

THE COLORADO COLLEGE GEOLOGY DEPARTMENT



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**Cover Photo: Grinnel Point, Glacier National Park
Taken by Steve Weaver**

The Precambrian Basement

2016-2017

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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!).

The department continues to do well. Megan Anderson completed work in the Bighorns and has been focused extensively on gravity and magnetic data in the Northwest; the latter of which has engaged a number of students. In fact her work has been sufficiently strong that the USGS asked her to work with them on projects in the Northwest. So Megan has taken a leave this year to pursue research in an active tectonic area. Henry Fricke is continuing his work on terrestrial paleoenvironments and paleoecology of Western North America in the later Mesozoic and early Cenozoic. He is being reviewed this year for promotion to full professor, the last step for faculty. Thank you to all of you who, as former students and advisees since his last promotion, sent us review comments. Eric Leonard continues to work on glaciation and paleoclimate in the Rocky Mountains as well as with the Snowmastodon project, completing an old neotectonic project in Chile, and a new project in New Mexico. Paul Myrow continues his extraordinary research, grant, and publication rates working in the Cambrian with brief forays into the Devonian and early Mesozoic around the world. He was the most-cited faculty member at Colorado College for at least part of last year! Rumors are that he has been spotted in Mongolia (within a week of having his appendix removed) and Myanmar recently. Christine Siddoway received the college award to be the next McKee Professor in the Natural Sciences reflecting her long record of outstanding teaching and scholarship. She continues to work in Antarctica and was able to send a student there this winter, as well as work on those sandstone injectites from the NeoProterozoic in Colorado, and on Wyoming tectonics. Her work in Antarctica is starting to bear a relationship to current concerns over melting in the Western Antarctica ice sheet. As the thirty-seven year mark for working at CC approaches, I continue to chair the department, reflecting on old mistakes and joys while working on new ways to teach and with research students on fascinating projects in igneous petrology, while still trying to bring the magma-mixing work to completion. With Christine on sabbatical and Megan on leave, we have two newcomers teaching with us this year. Meredith Bush graduated from CC in 2008 and returns to us while defending her dissertation at the University of Texas successfully this fall. She worked on "Recognizing the stratigraphic signatures of convergent mountain building in plate-interior basins", and is teaching Structural Geology. Bobby Karimi earned his PhD at the University of Pittsburgh studying "Resolving the Through-Going Active Fault Geometry and Fault Strength Parameters through Stress Modeling: A Study of the North Anatolian Fault (NAF)". He has taught Geophysics and Field Methods among other courses at Millersville and Clarion Universities.

Our students benefitted tremendously from the new Witter Family Fund for Internships in Geology. Nine students received funding and participated in an internship. These experiences were spread across the spectrum we anticipated, ranging from work in a specialized university lab, a USGS lab, a hydrology firm, the Smithsonian Global Volcanology Program, and the city of Colorado Springs, to the Denver Museum of Natural History. Students were uniformly thrilled with their experiences. They loved the work they did, enjoyed meeting professionals in their field, and appreciated their mentors. Some completed their projects and have moved on or returned to class; one presented her work as a research paper at the annual Geological Society of America meeting (this will become her senior thesis); and one published her

work on the Smithsonian website and is currently writing a professional paper with her mentor. You can read more about their stories within this volume. Please let me know if you have positions in future years (or during the academic year) that might be appropriate for student interns or know people who would like to mentor young students. We really appreciate all you can do for our students.

Jeff Noble, Geology Department Chair



Black Canyon of the Gunnison
Photo by Steve Weaver



PAUL MYROW
(Sedimentology/Stratigraphy)

Hello to CC Geo alumni. All is well in Palmer Hall, except for the massive construction project right outside my office where the renovation of Tutt Library is taking

place!

I had some great adventures and some hot fieldwork this year. It turns out that June in Dinosaur National Monument is not the best time to do field work. My student Gerry Ramirez and I had a primitive campsite a few miles into a canyon in the park, and it required a lot of hiking each day in hot weather. However, it was worth it to study the Cambrian rocks in a park known obviously for its Mesozoic section. Later in the summer I worked with CC student Tianran Zhang on various Proterozoic and Paleozoic rocks in Inner Mongolia. We found a great Mesoproterozoic section that we will work on again next year. The degree of difficulty of the trip was increased when ten days prior I had an emergency appendectomy in a hospital in San Diego. I had never had an internal organ removed from my body, and what I learned is that it can take the starch out of you for a few weeks!

This fall I spent a week in Myanmar and then a week in Thailand looking at Cambrian sections. The areas were very beautiful, and also very hot and humid. Not my cup of tea in terms of weather, but my students and I now have a great suite of geochronology samples to work on.

I had a number of papers published this year, but none more satisfying than one on the geochronology of the Neoproterozoic glacial deposits from Newfoundland. Few people can claim to have written a paper for which the data was collected over 27 years! I made the first collection of ash beds

in Newfoundland in 1989, and returned many times over the years to resample. We were able to constrain the length of the Gaskiers glaciation to <340 ka. Colleagues and I published a series of papers on Himalayan stratigraphy and paleontology as well. Finally, I am very excited to have a complete draft of a paper on the wave ripple experiments that I completed with Taylor Perron at MIT, which we hope to submit this January. As a spinoff of this project, I have also written a draft of a manuscript on the general idea of bedform disequilibria with Doug Jerolmack (U. Pennsylvania) and Perron. This has been an extremely intellectually stimulating project to work on.

I co-taught Regional Geology with Henry Fricke this fall, working our way through southeast New Mexico and all the way to Big Bend National Park. It was a great trip, and we saw some incredible outcrops. On another front, I am finishing my second and last year as Chair of the Organismal Biology and Ecology Department. It has been a really rewarding experience, including the hiring of a new faculty member. I can't say that I spent enough time in the OBE department to greatly enhance my understanding of Biology, but I enjoyed working with a great group of faculty.

Please stop by and say hello if you are travelling through Colorado!



CHRISTINE SIDDOWAY
(Structure)

Howdy, Folks! I'm writing this from the great state of Wisconsin, where I'm spending half of my sabbatical year – at the U, in Madison. (I grew up in WI, but it's been ages since I spent any substantial time here!) Faithful

Labradors Pearl and Bessie are with me, ensuring that our forays go off in a new direction at least every other day. The Lakeshore Preserve, right nearby, offers something new

each time: tundra swans on a southward migration; evasive maneuvers by ducks, as hunting eagles swoop low; the eerie sound of the ice booming after a -10°F night. Good subzero days when there are few people out. The house I'm renting is upon glacial deposits bordering Lake Mendota, but today we came upon a large sandstone outcrop, close to home... most rewarding, to have located the nearest bedrock. It's Cambrian to Ordovician.

Besides dog walks and eagle sightings, what's in store for the sabbatical months? The bulk of effort is on ROSETTA-Ice Project/NSF collaboration/aerogeophysical surveys and modeling of the sub-Ross Ice Shelf environment of Antarctica. Research advisee Alec Lockett, a CC senior, headed for McMurdo and took part in the airborne data collection in November-December, and now is getting underway with modeling the geology and structure of the sub-Shelf crust, using GeoSoft (that some of you used or are aware of). The first big exposé of results and preliminary interpretations, based on the 2016 data collection, was at AGU in December. At AGU, as ever, it was great to see many alums at our annual CC Geo get-together, and to visit current CC student presentations (e.g. Grace Guryan and Charlie Russell). It was a kick to meet Tim Metz for the first time, at AGU.

Naturally this spring, I also have a fair amount of writing to do! A couple of papers I'm working on with Italian colleagues from University of Bari. We are working on a model to evaluate whether and where there are nodes of geothermal heat beneath the West Antarctic Ice Sheet. I spent several weeks in southern Italy and in Elba last fall, to meet old and new colleagues, and get the manuscripts off the ground. I've not worked with any of them previously, but "go way back" with one of them, Domenico Liotta. We were postdocs together at University of Siena, >20 years ago, and after all this time our interests have converged, giving us a chance to

work together! Southern Italy, unexpectedly, offered much rich material to bring to CC general geology courses next year, including "Rocks and Ruins-Geological Framework for Mediterranean Cultures" and "In Extinction's Embrace: Geological Standpoints on Climate Nonfiction." After all the Tava sandstone furor of the past couple of years, I vowed to swear off of sandstone injectites for a few months during sabbatical (well, that is except for busting out refined Neoprot. ages at GSA in Denver). But lo and behold, during October field work in Calabria, I came face to face with the same diabolical problem: sedimentary intrusions in crystalline rock! The host is a spectacular tonalite, with sandstone injectites at one site, and extraordinary micrite injectites, at another! After a few moments of denial, I caved and delved in. The micrite injectites really got me – particularly once I realized they might/must be tsunami-related! Too much fun.



Jeff Noblett
(Igneous Petrology)

Greetings,
I continue to enjoy teaching: the blend of science and philosophical perspectives in our Physical and Environmental Geology First-Year experience is a wonderful way to introduce new students to CC, generating classroom debates, extensive written projects, and an appreciation for our spectacular local geology; the rocks haven't changed much in Igneous Petrology, though the integration of geochemical data in interpretations has grown considerably over the years; and Ecofeminism is undergoing a revitalization as people begin to realize that the stance of the early ecofeminists is more important than ever. I'm still pondering Volcanology in the near future, especially since New Mexico is such an amazing locale to

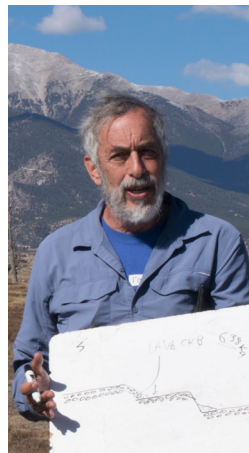
illustrate the range of continental volcanic products.

An alumni-parent tour of Iceland is being planned in two summers (~July 2018). I'm pledging to be a resident faculty person offering a few cool lectures and to provide an opportunity for people to walk in a mid-ocean ridge above a hot spot, not to mention check out hot springs, puffins, recent volcanism, and hot spot rift jumps (ok- there will be a few glaciers and products around- maybe even a chance to ride down a tunnel through a glacier)! Love to see a few geology faces along on that trip to keep the enthusiasm high! Watch for announcements from the alumni office.

One thesis student this year was also a Witter internship recipient. She worked at the Ar-Ar lab in the USGS in Denver and managed to undertake a geochemical study of those lovely shoshonitic (you heard that word in Igneous Petrology once!) lava flows on top of the two mesas outside of Golden, Colorado (in addition to helping set up a lab and do other assigned duties!). We processed her major and trace element geochemistry this summer and she gave a spectacular talk at GSA. The Argon data are being analyzed this fall and she hopes to have an article in review before graduation! I continue to be interested in working with students on local projects including the examination of trace elements in flows within the Rio Grande Rift, work on the multiple generations of dikes in the Wet Mountain area and ways we might sort out their history, on the infilling of a magma chamber within the Pikes Peak Batholith that created layered granite, or on mineral control of the magma mingling within Proterozoic sites in Colorado, etc.

My wife, Jenny, is happily engaged as Director for the Math Excel Center and teaching graduate math classes in topology and geometry at UCCS. My son-in-law's fancy concrete patio/driveway business is booming and my daughter Jenny is happily working as a housewife taking our seven-year

old granddaughter, Arden, to first grade, trying to keep up with the very active three-year old Daphne and giving birth to the newest (and last!) addition of Elisha this October. Hope you are all well and will drop in any-time!



Eric Leonard (Geomorphology)

Well, 2016 may not have been the greatest year in world history, but I was on sabbatical for much of the year, so it wasn't so bad for me. I spent the first few months of the year hidden out (somewhat successfully) in a lab in Palmer trying to get some writing and modeling done (also somewhat successfully). The interesting part of sabbatical, however, began in early April, when Lisa and I hopped a plane to Lisbon. We spent April traveling around Portugal and southern Spain, with a short junket to Morocco, shamelessly vacationing--eating great food, taking hikes, visiting amazing cultural, historical, and yes, geological, spots. Daughter Susan joined us for a week in Spain on her Spring Break. After that month of hedonism, at the beginning of May we dug out our parkas, mountain boots, and especially rain gear, and headed to Bergen, Norway.

I spent May and June as a visiting scholar in the Department of Geography at the University of Bergen, splitting my time between that department and the Earth Science Department. I gave a couple of talks, worked with graduate students, took part in two week-long glacier-focused field courses at Jostedalbreen and Nordfjord, and made a foray to the Lofoten Islands – maybe the most amazing landscape I have ever seen (close competition from the Torres del Paine/Fitzroy area in Patagonia). Lisa had to come home – someone has to work – before I

did, so at the beginning of July I convinced daughter Julia to meet me for several days in Iceland on my way home. Pretty amazing place that – glaciers, volcanoes, hot springs, puffins, and incredibly aggressive Kria (Arctic Terns).

During the summer I did a bit more fieldwork in the Sawatch Range with Geology major Charlie Russell, got a paper submitted on glaciation and paleoclimate in the Sangre de Cristo, and prepared myself to jump back into teaching. During block 1 I team-taught our 200-level physical processes with visiting professor (and returning paraprof) Meredith Bush – good class and really fun. I followed this up by leading a GSA field trip to the upper Arkansas River valley, taking the geomorphology class to the GSA meetings in Denver, and then teaching Geomorphology block 2. Since then I've been finishing up a couple of paleoglaciology/paleoclimate papers and getting ready to take over again as Southwest Studies Acting Director, but this time for only the spring semester.

