PennState
College of Earth
and Mineral Sciences

Department of Geosciences

GEOSCIENCES

NEWSLETTER FALL 2022

Message From the Department Head

Welcome to the 2022 Department of Geosciences newsletter.

If you walk into Don Fisher's office on the third floor of the Deike Building you will see the cross-section of the Appalachians on the chalkboard in the photo below. The picture is a geological masterpiece constructed and curated by faculty whose careers spanned more than sixty years, not to be erased only improved.

As I look back on the past year, without stretching the imagination too much, I see parallels between the development and protection of this hand-drawn cross-section and the evolving "masterpiece" that is our department. This year, for example, while we remember "Old Masters" who were lost from science Roger Cuffey (p. 10); Hu Barnes (p. 12) and celebrate retirees Dave Bice and Jim Kasting (p. 16) who contributed significantly to the departmental "masterpiece" for more than thirty years, we welcome several new faculty Ben Cardenas, Antonia Hadjimichael, Tushar Mittal, Anastasia Piliouras, (p. 8) bringing fresh ideas and expertise to the canvas.

The evolving masterpiece also reflects changes in administration. Associate Head of Undergraduate Programs, Maureen Feineman, and Associate Head of Graduate Programs, Mark Patzkowsky, stepped down in June after molding the programs for many years, handing leadership over to new associate heads Chuck Ammon for undergraduate programs, and Don Fisher for graduate programs (p. 11) And new staff members Nicole Cambridge, Suzanne Godissart, Amy Hasan (p. 9) have re-energized the department's administrative core.

In addition, our "masterpiece" is enriched by alumni and friends worldwide (p. 26), who, through continued generous support enable new opportunities for students, and through maintaining strong relationships with the department nourish the lives of faculty and students alike.

Close inspection of the cross-section reveals that some parts of it have faded. This is true for aspects of the department as well. More than two years of pandemic-induced isolation has impacted and diminished the education of our students and personal interactions in the department and our community. However, this past year we have made progress rebuilding our lost sense of belonging, togetherness, and spirit. Students are back in the classroom, participating in field trips and well-attended social events this fall, like the department picnic, Diodato Alumni reception at GSA, and AWG Pie-Off, reflect progress in reconnecting with colleagues and friends.

In closing, we thank you for your artistry as we build and grow and move forward. Just as the chalkboard drawing shows, we are not static, we are not monochromatic, and we welcome input to grow and improve the masterpiece.

Sincerely yours,

Andrew Nyblade

The Geosciences Newsletter is a publication of the Department of Geosciences in the College of Earth and Mineral Sciences at Penn State

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COVER PHOTO:

Penn State Geosciences Field Camp at the top of Flagstaff Mountain in Alta, Utah. See page 13 for more details.

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Alysha Ulrich – Undergraduate Student Profile

Growing up as a Girl Scout and as a member of a rural community, I realized that I wanted to dedicate my career to the preservation of the environment rather quickly. I entered Penn State in the Environmental Resource Management program in the College of Agricultural Sciences, but the concentration on the local ecosystem made me feel like something was missing. I had been eyeing the Earth Science and Policy program in the College of Earth and Mineral Sciences, and I fell in love with my academics once I made the switch. Not only does it capture my passions for the broader environment through the atmospheric sciences, but my major concentration in climate change is teaching me the most modern climate science so that I feel prepared to enter my dream career field in climate policy once I graduate.

The interdisciplinary nature of my degree has encouraged me to pursue internships with the Pennsylvania Game Commission, the City of Pittsburgh's Sustainability & Resilience Planning Division, organized through the City Semester Pittsburgh program, and the White House Council on Environmental Quality. I've also had incredible opportunities to study the natural hazards of climate change in Thailand, pursue atmospheric research with Dr. Michael Mann, and conduct independent research on the impacts of climate misinformation on momentum for climate action.

I will be graduating from Penn State in May 2024 with minors in political science and environmental inquiry as well as a certificate in climate and environmental change. I am so grateful to my mentors in the Department of Geosciences, the broader College of Earth and Mineral Sciences, and the Schreyer Honors College who have helped me find the perfect major.

Clay Wood – Graduate Student Profile

I am a sixth year Ph.D. student from a small town in Southeastern Ohio. I completed a B.S. degree in applied physics in 2016 at Emory University and worked as a research assistant in a fluid mechanics laboratory there for an additional year. My academic background exposed me to fundamental processes, and I learned to apply an analytical eye to complex systems. This led me to research on the complex system we all know and love—the Earth. You may be thinking, "wow, that's a lofty goal!" In all honesty, I thought I should write something that sounds nicer than, "I like the struggle of finding out how things work."

The quick version of my Ph.D. research is that I study properties of fractured rock using laboratory experiments. Much of the shallow subsurface is comprised of discontinuities—cracks, networks of fractures, faults—which can contain water or other fluids. The reason why we care about all of this is because small stress changes from earthquakes or from industrial activities can weaken fractures or reactivate other faults, which can cause earthquakes. We know this from observations of change in fluid flow properties in aquifers and from seismological records.

To understand the underlying physics, my colleagues and I have developed and executed highly controlled laboratory experiments where we use a large hydraulic machine—axial deformation apparatus—to apply stresses and small stress changes, approximating natural conditions, to fractured rock specimens. Additionally, we control the fluid flow through the fracture to measure changes in flow rate as we stress our fractured sample. While this is happening, we monitor, or image, the mechanical changes at the fracture interface using ultrasound—much like using ultrasound in medical applications. Ok, so what does all this mean? The simple answer is that even very small changes in stress applied to a fractured rock temporarily weakens it and larger changes result in weaker fractures. Similar to observations made in the field, fluid flow is transiently enhanced in response to stress changes.

I am very grateful for the support and patience of my advisers, Chris Marone and Parisa Shokouhi, and to my other advisers, Derek Elsworth, Jacques Riviere, and Tieyuan Zhu. Also, I am thankful for the help and friendship from Steve Swavely, Ben Madara, Kerry Ryan, Abby Kenigsberg, Srisharan Shreedharan, Chas Bolton, Tim Witham, Prabhakaran Manogharan, Raphael Affinito, Nolan Roth, Samson Marty, Chun-Yu Ke, and many others. Science is a collaborative effort and I have been enriched by the collegial atmosphere of the department.

Emma Hartke – Doctoral Student Profile

As a child, I always loved science and had a fascination with the natural world. I can clearly recall the times that my friends and I would gather at the playground to look for fossils in the rocks under the swings, when we would wander through the woods and collect animal bones, and other times where we would swim in creeks and pick up all of the turtles, snakes, and fish we could get our hands on. My youth primed me for a career in geosciences, which I ultimately discovered as a career path during my freshman year at the University of Iowa. I obtained my B.S. in geoscience from the University of Iowa in 2020. My undergraduate thesis research was heavily focused on carbon isotope chemostratigraphy of the Silurian Ireviken Event, and I knew I wanted to continue to explore other geochemical problems in graduate school.

I started my M.S. in geoscience at Penn State in fall of 2020 in the Freeman Biogeochemistry Lab. My master's project is focused on extracting lipid biomarkers—special organic molecules with specific natural sources—from Croatian Holocene paleolake samples to reconstruct landscape changes due to human and climate influence. During the Holocene, the Mediterranean region saw major changes to human and climate activity. Humans began settling into more permanent living structures and began practicing early agriculture. At the same time, the Earth entered a deglaciation state and the Mediterranean experienced several major pulses of aridity associated with ice-rafting events.

The biomarkers I am looking at for this project are n-alkanes and polycyclic aromatic hydrocarbons (PAHs), which can track changes in vegetation distributions and fire activity, respectively. By pairing these biomarker analyses with existing isotope data and archaeological evidence from our study site, we can attempt to explain and distinguish between human and climate interactions across this landscape. This is an exciting study because this will be the first geochemical analysis on one of several "Lost Lakes" in Croatia that have not previously been studied.

Two things I've really enjoyed about this project are learning how to operate a suite of new lab instruments and studying a topic so different from my undergraduate project that has both human and geochemical components. I am currently in the final stages of reviewing my data and making interpretations, and my hope is that this data will help resolve questions about the timing and spread of early agricultural practices as well as the impact(s) of human activity and changing climate across a more local landscape. I'm grateful for all that I've learned over the last year and a half, in spite of COVID-19, and look forward to continuing towards my Ph.D. here at Penn State in the Freeman Lab.

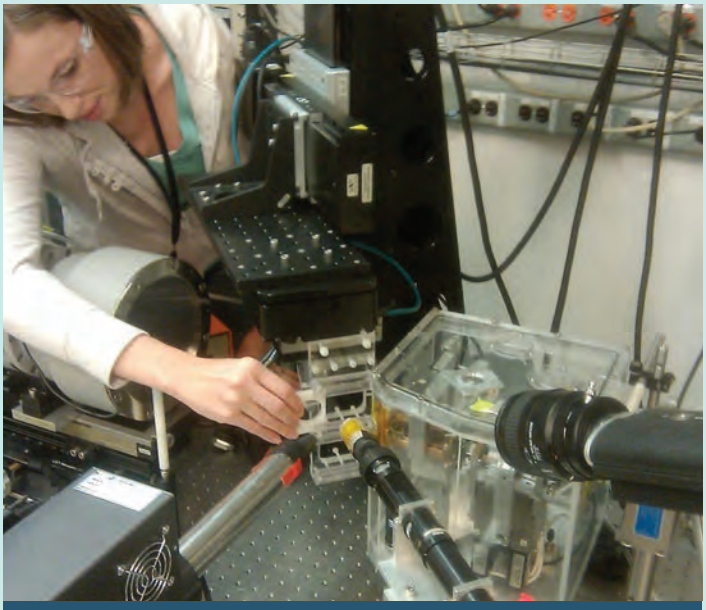
CHRISTINA LOPANO

ALUMNI PROFILE *by David Kubarek*

Penn State alumna Christina Lopano works at the National Energy Technology Laboratory (NETL), which is one of the three applied research labs among the seventeen national labs operated under the Department of Energy (DOE). So, she said, she's used to seeing the results of her work called upon for application in real-world settings.

But the massive push for extracting rare earth elements (REEs) from mining and energy-based waste products is something even she couldn't have foreseen. "It's very interesting when the research you do becomes such a hot topic," Lopano said.

Lopano, who earned her doctoral degree in geosciences from Penn State in 2007, has for several years been researching ways to unbind metals used in a range of electronics and other critical devices such as batteries, cellphones, and vehicles. REEs—which are part of a larger group of critical minerals—are deemed critical



Christina Lopano, research physical scientist at the Department of Energy's National Energy Technology Laboratory in Pittsburgh, uses knowledge of how minerals form to create more efficient ways of extracting metals and rare earth elements from coal waste byproducts. Lopano earned her doctorate from Penn State. *Photo courtesy of Christina Lopano.*

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because of the nation's necessity for them as well as a reliance on foreign powers for importing them. Penn State launched a critical minerals consortium in 2021 and began the Center for Critical Minerals in 2019.

Her research improved technology for recovering REEs by incorporating advanced imaging and spectroscopy techniques coupled with laboratory geochemistry to develop methodologies for removing the elements from coal waste byproducts. It earned Lopano the Secretary of Energy's Excellence Award.

"These awards are among the highest department honors a federal employee or contractor can receive," NETL Director Brian Anderson said. "With her background in mineralogy, Dr. Lopano has long been on the leading edge of geoscience research, and her work has made significant contributions in NETL's efforts to find solutions to clean our water and air, lower the environmental footprint of energy production, and help communities in need of new jobs and industries. We're fortunate to benefit from her expertise. She stands out as a driver of meaningful change."

