GEOLOGICAL SCIENCES
UNIVERSITY OF COLORADO BOULDER

Geology News

Our Deadly Planet

New 1000 Level Courses

Inside on page 12

Editors
Shemin Ge
Dan W. Mitchell

2017 - 2018

Letter from the Chair **Shemin Ge**

Twenty years ago, we moved into the Benson Earth Sciences Building. In Fall 2017, alumni and friends joined us to celebrate, reflect, and rejoice. The Building has witnessed our department grow to a top-tier entity in geoscience research and education. It facilitated a steady increase in our student population and a robust expansion in our research capabilities. For the past several consecutive years, the US News and World Report recognizes CU as the second best global university in Geosciences. All of you have been a part of our success.

After two years of preparation, we are rolling out a set of new 1000 level courses in 2018-2019. No more Geology I and Geology II. In their place are Our Deadly Planet, Water Energy and Environment, History of a Habitable Planet, Our Microbial Planet, and Exploring Earth for Scientists. These courses are not just new in name. Faculty, working in cohorts, are actively integrating the latest new knowledge and teaching pedagogy into designing these courses. It has been an unprecedented collaboration and transformative effort by the faculty.

We were delighted to welcome three new members to our faculty, Carl Simpson in Fall 2017, and Leilani Arthurs and Lizzy Trower in Spring 2018. Carl brings in excellent new expertise into our paleobiology program. Leilani expands our horizon into a new dimension in geoscience research and education. Lizzy fills in a critical void in soft-rock area left by Mary Kraus when she moved to university administration. Learn more about their background on pages 4-5. We are also excited in anticipating two new faculty, Irina Overeem in Fall 2018, a quantitative sedimentologist, and Alisha Clark in Fall 2019, a mineral and rock physicist. Irina will fill in the position vacated by Jai Syvitski who retired in January 2018 after 23 years of distinguished service at CU with a joint appointment in Geological Sciences and INSTAAR. While Jai's research and international lecture activities show little sign of abating, we greatly miss his presence in the Department and wish him the best.

The accomplishment of our existing faculty is a continuing source of inspiration. Some of their activities are reported on pages 5-9. A few highlights here: Peter Molnar was named University Distinguished Professor, CU's highest honor awarded to faculty. Bob Anderson received a College Scholar award from the College of Arts and Sciences to embark on studing rock glaciers in Alpine landscapes. Brian Hynek received a Leadership Education for Advancement and Promotion award from the Office of Faculty Affairs for analyzing microbiology samples from volcanoes in Costa Rica and Iceland that are considered analog sites to Mars hydrothermal systems. Greg Tucker was newly elected an AGU fellow. Paul Weimer received the Don R. Boyd Medal from the Gulf Coast Association of Geological Societies, a career award recognizing his distinguished standing in Gulf Coast Basin research geology and professional leadership. Eric Small received the 2017 Colorado Governor's High Impact Research Award for his collaborative work on using GPS reflections for measuring soil moisture and snow depth. Joe Smyth was awarded the Abraham Gottlob Werner medal from the German Mineralogical Society, the highest award of the Society to honor outstanding contributions to research in mineralogy and closely related fields. Rebecca Flowers joined the 2017-18 EarthScope Speaker Series of the EarthScope Education and Outreach program, selected for outstanding research accomplishments as well as the ability to engage audiences. Giff Miller is the recipient of the 2018 Distinguished Career Award from the American Quaternary Association that is the highest award made by that Association recognizing Giff's lifetime commitment and significant contribution to advancing Quaternary science. Professor Craig Jones received the Geological Society of America Structural Geology and Tectonics Division Outstanding Publication award for a 2014 paper in Geosphere entitled "P-wave tomography of potential convective downwellings and their source regions, Sierra Nevada, California". Finally, I am the lucky recipient of the 2018 Meinzer award from the Geological Society of America Hydrogeology Division.

Seventeen new graduate students joined us in Fall 2017. Our graduate students are a formidable presence in the Department's intellectual and social life. An increasing number of them are attracting national attention for their research accomplishments (pages 22-24) and we cannot be more proud. We celebrated the graduation of 50 BAs, 7 MSs, and 5 PhDs from Winter 2017 and Spring 2018 combined. Sean Sundermann (MS '02) spoke at the winter graduation. His successful career in geotechnical engineering showed the great value and versatility of a degree in Geology. Penny Patterson (PhD '90) spoke at the spring graduation. Her distinguished career path from entry-level geologist to senior science and technical advisor in a major energy corporation is a true inspiration. Their words to our graduates were down-to-earth and insightful.

We continue enjoying great support from our alumni and friends. Donations to the Bill Braddock in the Field funds remains strong. In the past two years, we embarked on a greater effort to fundraise for graduate student support. The effort is starting to bear fruit, as our capability in providing graduate student fellowships starts to expand. We are also extremely grateful and thrilled to receive new bequests for the betterment of the long-term future of the Department. These gifts enabled us to provide unique experience for our students that are often the most impactful experiences of their time in the Department. Our Advisory Board had a particularly active year. In addition to their continued assistance with the annual Bradley New Graduate Student Retreat and Career Night for undergrads, they formed a new fundraising subcommittee headed by Patty Corbetta. The efforts they are making is amazing. Alan Seeling and Sophie Berglund rotated off the Board this year, I want to thank them for their service and devotion over the years.

Finally, I want to thank our office staff for their earnest assistance to keep us on the right track on all fronts, Associate Chair Alexis Templeton for her insightful guidance for our Graduate Program, and Associate Chair Eric Small for his effective leadership in our Undergraduate Program.

Believing that I would be working with the finest and coolest people on Earth was my reason to step into the chair position three years ago. That belief remains intact today. In closing, my sincere thanks to all of you for taking the Department to where it stands today. As always, we love to hear from you.

Department Chair, Shemin Ge

Greetings from the Alumni Advisory Board

Dean Miller

It has been a busy year for the Advisory Board and the Department. Alan Seeling and Sophie Berglund rotated off the Advisory Board this year. Both of them will be missed as they both were enthusiastic members of the Board who made valuable contributions during their tenure.

As the Department Chair, Dr. Shemin Ge, discusses in her column, the Advisory Board has established a fundraising subcommittee to support the Advisory Board's role in spearheading efforts to meet Department fundraising goals, particularly with respect to graduate student fellowships. While the Department has been able to attract excellent graduate students, it is at a competitive disadvantage when competing for graduate students with other universities with large endowments. As a result, Dr. Ge has made fundraising for graduate fellowships a priority. In support of this initiative, the Advisory Board unanimously agreed to launch a campaign with a goal of raising $1 million dollars within the next 5 years to support a graduate fellowship excellence fund.

Working with the Department Chair and the CU Arts and Sciences Advancement Team, the subcommittee also is developing several initiatives to provide the Department alumni greater opportunities to engage with the Department, and enhance their connection to the CU geoscience community. This is critical because we have a very special community of people both currently in the Department and among those who came through the Department. Look for more information in the near future about how you can become more involved with the Department alumni community through the Geology Department website https://www.colorado.edu/geologicalsciences/.

One event in the planning stage is a Department-sponsored event associated with the Homecoming Reunion weekend of October 25-28. We will be reaching out to you soon with details. In the meantime, you can learn more about the Homecoming Reunion events at the CU Alumni Association Website (https://www.colorado.edu/homecoming/events)

The Board met with Department undergraduates in the Fall and graduate students in the Spring to discuss their experience in the Department. The students uniformly reported that they are continually impressed with the quality of the educational experience in the Department, despite the challenge of finding affordable housing in Boulder. In addition, the graduate students held a poster session after the Spring meeting, which highlighted the breadth of the research being done in the Department. The Board also held another career night for undergraduate and graduate students earlier this year. The students were very appreciative of the career and networking tips from the Advisory Board members who attended. As usual, please let us know if you know of any internships or other job opportunities for students.

L-R: Penny Patterson, Margaret Berry, Townes Pressler, and Dean Miller visit at the Benson at 20 event

Geological Sciences Advisory Board Members 2017-2018

Andres Aslan
Colorado Mesa University

Sophie Berglund
Williams Energy

Florie Caporuscio
Los Alamos National Laboratory

Patricia Corbetta
BHP Billiton

Gus Gustason
Enerplus

Dawn S. Kaback
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Davis Graham & Stubbs, LLP

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Penny Patterson
ExxonMobil Exploration Company

John Roesink
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Alan Seeling
Petroleum Geologist

Shannon Cheree' Stover
BP

Sean Sundermann
Brierley Associates

Chandler Wilhelm
Shell Exploration and Production Co.

Joe Zamudio
Exelis Visual Information Solutions

New Faculty

Leilani Arthurs

Leilani is one of the most recent additions, joining the Department in January 2018 as an assistant professor. Having served as a postdoc in the Department (2007-2010), she is happy to return to a place she considers an academic home. Her familial home is on the Big Island of Hawai`i, where the current volcanic activity in Leilani Estates has her family on high alert.

Leilani has interdisciplinary training and professional experiences in geosciences, social sciences, and science education research. She worked for ~5 years at the USGS Hawaiian Volcano Observatory on the geophysics team. She earned degrees in Peace and Conflict Studies from the University of California at Berkeley, Geology from the University of Hawai`i at Hilo, and Civil Engineering and Geological Sciences at the University of Notre Dame. In addition, she earned four certificates in pedagogy from Notre Dame's Kaneb Center for Teaching and Learning. Her postdoctoral training in STEM education research was through Dr. Carl Wieman's Science Education Initiative at CU Boulder.

She is a Discipline-Based Education Research scholar with a focus on the geosciences. Her research is motivated by the desire to advance our knowledge about how students can more effectively learn geoscience to be well prepared future geoscientists, science teachers, and/or contributing citizens of society. She is the director for the Geocognition Research for Advancing Science Communication and Education (GRASCE) Lab, the current secretary for the National Association of Geoscience Teachers' (NAGT) Geoscience Education Research (GER) Division, and a past associate editor for the Journal of Geoscience Education (JGE).

Prior to joining the CU faculty, she was most recently an assistant professor at the University of Nebraska-Lincoln where she initiated and coordinated the campus' Discipline-Based Education Research (DBER) Group, the Geoscience Education specialization, and a graduate minor in College STEM Education. She is currently a member of CU's DBER Group and a member of the Department Action Team on assessment.