Julia is working in DC still, when she isn't traveling the world. Susan is about to finish up at Bates College. Lisa won't stop working too hard. See, I got through 2016 without even mentioning the election.



**Henry Fricke
(Geochemistry)**

Hello Friends! Word on the street is I am the last person to write my update. So I am nothing if not consistent in this regard. With this in mind, let's jump right in...

In general, 2016 passed by pretty darn fast with the usual mix of research, teaching, other college duties, and family stuff. I'm still putting '2015' on checks. The research began early, with a trip in March to the San Juan basin in New Mexico to check out the

Paleocene-Eocene sequence of sedimentary rocks exposed there. The upside of the trip was a lack of bugs and mud, but the downside was high temperatures in the low 30's. It was worth it though, as Scott Wing, Kristi Zellman and I found evidence for Paleocene plants at the bottom of the section and Eocene plants at the top; now we are looking to see if the PETM might be present in between, which would be exciting indeed! At the end of May I took a trip to Baja Mexico to visit with some paleontologists from the University of Mexico who are studying late Cretaceous dinosaurs found there. It was wild – look east and it was like being in Montana; look west and get ready to surf. The travel to/from the field was also a great experience, which concluded with me trying to explain to Customs officials that PALEOsols are not the same as MODERN soils, and there was no need to confiscate all of my samples. This was after waiting 2 hours to walk across the border in the first place. In July I met up with colleagues (including Katie Snell, class of 2003!) working in the Piceance basin of western Colorado to continue our study of Paleogene hyperthermal events preserved there. This work became the basis for an NSF proposal, which is now in the review stage. Finally I am still working on the late Cretaceous in areas north of Baja, in particular in Utah and New Mexico, with colleagues from the Denver Museum of Nature and Science (including Ian Miller, class of 1999!).

On the teaching side of things I once again had a great opportunity to co-teach GY140 during block 1, this time with Bobby Karimi (who is filling in for Megan while she is on leave). These co-teaching experiences are a good way to introduce 'newbies' to the block plan, and I think the students really enjoy having multiple perspectives on the topics we cover in class. GY335 Geochemistry still frustrates me – I'm not sure why – but students and I were able to undertake some cool projects, one of which was a detailed geochemical investigation of the Morrison

Formation near Canon City. I think there is a good paper lurking around in that data... Lastly, Paul and I lead Regionals this fall (2016) and took the seniors on a trip down the Rio Grande Rift, through El Paso and West Texas, and on to Big Bend. Then back. Most of the places we visited were new to me, and I still can't believe how cool the geology was, not to mention the landscapes. Definitely Big Country down there. Students made the obligatory crossing to Mexico while we were in BB (missing the Mexican border patrol by about 10 minutes - yikes), and we didn't lose anyone in Carlsbad Caverns or Kilborne Hole or along any of Paul's Cambrio-Ordovician Spiky Plant High Cliff Death Hikes. So all around a good trip.

On the home front the kids continue to get taller (Eli has hit 6 feet at age 15!), and more busy with school and sports (Eli climbing, Annaliese volleyball, both skiing). We took our usual family trips to the Delaware beach and New Hampshire in the summer, and to the mountains in the winter. The big exception to our usual travel was a trip Erin and I took to Italy for two weeks in October, sans kids (!). Don't tell them, but it was freakin' awesome. The not-so-new dog is doing fine, and so is the can't-believe-he-is-still-alive-cat. We haven't destroyed our new house yet.

Well, I think this is pretty much my year in a nutshell! As usual I hope all is well out there in Alumniland, and I hope that you stop by and visit the department if you can!

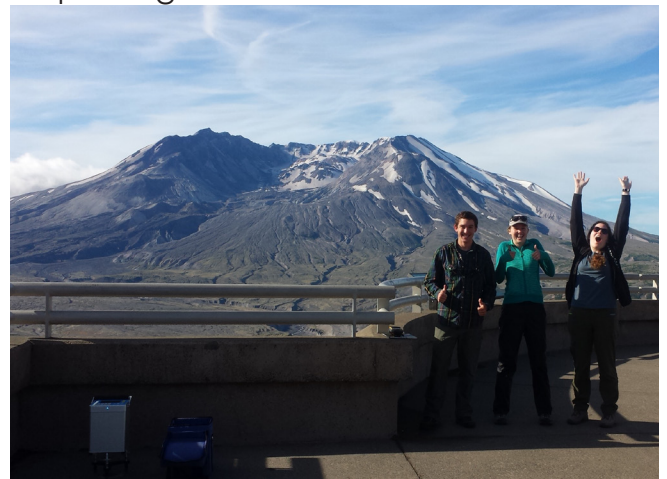
**Megan Anderson
(Geophysics)**



This year has been a bit unusual for me—I'm on a year leave in order to do some more intensive research collaboration with colleagues at the USGS in Menlo Park,

CA. This work involves continuing and start-

ing new projects researching the geohazards of the Pacific Northwest, but also working on a geothermal power research project coordinated through the Department of Energy. How can you say "no thanks" when someone asks for your help gathering field datasets in three areas of the Cascades, including at Mt. St. Helens and Mt. Baker? Sophomore students Matt Tankersley ('18) and Rowan Kowalsky ('18) thought a month of field work in the Cascades sounded good too, so we all joined a team of other scientists from different universities, the USGS, and the Washington State Department of Natural resources to beat the woods for geologic and geophysical data. Our team doing gravity work was spectacular and we had a great time hiking and driving forest roads, eating excellent baked goods and enjoying the scenery. Now it's spreadsheet time for data analysis! Glad I got to see a few of you briefly at the AGU pub night!



Left is Matt and in the center is Rowan. On the right is Megan Yakavonis from Western Washington University. We were measuring gravity at the base station at the Johnson Observatory north of Mt. St. Helens

**Stever 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 usual student and faculty field and lab based activity remains high with the analytical facilities getting lots of use.

I continue to be active with my photography with the highlight being a trip to Wyoming and Montana. I spent some time in Glacier National Park and on this visit finally got a fabulous image of Grinnell Point at sunrise in the Many Glacier area of the park. (the cover image of this PCB!) 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 Sulfran
(Staff Assistant)**

Well, here we are again – the years seem to go faster and faster! This past year was a lot of fun, working with the majors and seeing some of the alums when you were in town. I love catching up with you guys.

We had a good Senior Reception this past May but it was sad saying goodbye to students who left town. I miss your smiling faces! Of course some of our majors stayed here as paraprofs. Erica Evans was paraprof for our summer class, working with another alumna, Claire Lukens '04, teaching Geology of the Pikes Peak Region; Noah Cutter-Villamarin stayed as paraprof in the GIS lab; Sergio Perez and Colin Chupik stayed to paraprof for classes first and second blocks; and Sam Elkind and Cody Duckworth are the permanent paraprofs for 2016-17. Meredith Bush '08 was a paraprof in the department when I first started in Geology 7 years ago and she's back this year to teach as a year-long visitor as Christine Siddoway's sabbatical replacement. It's really nice to get to know her better.

Charlie & I have four grandkids now. Our daughter, Katie, had her third baby this past year. His name is Bryce and is a cutie. I've spent a lot of time with her kids and our other grandson this past year – especially in the summer. Kaylee, our only granddaughter, came to stay for two weeks during the summer and went to the Whiz Bang Science day camp on campus. That was fun but I was exhausted by the end of the camp!

We went salmon fishing on Vancouver Island in early August. It was wonderful! Charlie and I jointly caught a 17 lb. salmon (pictured). What an experience!

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.



Flowers at Great Sand Dunes National Park
Photo by Colin Chupik

This year in the Geology Department we have the pleasure of having two visiting faculty members. Bobby Karimi is filling in for Megan Anderson while she works with the USGS and Meredith Bush '08 is replacing Christine Siddoway while she is on sabbatical. This fall I had a chance to sit down with them so they could introduce themselves and share their thoughts on CC Geology.

Cody: So tell us a bit about yourselves.

Bobby: I got my PhD at the University of Pittsburg in 2014 and I have been bouncing around looking at different visiting assistant professor gigs for the last 3 years. I knew I was going to be a geologist from a very young age. The first Halloween costume that I came up with by myself was a "vampire geologist". I had a white lab coat, fake pointy teeth, and a rock with two puncture marks that had blood trickling out. It seems I have accomplished half my goals in life; the vampire thing is still alluding me.

Meredith: I'm back at CC after a brief detour to graduate school in Austin. I came into CC knowing I was going to be a geology major because, to me, it was the best way to combine all of the branches of science that I was interested in. It allowed me to do physics, chemistry, and math all while being outside. I got my bachelors degree from CC in 2008 then was a paraprof for a year and just completed my doctorate from the University of Texas this past October.

C: What do you all like to do outside of geology?

B: Are there things to do outside of looking at rocks!?

M: Barely! That's a hard one to ask to recent grads. I ride my bike as much as I can and enjoy the occasional libation. Anything that can help clear your mind, really.

B: Running and cooking in place of biking for me.

M: Good point, Bobby. I like to eat the food that you cook for me!

C: You all have touched on this a bit but could you describe your journey through geology. What have you studied and where have you been?

B: How I settled on studying tectonophysics is a bit obscure. I loved every single geology class I ever took except for sed/strat. It just pushed me outside of my comfort zone so much and it did not have enough math and physics for me. It seemed to have too many qualitative interpretations and I was awful at it. This pushed me towards some of the other disciplines



Bobby Karimi



Meredith Bush '08

and I really loved structural geology. It seemed as though everybody around me hated that course, so naturally I was even more drawn to it. It was a bit hipster of me, I will admit.

M: I actually did just hear Steve accusing Bobby of being the department hipster!

B: Well I do have a record player in my office. Anyway, I really got into tectonics by way of structural geology. When I got into grad school I started out in geophysics but the projects started turning more and more into tectonics works so I was happy to oblige.

C: Did it take you to any interesting places?

B: Unfortunately for me, it seems like every time I left the country to do field work I always get sick right away. For example, I went to Java with a volcanologist to collect gas samples and I caught a nasty case of the flu on day one so I was left in a hotel room to label and categorize the samples until we returned.

M: Bobby's field area really is the computer. I know he has servers in interesting places.

B: Yea, I have servers in some areas that you wish you could be! More recently though, I have been doing a lot here in North America. This past block I spent two weeks in Arizona and that was a great experience. But the coolest place I have ever been is AGU. Honestly, I love the conference and nerding out with all of the other people like me is wonderful.

M: Well I learned during my PhD that there are rocks everywhere and there is a lot to be seen in them. Originally, the work for my PhD was going to be entirely focused on the Tibetan Plateau, which has amazing geology and was a terrific area to work in, but the logistics were such a pain. I had experience with logistical planning when I was a paraprof but that didn't help going to work abroad any less of a hassle. Meanwhile there is so much to learn from the rocks right here in our backyard. The roadblocks that come up with international research are just too great when you can ask the same questions about the rocks that are right here. I remember when I was a senior here at CC and it was the first year the department transitioned regional studies from international trips to domestic. Everyone was bummed when they first heard about it but it was still fantastic. I did regionals with Henry and Megan and we drove from here all the way down to Baja, mainly spending time in Nevada and California. I still remember sitting in Joshua Tree reading Tanya Atwater's paper on the tectonic reconstruction of the San Andreas system and I think that trip and that paper was the inspiration for my studies. While we could've packed our bags and flown to some exotic place, just traveling in and learning about western North America made a much larger impact on the type of geologist I wanted to be.

C: Bobby what are your first impressions of CC?

B: I was lucky that the first two blocks I got to co-teach intro, first with Henry and then with Meredith. If I didn't have that I would have been extremely overwhelmed and terrified. But I really like it. I think I said to Jeff when I was interviewing for this position "What kind of ideal utopia is this that you're referring to?" Because Jeff was talking about how you can go into the field whenever you want to, classes are only 3.5 weeks, and students can't complain

about having other coursework to do. I was like “this sounds phenomenal!” Additionally, I think the freedom that we get to teach different kinds of courses and the freedom that we get within courses that are already structured is really cool.

C: Meredith, what is it like teaching at CC after graduating from here?

M: Well I thought I worked really hard as a student here, but I never realized how much you have to work as a professor. Especially how much you have to be constantly revising your plans. Every day you come in with a plan and it's never what you end up doing. So it's so much more exciting than the classes I TA'd for in graduate school at a big university where the courses must go to plan. I also really like that every time I teach a class it will never be the same as the last time I taught it. Even though I am teaching Intro 3 times, I will create new labs for each, I will visit brand new places, and it looks nothing like when I taught it two blocks ago. It's a great experience for new teachers.

C: Are there any classes that you all have really enjoyed teaching or any class that you all are particularly excited for?

B: I really like teaching Intro. You get all different types of students and, like Meredith said, it's dynamic and evolves with weather, the classes' mood, and the backgrounds of the students in the class. But I am very excited to teach petroleum geology, even though it has low enrollment right now. I think that it'll be different from what the students think it will be like.

M: I really enjoyed teaching GY212 Rocky Mountains as a Physical System during Block 1. I got to teach with Eric, cover a lot of material and get to meet the young majors in the department, all while putting together some great projects. But I am really excited to teach structure this year because only 6 students have signed up so far. It will give me so much more freedom than any class that I have taught before because I can split up the material just how I like and can spend a lot of time in the field. Stay out of that classroom!

C: Great, thank you guys so much for taking the time to tell us a bit about yourselves. It will be much appreciated by our readers of the Precambrian Basement.



Classic.

A Gneiss Introduction to CC: the Tuff Geology FYE

by Sam Aronson & Tom Bugg

I'm not sure if I knew what I was getting myself into when I started the Geology First Year Experience with Jeff Noblett. It was the most immersive learning experience I had ever had, it was seven weeks of bonding with people and ideas, and it was the best introduction to CC I could have hoped for.

