconsider. I thought, "Wow, that was really fun, travelling around the southwest in a van, looking at rocks. Maybe I'll major in geology, but still get all the med school requirements just in case." I took molecular biology and all the pre-med classes, but things started to shift in my senior year.

Eric told me about an REU program in Svalbard, which I did, and came back to CC with a senior thesis studying lake mud from the Arctic to understand global change. I was also realizing that climate change really sparked my interest—this was 2005-2006 when *Inconvenient Truth* had just come out and it was hitting everybody how big of a deal this was—so I had this moment when I said to myself, "You know what? Maybe I don't want to be a doctor, and maybe I want to actually do this geology thing." It was always meant to be like "I'm going to have fun in college, go on field trips, and learn about earth systems because it's really cool, before coming back and becoming a doctor," but eventually at a some point I realized that global climate change was really important to me and that I wanted to continue working in that field.



Regionals 2007. Left to right: Helen Lynn, Emily Parker, John Rotzien, Kerry Sicard, Caitlin Florentine, me, Nancy Calhoun, and Betsy Friedlander

BL: Are there any particular experiences from your time as a CC Geo Major that have stuck with you?

CA: So many adventures! Just in aggregate, so much joy and fun around the campfire with friends, going into the wilderness. In my regional studies course, we got to go to New Zealand. I remember walking up one of the volcanoes that was literally right out of Lord of the Rings and having lunch around the rim of its active crater. Later in the course, we wandered around the toes of these crazy glaciers, and it was so cool to have Eric there to point out every glacial feature you could imagine in a textbook, all laid out around you.

CC geology majors get to have such a huge wealth of experiences, from wandering down to monument creek or mapping the features in the local area, all the way to then when you load up the vans and go—even if you're just standing on a road cut somewhere—it was a really, really amazing experience.



Sharing a love of rocks with my husband Nick Rosen (fellow CC Grad!), circa 2013?

BL:

What are some of your best CC memories outside the geology major?

CA: Obviously, block breaks are so cool. You get to explore the mountains and surrounding areas with your friends! I had some incredible experiences exploring the desert—especially Canyonlands. Another thing CC afforded me that I probably wouldn't have gotten into otherwise was rock climbing. That ended up being a really cool part of my life—having Garden of the Gods and Turkey Rocks right there. It was incredible to be able to just jet out for a free afternoon and be right there with access to such amazing wilderness areas with rock climbing and skiing. These experiences were a big part of my life at CC.

BL: Where has geology taken you since CC, up to present day?

CA: I decided to apply for graduate school because of a lot of Eric Leonard's classes, and I was really into studying climate change through the lens of glaciology and impacts on paraglacial environments. I ended up speaking to Dr. Jim White of INSTAAR (The Institute for Arctic and Alpine Research), who said, "Listen, I don't do anything with glaciers, but if you want to

study greenhouse gases themselves, and look at the impacts of climate change through that lens, I have an opening.” I weighed my options—no cool field site, but the ability to live in Boulder, and thought that it sounded like a pretty good deal! My interest was kind of piqued because he was explaining that if you study these greenhouse gases and look at the CO₂ in the air, then you can fingerprint emitters. The ability to understand where emissions are coming from helps to validate climate protocols. So, I took that opportunity, and went and got my degree here at CU Boulder.

During and after graduate school, my trajectory continued to take twists and turns. I did a PhD project on CO₂ isotopes as tracers for drought stress across continental-scale areas. It was so cool that taking little samples of air from different places could tell you so much about climate and ecosystem functioning in response to climate change. In the last year or so of my PhD, I was at AGU, and I went to a talk on projecting corn yields in the future with d¹³C, and thought it was really interesting to apply techniques used for larger scale approximations of climate-driven stress directly to crop yields and the economy. So after the talk, I introduced myself to the speaker—his name is Noah Diffenbaugh—and that brief conversation opened the door to a postdoc with him at Stanford.