During her first semester on the faculty (Spring 2018), students working with Leilani were very active. Thomas Clifford had two projects about spatial and temporal scale, which will continue through the summer and into Fall 2018. Shelby Litton and Joel Rice started a team project about map reading skills, which will continue into the summer and lead into a new funded project in AY 2018-2019. Brooke Holman proposed and was awarded a UROP award for a research project in AY 2018-2019 to investigate science communication in social media. Sarah Baumann, a graduate from Carleton College, accepted an offer to be a graduate student in the GRASCE Lab, starting in August 2018.

At the time of this writing, Leilani is looking forward to a busy summer where she will be doing some research in Italy and Hawai`i, facilitating a two-day Earth Science professional development workshop for science teachers in rural Nebraska, and co-leading a nine-day field course across the Great Plains.

Leilani Arthurs

Carl Simpson

New to Boulder, Carl arrived as an assistant professor of paleobiology in Geological Sciences and as the Curator of invertebrate paleontology at the CU Museum of Natural History. Previously, He spent four years at the National Museum of Natural History, in Washington, D.C., He was also a postdoc at the Museum für Naturkunde in Berlin, Germany, and a postdoc in biology at Duke University. Carl received his PhD from the University of Chicago in 2006.

Carl Simpson

Carl is fascinated by the evolution and deep-time macroevolution of colonial marine animals such as bryozoans and corals. In these groups, evolution and adaptation occur at the interface of two hierarchical levels; the zooid, which is homologous to a single bird or ant, and the colony in which zooids are integrated and interacting constituents. His research focuses on identifying and understanding the timing and pattern of accumulating colony-level adaptations in living and extinct species, including these animals' ability to build reefs.

This year, Carl has been working on understanding the mechanisms driving the origins of multicellular organisms and on the strategies that bryozoans use to promote evolution at the colony level.

This summer, Emma Scher and Jorge Nieves, CU undergraduates, joined Carl's group as artists in residence. Emma is Senior Dance major. And Jorge is a Senior Film major. Both are interested in exploring ways to communicate the vastness of deep time and the large-scale patterns of the history of life.

Starting this fall, Sarah Leventhal will be joining the team as a graduate student. Sarah is coming from the University of Chicago and is interested in studying the evolution of growth strategies in colonial animals.

Lizzy Trower

Lizzy joined the Department in January 2018 as an assistant professor. Prior to coming to CU, she was an Agouron Geobiology Postdoctoral Fellow in the Division of Geological and Planetary Sciences at Caltech. Lizzy grew up in a suburb of Seattle, WA before moving to sunnier California for her academic training—first a BS in Geology from Caltech and then a PhD in Geology from Stanford. After having spent nearly twelve years in California, Lizzy was very excited to move to Colorado!

Lizzy is a process sedimentologist who focuses on chemical sediments—carbonates, cherts, and iron formations. Her research interests lie at the intersection of chemical sedimentology, geobiology, and geomorphology; her work applies modeling, experiments, field observations, microscopy, and in situ geochemistry to examine the interplay of chemical, physical, and biological processes on chemical sediments, with current projects concentrating on ooids, stromatolites, and granular iron formations. Through advancing understanding of the mechanisms by which these sediments form, Lizzy's research is expanding how these chemical sedimentary structures and strata can be utilized as quantitative paleoenvironmental proxy records.

Lizzy Trower

At CU, Lizzy's process sedimentology lab includes a new petrographic microscope optimized for advanced image processing and analysis, a dynamic particle size analysis instrument for rapidly and accurately characterizing size and shape of sediment particles, and a sediment transport laboratory to facilitate physical experiments exploring the interaction of sediment transport, fluid chemistry, and microbial activity on the rates, fabrics, and morphologies of chemical sediments. Instrument installation was completed during the Spring 2018 semester and the experimental facility should be complete by the beginning of the Fall 2018 semester. Lizzy is thrilled to join the scientific community at CU and looks forward to developing new collaborations.

Faculty News and Activities

Bob Anderson

The sastrugi of Niwot Ridge. Yes, sastrugi a real word, of Russian origin. It means parallel wave-like grooves and ridges sculpted into snow surfaces by the wind. Sastrugi are an example of a snow bedform, or a self-organized snow texture. Bedforms create roughness that has annoyed many polar explorers as they walk, ski or sled across snowbound landscapes. Graduate student Kelly Kochanski, working with Greg Tucker and Bob Anderson, is exploring their origin. She has deployed numerous time-lapse cameras on Niwot ridge. She has visited the ridge many times in the last three winters, working with undergraduates employed through the UROP program, to observe the evolution of the snow surfaces first hand. She has begun to unravel the typical history of a snow surface through careful analysis of the timelapse images. She has correlated the surfaces observed in the images with wind and air temperature records from nearby weather stations.

Sastrugi evolving on Niwot Ridge. View looks south toward Mt Evans on skyline. Wind consistently blows from the west, from right to left. New Geological Sciences faculty member Irina Overeem poses for scale. photo by Kelly Kochanski.

Snow falls smooth and flat, but during storms wind redistributes snow in both suspension and saltation. These processes collect snow into dunes that migrate downwind. Within hours these dunes begin to metamorphose, or sinter, through a process akin to the metamorphism of other minerals near their melting points. This hardens the snow and creates a hard surface. The new cohesive substrate is then sculpted by saltating snow grains that impact upwind-canted surfaces. They generate small ledges first, then complicated and higher amplitude three-dimensional grooves and ridges, like sastrugi.

Beyond being an interesting puzzle, the ornamentation of snow surfaces is important to understand because bedforms alter the thermal state of the surface as they evolve on sea ice, alter the surface roughness of our major ice sheets, and lower the reflectivity of all snow surfaces by creating small-scale shadows.

Becky Flowers

The CU TRaIL (Thermochronology Research and Instrumentation Lab) completed renovations and installed a new Agilent 7900 quadrupole ICPMS in Fall 2017 funded by NSF Instrumentation & Facilities grant EAR-1559306 to Prof. Becky Flowers and Dr. Jim Metcalf. This instrument has diverse capabilities, but is currently being used primarily to analyze the U-Th content of accessory minerals for (U-Th)/He geochronology and thermochronology.

Dr. Jessica Stanley, a former PhD student of Prof. Flowers, began a tenure-track assistant professor position at the University of Idaho in 2018. She received a Humboldt fellowship and completed a postdoctoral position at the GFZ-Potsdam in Germany during the last 1.5 years.

Agilent 7900 quadrupole ICPMS

Julio Sepúlveda

The Organic Geochemistry Lab (OG Lab) welcomed new members during the last year.

Graduate students Lina Pérez, Sarah Crump, Sebastian Cantarero, and Jon Raberg working in the OG Lab.

PhD student Sebastian Cantarero joined the OG Lab after obtaining a MS in Geology from the University of Minnesota Duluth and a BS in Geology from the University of Nebraska Lincoln. Sebastian is using intact polar lipids and compound-specific stable isotopes to reconstruction the diversity and physiology of microbial communities inhabiting oxygen minimum zones. PhD student Jonathan Raberg (co-advised by G. Miller and J. Sepúlveda) joined the OG Lab after obtaining a MS in Chemistry from the University of California Berkeley and a BA in Chemistry from Carleton College. Jon is working on the calibration of organic geochemical proxies for paleotemperature reconstructions in the Canadian Arctic (Baffin Island). Postdoctoral Scholar Dr. Greg de Wet (co-advised by G. Miller and J. Sepúlveda) joined the OG Lab after obtaining a PhD in Geosciences from the University of Massachusetts Amherst and a BSc from Bates College. Greg is working on the reconstruction of climate variability and its relationship with vegetation change in the Canadian Arctic (Baffin Island) during the Holocene and past interglacial period. Geology undergraduate student Steven Moran (Wichita State U.) worked as a UNAVCO RESESS summer intern during summer 2017 under the supervision of PhD candidate Garrett Boudinot.

Julio's group received essential funding during the past year from the American Chemical Society Petroleum Research Fund, NSF's Arctic System Science and Sedimentary Biology and Paleobiology Programs, and the Chilean National Commission for Scientific and Technological Research, which will allow them to continue expanding their research agenda and collaborations. Projects include: (a) Nitrogen Cycling During Black Shale Formation, (b) Predicting Arctic Change through Ecosystem Molecular Proxies (PACEMAP), (c) Faunal Composition, Provinciality and Paleobiology of a Late Cretaceous Arctic Vertebrate Assemblage Revealed Through Cross-Latitudinal Comparisons, (d) "CARbon Cycling and Physiological Traits in Phytoplankton Functional Groups under low pH/low OXygen conditions (CARpHOX)."

Julio's lab members also completed field work in different corners of the world. PhD student Lina Pérez-Ángel performed geological field work in the Sabana de Bogotá Colombia in summer 2017. PhD candidate Sarah Crump and postdoc Greg de Wet performed field work in Baffin

Island in Spring 2017 and 2018. PhD student Sebastian Cantarero was onboard the R/V Cabo de Hornos performing oceanographic sampling off the coast of northern Chile in Spring 2018. Julio and PhD student Jonathan Raberg plan to undertake field work in Baffin Island in summer 2018.

Anne Sheehan

Two PhD students from Anne Sheehan's research team, Danny Feucht and Jenny Nakai, completed their PhD degrees this past year – congratulations! Danny conducted a magnetotelluric study of the Rio Grande Rift for his PhD thesis, which included field work throughout Colorado and New Mexico and provided field opportunities to several undergraduate assistants as well as graduate students. Danny's work revealed an electrically conductive lower crust beneath the Rio Grande Rift attributed to partial melt and crustal fluids, and a transition from conductive to resistive mantle to the east beneath the Great Plains. Danny also interned at the USGS during his graduate studies, collecting new geophysical data as well as archiving legacy data sets. Danny is now working as a postdoctoral researcher at CU on a study of the geoelectric hazard to the US power grid, and will teach at the SAGE geophysics course in Santa Fe, New Mexico this summer. Jenny Nakai's thesis was entitled 'Earthquake studies of Continental Rift Deformation, Human-Induced Seismicity, and Subduction Zone Processes.' Jenny worked with seismic data from the EarthScope USArray and other networks to conduct a comprehensive study of seismicity in New Mexico and Colorado. She found many naturally occurring (tectonic) earthquakes, as well as even more earthquakes likely induced by wastewater injection activities, particularly in the Raton Basin area. Shemin Ge's former student Matt Weingarten conducted pore fluid pressure modeling to further explore the causative mechanism of the Raton Basin earthquakes in collaboration with Jenny. Further afield, Jenny participated in the deployment of ocean bottom seismometers offshore New Zealand, and conducted seismic attenuation studies using data from that experiment. She also deployed seismometers in Nepal to study aftershocks of the devastating April 2015 earthquake, in collaboration with scientists from UTEP, OSU, and UCR. Jenny was awarded an NSF postdoctoral fellowship to work at the University of New Mexico and starts that position on June 1, 2018.