When I first told people I was taking geology, many said, "I've heard that class is really hard." To be fair, this is true, but it doesn't do justice to the class's unique value. It's true that the work could be difficult and the labs frustrating. There were some late nights when I just could not figure out the difference between biotite and amphibole. There were many times when I was the only one left in the classroom working on a lab. It was difficult, but I wouldn't have had it any other way.

Initially, I signed up for Geology to take a hands-on science course that would allow to me to leave the confines of the classroom. The course certainly fulfilled this characteristic, but did so much more. Geology has made me much more aware of the world around us and the underlying complexities that make it uniquely ours. It has given me an understanding that informs a deeper appreciation of nature and our interactions with the natural world. Few were the days in class when something we saw or learned failed to astound me.

For every moment of intensive work, there were so many glorious moments I could not have experienced in any other class or at any other school. The frequent field trips make some of the best memories, like hypothesizing the formation of the Royal Gorge while eating lunch on an overhang, discussing the unconformities in formations, or descending a small ravine to retrieve a dropped field notebook. Even though Jeff



The Geology FYE enjoys lunch on the Dawson Fmt. in Palmer Park.

said the chances of seeing a bear in Bear Creek were almost nonexistent, as we descended into the valley in the north of the park, we saw a black bear followed by her two cubs. Instances like these made me so thankful to be in a class where I was learning about the world and seeing it at the same time.

For one project, we each researched the geological environments of our hometowns, making us think about subjects in terms of our own experiences. I've lived in Chicago my entire life and realized that I didn't know much about the place I called home, including the scope of environmental issues like water quality. At the end of the second block, when we were assigned a research paper on a topic of our choice, I chose water quality. I was able to dive into a subject that was important to me, and that would let me reflect on my own interests, values, and future. I discovered that I have an interest in environmental science, which I

may have never realized otherwise.

On one of my favorite assignments, we spent two days with a classmate mapping formations in Bear Creek Regional Park, trekking across a square mile of varied terrain, looking for outcroppings and clues. Though while in the field it seemed a little like we were just walking through nature and drawing pictures, after the weekend of working on the map and processing all the bits of data we had collected, I came to understand how the mapping project was a complete synthesis of everything we had learned up until that point, from minerals to order of formations to patterns of faulting and erosion.

What an introduction to Colorado College, to step outside into the vast expanses of geological space and time, to see and understand the continuing process of Earth's evolution etched into its living composition! For a new perspective on the world and for all the experience, awareness, and understanding it gave me, I can truly say that geology was the most rewarding class I've ever taken.

Geology Alumni Staying in the Classroom

Our alumni use their degrees in a variety of ways. While many stay with geology in some way, shape or form several others have decided to use their lessons in geology to teach the younger generations of our world. Here are a few accounts from alumni who are now teaching:

Jed Ball '16

I graduated from CC in 2016. In the fall, I was teaching English in Chile. I wanted the opportunity to live abroad while also working towards a career path in teaching or to see if I even enjoyed it or not.

The thing I like most about teaching is that it's different with every class and every student. Not every student or class learns the

same, and I enjoyed figuring out what works best for everyone. Kids are also smarter than you might think and hearing their take on something can be insightful.

I most appreciated the variety of teaching and classroom styles of each of the professors I had. Every professor I had taught a little differently and had different methods, whether it was extensive field work, lecture, discussion, small-group projects... There was no one right way to teach or learn geology and everyone was given an opportunity to display their strengths.

I am going to enroll in CC's MAT program in June and hoping to teaching high school science, preferably earth science or chemistry.



Jed snaps a photo with his Chilean students

Megan Hurster '12

After living abroad for a few years, I now live in Salt Lake City, UT and teach middle school math and science at the Weilenmann School of Discovery. WSD is a charter school emphasizing outdoor education and hands on, project based learning experiences.

Working in the field for my thesis work with Megan Anderson and capstone work with Paul Myrow and the rest of the department really emphasized for me the importance of context when studying complicated science concepts. My seventh graders study forces of motion on the football field, get to watch genetic practices happening

in the garden, and see geologic processes shaping the landscapes around them on a daily basis. CC geo not only empowered my teaching with the importance of place-based education, the professors modeled how passion and excitement can directly translate to your students on a daily basis. Someday, I hope to move out of the four-walled classroom and into the outdoors as my classroom full time. Geology alumni- if you are ever in the SLC area, please feel free to come visit my classroom any time! All are welcome.

Ellen Smith '16

I am from Dallas, TX, and I graduated in May 2016. I am in Denver teaching 7th grade math. The program I am doing is a little different though. I am working in a Title 1 school (90% of the kids are on free and reduced lunch), and I am trying to work with kids throughout the day in small groups to catch them up in their math classes. A high percentage of students who do not graduate from high school fail Algebra 1. The purpose of my job is try to keep these students on track and prepare them for math in high school.

Most people will tell you that teaching is a very rewarding job. It also really puts some things in perspective. I had a student who lost her older sister because she was murdered. Several other students come from rough backgrounds and have a lot going on, so it is hard for them to concentrate in school. My job makes me appreciative of my education and my friends and family. Something I dislike about teaching is all of the little rules kids are required to follow. I hate telling a kid that he has to go back to his locker because he doesn't have a school sweatshirt on. Kids are only allowed to go to the restroom/get water 2 times a day, and they are supposed to be silent during the hallways. I forgot how much structure middle school students need.

CC Geology has prepared me for any

profession. It taught me to work efficiently and to be flexible when things do not go as planned. Some of my co-workers are very overwhelmed by this job because it takes them a very long time to complete certain tasks and compared to the block plan, I have not found anything to be overwhelming.

I am still not sure what I want to do next year. Education is on my radar, and I deferred my acceptance to the CC MAT program in secondary science and math, but I am also applying to geology graduate school programs. Whatever I end up doing, my goal is to be involved in outreach programs that communicate important scientific information to the community.

Students Studying Abroad

Sierra Melton '18

Last semester, I was lucky enough to study in Copenhagen with the DIS Environmental Science of the Arctic program. Denmark, especially the Centre for Ice and Climate at the University of Copenhagen, plays a significant role in Arctic science research and Greenland ice core drilling since Greenland is under Danish rule. I took courses in Arctic Glaciology, GIS: Applied Climate Change Cases, and Danish Language 1-2



Still in awe after walking on the Greenland Ice Sheet!

(which fulfills the entire CC language requirement!). I also took a paleoclimate class called "Ice Cores and Ice Ages: Greenlandic Climate Change Case Study." This was by far my favorite class, as it included a three-day trip to Møns Klint and Stevns Klint (enormous chalk cliffs on the Danish coast by the Baltic Sea, with abundant belemnite fossils and the K/Pg boundary) and a five-day trip to Greenland!

The two professors of this class work at the Centre for Ice and Climate and have participated in numerous ice core drilling projects, so they are very knowledgeable about paleoclimate and Greenland arctic science. In Greenland, we saw muskoxen and reindeer, played with sled dogs, visited the Russell Glacier, hiked both on top of and to the base of the Greenland Ice Sheet, and saw magnificent displays of the Northern Lights. We also tasted some local delicacies and learned about life in Greenland in the home of a Greenlandic family. It was an unbelievable, life-changing experience that helped me realize my



On top of a wind turbine on Samsø, Denmark's renewable energy island

passions for glaciology and Arctic climate science. I now hope to return someday to both the historical, sustainable city of Copenhagen and the wild, majestic expanse of Greenland as a research scientist.

Alec Lockett '17

This winter, Senior Alec Lockett had the opportunity to travel to Antarctica to assist with airborne data collection for ROSETTA-Ice (A systems approach to understanding the **R**oss **O**cean and Ice **S**helf **E**nvironment, and **T**ectonic setting **T**hrough **A**erogeophysical surveys and modeling). Alec kept track of his experiences in Antarctica by maintaining an online blog. Below is his first entry in which he describes how he arrived in McMurdo Station, Antarctica. If you are interested in reading more about Alec's work and the ROSETTA-Ice project please follow the link below to see his other blog entries:

http://sites.coloradocollege.edu/blockfeatures/author/a_lockett/

The Journey to 77° South

I left the States from Denver on November 3rd and arrived at McMurdo Station on the 7th, travelling through Los Angeles, Sydney, and Christchurch. We arrived in Christchurch on the 5th, and the next day we were shuttled to the United States Antarctic Program (USAP) campus where we had a series of briefings & trainings regarding life on the Ice, and were brought to the Clothing Distribution Center (CDC) to be issued our Extreme Cold Weather gear (ECW).

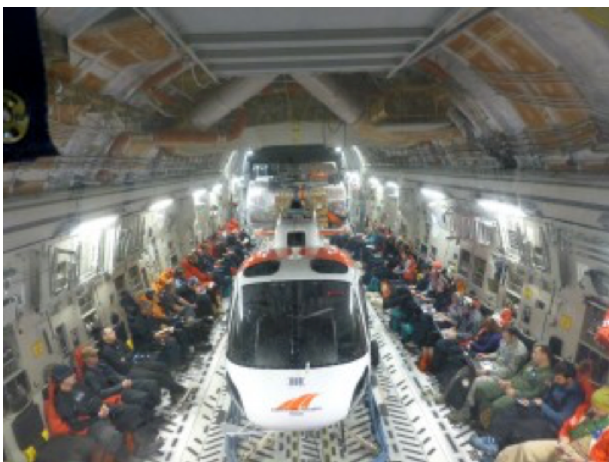
I say this now: the USAP uses a ridiculous amount of three letter acronyms. Fortunately, these trainings ended early enough so that we had about half a day to goof around in the city; I chose to go for a run with another member of ROSETTA-Ice, exploring Hagley Park and the Botanic Gardens, as well as some of the stone churches and buildings that were wrecked by the

recent earthquake. The following morning a shuttle picked us up from the hotel at 5:45 am and brought us back to the USAP campus to check in, obtain our boarding passes – which were simple laminated cards with a number – pass security, and board the plane. We flew on a C-17 cargo plane; there was a helicopter inside.



The CDC hosts a warehouse of parkas, fleece coats & pants, mittens, hats, goggles, boots, and pretty much everything else needed to keep you cozy while in the field – except for good ol' long undies. Anyone headed to McMurdo Station is allowed up to 85 pounds of luggage, including all the issued ECW.

Although I was certain I was going to fall asleep once on the plane, this proved to be a very silly prediction. I could hardly even read I was so excited and taken by the interior. The pilots allowed us on to the deck (I think I was the only person to go twice, it was that cool) so that we could see the ice from the sky, as the plane didn't really have any windows for passengers.



The inside of the C-17 from the deck.

I first tried looking through the window without my sunglasses, and it seriously hurt. Antarctica during these summer months is always sunny and one must learn to adjust to twenty-four hours of daylight.



Looking out from the deck.

When the plane landed and I at last stepped onto Antarctica, I got goosebumps. I will always remember that ineffable feeling. A shuttle then took everyone from the airfield to McMurdo Station. I cannot wait to fly again, with ROSETTA-Ice, in our mission to map the Ross Ice Shelf...



Here at last!

First year of Witter Family Fund for Internships in Geology Proves to be a Resounding Success

By Cody Duckworth

Thanks to a generous gift from Bill Witter '86, The Witter Family Fund was established for CC geology students and graduating seniors to connect with alumni and other professionals through geology-related internships. In the summer of 2016, the fund allowed nine Colorado College Geology students to receive funding for and complete internships. These internships involved projects with a wide range of topics across the United States and internationally. Interns assessed seismic hazards in Ecuador, studied at the Smithsonian, dug up dinosaurs in North Dakota, advised companies and government bodies on natural hazards and water resources, and researched at various geochemistry laboratories. After the completion of their internships, the students had a chance to reflect on their experiences and what they have learned.

Erica Evans ('16) and Matt Hess ('16) worked as field assistants in Marmath, North Dakota for the Denver Museum of Nature and Science by operating differential GPS systems, logging stratigraphic sections, and assisting at dinosaur quarries. "This was my first real introduction to field-based paleontology, and I relished the experience" recalled Hess. Evans agreed "Positions like this are invaluable because they allow students to be exposed to a variety of career options related to the geosciences. I had the opportunity to work with the Director of the Smithsonian, science educators, professors, media personalities, artists, and illustrators. Being able to work with such a range and variety of people allowed me to expand my



Erica Evans examining the stratigraphy exposed on a butte. (Photo by Matt Hess)



All of the field jackets ready to head back to Denver after a successful field season in North Dakota! (Photo by Matt Hess)

concepts of careers in geology and related fields." Evans was not alone in her admiration for the insight that she gained about her prospects. Ellen Smith ('16) worked with USGS in Menlo Park, CA and travelled to Ecuador to assess the damage caused by the April 16, 2016 earthquake (7.8 Mw). She spent several weeks assigning Modified Mercalli Intensity values to the various places she visited in order to create an isoseismal intensity map. "From this internship, I learned about structural engineering, geophysics, and earthquake hazards. It has made me reconsider options for graduate school programs, and allowed me to network and meet well-known scientists. My summer mentor also extended an invitation for me to return next summer as a paid intern" said Smith.