I joined a team of people who have figured out how to ruggedize this crazy, Nobel-Prize-winning laser, take it out into the field, and leave it for days to measure methane concentrations. My job was to take those concentrations and turn them around to figure out where they might have come from. That ended up turning into a startup called LongPath Technologies, which we cofounded in 2018. I still have a position as a research scientist here at CU Boulder, but a lot of my focus has been on this company. Soon, we are going to launch large-scale, continuous monitoring for leaks of methane, which is very important from a climate perspective. Leaks of methane gas can happen along the supply chain anywhere, from the production wellhead all the way to where the gas comes out of your stove. Because methane is such a powerful greenhouse gas, if you add it all up, it’s right at the threshold of being as bad or worse than coal as a climate forcing.

Natural gas, as a clean energy source, therefore has this huge caveat: you can’t have too many leaks. The infrastructure is likely so leaky right now that it needs to clean up if it will really act as a “bridge fuel,” as it is marketed. It feels really good to be using my skills to work on a climate change mitigation project, rather than just continuing to document climate change. Last spring the Colorado legislature passed strict new regulations on how much wells can leak, so we are well positioned right now. We’ve got this new technology, and now this state is going to try to use new tools to lower those emissions over time. So that’s where I am right now!



Lunch in the park with my little one, Willie, CC Geo Class of... 2040?

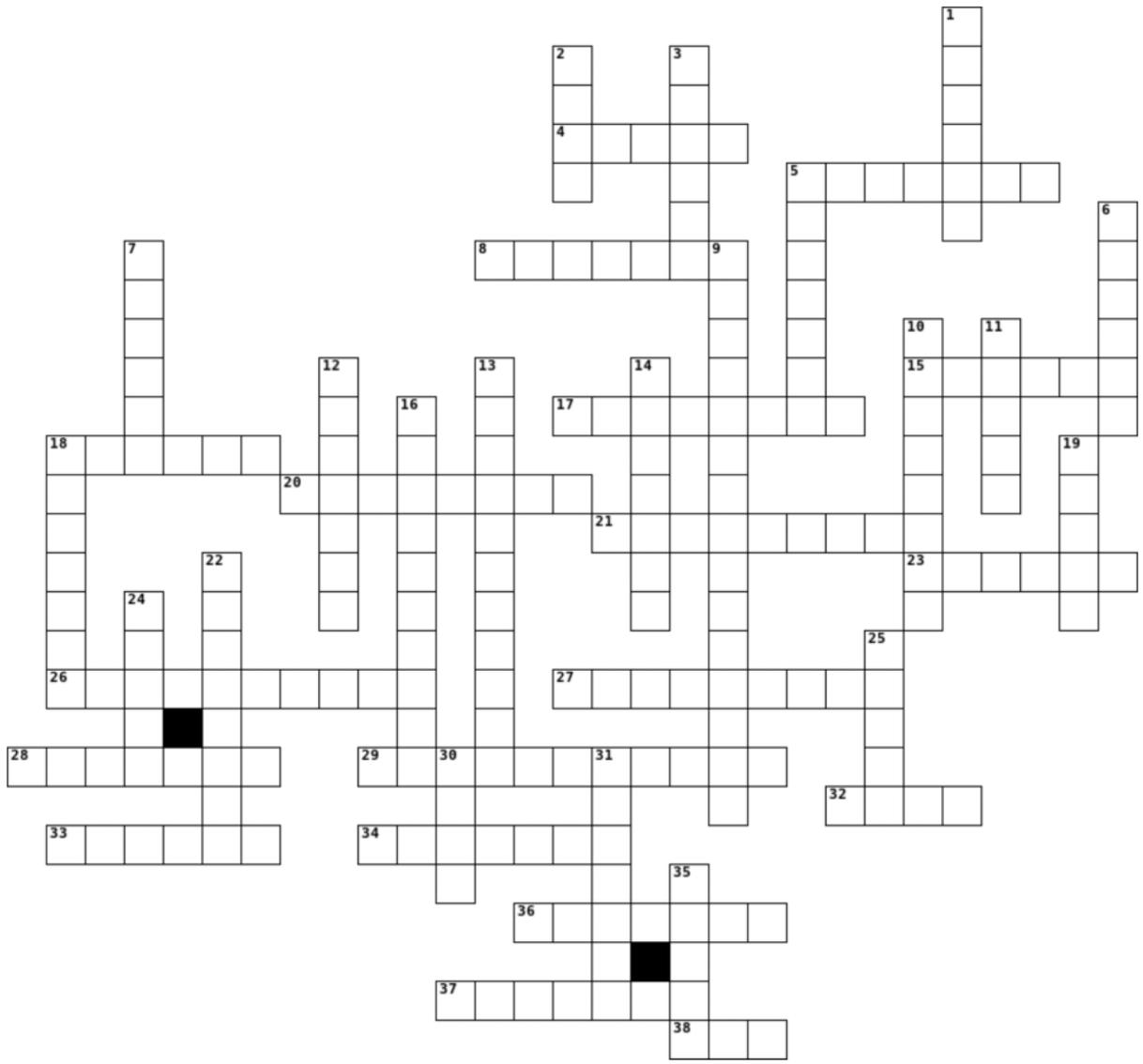
BL: In the future?

