

PC  
Basement

THE COLORADO COLLEGE GEOLOGY DEPARTMENT



2017-2018  
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**Cover Photo: Aztec Sandstone in Gold Butte National Monument, Nevada  
Taken by Steve Weaver**

**The Precambrian Basement**  
2017-2018

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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. We are entering a period during which the department is likely to change personnel dramatically. Last year, after her year's leave of absence, Megan Anderson resigned her position to pursue other opportunities. Eric Leonard has entered phased retirement and will teach three of his favorite classes next year before retiring. I plan to teach for two more years after this current year, retiring a year after Eric, pending various factors. If we do both retire on this timing, then the department will be looking for three new faculty hires in the next three years and thus may take on a very different appearance, much as occurred back in the late 70s-early 80s when Richard Pearl, John Lewis and Bill Fischer all left the department. In our search this year, we are looking for someone who will best complement the faculty and bring expertise in one of several fields including but not limited to: geobiology, evolution of earth systems (biological, oceanographic, tectonic), hydrology, geochronology, geohazards, and environmental geophysics. By our mid-November deadline, we had received over 150 applications with a nice number of our own alums applying to return to CC. We will be working hard to find the three best people to bring to campus for interviews early in the winter 2018 blocks and one of these to join us next fall! Henry Fricke's big news is that he was readily promoted to Full Professor with an outstanding record of teaching and research at CC. That leaves the department in the unusual position of having five full professors here, at least until we begin replacing ourselves. Christine Sidoway received the college award to be the next McKee Professor in the Natural Sciences reflecting her long record of outstanding teaching and scholarship. Paul continues to wander the Asian continent in search of the ultimate Cambrian boundary. We have one newcomer teaching with us this year, filling in for Megan. Will Levandowski is a seismologist from Princeton. He taught a course in Geophysics for us several years ago when Megan was on sabbatical.

Our students benefitted tremendously from the Witter Family Fund for Internships in Geology. Nine students received funding and participated in an internship this year. These experiences were quite varied, including work for the Avalanche Center in Crested Butte, the Ministry of Energy in Thailand, the New Zealand Geological and Nuclear Sciences firm, the Denver Museum of Natural Sciences, the State of Alaska Geological Survey and specialized labs at Stanford and Columbia Universities. Students were uniformly thrilled with their experiences. They loved the work they did, enjoyed meeting professionals in their field, and appreciated their mentors. You can read more about their stories within this volume. Please let me know if you have positions in geological fields (during summers or during the academic year) that might be appropriate for student interns or if you know people who would like to mentor young students. We really appreciate all you can do for our students.

On a more somber note, Nan Lindsley-Griffin, class of 1964, passed away this fall. I first met Nan at an International Geological Congress in Japan in 1992 when she and her husband John signed up for the same field trip through ophiolites and blueschist mélange that I was on and we quickly figured out the CC connection. I have enjoyed her stories about her somewhat perilous and fascinating journey as a woman through a geology career in indus-

try and ultimately as a professor. It resonated with many of the ideas I was discussing with students in the Gender and Science classes I taught, especially the section on the history of women in geology- some incredible, some distressing, some revealing the persistence and good humor with which Nan moved through life (note- if you enjoy reading about these issues, the recently published book by Robbie Gries on Anomalies-Pioneering Women in Petroleum Geology 1917-2017 is great). Ultimately she became a wonderful mentor for women in the University of Nebraska program as well as working to create new avenues for young women in middle school around Nebraska to enter the sciences. After I heard of her passing, I contacted her husband John, and asked if he would consider drafting a short statement or sending a few stories that we might share with people in this newsletter. He produced an amazing document of her career and I found myself loath to edit or cut it despite its length. Generally we are happy to share brief news and stories about faculty and alums who have passed in this newsletter, but I hope you will all bear with me in wanting to share this story- both with geologists (men and women) who saw some of these difficulties for women entering geology in decades past and for younger professionals for whom many (not all) of these barriers are less present. Best wishes,

Jeff Noblett, Geology Department Chair



Powell Point, Grand Staircase Escalante National Monument. Photo by Steve Weaver.



**PAUL MYROW**  
(Sedimentology/Stratigraphy)

Greetings from Palmer Hall! Things are great at the department, as usual. I had a wonderful year, working on a wide range of projects with fantastic students. My summer began with a field trip to the Precambrian-Cambrian boundary sections that I worked on for my PhD in Newfoundland. It was a blast to see the sections again. Later in the summer I traveled to Inner Mongolia with CC student Tianran Zhang and postdoctoral fellow Jitao Chen to work on Mesoproterozoic strata replete with extraordinary stromatolites. Tianran basically finished her thesis in mid-October, a record for the department, I am sure! Jitao has been back at the college working with me on a variety of projects, one of which is helping to turn Tianran's thesis work into a manuscript for publication. I took a trip to Dinosaur National Monument early this fall with senior George Fowlkes and my colleague John Taylor from Indiana University of Pennsylvania. We drove to Jensen, UT and back and did one long day of field work in a whirlwind trip. We are now convinced that the geology of the monument is incomplete in that it shows Cambrian strata directly overlain by Mississippian rocks. We now believe that there is a previously unrecognized unit of Devonian rocks, equivalent to the Parting Formation of Colorado, sitting below a thick paleokarst horizon just below the base of the Mississippian. We found a variety of unusual fragments of crustacean fossils, but have not been able to identify any of them...so we will sample again and hope to nail down the age. Hopefully, it will be Devonian as we suspect.

I have two other students working on senior theses. Everett Smith worked on experimental data he collected while working on

a flume at the University of Texas, Austin in David Mohrig's lab. Everett built up a slope within a long flume and produced turbidity currents on which he superimposed waves. The combined unidirectional and oscillatory currents were monitored on a fine scale for velocity and resulting changes in bed topography. His work has already produced very interesting results, which we suspect will lead to multiple manuscripts. Another student, Tristan White, is working on the geochronology of Cambrian and Ordovician ash and sandstone samples that I collected from Myanmar and Thailand last year. He spent a month last summer working with CC alumnus Blair Schoene at his lab in Princeton University. He also traveled to the University of Hong Kong to work on the detrital zircons of the sandstone samples at Ryan McKenzie's lab. We are excited to get ages for the ash beds, given that the rocks are upper Cambrian, and there are almost no radiometric dates for rocks of this age globally.

I had a couple of papers published this year, and have seven that are either in review or in press. These range from studies of experimental work on oscillatory bedforms, to stratigraphic and paleontological studies of Cambrian through Silurian strata. I am waiting to hear (three months and counting) about a paper out for review in Science in which my co-authors and I estimate the rate of global sea level rise during meltback of a Snowball Earth event. I also have a paper in review with the title "Bedform Disequilibrium", which looks at bedforms produced under unidirectional, oscillatory, and wind flows, with an eye towards understanding the nature and signature of bedforms that are out of equilibrium with their flows. This manuscript, written with Doug Jerolmack (U. Pennsylvania) and Taylor Perron (MIT) is a long "perspectives" paper that I hope will change the way that teaching bedforms is approached.

My stint as Chair of the Organismal Biology and Ecology Department is over, and I was given a reprieve from committee work

for 2017–2018. Nice! Otherwise, all is well. I am working on expanding my repertoire of chops for soloing on the guitar, including a lot of bluegrass riffs. I took a trip to Paris this fall and did plenty of other travel, including the AGU meeting in New Orleans. I hope that you will keep in touch and please stop by if you are at CC!



**CHRISTINE SIDDOWAY  
(Structure)**

Hey, everyone, the main news from me is (and YOU heard it here, first!): Antarctica's Ross Ice Shelf may not be as threatened by ocean water infiltration as others! This is thanks to a new (not before known) tectonic

boundary we've discovered beneath the ice shelf. Some good news from Antarctica, for a change! Other ice shelves around the glaciated continent are being monitored closely because they are at risk from the circulation of warming ocean water underneath. The discovery of tectonic boundary and consequences for Ice Shelf: those are results from the NSF ROSETTA-Ice Project that just finished up Season Three of airborne data collection. Our group busted out these big results at AGU in December... while at the same time I was teaching Regional Studies with CC visitor Will Levandowski and CC alum Warren "Wazza" Dickinson from Victoria University of Wellington. Warren and I planned for the CC seniors course to run in parallel with a field course for Kiwi students, and this was a great success: a sort of international exchange that involved a Colorado to California Transect. Lauren Dangles '14 joined the fun, as visiting paraprof, extraordinaire.

CC paraprof and past-year research advisee, Alec Lockett, has become a seasoned McMurdo resident, having spent two seasons working with Columbia University team members out of the Station. Matt Tank-

ersley '18 and Skye Keeshin '18 also are all-in on new ROSETTA research, this year.

My sabbatical leave last year --spent partly in Italy, and in part at Univ. Wisconsin--was hugely rewarding, with several manuscripts in progress and a new NSF proposal submitted last May, 2017. UW was a great place to spend time. I got to be in on the ground floor gaining experience with the new StraboSpot software for structural geology that has been mandated by NSF (released at GSA in Seattle, 2017: strabospot.org). Speaking of GSA, the CC Geology alumni party was fabulous – GREAT to catch up with all who turned out (and caused Henry and me to overdo it, slightly. Caroline, you know who I mean.)

Pearl, Bessie and Mike are holding steady, especially since Mike will vacate the Associate Dean position in July and be due for a sabbatical leave. Mike is beginning to say the words "new puppy" but I have difficulty imagining having three leashes in hand at times.



**JEFF NOBLETT  
(Igneous Petrology)**

Greetings, I continue to enjoy working with the introductory conceptions of the Earth that new students bring with them through sophomores struggling to recognize a critical mass of minerals in various contexts while understanding the geochemistry of the processes forming them; and though the rocks haven't changed much in Igneous Petrology, the geochemical data used in interpretations has grown considerably over the years. As Eric and I approach our twilight years in teaching, we decided to join forces and take a class to Iceland next fall to study volcanology and glaciology in a wild tectonic setting. Student interest is strong so we are hoping for good weather

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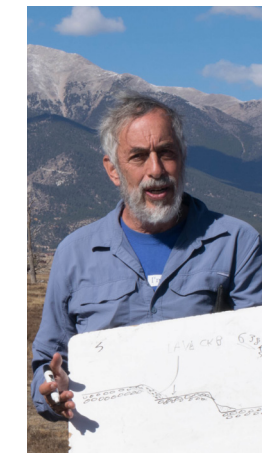
for those three-and-a-half weeks! We plan to start with the Golden Triangle and run around the Ring Road, spending time in the flows from Krafla, glacial landscapes in the south-east, and the volcanoes in Heimaey before students map the region where the mid-Atlantic ridge rises onto land and re-interpret a package of glacially-derived sediments.

I will also be the resident faculty person for the alumni-parent tour of Iceland (with possible digression onto Greenland) in late June-July 2018. Besides hearing me give a few cool lectures, the trip will provide an opportunity for people to walk in a mid-ocean ridge above a hot spot, check out hot springs, puffins, recent volcanism, and hot spot rift jumps (there will even 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.

Two recent thesis students are completing publication of their volcanological projects; two other papers are in progress. The two in revision include work on the conditions under which spatter cones may develop fresh lava (clastogenic) flows based on field work in Iceland; and a geochemical study of the shoshonitic lava flows on top of the two mesas outside of Golden, Colorado (above the Coors Brewery that some of you may recall). Two other papers are developing out of work done by students during their abroad semesters in New Zealand- one a synthesis of the origins of a lava sequence exposed along the coast and the other a study of how hydrothermal alteration may change physical properties of a volcano and thus timing of future eruptions. 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 still engaged as Director for the Math Excel Center and teaching graduate math classes in topology and geometry at UCCS. We both serve our three cats fairly well. My son-in-law's fancy concrete patio/driveway business is booming and my daughter Jenny is happily working as a housewife taking our eight-year old granddaughter, Arden, to second grade (Jenny is showing signs of becoming a ferocious helicopter Mom), trying to keep up with the very active four-year old Daphne and one-year-old Eli who is starting to run around on his own, and the newest addition- Rocky, a German Shepherd puppy. Hope you are all well and will drop in anytime!



**ERIC LEONARD  
(Geomorphology)**

Back home at CC after a sabbatical year, re-acustoming myself to life in the Geology Department. Actually, I still had one foot in Southwest Studies this past year, again directing that program for the spring semester. Now I'm back in Geology full time (yay!).

Teaching is still fun (it's the students mostly, but the geology is still really great) except, of course, for grading. Mostly I've been teaching my "standard" courses – Intro, Geomorphology, Glacial Geology, and our 200-level physical-processes course. I'm now gearing up for a new course on Southwest Paleoclimate, to be taught jointly with Scott Ingram in the Anthropology Department this

coming spring, and then for a field course next fall in Iceland.

Speaking of Iceland, I spent a week there again this past summer, scouting out projects of next year's course, braving some very questionable weather, and generally playing the geotourist. I was on my way back from another visit to Bergen, Norway, where I was an "opponent" on a PhD defense and where I began working with Norwegian colleagues on a new project in Arctic Norway. I will be heading up with the Bergen group to the Lofoten Island archipelago (Google it) for a couple of weeks of lake coring and sampling for CRN dating next summer. Other fieldwork this past summer took me back to the Sawatch Range and San Juan Ranges with senior thesis students for more CRN sampling there to help constrain glacial/climatic history, and back to Spruce Creek Rock Glacier with several students from the physical-processes and geomorph classes to (almost) finish up our 30+ year resurvey – one more trek back up next summer with the total station.

