UC DAVIS
EARTH AND PLANETARY SCIENCES

NEWSLETTER 2017

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UC DAVIS
DEPARTMENT of EARTH AND PLANETARY SCIENCES

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on the cover:
Active surface flow on Kilauea, Hawaii. Photo by Kari Cooper, taken during the GEL 138 course in September, 2017.

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Chair's welcome

Dear friends, alumni, students, and colleagues,

I hope you thoroughly enjoy this newsletter update on the Department of Earth and Planetary Sciences. Our diverse and enthusiastic students and faculty, excellent staff, and state-of-the-art facilities continue to propel the Department's reputation for innovative, world-class research. Both our undergraduate and graduate student population continue on a path of steady increase, and we have a growing, international group of visiting scientists and postdoctoral scholars in residence.

I am very pleased to welcome two additions to the Department of Earth and Planetary Sciences. Assistant Professor Max Rudolph joined our faculty over the summer. His expertise in geophysical fluids, from mud volcanoes to mantle flow, adds to our research strengths geophysics and geothermal systems. Max is also a field scientist, and he will be co-teaching our Field Geology course with me this Spring. Another addition, Dr. Gordon Moore, joined us as an adjunct assistant professor in charge of the electron microprobe facility. He brings deep expertise and an innovative spirit to managing this important research facility. Gordon will also teach our metamorphic petrology course this Spring, filling a critical gap in our undergraduate curriculum. In recognition of the importance of seeding research, the Department has established a microprobe gift account, with funds used towards providing greater opportunity for use of the facility by undergraduate and graduate students, and to facilitate high risk/reward exploratory research. All external donations to the account will be matched (up to $1000/yr) by faculty donations, with the intent to continue the match in future years.

Dr. Rob Zierenberg, better known as Z, retired at the end of 2016-2017 academic year. Z joined the department in 1996, coming to us after a career at the U.S. Geological Survey. Together with Dr. Peter Schiffman and Dr. Jim McClain, Z spearheaded the development of our geothermal research program. As retired faculty, and thus beyond reach of service and teaching requirements, Z plans to happily continue his vibrant research program, including analysis and drilling into geothermal areas in Iceland, and sampling geothermal fluids of the East Pacific Rise mid-ocean ridge system.

Z in front of the drill rig Thor at the IDDP-2 drill site in the Reykjanes Geothermal Field.

Visitors to Earth and Planetary Sciences may notice a few changes. Space has become tight as we undergo transitions in our faculty and grow our population of graduate students and post-doctoral scholars. On the first floor, one of the external-facing classrooms has been converted to office space for graduate students, and to host staff of the CalTeach/Math and Science Teaching (CalTeach/MAST) program. The petrography teaching lab has moved to space formerly occupied by the geology map library. Though maps are increasingly exchanged digitally, our wonderful paper collection remains accessible at the main Shields Library, curated by their full-time map librarian.

Philanthropy, through gifts large and small, supports enriching activities and student scholars that help our Department community to thrive. I am honored to announce the founding of Rand Schaal Graduate Fellowship, endowed through a very generous donation from Rand Schaal's estate. This fellowship will fully support a graduate student for most or all of the year, depending on return from the endowment. Rand Schaal was a steady and generous benefactor to the Department through matching donations to the Rand Schaal Geology Field Fund. One of the primary beneficiaries of this fund has been the graduate student-led Fall field trip, held annually just before the start of classes. A portion of the Schaal estate will endow this field fund so this support may continue. Inspired by Rand's generosity, we plan to invite some of our alumni donors to join us on this trip in future years. Please consider donating to help further support student opportunities in the Department of Earth and Planetary Sciences. The Rand Schaal Geology Field Fund, Cordell Durrell Fund, Robert Matthews Memorial Endowment, and the new Microprobe gift fund all extensively support student research. Extended field experiences for students, such as the Hawaii volcanoes course, ecogeomorphology of rivers and coasts, and especially our highly regarded summer field geology course, are all acutely in need of donor support in order maintain their vitality in the face of rising costs.

Earth and Planetary Sciences is happy to announce the availability of up to $25,000 to provide 1:1 matching funds for any donation to the department's new "Pathway to Professional Geology" program, which will fund and prepare UC Davis EPS students to take the professional licensure (ASBOG) exam. If interested in this match source or any other donation, please contact Charlene A. Mattison (**cmattison@ucdavis.edu**).

In closing, I thank all of you for continuing to participate in and support the Department of Earth and Planetary Sciences, and for demonstrating the value of your experiences here every day as you advance your careers and communities. Please check out the short updates from your fellow alums on page 15; and send us your update with the subject "Alumni News" to **gel-newsletterupdate@ucdavis.edu**, or drop by in person when you pass through Davis. You are always welcome here.

Sincerely,

Mike Oskin
Professor and Chair,
Earth and Planetary Sciences, UC Davis

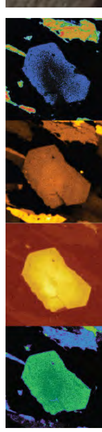
Support geology@ucdavis.edu

Your charitable, tax-deductible gift to the Department of Earth and Planetary Sciences at UC Davis is greatly needed and appreciated. Your donation will be used to support the highest priority projects in the department: our undergraduate and graduate geology students, departmental programs and facilities. Visit **http://giving.ucdavis.edu**.

Your gift to the **Rand Schaal Field Fund** provides funding for department field trips and student field research projects, which are vital to students' studies. Rand Schaal earned a bachelor's degree with honors in geology at UC Davis in 1973 and a master's degree in geology at UCLA in 1976. He completed his doctorate at UC Davis in 1991. As a UC Davis geology instructor, his lively teaching style inspired and entertained thousands of undergraduates.

The **Robert Matthews Memorial Fund** was established to help geology students meet their undergraduate academic and geological pursuits. Bob Matthews was the first environmental geologist hired in the Department of Geology at UC Davis. In memory of Bob, the UC Davis Geology Department (now Earth and Planetary Sciences) established the Robert Matthews Memorial Fund to further acknowledge his legacy and commitment to students.

Hawaii Class
September 2017



Electron Microprobe Gift Fund. The Earth and Planetary Sciences Electron Microprobe Facility yields precise quantitative chemical information at the micron scale that is critical for a broad variety of disciplines. It provides an excellent opportunity for students to collect their own data on high level analytical equipment and to learn how to interpret that data using sound statistical and analytical methods.

We just received a challenge gift, and are asking you to please consider making a donation as these experiences reinforce the fundamentals students learn in the classroom through real-world applications. Gifts will be used to provide greater opportunities for graduate and undergraduate student use of the electron microprobe.
https://give.ucdavis.edu/Go/MicroprobeFund

what does a magma reservoir look like?

My research program has recently been focused around the question of the conditions of magma storage beneath volcanoes – in other words, what does a magma reservoir look like? In particular, my collaborators, students and I have been studying how long magmas are present beneath volcanoes before eruptions, and how hot they are when they are down there. This is important because the temperature of a magma largely controls the proportion of crystals and liquid within it, which in turn controls how easily that magma can be mobilized and erupted. So if we can understand the temperatures and time scales of magma storage, we will be much better prepared to interpret present-day monitoring of volcanoes in terms of volcanic hazards.

- Kari Cooper

While textbooks and information for the general public usually presents a picture of a magma body as a large, roiling mass of molten material, there is a growing body of evidence that presents a different picture – that of a largely "crystal mush" system, where a magma reservoir has large regions that are mostly (more than ~50%) solid, and only small volumes of liquid-dominated magmas present. However, the fact that erupted magmas all have more liquid than crystals means that these liquid-dominated bodies have to exist for some period of time below the surface – but the questions now become how much of the reservoir is liquid at any given time, and how long do these liquid-dominated bodies persist before being erupted?

How do we take a magma's temperature?

We have no instruments that can survive a trip into a magma reservoir, and even if we did they would give us only a present-day snapshot of the temperature of a magma reservoir at one particular location. In order to get a longer-term and larger-scale picture of temperatures we use the thermal and age records contained within crystals in volcanic rocks. To do this, we date the crystals using radiometric dating (uranium-series disequilibrium dating), and combine those ages with temperature information from diffusive movement of trace elements between different zones of the crystals. Crystals can have complex histories, growing in multiple places in a magma reservoir and growing from magmas with different compositions, and they record those changes in their major and trace-element composition. At the same time, the different zones are continually re-equilibrating with each other, smoothing out initially sharp boundaries between zones, and the rate at which this smoothing happens is strongly temperature dependent. We can model the degree of observed diffusive re-equilibration to quantify the total amount of time that a crystal spent at or above a particular temperature. When we combine this information with the crystallization ages, we can constrain the amount of time that a crystal spent at high temperatures compared to low temperatures, providing information about the long-term temperatures within the reservoir.