CA: The future will be an interesting crossroads, whether I'll launch into startup world full-time, or stay at the university as a research scientist. For the next few years, I think I'll continue to do both. I have a few other projects at the university that are more focused on climate monitoring than climate mitigation, looking at cropland CO₂ fluxes and related topics, so I'll bridge both worlds for a while, but I don't know where it will take me. I'm always open to the next change, and whatever I plan doesn't seem to be what I end up doing anyway!

BL: What advice do you have for current students or alumni that are thinking of following in your footsteps, both in academia and the private sector?

CA: I think of something that Henry asked me when I was applying to grad school, which is "do you really know why you're applying?" At the time, I don't think I considered his question as seriously as I probably should have: my answer was basically, "I need a paycheck and it would be cool to keep going on field trips." Now, I realize that it is important to really think about what your goals might be, and then think about what you're hoping to achieve out of those next steps. Graduate school is a huge time and intellectual commitment and it will inevitably guide or alter your path forward in ways that you should try your best to be prepared for.

For example, once you have a PhD in something, you're now highly trained in something very specific, for which there may or may not be a very broad job market outside of academia. If you know you want to be a professor, then absolutely go for it, but those are extremely hard jobs to come by, so you do want to know what the other possible outcomes will be: what opportunities are you creating for yourself in the future? Is graduate school necessary to get you where you want to go? And if you don't know, that's fine, just know where you'll be positioned when you come out on the other side. Another thing that I think is important is to find mentors to help you think about those questions. Ask them, "What happens when you come out with a PhD?" or "What is academia all about?". It's important to start figuring out the ins and outs of publishing, postdocs, and professorships. And if your current mentors can't answer all of your questions, keep seeking out those people who can help you get a lay of the land for where you want to go. Academia can be a pretty confusing landscape, but if you find a path that works for you, it can be incredibly rewarding too. Even if you just stumble upon that path as different opportunities open up ahead of you! I am so grateful that I was able to be part of the CC Geo community and for the opportunities that opened up for me because of my mentors there. Go Tigers!



ACROSS

4. Fine, fertile soil
5. Chewing tobacco
8. This mineral needs food
15. Southernmost active volcano on Earth
17. Scarcity synonym in pig latin
18. Planetary alignment
20. Drinking establishment for meanderers
21. Creature with the biggest teeth
23. Hipsters liked it before it was cool
26. Earthy green pigment
27. An extraordinary bagel topper?
28. Meteorite impact product
29. National park that would make an apt WiFi network name
32. The living Earth
33. Foot exfoliator
34. The highest form of flattery?
36. It's bliss!
37. You need more than three to make a map
38. Hadean was the Earth's first