Our Colorado glacial/climate chronology and modeling work resulted in two papers published last year, two others nearly finished, and three meeting presentations, but there is still more writing to be done. Why is it so much more fun to do the work than to write it up?

So, you want to feel old? Susan graduated from college (Bates College in Maine) this past spring and is now working as a paralegal in an intellectual property law firm in Cambridge, Mass. Julia is still working in DC (certainly an interesting time to be a political media consultant there). Lisa is doing great work – way too much of the time – here in Colorado Springs.



**HENRY FRICKE**  
(Geochemistry)

Yes Alec, I will write my update now. Just give me a few minutes to gather my thoughts and try and remember what year it is. Ok, got it...

2017 started off with the usual mix of college goings-on, kids needing rides to some practice or other, and some snowboarding time mixed in. Here on campus I was tricked into chairing a committee that is revisiting the all-college general education requirements. There is a widely shared opinion that what we have in place needs to be revisited & revised, but of course the devil is in the details, and what this 'new Gen Ed' might look like remains to be seen. On a personal level I have learned a lot about 'best practices' in education while serving on this committee, and I have begun to incorporate them into my classes. For example, I 'flipped' my Geochemistry course in 2017 to make it 'student-centered'. What this means is that I ask questions (e.g. "what is stable isotope fractionation, and why does it take place?"), students try and answer them on their own, and when they can't I step in with 'content delivery' (i.e. explanatory lecture). There were definitely bumps in the road, but overall I think this new approach went well. At the end of the semester I was involved in another exciting 'education experiment' which involved co-teaching a course with an artist (Michael Arnsteen, who took his FYE with me back in 2007!). Called 'Two Views of One World: Geology & Art of the San Luis Valley', we spent the block visiting different localities to investigate them as a geologist would, before switching gears to use these areas as inspiration of a variety of pen & ink, charcoal, and 'found materials' drawings. It was a great class, very liberal-artsy, and I hope to teach other classes like it in the future (per-

haps as part of our new Gen Ed curriculum!). Fall 2017 saw me teach intro courses exclusively, where the most unusual thing I tried was oral exams. Nothing like watching them squirm.

Most research in 2017 involved ongoing projects in northwestern New Mexico, western Colorado, southern Utah, and the re-animation of long-dormant projects. A follow-up trip to the San Juan basin in New Mexico and subsequent carbon isotope analysis of samples suggests that the recovery of the PETM event is definitely recorded in the southern part of the basin, with a more complete PETM section possible further north. This is exciting stuff, as no terrestrial records of the PETM currently exist from below latitude. In July I met up with colleagues (including Katie Snell, class of 2003) to continue our investigation of younger hyperthermal events. Katie just got a shiny new clumped isotope mass spectrometer in the lab at CU Boulder, and I can't wait to have our students monopolize it (anything for Dear Old CC, right Katie?). My theme of working with CC alums continued, as Vikki Crystal (2014), Erica Evans (2015?), Ian Miller (1999) and I finalized our study of the paleohydrology of late Cretaceous landscapes in southern Utah, with Vikki working hard on completing the manuscript for publication. At the same time, current student Kayla Bronzo spent some time in Craig Lundstrom's (1987) radiogenic isotope lab at UI collecting strontium isotope data from Jurassic dinosaur teeth, in the process reviving my dormant 'dinosaur migration' research. Guess what – not all sauropods appeared to migrate, and their predators also had a variety of behaviors! Stay tuned for more research updates in the next PCB.

As I mentioned at the beginning of this update, the kids continue their time-intensive after-school activities. Annaliese joined a traveling volleyball team, and at 5'11" (hoping for 6' at least) she is gunning to be an 'outside hitter' someday. Eli now competes on a traveling climbing team (where else but

CO?), and at 6'3" he's got a long reach that helps him on the big walls. He also coaches middle school kids at the climbing gym, where he is known affectionately as Sticky Fricke. Erin, although now the shortest person in the house, has been elevated above the rest of us in terms of prestige, having recently been appointed by the governor to be a district court judge here in Colorado Springs. The dog-that-everyone-said-they-would-walk-before-we-got-him-but-they-never-do is fine, and so is the why-does-he-wake-me-up-at-night cat.

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!



**STEVE WEAVER**  
(Technical Director)

It has been another great year as Geo Tech Director supporting faculty and students in many class and research endeavors.

Student and faculty field and lab based activity remains high with the analytical facilities getting lots of use. It is very gratifying to see the quality of research our students continually produce. I continue to be active with my photography with a couple of trips to Wyoming and Montana during the summer, as well as teaching 2 photography workshops at the Zapata Ranch. On one of my Wyoming trips I photographed the total Solar Eclipse near Union Pass in the Wind River Range. In May I traded in my 2008 Toyota Tacoma with 279 thousand miles on it for a new 2017 Tacoma. It has lots of new technology in it! As always you can check out my work at my website: [www.stephen-weaver.com](http://www.stephen-weaver.com), and follow me on Facebook (@StephenWeaverPhotography.EarthSystemsImaging), and Instagram (weaveresi)

**MANDY SULFRIAN  
(Staff Assistant)**

Fall in Colorado has been beautiful so far! The trees are turning and Homecoming was a success, as usual. We bought the first couple of rounds at Phantom Canyon downtown to celebrate the return of alums. It was fun to see and catch up with alumni who could make it here. We're all hoping snow will fly soon!

First semester went so fast! We have had a bumper crop of paraprofs -- Arden Feldman '17 came back to help paraprof GY140 class with Henry; Erica Evans '16 was paraprof for our Block 2 GY140 class working with Henry; and Lexie Millikin '17 and Alec Lockett '17 are the permanent paraprofs for 2017-18.

Charlie & I sold our house on the mountain-side and moved closer to CC, downtown, and very close to Palmer Park. What a beautiful place for hiking! We like our house and the neighborhood is really great. We had some landscaping done and have been settling in -- seems like the boxes are endless though. I have all sorts of projects to do over winter break, so looking forward to a chunk of time to do them.

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.

**WILL LEVANDOWSKI  
(Geophysics/Tectonics/  
Geodynamics)**

Greetings current and former basement-dwelling Tigers! I am this year's visiting faculty member. After teaching one sabbatical-fill block in 2014, I was thrilled at the chance to return to CC to coteach Earth as a Physical System with Eric, Intro with Paul, and Regional Studies—this year a Colorado-to-California transect—with Christine and to go solo this Spring on Tectonics, another Intro with Lexie's paraprof skills and Geophysics with Alec's help.

I'm not a Colorado native, but I do have an anchor baby (Oliver, 2) and have been here for the past decade. After undergrad at Princeton, 6 miles from the only house I'd ever lived in, I came to CU for grad school, then my wife began a dual MD/PhD program split between Boulder and Denver, so we are pretty darn settled in our house in Boulder for the next five or so years. Most recently, I spent 3-plus years as a postdoc at the USGS Hazards Center in Golden.

My research life bounces around from the origins of topography in the western U.S. to earthquake ground motions. PhD time focused on the West, mainly using geophysical data and models to understand uplift of the Sierra Nevada and, more broadly, the Cordillera as a whole. These questions are still floating around in my head, and colleagues and I have a paper in press that tries to pin down why Denver is the Mile High City and how the heck the Colorado Plateau got so high. My postdoc work turned eastward, as part of the central and eastern U.S. earthquake hazards group at the USGS. The main project was to quantify patterns of long-term fault loading to determine whether currently active seismic zones are actually under more long-term stress. The latest of these papers

Cordillera as a whole. These questions are still floating around in my head, and colleagues and I have a paper in press that tries to pin down why Denver is the Mile High City and how the heck the Colorado Plateau got so high. My postdoc work turned eastward, as part of the central and eastern U.S. earthquake hazards group at the USGS. The main project was to quantify patterns of long-term fault loading to determine whether currently active seismic zones are actually under more long-term stress. The latest of these papers argued that the stress due to frozen-in density variations in the crust and upper mantle can largely explain the stress field from Colorado to Iowa, and both natural and induced seismicity is focused by these body forces. Realizing we needed a more continuous and more quantitative view of the state of stress in the U.S., I and several of my postdoc advisors recently developed a new nationwide stress map, which shows a surprising amount of heterogeneity and suggests that modern plate-tectonic forces are rather unimportant across much of the continental interior (we just finished the first round of revisions). Inspired by work with an undergraduate intern in 2016, I developed a new model of crustal seismic attenuation for the U.S.: Lo! and behold! boundaries in crustal attenuation structure generally coincide with changes in the stress field, reinforcing a causal link between stress and crustal structure. That work (paper in USGS review) also suggested a new way to remotely estimate shaking during earthquakes, and I have a grant to explore that further that should be funded (if the government ever gets its budget figured out). Otherwise, I have a hodge-podge of projects imaging lithospheric structure from central Asia to Nashville, and my wife and I even managed to end up as coauthors last summer!

It has been my sincere pleasure to be at CC this year. From Intro to Regional Studies, the students have been amazing. Aside from being intelligent and hard-working, they

have been a joy to work with, to speak with, to camp and to travel and to learn with. The Regionals transect closely mimicked a course that I TAed three times, and it was really special to be able to return to some of the same areas a few years later, and to be able to share them with the Seniors. Finally, I deeply appreciate the chance to learn, both scientifically and pedagogically, from Eric, Paul and Christine. Thanks, everyone!



Total Eclipse. captured in Wind River Range, WY, by Steve Weaver.

## It's Lith: The Fall 2017 Geology FYE

Anna Feldman '21

By selecting Intro to Physical and Environmental Geology as my first-choice FYE, I hoped to gain a sense of place in the dramatic landscape I would be calling home for the next four years. I knew that the department has a reputation for fun classes and laid-back people, so I went into it with high expectations. As soon as we received the syllabus, it was apparent that this was a course that could not exist outside of CC. The curriculum, an amalgam of geologic concepts, labs, field work, environmental science, and philosophy, balanced hard science with consideration of its application. The geology FYE proved to be an amazing eight weeks of hard work, lively discussion, friendship, and enough rock-to-mouth contact to concern anyone unfamiliar with the discipline. Much of the FYE was spent barreling around Colorado in the geo-vans, observing or applying concepts from lectures in the real world. These trips were among the most fun educational experiences I've ever had. I'll never forget the clear September morning we spent hammering trilobite fossils out of red limestone, or the day we stopped for lunch



Students in GY140/150 begin their mapping project at Bear Creek.

on the edge of the beautiful Royal Gorge. Also branded into my memory is the name of the Dakota, Colorado Springs' largest hogback, professor Jeff Noblett's most predictable quiz response, and, perhaps most importantly, the only formation upon which we ever saw a llama, silhouetted in the mist hanging low over Loveland. That we could spend so much time out of the classroom is a credit to the block program, not to mention an incentive to take more geology classes. For me, hands-on instruction in physical and structural geology was instrumental in thinking of the rock record as what it is: an incredibly detailed historical narrative. On our first field trip, a whirlwind tour of Colorado Springs' local column, we began to learn how much information is visible in an unassuming section of rock. After we made as many observations as possible about what we saw at each stop, Jeff named the formation and gave us the full story—that we stood on the compacted remains of an ancient mountain range brought down by tumultuous erosive events, or that we were looking at a fault that ceased its activity long ago. Beginning to make those connections ourselves was a fascinating change in perspective. Thanks to our many opportunities to decipher geologic clues in the field for ourselves, whether that involved identifying a single mineral or completing an ambitious map of Bear Creek, I became a more careful and capable observer of the world around me.

Another important takeaway from the curriculum was geology's impact on human life. Through our study of environmental geology, we learned how devastating the misuse of resources can be for the earth and its people. It's vital for every member of my generation to understand the changes the planet is undergoing: they will define this century. Issues like arable soil erosion, alteration of atmospheric currents, and exponential depletion of mineral resources will affect our lives and those around us at some point; having

learned about them here, we are better prepared to take positive action. Equally important to our curriculum was discovering the outsized harm that environmental damage, such as contamination of the water and air, brings to marginalized communities, as well as the steps people have taken to combat the perpetrators of these injustices. I appreciated this consideration of subjects relevant not only to geology as a science but to our role as compassionate community members on a volatile earth.

It was a delight to throw myself right into engaging work and thought at CC alongside my classmates, some of the kindest, brightest people I've met. I couldn't have made a better decision than to begin college in a department where experiential learning is so highly prioritized and effective. The geology FYE was a fantastic way to spend the first weeks of my CC education and inspired in me a love of the subject that I expect will be lifelong.

## A Critical Examination of Gender in Skiing

Annabelle O'Neill '19

Last winter break, my dear friend Anna Gilbertson and I moved to Chamonix, France for a month with funds from the Keller Family Venture Grant program to explore the ways women feel and present themselves while backcountry skiing. We both grew up skiing and we love it. Our experiences skiing with friends during college have been a blast, however they have also included subtle, complex scenarios and behavior patterns regarding our gender that troubled our critical minds. For example, our male counterparts would repeatedly "drop in" to ski first without asking us women if we wanted to take it. Meanwhile, important ski equipment such as the beacon, a device used to locate a missing person in an avalanche, is not designed

to accommodate bodies with breasts. When we finally began verbalizing these challenges to each other, we saw that similar circumstances exist in many of our other life pursuits, such as climbing and doing science. We researched literature on gender in outdoor sports and found three feminist frameworks that clarify and build on our experiences.