Daniel Feucht (PhD '17) conducting magnetotelluric study of the Rio Grande Rift in south-central Colorado.

Jenny Nakai (PhD '18) downloading data from seismograph station near Greeley, Colorado.

Alexis Templeton

Oman Drilling Project: Templeton Lab Explores Modern Microbial Ecosystems in Ancient Mantle Rocks

In January-February 2018, Prof. Alexis Templeton, along with PhD students Katie Rempfert and Daniel Nothaft and research scientist Eric Ellison travelled to the Samail Ophiolite of Oman to participate in the scientific drilling activities of the Oman Drilling Project (ODP). Ophiolites are slices of ocean crust and mantle that have been tectonically emplaced onto continents, and Oman hosts the largest and best exposed ophiolite in the world. The ODP is a multinational collaboration to collect petrologic, geophysical, hydrologic, and biological data across the entire ophiolite sequence, from crust to upper mantle

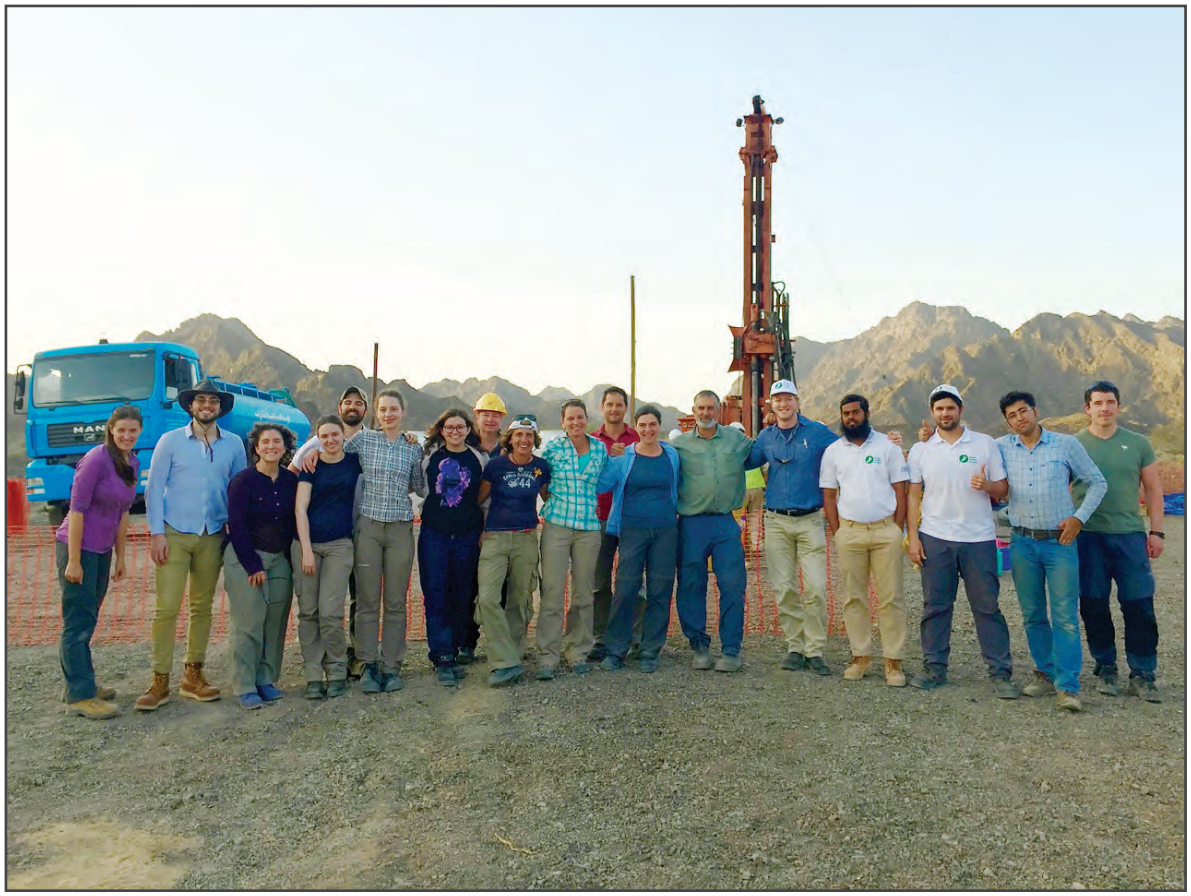
sections, to address a diverse range of scientific questions relating to the formation, hydrothermal alteration, and biotic and abiotic weathering of oceanic lithosphere. The Rock Powered Life (RPL; PI Templeton) NASA Astrobiology Institute (NAI) is a partner in the Oman Drilling Project focused on interdisciplinary research on how, when, and where geological systems power biological processes. The ultramafic rocks of the ophiolite react with water within the temperature limits of life, giving rise to hydrogen gas, a potent chemical feedstock that can be harvested by microbes in the subsurface, potentially fueling ecosystems independent of photosynthetic energy.

The CU-Boulder team coordinated the collection of high-integrity whole-round core samples to study subsurface biological activity. Katie Rempfert plans to look for organic signatures in the rock that are derived from the cell membrane lipids of microorganisms (lipid biomarkers) to determine whether detectable biosignatures are produced under these conditions that may persist and indicate any past presence of life. This "molecular fossil" record will inform the feasibility of future efforts to detect signatures of subsurface life in similar potential habitats on Mars or other rocky bodies with analogous mineralogical assemblages. Exploratory research in lipid biomarker analysis of Oman samples was funded through a Spetzler family departmental grant and is now supported through a NASA Earth and Space Science Fellowship awarded to Rempfert in 2017. Eric Ellison collected core for studies of microscale mineralogy, aiming to determine what specific chemical reactions are important during modern, low-temperature water-rock interaction and accomodate the production of hydrogen gas, a process that is not well understood at temperatures below about 150°C. Daniel Nothaft collaborated with ODP hydrologists using a packer system, which enabled the first fluid, gas, and biomass sampling at discrete, isolated depth intervals in an ophiolite. By controlling for fluid mixing during pumping, packer systems will facilitate the analysis of fluid chemistry changes across highly variable hydrogeologic regimes in the ophiolite. Nothaft will use these data to inform his ongoing studies on the origin and possible microbial cycling of methane and other carbon compounds in the ophiolite. RPL Co-I's and collaborators will conduct additional studies including rate assays targeting specific biological metabolisms of interest in the rock, metagenomics, and more.

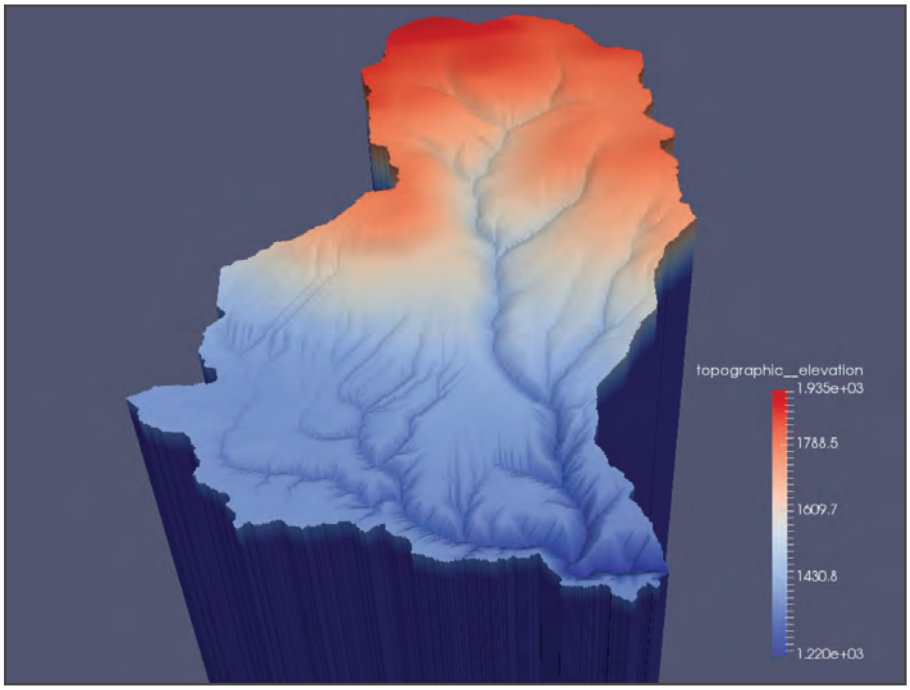
Greg Tucker

When hazardous waste material sits in a location that may be susceptible to erosion, how do we estimate the likelihood of future contaminant release? This is a question that Greg Tucker's group has been grappling with, in the context of a former nuclear fuel reprocessing plant in western New York State. During its operational life in the late 1960s and early 1970s, the plant generated a variety of radioactive waste products; much of this material remains entombed at the site today. The plant lies atop a plateau underlain by soft late Pleistocene glacial sediments. Active erosional processes, including landsliding and gully propagation, are gradually gnawing at the plateau edges. In a project spearheaded by Geological Sciences and CIRES postdoc Katy Barnhart (PhD '15), Greg and his team (whose CU members included

Alexis Templeton's Oman Drilling Project Geology and Biology Teams at Drill Site in Mantle Section of Semail Ophiolite.



postdoc Matt Rossi and PhD students Charlie Shobe, Rachel Glade, and Harrison Gray) undertook a computational modeling study of past and future long-term erosion at the site. They took advantage of a unique aspect of the site's recent geologic history: the last recession of glacial ice about 13,000 years ago left behind a relatively smooth surface that has subsequently been deeply incised by stream valleys. By reconstructing this smooth post-glacial surface and running a suite of erosion models forward in time from the late Pleistocene to the present day, the team was able to test and calibrate a collection of alternative models. The models were crafted using Landlab Toolkit, a Python-language modeling framework developed by Greg's group and Community Surface Dynamics Modeling System (http://landlab.github.io). In addition to providing a basis for making projections of future erosion, the results shed new light on the key principles of long-term landscape evolution in this type of post-glacial environment, and yielded a new method for testing quantitative models. (For more on this study, see https://www.westvalleyphaseonestudies.org, report titled "Modeling Long-Term Erosion…")



Snapshot from a computer simulation of drainage network incision since 13 ka in a small (~4 km^2) drainage basin. Scale bar shows elevation in feet above mean sea level.