Featured Faculty

Kari Cooper

What are we finding?

We first applied this new approach to understanding thermal conditions of magma storage at Mount Hood, as part of a collaboration with Adam Kent at Oregon State University (OSU). The surprising result was that while plagioclase crystals from two recent eruptions at Mount Hood are tens of thousands of years old (from the work of former M.S. student Gary Eppich), the total duration of storage of those crystals above 750°C was only a few centuries. This particular temperature is important because it (broadly) marks a transition between a magma at low temperatures with more than ~50% crystals (which as a result has a locked crystal network and behaves like a solid), and a magma at high temperatures (which is dominated by liquid, and therefore is more easily mobilized). While it isn't impossible to mobilize a crystal mush, it is more difficult – and presumably takes longer – than mobilizing a magma that is mostly liquid. So having a magma reservoir that spends more than 90%

of its time in a solid-dominant state means that the reservoir probably isn't just sitting around primed and ready to erupt at any moment, but rather that being in an easily-erupted condition is an unusual state.

These initial results generated some interest both within the scientific community and the general public, and were intriguing enough that we followed up with a project to extend this work to a number of other arc volcanoes (including Mount St Helens and South Sister in the Cascades, Katmai-Novarupta in Alaska, Pinatubo in the Philippines, and Quizapu and Huyanaputina in Chile). This project was funded by NSF in 2014 and has been supporting my Ph.D. students Kevin Schrecengost and Tyler Schlieder, as well as students working with Adam Kent at OSU. We are wrapping up the data collection and are starting to put it all together, and the general result seems to be that the Mount Hood "cold storage" story more or less holds at all of these other systems as well. There are some interesting variations that should provide us information about the processes that build large erupted bodies vs. small eruptions, and ultimately about what controls the thermal conditions of magma storage.

More recently, we have extended this approach to zircon in rhyolitic systems. This gives us two advantages over studies focused on plagioclase alone. First, because we can date zircon in situ by ion microprobe, and therefore can date different zones within the same crystal, we can more precisely constrain the total time that any given crystal was present in the reservoir. Second, by using NanoSIMS (which can measure trace elements at micron-scale resolution), we can measure variations in lithium concentration across zircon at very high spatial resolution to provide the constraints on diffusive re-equilibration and therefore temperature. This means that we can directly compare temperature information and age information for the exact same objects that were present in the reservoir, allowing us to get a crystal-by-crystal scale measure of the conditions in the magma reservoir. Finally, because zircon is a common accessory mineral in large rhyolitic eruptions, this approach allows us to examine conditions leading up to some of the biggest and most hazardous eruptions on the planet. This work was part of Allison Rubin's dissertation at UC Davis, and we just published a paper applying this to the most recent rhyolite eruption in New Zealand (the Kaharoa eruption, ~700 years before present). The results show that these zircon crystals spent less than a few decades to centuries out of the past ~50 thousand years at temperatures where there is more than a small percentage of melt present. These new results are in keeping with our other work on dacitic systems (but if anything even more on the "cold" end of the spectrum), and have been generating a fair amount of interest (and controversy!) in the community (as well as an interview on **Science Friday**).

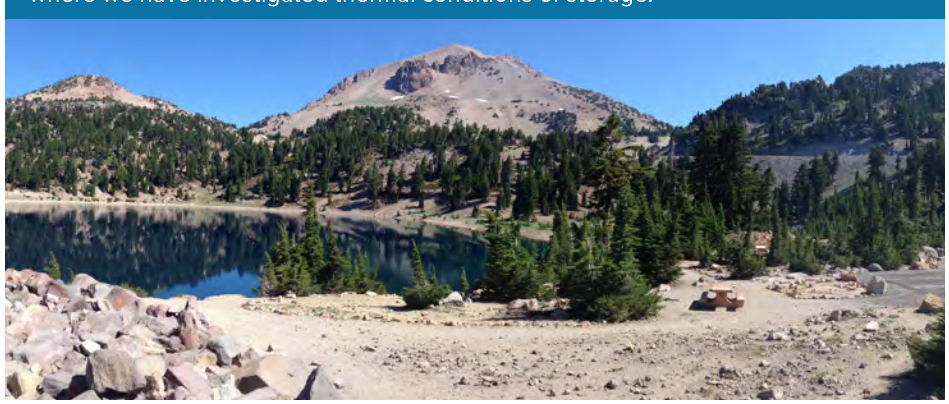
What are the implications of these results?

Broadly, this is consistent with some results of studies by other research groups who have studied diffusion of trace elements in volcanic crystals (but who don't have the age constraints on the crystals). However, one of the reasons that our new results are controversial is that they imply that a magma body can go from a mostly-solid state to eruption of >5 km^3 within only a few decades. The amount of heat that you need to add to a magma body to make this happen can't be added quickly enough by conduction, which implies that there must be a physical disruption of the crystal network and a more dynamic setting that leads up to eruption. Therefore, we need to look to different kinds of physical processes to mobilize magma bodies than were previously considered. It also implies that the liquid-dominated bodies that are erupted are assembled and stored only for years to decades rather than being present for thousands or tens of thousands of years. In terms of volcano monitoring, this provides important information for hazard assessment, because it implies that if we were to detect a large body of liquid beneath a volcano, it would represent an unusual state that bears close watching.

Where do we go from here?

My collaborators Adam Kent, Chad Deering at Michigan Tech and I recently got a new NSF award to look at changes in thermal conditions of storage leading up to and after large caldera-forming eruptions in New Zealand; and I am excited to see what the new results tell us about building a caldera-scale magma body. Ph.D. students Tyler Schlieder and Elizabeth Grant will be working on this project. In addition, volcano science as a field is at something of a crossroads, where the various methods of studying volcanic processes (for example, seismic and other remote sensing methods, experimental data, numerical modeling of the physics of magmas, and geochemical studies) are coming closer together in spatial and temporal scales than ever before. As a recent National Academies report summarizes, we are now at the point where these different fields can directly interact in a way that has never been possible before, and we are in a position to make discoveries that could fundamentally change our views of how volcanoes work. I am excited to be a part of this effort, and am looking forward to seeing what we learn in the next few years!

Lassen Peak (center) viewed from the south. Lassen is one of the volcanic systems where we have investigated thermal conditions of storage.



the shock compression lab

bringing out the "cannons" for planetary science

In the fall of 2016, Professor Sarah Stewart's group took possession of the department's newest – and largest – experimental facility constructed adjacent to the former location of the Geology Department (the Physics/Geology building). Stewart's group uses a combination of experimental and computational approaches to explore feedbacks between material properties and physical processes during planetary formation and impact events. Their new lab is one of very few in the world dedicated to using shockwave experiments to study the properties of rocks and minerals under conditions of extreme pressure and temperature. Using the lab's two cannons (or "light gas guns"), the group can achieve conditions comparable to those of the Earth's core and characteristic of those encountered during large impact events or during planetary accretion. The results help map out physical and thermodynamic properties of planetary materials in regimes far beyond those familiar to the traditional petrologist. These experimental results are critically important inputs for computational models of planetary collisions, including recent work on the origin of the Earth and Moon.

Various static compression techniques have been well developed for experimental petrology, covering the range of pressures traditionally of interest for the crust and upper mantle (e.g. multi-anvil press or diamond anvil cell). Dynamic compression techniques, including shock compression, permit exploration of a tremendous range of temperatures and pressures up to many millions of atmospheres and several thousand degrees Kelvin. In a typical experiment, gunpowder and/or compressed gas are used to launch a metallic projectile at speeds as fast as 7 to 8 km/sec. The projectile collides with a stationary sample, generating a strong shock wave which compresses and heats the sample material. A suite of optical diagnostics and electromagnetic gauges on or within the sample track the pressure history and temperature as a function of time, allowing Stewart's group to recreate the extreme conditions of a giant impact or deep planetary interior in the lab. Details about phase transformations, rheology and transport properties (e.g. conductivity) can also be gleaned from such experiments and, in some cases, samples can be recovered for post-shock analyses using traditional bench techniques.