Lexie Millikin ('17) worked with the USGS in the Argon Isotope Geochronology Laboratory (Lakewood, CO). "During my internship, I had valuable research experience, worked in and helped to set up a state-of-the-art laboratory and developed personal



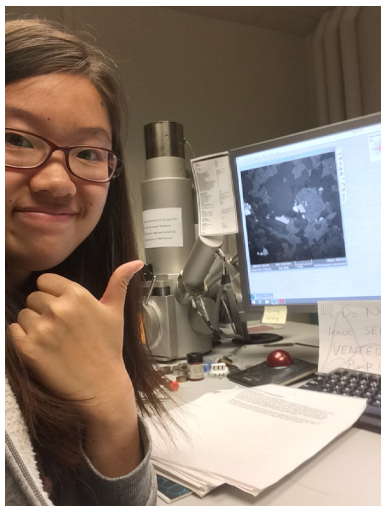
Ellen Smith (above and right) shows how damaging a M7.8 Earthquake can be.

and professional relationships with scientific researchers. Overall, the experience was beneficial to developing my career goals and experiencing the professional field of geology." Millikin has turned her summer work into the topic of her senior honors thesis at Colorado College and presented her findings in a talk at the 2016 GSA annual meeting in Denver, CO. Tianran Zhang ('18) had a similar geochemical experience working with Craig Lundstrom ('87) at the University of Illinois. Zhang studied silicon isotopes in quartz grains and helped in the development of a method for lutetium-hafnium dating. "I am so grateful to have this opportunity because for an international student like myself, it is particularly difficult to find a meaningful summer internship in the States. Also, by assisting in these two research projects, I learned a lot of new lab



techniques, acquired some new knowledge of igneous petrology/geochemistry and have a better understanding about the process of scientific research." An appreciation for scientific processes seems to be a common thing among many Witter Interns. "I have come up with a plethora of research questions that I want to pursue in the future, and I now know for sure that I want to study geodynamics and geophysics in graduate school" explains Erin Hightower ('16). She interned with the Smithsonian Global Volcanism Program (GVP) after discovering the work that the program does and reaching out to the Witter Fund for support. Hightower worked on a variety of projects including a global volcanic arc classification system, summaries of Pleistocene volcanoes for the GVP database, and mapping tectono-magmatic provinces and up-to-date plate boundaries. Hightower is concluding her internship by writing a paper with her advisor studying how patterns in volcano spacing and volcanic vigor along an arc relate to trench geometry and subduction slip rates.

While many of the interns conducted geological research, several others worked in more applied settings. Ben Justman ('16) interned with Bishop-Brogden Associates in Denver, CO and worked closely with CC alumni, Chris Sanchez ('94) and Tim Crawford ('00). Justman said "I was tasked with doing preliminary research for water rights projects concerning resource development, property evaluation and ground water removal. I summarized information and relayed it to my supervisor, who then used it to recommend actions to clients. I was also able to spend several days in the field getting hands on experience documenting wells, working on stream gauges and surveying ponds." This experience of ad-



Tianran Zhang selfies with the SEM at the University of Illinois while she waits for it to process.

vising organizations was not unique to Justman. Noah Cutter ('16) and Sergio Perez ('16) interned with the Colorado Springs Office of Emergency Management assessing the fire-flood cycle in Colorado Springs at the surrounding areas. Their task was to focus specifically on the 2012 Waldo Canyon burn and use remote sensing techniques to create temporal elevation models and analyze them using Geographic Information Systems software. Cutter comments on the importance of the work "These products have the potential to directly impact my fellow Colorado Springs citizens: their lives, their homes and their belongings."

Thanks to the Witter Family Fund and the opportunities provided by CC alumni, all participants gained valuable geologic experience, insight into the possibilities after graduating, and knowledge of how they can put their knowledge to use outside of Colorado College. If you have or know of any possibilities for future internships, please do not hesitate to reach out to the geology department here at Colorado College. The future is bright for these interns thanks to their experiences and there is hope for continued success with the next round of interns.



Sergio Perez examining erosion control features in Seven Falls. (Photo by Noah Cutter)

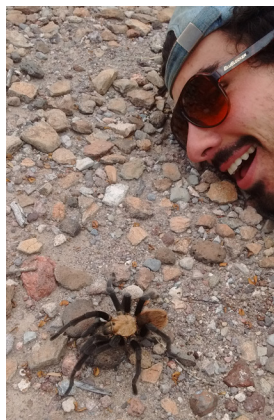


North Six Shooter, UT
Photo by Cody Duckworth

Regional Studies 2016 by John Borah

It is always a bad idea to drink heavily before a geology field trip. Unfortunately, like most bad ideas, it always seems like a really really good idea before all is said and done. And so, after a boozy Wednesday evening, I was left at 6:30 the next morning scrambling to pack the proper gear, notes, books, and clothing (anyone who suffered my smells on the trip will tell you that I didn't pack enough of the last items) before heading off to the Barnes loading dock.

The graduating class of geology majors is small, and our Regionals trip class was even smaller, with two classmates falling victim to either wake-boarding injuries or Antarctic research. With that, it was just Alexie Milliken, Issaac Becker, Grace Gruyen, David Candler, Arden Feldmen, Charlie Russell and myself, John James Juan Bosco Borah who climbed into the two Geo Vans early that Thursday morning.



John Borah (author) poses with his furry friend



The class dons their 'staches on Halloween

I believe that most geology majors become geology majors for several reasons; they like the sound of the field trips, they see the thriving, tight-knit community between majors, they are genuinely interested in rocks, or they like the idea of a block-long field trip as a capstone class. So, to actually embark on our regionals trip was quite momentous.

The ultimate destination of our trip was Big Bend National Park in West Texas. Before we would arrive, however, we broke up the drive with a prolonged stop at El Paso, along with short stops in New Mexico and other stops in Texas. At the wheels of the course were Paul Myrow and Henry Fricke.

Now, I had never truly met Paul before, and outside of awkward interactions at department events or side-by-side using Palmer's noticeably snug urinals, we had barely spoken a word to each other. As such, I wasn't quite prepared for his hilarious, manic, and blunt character. Paul exercises a frankness that is refreshing when most CC staff and faculty is engineered to coddle us young and fragile millennials. He is also driven to the point of being obsessed; he once nearly missed lunch, instead threatening to climb up the steep face of a cliff to prove that we were indeed looking at an anastomosing channel (we weren't).

Henry is the ying to Paul's yang. One a geochemist, the other a sedimentologist. One tall and lanky, the other short and hard to tip over. The yang would lead every hike, bouncing up the stratigraphic column like a mountain goat on amphetamines, whereas the ying would take up the rear, usually chewing on a tall piece of something, hanging out with us lazy senior geology students who have finally realized that the rocks are not going anywhere (during our lifetime). But together, they hated all of our stale, field smells and led one hell of a Regionals trip.

During the first leg of our trip, we focused mainly on the stratigraphic sections from Paul's research, which spanned rocks from the Cambrian to the Devonian. Most of

these strat sections are around the greater El Paso area, and so we became quite acquainted with the little west Texas town Marty Robbins once sang so fondly of (except for the part in the song where he dies, of course).

Highlights of Paul's strat sections include: iron ooids, stromatolite (contrary to popular belief, this is not a strombolite shaped like a handsome man, but rather a strombolite that is about 6 feet tall and 4 feet wide), and a hefty reserve of trilobite fossils. During this time, we also perfected the art of the salami-wrapped pepperoncini, which further worsened Henry's pepperoncini addiction. The man has been known to go through a jar in less than 12 hours.

After we studied, reviewed, and correlated our strat sections at University of Texas at El Paso, we were treated to an afternoon to explore El Paso at our leisure while Paul and Henry rented a hotel room to bathe. Not together mind you. Or perhaps it was together. I suppose I can't say one way or another.

Anyhow, I digress.

Our time in El Paso was relegated to a local watering hole where we sipped on Diet Cokes and Capri Suns while playing darts (I got smoked) and cornhole (also, smoked). From there we drove to the western end of the little city and rolled several frames at Bowl El Paso, where we all lamented the days where it was socially acceptable to play with the bumpers up.

Also happening on that fateful day was Game 7 of the 2016 World Series, in which the Loveable Losers clawed with their little Cubby claws back from Cleveland's 3-1 game lead to win their first World Series in more than a century. And there I was, a young man from Chicago's northern suburbs, listening to the game transpire on the phone with Paul, Henry, and Charlie as I salved my anxiety with thick helpings of GeoDip. (For you older geology major alums, that is a tor-

tilla chip dip composed of 1) Pace salsa, 2) more sour cream, and, depending if you're a purist or not 3) Chuluhla or Tapatio hot sauce.)

The day after the Cubs won, we packed up camp and headed over to Big Bend. This dusty ol' park hosts the Rio Grande and its name is derived from the river's sudden change from flowing southeast to northeast. Seeing the Rio Grande at Big Bend freely flowing and meandering at its own will is also a stark image compared to the site at El Paso, where the sickly brown Rio Grande is strictly channelized and its water is equal parts H₂O and trash. Apart from the Rio Grande, Big Bend also features cliffs and mountains with astounding relief, a sprawling desert, and a helluva lotta Javelinas—charming little devils that belong to the New World Pig family.

Our main geological focus in Big Bend were extrusives, paleosols, large-scale folds, fossil hunting, and exploring the therapeutic effects of hot springs.



Big Bend, TX

The latter we learned about on the banks of the Rio Grande. Of course, we would never cross over the Rio Grande into Mexico in between lectures. That would be illegal, and hardly a good idea for a swarthy little fellow such as myself, who wasn't carrying a passport at the time. However, it

was in the midst of this lesson that three or so Mexican men, presumably working for border control, walked over the opposite bank, clad in full body armor and carrying serious firepower. Paul was facing the other way, so he wasn't aware of the tiny army across the border, but us students, still soaking wet from having recently dipped in the water, were all too cognizant. In between Paul's sentences and us trying not to pee our pants, we tried to inform about the situation. Paul, determined as ever, continued on. Finally, we were able to remove Paul from his lesson plan, but only after I had found rocks I would hide behind just in case.

We left Big Bend after nearly a week. From there, we stopped at a little Texas town to hunker down and got to shower, change clothes, and eat a meal that didn't include rice. This is also where we hunkered down to watch the election. Something about an orange-skinned bully becoming the leader of the free world didn't sit well with the class or the professors.

The next day we drove to New Mexico and hiked up the El Capitan reef. It was an incredibly interesting, geologically rich feature, but most everyone on the trail was acting like an animal shelter full of adorable puppies was just bombed.



The class departs after a day in White Sands National Monument

Thankfully, we got to go to the two greatest, most-amazing, geologically-crazy sites in the entire U S of A— Carlsbad Cavern and White Sand Dunes National Monument. It was like your parents giving you a pet ferret when an animal shelter full of adorable puppies was just bombed. You're still all distraught and ambiguously upset at everything, but that new dumb pet ferret of yours makes you temporarily forget all that stuff!

And so, we tip toed through the Carlsbad Cavern and ooowed and aaawed at the grandeur of the caverns and their vaguely phallic speleothems. Later we rolled around in the Gypsum grains composing the dunes until we were sick with dizziness. After watching a beautiful New Mexican sunset, we returned to the vans only to be told by Paul and Henry that we had completed everything on the Regional's agenda and it was time to return to CC.

While we were excited to head over home and see our friends, pets, and Mandy again, I think it was a bittersweet time for us as well. Over the course of two weeks, we became better geologists and even better friends. We learned about the moth-attracting properties of bagged rice, how fun it is to immerse yourself in hot mud, the cute little hooved devils that are Javellinas, and, of course, the David Candler is king of Catan.

I believe I speak for the entire class when I thank Paul, Henry and everyone who made our Regionals 2016 trip not only possible, but exceptional.



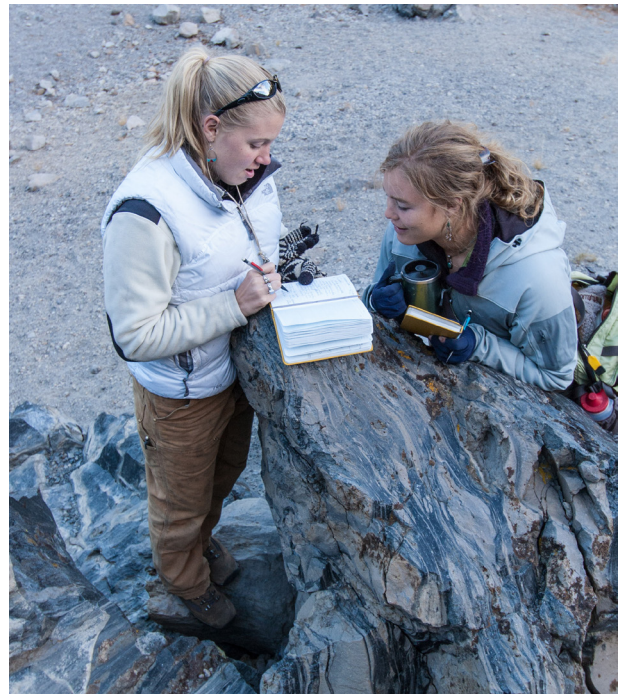
Jenny Haywood ('06) and Betsy Friedlander ('07)

Jenny and Betsy currently live in Vancouver, British Columbia, where they work for Teck Resources Limited, a diversified mining company with major business units in zinc, copper, steelmaking coal and oil sands. As mineral exploration geologists, they integrate various geo-science techniques to look for new mineral deposits and to better understand the deposits that Teck is currently developing. They have spent the last 5 years predominantly focused on exploring for zinc near Teck's Red Dog Operations, which is a world-class zinc mine in the western foothills of the Brooks Range in Arctic Alaska.