Paul Weimer

Paul taught three courses this past year: Sequence Stratigraphy and Basin Analysis; a reconstituted version of Geology of Colorado--now one of the 1000 level classes; and Unconventional Resources which was taught unconventionally. He organized the AAPG-SEG student section talks, which complemented all of the teaching. Highlights included: visiting the offices of SM Resources, Jagged Peak, Whiting, and Four Points where students were given detailed summaries of their activities in unconventional plays; talks from the Discovery Thinking sessions at the National AAPG Convention; and two AAPG and SEG Distinguished Lecturers.

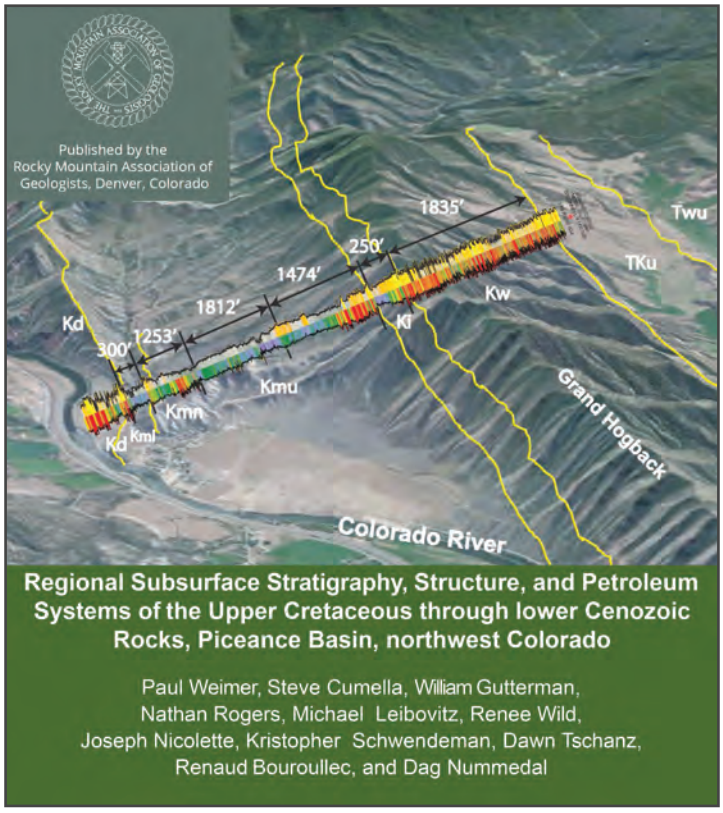
Paul supervised 7 graduate and 2 undergraduate students this past year. Their research focuses on the deep-water margins of Colombia, Falkland Islands, southwest Madagascar (Morondavo Basin), eastern Mediterranean, Myanmar, Delaware Basin, and Gulf of Mexico.

Later this year, Paul's third co-authored book will be published by The Rocky Mountain Association of Geologists. The book provides a detailed summary of the major scientific results of an industrial sponsored research consortium on the Piceance Basin. The book comprises 12 chapters, 850 pages, with 550 figures. The book evolved from the work of 6 MS theses and 2 research scientists.

Paul also has organized several sessions on global trends for the AAPG International meeting in October in London and for May meeting in Salt Lake City.

Last November, he received the Don R. Boyd Medal for Excellence in Gulf Coast Geology from the GCAGS in San Antonio. The award is given "for distinguished standing in Gulf Coast Basin research geology, and professional leadership." In May, he received Honorary Membership from the AAPG in Salt Lake City.

New projects include rebooting the geo-animations project (igp.colorado.edu) from suspended animation, and serving on the Executive Committee of the American Geosciences Institute (AGI).



Proposed cover of Paul Weimer's third co-authored book to be published by the RMAG.

Geological Sciences Front Office

The Department of Geological Sciences welcomes Kara Bajdas as the Graduate Program Administrator. Kara comes to the Department from the office of Admissions here at CU Boulder. She brings a wide array of experience to our Graduate Program and we hope she is with the Department for many years to come.

Kara Bajdas

L-R: Megan Brown, Marilynn Bender, Shana Mercer, and Nadine Reitman enjoying the Benson at 20 event.

The Department of Geological Sciences has a new website

The new site is filled with useful information and current news and events.
Thanks to Sebastian Kopf for spearheading the efforts and Toby Halamka for her outstanding assistance.
You can access the new site at www.cugeology.org or www.colorado.edu/geologicalsciences

Upcoming Events

There will be a Department-sponsored event associated with the Homecoming Reunion weekend of October 25-28. We will be reaching out to you soon with details. You can learn more about the Homecoming Reunion events at the CU Alumni Association Website https://www.colorado.edu/homecoming/

- Alumni Awards Ceremony - The second oldest tradition on campus, honoring CU Boulder's best and brightest
- BuffTalks - A micro-lecture series featuring professors from the Colleges of Arts & Sciences and Education
- Buffs on Tap - An afternoon of tasting beer and wine crafted by CU Boulder alumni
- Parade & Pep Rally - Buffs take over Pearl Street Mall for a celebration of CU pride
- Ralphie's Corral - The Official CU Tailgate before the big game against Oregon State
- Homecoming Football Game – All alumni save 20% on tickets to the Oregon State at CU game
- Plus, reunions, young alumni events and more!

Everyone that pre-registers and attends Homecoming 2018 will receive a free commemorative T-shirt.

Paul Boni Retires After 31+ Years

Paul Lyle Boni retired in September of 2017 after 31 years of service to the Department of Geological Sciences.

Paul served in many different capacities and was well know as the "facet" of the rock shop in the basement of the Benson Earth Sciences building.

Paul had been the building proctor for the Benson Earth Sciences building for the last several years of his tenure and was also very active in the state employees' union, Colorado WINS.

The Department held a retirement party for Paul on September 29th, 2017 and many friends stopped by to wish him well.

We hope that Paul has a rewarding and satisfying time hunting, fishing and spending time with family and friends during his retirement.

Thank you Paul!

On The Cover...

Cover photo: A graduate student samples lava from Kilauea, Hawaii, during the 2018 Planetary Field Geology course that was led by Associate Professor Brian Hynek and Research Associate Carolyn Crow.

New 1000 Level Courses in the Department of Geological Sciences

We revamped the 1000 level courses after two years of hard work involving many faculty. The curriculum committee chaired by Eric Small led the charge. In addition to maintaining our strong traditional geologic foundation, these new courses showcase our strengths in broader Earth Sciences. Each has a clear emphasis on relevant societal issues whether it is natural hazards or geo-energy, past and current climate or environment. We'll strive to offer these courses each semester by organizing a cohort of 4-5 faculty for each of the courses. As These courses will count towards the general science credit requirement, we hope these courses will be attractive to a broader population of students, majors and non-majors, from STEM or non-STEM fields.

GEOL 1010: Exploring Earth
Introductory geology for majors and non-majors. Studies Earth, its materials, its characteristics, its dynamic processes, and how it relates to people.

GEOL 1012: Exploring Earth for Scientists
Studies Earth, its materials, its characteristics, its dynamic processes, and how it relates to people. This course is an introductory geology course suitable for geology and other STEM majors. Like GEOL 1010, but taught at a higher intellectual level with a greater amount of quantitative analysis.

GEOL 1020: History of a Habitable Planet
In this three-credit lecture course, we explore how the physical aspects of the Earth (its oceans, crust, environments, atmosphere, and the climate) have changed over time due to the origin and evolution of life. We will use observations from the rock and fossil record, along with insights and comparisons to modern Earth processes, to analyze the pattern and explore the causes of those changes over billions of years. Because thinking about deep time and historical sciences are outside of our everyday experiences, we will learn about the history of deep time.

GEOL 1040: Geology of Colorado
Reviews the geologic evolution and history of Colorado. It first develops the basic concepts needed to interpret the geology and then systematically shows how the state evolved through geologic time. Designed for those who enjoy understanding the beauty and splendor of Colorado.

GEOL 1060: Global Change: An Earth Science Perspective
Focuses on evidence for planetary warming, climate change, glacier and ice-sheet melting and sea level rise both now and in the recent past. Attempts to develop understanding of the interactions within the coupled Earth system that regulate such changes. Utilizes examples from the geological and instrumental records, and evaluates the global warming forecast.

Alpine Glacier photo by Lon Abbott and Terri Cook

GEOL 1150: Water, Energy and the Environment: An Introduction to Earth Resources
Explores how geological processes and human populations together affect the quantity, quality and availability of Earth resources. Includes examination of the water cycle and how humans use and modify water; fossil-fuel and mineral resources, and renewable energy options. Sustainable versus non-sustainable use and population growth is considered.

GEOL 1170: Our Deadly Planet
This course investigates those events so dramatic and catastrophic that they have left evidence in the geologic record that suggest they significantly impacted life on the planet. These included, but are not limited to, violent volcanic eruptions, mega-earthquakes and associated tsunamis, landslides and collapse of volcanoes, megafloods, rapid climate change, superstorms, and impacts from asteroids and comments. The intent is to use examples from recent events and processes to frame and interpret evidence for these types of events observed in the rock record.

GEOL 1180: Our Microbial Planet
This course examines how microorganisms shape the world around us, both throughout Earth's history and today. Major topics include the origin and evolution of life, the awesome abilities of microbial life, the interplay between microbes and their environments, roles of microbes in global change, and applications of microbiology in biotechnology and energy.

Field Trips

2017 Bill Bradley New Graduate Student Field Trip

Rhiana Henry, Mike Zawaski, Katherine Pfiefer, Shemin Ge, and Emily Fairfax at the New Grad Student Field Retreat dinner at the Mountain Research Station.

Lon Abbott and Bob Anderson at the New Grad Student Field Trip.