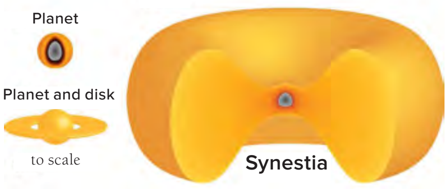
Featured Lab

Understanding planetary origins is a tricky business. While many geologists head to the field to gather data, planetary scientists must often turn to more indirect means to understand the physics and chemistry of planetary formation. Sometimes the most useful tools are unexpected and this might be said of Professor Sarah Stewart's Shock Compression laboratory, where huge cannons are fired (indoors) to study the early history of our Solar System.

- Dylan Spaulding

Shock Compression Lab

Although large cannons are not the first instrument to come to mind for most geologists, the science that they enable is broad. The lab contains two 'light gas guns', suited for different types of experiments and which access different conditions. The gun on the right (above photo) was relocated from Stewart's previous lab while the one on the left is a new addition that roughly triples the range of accessible pressures and temperatures. Stewart's group has examined magnetic effects in shocked materials, phase changes in ice and the effects of impacts on the volatile content of clays. More recently, the group has focused on measuring melting and vaporization in mantle minerals and has found that vaporization in large impacts has generally been underestimated, with implications for geochemical evolution during accretion. Armed with a more complete understanding of the physical and chemical outcomes of large collisions, the group has also recently proposed a new twist on the formation of the moon, in which the Earth-moon system evolves from a transient 'donut-like' structure composed mostly of rock vapor which they term a 'synestia'. The new structure may help explain observed chemical differences between the present-day



Earth and moon. Indeed, understanding how collisions modify the end-state of planetary evolution is a key theme for Stewart's group, whose future work will more deeply explore the chemical implications of such events and even what constraints may be required to form a habitable planet.

Given the Shock Compression Lab's unique capabilities and the broad range of applicable science, Stewart's group has expanded their collaborations since she joined the faculty in 2014. The lab is part of a recently funded University of California Center for Frontiers in High Energy Density Science, maintains active collaborations with the national laboratories to study problems in fundamental materials science and will soon begin work with the Simons Collaboration on the Origins of Life. The lab serves as a unique resource for UC Davis students to do hands-on experimental research in planetary science and the group welcomes inquiries from aspiring geologists, physicists and engineers who agree that a cannon sounds like just the thing for exploring processes in the early Solar System.

sarahtstewart.net

Dylan Spaulding joined the department as a project scientist in 2016. He received his Ph.D. in planetary science and shock physics from UC Berkeley and was previously an Origins Initiative postdoctoral fellow at Harvard University.

I've been asked to share some of my experiences and plans for the UC Davis Grand Canyon Ecogeomorphology class/trip with the Earth and Planetary Sciences family. How do I do justice to an experience like Ecogeo that – like many of our students, faculty, and alumni will attest – is so deeply visual and visceral? Words fail, but we've got the web – check the excellent "virtual field trip" at **grandcanyon.ucdavis.edu**. There are photos and video and 3D interactives, and somewhere there is UC Davis Canyon music that you can play in the background as you read onward.

- Nicholas Pinter

Photo: Joe Proudman/UC Davis

Each year since 2002, UC Davis faculty, students, and guides have investigated the science and dynamics of wild and scenic rivers (and once, an offshore island) of the Western Unites States and Canada. Ecogeo has evolved to include both undergraduate and graduate versions, with graduate Ecogeo focusing on the Grand Canyon for the past six years. The Canyon trip rafts 220 miles of the Colorado River, with most students doing either ~9 days' from Lee's Ferry to Phantom Ranch or else the ~9 days from Phantom Ranch down to Diamond Creek.

I am a newish arrival on the UC Davis campus, here now for two years. Already back in 2015, when I was waiting (and waiting and waiting) for the University to process my appointment, I joined the second half of the trip down the Canyon, hiking down to join the rafts at Phantom Ranch. I was spellbound from the start. From the first steps over the Rim and down the Bright Angel Trail, you leave civilization behind and enter a more primal world. I for one dawdled down the trail, looking at the rocks and savoring the geomorphology, and chatting science and otherwise slowing down the rest of the group. By the time we stragglers reached the Colorado River at the bottom of the Canyon, Jordy Margid, head of UC Davis Outdoor Adventures, was frantic to get on the water and through our first rapids.

And what rapids! Some of the biggest, wettest, and meanest rapids lie just downstream of Phantom Ranch. That first afternoon is an icy wake-up call and an abrupt lesson in why the rapids of the Grand Canyon have their own numerical scale. After that first day's whitewater gauntlet, the rafts pull ashore at the first sand bar camp of the second half – Granite Camp, as I recall – and the real magic of Ecogeo begins.

You might think that rowing rafts down the bottom of the Grand Canyon might be enough, but the wild and remote whitewater experience is really only one of the three pillars on which Ecogeo stands. First and foremost, Ecogeo is an intensely scientific trip. All of the student participants are graduate students just out of an intensive seminar class, each an expert in some aspect of Grand Canyon or Colorado River science or science-related policy. The third pillar of Ecogeo is that it is intrinsically interdisciplinary. The Colorado River lies at the nexus of so many different realms – the geology and the vegetation and the fish and the archeology and the hydrology and water demands from the Rocky Mountains to the Sea of Cortez. So too does an appreciation of the Colorado River and Grand Canyon demand understanding of geology and ecology and hydrology and policy and a whole range of different fields. Ecogeo brings together students and faculty from those different fields, drops them a mile deep into the crust, and shakes the whole mix up through giant rapids and hikes and dinners under the stars and passionate and nerdy conversations the whole way. Ecologists learn to appreciate how rocks across the arms-width span of the Great Unconformity can hide a gap of 1.2 billion years. Geologists learn how monsoonal rain patterns can generate debris flows that scour side canyons or even create all new rapids on the mainstem Colorado River.

Consider the average Ecogeo evening in the Canyon. If it was a smooth day – with no flipped rafts or fierce winds – the rafts pull up on the sand bar in late afternoon. Students and faculty and guests alike share the tasks of unloading the boats, setting up the kitchen and latrines, and making camp. There is often time for some hiking or tossing a frisbee on the sand, or some reading from the trip library. A few beers may be popped open, who knows? At 5 pm, the camp chairs are gathered up and the call goes out for … "SCIENCE." Typically the evening science session starts with a chance for anyone to share wondrous observation that day, of which there are always many, with lively discussion thereof. Next, a couple of students will present "Barefoot Talks," which are rigorous research-level lectures on the dynamics of the Canyon geology, ecology, hydrology, etc. All presented without Powerpoint or other classroom crutches. Some of the Barefoot Talks use the mile-high walls of the Canyon as their chalkboard; others walk through the flora of the sandbars. Dinner follows, typically a near-gourmet miracle emerged from the deepfreeze coolers. Conversations from the science session continue through dinner and into the darkness of the camp evening. After the pots are scrubbed and the dishes dried, the guitars and other instruments emerge, and the music bounces off the walls of the Canyon and drifts up towards the explosion of stars above.