Red Dog Mine is a fly-in/fly out operation with ~450-500 year-round employees, of which approximately 52% come from the local Inupiat villages. Red Dog Mine ore consists of massive sphalerite, galena and pyrite +/- barite hosted within a sequence of Mississippian black shale and chert with variable amounts of turbidite and limestone horizons. The district contains multiple high-grade (>20% Zn+Pb), world-class sediment hosted massive sulfide deposits. Mineralization likely occurred when metalliferous basinal brines ascending syn-sedimentary faults encountered a geochemical 'trap' – in this case, layers of weakly consolidated organic and carbonate rich mud (e.g. source of H₂S) – resulting in the complexing of sulfide with base metals, replacement of carbonate and barite horizons, and formation of sphalerite and galena (Blevings et al, 2013).

Jenny and Betsy agree that one of the benefits of working in mineral exploration is that they still get to work on the block plan, with a summer field schedule of 4 weeks in the field alternating with 2 weeks completely off! And as CC Alums, they love this block plan-style schedule, which gives room for dedicated focus on work with longer breaks for travel and other adventures. They also enjoy the variety that field and office seasons offer: they spend about half the year in the field, devoted to helicopter-supported field work, and the other half of the year working in an office in downtown Vancouver with the rest of the Exploration and Project groups at Teck. While in the field, day-to-day activities range from logging drill core and interpreting subsurface geology in cross sections to overseeing the logistics of drilling programs, including drill-rig safety inspections and database administration. They also perform regional geological mapping, pit wall mapping, soil and rock sampling, geophysical surveys, and various other tasks to keep the project running smoothly. In the winter, their office work involves more interpretation and presentation of data, including: writing reports, digitizing maps, modelling geology in 3D, processing geochemical data, targeting new deposits, and planning the next field season. So far, they enjoy their research and work in mineral exploration, but didn't initially set out for careers in the mining industry.

Jenny's first class at CC was the geology FYE with Jeff Noblett, which was a double block class combining physical geology and environmental philosophy (plus a little bit of reiki



Jenny (right) as a student at Colorado College studying the obsidian domes in Mono-Craters, CA with fellow student Julia Labadie '06.

healing). Historical geology with Henry Fricke later in the year solidified her choice as a geology major, and she hasn't looked back since! For her thesis research, she spent 2 months in Antarctica with Christine Siddoway investigating gneiss dome emplacement mechanisms and some beautiful garnet-K-feldspar-biotite \pm sillimanite \pm cordierite gneisses. It was the first of what has turned out to be many experiences working in remote field camps, and through this experience Jenny learned not only some amazing geology, but also valuable skills needed to successfully live and work with people in remote settings. After several years away from school, including another stint in Antarctica - this time doing science support work for Raytheon Polar Services - and a year coaching mogul skiing, she opted to head to graduate school. For her M.Sc. at the University of British Columbia (Vancouver, BC), she conducted a series of laboratory-based rock deformation experiments assessing the effects of temperature, pore fluid pressure and composition on the strength, stability and textural evolution of carbonate and phyllosilicate-bearing fault gouges. This project included field work in the Kluane Mountains of SW Yukon Territory, and several months of lab work at the University of Liverpool, United Kingdom.

Betsy's FYE at CC was also Introduction to Geology with Henry Fricke and Christine Siddoway and she instantly fell in love with geology. Her senior thesis research took her up to the Volcanology Petrology Lab at the University of British Columbia to perform high-temperature deformation experiments designed to explore the rheology and deformation mechanisms of pyroclastic material. This was a great opportunity to get a glimpse of what graduate school could look like, and two years later Betsy returned as a graduate student at UBC. For her M.Sc. she researched fault zone development and permeability during the 2004-2008 lava dome extrusion within the crater of Mount St. Helens. It was a great opportunity to collaborate with the USGS Cascade Volcanic Observatory and combine her interests in structural geology and volcanology. In addition to geology, Betsy is also passionate about teaching and science communication. Between CC and graduate school, she was a paraprofessional for the geology department (if any of you students are considering it, it really is the best job post-graduation!) and then worked for a science school in the Vail Valley while skiing and living in Minturn. Immediately after defending her thesis, Betsy stayed at UBC as a lecturer and field school coordinator. And even though she has a full-time job with Teck, the focused field schedule has allowed her to take time to teach block courses of geology at both CC and its sister school, Quest University in Squamish, BC.

Until they started graduate school at UBC, Jenny and Betsy were only vaguely aware of career options in geology outside of academia. While at UBC, however, they were regularly exposed to the mining industry and mineral deposit research because Vancouver is a major hub for mineral exploration and UBC has a research group focused on hard-rock mineral exploration. Although their research was not specifically related to mineral deposits, they chose to take advantage of some of the courses and seminars about ore deposit ge-



Betsy (left) as a Paraprof in 2007 & 2008.
Also pictured is Karri Sicard '07.

ology and mineral exploration. They learned that not only is the science of mineral deposits incredibly interesting and challenging, but also that successful mineral exploration requires integrating numerous aspects of geoscience, including: geological mapping, structural geology, geochemistry, stratigraphy and geophysics.

After graduation, Jenny and Betsy applied for jobs in mineral exploration, and eventually landed with Teck. They have enjoyed the benefits of working for a company that is



Betsy (left) and Jenny (right) mapping in the Red Dog District in the Western Brooks Range.

an industry leader committed to the highest safety and environmental standards, with projects all over the world. In fact, in addition to her focused work in the Brooks Range, Betsy spent three months in Ireland with the Teck Ireland staff working on the structure and stratigraphy of the Dublin Basin. Along with the obvious Guinness consumption and travel, she also enjoyed the integrated research and collaboration Teck Ireland has with the Irish Centre for Research in Applied Geosciences (iCRAG).

Beyond the geological aspects of mineral deposits, Jenny and Betsy are exposed to the rest of the mining and exploration industry, including: geotechnical modelling, mining techniques and mine development, permitting, resource modelling, ore processing and metallurgy, environmental reclamation, corporate social responsibility, commercial sales, and more. They get to collaborate both within and outside of the Exploration Group, and Jenny is transitioning into a new position within the Advanced Projects Group focused on structural 3D modelling. They have also been fortunate to work with several other CC Alums at Teck: Matt Rosales ('08), Christian Baxter ('98), Dave Freedman ('14) and Ed Crawford ('14).

Betsy and Jenny agree that CC provided a solid foundation in geology, especially field geology, along with an ability to learn new skills, think critically, and integrate information. Although they didn't initially set out for a career in the mining industry, they have both found that they enjoy the research and collaborative work environment that they've found in the private sector, and their education in fundamental geoscience at CC made the transition relatively easy. They always like to hear from CC geologists, so don't hesitate to contact them if you have an interest in mineral deposits or mining, or just happen to be passing through Vancouver!

References:

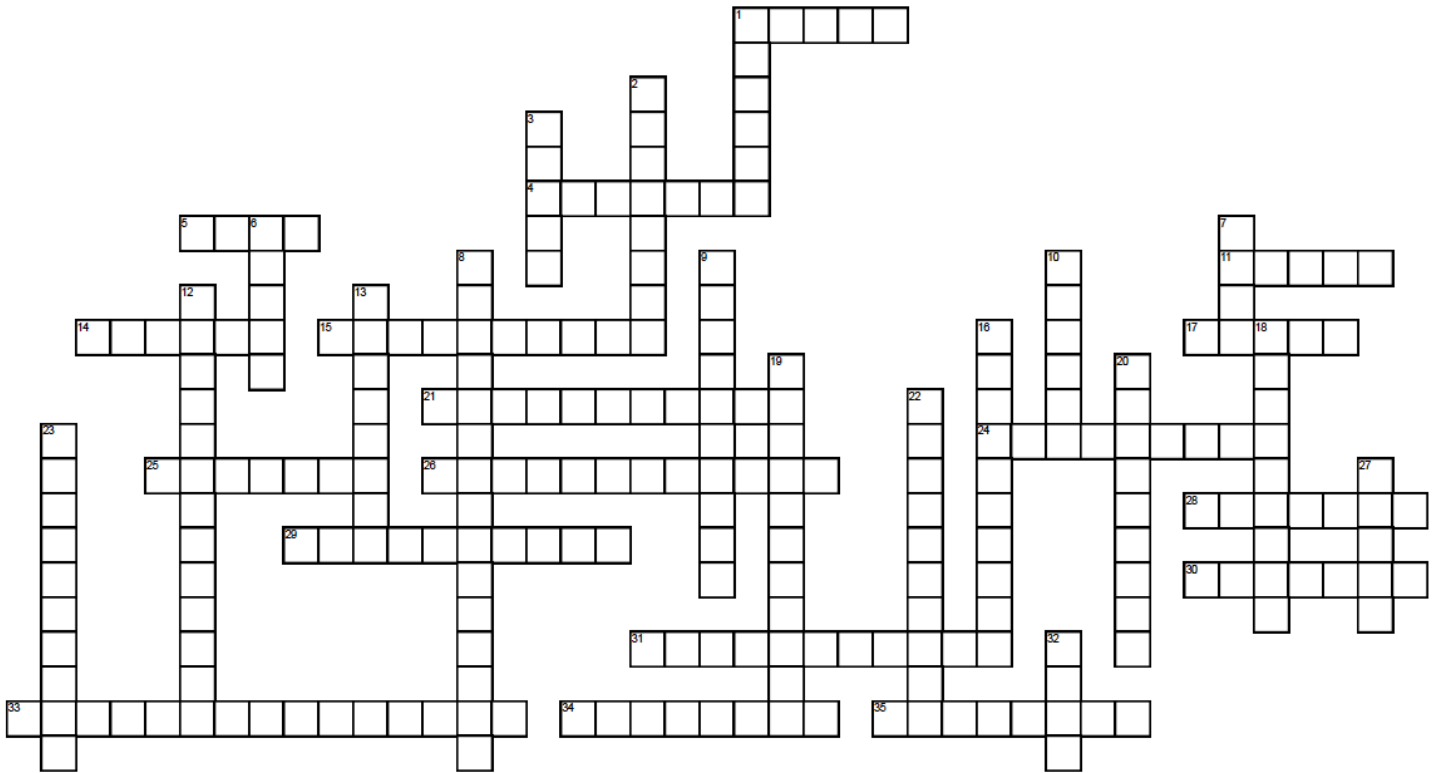
Blevings, S.K., Kraft, J.A., Stemler, J.U., Krolak, T.E, 2013, An Overview of the Structure, Stratigraphy and Zn-Pb-Ag Deposits of the Red Dog District, Northwestern Alaska: Society of Economic Geologists, Inc., Special Publication 17, pp. 361-387.



Mt. Whitney, CA
Photo by Steve Weaver

Rocks

Test your geologic skills



ACROSS

1. Slow slope diffusion process
4. Composed of glacial till
5. Horizontal intrusion
11. An abandoned meander
14. Father of Geology
15. Calcareous rock deposited by hot springs
17. Our one true love
21. Index Mineral formed at high temperature and pressure
24. Uniform in all orientations
25. Precambrian Supercontinent
26. The turning and mixing of sediment by organisms
28. Popular field Compass
29. Classic, layered igneous intrusion in Greenland
30. Gravity anomaly corrected for the height at which it is measured and the attraction of terrain
31. Antiquated, pre-plate-tectonics word for a passive margin
33. Formed by frictional melting along faults
35. "Foreign rock"

DOWN

1. 64-256 mm
2. Preferential, planar fracturing of minerals
3. Lineament in New Mexico associated with volcanism
6. Sandstone formation in Garden of the Gods
7. Seismic velocity discontinuity that separates the crust from the mantle
8. Ratio of the density of a material to the density of water
10. Light radiation reflected off a surface
12. Volcano composed of various layers of volcanic material. characterized by periodic, effusive eruptions
13. "Devils Toenail"
16. Olivine-rich, ultra-mafic rock derived from the mantle
18. Crater associated with the K-P extinction
19. "French" basal detachment fault
20. Lies between low and high tide marks
22. Mg_2SiO_4
23. Sedimentary protolith
27. _____'s reaction series
32. Calcareous, spheroidal grains

Answer on page 42

Geology Day

April 9, 2016, Tuttle Science Lecture Hall

Student Presentations:

Erica Evans '16 "Fluvial landscapes of the late Cretaceous: Insights from stable isotope geochemistry, sedimentology and taphonomy"

Jed Ball '16 "Reconstructing Forest Structure in Southern Utah during the Late Cretaceous through the use of Carbon Isotope Analysis"

Matt Hess '16 "Investigating Water Table Beneath Jacks Valley Using Seismic Refraction"

Katie Waters '16 "Gravity Gradient Analysis for New Fault Identification and Basement-Sediment Geometry Characterization for the Seattle Basin, Washington, USA"

Fischer Hazen '16 "Branching out of the Bighorn Basin: Records of Early Eocene Hyperthermals in The Piceance Basin of Western Colorado"

Erin Hightower '16 "Clastogenesis as a Result of Reactivation of Agglutinated Spatter"

Emily Beckham "Shallow Magmatic Recharge in an Intraplate Volcanic Complex, Akaroa, Banks Peninsula, New Zealand"

John Borah '17 "Siddoway's Antarctica"

Forrest Corcoran '17 "Using Electrical Resistivity to Image the Watertable at the United States Air Force Academy"

Erik Goosmann '16 "Geologic Map of the Caloris Basin, Mercury"

Ben Justman '16 "Gravity and Magnetic Analysis of Subsurface Geologic Structures in the Granite Falls Quadrangle, Washington"

Ryan Kroner '16 "Composition and rheology of overthickened lava flow units on Banks Peninsula, New Zealand"

Sierra Melton '18 "Organic Matter and Grain Size Comparisons in Sediments of Tidally-Influenced Freshwater Rivers"