Path to Penn State

Lopano grew up in Eastern Pennsylvania, hiking trails in places like Bushkill Falls and Jacobsburg Park, and said she was fascinated at the chemistry behind the iron-tinged waters. She saw firsthand the damage caused by acid mine drainage and other contaminants. A collection of rocks she accumulated followed her through life, at the distress of her father.

"I was one of those few rare people who knew early on that I wanted to be a geoscientist," Lopano said. "I started collecting rocks when I was in the third grade and never outgrew it. My dad carried those boxes of rocks to Virginia Tech and later to Penn State, and then finally to Pittsburgh. They're still in boxes in my home. He said 'this is the last time I'm moving these rocks.'"

While in high school, she considered going to Penn State but instead took a scholarship opportunity to Virginia Polytechnic Institute and State University. While attending conferences as an undergraduate student, she met Penn State geoscientists Susan Brantley and Peter Heaney.

That meeting led her to Penn State for her graduate education. Heaney advised Lopano, who was originally pursuing her master's degree, which quickly morphed into a doctoral degree when the scope of her research on manganese oxides became more involved. Manganese oxides are an inelegant yet important mineral in the soil systems, especially for their ability to incorporate heavy or trace metals into their crystal structure. Understanding how these minerals form is also relevant to REE recovery.

While working on her doctoral research, Lopano became accustomed to using equipment at Penn State and national labs in her research.

"During that time, I had my first experience using a synchrotron, which was at Brookhaven National Laboratory," Lopano said. "Peter encouraged me to write the proposals and get beam time."

'The impact this could have'

After earning her doctorate, Lopano worked for a few years as a mineralogist at a consulting firm in Pittsburgh before landing the job at NETL, where she's been for about ten years.

She's worked for years in REE research but recently it's become something that those working outside of specialized research circles are aware of.

"It's interesting to see that what I do is now talked about all over the place," Lopano said. "My brother is an industrial designer. He designs tools so he knows all about batteries, and he's curious about our solutions for elements like lithium."

Since she works at an applied research lab, Lopano is always thinking about the application for the research, she said. Often, they're exploring the fundamental research that could aid in a pressing societal problem. Or they're looking for gaps in the science where they can contribute or encouraging the DOE to fund external research such as the $1.2 million research project that's ongoing at Penn State.

"Even if it's more fundamental research, I need to be thinking about why this is important," Lopano said. "I need to always be thinking about the impact this could have in the real world. That's something about my career that's always appealed to me."

Mineral Dating Reveals New Clues About Important Tectonic Process

by Matthew Carroll

Minerals are visible in rock samples from the coast of Oman. Scientists said these rocks may reveal new information about subduction, an important tectonic process on Earth. Photo: Joshua Garber

Ancient rocks on the coast of Oman that were once driven deep down toward Earth's mantle may reveal new insights into subduction, an important tectonic process that fuels volcanoes and creates continents, according to an international team of scientists.

"In a broad sense this work gives us a better understanding of why some subduction zones fail while others set up as long-term, steady-state systems," said Joshua Garber, assistant research professor of geosciences at Penn State.

Subduction occurs when two tectonic plates collide, and one is forced under the other. Where oceanic and continental plates meet, the denser oceanic plates normally subduct and descend into the mantle, the scientists said.

Occasionally, oceanic plates move on top, or obduct, forcing continental plates down toward the mantle instead. But the buoyancy of the continental crust can cause the subduction to fail, carrying the material back toward the surface along with slabs of oceanic crust and upper mantle called ophiolites, the scientists said.

"The Samail Ophiolite on the Arabian Peninsula is one of the largest and best exposed examples on the surface of the Earth," Garber said. "It's one of the best studied, but there have been disagreements about how and when the subduction occurred."

The team, led by Penn State scientists, investigated the timing of the subduction using nearby rocks from the Saih Hatat formation in Oman, which was subducted under the Samail Ophiolite, according to the researchers.

Heat and pressure from the process created garnet, zircon and rutile crystals in a key suite of highly metamorphosed rocks that saw the most extreme conditions during subduction. Using state-of-the-art dating techniques, including measuring isotopic dates and trace elements, the scientists determined these minerals all formed at roughly the same time eighty-one to seventy-seven million years ago.

"What's interesting about this is that they were all dated by slightly different methods, but they all gave us essentially the same results," Garber said. "This tells us that all the minerals in the rocks have a coherent story. They all record the same metamorphic episode at the same time."

The findings, published in the *Journal of Geophysical Research: Solid Earth*, dispute previous results that estimated the event began 110 million years ago and happened in separate phases, the scientists said.

"What our findings suggest is that this continental material was not subducted deep into the mantle a long time before the ophiolite formed as previously thought," Garber said. "Our data supports a nice sequence of events that happened in a tighter window and that makes more geological sense."

The scientists said the subduction of the continental margin occurred after the obduction of the Samail Ophiolite. The most deeply subducted continental material was likely anchored to more dense rocks, and when this anchor broke, the buoyant continental rocks exhumed, first quickly, and then slowly during a lengthy residence in the lower to middle crust. It eventually become exposed in tectonic windows through the ophiolite.

"Subduction is a really big part of plate tectonics on Earth," Garber said. "It's the major recycling mechanism for surface material to the deeper mantle, so understanding how they eventually evolve into stable subduction zones or how they end very quickly is of great interest. I think here we've nailed down why this subduction zone ended and the sequence of events that came with it."

Also contributing to this work from Penn State was Andrew Smye, associate professor of geosciences. Matthew Rioux, assistant teaching professor, Bradley Hacker, professor emeritus, and Andrew Kylander-Clark, senior development engineer, at the University of California, Santa Barbara; Michael Searle, professor at Oxford University; Jeff Vervoort, professor at Washington State University; and Clare Warren, professor at the Open University also contributed.

The National Science Foundation and an ExxonMobil/Geological Society of America graduate student research grant provided funding.

NEW FACULTY

Ben Cardenas

I am excited to have established the Planetary Sedimentology Lab (PSL) at Penn State. Members of the PSL work to understand how the sedimentary record reflects the evolution of ancient landscapes on Earth, Mars, and other rocky planets and moons. We take a wide array of approaches to understand Earth's sedimentary record including field geology, 3-D seismic interpretation of Earth's subsurface, numerical modeling, remote sensing, and the investigation of modern sedimentary systems. The Earth-based research we do continually proves to be useful in our reconstructions of the histories of Mars and other planets and moons from satellite and rover data, and the data limitations in planetary science often motivate interesting investigations of Earth's sedimentary record.

I grew up in San Antonio, Texas, and received my B.S. in geology from the University of Texas at San Antonio in 2012. During this time, I developed an interest in planetary geology, geomorphology, and remote sensing. I pursued and expanded these research interests in the Jackson School of Geosciences at the University of Texas at Austin, where I received my M.S. in 2014 and Ph.D. in 2019. During my postdoctoral appointment at the California Institute of Technology, I became involved in rover operations and science, and received an NSF postdoctoral fellowship.

Antonia Hadjimichael

I am an interdisciplinary scientist studying complex human-earth systems, with a particular interest in water resources planning under uncertainty. My toolkit includes multiobjective evolutionary optimization, machine learning, visual analytics and high performance computing. My research tries to shed light on how human and earth systems interact across scales. I am most interested in how their interactions shape human impacts, such as drought conditions in the Southwest or sea-level rise at the coasts. At Penn State, I hope to interact broadly with water and climate experts on campus and contribute to the college's curriculum with new courses on data analytics and visualization.

I hold a B.Sc. in mathematics from the University of Leicester, and an M.Sc. in environmental modeling from University College London, both in the United Kingdom I also earned a Ph.D. in water science and technology from the University of Girona in Spain. I have also been a postdoctoral associate in the Reed Group at Cornell University. I serve as chair of communications for the Society for Decision Making under Deep Uncertainty, on the facilitation team for the MultiSector Dynamics Community of Practice, and I have recently been elected to Penn State's Water Council.

In my spare time I enjoy foraging, cooking, and online communities. I grew up on the beautiful island of Cyprus, and have lived in the United Kingdom, Spain, the Netherlands, and now the United States.

Tushar Mittal

I am a geophysicist who uses geophysics and fluid dynamics to investigate a wide range of problems on Earth and on other planets and moons. When I was growing up, my dream was to become an astronaut, which transitioned as I got older into an interest in everything related to space. During my undergraduate studies in physics at Johns Hopkins University, I conducted research in planet formation processes and asteriod/Kuiper belts around other stars while starting to learn about earth science on our own planet as well doing lab experiments. These introduced me to magmatic processes, and I was immediately excited in working on these processes both on Earth as well as in the solar system. In graduate school at the University of California, Berkeley my Ph.D. dissertation project focused on developing process-scale models of magmatic processes, especially for the largest volcanic eruptions in Earth history—continental flood basalts. I still have kept a few astrophysics projects going—including studying Mars' moons, icy ocean worlds such as the satellites of Jupiter and Saturn), as well as studying the dust mineralogy in protoplanetary disks using various space telescopes.

My primary research focus at present is investigating the evolution of magmatic systems—thermo-mechanical evolution, mush melt transport, and eruption dynamics of crustal magmatic systems both on land and underwater. On the

astrophysics side, I have active projects on icy satellite geophysics and ocean-hydrothermal dynamics, geochemical evolution of planetary cores, and planetesimal/asteroid formation. Alongside my research at Penn State, I am looking forward to teaching courses in volcanology and geophysics.

My long-term research goal is to understand how the environment and ecosystems on Earth, and other planetary bodies, evolve through time. My research encompasses two primary topics: volcano science (magmatic processes, submarine volcanism) and planetary geophysics (planet formation and geodynamics, planetary science), along with cross-disciplinary work on volcano/tectonic-climate interactions (climate interactions). I use two complementary approaches: 1) developing idealized models and 2) analyzing large observational datasets. I specialize in using fluid dynamics and thermo-mechanical theory, and some analog experiments, from earth science, astrophysics, and engineering, as well as data-driven approaches like machine learning to develop intermediate complexity models that span a wide range of material properties and dynamics.

Anastasia Piliouras

I grew up in the Hudson Valley in New York. Despite the beautiful setting, I never had much appreciation for or experience with the outdoors during my childhood. I initially pursued an undergraduate degree in systems engineering but quite randomly happened upon a geomorphology class during my sophomore year that set me on a new path. I earned a B.A. in earth science and a minor in music from the University of Pennsylvania in 2011. During my undergraduate career, I completed an internship at Woods Hole Oceanographic Institution, which instilled my interest in coastal processes. Following graduation, I attended the University of Texas at Austin, where I earned a Ph.D. in geological sciences in 2016. Though I had always been interested in a career in academia, I chose to pursue a postdoc at Los Alamos National Laboratory, drawn by their extensive research in Arctic and Antarctic climate change. I worked at Los Alamos for more than five years, first as a postdoc and then as a staff scientist, expanding my research into high latitude processes and remote sensing, before joining the faculty at Penn State in January 2022.

My research utilizes physical experiments, modeling, field work, and remote sensing to better understand the morphodynamics of fluvial, deltaic, and coastal systems; and interactions between vegetation, hydrology, climate, and surface processes. Understanding these complex interactions is essential for predicting landscape change, especially in a changing climate, and requires investigation across a broad range of temporal and spatial scales using a mixture of observational and modeling techniques. The goal is to understand not only how landscapes evolve but also how the processes and process interactions that shape landscapes change under different conditions. Given the rapid warming in the Arctic, much of my work is focused on high latitude landscapes, but I'm interested in morphodynamics, ecogeomorphology, hydrologic connectivity, and coastal change at all latitudes.