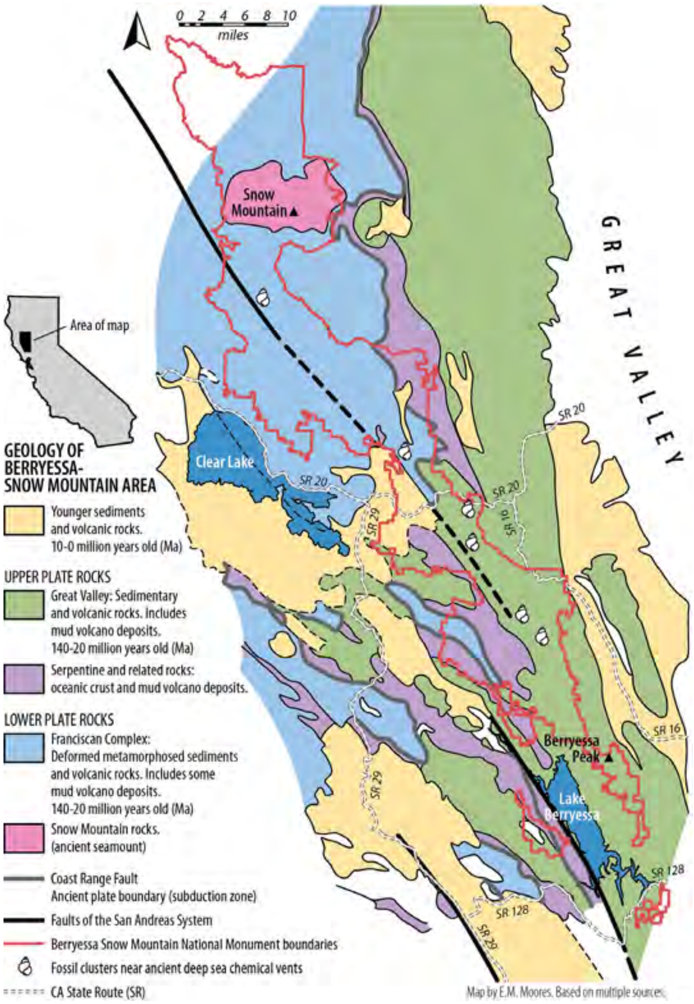
Time to fess up; I did not invent Ecogeomorphology. Rather, I inherited it from my predecessor, Jeff Mount. The whole Ecogeo experience is so unique and works so well that sometimes I'm afraid of tweaking anything for fear of throwing the mechanism out of kilter. I take my job as steward of Ecogeo very seriously. What we've done in the past couple of years, maybe, is recognize just how special the Ecogeo experience is and build upon it. For the past two years, the theme of the class and trip was "Communicating Colorado River and Grand Canyon Science," with trainings through the quarter on how we nerds should translate our research into language understandable by the press and of interest to the general public. We invited top journalists along on the trip, including Joe Palca, national science correspondent for National Public Radio. Our students benefitted enormously from this training, and the trip and Earth and Planetary Sciences gained national press attention. The 2018 theme is "Colorado River Science in service to Public Policy," and top political leaders will join our group and help train our students on how to present their research to guide sound policy and management. I won't name any names, but we initially put together a "wish list" of high-level national leaders, and it was amazing how high on that list we were able to snag people. Go figure – build an amazing experience, get the word out, and people want to join in.

Photo: Joe Proudman/UC Davis

Ecogeo owes many debts of gratitude. To Jeff Mount, for developing this incredible experience. To UC Davis Outdoor Adventures for providing expertise and organization and bringing us home safe from these things. To Roy Shlemon, who has been a long-time patron of EPS and supporter of Ecogeo trips in particular. And to several recent donors who have committed to help support future trips.

To me, the marriage of cutting-edge interdisciplinary science and wild outdoor expedition that is Ecogeo is UC Davis at its finest. I've been calling this marriage the "Expeditionary" model of education and research. In partnership with UC Davis Outdoor Adventure program, we've been pushing this model as a branding opportunity for the University as a whole. Cathy Busby and I just advertised a new franchise, "Coastal Ecogeo," which is a graduate course for geology and ecology or oceanography students followed by a week of sea kayaking down the unexplored southeastern tip of Baja California, sciencing the whole way. Other schools dip their toes in the water, but the idea is that UC Davis geologists and other students will learn and do their science out in the middle of it – on some of the wildest, most remote, and most scenic rivers and coastlines of California and the world.

Berryessa Snow Mountain National Monument



Berryessa Snow Mountain National Monument provides unique geologic and biologic features that have both current and future importance:

Geologically, the Monument contains perhaps the world's most accessible example of a convergent plate margin that includes the Great Valley Group, Coast Range Ophiolite (the oceanic crust on which the Great Valley was deposited), and the Franciscan subduction complex. These features include faunal concentrations around ancient chemical seeps, similar to features found in modern oceans.

The active Green Valley and Bartlett Spring faults, parts of the San Andreas Fault system, extend along the western margin of the Monument.

Snow Mountain itself is a Cretaceous seamount that was subducted to blueschist-facies depths and then exhumed with surprisingly little deformation.

The serpentine soils in the Monument contain unique plant communities that have been the subject of many scientific studies.

The Monument hosts significant biological diversity, both south to north and low to high elevations, providing corridors for animals and plants to move, which may be key to their survival as climate change proceeds.

The Monument's location near major cities means that it is easy for both scientists and the general public to visit and appreciate it.

There are no economically important mineral deposits in the Monument.

The accompanying geological map of the monument and its surrounding region is one that was prepared by Eldridge Moores for an article written with his wife Judy, and published in **Earth Magazine**, vol. 60, no. 11, November 2015, p. 8.

In early 2015, I accompanied a group from Tuleyome to Washington DC to lobby Congress and the Obama Administration for establishment of the Monument. The group met with representatives from the offices of three Congressional districts, including John Garamendi, our local Congressman; from the offices of Senators Barbara Boxer and Diane Feinstein; from the Departments of Interior and Agriculture; and from the Environmental Protection Administration. All decided to support the monument designation. And on July 10, 2015, President Obama issued a proclamation establishing the Berryessa Snow Mountain National Monument.

- Eldridge Moores

The recently designated Berryessa Snow Mountain National Monument located in the Coast Ranges west of Davis, extends from Lake Berryessa to Snow Mountain, about 90 miles north. Tuleyome, a local non-profit environmental organization, led the effort to establish the monument over a number of years, and succeeded in recruiting support from other environmental groups, local members of Congress, Boards of Supervisors of the 5 counties surrounding the Monument, local towns and cities, and many local citizens. Tuleyome's Senior Policy Director, Bob Schneider (B.S. 1972, Geology, UC Davis) served as a key volunteer organizer of the drive to have the Monument designated. The Winters Chamber of Commerce prepared an analysis of the economic benefits of the Monument, and many other organizations, including an off-road vehicle group, rallied to give their support to the Monument.

The Berryessa Snow Mountain National Monument is one of the recently designated National Monuments currently undergoing review by the Trump administration. Tuleyome Senior Policy Director Schneider has prepared and forwarded a comprehensive letter of support with accompanying documents, including support letters from many public officials, and local environmental, governmental, and other organizations urging preservation of the Monument in its present configuration.

We all hope that the Monument, with its many benefits to the local region, scientifically, culturally, and economically, will be retained with its present size and configuration. Contact **Tuleyome.org** to find out how you can help.

Magali Billen. In the past year, Katrina Arredondo completed her Ph.D. and I've been focused on getting publications out from her great research. Her models show how phase transitions cause subducted lithosphere to buckle and fold in the upper mantle and how this in turn causes changes in plate motion at the Earth's surface. I've also been digging into new projects related to arc rifting and using lattice-preferred orientation to map mantle flow. I attended the subduction zone-focused CIDER in Berkeley for two weeks in the early summer. This was a great chance to learn about all the recent work being done and I came away with lots of new ideas on how to better connect numerical models to geologic observations. This summer I also started a year-long sabbatical in Munich, Germany where my focus is on learning more about seismological data, subduction beneath the European Alps, and how to speak german (this will be the biggest challenge!). This year was also my last year as Chair of the Graduate Program - I will miss the special opportunity this position gave me to get to know all of the graduate students in our program and watch them achieve their academic goals.

Hiking (climbing) up Wallberg in southern Germany with Lucas (6), Eliane and Sophie (4) in August 2017. Check out those great vertical sedimentary layers as we approach the peak at 1729 m (yes, we took the gondola most of the way up!). - *Magali*

Sandy Carlson. I had the good fortune to be able to participate in the March for Science in Washington, D.C. on Earth Day, April 22, 2017. I joined about 100 paleontologists to march together as a group, demonstrating solidarity for Science Not Silence. Grandparents, parents, and children all marched together — it was inspiring! And it was gratifying to see the large numbers of people who marched the entire length of the mall, in the pouring rain and very chilly temperatures, to demonstrate their support for science. I hope that our efforts will raise awareness of the critical need for greater science literacy and for the appreciation of science in every aspect of our daily lives.

Here I m proudly displaying our new Paleontological Society logo, which was on one side of the poster I carried overhead for the whole march –- a previous Paleontological Society President, Karl Flessa at the University of Arizona, took my photo, during a (very) brief rain break in the cold and wet day. - *Sandy*

Kari Cooper. Over the past year, I have been embracing more the role of volcanologist (having always considered myself more of a geochemist, broadly speaking), both in my research described on page 4, and also in terms of teaching and service to the community. In the service realm, I was part of a National Academies committee on improving understanding of volcanic eruptions, with a report that came out in April. It was exciting to be a part of defining the future of volcano science, and to see more clearly how the various realms of volcanology have the potential for coming together as never before to understand volcanoes. In teaching, in addition to the GE volcanoes class (GEL 32) I have started teaching GEL 138: Introduction to Volcanolgy. With Rob Zierenberg's recent retirement, he is passing the torch for this class. In fact, as I write this article for the newsletter, I am in Hawaii teaching GEL 138 with Z as my "super-TA" to help with the transition. This class is partially supported by the Bob Matthews Field

Geology 138 - LAVA!