Lexie Millikin '17 "GIS Development of Water Quality in the Fountain Creek Watershed"

Sergio Perez '16 "The Rock in Between: The Tava Sandstone"

Noah Villamarin-Cutter '16 "Microtopography at the onset of the PETM in the Bighorn Basin, WY"

Colin Chupik '16 "Surficial geomorphic mapping and slip rate analysis of the Wairau Fault, South Island, New Zealand"

Cody Duckworth '16 "Consequences of Fault Initiation on Sandstone Injection Mechanisms: A comparison of structural features and local injectite units on Cheyenne Mountain, CO with well characterized injectite systems elsewhere"

Sam Elkind '16 "Creation of a geological map dataset of Marie Byrd Land, Antarctica"



Fischer Hazen '16 dishes out Hamburgers at Geology Day

Venture Grants

Year: 2015-2016

2015-2016 Venture Grant Recipients	Grad	Project	Where
Bastien, Salvador Burk, Erin Chupik, Colin Purtell, Joe Riggio, Nina	16; 18; 16; 18; 17	Beyond Red Stone: A Study of Ethics and Aesthetics in the American Southwest	CO and NV
Borah, John O'Neill, Alex	17; 17	Shark Tag & Recapture Study In and Around the Historic Boca Grande Pass	Gasparilla Island, FL
Elkind, Samuel	16	Geologic Investigations of West Antarctica	Dunedin NZ
Evans, Erica	16	Using Clumped Isotope Thermometry to Study the Climate and Hydrology of Western North America During the Late Cretaceous	WA

Senior Awards

Annual Awards

Year: 2015-16

Rocky Mountain Association of Geologists

Award:

Erin Hightower '16

Estwing Outstanding Senior Geologist:

Fischer Hazen '16

Association of Women Geoscientists:

Emily Beckham '16

Rocky Mountain Association of Geologists McKenna Scholarship (for a junior the previous year):

Fischer Hazen '16

Cody Duckworth '16

Buster Scholarships:

Jed Ball '16

Emily Beckham '16

John Borah '17

Forrest Corcoran '17

Sam Elkind '16

Erica Evans '16

Grace Guryan '17

Matt Hess '16

Ben Justman '16

Lexie Millikin '17

Sergio Perez '16

Charlie Russell '17

Katie Waters '16

Gould Scholarship Recipients:

Grace Guryan '17

Ben Justman '16

Sergio Perez '16

Putman Scholarship Recipients:

Grace Guryan '17

Ben Justman '16

Sergio Perez '16

Rhoades Scholarship:

Grace Guryan '17

Sergio Perez '16

Hannigan Family Fund:

Tianran Zhang '18

Witter Family Fund for Geology Internships:

Student	Organization
Erica Evans '16	Denver Museum of Nature & Science
Matt Hess '16	Denver Museum of Nature & Science
Ellen Smith '16	USGS (Menlo Park)
Lexie Millikin '17	USGS (Denver)
Ben Justman '16	Bishop Brogden Associates Inc.
Erin Hightower '16	The Smithsonian
Tianran Zhang '18	University of Illinois
Noah Villamarin-Cutter '16	City of Colorado Springs
Sergio Perez '16	City of Colorado Springs



Annabelle O'Neill '19 and Rowan Kowalsky '18 take a tumble in Great Sand Dunes National Park.
Photo by Colin Chupik '16

Student and Recent Alumni Conference Presentations 2016

GSA in Denver, CO Fall 2016

Grace Guryan '17 "Two dimensional stability and seismic loading models of Crater Lake outlet, Mount Ruapehu, New Zealand"

Alexie Millikin '17 "Geochemistry and petrogenesis of the Table Mountain lava flows, Golden, Colorado"

Samuel Elkind '16 "First digital geological map dataset of Marie Byrd Land: a product of the SCAR geomap project"

Erica Evans '16 "Fluvial landscapes of the Cretaceous: insights from stable isotope geochemistry, sedimentology and taphonomy"

Erin Hightower '16 "Clastogenic flow as a result of reactivation of agglutinated spatter"

Austin Miller '15 "Tracking the onset of Phanerozoic-style redox-sensitive trace metal enrichments: new data from Neoproterozoic post-glacial strata in NW Canada"

Vikki Crystal '14 "Using carbon isotope ratios to study forest soils and canopies of the late Cretaceous in southern Utah"

Brennan O'Connell '13 "A pre-Colorado River northern Gulf of California marine embayment recorded by tidal rhythmites in the southern Bouse Formation"

Kye Birchard '13 "The central Snake River plain low $\delta^{18}\text{O}$ rhyolite province: crustal melting processes"

Devon Cole '13 "A chromium isotope perspective on Burgess-shale type preservation"

Ryan Gall '13 "Stabilization of Eocene climate recorded in fluvial deposits of the Douglas Creek Member"

Dirk Rasmussen '12 "Provenance of early Paleogene strata in the huerfano basin: implications for uplift of the Wet Mountains, Colorado, USA"

Tom Ashley '12 "Estimating bedload from gage data to improve flux-based sediment budgets"

AGU in San Francisco, CA, Winter 2016

Grace Guryan '17 "Applications of Ground Penetrating Radar for Mapping Fluvial Sediment at the East River Floodplain Near Crested Butte, Colorado"

Charlie Russell '17 "CRN Dating and Numerical Glacier Modeling to Investigate Climate During the Last Glacial Maximum, and the Subsequent Deglaciation, Sawatch Range, Colorado"

Seminar Series Spring Semester 2015-16

Block 6 -- March 4 -- Professor Roger Billham, University of Colorado Boulder, "The dangerous southern edge of the EuroAsian plate: earthquakes and corruption" and "New insights into Himalayan earthquakes following Nepal's 2015 Mw7.8 incomplete rupture".

Block 7 -- March 28 -- Dr. Lidya Tarhan, Yale University NSF Earth Sciences Postdoctoral Fellow, "Development of Bioturbation and Implications for Global Sulfur Cycling in Early Paleozoic Oceans".

Block 8 -- April 21 -- Meredith Bush '08, University of Texas at Austin PhD candidate, "Reconstructing Mountain Building – Studies of deformation and sedimentation from Tibet and the southern Rocky Mountains".

Block 8 -- April 26 -- Alessio Fabbrini, Università di Siena, Italy, "Insights on a shallow volcanic plumbing system: Punta dello Zenobito volcanic complex, Isla Capraia, Italy"

Block 8 -- April 29 -- Dr. John Wilson, Assistant Professor of Biology, Haverford College, "An evolutionary history of plant form and function"

Seminar Series Fall Semester 2016-17

Block 1 – September 30 – Dr. Beth McMillan '91, Professor and Chair, Department of Earth Sciences, University of Arkansas at Little Rock, "On the shoulders of giants: subsummit surfaces and the Rocky Mountains"

Block 4 – December 2 -- Ana Vargo '84, Professional Geologist, Natural Resources Conservation Service, Denver, CO, "What an engineering geologist does"

Block 5 -- February 1, 2017, Dan Niemela '00, Hydrogeologist, Bishop Brogden Associates, Denver, CO, "History of Water Rights in Colo-

rado"

Block 6 -- March 1, 2017, Celeste Mercer, Research Geologist, USGS, Denver, CO, Title TBA

Recent Faculty Publications

*Indicates Colorado College student

Anderson:

O'Rourke, C., Sheehan, A. F., Erslev, E. A., Anderson, M., 2016, Small-magnitude earthquakes in north-central Wyoming recorded during the Bighorn Arch Seismic Experiment, *Bulletin of the Seismological Society of America*, v. 106, p. 2320-2331, doi:10.1785/0120160035.

Dragovich, J. D., Mavor, S.P., Anderson, M. L., Mahan, S. A., MacDonald, Jr., J. H., Tepper, J. H., Smith, D. T., Stoker, B. A., Koger, C. J., Cakir, Recep, DuFrane, S. A., Scott, S. P., *Justman, B. J., Geologic map of the Granite Falls 7.5-minute quadrangle, Snohomish County, Washington: Washington Division of Geology and Earth Resources Map Series 2016-03, 1 sheet, scale 1:24,000, 63 p. text.

Bush:

Bush, M.A., Horton, B.K., Murphy, M.A., and Stockli, D.F., 2016, Detrital record of initial basement exhumation along the Laramide deformation front, southern Rocky Mountains: *Tectonics*, doi: 10.1002/2016TC004194.

Bush, M.A., Saylor, J.E., Horton, B.K., and Nie, J., 2016, Growth of the Qaidam Basin during Cenozoic exhumation in the northern Tibetan Plateau: Inferences from depositional patterns and multiproxy detrital provenance signatures: *Lithosphere*, v. 8, p. 58–82, doi: 10.1130/L449.1.

Fricke:

Zellman, K., Fricke, H.C., Plink-Bjorklund, P., Wing, S.L., Harrington, G. (2016) Revisiting the Paleocene-Eocene boundary in the San Juan Basin of New Mexico. *GSA Abstracts*

with Programs Vol. 48.

*Evans, E.S.J., Fricke, H.C., Crystal, V., Sertich, J.W., Miller, I. (2016) Fluvial landscapes of the Cretaceous: insights from stable isotope geochemistry, sedimentology and taphonomy. GSA Abstracts with Programs Vol. 48.

Fricke, H.C., *Crystal, V., Miller, I. M., Sertich, J., and Diefendorf, A. F. (2016) Using carbon isotope ratios to study forest soils and canopies of the Late Cretaceous in southern Utah. GSA Abstracts with Programs Vol. 48.

Karimi:

Karimi, B. and Karimi, H.A. An Automated Method for the Detection of Topographic Patterns at Tectonic Boundaries. PATTERNS 2017

Leonard:

Leonard, E.M., Laabs, B.J., Plummer, M.A., *Kroner, R.K., Brugger, K.A., *Spiess, V.M., Refsnider, K.A., Xia, Y., Caffee, M.W., 2017, Late Pleistocene glaciation and deglaciation in the Crestone Peaks area, Colorado Sangre de Cristo Range – chronology and paleoclimate. Quaternary Science Reviews 157, 127-144.

Schweinsberg, A.D., Briner, J.P., Shroba, R.R., Licciardi, J.M., Leonard, E.M., Brugger, K.A., *Russell, C.M., 2016. Pinedale glacial history of the Upper Arkansas River valley: new moraine chronologies, modeling results and geologic mapping. in: Keller, S.M., and Morgan, M.L., (Eds.), *Unfolding the Geology of the West: Geological Society of America Field Guide 44*, 335-353.

Myrow:

Bayet-Goll, A., Myrow, P.M., Aceñolaza, G.F., Moussavi-Harami, R., and Mahboubi, A., 2016, Depositional controls on the ichnology of Paleozoic wave-dominated marine facies: New evidence from the Shirgesht Formation,

central Iran: *Acta Geologica Sinica (English Edition)*, v. 90, p. 1801-1840.

Gilbert, I.R., Hughes, N.C., and Myrow, P.M., 2016, Cambrian microfossils from the Tethyan Himalaya: *Journal of Paleontology*, v. 90, p. 10-30, DOI: 10.1017/jpa.2015.74.

Myrow, P.M., 2016, Storms and Storm Deposits, in Selley, R.C., Cocks, R., and Pilmer, I., eds., *Encyclopedia of Geology: Reference module in Earth systems and environmental Sciences*, Elsevier Limited, Oxford, UK, revised entry.

Myrow, P.M., Hughes, N.C., McKenzie, N.R., Pelgay, P., Thompson, T.J., Haddad, E.E., and Fanning, C.M., 2016, Cambrian–Ordovician orogenesis in Himalayan equatorial Gondwana: *Geological Society of America Bulletin*, v. 128, p. 1679-1695.

Pu, J., Bowring, S.A., Ramezani, J., Myrow, P., Raub, T.D., Landing, E., Mills, A., Hodgkin, E., and Macdonald, F.A., 2016, Dodging Snowballs: Geochronology of the Gaskiers Glaciation and the first appearance of Ediacaran biota: *Geology*, v. 44, p. 955-958.

Sullivan, N.B., Over, D.J., Chuluum, M., and Myrow, P.M., 2016, Subsidence and drowning of a carbonate platform in south-central Mongolia (Gobi Altai Region) during the Late Eifelian to early Givetian: A Synthesis of biostratigraphy, magnetic susceptibility and paleoecology: *Journal of Asian Earth Sciences*, v. 115, p. 204-213.

Xiao, S., Tang, Q., Hughes, N.C., McKenzie, N.R., and Myrow, P.M., 2016, Biostratigraphic and detrital zircon age constraints on the basement of the Himalayan Foreland Basin: Implications for a Proterozoic link to the Lesser Himalaya and cratonic India: *Terra Nov*, v. 28, p. 419-426

Siddoway:

Langridge, R.M. Ries, W., Dolan, J., Schermer, E. and Siddoway, C., in press, 2017, Geologic slip rate estimates for the Alpine Fault at Maruia River (Calf Paddock), New Zealand, *New Zealand Journal of Geology & Geophysics*, 10.1080/00288306.2016.1275707. With thanks to the CC students of Regional Studies, Year 2000, who assisted with the initial survey! Whew, this publication happened on geological time scales.

Siddoway, C., (2017 - with publisher), *Geology of West Antarctica* (invited chapter), in Kleinschmidt, G., ed., *Geology of the Antarctic Continent*. Stuttgart: Gebrüder Borntraeger Verlagsbuchhandlung.