In the Field

Planetary Field Geology Course in Hawaii

In February, 2018, 20 aspiring planetary geology graduate students joined Associate Professor Brian Hynek and Research Faculty Carolyn Crow for a week-long field course on the Big Island of Hawaii. This course provided an in-depth study of volcanic, tectonic, and fluvial analogs in Hawaii for Mars, Venus, Mercury, and Io. They examined eruption styles and the evolution of shield volcanoes on the flanks and/or summits of Kilauea, Mauna Kea, and Mauna Loa and the associated tectonic features including active rift zones and landslide scars. The Fire Goddess Pele cooperated, and they were able to hike to active lava flows – a sure highlight of the students' graduate careers! They are deeply thankful for departmental funding from the Bill Braddock Field Fund to support this amazing educational experience for our students.

Graduate student Mike Zawalski making new rocks.

Field Geophysics

Undergraduate Corey Flynn sets up magnetics and ground conductivity survey for field geophysics class, CU South Campus.

Field geophysics class conducting electrical resistivity and seismic refraction study on CU South Campus.

Field Hydrogeology

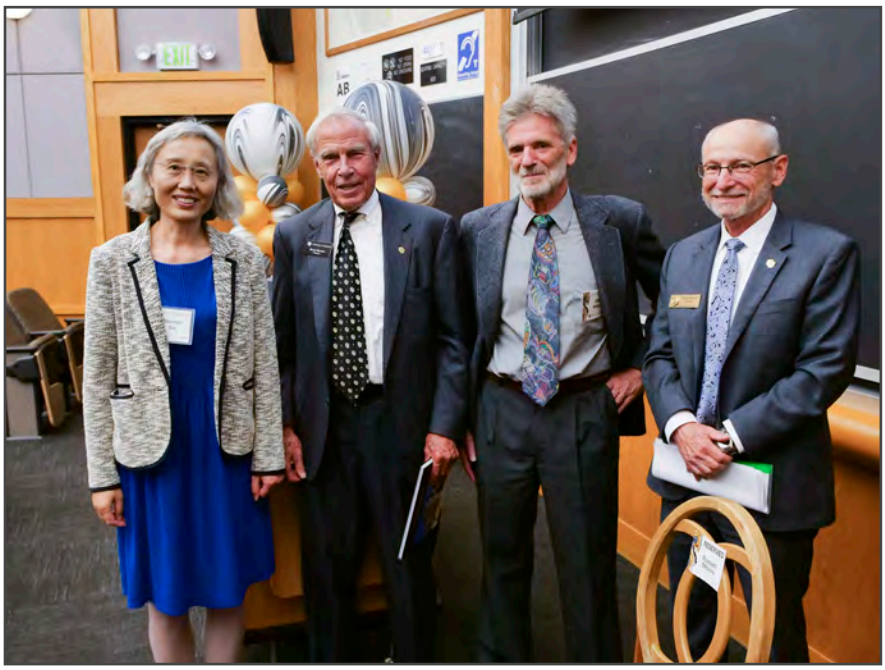
Students examining heterogeneity in outcrops at Sawhill Ponds near Boulder.

Students sampling wells for water quality below a mine near Ward, CO.

Your generous support helps to fund many of our graduate and undergraduate field trips.
Thank you!

Post-Benson 20 Celebration

L-R; Shemin Ge, Bruce Benson, Giff Miller, and Russ Moore



Patty Corbetta and Ria Spetzler

Toby Halamka

Donna and Larry Anderson

Chuck Stern and Dave Peterson

Lukas Haas

Marcy Benson, Suzanne Larsen, Chris White, an

David Budd and James Judd

Matt Silverman

Pete Birkeland, Joe Smyth, Sue Birkeland, and Sebastian Kopf

L-R; Bruce Benson, Hartmut Spetzler, Emily Verplanck, Alex Skewes, and Chuck Stern

Pete Birkeland, Heather and John Roesink

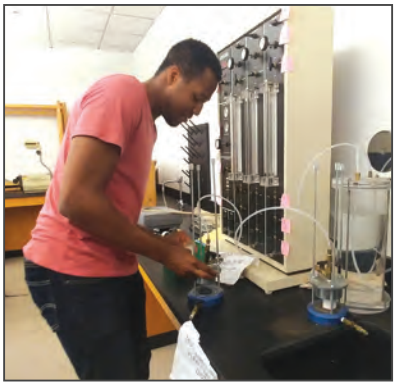
d Jim White.

A new era in Electron Microprobe Analysis at CU begins with hiring of Dr. Aaron Bell

The Department of Geological Sciences welcomes Dr. Aaron Bell as a Research Associate and the new Electron Microprobe Lab Manager. He is taking over for Dr. Julien Allaz, who recently left to return to his home country for a similar position at the ETH in Zurich, Switzerland. Aaron started here on June 4, 2018. Aaron obtained his PhD from the University of Nevada-Las Vegas in 2010 in the area of experimental petrology and magmatic-hydrothermal ore deposits. Prior to coming to CU, he was a research scientist at the Institute of Meteoritics at the University of New Mexico. Aaron brings over 10 years of experience operating EMPs and prior experience managing a probe lab at UNLV. His current research interests range from the processes responsible for formation of chromite horizons in layered mafic intrusions to redox signatures in achondrites and Martian meteorites.

Geology BBQ in North Boulder Park

2017-2018 Undergraduate Mentoring Projects



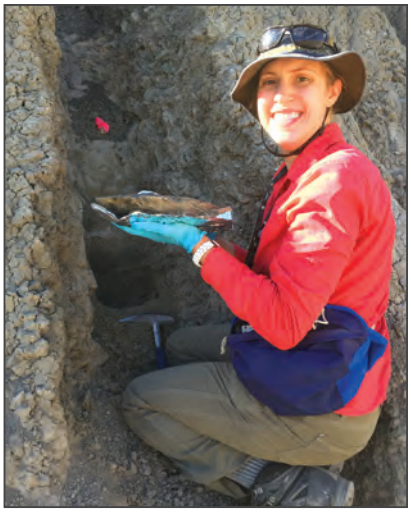
Mazi-Mathias Onyeali measuring hydraulic conductivity of core samples using constant-head permeameter tests.

Mazi-Mathias Onyeali has spent the last year and a half working with graduate student Megan Brown on a project entitled: Denver Basin Combined Disposal Zone Hydraulic Conductivity Estimation via Constant-Head Permeameter Testing. Mazi has been running constant-head permeameter tests on core samples from the Denver Basin. In addition, Mazi is working on a generic modeling project testing how heterogeneity in the wastewater disposal injection interval changes pore pressure results. Mazi is taking the results of the permeameter tests and creating relations to previous permeability results completed on core samples by petroleum and service companies. He then is using his relations to estimate the heterogeneous hydraulic conductivity for the injection interval (~500 m) and using the results as a guide for his generic models.

Michael Dulay has worked with grad student Becky Simon on a project to identify small-scale periodic lithologic variability in the Niobrara Formation. Mike's objective was to learn to use high-resolution drill core photos as a proxy for smaller-than-well log-scale lithological measurements, and to identify periodic alternations between light-colored, calcite-dominant layers and dark-colored, organic-rich layers. Mike formatted the core image data, performed a series of Blackman-Tukey Fourier Transforms to find repetition over the length of a core, and then converted the Fourier frequencies back to length units to show which alternating calcite and organic rich rock layers are part of a mathematically significant pattern.

Toby Halamka is working with Shemin Ge and graduate student Becky Simon on a project to track water consumption for hydraulic fracturing operations in Colorado. Toby tallied fracturing treatment water usage in the Denver and Piceance basins for the last 5 years and compared it to the cumulative fractured-treated wellbore lengths completed over the same time frame, to construct a series of predictive probability density functions for each oil and gas operator's water use. She used those functions to estimate the likely water usage for proposed wells in the next two years, and presented her results at the 2017 AGU (American Geophsyical Union) Fall Meeting in New Orleans, LA.

Anna Todd is working with Anne Fetrow to describe sedimentologic, climatic, and environmental variability during the early Cretaceous in Nevada. They conducted three weeks of field work in central Nevada measuring and



Anna Todd (senior undergraduate geology major) collecting bulk organic carbon samples during field work in central Nevada.

describing sedimentary section, and collecting carbonate and bulk organic carbon samples. During the year, they have been working together in the CUBES-SIL throughout the geochemical prep and analysis process. Anna plans to return to the field this summer to finish sample collection with the help of the UROP undergraduate grant.

Andy Whittle is working with Emily Fairfax. Andy has been using Google Earth satellite imagery to map all of the beaver dams and beaver ponds in the Medicine Bow National Forest between Laramie, WY and Cheyenne, WY. So far, he has mapped over 700 dams within an 86 mi2 area. Using empirical models previously derived in the literature, Andy estimated the total volume of water stored in these beaver ponds and will compare it water volumes stored in nearby manmade reservoirs. Additionally, during field work this summer Andy and Emily will collect bathymetric measurements and ground survey of a portion of the mapped beaver ponds, and compared volume estimates from the models with the field data. Andy has already made a scientific poster of some of his results, and Emily and Andy hope to combine Andy's dam mapping work with previous dam mapping efforts and coauthor a paper on the distribution of beaver dam sizes and associated pond areas in the American West.

Nancy Barnard, Fred Barnard, Mara Marks, and Steve Marks at Benson 20.

Graduate Student Research, Outreach, Publications and Awards

Megan Brown and **Becky Simon** were selected as part of the Governor's Energy & Environment Fellowship Program. They were two of seven Colorado fellows chosen to spend 15 weeks working alongside members of the state's Executive Agencies. Both were placed in the Department of Natural Resources with the Colorado Oil and Gas Conservation Commission. Megan worked to improve training programs for operators regarding the Underground Injection Control permitting process, which addresses permanent storage of liquid wastes from oil and gas operations. Becky analyzed public feedback on proposed drilling sites, including the major comprehensive drilling plan proposed in eastern Boulder County, to identify ways that the Commission might interact more effectively with citizens who are likely to have oil and gas development near their homes.

Jackie Baughman has had an exciting 2017-2018 academic year! She just wrapped up teaching GEOL 1010 (Intro to Geology), which provided her with excellent teaching experience and allowed her to hone her time management skills. Importantly she thinks that the students enjoyed the course as well – "I really enjoyed how involved the class was despite being a 100+ student lecture. The in-class activities and place project helped solidify topics we covered in class, and it was way more fun to get to interact with classmates!" – 1010 student response.

