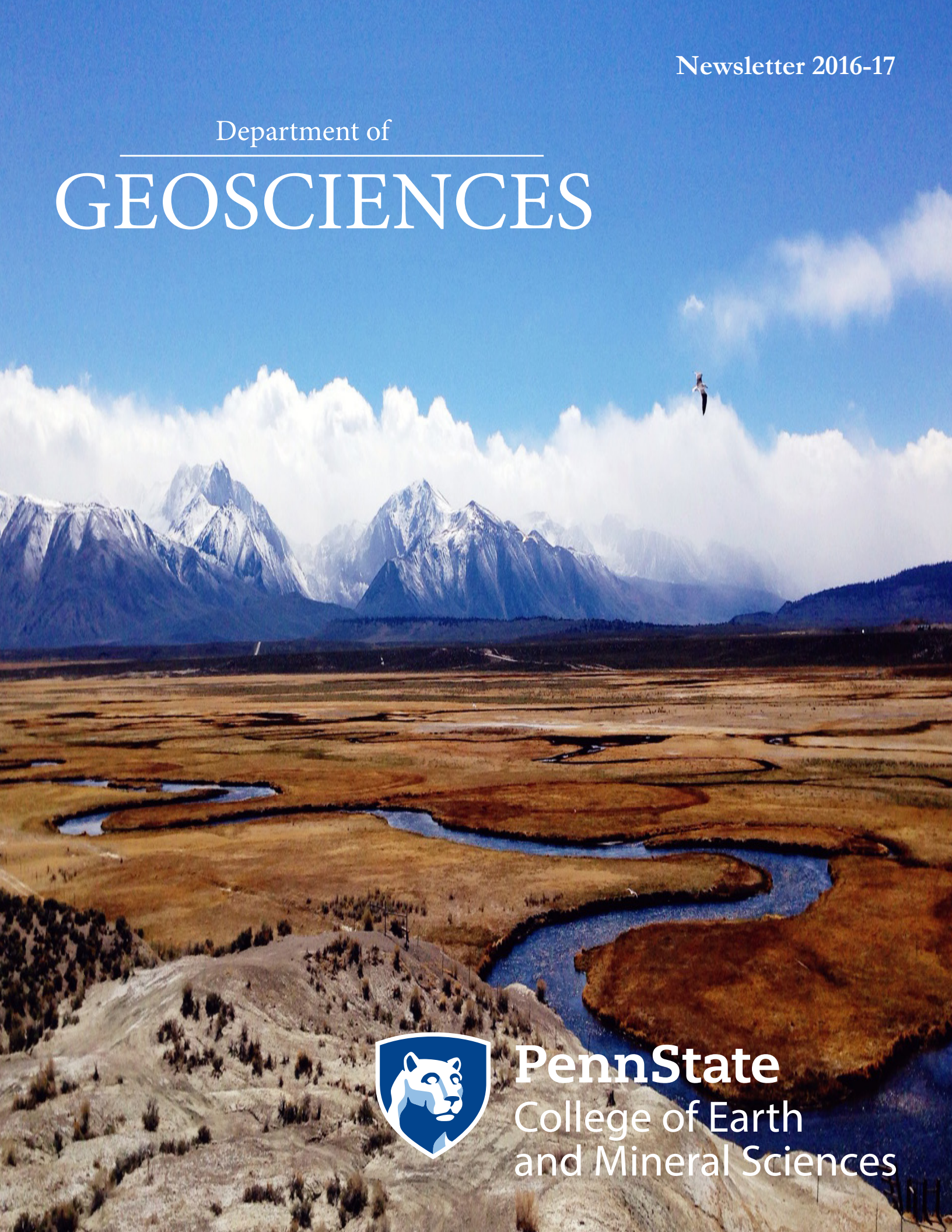
Newsletter 2016-17

Department of

GEOSCIENCES



PennState
College of Earth
and Mineral Sciences

From the Department Head

Seeing the Rocks

It's been said that the best geologist is the one who has seen the most rocks. Geological understanding is like wisdom; it comes with protracted diligence. This edition of the departmental newsletter highlights various ways in which Penn State geoscientists see the rocks.

We celebrate the careers of four emeritus faculty recently deceased whose protracted diligence led to tremendous geo-wisdom, and whose dedication to Penn State shaped the department and influenced hundreds of students. Memories of experiences in the field provide the gist of moving tributes to Rob Scholten and Gene Williams. They, along with Al Traverse and Wayne Burnham, dedicated their lives to science but, as importantly, to their students and junior colleagues. And, most notably, they did so at Penn State, for a combined 122 years of service to the department. The cumulative impact on Penn State students, staff, and faculty is immense.