Brown, C., Yakymchuk, C., Brown, M., Fanning, C.M. Korhonen, F.J., and Siddoway, C.S., 2016, From source to sink: Petrogenesis of Cretaceous anatectic granites from the Fosdick migmatite–granite complex, West Antarctica, *Journal of Petrology*.

Siddoway, C.S., Cox, S.C., Elkind, S. and White, T., 2016, Digital Geological Map and GIS Database for Marie Byrd Land, Antarctica, for Antarctic GeoMap project (<http://www.scar.org/geomap>), Scientific Committee on Antarctic Research. See <http://sites.coloradocollege.edu/csiddoway/digital-geological-map-of-marie-byrd-land/> for further information and map data.

Student abstracts:

White, T., Elkind, S., Cox, S.C., Siddoway, C.S., Lytle, B.P., and Morin, P.J., 2016, Digital Geological Map for Marie Byrd Land, West Antarctica: A resource for investigation of geotectonic frameworks and future glaciological change: AGU Fall Meeting, C53C-0731 .

Elkind S., Siddoway, C., Cox, S., Morin, P. and Smith Lytle B., 2016, First digital geological map dataset of Marie Byrd Land: A product of the SCAR GeoMap project, XXXIV SCAR

Biennial Meeting and Open Science Conference, Kuala Lumpur, Malaysia (22-26 August).

Some of my 2016 abstracts:

Siddoway, C., Tinto, K., Bell, R., Padman, L., Fricker, H.A. and Springer, S.A., 2016, Ross Ice Shelf, Antarctica: Bathymetry, Structural Geology and Ocean Circulation from New IcePod Airborne Geophysical Data, AGU Fall Meeting, Abstract C53C-0724.

Siddoway, C., Tinto, K., Bell, R. and ROSETTA-Ice team, 2016, Large scale continental extension in West Antarctica, *Geological Society of America Abstracts with Programs*, v. 48.

Siddoway, C., Ault, A.K., and Reiners, P.W., 2016 (invited), A hematite (U-Th)/He minimum age for Cryogenian Tava Sandstone, Colorado, and variations in detrital zircon provenance that illuminate the paleogeography of the region, *Geological Society of America Abstracts with Programs*, v. 48.

Siddoway, C., 2016, Use of a digital subglacial geological map of western Marie Byrd Land to illuminate East Gondwana crustal growth and dispersal, XXXIV SCAR Biennial Meeting and Open Science Conference, Kuala Lumpur, Malaysia (22-26 August).

Siddoway, C. and Elkind S., 2016, Antarctic GeoMAP for Marie Byrd Land: A digital map of exposed and subglacial geology and surficial glacial deposits, XXXIV SCAR Biennial Meeting and Open Science Conference, Kuala Lumpur, Malaysia (22-26 August).

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

Paul Osmundson '83

Cappi and I just celebrated our 32nd wedding anniversary, and our three children (Phil – 27, Teddy – 25 and Margi – 23) all live in Sonoma County, near our home in Petaluma. My company continues to do interesting real estate development work in San Francisco. We built and are partners in a new restaurant right next to the SF Giants AT&T Park called Atwater Tavern (www.atwatertavern.com). We also continue to do work on historic building renovations as a project / construction manager, and managed the 34th America's Cup project in 2013, which was interesting and exciting.

Tim Metz '89

I am the Director of Finance for Mountain Hardwear these days, but I still love geology as an avocation and will dig for minerals anytime, anywhere. Thought I would share this picture as a bit of advice for the kids. Be sure you use the right vehicle when you take a shortcut through the Carboniferous Clay Slates of the Calaveras Group as you drive from one ridge covered with Auriferous Gravels to another in search of the last remnants of the Great Blue Lead! Happy digging!



Thomas E. Ewing '75

Still maintaining my geoscience consulting office, have currently been working on a regional stratigraphic grid for Miocene strata in the Texas Gulf Coast in association with brackish-water exploration. As of last week, my book "Texas Through Time: Lone Star geology, landscapes and resources" has been published by the Texas Bureau of Economic Geology, the culmination of a 3-year effort. It's 431 pages long, full color; it tells the story of Texas from landscapes to geologic time, from 1700 Ma to the present, and summarizes the varied resources and geologic hazards in the State — all with an eye to a general adult audience. I've been giving talks about the book and about the Texas story to a wide variety of groups over the last year. I am presently serving as President of the Gulf Coast Association of Geological Societies (GCAGS), which is the Gulf Coast Section of AAPG. We are holding our convention in San Antonio in 2017 (Nov 1-3). Also still directing the San Antonio Liederkrantz men's choir as I have since 2000. Next year is our 125th anniversary!

Debbie Hingston Dolson '73 and John Dolson '71

We continue to enjoy semi-retirement in Coconut Grove, Florida. John still teaches as an Adjunct Professor at the University of Miami, stays active in AAPG activities, local conservation efforts and as a Senior Geological Advisor for Delonex Energy in London. This year, they are celebrating completion of his book (photo attached), *Understanding Oil and Gas Shows in the Search for Hydrocarbons* (Springer-Verlag, 2016). The book is a comprehensive treatment of the basics of oil and gas exploration from the standpoint of data and mind-set needed as told through many case histories and anecdotes from the author's 37 years of exploration experience.

John gives a lot of credit to great teachers at Colorado College for forcing him to write so many papers during his undergraduate work there.



Sarah Andrews '73

Greetings, CC rock jockeys and pebble pimps:

I'm pleased to share that this year at the annual meeting of the Geological Society of America in Denver, I was presented the President's Medal "for outstanding support of the geosciences," recognizing the mystery novels I have written in order to create a bridge over which the public can better understand geology and appreciate the work of geologists. Outgoing president Jonathan G. Price presented the medal, in his citation making quips about how many state geologists I had murdered in the process. Research for such writing is a highly collaborative process, so the celebration continued at the Ship's Tavern at the Brown Palace Hotel, where I rounded up everyone in the area I could locate who had helped in one key way or another with that collaboration. I was sorry to learn that CC Professor John Lewis, who inspired me to study geology, had recently moved from Colorado, but among those

present was Professor Christine Siddoway, who supported me in preparing for and carrying out work with the National Science Foundation, which sent me to Antarctica back in 2005 to research the eleventh novel in that series, *In Cold Pursuit*. Happily in my mind's eye is the memory of Chris's grin as she stood on the ice at McMurdo Station, guiding me onward to high adventures as a helicopter lifted me up into the brilliant blue Antarctic sky en route a field camp in the Transantarctic Mountains.

The day after the medals ceremony, I was further honored to present a medalist's lecture in a topical session at the convention. I then headed to Wyoming with my family for a week of camping in the Wyoming Range west of Big Piney. While there, we were visited by Jim McChristal, who graduated from CC a couple years ahead of me. Jim was one of a cadre of hardy souls who rolled the famed Lewis Rocks into place just outside a window of Palmer Hall's Precambrian Basement in honor and lampoon of Professor John Lewis's earlier trip to Antarctica, for which an Antarctic outcropping there was similarly named for him. Having known Jim in the Colorado College Mountain Club, we had a great time catching up on what we'd been up to for the past four decades; while I "did" geology at the USGS, in the oil patch, environmental consulting, teaching, and writing the books, he served as a river guide on Cataract Canyon for eight years, then as a law enforcement ranger with the National Park Service at a variety of locations. His river experience came in handy as I attempted to bake sourdough bread in camp in a Dutch oven, as he knew all the tricks for keeping the oven hot. He and Chris James and Larry Carpenter, all prime movers of the CCMC (which lives on in our minds, though apparently not at the college) had prepared another award, the CCMC Furthest South Award, which Jim kindly presented to me at fireside. I now proudly display the two

awards together, and wonder what adventure comes next.

Drew Beckwith '01

I continue to work on water policy issues at Western Resource Advocates, now closing in on eight years with the organization. I can report that not much has been more fun than helping to legalize rain barrels in Colorado, finally securing passage of HB 16-1005 after two years of legislative effort. After signing the bill, Governor Hickenlooper signed a few rain barrels too, which WRA promptly auctioned off at our annual fundraiser!



Bonita Lahey '69

Well, it was a busy year. I have been the Museum of Nature and Science's petrographer on two major projects for a couple of years. This year two papers were presented (by Curator James Hagadorn) at the GSA and my name is on both. 1. "The Permian-Triassic of Eastern Colorado: redbeds, slimes, salt, dunes, and a possible extinction?" and 2. "Colorado Mass Extinction: weird facies and cool fossils from the end-Devonian formation." One of those was written up and peer-reviewed and is in the Field Guide 44 - Unfolding the Geology of the West - The Permian-Triassic transition on Colorado. My name is on it as well. (One of our field sites made the cover!) I was a co-leader on the

field trip to some of the sites. Also, had a great time with Steve Spear '69 at the GSA and we ran into a classmate we haven't seen since 1969 - Ruth Stenmark Martin '69 - at the CC meet-up at the GSA.

Lisa Greer '93

I am in my 14th year of teaching in the Washington and Lee Geology Department. My current research is focused on modern and recent coral reefs (now in Belize), particularly endangered *Acropora* spp. (Staghorn/Elkhorn) corals. This work stems from a Keck Geology project I ran with 11 undergraduates in 2014, and my own 1993 Keck/undergraduate thesis work at CC. Thanks to all my CC profs for all you did to inspire me!



Virginia Hill '15

After working in a geochronology lab in Boston last year I decided pure geology was not for me, so I will be going to law school in September 2017 for Environmental Law. In the interim I am planning to move to the Colorado/Utah area to get some good skiing and hiking in before I have to spend more time in the library.

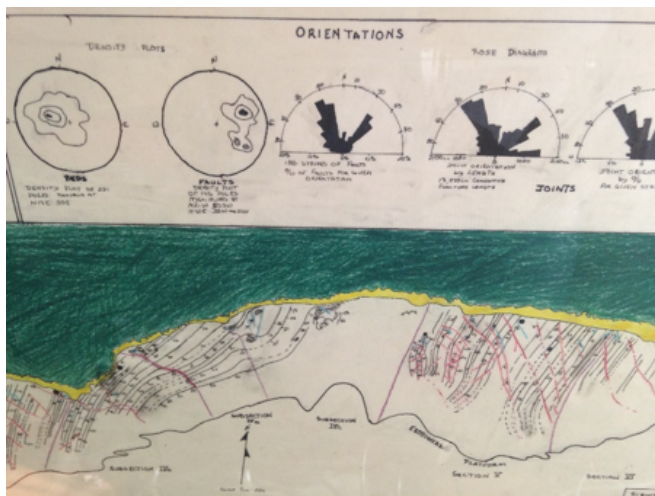
Woody Fischer '00

Life has been great at Caltech, though I've been away on fellowship at Stanford working out a new (and maybe impossible?) set of experiments at the synchrotron. In my

group we continue to work on the evolution of photosynthesis and the history of oxygen in our atmosphere. Family is also doing well. My spouse Lizzie Fischer, née Connelly (CC 2001), and toddler Henry (CC 2034) are looking forward to the ski season—perhaps even with some natural snow!

Doug Haller '88

I am working on a GIS certification. As his senior project he mapped a portion of the western coast of Costa Rica by hand! Today, he is using modern technology to help visualize the world.



Larry Wyman '74

I retired in June from BP Alaska as an acquisition geophysicist / seismic project manager. Perfect timing for low oil prices! Now traveling the lower 48 in an RV looking for the next place to settle down. Hopefully in a warmer climate. Still scuba diving in tropical waters and looking to do more sailing.

Timothy Gibson '10

I'm currently in the 4th year of my PhD at McGill University in Montréal and have managed to convince my supervisor that a 4th field season in Arctic Canada is great idea. I look forward to reconnecting with the department while teaching GY135: Geology of the Pikes Peak Region next summer during A block before heading north. Get in touch if

anyone finds themselves in Québec!

Tania Plascencia '96

I currently live in San Diego with my husband, our 1 1/2 year old daughter, and our 2 rescue pups - Alice & Curly. Been in San Diego since 2001 and I work as an Innovation Consultant for a global market research firm - which translates to - I help our clients come up with new ideas for products and services. I travel quite a bit for my job, and when I'm not globetrotting I spend my time wrangling our band of super heroes! San Diego affords us the luxury of spending a lot of time outdoors - so we do a lot of hiking and exploring where I get to show off my geo skills by identifying rocks! Haha! Hope all is well with everyone - and if you should find yourself in the SoCal area - please do look me up!



James Bradbury '95

I live in D.C. with my wife, Jenny, and daughters, Ella and Zoe. Last summer we started backpacking together as a family for the first time (picture attached), which was my big highlight for the year! I work at the U.S. Department of Energy as a Senior Policy Advisor. One of my focus areas is reducing methane emissions from the oil and natural gas sector; I also work on building the resilience of energy infrastructure to the impacts of climate change. So, earth sciences continue to be a big part of my professional and personal life. Looking forward, into 2017, I'm hopeful that our fellow CC alumnus and Trump

transition team leader for the U.S. EPA, Myron Ebell, recognizes the critical role for science in guiding environmental policies that protect our air, water and the future climate of our planet.



Dave Rodland '96

It's been a busy year! My wife Amber & I are proud to announce the arrival of our daughter Zoe (on Charles Darwin's birthday, no less). Unfortunately, childcare and a heavy teaching load meant that I wasn't able to come out to the annual GSA meeting this year - the first time I've missed Denver since my CC days - and I missed the chance to catch up with the old crowd. But we can't wait to come back and show Zoe what real mountains look like some day! Sending all our best!