DOWN

1. Group of mountains
2. Straining in response to a bad poker hand
3. _____ and bappper
5. Lowest exposed land on Earth's surface
6. One might have faults related to this
7. Minerals that are a little less than liters?
9. Changing everything
10. Divination involving the interpretation of thrown rocks
11. Imaginary surface corresponding with Earth's sea level
12. Source of oil in shale
13. Type of mineralogical shotgun?
14. Upcoming world phenomenon?
16. Layer of the Earth's atmosphere that reflects radio signals
18. Under the HVAC?
19. Element with a low atomic number that is not found naturally on Earth
22. Blowing off steam?
24. Topographic home to caves and sinkholes
25. Lunar seas
30. Good earth
31. First satellite to orbit Earth
35. To prospect with a divining rod

Answers on page 38

Geology Day

April 7, 2019, Olin Lecture Hall

Student Presentations

Annabelle O'Neill '19 "Relating fen hydrology and chemistry to source waters within a rock glacier and talus slope at Ophir Pass in the San Juan Mountains, CO"

Ben Lloyd '19 "Paleoclimate in the Wake of the K-Pg Extinction: Changes in Leaf Morphology and Carbon Cycling in the Early Paleocene at Corral Bluffs, Colorado"

Michael Hasson '19 "Physical Stratigraphy, Chemostratigraphy, Paleontology, and Detrital Zircon Geochronology of Lower Paleozoic Strata, Dinosaur National Monument"

Kevin Patterson '19: "Quantifying strain across the Five Points Shear Zone"

Zoe Krauss '19: "Modeling of the Crustal Geology beneath the Ross Ice Shelf, Antarctica using Rosetta Magnetism and Gravity Data"

Ellie Meyer '19: "Strike Three Geologists! - Faults That Slipped Past"

Drew Ceglinski: '19: Virtual Field Trips: The Potential of VR Software in Making Geology Accessible"

David Sachs: '19: "Geodesign applied to an urban campus and its river reach: Colorado College and Monument Creek"

Nerissa Barling: '21: "Geoarchaeology of the Bronze Age Theran Eruption: Mapping and Sampling the Precursory Tephra Fall and Interpreting Archaeological Surveys"

Drew Ceglinski: '19 (VR Presentation): Virtual Field Trips: The Potential of VR Software in Making Geology Accessible"

Will Rundquist: '19: Monument Creek Project Phase III: Enhancement of the Natural-Urban Interface Through Geodesign

Robin Hilderman: '20: Effect of Confining Pressure on Permeability of a Hydrothermally Altered and Fractured Ballistic from the Conduit of Whakaari Volcano, New Zealand

Senior Awards

Annual Awards
Year: 2019-2020

Rocky Mountain Association of Geologists (RMAG) Award:

Ben Lloyd '19

Estwing Outstanding Senior Geologist:

Michael Hasson '19

Association of Women Geoscientists:

Zoe Krauss '19
Ellie Meyer '19

William A. Fischer Special Recognition:

Kevin Patterson '19

RMAG McKenna Scholarship:

Annabelle O'Neill '19

Buster Scholarships:

Peter Mow, '20
Michael Hasson, '19

Gould Scholarships:

Peter Mow, '20
Jonathan Norwine, '21

Putman Scholarships:

Andrew Ceglinski, '19
Helen Carter, '20
Sarah Packard,
Nerissa Barling, '21

Charles Rhoads Award:

Ellie Meyer, '19

Hannigan Award:

Ben Lloyd, '19

Witter Family Fund for Geology Internships:

Company	Location	Name	Class
Leaf Environmental	New Orleans, LA	Anna Feldman	Soph
USGS	Denver, CO	Robin Hilderman	Jr
LDEO	Manhattan, NY	Jonny Norwine	Jr
DMNS Paleontology Research Intern	Denver, CO	Helen Carter	Jr
LDEO	Manhattan, NY	Sarah Packard	Soph
DMNS Paleontology Research Intern	Denver, CO	Ada Bowles	Soph
State of Alaska Division of Geological & Geophysical Surveys (DGGs)	Fairbanks, AK	Julian Lopez	Jr
Neptune & Co	Denver, CO	David Sachs	Senior
DMNS Sed & Geochron	Denver, CO	Hannah Runyon	Jr
University of Hawaii	Manoa, HI	Nerissa Barling	