Jackie also wants to thank the Department for a travel grant, which allowed her to attend both GSA and AGU this year. During which she joined the GSA Structural Geology and Tectonics Division as the student representative, convened a session at AGU, and made several important contacts – one of which helped her land her new position as a Visiting Professor at Bowdoin College starting fall 2018. She defended her PhD in late June and with the second chapter published in G-cubed in April - "Deciphering a 2 Gyr-long thermal history from a multichronometer (U-Th)/He study of the Phalaborwa carbonatite, Kaapvaal craton, South Africa" - she is feeling optimistic that she will actually have a little time to sleep during the homestretch.

Jackie thanks CU Geological Sciences department for continued encouragement, support and opportunity! And thanks Becky Flowers for being a truly tremendous advisor!

Victoria Crystal models a triceratops nasal horn.

Victoria Crystal's finger at the K-Pg boundary in North Dakota.

Victoria Crystal is a third year PhD student working with Dr. Jaelyn Eberle and Dr. Katie Snell. Her research focuses on reconstructing changes in temperature and carbon cycling across the Cretaceous-Paleogene (K-Pg) boundary in the Denver Basin and the Williston Basin. She also assists the Denver Museum of Nature and Science in the field collecting dinosaur fossils. Along with her research, She is also passionate about teaching. Victoria has TA'd the GEOL 3410 Paleobiology Lab for the last three years, and this fall she will be teaching the full lecture portion of the class. She is really looking forward to it!

Emily Fairfax worked with fellow graduate student Megan Brown to develop and implement a TA training on accessibility and inclusion for the new and returning TAs in fall 2017. They also administered over 1000 surveys to the undergraduate students enrolled in lab courses taught by those TA's to assess the effectiveness of their training at increasing feelings of inclusion amongst the undergrads. They are currently working on writing their work up for publication this summer.

She also TA'ed the lab for GEOL 4241 Geomorphology and built several demos for and added warm up activities to many of the labs. As an optional assignment, the students could submit a photo of them with their favorite geomorphic feature from the Utah field trip along with a haiku describing the feature. The students wholly embraced their creative side, and Emily thoroughly enjoyed looking through their pictures and reading their poems.

Emily's CU Summer Discovery high school interns monitor a beaver dam in the early stages of construction on Boulder Creek.

Emily is helping with the RESESS (Research Experiences in Solid Earth Sciences for Students) this summer, an REU style internship program designed to increase the diversity of students studying the geosciences.

Emily also mentored two high school students last summer through the CU Summer Discovery program. Their work culminated in a poster session, and Emily's interns combined Google Cardboard Virtual Reality and traditional poster-making techniques to create multimedia poster presentations. People who visited her interns' posters had the opportunity to "visit" the field sites in virtual reality while the students described the work they did at the sites.

Emily submitted her first paper for publication this past August and presented a talk at the GSA annual fall meeting on her results. Her work was on the ability for beaver dams to buffer the effects of drought on riparian vegetation on Susie and Maggie Creeks in Nevada.

Emily is a member of the graduate student colloquium planning committee, and this year they rolled out the new post-colloquium social hour. The initiative for the social hour was driven by fellow graduate student Anne Fetrow. Emily's main responsibilities this year were helping organize colloquium logistics, bar tending social hour, and helping improve the sustainability of the committee.

She also volunteered as a science judge at the Regional Ocean Science Bowl and National Ocean Science Bowl this year. She learned a lot about oceans, fish, and ocean policy. She also learned that there are some seriously impressive high school students out there who sincerely care about the future of our oceans.

Anne Fetrow is an active member of the Geology Colloquium planning committee and this year she spearheaded the effort to establish the new Colloquium Social Hours where food and drink are served to help in fostering discussions with our weekly speakers. Anne is happy to report that Social Hours have proved to be a big hit with the Department and they will continue next year every Wednesday from 5-6pm in. Join us for a beer!

Anne, along with Lina Perez-Angel and Rachel Havranek (all PhD students), led a paleoclimate focused workshop for CU's annual "Expanding Your Horizons" conference for middle school-aged girls interested in exploring possible STEM careers. They explored how paleoclimatologists examine how the Earth's climate has varied in the past and why we should be concerned about our currently changing climate.

Mylène Jacquemart, together with a team of female graduate students from CU Boulder (current and former E-Bio graduates) and the University of Alaska Fairbanks (UAF), Mylène has co-founded Girls on Rock, a tuition-free field-science expedition for high school girls from underrepresented communities. Girls on Rock runs under the umbrella of Inspiring Girls Expeditions (IGE), originally founded by glaciologist Erin Pettit (UAF). Today, the Inspiring Girls Expeditions have a nearly 20-year track record of inspiring young women from all backgrounds to embrace science and the outdoors. With Girls on Rock, this opportunity is now also available through CU and is officially hosted at CU's Cooperative Institute for Research in Environmental Sciences (CIRES).

Girls on Rock's mission is to kindle young women's interest in science in a challenging alpine environment, that increases their physical and intellectual self-confidence. Many girls don't have the opportunity to experience the thrill of scientific exploration, or to discover the empowerment of travelling through challenging alpine environments. The 9 expedition participants and 4 instructors will spend 10 days in Colorado's rugged Gore Range. Over the course of the expedition, the girls will learn to observe and think like scientists. They will design and conduct their own field research projects, which they will present to the public at CU's Mountain Research Station on July 31st, 2018. For ways to support Girls on Rock, stay informed or volunteer, visit http://cires.colorado.edu/outreach/projects/girlsonrock

Your generous support helps to fund many of our graduate programs and research initiatives enabling our graduate students the ability to positively impact the world around us.

Thank you!

Mylène Jacquemart with Girls on Rock.

Graduate Student First-authored Publications

Baughman, J.S., Flowers, R.M., Metcalf, J.R., and Dhansay, T., (2017), Influence of radiation damage on titanite He diffusion kinetics: Geochimica et Cosmochimica Acta, v. 205, p. 50-64.

Brown, M.R.M., S. Ge, A.F. Sheehan, and J.S. Nakai (2017), Evaluating the Effectiveness of Induced Seismicity Mitigation: Numerical Modeling of Wastewater Injection near Greeley, Colorado, Journal of Geophysical Research Solid Earth,122, 6569-6582, doi: 10.1002/2017JB014456.

Brown, M.R. and S. Ge, 2018, Small earthquakes matter in injection induced seismicity. Geophysical Research Letters, 45. doi: 10.1029/2018GL077472.

Feucht, D. W., A. F. Sheehan, and P. A. Bedrosian (2017), Magnetotelluric imaging of lower crustal melt and lithospheric hydration in the Rocky Mountain Front transition zone, Colorado, USA, J. Geophys. Res.: Solid Earth, 122, doi:10.1002/2017JB014474.

Glade, R.C., and Anderson, R.S. (2018) Quasi-steady evolution of hillslopes in layered landscapes: An analytic approach: JGR Earth Surface, 10.1002/2017JF004466.

Gray, H.J., Tucker, G.E., Mahan, S., McGuire, C., and Rhodes, E.J. (2017) On extracting sediment transport information from measurements of luminescence in river sediment. Journal of Geophysical Research, v. 122, no. 3, p. 654-677, doi:10.1002/2016JF003858.

Gray, H.J., Shobe, C.M., Hobley, D.E.J., Tucker, G.E., Duvall, A.R., Harbert, S.A., and Owen, L.A. (2017) Off-fault deformation rate along the southern San Andreas fault at Mecca Hills, southern California, inferred from landscape modeling of curved drainages, Geology, v. 43, no. 1, p. 59-62. doi:10.1130/G39820.1.

Harning, D.J., Geirsdttir, and Miller, G.H., 2018a. Punctuated Holocene climate variability of Vestfirir, Iceland, linked to internal/external variables and oceanographic conditions. Quaternary Science Reviews 189, 31-42.

Harning, D.J., Thordarson, T., Geirsdttir, Zalzal, K., and Miller, G.H., (2018b). Provenance, stratigraphy and chronology of Holocene tephra from Vestfirir, Iceland. Quaternary Geochronology 46, 59-76.

Harning, D.J., Geirsdttir, Thordarson, T., Miller, G.H., (2018c). Climatic control on Icelandic volcanic activity during the mid-Holocene: COMMENT. Geology 46, e443.

Johnson, J.E., Flowers, R.M., Baird, G.B., and Mahan, K.H., (2017), Inverted zircon and apatite (U-Th)/He dates from the Front Range, Colorado: High-damage zircon as a low temperature (<50C) thermochronometer: Earth and Planetary Science Letters, v. 466, p. 80-90.

Nakai J. S., Weingarten M., Sheehan A. F., Bilek S. L. and Ge S. (2017). A possible causative mechanism of Raton Basin, New Mexico and Colorado earthquakes using recent seismicity patterns and pore pressure modeling. Journal of Geophysical Research: Solid Earth, 122. https://doi.org/10.1002/2017JB014415.

Pendleton, S.L., Briner, J.P., Kaufman, D.S., and Zimmerman, S.R., 2017, Using cosmogenic 10Be exposure dating and lichenometry to constrain Holocene glaciation in the central Brooks Range, Alaska: Arctic, Antarctic, and Alpine Research, v. 49, no. 1, p.115–132, doi:10.1657/AAAR0016-045.

Pendleton, S.L., Miller, G.H., Anderson, R.A., Crump, S.E., Zhong, Y., Jahn, A., and Geirsdottir, Á., (2017), Episodic Neoglacial expansion and rapid 20th century retreat of a small ice cap on Baffin Island, Arctic Canada, and modeled temperature change: Climate of the Past, v. 13, no. 11, p.1527.

Pérez Angel, L. C., and Molnar, P. (2017). Sea Surface Temperatures in the Eastern Equatorial Pacific and Surface Temperatures in the Eastern Cordillera of Colombia During El Niño: Implications for Pliocene Conditions. Paleoceanography, 32(11), 1309-1314.

N. R. Schnepf (2017). Going electric: Incorporating marine electromagnetism into ocean assimilation models. Journal of Advances in Modeling Earth Systems, 9. doi:10.1002/2017MS001130.

Shobe, C.M., Tucker, G.E., and Barnhart, K.R. (2017) The SPACE 1.0 model: a Landlab component for 2-D calculation of sediment transport, bedrock erosion, and landscape evolution, Geoscientific Model Development, v. 10, no. 12, p. 4577-4604. doi:10.5194/gmd-10-4577-2017.