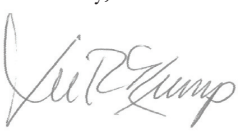
Whether it's the bucolic setting, magnificent road-cuts and classic Appalachian geology, the relatively low cost of living, the institution, or the students it attracts, Penn State retains its geoscience faculty. Like his adviser Gene Williams, recent retiree Rudy Slingerland completed his Ph.D. at Penn State and stayed for decades of teaching, research, and service. I've watched the graduate students cluster around Rudy during his regular visits to the Monday coffee and donuts and wonder where he got his oracle qualities. Barry Voight's tribute to Gene Williams suggests an answer: Rudy is the incarnation of Gene. We now face the impending retirements of Terry Engelder and Mike Arthur, two other highly impactful faculty members who will be sorely missed. Their legacies will be the students they advised, now successful in a variety of careers, and the way they carried us "eyes open" into the hugely promising but deeply challenging world of Marcellus gas exploitation.

We continue to do our best to give our students a jump-start on becoming the "best geologists," with ample opportunities to "see the rocks." As always, the lens for seeing the rocks can be field work, but it also can be laboratory experimentation or numerical modeling. And we use the term "rocks" rather loosely to include water (liquid or solid), atmospheric gases, or microorganisms. Penn State geoscientists conduct research on Earth's "Critical Zone" where these various types of "rocks" come together to create life-sustaining soil from bedrock, organic detritus, and water. Penn State geoscientist Sue Brantley was instrument in making Critical Zone research a national and international priority. Now others in the department are promoting an National Science Foundation (NSF) investment in an expanded Earth Surface Observatory (see page 4).

"Seeing the rocks" these days also involves computers. Pulse of the Earth undergraduate interns working with Pete La Femina (see page 16) observe changes in volcanoes, including the size and shape of craters and dynamics of eruption, using time series of images, digital elevation models and structure from motion techniques. Peter Wilf has developed a new computer imaging program that can automatically determine the taxonomical affinity of a modern or fossil leaf (page 18). The program learns what parts of the leaf are diagnostic and then applies those criteria to the classification of other leaf or fossil samples. And of course computers, in the form of digital cameras, document the beauty of nature, as revealed in our annual Graduate Colloquium photo contest (page 14).

Your financial support of the Department is what makes these opportunities a reality. We thank you for your protracted diligence and dedication to Penn State Geosciences!

Sincerely,



Lee Kump

Professor and Department Head

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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In This Issue...

Cover: The Owens River in the Sierra Mountains, California
Photo Credit Joanmarie DelVecchio

Understanding the Past, Present

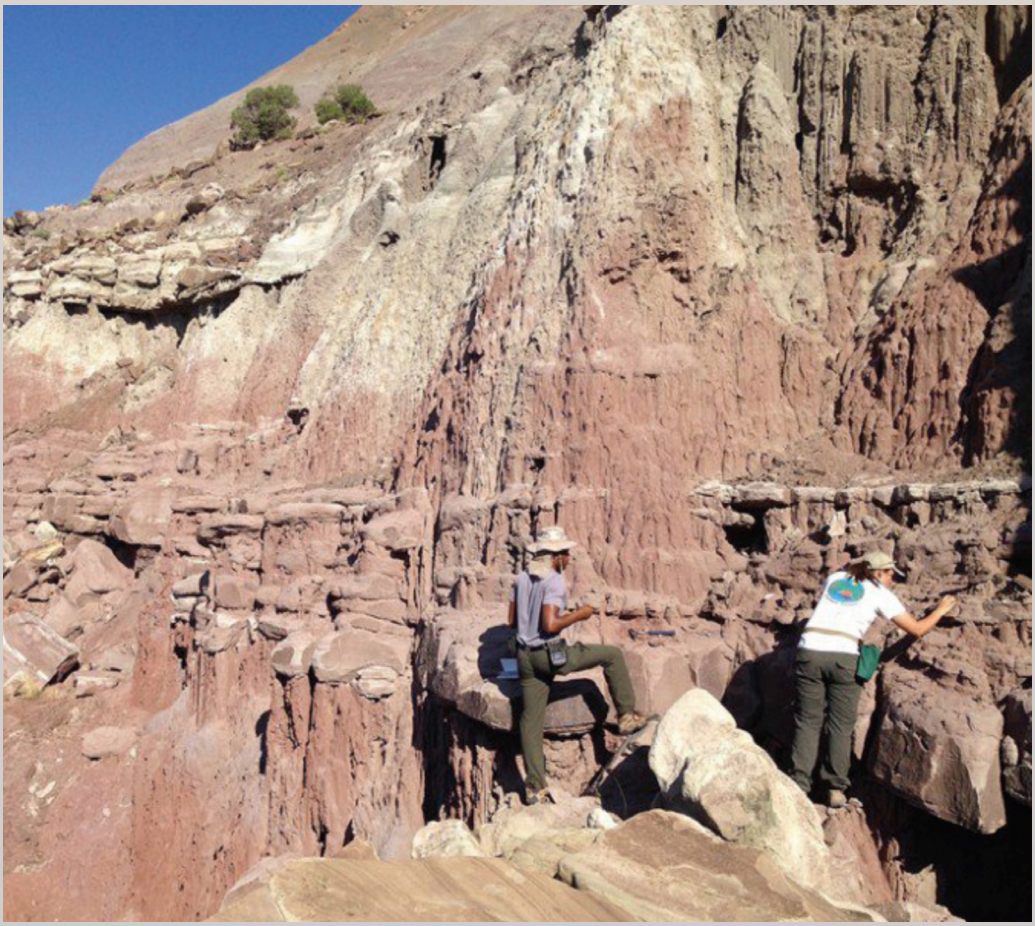
By Elizabeth Hajek, assistant professor of geosciences