Paul and Cara Bovet ('02 and '03)

We are living in Houston, Texas with their two daughters Helen, age 6, and Edith, age 3. Paul is currently working for Chevron as a reservoir modeler and Cara works for Schlumberger as a chemist. We are preparing for a move to Lagos, Nigeria next year where

Paul will continue his work with Chevron. We recently visited Switzerland where we were refreshed with a short stay in the mountains. Our daughter Helen kept warm with her CC sweatshirt.



Terri Olson '80

I am staying busy as a consulting petrophysicist. I gave a talk ("Combining high-resolution with larger volume images for improved characterization of mudstone reservoirs: an example from the Barnett Shale) in Iceland in June, and got to travel around the country as a tourist with my family afterwards (see photo). I am the new president-elect for the Rocky Mountain Association of Geologists for 2017. I edited a book for the American Association of Petroleum Geologists' Memoir series, "Imaging Unconventional Reservoir Pore Systems" and coauthored 2 papers for that volume (Dec. 2016). I live with my husband in Golden, CO



Kate Zulaski '99

spends much of her time making silly Geology puns that nobody else gets, since she works in a field devoid of the special type of geek known as a Geologist. She misses the knowing look on someone else's face when she says "Oh schist!". Kate sends a warm greeting to all the CC Geology students and alumni around the globe, and hopes you don't feel taken for granite.

Justin Strauss '06

My wife ('07 CC alumna Elena Mihaly) and I are finally settling into our new community of Norwich, VT. I started as an Assistant Professor in the Department of Earth Sciences at Dartmouth College in January 2016, and it's been a busy year of getting a lab built, developing new classes, and starting a Sedimentary Geology research program! If you're in the Upper Valley, please stop by for a visit

Erik Goosemann '16

In the fall I began a PhD program in Earth & Space Sciences and Astrobiology at the University of Washington. My work focuses on using paleobarometric proxies in order to determine atmospheric changes in the Archean, with implications for astrobiology,

nitrogen cycling, and the 'faint young Sun.



Megan Hurster '12'

After living abroad for a few years, I now live in Salt Lake City, UT and teach middle school math and science at the Weilenmann School of Discovery. WSD is a charter school emphasizing outdoor education and hands on, project based learning experiences.

Working in the field for my thesis work with Megan Anderson and capstone work with Paul Myrow and the rest of the department really emphasized for me the importance of context when studying complicated science concepts. My seventh graders study forces of motion on the football field, get to watch genetic practices happening in the garden, and see geologic processes shaping the landscapes around them on a daily basis. CC geo not only empowered my teaching with the importance of place-based education, the professors modeled how passion and excitement can directly translate to your students on a daily basis.

Someday, I hope to move out of the four-walled classroom and into the outdoors as my classroom full time. Geology alumni- if you are ever in the SLC area, please feel free to come visit my classroom any time! All are welcome.

Gabi Rossetto '15

I've been working at the Denver Museum of Nature & Science for fellow CC alum and current curator of Paleontology, Ian Miller ('99). I started as an intern at DMNS after graduating from CC Geo in May 2015, and now am here as full-time staff as Paleobotany Collections Assistant. I have been doing a lot of field work with the museum collecting fossils, including annual trips to the San Juan Basin in New Mexico, the Kaiparowits Plateau in Utah (see photos), and the Williston Basin in North Dakota and Montana with 2 CC Witter Family interns, Erica Evans ('16) and Matt Hess ('16). Fun times! Now I am applying for Ph.D. programs in Paleobotany and hope to attend graduate school next fall.

**Devon Cole '13**

I'm currently in the third year of my PhD at Yale, where I've been tackling early Earth questions using a combination of sedimentology and trace metal isotopes. My focus is on the relationship between the rise of oxygen and the timing of major biotic events such as the diversification of complex life and the rise of animals. I've logged some long hours in the lab, but have also spent major time in the field looking for nice Precambrian sedimentary rocks! This has included fieldwork in Northwest Territories, Canada, Northern India, Botswana, Zimbabwe, and the western US in the last year. Give a shout if you find yourself in New Haven!

Jim Bowman '80

Occupation: Instructor Pilot, United Airlines
 Residence: Monument Colorado
 Spouse: Jeanne Nazimek (CDR USN Retired)
 2017 Highlights: Camping and hiking locally and around the state of Colorado. Trips to Switzerland, Germany, Paris, and the Normandy Region of France. Spending time with friends and family.

James King '68

After graduating with a BA in Geology in 1968, I completed a PhD in Geosciences at the University of Arizona in 1978. I was a faculty member and administrator (Dean of Undergraduate Students) at California State University Dominguez Hills from 1975 through 2004. I retired in 2004 after the death of my husband, John Webb, and moved to Tucson, Arizona where I married a friend, Jim King, from graduate school. We continue to reside in Tucson where I keep busy reading, cooking, playing golf, and just enjoying the sun. I have two children, John and Jamie, and 3 grandchildren, Anna, Eli, and Forrest.

Fransiska Dannemann '12

Wow, what a year! After successfully defending my M.S. thesis entitled "Improving Infrasound Signal Detection and Event Location in the Western US using Atmospheric Modeling" and graduating from Southern Methodist University in August, I re-located to Santa Fe to start a research position within the Geophysics group at Los Alamos National Laboratory. I am building upon my M.S. research looking at seismoacoustic applications to national security measures, as well as beginning to delve into examining infrasonic signatures from wind farms within the United States. I have quickly learned that full-time research positions involve much more time on the computer and much less time in the field than I was expecting, however; the local ski hill is ten minutes up the road from my office at the lab, so I've been enjoying the occasional lunch break ski run and taking

advantage of all that Northern New Mexico has to offer!

I recently found myself on the Class of 2012 5th Reunion Committee, and am looking forward to returning to Colorado Springs in October for Homecoming. Hope to see you then!

Pete Kingston '06

I've been living in Seattle for the past 10 years skiing and sailing (thanks senior regional geology class for showing me how to sail!). Getting married to a geologist in late 2017. I'm working for SoundEarth Strategies and currently manage the company's Geology Group. They might not let me outside anymore but at least the office view is okay.



Emily Pope '04

Works at the Natural History Museum at the University of Copenhagen, Denmark, with her husband, Solomon Seyum, and new daughter Iris!



Students in GY320 Geomorphology head back to camp under the rising moon.

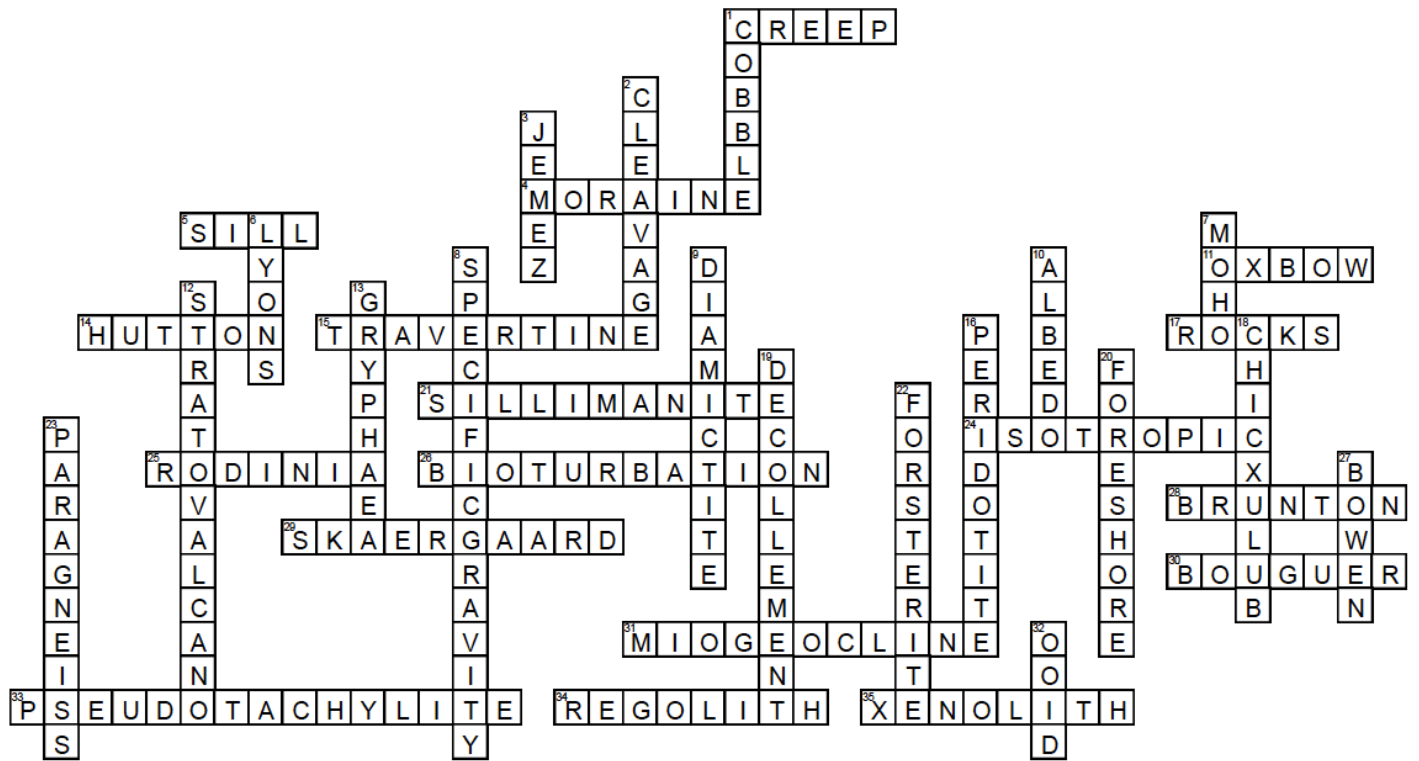
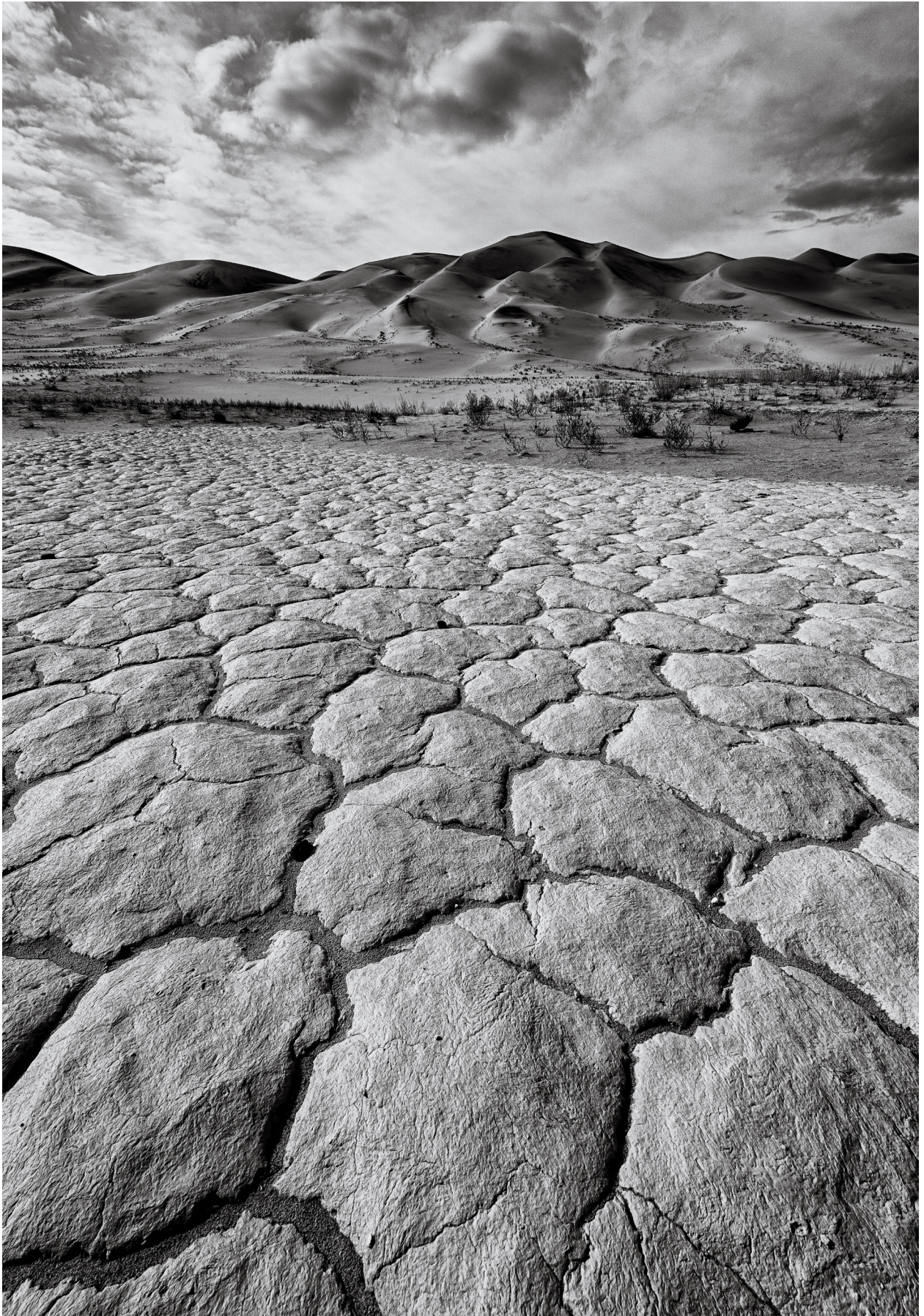


Photo by Cody Duckworth



Desiccation Cracks in Death Valley
Photo by Steve Weaver

Dear Colorado College Geology Alum:

We hope you have enjoyed the 2015-16 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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