Student Conference Presentations 2019

GSA in Phoenix 2019

Robin Hilderman, '20: Effect of Confining Pressure on Permeability of a Hydrothermally Altered and Fractured Ballistic from the Conduit of Whakaari Volcano, New Zealand

AGU in San Francisco, Fall 2019

Ben Lloyd, '19: Paleoclimate in the Wake of the K-Pg Extinction: Changes in Leaf Morphology and Carbon Cycling in the Early Paleocene of the Denver Basin, Colorado

Seminar Series Fall 2019

September 6, 2019 - **Dr. Calvin Shackleton**, University of Tromsø, Norway: "Subglacial hydrology of the Fennoscandian and Barents Sea Ice Sheets"

September 11, 2019 - **Dr. Carol Dehler**, Utah State University "Neoproterozoic strata of the southwestern U.S.: A record of rifting, global glaciation, and eukaryotic evolution (plus: How does Tava Sandstone fit in?)"

September 16, 2019 - **Dr. Mariana Esteves** from the University of Trømso, Norway, "Palaeo-Ice Stream retreat patterns and dynamics during deglaciation of the central Barents Sea"

October 3, 2019 - **Dr. Trevor Hillebrand**, Postdoctoral Research Associate Fluid Dynamics and Solid Mechanics Group, Los Alamos National Laboratory, "Did the West Antarctic Ice Sheet collapse during the Pleistocene?"

Seminar Series Spring 2020

January 23, 2020 - **Kristen Rahilly**, PhD Candidate at University of New Mexico, "Diffuse carbon dioxide emissions from volcanoes: the Yellowstone caldera story"

January 27, 2020 - **Dr. Hector Lamadrid**, Postdoctoral Fellow at University of Missouri, "Serpentinization and other hydrothermal reactions in crustal processes: Experimental and analytical developments in the study of fluid-rock interactions."

January 30, 2020 - **Dr. Michelle Gevedon**, Postdoctoral Fellow at Southern Methodist University, "Stable isotopes and U-Pb dating of skarn garnets: A new non-traditional paleoenvironmental indicator?"

March 4, 2020 - **Dr. Sam Johnstone**, US Geologic Survey, "What's all this noise about fans? Simulating randomness to understand the patterns of preserved alluvial fan sequences"

Recent Faculty Publications

Bold indicates Colorado College student/faculty

Myrow

Hughes, N.C., **Myrow, P.M.**, Ghazi, S., McKenzie, N.R., and DiPietro, J.A., 2019, The Cambrian geology of the Salt Range of Pakistan: linking the Himalayan margin to the Indian craton: Geological Society of America Bulletin, v. 131, p. 1095-1114.

Hughes, N.C., **Myrow, P.M.**, Peng, S., and Banerjee, D., 2019, The Parahio Formation of the Tethyan Himalaya: Further consideration of a case history in lithostratigraphy: Journal of the Palaeontological Society of India, v. 64, p. 275-282.

Myrow, P.M., Fike, D.A., Malmskog, E., Leslie, S., ***Zhang, T.**, Singh, B.P., Chaubey, R.S., and Prasad, S.K., 2019, Ordovician–Silurian boundary strata of the Indian Himalaya: Record of the latest Ordovician Boda Event: Geological Society of America Bulletin, v. 131, p. 881-898.

***Smith, E.**, Daniller–Varghese, M., **Myrow, P.M.**, and Mohrig, D., 2019, Experimental investigations of combined-flow sediment transport: Journal of Sedimentary Research, v. 189, p. 808-814.

Schanz

Schanz, S.A., Montgomery, D.R. and Collins, B.D., 2019. Anthropogenic strath terrace formation caused by reduced sediment retention. *Proceedings of the National Academy of Sciences*, 116(18), pp.8734-8739.