Fund, which helps relieve some of the financial burdens of the travel and course costs for the students. The students are all very excited about having just seen the active summit lava lake and some surface flows, and it is a fantastic opportunity to teach field geology and volcanology - we are looking forward to more exploration of the volcano in the coming days!

At Utviri pass, between the Nenskra and Nakra rivers in the Georgian high Caucasus. View is to the east. Snowy peaks in the distance are in the crystalline basement in the hanging wall of the Main Caucasus Thrust. - *Eric*

Eric Cowgill. My research uses geologic observations to quantify deformation within continental plate-boundaries. One main focus is on the Cenozoic evolution of the Greater Caucasus, in the Arabia-Eurasia collision zone. This year, we published a paper arguing that the range results from subduction of a relict backarc basin, followed by slab breakoff beneath the western half of the range. Ph.D. student Chad Trexler has been preparing manuscripts on the regional geology and structural architecture of the range and rates of active shortening at the range front and new M.S. student Dylan Vasey has started an integrated structural and thermochronologic investigation of Main Caucasus Thrust to determine the timing and magnitude of slip on this probable crustal-scale, basement-involved thrust in the high Caucasus. A second main focus has been an NSF-supported project to test for possible changes in slip rate over time along the Mojave section of the San Andreas Fault. M.S. student Elaine Young has completed an excellent thesis investigating two slip-rate sites, which we're now working up for publication. New M.S. student (and former UC Davis undergrad) Grasshopper Anderson-Merritt is using luminescence dating at a site he started working on for his Senior thesis, and Postdoc Adrien Moulin is both investigating two additional slip-rate sites, and using 10Be geochronology to quantify rates of slip and off-fault deformation over the Quaternary.

Louise Kellogg. My research and teaching has become more interdisciplinary and involves some exciting technology development. Looking into the Earth's deep interior, my students and I are currently exploring where carbon goes through geologic history, how much resides in the mantle and core, and how it migrates through the major reservoirs. Last year, an educational spinoff of the KeckCAVES took wings: the **Augmented Reality Sandbox**: a box of sand, a computer, a camera, and a projector, with some powerful software. When a student builds a hill or a valley, the computer scans the surface and converts it to a topo map which is projected onto the sand: the sand color represents the elevation. A hand held over the AR Sandbox becomes a 'rain cloud', sending virtual water onto the ground, teaching the student about watersheds, landscapes, and floods. We made the instructions and software freely available, so anyone can build their own; there are now more than 300 in museums and schools around the world. Last year, the National Science Foundation hosted AR Sandbox visits to the White House, Congress, and the USA Science and Engineering Festival, attended by approximately 300,000 people.

A visitor enjoys the Augmented Reality Sandbox demonstration at Picnic Day.

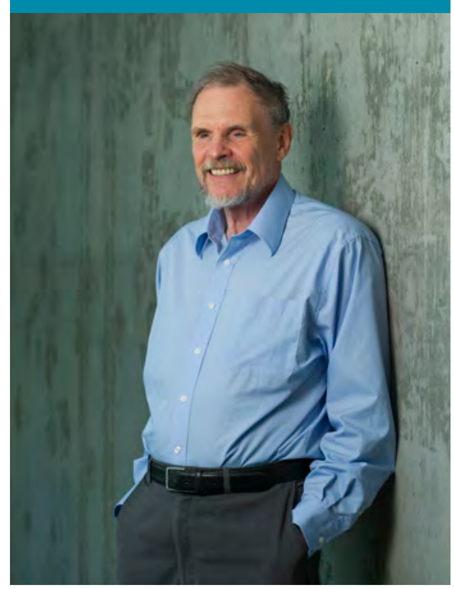
Mike Oskin. My research mainstays remain active tectonics and earthquake geology, with a dose of process geomorphology. I continue to lead a collaborative study of how major structural complexities halt earthquakes along the Altyn Tagh fault in western China, with Ph.D. student Veronica Prush and former student Austin Elliott (Ph.D. 2015, now a post-doc at Oxford). As an outgrowth of this project, Veronica and I came up with a process-based model to interpret populations of surface-exposure age dates from sediments. Our technique reveals new information about landscapes, and more rigorous age interpretations, from data that prior studies discarded. With Ph.D. student Yiran Wang, I am investigating patterns of uplift related to the North Qilian Shan reverse fault. Dramatic, climate-driven cycles of river terrace formation here (see photo) created a unique record on long-wavelength deformation related to deep fault structure. In California, Ph.D. student Alex Morelan is wrapping up a slip-rate study of the not-quite-dead northern strands of the San Andreas fault through San Gorgonio Pass. Its a good thing that Veronica, Yiran, and Alex are all well into their Ph.D. research, because I am now extra busy learning the ropes as Department Chair.

Ph.D. student Yiran Wang, standing 200m above the Beida River in the Qilian Shan of western China in late June, 2017. Extensive river terraces, visible on opposite side of canyon, record uplift of the range. Dust plume in background is from an active landslide.

Dawn Sumner. The 2016-2017 academic year was an interesting one for my lab group. Tyler Mackey finished his Ph.D. and moved on to MIT. Mohammed Almatar joined our group to work on Cambrian thrombolites, and Jessica Mizzi joined us to study Antarctic microbial communities. We have been working on diverse projects spanning spatial and temporal scales from modern genes in cyanobacteria from Antarctic lakes to ~3.5 billion-year-old depositional environments on Mars. These projects all shed light on how microbial communities interact with their environments, through Earth history and maybe on other planets. Several highlights of our results include: 1) the discovery of novel bacteria (Melainabacteria) that are providing constraints on the evolutionary processes leading to oxygenic photosynthesis; 2) analyses of how microbial mats create pockets of O_2 under anoxic water; 3) new insights into how stromatolite morphology reflects both microbial communities and sedimentation; and 4) documentation that at least one suite of environments on Mars was habitable for >100 million years. We are looking forward to new results and changes in the coming year, with Frances Rivera-Hernandez, Megan Dillon, and Kate Wall finishing their Ph.D. theses and Emilia Hernandez and Sydney Salley joining our group!

Geerat J. Vermeij. During the last year I gave two plenary lectures, one on science education for the blind in Monterrey, Mexico, and the other on how to sustain a healthy non-growing economy for an economics conference in Eindhoven, the Netherlands. In addition I have been writing lots of papers: on sand-burrowing gastropods and their surprisingly recent history and evolution; on the fact that the limpet form in snails has evolved 54 times independently; on some taxonomic matters, including the description of a new Pliocene snail genus from California; and on how some rare species could evade extinction. In November, I received the Addison Emery Verrill Medal from the Peabody Museum of Natural History at Yale and took part in a concurrent symposium with a talk on forbidden phenotypes and the limits to evolution.

Geerat Vermeij



Ph.D. student Frances Rivera-Hernandez exploring processes transporting sediment onto ice-covered Lake Joyce, Antarctica.