The first is "intersectionality," which means that one's social and cultural position comprises an intersection of their multiple identities, e.g. white, woman, skier, aspiring scientist. The second is "phenomenology," which relates to how society's constant subliminal messaging impacts how we move and present our bodies. An example of this is



Many emotions felt at the Mer de Glace

the idea of "throwing like a girl" (Young). The third is "objectification," a theory meaning that our cultural emphasis on visual presentation as an indicator of value leads to identity groups such as women internalizing the looking-glass perspective and then viewing themselves through other's eyes (Roberts). This results in higher cognitive load which reduces performance.

Our grant investigated the presence of these frameworks in the birthplace of skiing. We spent the month observing other skiers, interviewing skiers of all levels, reading local magazines, noticing advertisements, and most importantly: enjoying beautiful turns in the great outdoors.

Cool findings: confidence is the key to high performance and enjoyment! Women reported more frequent feelings of lower self-confidence while skiing in mixed-gender groups which made them feel less capable. However, women held more skill and safety certifications than men. Additionally, ski gear deemed “for women” is generally flimsier and less functional. The phrase “shrink it and pink it” holds true here. Because of this, every female pro skier we interviewed uses men’s skis. Furthermore, many retailers carried far more gear options for men than women; one store had 15 ski pant options for men and only 3 for women.

In between ski runs we ventured up to glaciers and reveled in French cuisine. Last spring, we led an open-campus discussion on identity in outdoor sports and learned a whole lot from our peers.

How you can encourage inclusivity in the outdoors: discuss potential risks as a group before starting, ensure everyone speaks when making decisions, keep your senses open to noticing exclusive scenarios, and support each other. After, ask each other how their day was and ask your hard questions.

Thanks to CC for supporting intrepid, worldwide investigation! Cheers to great times in the mountains.

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## GSA Conference Story

Tianran Zhang '18

It was overwhelming, rewarding and absolutely wonderful. It was the 2017 GSA annual meeting in Seattle.

Last October, I had the opportunity to present the research project that I did when I was studying abroad in New Zealand the previous semester with the Frontiers Abroad Geology Program. For my project, I collaborated with scientists from the National Institute of Water and Atmospheric research (NIWA) and professors from the University of Canterbury Geological Sciences Department. Our study recorded and interpreted the geochemical signatures of surface sediments deposited by the 2016 Kaikōura tsunami. We sampled surface sediments from Little Pigeon Bay on Banks Peninsula, one of the areas that were most affected by the tsunami, and analyzed the geochemical profiles of these samples using a portable X-Ray Fluorescence (pXRF). Our results can also serve as benchmarks for future studies on paleo-tsunami deposits in this region.

This was my second time going to the GSA annual meetings, but it was just as mind-blowing as the first time. So many fascinating talks were scheduled at every minute throughout the entire four days that sometimes it was impossible to make it to all the ones that I set my mind on. Other than the presentations, there were also tons of interesting exhibition booths as well as hundreds of posters to check out. I remember being so exhausted at the end of every day but also so reluctant to leave because there were always so many more things to see. Besides, GSA is also an incredible social event. I got the chance to reunite with lots of my geo buddies, as well as meet new people and make new connections. It was particularly fun to attend the CC mixer on the second night. In that crowded yet cozy

restaurant lounge, I not only chatted with some old friends and heard about their amazing adventures beyond CC, but also got acquainted with lots of alumni who are all so inspiring on every level.

GSA Seattle gave me the best possible experiences I have ever expected, and I am so looking forward to my next national conference!

\*\* see page 42 for more alumni connections at GSA!



Tianran Zhang (author).



Armagosa Range, Death Valley National Park. Photo by Steve Weaver.



## Obituary

**Dr. Nancy "Nan" Lindsley-Griffin January 13, 1943 — November 20, 2017**

Nan graduated from Colorado College with a Geology BS degree in 1964. After graduating she went to California and entered University of Southern California to get an advanced degree in Geology.

Her major professor did not believe women should be practicing geologists so she left USC and went to work as a Junior Geologist with Signal Oil and Gas Company in June 1965. Most of the geologists on the staff considered her to be just a glorified secretary except one of the senior geologists who encouraged her. She was assigned to archiving old reports and prospects. While doing this project she saw one old prospect that looked like it had potential and she took it to the senior geologist, and convinced him of its potential and the company drilled it and was a successful well.

In February of 1966 she left Signal and entered the University of California Riverside as a geology graduate student. Her master's thesis was on the paleomagnetism of samples collected by the USGS from the Dufek Massif in Antarctica. After getting her master's degree she wanted to continue and get a PhD on work in the Antarctic, but at that time travel and logistics to the U.S. controlled region of Antarctica was operated by the U.S. Navy and they did not allow women to go to Antarctica, so Nan stopped her career in paleomagnetism.

June 1968, she married fellow UCR graduate student John Griffin. John worked for the Maine Geological Survey mapping the bedrock of central Maine during the summer. Nan joined John working for the Maine Geological Survey mapping during the summers of 1968-1972. As a result of the mapping, John and Nan published a field guide and a paper on soft sediment structures in the New England Geological Congress field guidebook.

Spring 1969, John took a temporary teaching assignment at University of California Davis where Nan joined him as a faculty wife and completed writing her Master's Thesis.

Fall 1969 John took a second temporary teaching job at Oregon State University, Corvallis, Oregon and Nan again became a faculty wife. While at OSU John got a grant to do geologic mapping in the Klamath Mountains of California. The chair of the Geology Department was interested in the Paleontology of the Klamaths and provided Nan with funds for two field seasons to map the underlying "igneous" rocks of Klamath's, which she identified as ultramafic rocks, and the overlying sedimentary rocks as mélangé.

Nan wanted to get a PhD so she contacted her former friend at UCD, Professor Eldridge Moores to come and see the ultramafic rocks that she was working on and convince him to take her on as a graduate student and work on them as a PhD project at UCD.

Nan and John moved back to Davis, California and Nan became a full time graduate student mapping the ultramafic rocks and surrounding mélangés of the Klamath Mountains. As a result of her research she was able to lead a Penrose Conference on Ophiolites through her research area.

In 1977 John got a job working in uranium exploration in Casper Wyoming and in the



the spring of 1977 Nan joined him in Casper, Wyoming. While in Casper Nan volunteered for the local Wyoming Geological Association, gave talks on her research to the association, and became a consulting geologist, providing information to the local geological companies, and giving short courses to the companies on plate tectonics. While in Casper, she wrote her PhD thesis and submitted it in 1982.

In the early 1980's, the uranium industry and the oil industry were closing offices and laying geologists off. John was the Regional Geologist for Bendix Field Engineering Company, a prime contractor to Department of Energy, for the evaluation of uranium potential in a six-state region. John had to lay off his whole staff of geologists, close the Casper office, and became unemployed. Nan and John sent out their resumes and agreed whoever got the first job offer, they would take it.

In 1983 Nan had a brand new PhD, she had worked in industry, taught short courses; she was not the typical new PhD. She had developed a two-screen presentation of her Klamath research (two screen presentations were then just beginning).

Nan interviewed at the University of Nebraska Lincoln and they were impressed with her presentation and hired her as a beginning Professor in Structural Geology.

As a new professor, one of her assignments was to teach one of the large (180-200) undergraduate beginning geology courses. Nan was a success in this course, her industry experience helped her. She was not pretentious. She had the students call her "Dr. Nan" which at first the other faculty thought was undignified. She enjoyed teaching the beginning course and taught it her whole career at the University of Nebraska Lincoln. As a beginning professor, Nan was outspoken at faculty meetings, voicing her opinions. Her willingness to voice her opinions early in her career at UNL so impressed a dean that at her retirement party he retold the story of her brazenness as a new hire.

Nan taught courses in Structural Geology, Advanced Structural Geology, Geophysics, and Public Speaking for Geologists.

While at Colorado College, Nan had worked on a mapping project of the gravels in the Garden of the Gods. When she was looking for an area for her UNL class of Structural Geology students to map as a class project, she decided on a four day mapping project in the Garden of the Gods, and she would bring her class each spring to Colorado Springs to map.

Nan's Research area was the Klamath Mountains of California, and she published many papers of her research, and papers with her students, on the area. She would allow her graduate students to pick their research in areas that interested them. Two of her best PhD students worked on projects that were not related to the Klamaths. One worked on high grade metamorphic rocks of the Adirondacks of New York and the other on the statistics of rock falls in Virginia.

Nan was a Sedimentary Scientist on the Joides Resolution drill ship for three Ocean Drilling Legs: Leg 112, Peru Continental Margin; Leg 141 Chili Triple Junction; and Leg 170 Costa Rica Accretionary Wedge. As a result of her onboard studies of recovered sediment she was able to see a resemblance in origin between recovered deep trench sediment with the metamorphosed rocks of the mélangé in Klamath Mountains that she had been working on.

While at UNL, the two accomplishments that she was most proud of were the WISE Project and the Nebraska Professional Geology Registration. Nan received and ran a four year NSF funded project for Nebraska urban and rural girls called Women Investigating Science and the Environment. She and a staff of middle school Science teachers would have the girls attend the university for a week and be taught science and then they would travel

around the State of Nebraska to learn the states geology and camp out. She was also proud of her part in establishing Professional Registration for geologists in Nebraska. When Nan was president of Nebraska Geological Association she was instrumental in getting members of the Association to meet with state legislators and get them to act on legislation for registration. Nan was elected to the first State Board of Professional Geologists as Chair. After serving her time in office, the Board appointed her Emeritus member until she left the state in 2011.

When Nan arrived at UNL, she was the first woman in the Geology Department to receive tenure. She became a full professor in 1994 and retired as Professor Emeritus in 2009. Now the Department has 11 women professors, she was replaced by a woman Structural Geologist and the current chair of the Department is a woman.

Nan and John retired to Jacksonville, Oregon in 2011 to be close to their research area in the Klamath Mountains of California, an hour and half away. Nan led visiting geologists through her area until 2015 when health issues prevented it.

In 2016, Nan revised the road guide and rewrote the section on the Klamath Mountains of California in the "Roadside Geology of Northern and Central California, Second Edition" (Mountain Press). Because her revisions of the geology were so extensive, the authors of book listed her as the author of the section on the Klamath Mountains.

I came to know Nan Lindsley-Griffin in 2007, just after I made the move from Colorado Springs to Omaha, Nebraska. I had just finished up working as a paraprof at Colorado College and was starting a job with an environmental consulting firm in Omaha. I was soon bored with the job and learned of Nan through the Colorado College alumni network. She was a structural geology professor at University of Nebraska-Lincoln. She was eager to get to know me, and help me find my way professionally in Nebraska, even though I had no interest in becoming a structural geologist like her and she knew that. Shortly after I met Nan, she invited me to University of Nebraska-Lincoln for a visit. As a professor myself now, I know how many student interest inquiries I field and how little time I have to do it. I know now that finding someone so open, jovial, and willing to help, like Nan, was a true blessing. Nan connected me with the two wonderful scientists and mentors at University of Nebraska-Lincoln, Drs. Tracy Frank and Chris Fielding that soon became my PhD advisors. In hindsight, I can only speculate that Nan saw a bright budding female scientist and wanted to help. That was, quite simply, Nan. I am grateful for her contributions to science, teaching and mentoring throughout her career.

-Lauren Tice Birgenheier '02

## Witter Family Fund for Internships

Alec Lockett '17

The Witter Family Fund, established by Bill Witter '86, supports geology students and recent graduates with geology-related internships in more practical fields within government, industry, non-profits, and universities. This past summer of 2017, five Colorado College Geology students and four recent graduates received stipends. Students dug up dinosaur bones in the Dakotas, analyzed petroleum well data in Thailand, and investigated causes of Greenlandic glacial earthquakes, to name a few projects.