Collins, B.D., Dickerson-Lange, S.E., **Schanz, S.** and Harrington, S., 2019. Differentiating the effects of logging, river engineering, and hydropower dams on flooding in the Skokomish River, Washington, USA. *Geomorphology*, 332, pp.138-156.

Siddoway

Jordan, T.A., Riley, T.R. and **Siddoway, C.**, 2020, *Geology of West Antarctica*, *Nature Reviews Earth and Environment*, doi:10.1038/s43017-019-0013-6, <https://rdcu.be/b0OL8>.

SCAR GeoMAP (Geological Mapping Update of Antarctica). https://data.gns.cri.nz/ata_geomap/index.html?map=Antarctic [CC student contributors, a.k.a. "the engine room": **Alexie Millikin, Sam Elkind, Noah Villamarin-Cutter, Tristan White.**]

Siddoway, C., Palladino, G., Prosser, G., **Freedman, D.**, and **Duckworth, W. C.**, 2019, Basement-hosted sand injectites: Use of field examples to advance understanding of hydrocarbon reservoirs in fractured basement rocks, in Bowman, M. (ed.), *Sub-surface Sand Remobilization and Injection*, *Geol. Society of London Special Publication* 493, doi: 10.1144/SP493-2018-140.

Tinto, K. J., Padman, L., **Siddoway, C.S.**, Springer, S. R., Fricker, H. A., Das, I., Caratori Tontini, F., Porter, D. F., Frearson, N. P., Howard, S. L., Siegfried, M. R., Mosbeux, C., Becker, M., Bertinato, C., Boghosian, A., Brady, N., Burton, B. L., Chu, W., Cordero, S. I., Dhakal, T., Dong, L., Gustafson, C. D., **Keeshin, S.**, Locke, C., **Lockett, A.**, O'brien, G., Spergel, J. J., Starke, S. E., **Tankersley,**

M., Wearing, M. & Bell, R. E., 2019, Ross Ice Shelf response to climate driven by the tectonic imprint on seafloor bathymetry, *Nature Geoscience*, 12, 441–449. Data here.

Pope

Pope E., Boyd A, Rosing M, Connelly J, Bizzarro M. 2.8 Ga meteoric water alteration of the Isua Supracrustal Belt. *Goldschmidt Meeting, Barcelona, Poster*, 2019.

van der Meer Q, Scott J, Serre S, Whitehouse M, Kristoffersen M, Le Roux P, **Pope E.** Zircon Megacrysts in Alkaline Basalts Record Low- $\delta^{18}\text{O}$ Domains in Zealandia's Lithospheric Mantle. *Goldschmidt Meeting, Barcelona, Oral*, 2019.



Students climb Neoproterozoic sedimentary rocks in Saratoga Spring, California.
PC: Ben Lloyd



Christine with a fold! PC: Ben Lloyd

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

Steve Spear, 1969

I had a very productive Retired Geologist Year. I went to our 50th reunion in October and spent a lot of time with my Senior Thesis Partner-in-Geologic-Crime, and BFF Bonita Lahey. In May I went to the Indian-Eurasian plate boundary in Tibet and did my best to slow the collision.



From there I went to Everest Base Camp on the Tibet side.



I still adhere to the philosophy that "He who sees the most rocks, wins."

Bonita Lahey, 1969

I am now a Tour Guide at Dinosaur Ridge in Morrison, CO

John Dolson, 1971



John Dolson has just been awarded the American Association of Petroleum Geologists John Shelton Search and Discovery Best Paper Award for this paper:

Dolson, J., Z. He, and B. W. Horn, 2017, Advances and perspectives on stratigraphic trap exploration-making the subtle trap obvious, AAPG 2017 Middle East Region Geosciences Technology Workshop, Stratigraphic traps of the Middle East, Muscat, Oman, AAPG Search and Discovery Article #60054 (2018), p. 67.

This is the description going with the AAPG awards booklet for the June, 2020 convention in Houston, Tx.

This paper summarizes, using an updated AAPG giant fields database, a step-change in successes finding giant fields since the year 2000 in combination and stratigraphic traps. We demonstrate this change is predominately from advances in seismic 3D reservoir imaging and better data integration.