Meet Our Newest Staff Members

Nicole Cambridge

Administrative Support Assistant

Suzanne Godissart

Alumni Relations and Stewardship Coordinator

Amy Hasan

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Remembering Dr. Roger Cuffey

by Charles Miller, Jr. and Kent Newsham

Dr. Roger J. Cuffey, professor emeritus of paleontology, died on January 1, 2022. He is probably best remembered for his forty years at Penn State, where he mentored students and conducted research. He retired in 2007 but continued publishing, leading and attending field trips, editing and advising, and attending conferences.

Cuffey specialized in fossil bryozoans, but his paleontological research was diverse including topics ranging from fossil fish to insects to dinosaur footprints to military geology to Pleistocene vertebrates. His research contributions are widely recognized especially for his work in paleobryozoology. Two fossil bryozoan species are named in his honor: the Late Ordovician bryozoan *Cuffeyella arachnoidea* from the Cincinnati region and *Diplotrypa cuffeyi* from Middle Ordovician strata of the Canadian Arctic. He authored more than 300 articles and monographs. His most-cited work is a 1985 Geology article presenting an expanded classification for carbonate reef-rock textures.

He had been a captain in the U.S. Army and had specialized training in the chemical corps, ending as an epidemiological analyst at the Walter

Reed Medical Center in Washington, D.C. That training greatly influenced the rest of his personal and professional life. This is reflected in his organizational skills, as with geology field trips, and in coping with discomforts and physical challenges, also useful for field work.

A People Person

To say he impacted people is an understatement. He was always very kind, encouraging, and helpful to literally anybody who was interested in fossils, geology, and other topics. He treated everybody as if they were all equally important. He also took the time to help, spending a great deal of time and energy helping students, colleagues, and others advance their lives and careers. His influence can be seen in his former students and in his two sons, both of whom are geologists.

One favorite story is about how a young girl and her parents went fossil collecting with him, inspiring that girl to become a paleontologist. That young girl, Isabel Montañez, now a distinguished professor and director of the John Muir Institute of the Environment at University of California, Davis, said that Roger "is single handedly the reason she went to college to be a paleontologist." She served as both vice president and president of the Geological Society of America and said, "somewhere in the process I became intrigued with paleoclimatology but my past decade of publications illustrates how much the 'life' part of the Earth system is at my core."

Impact on Students

Kent Newsham remembers his first encounter with Cuffey during his freshman winter after taking GEOSC 1 Physical Geology in the winter quarter of the 1974-75 academic year. He met with Cuffey because he was trying to decide whether he should officially enroll in the Geosciences or Earth Science program.

"He had that corner office that seemed like a catacomb of fossils, where it felt like walking through 'canyons' of bryozoans to get to his office desk," said Newsham. "Upon first contact, I was met with a man of significant stature, but it was that 'Grand Canyon' of a smile that made me immediately feel relaxed and comfortable in his presence, especially as I was a rather shy freshman."

Newsham also said that Cuffey always looked after his students by informing and guiding them. "It was Roger that informed me about Dr. Al Guber's Wallops Island Program, a ten-week live-in program at the Wallops Island Marine Science Consortium, located on the Eastern Shore of Virginia. This was a life changing experience for me, personally, as it provided an incredible discipline range in 'mind expansion' and allowed for personal engagement with numerous influential professors. Wallops provided me with the subject matter of my undergraduate thesis, 'The Origin of the Carolina Bays.' "

Charles Miller, Jr. recounts his first encounter with Dr. Cuffey on a 1974 cross-country geology field trip that he co-led. "Because of his stint in the Army, I wondered, would the field trip be run like boot camp? Was there going to be reveille each morning? In retrospect, this probably was my most impressionable geology course. What a great way to study regional geology."

Cuffey was an adviser for Anne Lutz. She said that she will miss him greatly. "He mentored my change in focus in graduate school from geomorphology to paleontology, advised me what courses to take to bring me up to speed, and how to be a good paleontological field person, said Lutz. "I will never forget one of his field mottos, 'A geologist knows no weather,' which completely dismayed me, but which I well understood. No matter my choice of jobs, he advised and supported me, and I considered him my life coach as well as my adviser."

Always a Scientist

Miller said, “He was an amazing source of information, both geological and otherwise. I once asked a historical question about the Middle East, and he gave a twenty-five-minute recitation going back at least a thousand years. At dinner two days before his death, I mentioned a misidentification of a planet. He gave the celestial explanation as to why that identification was wrong.”

Newsham’s last contact with Cuffey was in a Christmas letter where he updated him on his family’s success and stayed true to his passion with the following in reference to his son, Kurt’s trek in Nepal with a photo of Mount Everest included.

“Look at the middle of its face; note the ‘grain’ of the terrain, enhanced by the snow streaks, which slant downwards to the left,” wrote Cuffey. “Those are thin beds of limestone, which Indian and Chinese geologists have found to be of Ordovician age, ~450 million years old. Ordovician strata, like around Cincinnati, Ohio, often contain nice fossil bryozoans, although no one has looked for such specimens up here yet, so far as I know. That would be a great research project for someone capable of high-altitude fieldwork, which unfortunately I am not; but I hope another paleobryozoologist will take up the challenge here.”

Newsham said, “Roger was a true scientist, educator, and mentor. My condolences go out to his family, Cliff, Barbara, Kurt, and Pete. Know that Roger was an important influence on many students, impacting the lives of those that have done good for science and society. His legacy lives on through those many he touched. He is missed but not forgotten. With deepest sympathy but greatest good fortune to have been one of Roger’s kids, **Roger and out!”**

New and Former Geosciences Associate Heads

Maureen Feineman

Mark Patzkowsky

Donald Fisher

Chuck Ammon

Maureen Feineman was the associate head for undergraduate programs from 2016 to 2022, a time that saw great change in geosciences, higher education, and the world. In 2016 and 2017, we were riding the crest of the largest enrollment of undergraduate students in recent memory, peaking at 220 enrolled majors. More than 60 percent of the students at the time were Geosciences bachelor’s of science majors, and just a little over 10 percent were enrolled in the Earth Science and Policy B.S. program. By 2021, the number of students in the Earth Science and Policy major had doubled, and enrollments in Geosciences subsided, and in 2020—an anomalous year by any measure—we produced more Earth Science and Policy graduates than we did Geosciences graduates. The arrival of COVID-19 in spring 2020 sped up the rate of some changes we were already starting to see. The rapid transition to remote learning led to a step-function increase in the use of technology in undergraduate education and data analysis in research. Graduates are following career paths in data analysis, risk assessment, environmental protection, sustainable finance, in addition to the classic oil and gas or hydrogeology career paths. Looking forward to the next ten years of higher education, Feineman honestly does not know what it’s going to look like, but she is certain it will be very different from what it has been in the past. She is excited to see where this next generation of earth scientists takes us.

From 2018 to 2022, Mark Patzkowsky was the associate head for graduate programs. Mark is now a “regular" faculty member again and focuses on his teaching and research. He is continually amazed by the energy and creativity of our graduate students and that was the main reason he agreed to step into the position four years ago. He enjoyed working with students to advance their career goals and learned a lot in his four years in the position, but two things stand out. One is that students face many challenges in pursuing graduate studies, such as mental health, financial and emotional support, and that never ending feeling that they don't belong. These challenges were only magnified by the pandemic. Second, he learned that despite all the challenges of graduate school, students are persistent and resilient. Research continued, teaching continued, and students made great progress toward their degrees and future careers. Watch this group. They are doing, and will continue to do, amazing things!

Effective July 1, 2022, Donald Fisher was appointed the associate head of graduate programs, and Chuck Ammon was appointed the associate head for undergraduate programs.

Contributions to Research, Students Shaped Legacy of Hu Barnes

by David Kubarek

Hu Barnes and his close friend Robert Schmalz

In the late 1940s, a budding electrical engineer named Hu Barnes spent the summer working with General Radio Company. In a time before the widespread use of computers, he watched as doctoral students toiled over drafting tables.

That fall, when the undergraduate student returned to Massachusetts Institute of Technology, he took an elective–geomorphology. In that course he was surrounded by a "hard-nosed crew" of World War II veterans who were frequently roused by the lectures of a professor who told stories of traveling the globe to far-flung places such as Afghanistan, where he sometimes rode on the fender of a Ford Model T while sketching rock formations.

"It made the thought of a career as an electrical engineer pretty calm compared with that kind of life," said Barnes.

That one course prompted Barnes to shift gears and start down a path to becoming a geochemist and one of the leading experts on how ores are formed under heat and pressure. Barnes earned his bachelor's degree in geology from MIT in 1950 and his doctorate from Columbia University in 1958. While at MIT, he met his future wife, Mary. Mary Barnes earned a doctorate in chemistry from Penn State and worked as a research scientist in Penn State's Materials Research Laboratory; she died in 2017.

Barnes' entire life was driven by curiosity. He chased his research objectives for thirty-seven years at Penn State and remained active for decades as a professor emeritus.

He taught in places such as China and Russia and often referred to every day of his career as "pure fun."

A curious life

In high school, Barnes built ham radios. He and his friends then took up Morse code. He learned how to plumb, wire, and work with wood while working for a construction firm. He could fix anything: In his late 80s, when a neighbor's lawn mower broke, Barnes repaired it right in the yard.

At MIT, he paid the bills by building lab instruments. He used these skills throughout his career. While at Penn State, he created several inventions to fuel his research, his most famous being the rocking autoclave.

Barnes spent the early part of his career exploring the fundamentals of how ore deposits are formed, much of the work relying on his own laboratory inventions. His research and techniques are still used today, said colleague Hiroshi Ohmoto, professor emeritus of geosciences. Ohmoto, who joined Barnes at Penn State in 1970, said Barnes' seminal work comprises his three volumes on hydrothermal ore deposits; Ohmoto contributed to two of the three.

"They were sort of the Bible for students and researchers in the field," Ohmoto said. "He'll be remembered as the person who developed the geochemistry of hydrothermal ore deposits."

Later, Barnes turned his attention to the applied sciences, particularly those that bettered the environment. After his retirement, he built pieces of his nano lab in his garage, and at the time of his death was still working to improve research related to acid mine drainage and iron pyrite, a local environmental issue that threatens freshwater streams here and beyond. His research generated several patents–one of which resulted in the treatments of the road cuts at Skytop.

He loved the outdoors, skiing, and sports, especially Penn State football.

A legacy of learning

If you asked Barnes, his greatest contribution–his research legacy–was his graduate students.

That's the answer he gave Julianne Snider, director of the Earth and Mineral Sciences' Museum & Art Gallery, who interviewed Barnes for her dissertation.

"He was very proud of his students," Snider said. "He had some very successful graduates. He was very proud of getting them to a level of success where they would go off and do these great things. When we talked, he walked in with several sheets of paper, and he said, 'I made a list of people who have earned degrees with me. I don't know whether that's of any consequence, but it gives you an idea of who I am.' "

Snider knew Barnes through his commitment to improving the museum. He gave to several causes, including some of the custom cabinets displaying the exhibits, and he was working to finalize plans for reinstating the granite slabs, which were put

in storage in the early 2000s. Barnes, who always stressed the importance of field work, felt that the visible structures in the slabs told great stories, and were great teaching tools. He also gave to Penn State faculty, establishing an endowed professorship with his wife so faculty members could advance their research.

'You didn't work for him, you worked with him'

One of Barnes' former students–a bit of who he was–remembers Barnes as a tough but caring mentor. Martin Schoonen, associate laboratory director at Brookhaven National Laboratory, earned his doctorate under Barnes in 1989.

"He was really one of the preeminent researchers in my field," Schoonen said. "It was an extraordinary opportunity

to work with him. He challenged his students to tackle some of the hardest problems in the field."

Schoonen also remembers Barnes for all the soft skills he taught. If an experiment failed or a publication was rejected, Barnes taught them that that, too, was a learning experience. The relationship, said Schoonen, isn't like a traditional occupation; it's more like family.