Grace Guryan '17 felt more strongly about her pursuits after interning at Bishop Brogden Associates (BBA), in Denver, CO. Although the private firm hosts CC alumni Chris Sanchez '94 and Tim Crawford '00, Guryan branched out to work with additional staff, participating in a variety of projects. Guryan says "Before my internship started I felt that I was coming out of CC with strong research skills, but I was concerned that I didn't have any industry experience. Interning with BBA filled that gap perfectly." Her work mostly involved groundwater analysis, with some surface water projects. She learned much about water rights, and the "complex and fascinating world of Colorado water law." Guryan says "I'm really glad I was able to work in that kind of environment immediately after graduating – I feel a great deal more prepared to pursue an industry career than I did before the internship. Perhaps the greatest thing I gained from interning with BBA was realizing how enjoyable a career in consulting could be, and that it's something I hope to pursue in the future." Arden Feldman '17 interned for a semester at the Crested Butte

Avalanche Center (CBAC), a nonprofit that produces daily avalanche forecasts for the Crested Butte community. Feldman was responsible for completing "a full profile snow pit every two weeks at the CBAC's snow study plot. Avalanche professionals use snow pits to study the layers of the snowpack and to conduct stability tests on it." He says this enabled him to "see first-hand the metamorphism that constantly affects snow crystals." Additionally, Feldman learned how to safely traverse avalanche terrain, and recognize "slopes of concern" and "evaluate snowpack stability." With this information, Feldman wrote weekly snowpack reports and weather summaries for CBAC's website. These records were crucial for identifying how the snowpack changed throughout the season. Feldman reflects, "I feel that I have gained a much deeper understanding and appreciation of the intricacies of the snowpack. The internship helped me decide to continue pursuing snow science professionally." Fai Chanchai '20 interned with the Department of Mineral Fuels, Ministry of Energy, in Thailand. After introducing herself to the geology of Thailand, petroleum exploration, production, and opportunities, she "moved on to learn specifically on petroleum management systems...well log interpretation, and reserve estimation". From this internship she gained a thorough understanding economic geology on a government platform. "According to a Thai petroleum policy, concessionaires have to report their raw data to the Ministry of Energy. The government institution will analyze this data and use it to inform incoming investors. My project is about comparing net pay thickness and EUR among several gas and oil fields." Chanchai was responsible for managing and interpreting the data for about 10,000 wells. "On each well there is a lot of data such as gross sand, net pay, porosity, water saturation, etc." She also had an opportunity to step away from the data and spreadsheets. Chanchai took field trips to production sites and learned about some differences between wells, and observed geologic features related to petroleum fields. Chanchai says, "I had a good time searching through Permian limestones for a couple-meters clams (*Alatoconcha*



Feldman '17 next to a large avalanche crown.

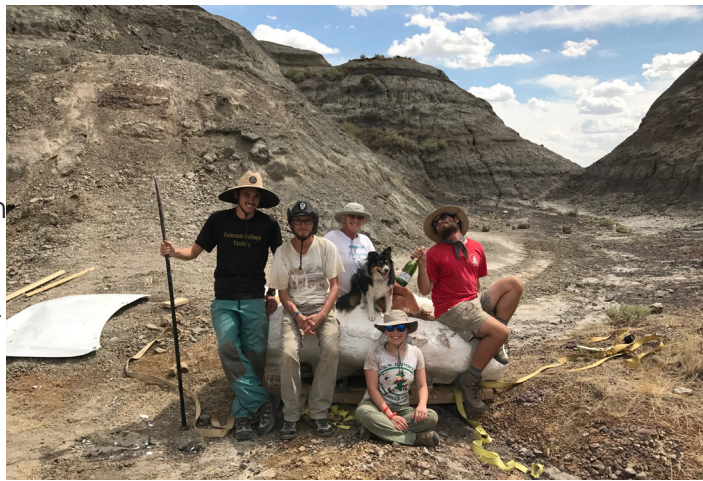


Lockett '17 is relieved after sampling bedrock without digging.

vampyra)." Alec Lockett '17 also worked under a branch of government, interning with the State of Alaska, Division of Geological & Geophysical Surveys, in Fairbanks. For half the summer, he worked with Karri Sicard '07 in the Mineral Resources section on a reconnaissance mapping project, and the remaining time with the Geophysics Section, mostly collecting local gravity and resistivity measurements. "The aim of the field project was to provide ground-truth for airborne geophysical surveys of the area and identify the sources of the geophysical anomalies by mapping the bedrock, with the purpose of understanding Alaska's mineral resources." He was happy to see, after each day in camp, other geologists on the field-team marking the map in colored-pencil – yes, professional geologists do this too! Lockett comments, "As the project developed the geologic map became more detailed, the geologic history and cause of mineralization in certain locations more complex." Ben Lloyd '19 worked with Dr. Tyler Lyson, the Curator of Vertebrate Paleontology at the Denver Museum of Nature and Science, doing fieldwork in North and South Dakota. They were specifically looking at the Hell Creek Formation, "a Maastrichtian formation, preserving the last million years before the end-Cretaceous extinction." Fieldwork was tough: he would sometimes hike miles and miles seeking new spots, before digging, digging, digging. The rewards were plentiful. Lloyd helped excavate "a perfectly intact triceratops skull...another

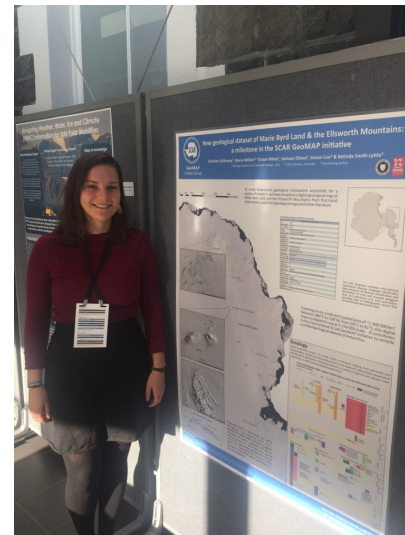
triceratops, a hadrosaur, a thescelosaur, three turtles, and various bits and pieces of other dinosaurs. I personally found two theropod tibiae, likely from oviraptors or dromaeosaurs. I also excavated the largest bone ever recovered from the site, a nearly complete shell from a Basilemys, a rare type of large tortoise-like turtle." Lloyd says, "The Witter Family Fund is a stellar program that deserves to be continued and developed further."

Some students received Witter internships which allowed them to work in more research-oriented positions. Zak Armacost '19 conducted fieldwork at Lake Peters, AK, assisting with Northern Arizona University's Arctic Glacial Lakes Project. "The purpose of the project I worked on was to study sediments that accumulate in Arctic proglacial lakes to see what information they could possibly glean about past and present environmental changes within a watershed", Armacost explains. His field tasks were extensive: he monitored glacial accumulation and ablation using stakes and cameras, measured various properties of the lake and streams, and established weather stations throughout the area. He also had the opportunity to use a percussion core sampler to retrieve sediment cores from the lake. Armacost says, "Because lakes in glaciated watersheds record changes in the melt rate of upstream glaciers, the project hopes to develop the first quantitative system model using lake deposits in glaciated catchments as a proxy for how weather and climate affect the glacial-lake-sedimentation system." Working with just two others for almost four weeks in the High Arctic, Armacost has been "exposed first hand to what life is like for a geologist living in the field." He comments, "It was a busy month, but we still had a little extra time to fish for fresh food and explore the gorgeous Alaskan Brook's Range." Isabella Bussian '18 worked with Dr. Erik Sperling at the Stanford University Historical Geobiology Lab, focusing on paleo-redox reconstruction. "I was assigned a core from the Yukon...and ran Chromium Reduction Sequential (CRS) and Iron sequential extraction procedures on my samples to access different iron speciation proportions. My goal was to understand



From left: Loyd '19, Yann Rollot, Liz Miller (mom of curator, Ian Miller '99), Vikki Crystal '14, and Will Bullard (with champagne).

the iron speciation data and major and minor element data to assess the shifting redox conditions throughout the Upper Devonian, across the Devonian mass extinction, and into the Mississippian." Bussian labored long hours in the lab processing samples, assembling large data sets, and inputting these data into the program R to produce plots. Two larger projects, the Sedimentary Geochemistry and Paleoenvironments Project (SGP) and the Stanford Natural Gas Initiative, will benefit from Bussian's careful work. Says Bussian, "I learned so much about redox conditions and the role of iron and trace metals in interpreting paleo redox conditions, as well as, the complexity of understanding their cycling." Matt Tankersley '18 interned at Columbia University's Lamont-Doherty Earth Observatory, researching glacial earthquakes in Greenland. He was mentored by Dr. Meredith Nettles and Kira Olsen '11. In the beginning, Tankersley triumphantly tackled software programs he was not exposed to in his geology courses, such as Python and GMT. "Both programs took a long time to learn due to my limited amount of programming experience, but these skills ended up being some of the most useful parts of the internship". Without much experience in glaciology, Tankersley developed a strong understanding of the relationship between glacial earthquakes, calving fronts, and seasonality. Applying this knowledge along with new skills in programming, he was urged to take it a step further, and began "researching the shapes, orientation, and seasonality of the calving fronts at two glaciers, Kangerdlugssuaq and Helheim." He explains, "I was using a data set of digitized calving fronts between 1999 and 2010. These calving front lines used together with Landsat imagery of the glaciers, provided a much-needed examination of many factors of these calving fronts. I looked into seasonality, year to year changes, and the relationship between calving front and glacial earthquake." Tankersley concludes, "the most valuable part was learning what graduate school and academic research consisted of and realized that it is the path I want to pursue after I graduate." Like Tankersley, Alexie Millikin '17 also contributed to polar research. She spent her summer abroad in snowy Dunedin, New Zealand, working with Simon Cox of GNS Science on the GeoMap project. "GeoMap is an international collaboration led by the Scientific Committee on Antarctic Research (SCAR) to create a digital geologic map of the entire Antarctic continent", Millikin explains. "My day-to-day work consisted of outlining rock exposures based on satellite imagery and coding every outcrop with information about its age and rock type." Already comfortable with GIS, Millikin was introduced to the international Geoscience markup language (GeoSciML) and learned to work within a "well-established data protocol", a necessary and critical skill when dealing with data for a continent widely unexplored, data which is compiled from teams spanning several countries. "Through working on the GeoMap project I gained important skills in data management and protocol as applied to an international mapping effort, and great insight into the complex world of Antarctic science."



Millikin '17 presents at the New Zealand Antarctic Conference.

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Lloyd '19, with a triceratops brow horn.

Many thanks to the alumni and mentors at these host organizations, and especially, to Bill Witter. These internships have given students invaluable experience in practical settings, and insight into career possibilities and objectives after Colorado College. Please reach out to the geology department if you know of any internship possibilities. We hope for another successful summer for our geology students!

## Regional Studies 2017

by Turner Brett

The Regionals 2017 trip started and ended much in the same way – very abruptly. A mere 36 hours after returning from Thanksgiving break we were cruising towards Cañon City in the vans, tired and hungover (to be fair, Christine recommended that we drink before we left). These conditions however did not deter us from ravenously tearing through the first of countless fruit snacks and cheez-its. CC geologists are fantastic boredom eaters.

From the get-go, this was a unique Regionals trip due to the addition of 10 students and an extra professor from the Victoria University of Wellington in New Zealand. The Kiwis were instantly in unfamiliar territory with a semi-arid climate, 1.08 billion year old granite, and the famed Cañon City dinosaur footprints. On the other hand, they ran circles around us with their knowledge of volcanics, so each group had its fair share of unfamiliar territory.

I can say with conviction that our day at Valley View Hot Springs in Moffat, Colorado was unfamiliar territory for everyone involved. Will Levandowski, professor of Geophysics, informed us that morning that we would be doing some geophysics work at the hot springs to help shed some light on a water contamination problem. Wow, applied geology! That's cool. Well, it was cool, however we did not realize that we would be doing our work amongst the several natural pools that dot the facility. So we spent the day swinging sledgehammers and sending electric currents through the ground while nude revelers of many ages enjoyed the pools around us. Luckily, a number of us were able to ditch our clothes at the end of the day and enjoy the pools that we had spent the day dreaming of. The older woman in the pool we chose was either startled or extremely thrilled to find ten naked young

men joining her. In all, this day was quite the interesting experience. Big thanks to Will for setting that up.



Warren "Wazza" Dickinson, professor at Victoria University, leads the class.

After a few days in Crestone the New Zealand contingent split off from the CC half. Something about a big canyon in Arizona that they just had to see. Meanwhile, us Tigers boogied on down to New Mexico where we rejoined our beloved I-25 in Santa Fe and made our way south to near Socorro, New Mexico.

For several days we immersed ourselves in studying the Rio Grande Rift and became increasingly more addicted to Geo-Dip.

It was also during this stint in New Mexico that we suffered our first injury of the trip. Near the end of a day of hiking and driving bumpy roads, our intensifying hunger caused us to get in touch with our more primitive tendencies, and we made the exhilarating discovery that rock hammers produce sparks on rocks in the dark. Young Mr. Everett Smith became our casualty, as an attempt to hit a rock in his left hand led to the near destruction of his thumb. He would hold onto the nail until New Years 2018, when the doomed nail finally parted with him.

After an uneventful stay in the town of Show Low, Arizona, and a stunning drive through the canyon country of northeastern Arizona, we found ourselves cruising into the bustling metropolis of Phoenix. There is

something very bizarre about seeing such an enormous urban sprawl pop up in the middle of the desert. For those of us who thought Colorado Springs was dry (like me, coming from Vermont) this was remarkable.

We spent the next week and a half in the Basin and Range Province, getting up close and personal with metamorphic core complexes, marveling at saguaros, and developing a collective odor likely unrivaled anywhere else in the Lower 48. Perhaps the crux of our trip occurred just across the California border. A long day of geology led to us arriving in the Big Maria Mountains after dark. When the van doors opened, we immediately entered the wind tunnel that we lived and got sand blasted in for the next four days. A nearby wash (thankfully it almost never rains there) provided just enough shelter for us to sleep through the night before embarking for the nearby ridgelines in the morning. Were it not for evening beer and Lauren Dangles' masterfully crafted meals, some spirits may have been broken here. It was also here that we celebrated Bella Bussian's 22nd birthday with Christine Siddoway's excellent margaritas and a cheered on a shotgunning race between the two of them. We ultimately left this locale with some pretty maps, a really funky looking cross-section, and a deep appreciation for wetter and less windy locales.



Having fun with salt.