Patrick Williamson, 1982

Patrick continues to work as an international mining consultant, focusing on waste rock geochemistry and water supply/quality for mining projects in Latin America and the US. He is currently working for INTERA Inc out of their Boulder office. Patrick is the proud father of a second generation environmental geologist (Bryce) who also works for INTERA in Albuquerque.

David Williams, 1987

In 2019, the University of Washington Press put out a paperback edition of my book, *Stories in Stone: Travels Through Urban Geology*, which originally came out in 2009. The book weaves together human and natural history of building stone from around the country, including the granite for the poet Robinson Jeffer's house in Carmel, Salem Limestone from Indiana, and petrified wood from a gas station in Lamar, Colorado. I am also working on a book about people and place in Puget Sound.

Nathan English, 1996

I'm still in Australia at Central Queensland University, with a recent promotion to Senior Lecturer in Environmental Science and continuing my role as Head of Course for the Environmental Sciences. Just finished a recent field expedition funded by National Geographic to collect tree-rings from 200 year-old trees in Southern Tasmania. Thinking of you all in beautiful, wintery Colorado while we recover from our horrific bushfire summer, please send precipitation this way!

Rob Backlund, 2005

Rob Backlund, class of 2005, lives with his wife (Meredith Niles), seven month old daughter (Suvi Backlund-Niles) and dog Finn at the end of a dirt road in Vermont. Rob owns and operates a handyman and woodworking business. He spends most of his time presently entertaining and educating his daughter while Meredith brings home the bacon.

Matt Rosales, 2008

Big changes this year! After spending the last 8.5 years working with CC geo Alums Betsy Friedlander, Jenny Haywood, and Christian Baxter at Teck in Vancouver, I moved on to join the metals & mining banking team at ING in New York. Big

change from the immediate access to the outdoors which Vancouver

Image Caption:

(Photo credit: Jon Rotzien from the Noblett-Leonard fest).



From left: Jon, Cate Collinson (my wife, non-CC biologist) Me, Jenny Haywood, Jeff Wollenberg, Betsy Friedlander, Larissa Phillips) I think Jon and Jenny are class of 06, Betsy is 07, and Jeff, Larissa and myself were '08.

offers to the bustle of city, but Cate, Arlo (our dog) and I are happily settling in. While the new position certainly involves learning a lot about banking and finance, I still am practicing geology every day as I evaluate the technical risks, along with the environmental, social, and financial aspects of new projects for development. So far this year I have visited fascinating deposits in Mauritania, Quebec, Ontario, and Guatemala, with several more planned already for the new year. Of course, a highlight of the year was attending the Noblett-Leonard fest! It was so good seeing our CC family and learning about all of the great new research initiatives of faculty, students, and alumni. Congrats to both of you on the many successful years of teaching and mentorship, and best wishes in retirement. For anyone traveling through NYC, please send me a note!

Zion Klos, 2009

Greetings from myself and my partner, Lucy Holtsnider (CC '11 Alum), from Marist College in Poughkeepsie, New York! My life has come full circle from my days learning (and eating!) in the department at CC. I'm now a liberal arts professor myself, teaching some fun and engaging field-based courses as my undergraduate majors learn and explore the Hudson Valley and travel out West/Alaska/where next? As a tenure-track faculty in a rapidly changing environmental science department, and the college's first Earth scientist, I've been able to bring some new curriculum into the program with my courses in geology, hydrology, and ecology. I also spend much of my week, and most of the summer, advising a group of young hydrologists as they practice the processes of proposing, performing, and presenting/publishing their research. It was great to bring a group of three research advisees to their first AGU this past month in San Francisco as they each presented their independent research and networked for future graduate opportunities. Their research topics included structural hydrogeology, hyporheic exchange, and hydrologic controls on harmful algal blooms.