Schoonen, who is from Holland, really appreciated that. Lessons he learned beside Barnes in the lab had the same impact as Thanksgiving dinners, which they sometimes shared in the Barnes' home with fellow students. Hosting graduate students at Thanksgiving, when they might otherwise be alone, was a Barnes family tradition.

But make no mistake, Schoonen said, Barnes demanded excellence.

"One thing Barnes would say is, 'when you leave here, my expectation is you're the world expert in your research area.' One thing I took from him that I still rely on is that you didn't work for him, you worked with him. He looked at it like this: I'm going to teach you. I'm going to transfer knowledge to you. But, after a few years, you're going to teach me what you're finding. And we'll solve these problems together. He viewed this as a relationship that became equal and then you were supposed to, as a graduate student, begin telling him what you know, where the field is going, what the future holds, and what is the next question to solve."

Hu Barnes died August 3, 2022, at the age of 94. The Department of Geosciences acknowledges his contributions to the department, to geochemistry, and to the generations of students who will look for the next question to solve.

2022 FIELD CAMP

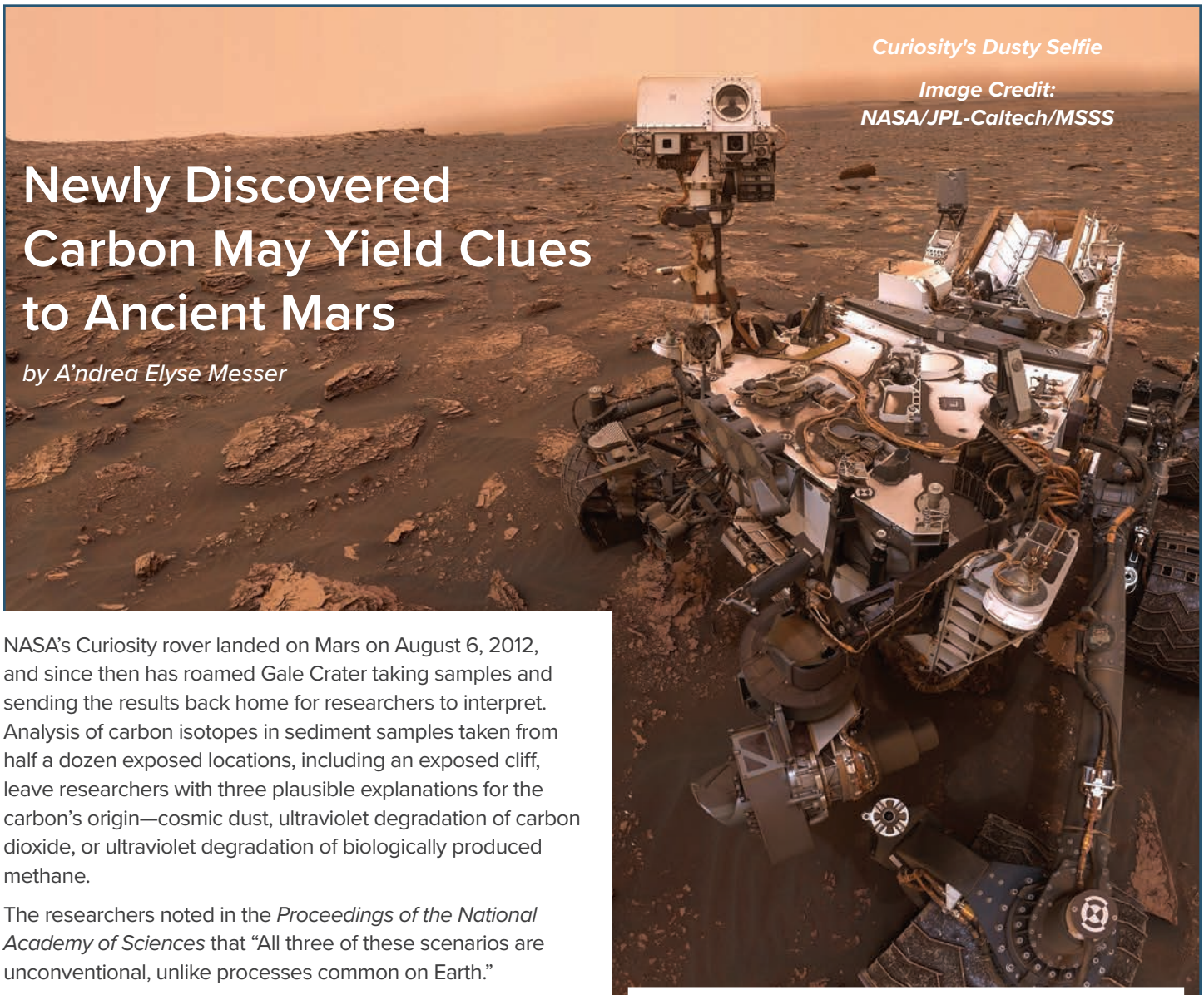
Students mapping the geology of the White Knob Mountains in Idaho.

After two years of virtual and hybrid field exercises, the Penn State Geosciences Field Camp returned to the intermontane region of the Rocky Mountains in 2022. The caravan left Deike Building in early June for the Yellowstone Bighorn Research Association's (YBRA) facility in Red Lodge, Montana to begin the counterclockwise tour across Montana, Wyoming, Idaho, and Utah before returning to Penn State. The exercises in 2022 would be familiar to many alumni, but there were also some significant changes, with an infusion of new faculty expertise from Brian Kelley, Kimberly Lau, Miquela Ingalls, Max Lloyd, and Jesse Reimink as well as instruction from long time faculty contributors Roman DiBiase, Don Fisher, Andy Smye, and Kevin Furlong. Field Camp relies heavily on graduate teaching assistants, Tsai-Wei Chen, Hanna Leapoldt, Leonie Strobl, Adam Benfield, Kayla Izarry, Leah Youngquist, Sarah Jonathan, and Charlotte Connop, who were critical contributors for both the pedagogy and the logistics. Exercises continue to be designed around fundamental questions related to a wide diversity of geological processes, but operations have evolved over the last two decades in response to scientific advances and improvements in software and technology. Next year will be Don Fisher's last year as director of the Field Camp, with Roman DiBiase assuming that role in the fall of 2023.

Roman DiBiase lectures in the Grand Teton National Park.

Newly Discovered Carbon May Yield Clues to Ancient Mars

by A'ndrea Elyse Messer



Curiosity's Dusty Selfie

Image Credit: NASA/JPL-Caltech/MSSS

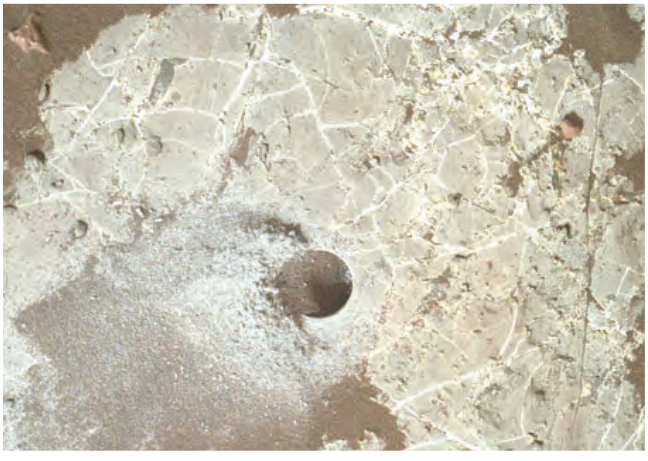
NASA's Curiosity rover landed on Mars on August 6, 2012, and since then has roamed Gale Crater taking samples and sending the results back home for researchers to interpret. Analysis of carbon isotopes in sediment samples taken from half a dozen exposed locations, including an exposed cliff, leave researchers with three plausible explanations for the carbon's origin—cosmic dust, ultraviolet degradation of carbon dioxide, or ultraviolet degradation of biologically produced methane.

The researchers noted in the *Proceedings of the National Academy of Sciences* that "All three of these scenarios are unconventional, unlike processes common on Earth."

Carbon has two stable isotopes, 12 and 13. By looking at the amounts of each in a substance, researchers can determine specifics about the carbon cycle that occurred, even if it happened a very long time ago.

"The amounts of carbon 12 and carbon 13 in our solar system are the amounts that existed at the formation of the solar system," said Christopher H. House, professor of geosciences. "Both exist in everything, but because carbon 12 reacts more quickly than carbon 13, looking at the relative amounts of each in samples can reveal the carbon cycle."

Curiosity, which is led by NASA's Jet Propulsion Laboratory in Southern California, has spent the last nine years exploring an area of Gale Crater that has exposed layers of ancient rock. The rover drilled into the surface of these layers and recovered samples from buried sedimentary layers. Curiosity heated the samples in the absence of oxygen to separate any chemicals. Spectrographic analysis of a portion of the reduced carbon produced by this pyrolysis showed a wide range of carbon 12 and carbon 13 amounts depending on where or when the original sample formed. Some carbon was exceptionally



The image above shows the Highfield drill hole on Vera Rubin Ridge. Drill powder from this hole showed carbon isotope values indicating a carbon cycle that includes either subsurface life, intense UV radiation penetrating the atmosphere, or Interstellar dust. The image was taken by the Mars Hand Lens Imager on sol 2247. Credit: NASA/Caltech-JPL/MSSS.

depleted in carbon 13 while other carbon samples where enriched.

"The samples extremely depleted in carbon 13 are a little like samples from Australia taken from sediment that was 2.7 billion years old," said House. "Those samples were caused by biological activity when methane was consumed by ancient microbial mats, but we can't necessarily say that on Mars because it's a planet that may have formed out of different materials and processes than Earth."

To explain the exceptionally depleted samples, the researchers suggest three possibilities—a cosmic dust cloud, ultraviolet radiation breaking down carbon dioxide, or ultraviolet degradation of biologically created methane.

According to House, every couple of hundred million years the solar system passes through a galactic molecular cloud.

"It doesn't deposit a lot of dust," said House. "It is hard to see any of these deposition events in the Earth record."

To create a layer that Curiosity could sample, the galactic dust cloud would have first lowered the temperature on a Mars that still contained water and created glaciers. The dust would have deposited on top of the ice and would then need to remain in place once the glacier melted, leaving behind a layer of dirt that included the carbon.

So far, there is limited evidence of past glaciers at Gale Crater on Mars. According to the researchers, "this explanation is plausible, but it requires additional research."

A second possible explanation for lower amounts of carbon 13 is the ultraviolet conversion of carbon dioxide to organic compounds like formaldehyde.

"There are papers that predict that UV could cause this type of fractionation," said House. "However, we need more experimental results showing this size fractionation so we can rule in or rule out this explanation."

The third possible method of producing carbon 13 depleted samples has a biological basis.

On Earth, a strongly carbon 13 depleted signature from a paleosurface would indicate past microbes consumed microbially produced methane. Ancient Mars may have had large plumes of methane being released from the subsurface where methane production would have been energetically favorable. Then, the released methane would either be consumed by surface microbes or react with ultraviolet light and be deposited directly on the surface.

However, according to the researchers, there is currently no sedimentary evidence of surface microbes on the past Mars landscape, and so the biological explanation highlighted in the paper relies on ultraviolet light to place the carbon 13 signal onto the ground.

"All three possibilities point to an unusual carbon cycle unlike anything on Earth today," said House. "But we need more data to figure out which of these is the correct explanation. It would be nice if the rover would detect a large methane plume and measure the carbon isotopes from that, but while there are methane plumes, most are small, and no rover has sampled one large enough for the isotopes to be measured."

House also notes that finding the remains of microbial mats or evidence of glacial deposits could also clear things up, a bit.

"We are being cautious with our interpretation, which is the best course when studying another world," said House.