Weisberg, W.R. (undergrad RESESS intern), Metcalf, J.R., Flowers, R.M., (2018), Distinguishing slow cooling versus multiphase cooling and heating in zircon and apatite (U-Th)/He datasets: the case of the McClure Mountain syenite standard: Chemical Geology, v. 485, p. 90-99.

Alexis Templeton
and graduate Kelly Curtis.

Fall 2017 graduates enjoying cupcakes
and punch at the reception.

Fall 2017 Geology Graduation Ceremony.

Graduate Student External Awards

Megan Brown

- The Spetzler Grant assisted Megan Brown to learn a new software for studying coupled thermo-hydro-mechanical problems in geological media.
- Outstanding Student Paper Award (OSPA) Award.

Emily Fairfax

- Outstanding Student Award from the Association for Women Geoscientists in spring 2018. Emily feels honored to be part of a network of such incredible, inspiring women.

Anne Fetrow

- The Department Travel Grant helped Anne to travelled to central Spain to the Las Tablas de Daimiel National Park to kick-start a new project seeking to create modern calibration of palustrine (pond) carbonates.
- National Science Foundation Graduate Research Fellowship to develop a modern calibration to better interpret traditional stable and clumped isotope data from wetland carbonates that are preserved in the rock record.
- This summer, Anne will travel on a NSF travel scholarship to central Italy to participate in the Urbino Summer School in Paleoclimatology. USSP is an annual short course that focuses on past climate dynamics and provides valuable networking opportunities with leading paleoclimate scientists from around the world.

Rachel Glade

- GSA (John T. and Carol G. McGill Research Award)

Simon Pendleton

- Outstanding Student Presentation Award (OSPA) from the 2017 AGU meeting.
- GSA Research Grant Award
- Colorado Mountain Club Foundation 14'er Fund Grant

Lina Perez

- Department Travel Grant which allow me to go for the first time to AGU2017 in New Orleans. I presented a poster and receive a lot of good feedback in my doctoral thesis.
- Honorable Mention Award of the Figueroa Family Fellowship from the Graduate school. (scholarship is awarded in recognition of your commitment to the achievement of a diverse student body and your work in improving the state of our world and its people.)
- The 2017 Lewis and Clark award to do my fieldwork in Colombia

Charlie Shobe

- CU Beverly Sears Graduate Research Fellowship
- GSA Research grant
- Thompson writing award from CU's Center of the American West.

Rebekah Simon

- AAPG Best Student Oral Presentation Award

Jefferson Yarce and Melissa Bernardino at the Seismological Society of America meeting in Miami.

Graduate Student Department Awards

Johnston Award	Rachel Havranek
O'Dunn Scholarship	Megan Brown
Patterson Geology Scholarship	Emily Fairfax
Spetzler Family Fund	Clara Asamoto, Anne Fetrow, William Skorski, Mike Zawaski, Colin Sturrock
W. Thompson Research Fund	Enrique Chon

Rachel Glade accepting the GSA John T. and Carol G. McGill Research Award.

Sean Sundermann was the Fall 2017 commencement speaker. Sean is a Geological Sciences Alum and also serves on our Advisory Board.

Spring 2018 Geology Graduation Ceremony.

L-R: Chris Chapman, Andres Lopez, Diego Gonzalez, and Mazi-mathias Onyeali at the 2018 Spring graduation ceremony.

Penny Patterson delivers the commencement speech at the 2018 Spring graduation ceremony.

Degrees Awarded (Fall 2017- Spring 2018)

BA Geology Majors

Dane Abernathy
Ragan Anthony
Colton Burkhart
Jonah Charles Chamberlain
Christopher Troya Chapman
Kelly Christine Curtis
summa cum laude
Hassan Sultan Dasuki
Sydnie Michal Diers
Christopher Donaldson
Michael Dulay
John Stonebracker Edwards
Lauren Ellissa Eng
Kristin Noel Farber
Jordan Christian Fushimi
William Gieser
Diego Alejandro Gonzalez Osuna
Eric Gunderson
William Gutterman
Blaise D. Halloran
Robert Hauck
Dylan James Helt
Chelsea Ann Herbertson
Isaac Louis Hinz
magna cum laude
Arian Syah Jenie
Gary William Johnson
Blake Lawrence
Ricardo Flores Madera
Sonal Sudhir Marfatia
Kyle Charles Mathews
Noah Keegan McCorkel
Carrie McWhorter
summa cum laude
Will Nelson
Emily Kathleen O'Hare
Mazi-Mathias Chukwuezi Onyeali
David Francis Pasquale
Alexander Peleman
Rayssa Martins Pimentel
summa cum laude
Emma Plentl
Hairil Ramena
Tyler Allen Reyes
Tayler Robertson
Alejandro Jose Murillo Silva
magna cum laude
Alexander Michael Sketers
Helle Leth Skjetne
Connor Macrossie Smith
Samuel Prescott Walker
Janice Wallenburg
Dianao Wang (Dion)
Colby Leland Zink

Geology Majors Graduating with Honors Theses

Kelly Christine Curtis	Using zircon morphology to understand metasomatic fluid alteration during the Big Sky Orogeny
Isaac Louis Hinz	Understanding early life through the formation of iron-silicates in banded iron formations
Rayssa Martins Pimentel	Zircon (U-Pb) and (U-Th/He) geochronology of the Sante Fe impact structure
Alejandro Jose Murillo Silva	Paleoclimate of the South Park Basin ca. 34 Ma

Undergraduate Student Awards

Outstanding Geology Major, T. Keith Marks Scholarship	Anna Todd
Outstanding Geology Senior, Johnston Scholarship	Evan Tucker
Outstanding Geology Major, Kolber Scholarship	Rayssa Pimentel
Rocky Mountain Association of Geologists "Pick" Award, Gustafson Scholarship	Isaac Hinz
Association of Woman Geoscientists Outstanding Woman Geoscience Student, O'Dunn Scholarship	Spencer Zeigler
Outstanding Geology Major, Bruce Curtis Scholarship	Toby Halamka
Outstanding Geology Major, T. Keith Marks Scholarship	Michael Dulay
Outstanding Geology Major, Stanton Scholarship	Corey Flynn

Spencer Zeigler and Shannan O'Dunn at the Association for Women Geoscientists Award Banquet.

Jazmin Brook, Dawn Welsh, Kimberly Gustafson, Isaac Hinz, Marilyn Gustafson, and Anna Todd at the Arts & Sciences scholarship banquet.

2018 Undergraduate Awards

MS Candidates Graduating with Degrees

	Advisor	Thesis Title
Oat Pongsit C.	Paul Weimer	Seismic Sequence Stratigraphy and Reservoir Character of Deepwater setting in M11 block, Mottama Basin, Myanmar
Lucas Haas	Paul Weimer	Sequence Stratigraphy of Upper Cretaceous and Cenozoic Sections, Morondava Basin, offshore Madagascar
Allison Jean Kimbrough	Paul Weimer	Seismic sequence stratigraphy of Cretaceous rocks and mechanisms controlling basin evolution, Falkland Plateau Basin, southern Atlantic Ocean
Daniel Medina	David Budd	Peripheral Clay Replacements as the Critical Diagenetic Feature Controlling Matrix Permeability in the Codell Sandstone, Northeastern Colorado
Arian Sarmiento Orjuela	Paul Weimer	Sequential Characterization of Deep Water Deposits in an Active Margin: Colombian Caribbean Case
Craig Peterson	David Budd	Three-dimensional Characterization of Pore-Network Connectivity in the Niobrara Interval, Denver-Julesburg and Piceance Basins, Colorado, USA
James Stewart-Moore	Karl Mueller	Numerical Modeling of Marine Terrace Platforms in Southern California: Implications for incomplete records of steady-state coastal uplift

Ragan Anthony - 2018 graduate

L-R; Penny Patterson, Alexis Templeton, Brian Hynek, Shemin Ge, and David Budd at the 2018 Spring graduation ceremony.

PhD Candidates Graduating with Degrees

	Advisor	Thesis Title
Sarah Black	Brian Hynek	Identification and Characterization of Martian Acid-Sulfate Hydrothermal Aleration: An Investigation of Instrumentation Techniques and Geochemical Processes Through Laboratory Experiments
Daniel W Feucht	Anne Sheehan	Magnetotelluric Imaging of Lithospheric Modification in the Rio Grande Rift, Colorado and New Mexico, USA
Katherine Kravitz	Karl Mueller	Defining the Spatial and Temporal Behavior of a Gravity-driven Salt System, Southeast Utah
Jenny Nakai	Anne Sheehan	Earthquake studies of continental rift deformation, human-induced seismicity, and subduction zone processes
Isaac J. Vimont	James White	Carbon Monoxide Stable Isotopes: Extraction Technique Development and Urban Atmospheric Analysis

In Memoriam

Wolfgang "Wolf" Berger, an oceanographer, author, longtime professor and former interim director of Scripps Institution of Oceanography at the University of California San Diego, died August 6, 2017 at the age of 79.

Berger was one of the pioneers in paleoceanography and seamlessly integrated all branches of oceanographic science: physical, chemical, biological and geological. His research included investigations of plankton ecology, the carbon cycle, the history of climate, and the productivity of the oceans. Considered an ambassador for science, Berger was a renowned expert on how the ocean, atmosphere, and climate develop and change over time.

"Wolf Berger was one of the architects of the field of paleoceanography for which he received the Bigelow Medal, the Ewing Medal and the Balzan Prize among many other awards," said Margaret Leinen, director of Scripps Institution of Oceanography and Vice Chancellor for Marine Sciences at UC San Diego. "We were fortunate to have him spend most of his career with us as a student, faculty member, division director and interim director. His text books and popular oceanography books also excited students and the public around the world."

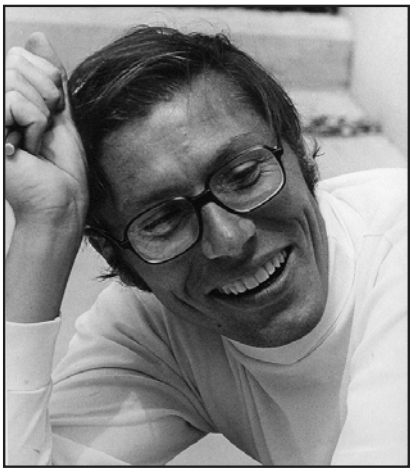
A native of Erlangen, Germany, Berger came to the United States as an exchange student at the University of Colorado. He received an MS in geology from that university in 1963, and a PhD in oceanography at Scripps Oceanography in 1968. That year, he was appointed an assistant research oceanographer at Scripps and an assistant professor of oceanography at San Diego State University. He held both positions until 1970 when he returned to Germany to serve as an assistant research scientist in geology at the Universitaet Kiel.