The final week of the class was spent near Death Valley National Park at the infamous



Shear field camp in Shoshone, California, whose population we doubled upon arriving. Our long lost Kiwi brethren and sistren reconvened with us here, having survived a trek through the Grand Canyon in some not-so-warm weather. This far west we were no longer just under the influence of Basin and Range extension, but also strike-slip motion associated with the Eastern California Shear Zone. Evidence of this is Death Valley itself, a rhombochasm valley opened up by the combined effects of these processes. Luckily our stint there preceded the January government shutdown, so we were allowed full reign within the park, which is the size of several northeastern U.S. states. Day trips around the park were very rewarding: getting face-to-face with a huge low angle normal fault, scrambling around incredible volcanic rocks, witnessing mile-high alluvial fans, bloodying our feet on the Badwater salt flats, and generally being blown away by the geological diversity of the park.

We capped off our time in Shoshone in style with some delightful hot spring soaks and a rowdy birthday party for Paul Ammons at the local watering hole, the Crow Bar. It was also around this time that patient zero, Mr. Skye Keeshin, began infecting the group with a devastating stomach bug. In the end it would only claim six stomachs, however the suspense of waiting to get it took a heavy toll on the entire group morale. A bright spot during this tumultuous time was LiteCoin reaching an all-time high, much to the pleasure of

cryptocurrency tycoon Matthew Tankersely and his comrades.

A few hours after waking up from our final night camping in the California desert we were driving through the Los Angeles smog, the vans containing a toxic odor from our accumulated camping stench. A glamorous dinner in Santa Monica saw us off and within 24 hours we were all scattered across the country or driving vans packed with gear back to Colorado. What a long strange trip it was.

The students pass on our infinite thanks to professors Christine Siddoway and Will Levandowski, as well as paraprofessional Lauren Dangles (and future paraprof George Fowlkes), for the hard work, dedication, knowledge, and energy they put into this trip. Regionals 2017 was certainly the most enriching experience that I have had at Colorado College, and affirmation of why we study

geology.



Photo by Tristan White.

## Emily Pope '04

Hello CC Department Alums and Friends!

What a neat opportunity this is, to look back at how, from a wonderful time traipsing around my own back yard in the Colorado Rockies with the CC geo department, I landed in a place where whenever I give a talk or start a class lecture, I get to begin with the phrase 'Sorry, but this is going to be in English.' I currently live in Copenhagen, Denmark, where I am an assistant professor at the Natural History Museum of Denmark, which is both a national museum and a department within the University of Copenhagen.

When I started at Colorado College in 2000, I was pretty sure that I wanted to be a Geology major. I was introduced to geology as a middle school student. A professor from the local university led summer geo-field camps to Yellowstone and the Grand Canyon. I loved it, going three summers in a row, but as a college student I had to be absolutely, completely sure that I loved nothing better. So, my first two years at CC were filled with Shakespeare and Brontë, Buddhism, anthropology, astronomy and music theory classes. Finally, I got around to an introductory geology course in block 7 and 8 of my sophomore year, and sure enough, this was the place for me. My life has been essentially geology non-stop from that point on. To make the requirements for the major with my late start, I had to take 7 blocks of geology (including all the core courses) my junior year, and 6 in my senior year. Burn out? Hell, no! Okay, maybe a little. But not so much that I didn't jump at the chance to do a year-long stint as a paraprof.

As a recent CC grad, I was as uncertain as most about the future that I wanted, but I was pretty sure that finding a career in geology would be easier with at least an MSc degree, so I started applying to grad school. I applied to Stanford University, thinking I wanted to get a master's doing a project involving metamorphic petrology and tectonics. Instead I got a call from a professor of theoretical geochemistry, offering me a PhD where I would use stable isotopes to study hydrothermal systems in Iceland. PhD: sounds scary. Iceland: sounds awesome. I went for it, and got to be part of an international science team that was testing the feasibility of drilling 5km into the active spreading margin in Iceland to tap supercritical fluids as a renewable energy source, and as a bonus, to learn more about how mid-ocean ridge hydrothermal systems work.

The coolest part of this project? We failed horribly. Instead of drilling to supercritical fluids, we drilled into magma. The upshot for me was that my 2008 summer plans changed from working on a drill rig in northern Iceland to measuring oxygen and hydrogen stable isotopes of quenched glass shards that formed as magma rushed into the drillhole and met the drilling fluids. Turned into a pretty cool little study, but it also meant that I was out of a research project, and only half-way through my PhD.

This is the point at which I learned that sometimes your future just falls in your lap. It happened that Minik Rosing, a rather famous professor from Copenhagen was visiting Stan-



Fieldwork in Iceland, 2006. This was before we drilled into magma, and I was learning about hydrothermal plumbing systems in volcanoes by studying some of the glacially eroded central volcanoes of east Iceland.



Fieldwork in Isua (2014), right next to the Greenland ice sheet.

ford while I was trying to figure out my next move. Professor Rosing had identified the oldest geochemical evidence of life in carbonaceous black shales from a suite of rocks in west Greenland that are more than 3.7 billion years old, called the Isua supracrustal belt. He had some samples from Isua with him; and we decided to just see what the hydrogen isotope compositions of these rocks were – no one had ever checked before. After a few hundreds of isotopic analyses, we had found some pretty huge things. In particular, we found one outcrop of rocks in Isua – a serpen-

tininite formed in the early Archean ocean, probably much like the serpentinite mud seamounts of the Marianas trench today, that retained a hydrogen isotope composition of >3.7 billion-year-old seawater. Trying to understand how and why there is a difference between the hydrogen isotope composition of that ancient seawater and modern oceans has led to a multitude of questions about how water is distributed and transferred between major reservoirs on Earth.

I chased those questions to the Natural History Museum in Denmark, working with Prof. Rosing for a postdoc studying proxies for climate in Precambrian rocks, and how paleo-surface temperatures related to the evolution of Earth's albedo. That position evolved into a professorship, where I am slowly building my own little group, where we investigate water cycling through subduction zones and its role on orogenic gold formation, mantle rheology, and the onset of plate tectonics. Working as a researcher in a museum is an amazing opportunity – not only are you surrounded by brilliant scientists across all kinds of disciplines you might not interact with in a normal department (my colleagues include astrophysicists, geneticists and ecologists), but you are constantly sharing your research with the public, and as a result your research goals are shaped by the necessity of being relevant and relatable to a general audience.

On top of that, living in a different country for the last 7 years has been a fantastic experience in itself. I still get a little CC flavor – learning a new language and culture as I continue my research. And haven't yet gotten over the fact that my office is across the street from a castle, and every now and again I run into the queen (we were at a film premiere together, and she visited us in our camp in Isua once – we drank wine and had homemade foie gras).



The castle across the street from my office – not a bad view.

tininite formed in the early Archean ocean, probably much like the serpentinite mud se-

I never imagined as a freshly minted geologist graduate from CC that I would settle down in Europe, or that I could work as a scientist at a museum, but both are amazing opportunities for anyone who wants a career in geology. If you ever find yourself in this corner of the world, please look me up – we can sneak in a behind-the-scenes tour of the dinosaur exhibit.

All the best,  
Emily Pope '04

## Ian Miller '99

My first memory of geology was discovering the undeniable power of erosion. When I was about 4, my brothers and I sluiced away our steeply sloped backyard in Seattle, WA. After the downstream neighbors threatened lawsuits, my parents realized that the city was no place for three brothers and their penchant for geomorphic experiments. They moved us east, to a ranch nestled among the mountains flanking the Methow Valley on the dry side of the Cascades (later to carry the fond family epithet the "brain shadow") deep in the orcharding bosom of Washington State, where they quickly spawned two more boys. Without neighbors to terrorize, taming nature became our purpose. The five brothers dammed (and repeatedly flooded) the ranch creek, trundled any precariously perched rock on the surrounding mountains, and scavenged abandoned and partially collapsed gold mines. In retrospect, it's pretty much a miracle that we all achieved adulthood!

Both my parents are outdoor enthusiasts, and they encouraged exploration and discovery. They raised llamas on our ranch, among a menagerie of other barnyard creatures, and ran an outfitting business taking Seattleites deep into the remote North Cascades. They

alternatively hired me and my brothers as llama "wranglers" for \$5 a day. I still don't know what a llama wrangler actually does (most llamas are benign and don't need wrangling), and I'm pretty sure that even then a wage of \$5 a day was illegal. But I spent my summers camping, fishing, and meeting amazing people from around the world, all while exploring one of the great mountain ranges of our continent. Little did I know then, my parents were giving me a gift and instilling in me an intense passion for the outdoors.

It was sort of a wonder that I ended up at Colorado College. Our local school was small. My graduating class was just 13 kids—10 of us met in kindergarten, learned to tie our shoes together, and spent the next 13 years slogging toward high school graduation, all in the same building. In fact, there was a standing page in the yearbook for the "13-year seniors," which always seemed to me to indicate that we had to have repeated a grade.



Outrunning administrative tasks at the Museum.



Changing the lives of the young and impressionable by placing their heads in the mouth of a sabretooth cat. It is the thing of nightmares...

Needless to say, college was not the trajectory for most (there were apples to be picked!), and maybe not even for me without the right encouragement.

My grandfather, omnipresent throughout my childhood, drummed into me that “perseverance furthers.” He once made me read all 800 pages of *The Good Soldier Švejk* for a school book report... out loud. It took three months. As may be surmised, he had high hopes for my education. In fact, when I was about 12, he declared that I should be a geologist. Maybe it was the gold mine scavenging or the creek flooding but after that there were mandatory fieldtrips to various points of geologic interest in eastern Washington. While I loved the rocks, I eschewed the

career path, proclaiming that I would be a doctor, much to Grandpa’s chagrin (he was of the generation that found medical doctors suspect). He was mollified, however, by the fact that I had at least some semblance of a concrete idea for my future.

I found Colorado College by chance and applied more or less on a lark. One of my older cousins raved about the students that she had encountered from CC on a semester abroad in Costa Rica. She had attended Carleton College and said the (other) CC students were the most engaging, adventurous, and fun-loving people she’d ever met! With that recommendation, I was hooked—I could go to college AND have fun. In fact, even though I did the obligatory college tours, I didn’t even visit CC. After I was accepted, I just showed up and jumped in!

My fate as a geologist and paleontologist was sealed my first block at CC. The class was called Natural History, co-taught between the geology and biology departments. Paul Myrow was the geo prof, and he was just about the most inconceivable person I had ever met: geologist, paleontologist, musician, and comedian, with the most amazing zest for life! I couldn’t help but be pulled into his bow wake. During the class, we visited Yellowstone National Park for 10 days, camping and exploring the incomparable ecosystems and landscapes of the park. About halfway through the trip, just about the time everyone was settling into the routine of long days of fieldwork and class on the outcrop, Paul threw us a curve ball. It was snowing to beat the band and any reasonable human being would have kept the students in camp. Not Paul. I can vividly remember him ushering everyone onto the bus early in the morning. After an hour or so of driving and everyone wondering what the hell we were doing, Paul had the bus stop on the side of the road in the Lamar Valley. He set off into the cold, wet weather, beckoning everyone to follow. We approached the Lamar River, and without any



Exploring the alien “Tsingy” landscape of Madagascar with my colleague, DMNS curator of dinosaurs, Joe Sertich.

preamble, he took off his shoes, rolled up his jeans, and started fording the river. The students, myself included, were agog! About halfway across, he just looked back and exclaimed: “What are you all waiting for? The rocks are over here!” Soon, the entire class was wading the swift and frigid waters. The snow was almost horizontal, and you could see bison herds milling around in the distance—even they looked cold. After clawing up the slippery bank, we donned our boots, hiked across a wide-open plain and then scrambled up the better part of a mountain on the far side of the river. There, in layer after layer of ancient sediment, stood a whole forest of petrified trees that had been catastrophically buried by volcanic mudflows more than 50 million years ago. I was in awe. After that day—snow, bison, river crossings, freezing temperatures, incredible fossils, and Paul—and combined with my roots in the outdoors, I knew it was geology or bust. Upon hearing the story and of my now vigorous interest in geology, my grandpa was jubilant, and more than a little smug.

My career as a paleobotanist, which is what pays the bills today, got its start when I interned for the Denver Museum of Nature & Science (DMNS) with then-curator Kirk Johnson, who is now the Director of the Smithsonian. With Kirk, Paul, and CC geology professor Christine Siddoway, I devised a plan to study the Early Cretaceous plant fossils in my backyard in Washington, and use them to gain insight into the tectonic history of large allochthonous continental blocks that now comprise much of the state. We found that the fossil plants in Washington on these “far-travelled” blocks indicated a climate more in line with that of ancient Mexico than their final resting place in the Pacific Northwest. Our finding supported the “mobilists” (as opposed to “fixists”) in the “Baja BC Controversy.” It also laid the foundation for my graduate work on the same topic.

After a brief two-year interlude as a field geologist with a New Mexico geotechnical engineering firm, I couldn’t let the fossil plants go and I headed off to Yale University, where I studied paleobotany and tectonics, earning the title “tectonobotanist.” I dove into the Baja BC problem with gusto and five glorious years of science few by. As a freshly minted PhD, I was fortunate enough to be hired by Kirk (at that point still a curator at DMNS) as his



Digging Cretaceous fossil leaves in the Grand Staircase-Escalante National Monument. Yes, you should help save it from the Trump administration for no other reason than the amazing fossils.