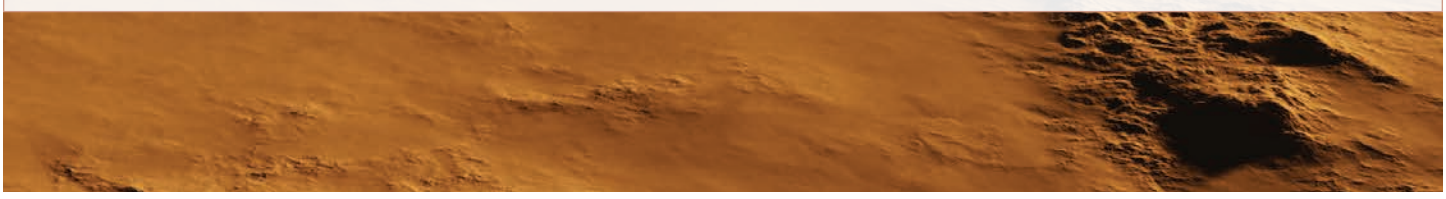
Curiosity is still collecting and analyzing samples and will be returning to the pediment where it found some of the samples in this study during the spring of 2022.

"This research accomplished a long-standing goal for Mars exploration," said House. "To measure different carbon isotopes—one of the most important geology tools— from sediment on another habitable world, and it does so by looking at nine years of exploration."

Also working on the project from Penn State was Gregory M. Wong, recent doctoral recipient in geosciences.

Other participants in the research were, at NASA Jet Propulsion Laboratory: Christopher R. Webster, fellow and senior research scientist; Gregory J. Flesch, scientific applications software engineer; and Amy E. Hofmann, research scientist; at Solar System Exploration Division, NASA Goddard Space Flight Center: Heather B. Franz, research scientist; Jennifer C. Stern, research assistant; Alex Pavlov, space scientist; Jennifer L. Eigenbrode, research assistant; Daniel P. Glavin, associate director for strategic science; Charles A. Malespin, chief, Planetary Environments Laboratory; and Paul R. Mahaffy, Retired Solar System Exploration Division Director; at University of Michigan: Sushil K. Atreya, professor of climate and space sciences and engineering and director of the Planetary Science Laboratory; at Carnegie Institution for Science: Andrew Steele, scientist; and at Georgetown University and NASA Goddard Space Flight Center: Maëva Milan, postdoctoral fellow.

NASA supported this project.



Congratulations to Jim Kasting and Dave Bice on their Retirement from Penn State

Jim Kasting

Jim Kasting retired in June, bringing to close a remarkable career. Kasting joined the Penn State faculty in 1988 as an associate professor of geosciences and meteorology. In 2003 he was named a distinguished professor of geosciences, and in 2012 he was named an Evan Pugh University Professor, the highest honor the University bestows on its faculty.

Kasting is a world expert in the evolution of Earth's climate and atmosphere. His investigations of the evolution of carbon dioxide and other atmospheric gases—oxygen, methane, nitrous oxide—provided insight into the proliferation of life on early Earth. His research has also focused on the study of habitable zones around other star systems, a field that is critical to the search for extraterrestrial life. He has made major contributions to the search for life on other planets, including refining the concept of the "habitable zone"—the area around a star where a planet can support liquid water and possibly life.

Kasting's contributions to the department go well beyond his research. Kasting, together with Lee Kump and Rob Crane, evolved their work on earth system science into one of the most popular undergraduate courses offered by the department, and wrote a well-known textbook on the topic, The Earth System. And in his thirty-five years at Penn State, Kasting advised or co-advised many graduate students and postdocs, many who today hold prominent positions in NASA and academic institutions throughout the world.

Kasting is a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the American Geophysical Union, the Geochemical Society, the International Society for the Study of the Origin of Life, and a member of the National Academy of Sciences. In his retirement, Jim will continue his affiliation with the department as an Inaugural Atherton Professor, a newly formed position for Emeritus Evan Pugh University Professors. We wish him all the best in his retirement.

Dave Bice

Professor Dave Bice has retired from teaching to launch a foundation focused on climate change adaptation and equity. Bice came to the department in 2004 from Carleton College where he aquired a national reputation for his work in cutting-edge curriculum design, including the development of innovative hands-on, active learning techniques.

In his eight years as associate head for undergraduate programs, he worked very hard to import these techniques to the department and he was instrumental in the development and launch of our Earth Science and Policy and Geobiology degree programs and our Earth and Sustainability certificate.

Over his tenure, Bice taught an impressively wide array of classes in the department and played a major part in our undergraduate program. He was uniquely poised to do this because of his extremely broad research

background in structural geology, sedimentology, stratigraphy, and impact geology. He worked hard in several of the face-to-face and fully online classes to make them more active, for example by involving the intuitive modeling program STELLA in the Earth classes that allows students to explore the climate system through experimentation with models that they construct. He received the G. Montgomery and Marion Hall Mitchell Award for Innovative Teaching in 2011 for his leadership in active learning.

Bice inspired hundreds of students as well as those of us professors who were fortunate to have taught with him. He was especially effective because he always thought beyond the course, connecting material to other classes, and to an individual student's interests. His warmth and humor transformed the atmosphere of a class into a collaborative, fun, and effective leaning environment.

Teaching in the field was Bice's true forte and one of his signature educational initiatives is the Italy field camp. He took between fifteen to twenty students to the Coldigioco field station several times where they took field geology and a range of other classes. The course was a transformative experience for the students, cementing their interest in geosciences, and spurring them to continue studies in graduate school.

Bice was also a wonderful faculty colleague, his remarkable breadth of geological expertise and his insight combined with his warmth and generosity made collaborations productive and fun. On behalf of his many colleagues in the department, we thank him sincerely for his major contributions to the department.

by Tim Bralower (with input from Sridhar Anandakrishnan, Roman DiBiase and Jim Kasting).

A Visit from Discovery Space

Discovery Space of Central Pennsylvania, located in State College visited the Rock Mechanics Lab in July 2022 as part of their 'Make Waves' summer science camp for middle school students, ages 11 through 14. The group led by Science Educator, Anna Schurter, was doing a waves-themed camp and came to Penn State to learn about earthquake physics, laboratory measurements of stress and strain, and rock friction. The campers were met by Chris Marone, professor of geophysics; doctoral students Clay Wood, Raphael Affinito, and Nolan Roth; and postdoctoral scholar Aagje Eijsink. They saw a demonstration of ultra-high-resolution deformation measurements involving strain gauges and a Wheatstone bridge where every camper was able to squeeze and bend a piece of granite, a cube about 2 inches in size and watch its size change by a few microns. They also saw stick-slip frictional sliding and learned about the role of loading stiffness for the stability of frictional slip; how a laser can be used to image flow along an optical fiber; listened to laboratory earthquakes under the stress conditions of Earth's upper crust.

Discovery Channel Filming

Chris Marone, professor of geophysics, and his team's exciting work on the use of machine technology in the pursuit of potential earthquake prediction was filmed this year as a part of a new ninety-minute documentary for the Discovery Channel on the earthquake hazards along the West Coast in the United States. The team were both gracious and patient with having to explain and re-do things multiple times and the crew really enjoyed learning about the work being done, and spending time with Chris and the team.

Penn State Alumni Make Mark on NASA Mars Missions *by Matthew Carroll*

This fall, NASA's Curiosity rover reached new heights.

Curiosity landed on Mars a decade ago to study whether Earth's rocky neighbor could have supported microbial life in its deep past. Since then, the rover has thrilled scientists and the public alike by finding evidence that the planet's ancient history included persistent liquid water, the right chemistry to support living microbes, and intriguing carbon signatures, among many other discoveries.

Along its journey, Curiosity has driven 18 miles within Gale Crater and more than 2,000 feet up Mount Sharp–a three-mile-tall Martian mountain at the crater's center. In October, the rover finally reached a long-sought region of the mountain enriched with salty minerals possibly left behind as the planet dried–climbing higher than it ever has in the process.

Back on Earth, Ben Tutolo can relate.

"I still haven't come back down from the fact that I was picked to be part of the Curiosity team," said Tutolo, an associate professor of geosciences at the University of Calgary who was selected by NASA to study data from the salty region.

Tutolo, who received his undergraduate degree from Penn State, was one of four graduates of the College of Earth and Mineral Sciences selected this year to join the Curiosity science team as participating scientists. NASA picked about two dozen proposals in a competitive process, choosing a new group of scientists to play active roles in daily planning and to conduct research important to the mission.

Also selected were Elisabeth (Libby) Hausrath, professor of geosciences at the University of Nevada, Las Vegas, Laura Rodriguez, staff scientist at the Lunar and Planetary Institute and Jennifer Eigenbrode, an astrobiologist at NASA's Goddard Space Flight Center, who all received their doctoral degrees from the Department of Geosciences. Tutolo, Hausrath and Rodriguez are new to the mission.

"I think this speaks to the quality of our college," said Chris House, professor of geosciences and director of the Consortium for Planetary and Exoplanetary Sciences and Technology at Penn State, and a participating scientist on the rover team. "This is an eclectic mix of people. They are different scientists who all came from EMS with different advisers, and they were chosen in this competitive process."

The group joins a larger cohort of Penn State geosciences faculty and alumni who are active on rover missions–both Curiosity and the Mars 2020 Perseverance Rover.

"I didn't realize the full extent of it until an astrobiology conference last May," said Rodriguez, who at the time was a postdoctoral scientist at NASA's Jet Propulsion Laboratory. "We had a Penn State reunion and all these people showed up. There were a lot of them, and many were working on Mars missions."

House said the deep connections demonstrate the increased involvement of geoscientists in NASA missions, and Penn State's work preparing its students to rise to the occasion.

"I think for many years we've been preparing our students really well in astrobiology," House said. "So as NASA missions become more and more astrobiology related, Penn State people have become more and more relevant for those missions. It's a super exciting time as mission topics become related to the search for life, and I hope that excitement translates to new scientists coming on board and also the public's engagement in these missions."

WE ARE ... Martians

Tutolo's journey to Mars began on a gently sloping forest hillside near the University Park campus.

An environmental systems engineering major at Penn State, Tutolo discovered a love for geochemistry his last semester while taking GEOSC 413W Techniques in Environmental Geochemistry, which included field work at Shale Hills Critical Zone Observatory near Shaver's Creek Environmental Center in Huntingdon County.

"Now Shale Hills is this globally famous place I read about in research, but really it's just another swale somewhere in Pennsylvania," said Tutolo, who grew up in Lower Burrell, a small city just northeast of Pittsburgh.

"But it was an eye-opening experience," he said. "We took all these things I'd been learning since grade school about the scientific method–hypothesis and data collection, all this stuff–and we were actually doing it. It was the first time as a scientist that I was doing investigative science and it was really life changing."

Tutolo followed his passion for aqueous geochemistry, and he is now an associate professor at the University of Calgary. His research includes work on magnesium sulphate lakes in British Columbia–rare on Earth and a potential analogue for conditions on ancient Mars.

As these ephemeral lakes evaporate, they actively precipitate sulphate minerals–including Epsom salt. Scientists believe the salty region on Mount Sharp contains similar minerals. And studying this region on Mars may provide new clues about how and why Mars' climate changed from one with permanent water to the frozen desert it is today, NASA scientists said.

"The rover can shoot these minerals with a laser to see their chemistry and that can give us clues for the habitability – the potential origins of life on Mars," Tutolo said. "Is it possible they are so salty you can't originate life or is it possible that you actually need this cycling between wet and dry to have reactions that produce amino acids and nucleotides?"

Life on Mars?

Studying the origins of life can smell so sweet.