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Rob Zierenberg. The start of the 2016-2107 academic year found me living in Iceland on sabbatical leave working on the Iceland Deep Drilling Project (IDDP). It took more than 14 years from the first planning meeting I attended to completion of the IDDP-2 drill hole on the Reykjanes Peninsula, but we have finally achieved the goal of drilling into supercritical conditions in the roots of an active, seawater-recharged, hydrothermal system that is an on-land analog of mid-ocean ridge "black smoker" systems. Drilling was technically challenging, but we succeeded in drilling a 4659m deep hole into the upflow zone of the Reykjanes Geothermal Field, with spot recovery of drill core from 3648m to the bottom of the hole. Thanks to a fellowship from the US Fulbright program, I was able to live in Iceland from August until New Years, logging the drill core as it was recovered. Some time next year we will start the process of letting the hole gradually heat up in the hopes of producing fluids from the deep hydrothermal feed zones encountered by drilling. Only then will we know the true down hole temperature and the potential for this hole to produce electrical power. Near the end of drilling, we allowed the hole to heat up for about six days prior to making down hole temperature measurements and found the deepest zone had reached 426° C, putting it well into the supercritical region for sea water salinity fluids. Our earlier attempt at a deep drill hole (IDDP-1) in northern Iceland at the Krafla Geothermal field had to be terminated at a shallower depth (2100 m) when we drilled into high-silica rhyolite magma. That hole produced super heated steam for several months at a well head temperature of 452° C before we had to shut in the hole due to problems with the flow control valves. Time will tell whether or not these very high temperature wells will be the first to successfully harness supercritical fluids for power generation, but there is hope that an individual supercritical well can produce as much as 10 times as much power as a conventional geothermal well, allowing us to increase the efficiency and decrease the environmental impact of this important low carbon energy source. We are still working to fully characterize the alteration mineralogy in the recovered drill core, but are seeing very high temperature metamorphism/hydrothermal alteration at the magmatic-hydrothermal transition, including alteration assemblages of calcic plagioclase-hornblende ± biotite, clinopyroxene, orthopyroxene and olivine. In order to be able to spend more time working on these great rocks, as well as plan for upcoming dive cruises to the southern Pescadero Basin vent field that was described in last year's newsletter, I decided to retire from teaching and have joined the ranks of the emeriti.

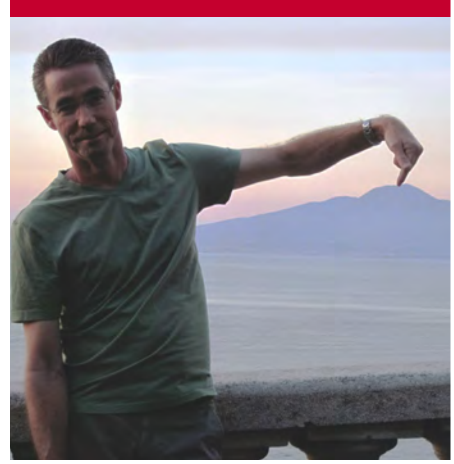
From IDDP: **Drilling Into The Unknown** (http://iddp.is/2017/08/22/drilling-into-the-unknown/)

Sunset (3:30 PM on Dec. 10, 2017) at the Reykjanes Geothermal Field, Iceland, where the Mid Atlantic Ridge comes on shore. - *Z*

Scientists & Academic Federation News

Gordon Moore. Hello! I am very pleased and excited to be joining the department here as an assistant adjunct faculty, and as the new director of the Electron Microprobe Lab. My background is in experimental petrology, with a focus on the role of volatiles in igneous and volcanic processes. Volatile components such as H_2O and CO_2 strongly influence many of the physical and chemical aspects of magmas, and yet that influence is extremely difficult to constrain due to their fugitive (volatile) nature and tendency to escape during eruption. It is by recreating magmatic conditions at high pressure and temperature in the laboratory that we can quantify how volatiles affect pre-eruptive magmatic properties such as density and viscosity, as well as crystal-liquid phase equilibria and volatile solubility. Of course, any successful experiment has to be analyzed to be useful, and the electron microprobe, with its micron scale analytical resolution, is one of the most invaluable tools I use to characterize both natural and experimental samples. While my past research has involved constraining the solid-liquid phase equilibria in hydrous intermediate arc magmas, as well as defining the solubility of H_2O across a spectrum of magma compositions, my current research is focused on experimentally measuring the thermodynamic activity of H_2O in under-saturated hydrous magmas.

Doing my best volcanic hazard work at Vesuvius. This is what happens when you take an experimental petrologist out in the field. - *Gordon*



Featured Graduate Students

Carina Fish. My first year of grad school brought a lot of change including two changes of scenery – first from NYC to Davis, and after finishing the bulk of my coursework and attending IsoCamp, a second from Davis to Bodega Bay. From setting foot on campus without an idea to writing my prospectus, I crafted a project centered on modern ocean change (i.e. carbonate chemistry, oxygenation, temperature) using both in situ oceanographic parameters and the geochemistry of deep sea corals. After spending 46 days at sea over the span of five separate cruises, my project really began to take shape this summer.

Aboard the E/V Nautilus (August 2017) exploring the deep sea of Cordell Bank National Marine Sanctuary with ROVs (Argus & Hercules, both pictured). - *Carina*

Our field team members displaying the first bedrock core at one of the drill sites within the Ohio Range.

Left to right: Zachary Mason, Seth Campbell, Grant Boeckmann (standing), Jen Erxleben, and Sujoy Mukhopadhyay. - *Zach*

Zachary Mason. I went on an Antarctic field expedition, conducting glacial geology research at the Ohio Range. We drilled through the ice to collect bedrock cores, which contain nuclides produced during exposure to cosmic rays. These cosmogenic nuclides are only produced in significant amounts when the bedrock is ice-free. Therefore, we will use the concentrations to investigate the bedrock's ice-cover history. This summer, I extracted these nuclides to measure their abundances. I plan on using cosmogenic nuclide concentrations to gain insight into West Antarctic Ice Sheet behavior and constrain an Antarctic ice sheet model to simulate future behavior in a changing climate.

Hannah Palmer. I am a second year Ph.D. student studying ocean change through time. I am particularly interested understanding how marine ecosystems respond to climate change. My work integrates paleoecological analysis and oceanographic analysis on multiple timescales. I am primarily located at the Bodega Marine Laboratory and I enjoy engaging with the ocean everyday. This year I had the opportunity to go out to sea on several occasions to support efforts to monitor ecosystem and oceanographic change off the coast of Bodega Bay.

Aboard the RV Fulmar - collaborating with National Marine Sanctuaries and Point Blue Conservation Science to monitor ecosystems and oceanography off the Northern California Coast. - *Hannah*

In memoriam


Dr. Harry Green

We are saddened to report that a former member of the UC Davis faculty, Dr. Harry Green, has passed away. Harry was a Professor of Geology at UC Davis from 1970 to 1992, and was chair of the Geology department from 1984-88. He took a faculty position at UC Riverside in 1992, where he spent the remainder of his career, retiring to hold the title of Distinguished Professor of the Graduate Division at UC Riverside.

Harry was a brilliant scientist who made many groundbreaking discoveries in the fields of high-temperature/high pressure mineralogy and petrology, and collaborated extensively with many others. Those who knew him during his two decades at UC Davis will remember how he contributed to making our department an exciting place for faculty and students alike. Harry had a special level of enthusiasm for research and was always looking to bend one's ear about some new observation in thin-sections or an interesting discovery coming out of his lab. He was welcoming and enthusiastic and supported the intellectual growth and careers of many early career scientists. He was a relentless advocate of bringing new technology to bear on geologic issues, and championed the acquisition of the first department computer system in the early '80s, enabling cutting edge research by students and faculty. Professor Emeritus Howard Day recalls a story that we think perfectly captures Harry's passion for science: "[Harry's] enthusiasm stimulated a memorable conversation with Rob [Twiss] and me on a long plane ride home from a meeting. The three of us occupied a single row and had a flight-long, excited conversation about entropy in non-equilibrium systems (of all things!). It was truly an amazing, once-in-a-lifetime experience, but I can only guess what people around us must have thought about what was going on. But that's the kind of scientist that Harry was."

Alumni News in 140 characters (more) or less

Thanks to everyone who sent us their news updates.
If you'd like to keep your fellow Geoaggies updated throughout the year, please send your news to gel-newsletterupdate@ucdavis.edu (subject "Alumni News") in 140 characters or less (not including name and degree) in the following format:

First-name Last-name, B.S./M.S./Ph.D. year. 140 characters of news!

Your submission will be posted on http://geology.ucdavis.edu/alumni

Blair Alexander, B.S. 81. Global Business Continuity Specialist, Barclays Bank. Go Aggies!

Norm Althausen, B.A. 75. M.S. Civil Engineering (Water Resources Engineering) 2005. currently teaching Physics and Engineering at the Gwinnett School of Mathematics, Science and Technology (Lawrenceville, GA)

Katrina Arredondo, Ph.D. 16. Happy at an environmental engineering and consulting firm, studying for a professional geologist license.