Holding the claw of the extinct giant ground sloth *Megalonix jeffersoni* in Snowmass, Colorado.

postdoc and get the chance to move back to Colorado. Soon thereafter, the Museum hired me as a curator of geology and paleobotany. The rest, as they say, is history.

Over the last 11 years, I've climbed the proverbial corporate ladder and now hold the title of Director of the Earth and Space Sciences. Fortunately, I am still a curator and get the chance to travel the world, near and far, in search of amazing fossils. My scientific interests fall in the wildly popular -ologies of paleobotanical proxies for and statistical analysis of paleoclimate, paleolatitude and paleoelevation; the evolutionary history and ecological radiation of Cretaceous angiosperms; the deep-time origins of the flora of Madagascar; the recovery of terrestrial ecosystems following the K/T extinction; and the tectonic evolution of the Western Cordillera of North America. I've also had the chance to step out of my Cretaceous/Paleocene wheelhouse and spend time in the Pleistocene.

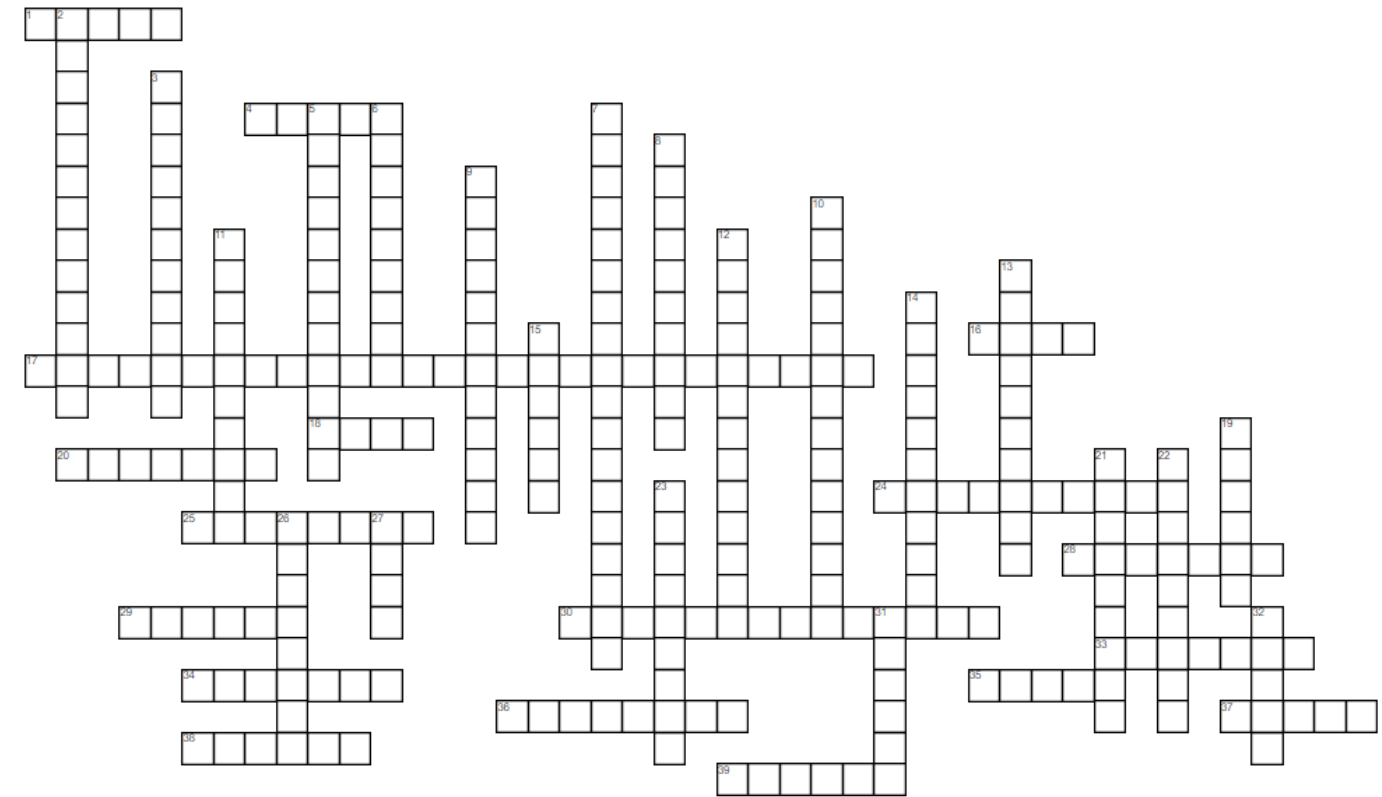
From 2010–2014, along with Kirk, I had the chance to run the massive Snowmastodon Project, which ended up being Colorado's biggest paleontological discovery and one of the biggest paleontological discoveries in US history. The construction of and excavation for a dam near Snowmass Village, Colorado, provided the brief opportunity to dig into an ancient lake deposit and amass an unparalleled collection of fossil plants and animals from a series of stacked and exquisitely preserved ecosystems that existed between 130,000 and 50,000 years ago. In particular, the excavation unearthed approximately 5,500 large mammal bones from extinct Late Pleistocene animals including American Mastodons, Columbian Mammoths, Jefferson's Ground Sloths and extinct Ice age bison, horse, deer and camels. Tens of thousands of small bones were also screened from the matrix at the site, which led to the discovery of more than 50 species of small animals including otters, muskrats, minks, rabbits, beavers, salamanders, frogs, lizards, snakes, fish, and birds. Combined with whole trees, leaves that were so well preserved that they were still green after 100,000 years, and fossil pollen, the unique collection of fossils have helped us understand the ecosystems of the high Rockies and climate change during the most recent warm period to the present day.

One of the thrills of the project was leading the more than 50 scientists from 18 institutions. On the science team was CC geology professor Eric Leonard, who modeled the ancient glaciers that formed the ancient lake; and Saxon Sharpe, CC alum and scientist at the Desert Research Institute, who studied some of the fossil invertebrates from the site. We also hired 10 interns for the project, two of which were from Colorado College. Today, one of my passions is paying it forward to CC students. Over the past eight years, CC geology professor Henry Fricke and I have co-advised ten CC interns hosted both at CC and at the Museum. Three of them are working on graduate degrees now and a few more are knocking at the door.

I have been so fortunate to be able to make a "living" out of studying the vast and intricate evolutionary history of life on earth. Essentially, I get paid to find fossils and share them with the people of Colorado. CC made it all possible. Today, when I'm not digging fossils or scheming new quarries, I can be found fishing, skiing, or hiking Colorado's mountains with my lovely wife Robyn (also a CC alum!) and my perpetually joyful dog Wilson.

## Rocks

Have fun!



### ACROSS

- That sandstone is crazy!
- \_\_\_ terrain; umbrella term used to describe complex, deformed planetary & lunar surfaces
- Ash, lapilli, block, or \_\_\_
- Low-angle crossbedding formed during a storm
- Neoproterozoic unit of sandstone injectites
- Class 2 fold; think automobile
- $(Mg,Fe)_2Al_3(AlSi_3O_{18})$
- Seismologists don't use iPhones, they use a \_\_\_
- >25% feldspar
- Describing saturation (or lack of) from surface to water table
- Four-legged Labs
- Flow line of deepest part of a river
- Fault that flattens downward
- When 37 across is <10m
- Your favorite sedimentary structure
- Inuit for mound; dome-like, ice-filled features in areas of permafrost
- $(1 N)/(1 M^2)$
- Corrects for aircraft's velocity relative to the rotation of earth at a specific latitude

### DOWN

- Formed *allos*; what is this doing here?!
- Angle (on horizontal plane) between magnetic and true north
- FeAsS
- This stone transforms any metal into gold
- Orbital variations of Earth that may be recorded in sedimentary rock
- Strain, defined by  $(\ell - \ell_0)/\ell_0$
- Glacial erratic; colonial
- 1mm – 2mm
- The most religious rock in the world
- A is deposited quickly and E slowly
- Potassium rich basalt
- In these organisms, each valve is bilaterally symmetrical
- Metallic mineral with specific gravity of 7.6 and hardness of 2.5
- Form of englacial drainage; from the French word "mill"
- Limestone cliff once said to mark the limit of the known world
- $\sqrt{(\mu/\rho)}$  describes velocity for \_\_\_ body waves
- Mineral first named after gooseberries
- Between water table and bedrock
- Archean Formation in Pikes Peak Region
- Southernmost active volcano
- Shape of the earth calculated using global mean sea level



## Geology Day

April 1, 2017, Tutt Science Lecture Hall

### Student Presentations:

John Borah '17 "Brittle Fault Kinematics of the San Juan Fault Zone in Southern Vancouver Island, British Columbia"

Forrest Corcoran '17 "Efficacy of Geophysical Methods in Identifying and Characterizing Landslides at Different Stages of Development"

Grace Guryan '17 "Ground-penetrating Radar Analysis of the East River Floodplain Near Crested Butte, Colorado"

Rowan Kowalsky '18 "Geothermal Assessment and Development of the Hawaiian Ocean Island Hotspot"

Alec Lockett '17 "Investigating the subsurface geology of the Ross Ice Shelf, West Antarctica, using potential fields geophysical data"

Sierra Melton '18 "Comparing methods of quantifying rapid topographic changes"

Lexie Millikin '17 "40Ar/39Ar geochronology and petrogenesis of the Table Mountain Shoshonites, Golden, CO"

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

Matt Tankersley '18 and Rowan Kowalsky '18 "Gravitational and Magnetic Field Surveying to Improve Subsurface Resolution of Geothermal Targets in the Cascade Magmatic Arc"

Cole Thompson '18 "Analysis of the Geometries of Shallow Intrusions in Canterbury Basin Using Seismic Reflection and Outcrop Analogies"



Spring FYE with Christine Siddoway in San Ysidro, NM.

## Venture Grants

Year: 2016-2017

2016-2017 Venture Grant Recipients	Project	Where	Advisor
Anna Gilbertson '18 and Annabelle O'Neil '19	A Critical Examination of Gender in Skiing: Effects of An Objectifying Culture	Switzerland and France	Tonja Olive, Miro Kummel, and Tomi-Ann Roberts



## Senior Awards

Annual Awards  
Year: 2016-17

### Rocky Mountain Association of Geologists Award:

Alexie Millikin '17

### Estwing Outstanding Senior Geologist:

Arden Feldman '17

### Association of Women Geoscientists:

Grace Guryan '17

Alexie Millikin '17

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

Grace Guryan '17

Alexie Millikin '17

### Buster Scholarships:

John Borah '17

Forrest Corcoran '17

Arden Feldman '17

Grace Guryan '17

Alexie Millikin '17

Charles Russell '17

Matthew Tankersley '18

### Gould Scholarship Recipients:

Grace Guryan '17

Andrew Ceglinski '19

Guy "Beckley" Stearns

### Putman Scholarship Recipients:

Andrew Ceglinski '19

Grace Guryan '17

Guy "Beckley" Stearns '18

Tristan White '18

### Rhoades Scholarship:

Tristan White '18

### William Fischer Endowed Fund:

Sierra Melton '18 & Kayla Bronzo '18

### Tashjian Crecelius Family Prize for Women:

Tianran Zhang '18

### Witter Family Fund for Geology Internships:

Student	Organization
Zak Armacost '19	Arctic Glacial Lakes (NAU)
Isabella Bussian '18	Stanford University Historical Geobiology Lab
Fai Chanchai '20	Ministry of Energy, Thailand
Arden Feldman '17	Crested Butte Avalanche Center
Grace Guryan '17	Bishop Brogden Associates Inc.
Ben Lloyd '19	Denver Museum of Nature and Science
Alec Lockett '17	State of Alaska DGGGS
Alexie Millikin '17	GNS Science, New Zealand
Matt Tankersley '18	Lamont-Doherty Earth Observatory, Columbia University



## Seminar Series 2016-17

*Block 2, September 30* — 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 6, February 24* — Dan Niemela '00, Hydrogeologist, Bishop Brogden Associates, Denver, CO, "History of Water Rights in Colorado"

*Block 6, March 1* — Celeste Mercer, Research Geologist, USGS, Denver, CO, "Magmas to metals: Insights into evolution of magma parental to one of Colorado's premier ore deposits"

## Seminar Series 2017-18

*Block 2, September 29* — Dr. John Taylor, Indiana University of Pennsylvania "Biogeographic and Paleogeographic Utility of Cambrian–Ordovician Faunas"

*Block 2, October 9 -10* — Dr. Richard Heermance '95, Department of Geological Sciences, California State University Northridge "Successes and failures of  $^{10}\text{Be}$  cosmogenic dating for evaluating slip rates and earthquake history of the southern San Andreas Fault" and "14.6 Ma aridification and development of the ancestral Taklimakan desert between the Pamir and Tian Shan orogens, western China, climatically or tectonically controlled?"

*Block 3, November 13* — Dr. Cecilia McHugh, Queens College, CUNY, presented the 2017-18 Ocean Discovery Lecture Series "Can

## Student Conference Presentations 2017

GSA in Seattle, WA, Fall 2017

Kayla Bronzo '18, "Using oxygen, carbon and strontium isotope ratios of tooth enamel from dinosaurs to infer patterns of movement over the Late Jurassic landscape of Colorado, Utah, and Wyoming"

Sierra Melton '18, "Response of carbon fluxes to soil moisture variability across an Alaskan tundra landscape"

Everett Smith '18, "Depositing combined-flow turbidites below wave base: experimental evidence for teleconnection of surface waves and the deep seafloor by turbidity currents"

Tianran Zhang '18, "Geochemical characteristics of deposits laid down by the 2016 Kaikoura Tsunami at Little Pigeon Bay, New Zealand"

Continental margin sediments be globally correlated during large amplitude, Glacioeustatic fluctuations?"