Wafts of caramelizing sugar would greet Laura Rodriguez during her doctoral research at Penn State, studying how genetic precursors formed on early Earth. Her work focused on how heterocycles–ringed molecules that serve as nucleobases, or subunits, of DNA and RNA–reacted with complex prebiotic mixtures on early Earth to form more complex molecules–including how heterocycles reacted with the process theorized to have first formed complex sugars on Earth.

"I got a unique skillset from doing organic chemistry in a geosciences department where I also acquired the planetary science background," Rodriguez said. "That was a huge deal, because I already had the foundational knowledge from Penn State of what are we doing on Mars. That put me ahead of the game and gave me the foundation to choose where to go in my career."

Because her doctoral work produced large amounts of data, Rodriguez also started down the path of data science while at Penn State. She honed those skills as a postdoctoral scholar with NASA's Jet Propulsion Laboratory, analyzing samples taken from deep sea vents with Laser-Induced Breakdown Spectroscopy (LIBS), an analytical method that can identify organic and elemental hotspots strongly correlated with life.

This process is difficult because contaminants like iron and atmospheric carbon dioxide can mask the organic signals. But Rodriguez developed a method to tease out useful information from the spectra. And the process may be applicable to instruments on rover missions.

"Once we have a good method of teasing out organic compounds, we can use ChemCam to look for organic carbon hotspots," she said. "The ChemCam is fast–shoot it, get the data the next day–so my idea was that if we could develop this, we can use it a of survey tool to help identify interesting sites for further analysis."

Follow the water

Elisabeth Hausrath was a doctoral student studying aqueous geochemistry at Penn State in 2004 when the twin Mars Exploration Rovers–Spirit and Opportunity–landed on Mars.

When the rovers sent back evidence of water in the red planet's past, it piqued Hausrath's interest in water-rock interactions beyond Earth. She and her adviser Sue Brantley, Evan Pugh University Professor and Barnes Professor of Geosciences, wrote a NASA proposal that funded the rest of Hausrath's work at Penn State.

Her work included a trip to Svalbard, a remote artic archipelago about halfway between Norway and the north pole, to study water-rock interactions in an environment that's a stand-in for Mars.

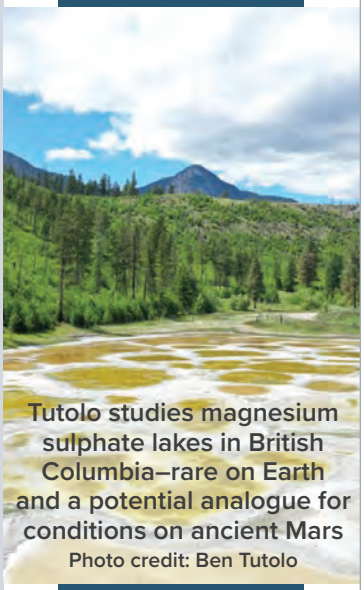
"I owe a deep debt of gratitude to Penn State and especially Sue Brantley," Hausrath said "She was great at teaching us how to give talks and how to write and practice good ethical science. I still quote her to this day to my students."

As part of the Curiosity mission, Hausrath will examine chemical and mineralogical evidence of alteration in Gale Crater to help understand water's role in its geological history.

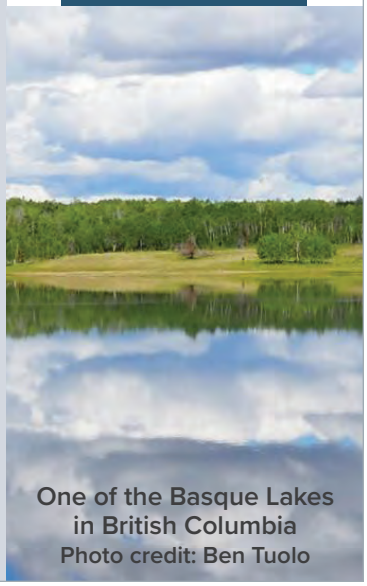
Hausrath, who is also a participating scientist on the Perseverance rover science team, said she wrote several proposals to join Curiosity before she was selected this year.

"Perseverance is really well named–because that's what it takes to stay in science," she said. "I would really encourage students to persevere in science because it can be a really challenging and difficult road. It's difficult for everybody. But if they persevere, then we all benefit from a more diverse and larger scientific community."

Ben Tutolo, associate professor of geosciences at the University of Calgary and Penn State graduate
Photo credit: Qin Zhang



Tutolo studies magnesium sulphate lakes in British Columbia–rare on Earth and a potential analogue for conditions on ancient Mars
Photo credit: Ben Tutolo



One of the Basque Lakes in British Columbia
Photo credit: Ben Tuolo

REU: Geosciences Program in Energy and Environmental Resource Sustainability (GeoPEERS)

by Patricia Craig

The geosciences fields are at a turning point, where the jobs of the next fifty years are likely to be quite different from the jobs of the last fifty years. As the world's dependence on energy increases, it is becoming increasingly clear that the ways in which those energy needs must be met are changing.

Through funding from the National Science Foundation's Research Experiences for Undergraduates (REU) program, Maureen Feineman, associate research professor, is leading a three-year REU, Geosciences Program in Energy and Environmental Resource Sustainability or GeoPEERS, to address those needs.

The goal of the REU is to prepare a diverse cohort of geoscientists to succeed in a rapidly evolving professional landscape. Energy continues to be a dominant employment target for geosciences graduates, yet the field is rapidly expanding beyond fossil fuels and into new markets, such as critical minerals exploration to provide raw materials for energy.

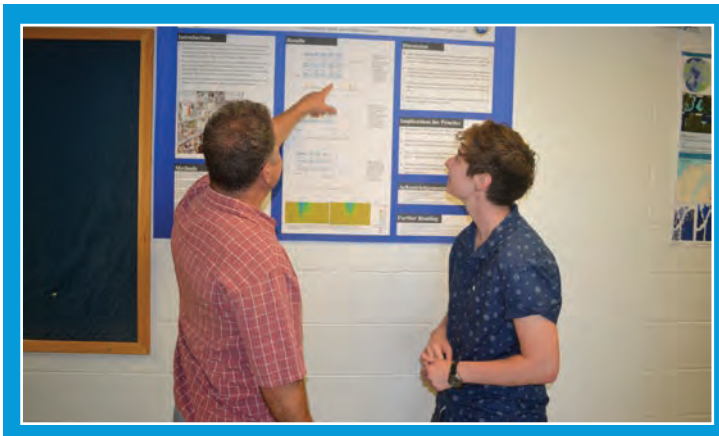
"Looking to the future, we can no longer think about energy and environmental science as two separate disciplines," said Feineman. "We need to train the next generation geoscience workforce for industry and academia to consider the whole system. We have increasing energy needs, and we need to develop sustainable ways of meeting those energy needs. All fields of geosciences, and well beyond, must include sustainability in their business models on all levels."

Geosciences has historically been one of the least diverse fields in the sciences. This REU is one of several efforts aimed at broadening participation in geosciences by opening doors for under-represented and non-traditional students and building inclusive research communities.

"The goal of REU programs, broadly speaking, is to make research programs more accessible to students who wouldn't necessarily have access at their home institution or wouldn't be able to afford to take a summer away from work to conduct research," said Feineman. "Through the NSF funding, the students are given a stipend and housing to come to Penn State and work over the summer. This creates the opportunity to have an authentic research experience as an undergraduate student at an R1 research institution without sacrificing summer income or enduring other significant financial hardships in order to have that experience."

The students spend eight weeks during the summer conducting research and engaging with their faculty mentors. Field trips, group discussions, and engagement with graduate students are also part of the program. REU participants also have the opportunity to submit an abstract and present their research at a national conference. Members of the 2022 cohort attended or presented at conferences including the National Association for Black Geoscientists (NABG), the Society for Advancement of Chicanos and Native Americans in Science (SACNAS), the Geological Society of America (GSA), and the American Geophysical Union (AGU).

"This first summer, we had eight students," said Feineman. "Their individual projects pertained to either energy or the environment or some combination of both. We had group discussions on how the subdisciplines of geosciences interface with the United Nations Sustainable Development Goals, how energy systems and environment systems overlap, and how the synergies between them tie into urban living, food production, air quality, and water quality."



Sarrah Vipond

Aiden Thomas

Students accepted for the REU do not need to be majoring in geosciences. Aiden Thomas, now a senior at Cornell University in the Earth and Atmospheric Sciences program, said he applied to the REU program because he wanted the research experience.

"One of the main drivers to apply is that I wanted to experience doing research outside of the classroom setting," said Thomas. "We have research projects and stuff in classes but it's very different when you're leading your own project. A lot of programs have great research opportunities, but I think what set this apart was our weekly meetings with various professors who talked about opportunities after graduation and discussed connecting global issues with sustainable development."

Sarrah Vipond, who grew up in Colorado Springs and spent four years in the military stationed in Virginia Beach before starting college, said the program opened her eyes to the vast possibilities in the field of geosciences.

"The really great thing about this program is that it opened my eyes to other possibilities," said Vipond, who is majoring in geosciences at the University of Colorado Boulder. "I thought that geochemistry was what I really wanted to do, but I now realize that there are so many sub-components like hydrology, oceanography, or oil and gas to consider. It's so exciting just to know that there so many options."

Through emphasis on fundamental research in geosciences fields related to energy and the environment, the REU hopes to provide transferable skills that will support participant success in graduate school and careers.

"We aim to train future leaders in sustainable, socially responsible resource production, and environmental management by providing exposure to concepts and skills relevant for emerging research directions," said Feineman.

Visit https://www.geosc.psu.edu/undergraduate/beyond-classroom/geopeers-reu for application information for the 2023 program.

Kimberly Lau Received Young Scientist Award from the Geological Society of America *by Patricia Craig*

Kimberly Lau, assistant professor of geosciences and an associate in the Earth and Environmental Systems Institute, was honored by the Geological Society of America (GSA) with its 2022 Donath Medal, or Young Scientist Award. Lau received the award at the GSA's annual conference, which was held in October in Denver.

The Young Scientist Award was established in 1988 to honor young scientists—age 35 or younger throughout the year in which the award is to be presented—for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences, according to the GSA.

"As an early career scientist, Kim has transformed our understanding of nontraditional isotopes in reducing environments and made major discoveries of the causes and consequences of oceanic anoxia in Earth history," said Andrew Nyblade, professor, and head of geosciences. "She is highly deserving of this award."

The award, consisting of a gold medal called the Donath Medal and an honorarium, was endowed by Dr. and Mrs. Fred A. Donath. Fred Donath was a famed professor of geophysics and earth science.

"I am deeply honored to receive the Young Scientist Award from the Geological Society of America," said Lau. "I am very grateful to my collaborators, research group members, advisers, and colleagues for their support and for their hard work."

Lau is a sedimentary geochemist who uses isotopes and modeling to understand the controls and feedbacks on biogeochemical cycles in Earth's past. She uses geochemical clues in the marine sedimentary record to reconstruct environmental change in Earth's history, to evaluate the growing toolbox of geochemical proxies to understand how and why these changes occurred, and to develop models to investigate Earth system feedbacks.

Before joining Penn State in July 2020, Lau was an assistant professor at the University of Wyoming and an Agouron Geobiology Postdoctoral Fellow at the University of California, Riverside. She received her bachelor's degree in geology and geophysics with honors from Yale University and her doctoral degree in geological sciences from Stanford University.