Duane Balch, B.S. 75 (M.S. 81 SDSU). Recent Pub 2014-GSA Memoir 211, Re: Penasquitos Fm; w/US Army Corps of Engineers-Sacramento District. The "Geology" department wasn't very large when I graduated at the end of summer 1975. Many fond memories though, of Drs. Durrell, Moores, Twiss, Green, Bond, Higgins & Cowen; a handful of great grad students; and truly kind departmental support staff. I'll never forget the look of consternation when I told Dr. Moores I was applying for a Masters program at San Diego State University (as I mumbled some suspect concern about practicality vs. theory)! LOL! I have had a successful 39-year career in the the earth sciences, ranging from petroleum geology to environmental engineering; with SUNOCO, Dames & Moore, Tetra Tech EM, and now 15 years with the US Army Corps of Engineers, out of Sacramento. Thanks to UC Davis and your department (and its predecessors) for providing the foundation that supported that career! And my livelihood!

Greg Baxter, B.S. 95. Still here at UC Davis, brief impersonation of Geology grad student turned into 20 years (and counting) as staff member.

Ray Beiersdorfer, Ph.D. 92. Dr. Ray took his YSU students to Everest Base Camp in Tibet in June 2017

Benjamin Blumenfeld, B.S. Geology. In San Francisco, living my hot young life. I am currently working as a geologist in environmental consulting in west Berkeley.

John Bobbitt, B.S. 76, M.S. 82. "First there is a mountain, then there is no mountain, then there is." Petroleum exploration and environmental geology-hydrogeology has been very good to me.

Pamela Burnley, Ph.D. 1990. Recently accepted a position as a tenured Associate Professor at the University of Nevada, Las Vegas.

Rob Campbell, B.S. 85 (M.S. Cal State East Bay 06). Professional Geologist No. 6454; Certified Engineering Geologist No. 2089. Principal Engineering Geologist with GeoSolve, Inc. (www.geosolve-inc.com). As the Principal Engineering Geologist, we perform environmental remediation, landslide and fault investigation and mineral resource evaluations for many clients in California, Arizona and Washington State. I love geology and thank you UC Davis for giving me the skills to work in an industry I love every day! Other interests include hiking, biking, reading, painting and writing poetry.

Philippe Claeys, M.S. 1989, Ph.D. 1993. Currently Peter Wall Institute for Advanced Studies Visiting research scholar at University of British Columbia, Canada, working on isotopic analyses of Antarctic micrometeorites.

Martin Col, B.A. 73. Been working around the world with innovative designs for Gold, Copper and Oil Sands mining systems.

Michael Cooke, B.S. 90. Worked as an environmental consultant until 1997 then founded a commercial and industrial electrical construction business. I have one son at Davis and one transferring next year.

Phillip Dawson, B.S. 80. @USGS for 35 years and counting!

Gail Eaton, B.S. 90, M.S. 93. Project Manager (Stantec) engineering design of water/wastwater treatment plants. Guitarist in Heartless (Heart Tribute).

Roger Escalle, A.B. 84. Retired: 2009, 28 year career in the state fire service. Retirement: rock hounding the American southwest.

Chad Fleschner, B.S. 96. Still interested in geology, but not working in that field anymore.

Alvin L. Franks, Ph.D. I got my Ph.D. at U.C. Davis in Engineering Geology in 1980 and will be turning 93, Oct.21 this year and still playing golf 3 days a week.

Jonellen Goddard, B.S. 81. retired, long time member of American Association of University Women (AAUW), recently moved to Burien, WA.

Katie Grafft, B.S. 79. Now Reverend Kate Freeman, Chaplain, retired. Living joyously in Truckee, CA; quilting, skiing, hiking, shoveling snow with hubbie Dean of 35 years. Two kids: Eric (married to Jenn) and Ali.

Thomas Gutcher, B.S. 1983. MS CSULB 1990.

Sean E. Hagerty, B.S. 78. Retired in 2015 from the USDI-Bureau of Land Management after 35 years of working on mineral and geothermal energy projects. Currently a p/t motorcycle safety instructor. Getting married on August 26, 2017.Loving retirement and new life with La Vonnia and family!

Kerry Hegarty, B.S. 78. Still in Melbourne, Australia. Turning research into products and practice. Had fun with fission track analysis and moved on. Very grateful for solid start at UCD. Best to all.

Lara Heister, Ph.D. 06. Lives in The Woodlands, TX with her 2 Aussies and is a Project Geological Advisor/Technical Team lead of the petroleum systems team at Anadarko Petroleum.

Chris Higgins, M.S. 77. Just completed my 40th year at California Geological Survey. Working on mineral hazards throughout the state.

Daniel Horns, 1992. UC Davis alum Mike Bunds (M.S., 1994) and I are both at Utah Valley University. We are collaborating on a study of tsunami hazards in Indonesia.

Forest Kan, B.S. 16. Environmental Consulting in Santa Rosa, enjoying life as it rolls through.

John Kleinschmidt, B.S. 78. Love to Cycle.

Jon Luchini, B.S. 85. Enjoying retirement living on the Mendocino coast.

Glen Lusebrink, B.S. 85. Living in Davis, teaching in Woodland/Knights Landing.

Jennifer (Jenny) McCabe, B.S. 98, M.S. 01. Currently Professor of Geology, Geography, and Physical Science at Woodland Community College.

Steve McCabe, B.S. 90. Professional Geologist, Certified Hydrogeologist. Currently working as a Senior Business Systems Analyst in Financial Aid at UCB. Completed several sections of the Bay Area Ridge Trail, so please contact me if you live in the Bay Area and would like to go hiking. Contact me at hydrosteve@ gmail.com Go Aggies!

Cynthia McClain, B.S. 08. Designing monitoring to assess impact of oil sands development on groundwater dependent ecosystems in northeastern Alberta, Canada.

William Lawrence Miller, B.S. Chemistry 63, M.S. Geology 67. Formerly Asst. Dir. U.S. Bur. of Mines, currently Genealogist, Nat. Soc. Daughters of the American Revolution, Washington, DC.

Bill Mitchell, B.S. 82. I am Professional Geologist in California and have been practicing environmental consulting for various environmental firms in Northern California for the last 30 years. I still have memories of Summer Field Geology in Death Valley with Bernie Troxel, especially arriving there at 7:30 PM and seeing a thermometer recording 120 degrees in the shade. Then we were off to Cisco Grove in the Sierras, where snow was still on the ground. Thanks to my many mentors!

Jacob Moore, B.S. 03. Ph.D. from Cornell 09. Exploring for gas in Trinidad with Shell. Living in Houston with wife Holly and son Charles (6).

Matthew O'Banion, B.S. 07. Recently joined the faculty in the Department of Geography and Environmental Engineering at West Point.

Peter Osmolovsky, B.S. 89, M.S. 94. A tour of duty in Gulf Coast oil patch, then lucked into nirvana on California's central coast. Cheers!

Jeanne (Blohm) Perkins, B.A. 72, M.S. 74. Managed Earthquake & Hazards Prog. at the Assoc. of Bay Area Gov'ts (ABAG) for decades; now happily retired!

Rob Phillips, B.S. 83. Retired US Naval Aviator, currently international Pilot for Delta Air Lines. Lives in Gig Harbor, WA.

Michael Poland, B.S. 97. Geophysicist at the Cascades Volcano Observatory and incoming scientist-in-charge of the Yellowstone Volcano Observatory.

Anne Ewing Rassios, Ph.D. 81. I move tectonic plates for a living, but only in the Jurassic, and I don't move them very far. 40 years in Greece, and the story continues…

Loren Raymond, Ph.D. 73. I'm keeping the focus on Franciscan geology in retirement and enjoying Santa Rosa (vs. NC).

Rob Risley, B.S. 80. I continue to negotiate international mining property transactions for Freeport-McMoRan Inc.

Tetsuya Sato, B.S. 2009. Selected for this year's Hix Preparators Grant, Society of Vertebrate Paleontology. The grant will be used for improving the standard of fossil preparation in China.

Bob Schneider, B.S. 72. Sen. Policy Dir., Tuleyome, conservation org., Woodland. Helped establish theBerryessa Snow Mountain National Monument.

Larry C. Shubat, B.A. 76. Currently teaching Surveying, Mapping, and Geographic Information Systems at The University of Akron, Ohio. Retired from the US Army, Corps of Engineers with 20 years of service in 1997.