## Recent Faculty Publications

\*Indicates Colorado College student

### Fricke:

D'Ambrosia, A.R., Clyde, W.C., Fricke, H.C., Chew, A.E., (2017). Repetitive mammalian dwarfing during ancient greenhouse warming events. *Science Advances*, Vol. 3: e1601439.

Fricke, H.C. (2017). The present isn't always the key to the past: challenges and rewards associated with the interpretation of biogeochemical data from pre-Neogene biogenic and authigenic materials. Presented as an invited participant in a Paleontological Society Short Course.

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.

\*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.

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.

### 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.

### Levandowski:

Levandowski, W. and Powell, C.A. Earthquake statistics in the Eastern Tennessee Seismic Zone are inconsistent with an after-shock sequence: submitted, *Seismological Research Letters*.

Levandowski, W., Weingarten, M., and Walsh F.R. III. Influences on geomechanical susceptibility to injection-induced seismicity: in review, *Geophysical Research Letters*.  
Levandowski, W., Abdel Hameid, D., McNamara, D.E., and Boyd, O.S. Multi-frequency Lg attenuation structure of the central United States: USGS internal review.

Levandowski, W., Herrmann, R.B., Briggs, R., Boyd, O.S., and Gold, R. An updated crustal stress map of the continental United States: revised, *Nature Geoscience*.

Abolins, M., and Levandowski, W. Formation of the Nashville Dome by inversion of a previously undescribed rift: in review, *Geology*.  
Deng, Y., and Levandowski, W. Lithospheric alteration, intraplate crustal deformation, and topography in eastern China: revised, *Tectonics*.

Levandowski, W., Butcher, L., Jones, C.H., and Mahan, K.H., Cenozoic uplift of the North American Great Plains and Colorado

Plateau by crustal hydration: in press, *Geosphere*.

Brandenburg, W.E., Levandowski, W., Califf, T.C., Manly, C., and Levandowski, C.B. (2017). Animal, Microbial, and Fungal Borne Skin Pathology in the Mountain Wilderness: A Review. *Wilderness and Environmental Medicine*, v. 29, n. 2.

Levandowski, W., Zellman, M., and Briggs, R. (2017) Gravitational body forces focus North American intraplate earthquakes: *Nature Communications*, v. 8.

Deng, Y., Levandowski, W., and Kusky, T. (2017) Lithospheric density structure beneath the Tarim basin and surroundings, northwestern China, from the joint inversion of gravity and topography: *Earth and Planetary Science Letters*, v. 460.

### Myrow:

Myrow, P.M., Chen, J., \*Snyder, Z., Leslie, S., Fike, D.A., Fanning, C.M., Yuan, J., and Tang, P., 2017, Depositional history, tectonics, and provenance of the Cambrian–Ordovician succession in the western margin of the North China Block: Reply: *Geological Society of America Bulletin*, v. 127, doi.org/10.1130/B31835.1.

Palacios, T., Jensen, S., Barr, S.M., White, C.E., and Myrow, P., in press, Organic-walled microfossils from the Ediacaran–Cambrian boundary stratotype section, Chapel Island Formation and Random Formation, Burin Peninsula, Newfoundland, Canada: Global correlation and significance for the evolution of early complex ecosystems: *Geological Magazine*.

Tang, Q., Hughes, N.C., McKenzie, N.R., Myrow, P.M., and Xiao, S., 2017, Late Mesoproterozoic–Neoproterozoic organic-walled microfossils from the Madhubani Group of

the Ganga Valley, northern India: *Palaeontology*, v. 60, p. 869-891.

### 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., Lyttle, 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 Lyttle 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).



Spring FYE with Christine Siddoway in New Mexico, at a roadcut displaying awesome contact metamorphism

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

### Ben Borkan '11

Ben graduated with his Master's in Social Work from Smith College School for Social Work in August 2017 and is currently in Maine working as an in-home clinician with families that receive Mainecare. He is currently using his knowledge acquired from studying geology to develop meaningful metaphors for people to better understand themselves.

### Ann Clarke '72

I retired from NASA and have been teaching Environmental Law at the Monterey College of Law as a Lecturer. Here is a photo. I caught a 15 lb silver salmon in Alaska on the Tsui River after having spent 3 days fishing on a wilderness lake and river-Hanagita Lake in the Wrangell-St. Elias NP. Beautiful.



### Laura (Laurie) Jones Crossey '77

I have had an exciting year in geologic exploration and research! This story captures some of the excitement of our 30-day geo-

thermal and tectonic research trip (funded by NSF) across remote Tibet with an intrepid crew of geoscientists from UNM, Stanford, and the Chinese Academy of Sciences. <https://www.nmepscor.org/blog/geothermal-journey-tibet-co-lead-laura-crossey>. I



have a fun presentation called 'Chasing Helium' that talks about the basic science, the fieldwork and the culture- including photos and several short videos. I am also serving since August, 2017 as Associate Dean for Research at UNM (in addition to being a professor in Earth & Planetary Science) which has been an exciting opportunity to foster research across the range of disciplines in our College of Arts & Sciences. I have enjoyed meeting up with CC faculty, students and fellow alums at the GSA gatherings.

### Cody Duckworth '16

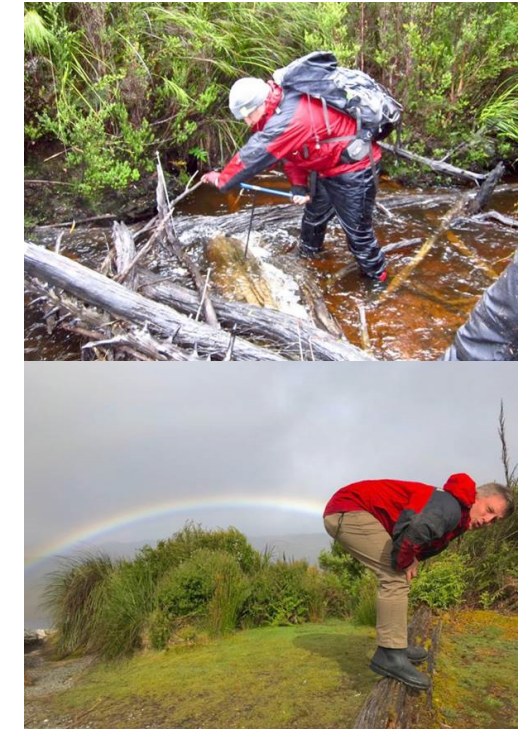
Apart from eating crackers in close proximity to glaciers, I have just completed my first quarter of my Masters degree at Western Washington University. It feels like that not long ago I was the one in the paraproof office putting together the 2017 edition of the PCB! For those that are interested, my research focuses on characterizing active crustal faulting on the Olympic Peninsula of Washington. This work is still in its early stages but it will include components of measuring cumulative fault slip from offset geomorphic features in lidar, paleoseismic coring/trenching, and crustal strain modelling. I have to say that doing geology in the rainforests of western Washington is much different than in Colorado! If any of you alums are ever in the Bellingham area, please look me up!



### Nathan English '96

I'm now a lecturer at Central Queensland University and Head of Course for Environmental Science. Just spent a great week in Tassie (Tasmania) with colleagues conducting vegetation surveys on the Central Plateau in areas burnt by the 2015 bushfires and then searching for and coring buried Huon Pines in a bog in southwestern (and very wet)

Tasmania. My family and I are enjoying the tropical sunshine and welcome anyone to come to Townsville (Australia's most originally named city) to enjoy it as well!



### Pamela Polite Fisco '77

Pam is the owner and sole principal of Rocks Talk, an Earth and Planetary Science program comprised of classes, field trips, curriculum development and workshops for K-12 students and teachers. She has developed and run the program for both public and private schools over the past 25 years. As a California Certified Master Gardener Pam conducts, educational lectures and workshops for fellow Master Gardeners and the general public. In conjunction with Marin Municipal Water District she provides home garden walks to educate clients on Bay Friendly gardening practices and the reduction in water use. Pam has served in leadership positions on the Boards of a variety of schools, clubs, civic and sports organizations and actively participates in coaching, educational, fundraising and advisory capacities. Over the past ten years, Pam has become increasingly involved in residential property management

for Hawk Heights a small, private investment. Pam earned her BA in Geology from Colorado College and an MA in Geology from Rice University researching Antarctic marine glacial sedimentation. Pam lives in Mill Valley with her husband Dennis and has three grown children, two of whom also graduated in Geology, and the third is in Real Estate.

#### Ben Gardner '11

I am a science teacher at Telluride Mountain school and this year am charged with taking my class to Hawaii to study the geology there.

#### Timothy Gibson '10

I'm in the last year of my PhD at McGill University in Montréal, but have been spending much of my time writing in New York City with my partner. I had the pleasure of teaching GY135: Geology of the Pikes Peak Region last summer and plan to teach it again next summer during A block. It was great to be back in the department and to revisit the outcrops I learned from as a student—the Front Range is a spectacular place to study geology!

#### Rowan Hill '09

After 5 years in Durango, CO I moved to Denver. I started grad school as a part-time student at Metro State, where I'm getting my Master's in Social Work. I am also working for a fabulous company called Sandstone Care. We are a substance use and co-occurring disorder treatment program for adolescents (13-18) and young adults (18-30). I am loving my job and am part of a great team. My main contact with rocks these days is through rock climbing.

#### Cliff Koontz '00

Cliff (pictured next column, top of page) was inducted into the National Off-Highway Vehicle Conservation Council, or NOHVCC, Hall of Fame. This honor recognizes one who "cares more than others think wise, risks more than others think is safe, dreams more than

others think is practical, and expects more than others think can be achieved."



#### Bonita Lahey '69

Steve Spear '69 Geology and Bonita Lahey '69 Geology met in Idaho and traveled to Oregon for the perfect eclipse experience. With us is Steve's wife, Anne, and Joann Zimmerman CC '69. Steve, of course, did extensive field work for two years prior to the eclipse to make sure we had the perfect spot.



#### Roland LaForge 1972

Greetings to all from the Lewis/Fisher/Pearl era. Finally "retired" in 2015 after 40+ years in the field of seismology and seismic hazards, including 25 years with the Bureau of Reclamation here in Denver and 10+ with consulting companies. Am now the sole proprietor of LaForge Geoconsulting, doing work for various federal agencies charged with protecting our critical infrastructure from earthquake damage. I've also had time now to publish past research project results, including one on local effects in western Puerto Rico from the 1918 offshore earthquake and tsunami. Ironically, this my least "scientific" work (i.e. no equations) has gotten the most buzz, including a Scientific American podcast. Otherwise I've been enjoying playing my guitar in rock bands and traveling with my 2 (grown) boys. Photo is hiking Hadrian's Wall in north England (built 122 AD) with my son Gordon earlier this year. <https://www.scientificamerican.com/podcast/episode/old-records-help-resurrect-historic-quake/> <https://phys.org/news/2017-07-forgotten-archives-reveal-street-level-impact.html>



#### Claire Renault '84

Claire Renault, Professional Geologist (Louisiana) and co-owner of Leaaf Environmental,

LLC, has run her own business for 13 years. This year we doubled our revenue and now have a staff of 17. We have two large contracts, one with the City of New Orleans and the second with the State of Louisiana that have brought our company into the spotlight. An exciting tidbit is that we are remediating an abandoned gas station and building our new office on the site utilizing a Brownfields Grant for funding. We figured if we are going to be an Environmental Consulting Firm we should practice what we preach. We are always looking for talented geologist.

#### Fiona Smith '10

I'm currently teaching 6th grade math/science in my home state of Washington where I moved last year. I just got married and bought a house. My husband and I are enjoying skiing and climbing in the mountains of the Pacific Northwest and exploring the Salish Sea. I'm pursuing a Masters of Science in Science Education from Montana State University.

#### Ted Starns '07

I'm still up in Anchorage working as a geologist for ConocoPhillips on a coiled tubing development drilling program. Life is good, getting pretty efficient at catching salmon. Had a good year for kings and got a moose with my buddies. Moose are very heavy. Working with Ben Gross these days (class of '03?), we give each other a hard time, it's good for the soul.

#### Karl Thompson '01

I'm living in Boulder, trying to extend 8th Block Break into its 17th year. I have new CC biology grads as tenants downstairs, so that's re-invigorated the spirit a bit. They hijack the conversation to talk about our menacing bears that destroy the trash cans, the bobcat that lurks down the irrigation canal, and the owl that is constantly being harassed by the neighborhood mag-pie gang. Noth-

ing to do with geology....Speaking of having nothing to do with geology, I saw fellow geo grads Andy Tankersly and Pete Williams at fellow Ccer Pat Kearny's wedding in Jackson hole last weekend. Andy, who recently got hitched, is teaching in SLC and Pete designs sneakers in Portland. Pete's adorable son ended up giving everyone norovirus, which obligates you to stay within feet of a toilet for 24 hours. Super fun. I played music for another geo Caroline (Alden) Rosen's wedding this summer. She married the hottest guy in Boulder, CC alum Nick Rosen. If you don't believe me, check out his head shot in Outside Magazine, so dreamy. Enough about everyone else, let's talk about me. I'm putting my masters in geology to work right now by securing financing for home-buyers. Turns out after 18 years of schooling I started a profession where you don't even need a college degree. But hey, after a good nine years in environmental consulting it was time to switch it up and re-invent myself; which is pretty easy to do after being equipped with all the tools necessary to tackle the unknown. Thanks CC Geo Department! To my homies, if you're reading this I hope you're well.