Outside life on campus, Lucy and I have found a great community in the Hudson Valley – some great people here, and an easy train ride to NYC as she pursues her fine arts career – plus easy access to days adventuring in the Gunks, Catskills,

and Adirondacks to “shred the gnar” or lounge in a canoe along an empty wilderness beach with some good friends and our pup, Olive. Let us know if you're living/visiting the area, we'd love to connect with more fellow CC alums!

Maisie Richards, 2011

I continue to work on the West Coast for Inter-Fluve, a river restoration consulting firm, and have been slowly (and somewhat stealthily) shifting my role from fluvial geomorphologist to visual communications. Ever since the support of Henry Tony Hawk Fricke to scientifically illustrate my CC thesis, I have now made a pattern of convincing people of my scientific capability only to transform myself into an ~*artist*~ once I've weaseled my way in. Despite this, somehow they keep letting me stay, and I keep coming up with new ways to incorporate graphics and illustration into the field of river restoration (see attached). In a week I give a plenary talk on Science and Art in River Restoration at the Upper Columbia Science Conference! Don't worry, I still get to enjoy the pure bliss of a pebble count in snowmelt rivers every so often.

On the side-- though it's also the work I feel most inspired by-- I'm learning how to use visual communication, and graphic recording in particular, to support racial equity work. Whenever faced with a complex concept, it has always helped me to draw it out (see: all of my field notebooks). Turns out it's helpful to others as well, and it's called graphic recording! Excited to continue exploring how this tool can help improve our conversations around racism.

Virginia Hill, 2015

2015 geology grads Virginia Hill and Daniel Butler were married on May 26, 2019 in Charlottesville, VA. We were fortunate to be able to celebrate with many CC friends (geology and otherwise) in attendance. We are looking forward to returning to rockhounding in Colorado in August 2020 when we move from New York City to Denver.

Jed Ball, 2016

I was involved in making an informational sign for the Great Uncomformity at Rainbow Falls. I don't think it's up yet, but should be this Spring I believe.

Aaron Farquhar, 2018

I live in Portland, Oregon. In the past year I officially had some of my CC thesis data published! I also started working at a geo-spatial mapping service called Quantum Spatial, where I am learning how to produce orthorectified imagery. I also ate a lot of pad kee mao. Looking forward, I hope to drink more water - 2020 is the year of hydration!

Matt Tankersley, 2018

I'm still thawing out from my recent trip to the Kamb Ice Stream on Antarctica's Ross Ice Shelf! I was collecting seismic and gravity data near the grounding zone to help determine a site for a future sediment drilling operation. Now I'm back in New Zealand at the Victoria University of Wellington and beginning my PhD where I'll be using geophysics to create a better geologic model of the crust under the Ross Ice Shelf. If anyone is visiting Wellington please say hi!



Matt in Antarctica



Students discussing a field site during Regional Studies

Across

- 4: Loess
- 5: Dipping
- 6: Apatite
- 15: Erebus
- 17: Earth Day
- 18: Syzygy
- 20: Point bar
- 21: Megalodon
- 23: Carbon
- 26: Terre verte
- 27: Supernova
- 28: Tektite
- 29: Yellowstone (it's a hotspot!)
- 32: Gaia
- 33: Pumice
- 34: Plateau
- 35: Igneous
- 37: Strikes
- 38: Eon

Down

- 1: Massif
- 2: Folding
- 3: Basalt
- 5: Dead Sea
- 6: Stress
- 7: Quartz
- 9: Earth shattering
- 10: Geomancy
- 11: Geoid
- 12: Kerogen
- 13: Double beryl
- 14: Orogeny
- 16: Ionosphere
- 18: Subduct
- 19: Boron
- 22: Phreatic
- 24: Karst
- 25: Maria
- 30: loam
- 31: Sputnik
- 35: Dowse



Mud cracks near geothermal area near Myvatn, Iceland
Photo by Steve Weaver

Dear Colorado College Geology Alum:

We hope you have enjoyed the 2019-20 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) _____
City _____ State _____ Zipcode _____
Home Phone _____ Business Phone _____
Email _____ Website _____

Current Employment or Graduate School Info:

Recent Events, Exciting Adventures, and other Comments

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