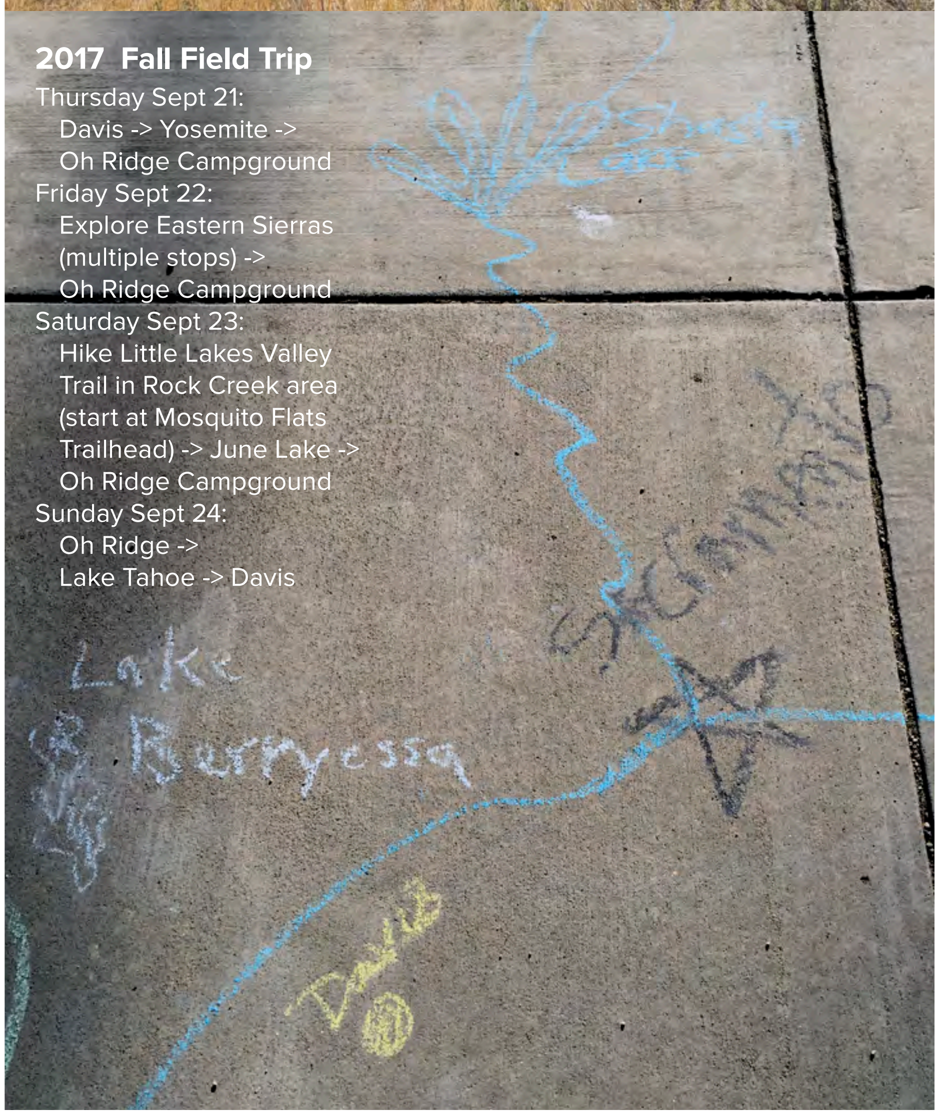
1999

2002

2006

2008

2009



2017 Fall Field Trip

Thursday Sept 21:
- Davis -> Yosemite -> Oh Ridge Campground

Friday Sept 22:
- Explore Eastern Sierras (multiple stops) -> Oh Ridge Campground

Saturday Sept 23:
- Hike Little Lakes Valley Trail in Rock Creek area (start at Mosquito Flats Trailhead) -> June Lake -> Oh Ridge Campground

Sunday Sept 24:
- Oh Ridge -> Lake Tahoe -> Davis

Douglas Fraser Smith, B.S. 85. Supervising Geologist for the Lahontan Water Board in South Lake Tahoe; regulates stream restoration, polluted groundwater cleanup, landfills, mines, and Department of Defense cases.

Paul Spitler, B.S. 1996. I now live in Bozeman, Montana with my wife Shawnee (met at UC Davis), and two boys Ansel and Pascal, ages 11 and 9. I work for The Wilderness Society trying to protect American public lands.

Jesslyn Starnes, M.S. 14. PhD student at Washington State University and graduate assistant at the Center for Digital Scholarship and Curation.

Bob Stern B.S. 74. This year, Melissa and I celebrated 40 years of marriage and 35 years on the faculty of U Texas at Dallas. At 66 I have no plans to retire.

Lori Summa, Ph.D. 1985. Retired from ExxonMobil in 2016, now Adjunct Faculty at Rice University and Research Collaborator at UT Austin.

Sam Swanson, B.S. 64. M.S. 70, Ph.D. Stanford 74. retired professor, 41 years of university teaching in North Carolina, Alaska and Georgia.

Danielle Torres, B.S. 2015. MSc Applied Geoscience at RWTH Aachen in Germany.

Pam Uphoff (maiden name McWhorter), B.S. 74. After 10 years as a geophysicist with British Petroleum and Sohio, I quit to raise two children, too many horses, and wound up morphing into a Science Fiction writer. https://www.amazon.com/Pam-Uphoff/e/B006WBZIN0/ I live with my husband, dogs, and horses in Texas.

Caryl Weekley, B.S. 89, M.S. 95. CA PG, Project Manager Chevron Environmental Management Co.

Ken Werner, B.S. 86. Working for Chevron. Just spent 8 years in Thailand, now an Earth Science Advisor in Louisiana. A big hello to Dr. McClain and Dr. Verosub!

Patricia Winton, B.S. 82. Retired residing in Davis still and volunteers at UC Arboretum.

Maroniae (Oleson) Zatzke, B.A. 03, M.A. Ed 07. Living on a ranch with my family-teaching secondary geology, chemistry, and physics for 13 yrs.

Xiaoming Zhai, M.S. 91, Ph.D. 97. I have been teaching courses related to Earth Science at community colleges in Illinois since 1996. Still love field trips! Organized and led many field study trips to Grand Canyon. Zion and Bryce Canyons (5 times), Black Hills (5 times), Baraboo Hills in WI (2 times), Tibet (2 times) and many places in China (8 times)! Expanded the Earth Science program for College of Lake County into one of the largest ones at community college level in the country with courses covering Earth Science, Meteorology and Astronomy. Developed dual credit Earth Science programs with 8 local high schools, one the largest dual credit Earth Science programs in the nation. Currently live in Grayslake, IL with wife, daughter and mother in-law. Enjoy tennis, biking, piano, and, of course, travels!

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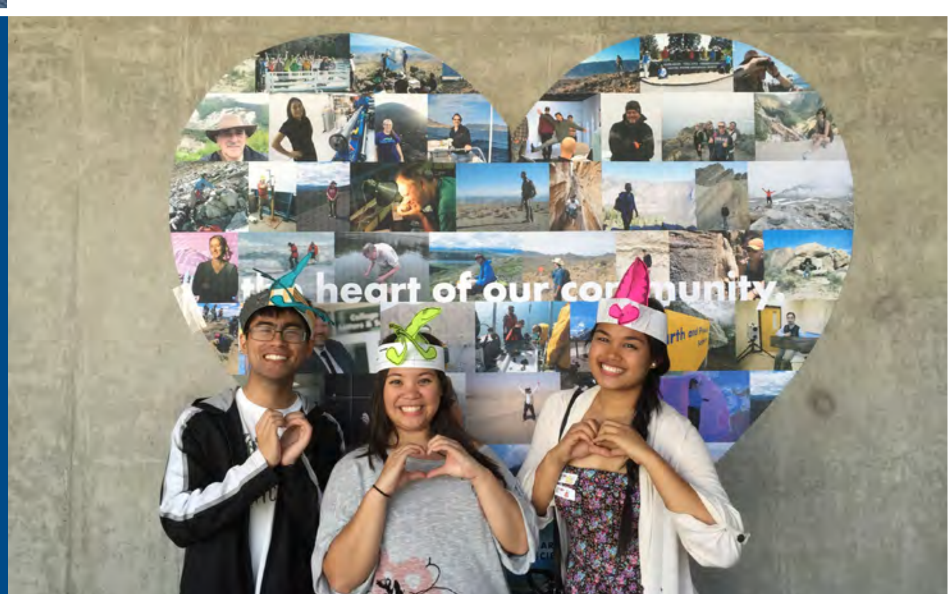
we heart **picnic day**

saturday, april 21, 2018

come for the dino hat…
stay for the science.



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