UNDERGRADUATE
Scholarships & Awards

Joseph Berg Award for Undergraduate Research: *Courtney Aubain, Jarem Cortez, Alex Cunfer, Olivia DiPrinzio, Jiahao Guo and Hunter Reeves*

Barton P. Cahir Award Endowment: *Neel Bishop*

Frank and Lillie Mae Dachille Memorial Award in Geochemistry: *Renan Beckman and Halina Dingo*

General Scholarship Endowment: *Jesse McConville*

David P. "Duff" Gold Undergraduate Scholarship Fund: *Francis Kuklis, Victoria Paul, Megan Vinella, Isabella Plotkin, Frank Santini and Sunday Siomades*

John C. and Nancy Griffiths Scholarship: *Jacob Irwin, Gemma Morrison, Noah Opferman, Deanna Richards, Easton Rinfrette and Travis Krivitski*

James and Nancy Hedberg Scholarship: *Ethan Lionetti, Erin Martin, Justin McGowan, Lindsey McMackin, Hrishi Mohan, Madeline Murtaugh, Kacper Orpik, Akira Regotti, Zane Saylor, Benjamin Smith, Seamus Smith, Octavia Szkutnik and Katrina Taylor*

John and Elizabeth Holmes Teas Scholarship Fund: *Sarah Kummerfeldt, Emma Stolinas and Zachary Baran*

Arthur P. Honess Memorial Award: *Emmy Gardner, Sydney McCarthy, Abigail Mensch, Joseph Miller, Zachary Terefenko and Madalyn Reed*

Benjamin F. Howell, Jr. Award: *Sarah Davis, Emma Enos, Nicholas Hornicak, Hollin Williams and Hunter Reeves*

Ronald A. Landon Endowment in Hydrogeology: *Kathleen McGowan and Taylor Rosen*

Maureen and Dennis Maiorino Undergraduate Scholarship in the Department of Geosciences: *Grace Boyle, Seth Farabaugh, Isabella Ferreira, Sarah Fetter, Alexander Filetti, Riley Foster, Olivia Friend, Megan Vinella, Riley Paul-Cook, Allison Welch and Dylan Wilt*

Perez Family Undergraduate Scholarship: *Sarah Perez, Angelina Santamaria, Regan Davis, Cris Kocian and Kurt McAuliffe*

Thomas Kenneth (T.K.) Reeves, Jr. Family Scholarship: *Heather Gilga, Jacob Manion, Madison Naylor, Joshua Rechenberg, James Regensburger and Zoe Zenker*

Robert F. Schmalz Award: *Olivia Adams, Mason Barner, Jared Bowman, Alexander Cerminaro, Jin Uk Choi, Matt Christie, Ciaran Costello, Bradly Crouthamel, Gavin De Mars, Gabriel Felker, Logan Fowler, Dominic Grasso, Molly Gulden, Hannah Hayes, Joshua Karas, Maya Kita, Hannah Luckenbaugh and Arnav Lund*

Julie and Trem Smith Family Undergraduate Scholarship: *Asala Al-Wadhahi, Zachary Baran, Sabrina Blacklock, Allison Clark, Emma Cox, Alexander Czeczulin, Eathan Gottshall, Robert Hull, Tommy Lutz, Seanna Pryor, Bridget Reheard, Kenneth Wasiulewski and Katerina Wood*

Daniel and Deborah Stephens First-Time Endowed Scholarship: *Jalen Scott, Alexander Waldman and Sophia Wood*

Timothy and Courtney Watson Undergraduate Scholarship: *Lindsay Leber, Anna Lee, Alysha Ulrich, Megan Vinella and Riley Wian*

Field Camp Awards

Thomas F. Bates Undergraduate Research Enhancement Fund: *Riley Foster and Nick Hornicak*

David M. Demshur Undergraduate Research Endowment: *Mason Barner, Renan Beckman, Jin Uk Choi and Logan Fowler*

The Edwin L. Drake Memorial Scholarship: *Matthew Felici, Daniel Hayden, Robert Hull, Tommy Lutz, Margaret Maenner, Sydney McCarthy, Yurik McCray, Madeline Murtaugh, Victoria Paul, Reed Plunkett, Garrett Reed, Madalyn Reed, Sunday Siomades, Lauren Stern, Kenneth Wasiulewski, James Regensburger and Katerina Wood*

James and Nancy Hedberg Scholarship: *Sarah Perez, James Regensburger and Katerina Wood*

Earle S. Lenker Fund for Field Studies in Geology: *Asala Al-Wadhahi, Devon Chenot, Emmy Gardner, Ethan Lionetti, Alexander Nikitin, Garrett Paley and Frank Santini*

Reif Undergraduate Summer Field Camp Endowment: *Sarah Davis, Samuel Dikeumunna, Eathan Gottshall, Francis Kuklis and Daniel Smith*

Dr. David E. W. Vaughan and Mrs. Julianne S. Vaughan Field Camp Fund: *Allison Clark, Sarah Perez and Megan Vinella*

Timothy B. and Cindy Lynch Mullen Scholarship: *Hannah Hayes, Jacob Manion and Hunter Reeves*

Robert F. Schmalz Award: *Megan Vinella*

GRADUATE
Scholarships & Awards

Alley Family Graduate Scholarship: *David Early, Thomas Givens and Ian Lee*

Chevron Scholarship: *Raphael Affinito, Zi Xian Leong, Paul Volante and Clay Wood*

R.J. Cuffey Fund for Paleontology: *Adam Benfield, Hanna Leapaldt and Kayla Irizarry*

Charles E. Knopf, Sr. Memorial Scholarship: *Ran He, Cristy Ho, Young Cheol Kim, Kate Meyers, Shavonne Morin, Emilie Saucier, Erik Schoonover, Leonie Strobl and Paul Volante*

Hiroshi and Koya Ohmoto Graduate Fellowship: *Shelby Bowden, Judit Gonzalez Santana, Eric Hasegawa, Aoshuang Ji and Karen Pham*

The Paul D. Krynine Memorial Fund: *Adam Benfield, Fai Chanchai, Tsai-Wei Chen, Hee Choi, Luis Alejandro Giraldo Ceron, Thomas Givens, Judit Gonzalez Santana, Cristy Ho, Aoshuang Ji, Young Cheol Kim, Hanna Leapaldt, Kate Meyers, Karen Pham, Youki Sato, Erik Schoonover, Adam Stone, Leonie Strobl, Alexander Thames and Tengxiang Wang*

Earle S. Lenker Graduate Fellowship: *Adam Benfield, Kayla Irizarry, Nolan Roth, Alexander Thames and Haochen Ye*

Michael Loudin Family Graduate Scholarship: *Chanel Deane, Thomas Givens, Ian Lee, Garrett Shepherd and Adam Stone*

Richard R. Parizek Graduate Fellowship: *Kaitlyn Horisk, Sierra Melton, Emilie Saucier and Samuel Shaheen*

Pottorf Endowment for Graduate Excellence: *Andrew Shaughnessy and Ran He*

Shell Geosciences Energy Research Facilitation Award: *Raphael Affinito, Safiya Alpheus, Shelby Bowden, Tsai-Wei Chen, Gabriel Dos Santos, Karen Pham, Youki Sato, Erik Schoonover and Jasmine Walker*

Richard Standish Good Graduate Scholarship: *Ran He, Cristy Ho and Kaitlyn Horisk*

Donald B. and Mary E. Tait Scholarship in Microbial Biogeochemistry: *Hanna Leapaldt, Shavonne Morin and Claire Shaughnessy*

Barry Voight Volcano Hazards Endowment: *Judit Santana*

Scholten-Williams-Wright Scholarship in Field Geology: *Kathleen Grosswiler, Kayla Irizarry and Leonie Strobl*

Awards, Recognitions & Service

Safiya Alpheus: Marathon Alumni Centennial Graduate Fellowship

Carl F. Aquino: EMS Graduate Fellowship for Science Advocacy and Diversity; Catherine Lyon Diversity, Equity, and Inclusion Award

Danielle Buchheister: Funds for Excellence in Graduate Recruitment (FEGR); NSF Graduate Research Fellowship Program (GRFP)

Luis Alejandro Giraldo Ceron: Geological Society of America (GSA) Graduate Student Research Grant

Rory Changleng: University Graduate Fellowship (UGF)

Chanel Deane: Marathon Alumni Centennial Graduate Fellowship

Juliana Drozd: Funds for Excellence in Graduate Recruitment (FEGR)

Ran He: Geological Society of America (GSA) Graduate Student Research Grant; MSA Grant for Student Research in Mineralogy and Petrology, Mineralogical Society of America; Evolving Earth Foundation Grant, Evolving Earth Foundation

Hanna Leapaldt: Institutes of Energy and the Environment (IEE) Biogeochemistry Award

Sierra M. Melton: AGU Local Science Partners Ambassador

Fran Meyer: Funds for Excellent in Graduate Recruitment (FEGR); Earth and Environmental Systems Institute (EESI) Environmental Scholar Award

Kate Meyers: Geological Society of America (GSA) Graduate Student Research Grant

Karen Pham: GSA/NSF Graduate Student Research Grant; Paleontological Society Rodney M. Feldmann Research Grant; Penn State Center for Land Dynamics Research Grant; AWG Sand Award; Best oral presentation from the Geobiology and Geomicrobiology Division at GSA 2021

Jackson Saftner: Marathon Alumni Centennial Graduate Fellowship

Judit Gonzalez Santana: NASA FINESST (Future Investigators in NASA Earth and Space Science and Technology) Program Grant; Outstanding Student Presentation Award (OSPA), AGU Fall 2021 Meeting

Youki Sato: Marathon Alumni Centennial Graduate Fellowship

Noshin Sharmili: Funds for Excellence in Graduate Recruitment (FEGR) Award

Garrett Shephard: Anne C. Wilson Graduate Fellowship; AAPG Grants-in-Aid Award; Marathon Alumni Centennial Graduate Fellowship

Edward Spagnuolo: Dean's Distinguished Graduate Scholarship (DDGS); EMS Wilson Award; Earth and Environmental Systems Institute (EESI) Environmental Scholar Award; NSF Graduate Fellowship Application Incentive Award; NSF Graduate Research Fellowship; Dean Edward Steidle Memorial Scholar Award

Miranda Sturtz: Earth and Environmental Systems Institute (EESI) Environmental Scholar Award

Jasmine Walker: EMS Graduate Fellowship for Science Advocacy and Diversity: Marathon Alumni Centennial Graduate Fellowship

Tengxiang Wang: Geological Society of America (GSA) Graduate Student Research Grant; Earth and Environmental Systems Institute (EESI) Environmental Scholar Award

Amanda Willet: NASA FINESST (Future Investigators in NASA Earth and Space Science and Technology) Program Grant

Zi Xian: Society of Exploration Geophysicists (SEG)/Chevron Student Leadership Symposium (SLS) 2022 Award

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Dr. John J. Kelley, ‘58 • Mr. Joseph R. Motto, ‘58 • Dr. John B. MacChesney, ‘59 • Dr. Gabriel A. Leblanc, ‘66

Mr. Thomas R. Schultz, ‘74 • Mr. Robert Y. Chapman, ‘51 • Mr. Theodore O. Schmidt, ‘55 • Mr. Christopher M. Mc Cann, ‘97

Mr. Robert G. Graf, ‘56 • Dr. Ranajit K. Datta, ‘61 • Mr. David C. Hubley, ‘86 • Ms. Kathryn A. West, ‘88 • Dr. David A. Vacco, ‘09

Dr. Lois A. Luedemann, ‘56 • COL C. Allan Egolf, ‘78 • Ms. Barbara L. Hajel, ‘79 • Mr. Roger M. Bould, ‘83 • Dr. Jesse C. Stepp, ‘71

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Dr. William M. Flock, ‘60 • Mr. Robert J. Hessler, ‘62Dr. Dennis W. O'Leary, ‘72 • Dr. Gregory A. Merkel, ‘84

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Alley Family Graduate Scholarship in the Department of Geosciences

Arthur P. Honess Memorial Award

Baker Hughes Natural Gas Research Fund

Barry Voight Volcano Hazards Endowment in the College of Earth and Mineral Sciences