In 1971, Berger rejoined Scripps, where he remained for the rest of his career, eventually serving as chair of the Geosciences Research Division from 1994 to 1996. He also served as interim director of Scripps Institution of Oceanography in 1996.

Following the establishment of the Department of Geosciences at the University of Bremen in Germany in 1986, Berger worked for many years as a guest professor. He was awarded an honorary doctoral degree from the University of Bremen in 2011.

Berger is the author of nearly 250 scientific publications and is known for his work on the selective preservation of calcareous fossils on the deep-sea floor, which had wide-ranging implications and ramifications for the understanding of the carbon cycle in the sea, and its link into climate variations. He also led the study of the history of productivity in the oceans and its role in the evolution of marine life, including that of the great whales. In recent years, he explored the mechanisms of sea-level change and modulation of climate by variations in Earth's orbital dynamics.

"Wolf was a most generous and kind person who excelled in everything he did," said Miriam Kastner, professor of geochemistry at Scripps Oceanography. "In addition to his deep involvement with science, Wolf also had other interests – he was a first class chess player, and wrote children books and guide books on the geology and ecosystems of La Jolla and the North County."



In addition to his studies, Berger is the author of the widely used textbook The Sea Floor (4th edition revised, 2017) and the popular book, Walk Along the Ocean, a guide to the shoreline of San Diego's North County, as well as two other books with local themes--Coast to Crest and Beyond set in the San Dieguito River Park, and San Elijo Lagoon: a Wetland in Southern California. He also wrote Feed Me: the Story of Penny the Penguin Chick for children. He also served on the editorial boards of Geology, the AGU Monograph Series, Marine Geology, Marine Micropaleontology, the Journal of Foraminiferal Research, AGU Paleoceanography, and the Journal of Paleoclimatology and on the advisory board of the Aquarium of the Pacific.

Berger's accolades were numerous and global. His honors included receiving the Milutin Milankovich Medal from the European Geosciences Union (2012), the Francis P. Shepard Medal from the Society for Sedimentary Geology (2001), the Steinmann Medal of the German Geological Association (1998), the international Balzan Prize for his pioneering work in paleoceanography using micropaleontological methods for deciphering the geological history of the oceans and climatic implications (1993), the Maurice Ewing Medal from the American Geophysical Union and the U.S. Navy for contributions in marine geophysics (1988), the Humboldt Award from the Alexander-von-Humboldt Foundation for contributions to the earth sciences (1986), the Huntsman Medal of the Bedford Institute of Oceanography for contributions to the marine sciences (1984), and the Henry Bryant Bigelow Gold Medal from Woods Hole Oceanographic Institution for distinguished service to oceanography (1979).

In January 1998, Berger was appointed director of the California Space Institute, a statewide education and research center at UC San Diego, where he oversaw basic and applied research in interdisciplinary, space-related fields at UC San Diego and other UC campuses. He officially retired in 2006.

Berger is survived by his wife Karen, and children Karl and Katrina and five grandchildren, Brianna, Lukas, Kaleb, Rohan, and Clara.

Dr John Small Jr was born on May 28th, 1931 in Connecticut USA, and died at his UK home on May 29th, 2017, 86 years and 1 day later. He spent 4o+ years in the oil & gas business with GSI, Chevron, Norsk-Hydro, IEDC and KUFPEC. He was a regular attendee of PESGB events, until deteriorating health made it difficult for him to travel.

John went to MIT in 1948 to study Civil Engineering, but, in his own words was ready for disaster with lathes or drills. He switched to Geology and opted for oil & gas after a traumatic trip down a coal-mine and a pleasant summer job on a seismic crew in Louisiana. He graduated in 1952 with a diploma in one hand and a commission for the Korean

War in the other. He was shipped to Japan with the Corps of Engineers for pre-combat training, during which he visited Hiroshima and helped build a stage for Marilyn Monroe, only to be sent on manoeuvres before her show. John spent 2 years in on the front-line in Korea, and was awarded a Bronze Star. Before joining Chevron, he undertook a teaching fellowship at Colorado University which led to a PhD in 1962 on the Petroleum Geology of SW Ecuador. In 24 years with Chevron, John had postings in Colombia, Trinidad, Ecuador, West Texas, The Hague, Spain & California. He left Chevron for Norsk Hydro in Oslo, just as they were becoming an Operator. John headed the team that acquired acreage in the Norwegian 4th Round, including three licenses that contained billion-barrel fields.

Eventually Norsk-Hydro gave John an ultimatum -become Norwegian or leave. John left and came to England to join a company called IEDC, a company backed by the World Bank that wanted to help "third-world" countries. The 1986 oil-price crash ended its aspirations. IEDC was absorbed into a company called KUFPEC and John moved to Kuwait. He was on vacation when Kuwait was invaded by Iraq in 1990. The company opened a London office and John persuaded the Kuwaitis to pay funds into employee accounts, saving many a mortgage and marriage. He grew a beard to protest the invasion and commuted to an office near Victoria. When hostages were released from Kuwait in December, he met them off the plane at Gatwick. The Press took one look at those exiting the arrivals gate, went straight past the hostages and asked John "How does it feel to be free'?"

John's Middle East adventure came to an end, when after a posting in Dubai, he returned to the UK, rather than go back to Kuwait.

Ten years ago he was diagnosed with cancer of the ear and he has been through various treatments ever since. Earlier, there had been concerns over his heart and more recently a broken hip. If these affected his spirit, it didn't show and he remained good-humoured, stoic and defiant of all that was thrown at him. Liberal in his politics, a book lover, an aficionado of TV detective series, with an encyclopedic memory for geology, proud of the USA, prone to fall asleep instantly (even in company), he completed the London-Brighton cycle ride more than half a dozen times, yet owned a book called How to Exercise Without Moving a Muscle and spent much of his time finessing these exercises. In the UK he leaves behind his wife Elisabeth, daughter Amy and two grandsons; and in the USA, three children from his first marriage, a grand-daughter and his sister. His compatriot Abraham Lincoln said, "Most folks ore about as happy as they make up their minds to be. John was a living example of that."

Wolfgang H. Berger (MS '63)
Craig O. Canon (BA '61)
Dean L. Christensen (BA '57)
Don U. Deere (MS '49)
Jerome S. Desanto (BA '56)
Ryan P. Doherty (BA '95)
John R. Dyni (PhD '81)
O. Winston Hampton (BA '50; MS '57)
Charles C. Hawley (PhD '63)
Steven M. Kolesar (BA '77)
John O. Maberry II (BA '61)
Richard H. Pearl (BA '58)
Paul E. Riley (BA '48; MS '50)
Edwin H. Ross (BA '58)
D. Rhoades Schroeder (BA '55)
Clark M. Shimeall (BA '43)
John Small Jr. (PhD '62)
Leo A. Speno (BA '55; MS '58)
Theodore J. Swiderski Jr. (MS '74)
Brian T. Ward (BA '06)

Attention Alumni

By completing and mailing in this form, you can help us do a better job of keeping up with you, your whereabouts, and your career or family news. We all enjoy reading about classmates and not-so-close-mates who survived Boulder in whatever era! So send us some news or some recollections—we promise to use them.

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Degree(s) (years and institutions) _____

Current Position/Employer _____

News About Yourself/Family/Friends _____

Mail to: Geology News, Department of Geological Sciences, 399 UCB, University of Colorado, Boulder, CO 80309-0399

Or Email your Alumni News to: GeoAlum@Colorado.EDU

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Alumni News

Karen E (Dare) Simmons (BA '67)
I used my geology degree to explore geology on the planets. For 50 years I worked for LASP at CU and helped send ultraviolet instruments on spacecraft to all of our solar system planets, and now beyond as Voyager, caring a CU instrument enters interstellar space. It was the exploration of our solar system and CU geology was there! I've enjoyed reading about more recent graduates of CU and what they are doing as well as current research. How about some news on Steve Mojzsis research on Mars or Bruce Jakosky on Maven!!

Andrew Gordon (BA '09)
After graduating from CU, I have worked in the oil & gas industry in Texas, Australia, and Colorado. In 2014 I went back to school to obtain my masters in Geology at Colorado School of Mines. I am expected to graduate December of 2017. My research is focused on the Green River Formation Stratigraphy of the Uinta Basin in Eastern Utah.

James (Jim) Mulholland (BA '64)
I was sorry to read of Ted Walker's passing this year. I think I took sedimentology from him, and during my consulting career worked closely with his daughter-in-law, Valerie Walker.

While at EPRCo. I worked with the sequence stratigraphy group, and in the Western Division during the 80's I was part of a team that completed a massive multi-year sequence stratigraphic analysis of the entire Rocky Mountain Cretaceous, from Trinidad to Williston, and from Kansas to Utah.

Long in retirement, I enjoy reading, my wife of 49 years, my two children and my five grandchildren.

I enjoy the Geology News, but must confess the work being done by faculty and students bears little resemblance to anything I learned 50 years ago. Maybe you could send a few grad students up here to Grand County to explain the geology. I see volcanic dikes and lava beds, Dakota hogbacks, a lot of faulting and block rotation, Tertiary sandstones, glacial moraines and lake beds, and fluvial river terraces.

Emeritus Professor News

Emeritus Professor **Bill Bradley** was mentioned in a June 17th, 2018 article from the Daily Camera. The Article is entitled "Instruction, accessibility key to waste diversion in Boulder County senior, low-income communities" Numerous methods to prevent contamination of recycling, compost hauls by Staff Writer, Sam Lounsberry. The article stated "Having people "who are not scared to put their hand in a trash can to save an aluminum can" can make a big difference."

Bill Bradley at Frasier retirement community said he is one of 12 people in the complex who monitors the items going into the recycling, trash and compost bins in each wing of the campus.

Photo by Daily Camera

Emeritus professor gathering in April 2018. Wes Masurier, Bill Bradley, Ed Larson, Don Runnells, and Pete Brikeland.

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