#### Ron and Zana Timroth '54 and '59

My husband, Ron Timroth, (B.S.'54, Master's '58, the only Master's degree given in the CC Geology Dep't) went to Alaska, 1998, staked and bought claims and started a mining company, XII Caesars Gold. He's gone up every summer but one for 4 plus months with crew, heavy equipment. This year his mine, XII Caesars Gold, was honored at the National Mining Convention. Ron went to Washington, D.C. and accepted the BLM 2017 Hardrock Mineral Small Operator Award. At 85 it was the icing on his professional career.

#### David Williams '87

In 2017, I was fortunate to have two books published. *Seattle Walks: Discovering History and Nature in Seattle* describes 17 walks around the city. Several highlight the local

geology. *Waterway: The Story of Seattle's Locks and Ship Canal*, co-written with Jennifer Ott, focuses on the history of the city's famous locks and their effect on the landscape. Curiously, the canals are built in one of Seattle's geologic anomalies and one whose origin is still debated. I am now at work on a book about human and natural history of Puget Sound.

#### Van Wombwell '85

After failing and bailing in 2015 due to unstable snow and ice thanks to El Niño, we had better luck this year and stood on the summit of Alpamayo on a calm, sunny morning. There's a great drone video someone shot in 2016 that gives you a sense of the topography: <https://www.youtube.com/watch?v=nMFdqXeMUu4>. A friend put it well: "Dang, it's like Whoville!". Huaraz, Peru is a happening, social basecamp for trekking & climbing adventures during the North American summer.



#### Dan Woodell '09

This year has been a big one for Dan! He got married to his wonderful partner Ivanka Mitrović and had two different ceremonies, one in Oregon and one in Serbia! Lots of CC grads made the trek out to Serbia for one of the weddings, check out the photo! And to top off the year, his son Teodor was born right at the tail end, on Dec 27. He and his wife are both still working on their PhDs in geology in Vienna, and anyone is welcome to stop by if they make their way to Austria.

In the picture, left to right:

Ethan Axelrod, '09  
Barbara Lish, '09  
Janie Luong, '09  
John Barker, '09  
Daniel Woodell, '09  
Ryan Grenoble, '09  
Matthew Rosales, '08  
Tyler Ruggles, '09



View from Whitney Pocket, in Gold Butte, NM. Photo by Steve Weaver.

## Alumni Reunite

*GSA Conference, Seattle, Washington*

Many CC alumni and current students gave presentations and attended, so there was a big, festive turnout at the CC alumni night in Seattle at GSA!

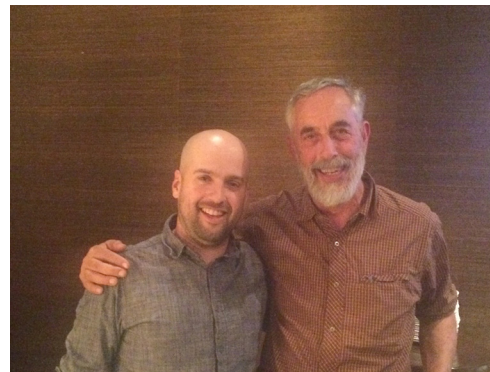


2013 CC graduates, from left to right: Brennan O'Connell, Mike Curran, Christine Siddoway, Devon Cole, and Hannah Karlsson. Christine also had the chance to catch up with Pete Kingston (Associate Geologist at Farallon Consulting, <http://www.farallonconsulting.com/people/staff-profiles/pete-kingston>), Woody Hoyt '06 and Caroline Nuyen '06.

One featured lecture at lunchtime was given by David B. Williams '86, titled "The Protean City: Reshaping the Seattle Landscape". Anyone who'd like to enjoy it can go to: <https://livestream.com/accounts/7595903/events/7758347/videos/164822701>



Left: Present members of the 2006 geology class: Jenny Haywood, Pete Kingston, JC Creveling, Justin Strauss, and Woody Hoyt. Justin Strauss is in the Northeast while the other four are based in the Pacific Northwest region. Right: Woody Hoyt and Eric Leonard.



## Alumni Reunite

*Shoshone, CA*



Christine Siddoway, structural geologist and geo photographer Marli Miller (alum), and Warren "Wazza" Dickinson (alum), Victoria University professor, during the Regionals class. Lauren Dangles '14 returned for Regionals as a paraprofessional but is not pictured, as she was incapacitated by a 24-hour flu that affected (thankfully only a small) part of the 32-person group.

*Vancouver, British Columbia*



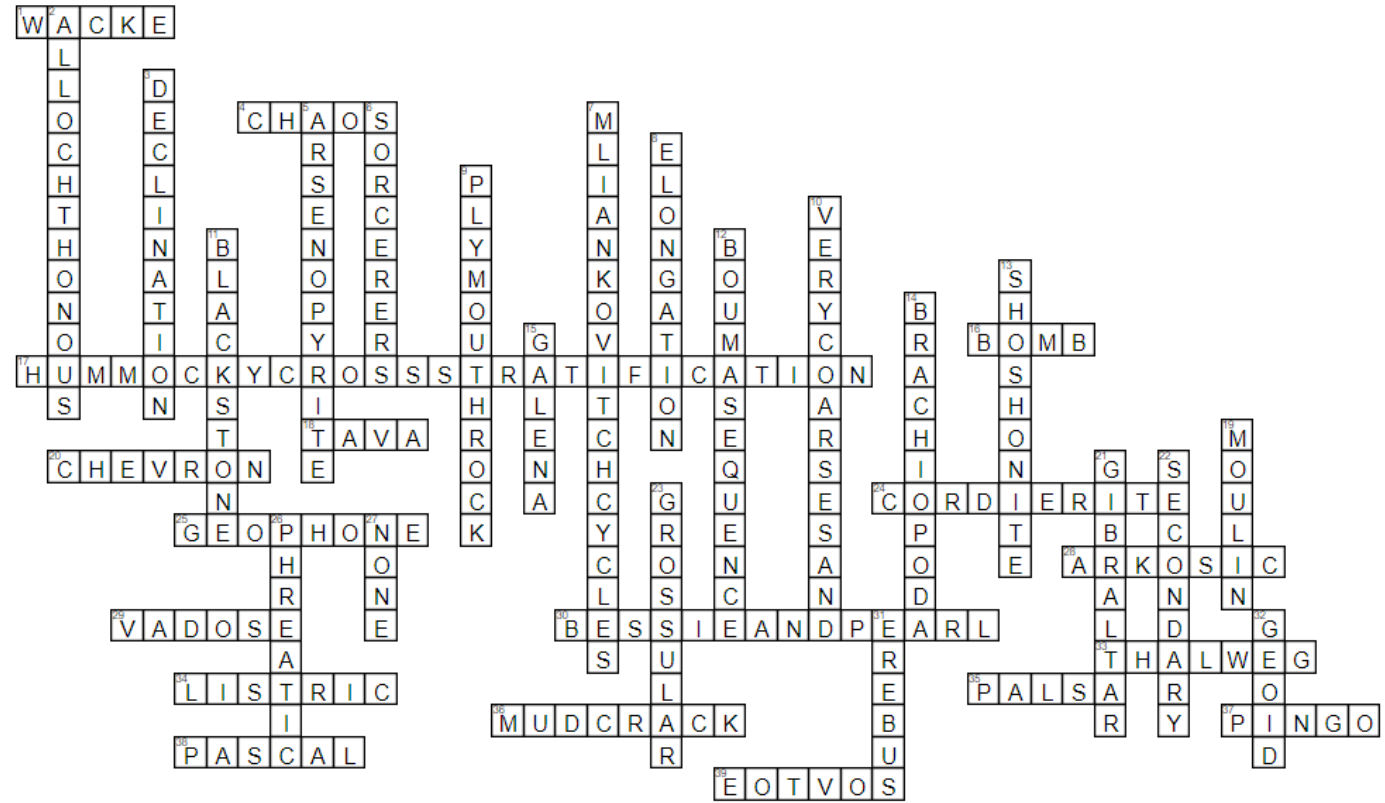
Teck Resources Limited is a Canadian minerals company that employs a large number of CC grads! Although Teck is based in Vancouver, several alumni have spent time in Northwest Alaska at Red Dog Mine, one of Teck's active mines.

Pictured: Ryan Gall, Ed Crawford, Kye Birchard, Betsy Friedlander.  
Also at Teck: Christian Baxter, Matt Rosales, Jenny Haywood  
Past employees are Dave Freedman and Tom Ashley.

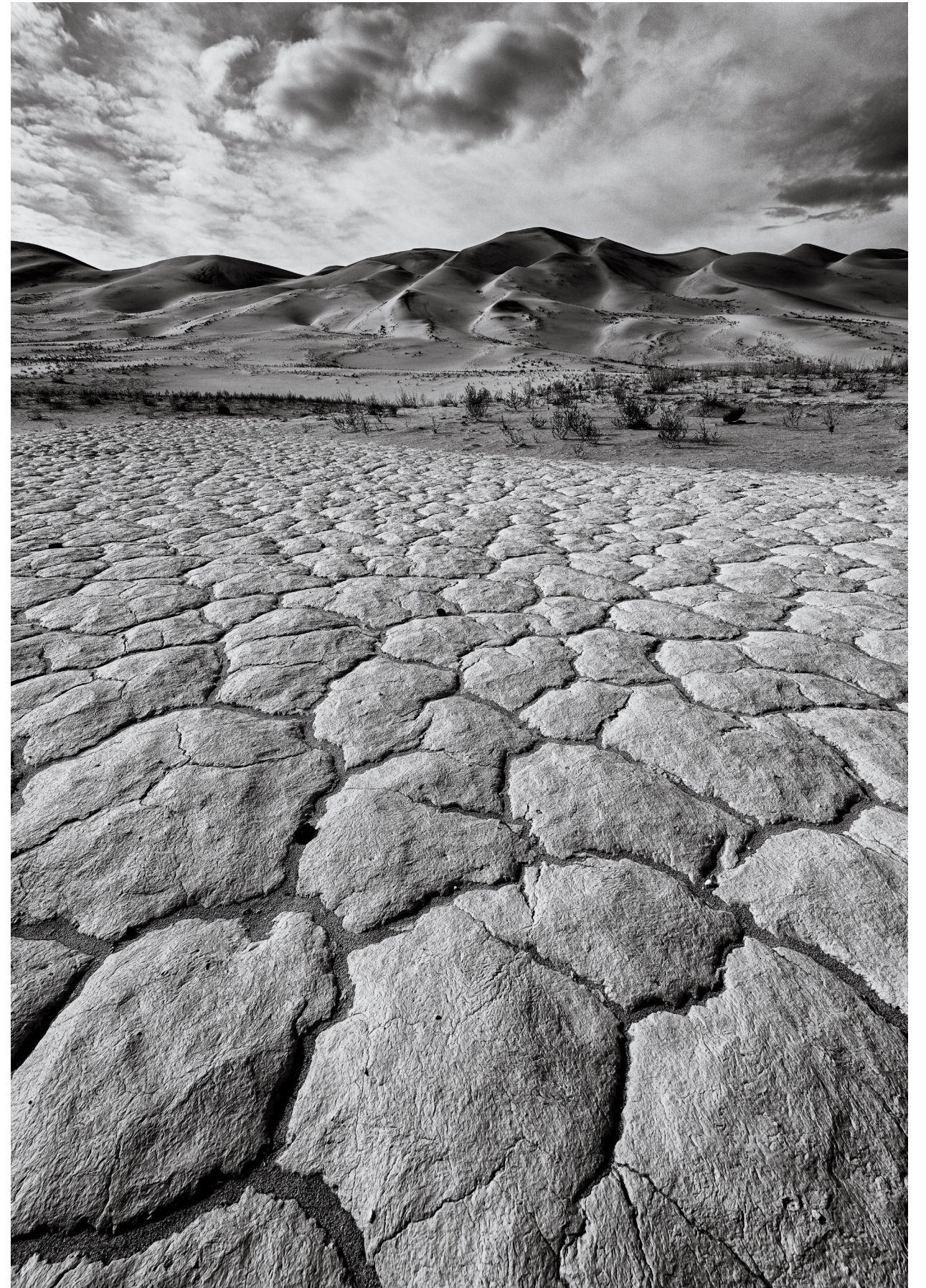
*Moscow, Idaho*



Pictured (from left): Lee Vierling, Teresa Cohn, Christine Siddoway, Beth Kochevar, Dave Freedman



Campfire-chilling during Regionals. Photo by Rowan Kowalsky



Desiccation Cracks in Death Valley  
Photo by Steve Weaver



Dear Colorado College Geology Alum:

We hope you have enjoyed the 2017-18 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](mailto: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:

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Recent Events, Exciting Adventures, and other Comments

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