Barton P. Cahir Award Endowment in Earth and Mineral Sciences

Benjamin F. Howell, Jr. Award in Geosciences

Charles E. Knopf, Sr. Memorial Scholarship

Daniel and Deborah Stephens First-Time Endowed Scholarship

David M. Demshur Undergraduate Research Endowment in Geosciences

David M. Diodato Geosciences Fund

David P. "Duff" Gold Undergraduate Scholarship Fund in Geosciences

Donald B. and Mary E. Tait Scholarship in Microbial Biogeochemistry

Dr. David E. W. Vaughan and Mrs. Julianne S. Vaughan Field Camp Fund in the Department of Geosciences

Dr. Gregory and Mrs. Mitra Pavlin Fund for Graduate Research Innovation

Dr. Hubert Barnes and Dr. Mary Barnes Professorship in Geosciences

Earle S. Lenker Fund for Field Studies in Geology

Earle S. Lenker Graduate Fellowship in the Department of Geosciences

Frank and Lillie Mae Dachille Memorial Award in Geochemistry

Fund for Excellence in Lithospheric Geodynamics in the College of Earth and Mineral Sciences

General Scholarship Endowment in Geosciences

Geosciences Enrichment Fund

Heller Marcellus Shale Research Initiative Endowment

Hiroshi and Koya Ohmoto Graduate Fellowship in Geosciences

James and Nancy Hedberg Scholarship in Geosciences

Janet C. Kappmeyer and Andrew M. Isaacs Experiential Learning Fund in Marine Sciences in the Department of Geosciences

John C. and Nancy Griffiths Scholarship in Geosciences

Joseph Berg Award for Undergraduate Research in Geosciences

Julie and Trem Smith Family Undergraduate Scholarship

Kappmeyer-Isaacs Field Camp Award

Katherine H. Freeman and Mark E. Patzkowsky Graduate Research Fund

Kent and Helen Newsham Geosciences Endowment in the College of Earth and Mineral Sciences

Lattman Visiting Scholar of Science and Society Endowment

Maureen and Dennis Maiorino Undergraduate Scholarship in the Department of Geosciences

Michael Loudin Family Graduate Scholarship in Geosciences in the College of Earth and Mineral Sciences

Open Flow Gas Supply Corporation Endowed Program Fund in Geosciences

Petroleum Geosystems Enrichment Fund

Pottorf Endowment for Graduate Excellence in Geosciences

R.J. Cuffey Fund for Paleontology

RADS Equipment Fund for Field Studies in Penn State Sedimentary Geology

Reif Undergraduate Summer Field Camp Endowment

Richard B. and Cynthia R. Alley Faculty Enhancement Program Fund

Richard R. Parizek Endowment for Field Study in Geosciences

Richard R. Parizek Graduate Fellowship

Richard Standish Good Graduate Scholarship in the Department of Geosciences

Robert F. Schmalz Award in the Department of Geosciences

Ronald A. Landon Endowment in Hydrogeology

Rudy L. Slingerland Early Career Professorship in the College of Earth and Mineral Sciences

Scholten-Williams-Wright Scholarship in Field Geology

South Jersey Resources Group Endowed Program Fund in Geosciences

St. Mary Land and Exploration Endowed Program Fund in Geosciences

The Paul D. Krynine Memorial Fund

Thomas F. Bates Undergraduate Research Enhancement Fund for Geosciences in the College of Earth and Mineral Sciences

Thomas Kenneth (T.K.) Reeves, Jr. Family Scholarship

Timothy and Courtney Watson Undergraduate Scholarship in the College of Earth and Mineral Sciences

Timothy B. and Cindy Lynch Mullen Scholarship in Geosciences

Timothy D. Watson Fund in Geosciences

ALUMNI NEWS

Don Woodrow '57: Woodrow earned his Ph.D. at the University of Rochester, he taught geology at Hobart and William Smith Colleges in Geneva, New York for thirty-six years. During that time, he and Bill Ahrnsbrak founded the Geoscience Department. He worked at the USGS in Menlo Park for about fifteen years generating publications on sediment cores from the San Francisco Bay. For about ten years, he taught an introductory geology course at Berkeley City College.

Lynn Brant '64 '71g '80g: Brant graduated three times from Penn State; 1964 with a B.S. in geosciences, 1971 with an M.S. in geology, and 1980 with a D.Ed. in earth science. He retired from the University of Northern Iowa in 2007 but is still doing research.

Ihor A. Kunasz '68 '70g: Kunasz earned his Ph.D. researching the lithium deposit in Clayton Valley, Nevada (the first brine deposit from which lithium carbonate was produced). As chief geologist, he has spent more than forty years in the lithium industry exploring and evaluating all world pegmatites and brines. He was awarded the prestigious Hardinge Award from the American Institute of Mining, Metallurgical and Petroleum Engineers. Retired, he has submitted a book for publication *The Lore of Lithium* covering all aspects of lithium from discovery to the electric car.

John Bender '72: Bender graduated with an M.S. degree in geochemistry. His adviser was Darryl Kerrick and upon graduating he took a lectureship position in geology at Winthrop College in Rock Hill, South Carolina. After three years at Winthrop, he left to pursue his doctorate at SUNY Stony Brook and graduated with a Ph.D. in geochemistry in 1980 and was hired as an assistant professor of earth sciences at the University of North Carolina at Charlotte in 1982. He retired in 2015 professor emeritus.

Ray Wells '72: Wells retired from the USGS in Portland, Oregon in 2016 but has been rehired for a seismic hazard study of a nearby Bureau of Reclamation dam. At the GSA Annual meeting in October 2022, Wells presented the Woollard lecture and received the George P. Woollard Award from the Geophysics and Geodynamics Section for the application of geophysics to geologic problems.

Daniel S. Dunmire '75: Dunmire retired in November 2020 after twenty-five years as district manager for the Mifflin County Conservation District in Pennsylvania. During that time his priorities were stream restoration in ag-impaired watersheds, non-point pollution abatement, farmland preservation, stream assessments, and environmental education.

Jim Anspach '77: Anspach was elected to the National Academy of Construction this summer. He is a distinguished member of the American Society of Civil Engineers and is the founding governor and 2018 president of the Utility Engineering and Surveying Institute. He is currently an affiliate assistant professor at Iowa State University where he is creating the first Utility Engineering graduate curriculum in the country.

Colm Chomicky '77: Chomicky, who earned his B.S. in geology in 1977, retired in July 2017 after twenty-eight years with Burns & McDonnell Engineering in Kansas City. A professional engineer and registered geologist, he also has a B.S. in civil engineering from the University of Texas at Austin. He and his wife Judy, sons Matthew and Sean, continue to reside in Kansas City.

Kent Newsham '78: Newsham was named an Oxy Fellow, Occidental Petroleum's highest technical position, in petrophysics in 2022. He is currently global chief of petrophysics and senior director of subsurface characterization at Occidental Petroleum in Houston, Texas. He is a proud member of the 1977 "Wallopsters" Alumni.

Dave McCarren '79: McCarren retired in July 2022 as the chief scientist for the Oceanographer of the Navy. His time included twenty years of uniformed service and thirteen years in federal service.

Stephen Howe '81: Howe worked for thirty-eight years as a research geochemist for the U.S. Geological Survey, the University of Vermont, Northwestern University, and the University at Albany. He retired in October 2019. He lives in Vermont with his wife and daughter where he enjoys leading occasional geological field trips for local organizations and hiking in the woods behind his home.

James Pinta, Jr. '81: Pinto had a great career in geology (registered Professional Geologist in Pennsylvania and North Carolina) culminating with his last employment as vice president in Geological Sciences for Civil & Environmental Consultants, Inc. He taught at both LaRoche University and Duquesne University as an adjunct professor for twenty years. He has been retired for seven years and he is proud to wear his Penn State polos on golf courses in Pittsburgh and Palm Springs, California.

Timothy Demko '83: Demko is retired after twenty years with ExxonMobil in Houston, Texas. He is now working as a geologist for the Bureau of Land Management in Phoenix, Arizona.

Carolyn Ng '83: Ng is a contractor and an informal education specialist with the NASA Heliophysics Education Activation

Team (NASA HEAT). Part of her job is to support NASA Headquarters in two upcoming celestial events. On Saturday, October 14, 2023, an annular solar eclipse will cross eight states and on Monday, April 8, 2024, a total solar eclipse will trace a narrow path in thirteen states. Outside of the paths of annularity and totality, everyone will see partial eclipses.

Gary Gittis '83: Gittis is the president of the Downingtown Area Education Association and vice president of the Pennsylvania State Education Association Southeastern Region. He is now in his thirty-third year of teaching.

Andy Phelps '83 '87g '90g: Phelps retired to Fond Du Lac, WI. Will White was his graduate adviser for two of his degrees.

Sharon Locke '84: Locke was elected vice chair of the International GeoScience Education Organization.

Gary E. Thompson '87: Thompson retired in February 2020 from federal service at the Defense Mapping Service, the National Intelligence and Mapping Agency and the National Geospatial-Intelligence Agency after thirty plus years.

Dan Leppold '93 '05g: Leppold is a ninth grade earth science teacher as well as a twelfth grade advanced geology teacher at Spring-Ford Area High School. He recently published a children's book based on true events from his farm just south of Reading, Pennsylvania. The story is about the real relationships that his cat has with critters like chipmunks and frogs. He has been donating copies to Little Free Libraries in Reading and New York City. Also, one of his former students put one in the Penn State's Little Free Library.

Keith Saroka '93: Saroka is entering his thirtieth year of teaching middle school science in the Interboro School District in Pennsylvania and his twentieth year as Middle School Science Department Head.

Greg Baker '01: Baker started his own geotechnical a nd environmental drilling company, Allprobe Environmental Inc., seventeen years ago. His most influential professor was Dr. Parizek, professor emeritus of geosciences, and fortunately he was able to spend a lot of time in the field with him studying the Living Filter, mine seeps, sink holes, and municipal water supply wells.

Abrar Alabbad '11: Alabbad is currently a Ph.D. candidate at King Fahd University of Petroleum and Minerals (KFUPM) in Saudi Arabia and she is the first female Ph.D. student in KFUPM's College of Petroleum Engineering & Geosciences.

FACULTY ACCOMPLISHMENTS

SUSAN BRANTLEY *was selected to give the George and Rosalind Helz Distinguished Lecture in Geology at the University of Maryland. George and Rosalind Helz, both of whom received doctoral degrees from Penn State, established the lecture in 2014.*

- *Named an Evan Pugh University Professor*
- *Elected a foreign associate of the French National Academy of Sciences*
- *Received the IAGC Vernadsky Medal in 2022 from the International Association of GeoChemistry for "a distinguished record of scientific accomplishment in geochemistry over the course of a career."*

KATHERINE FREEMAN

Received an honorary Doctorate of Science from the University of Chicago

ANTONIA HADJIMICHAEL

Elected to Penn State's Water Council

SARAH IVORY

- Named a Wilson Faculty Fellow
- *Recipient of Geological Society of America Continental Scientific Drilling Division Distinguished Lecturer Award*

BRIAN KELLY

Gladys Snyder College Award

LEE KUMP

Elected a Fellow of the U.S. National Academy of Sciences

KIMBERLY LAU

Gladys Snyder College Award

CHRISTELLE WAUTHIER

President-elect for the Natural Hazards section of the American Geophysical Union (AGU).

PETER WILF

Recipient of the College of Earth and Mineral Sciences' Wilson Award for Excellence in Research

KATHERINE FREEMAN *and* **JENNIFER MACALADY** *would like to announce that Penn State received an award from the Agouron and Simons Foundations to fund the International Geobiology Course for the next five years. The course had previously been run by University of Southern California and more recently by Caltech.*

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