Earth's surface – our home – is the interface between solid ground, air, water, and life. The flow of energy, nutrients, minerals, and water across Earth's outer skin is a complex response to tectonic, climate, and biological forces acting over timescales as old as the Appalachians and as rapid as earthquakes. These dynamics fuel our economies, nourish our crops, transform our coastlines, and regulate our climate. Understanding Earth-surface processes is essential to sustaining our way of life.

Currently there are several large federal and international programs aimed at monitoring Earth's dynamic interior and increasing satellite and airborne imaging capabilities to help track atmospheric, oceanic, and land-cover conditions across our planet. But connecting these observations to make meaningful, ground-level predictions about Earth's surface remains elusive. In large part this is due to a lack of infrastructure – both physical and organizational – to bridge across existing observation networks, connect remote-sensing data with accurate field observations and state-of-the-art laboratory analyses, and integrate science that spans modern observations through Earth's deep-time history.

The National Science Foundation Surface Earth Processes (SEP) Section reflects the multitude of intersecting perspectives required for addressing areas of critical societal need. Programs within the section include Geobiology and Low-Temperature Geochemistry, Geomorphology and Land Use Dynamics, Hydrologic Sciences, and Sedimentary Geology and Paleobiology, which collectively focus on the physical, chemical, and biological processes acting on Earth's surface both today and throughout Earth's dynamic past. Independently these programs facilitate critical fundamental science advances that strengthen our understanding of Earth's life-sustaining surface and the processes that shape our planet's crust. However, the challenges we currently face – outlined in a number of recent National Academies of Sciences reports and white papers – far exceed the abilities of any one program or small group of scientists.

To address this issue, Professor Lee Kump organized a workshop to evaluate what resources will be required to tackle next-level, societally critical research questions about Earth's surface. At the meeting titled "Research Infrastructure in Support of NSF-SEP Grand Challenges" twenty-one researchers (including Penn State geoscientists Lee Kump, Timothy Bralower and Elizabeth Hajek) representing the broad range of disciplines within the SEP section, discussed infrastructure challenges that are currently limiting our ability to understand, predict, and manage Earth's surface systems. The concept, summarized in a white paper published in *EOS*: "Taking the Pulse of the Earth's Surface" (Larsen et al., 2015), is a broad vision for a comprehensive Earth Surface Observatory – a network of facilities working in concert to study and characterize Earth-surface dynamics across the United States linking a roving ground-measurement facility with a cutting-edge laboratory network and a deep-time critical zone observatory. Together, these components could provide holistic understanding of the processes and dynamics that drive Earth-surface conditions across diverse provinces throughout the U.S.



Above: Penn State students Tramond Baisden (MS 2015) and Ellen Chamberlin (PhD 2016) collect data from 55-million-year-old sediments in Colorado to understand how Earth's surface changed in response to a rapid change in climate. Photo credit: Liz Hajek

and Future of Earth's Surface

The Earth Surface Observatory envisioned by workshop participants would leverage existing efforts and connect them through targeted infrastructure investments. First, science advances that have arisen from NSF's Critical Zone Observatory network would be packaged and mobilized into an Earth Rover campaign comprising field vehicles equipped with instruments for measuring the geophysical, geochemical, and biological processes operating at a study site. Over the course of several years, these Earth Rovers would roll across the country making detailed and consistent observations of Critical Zones across 50-80 sites spanning key physiographic provinces of the U.S. Simultaneously investments into infrastructure supporting a Deep Time Critical Zone Observatory and a Distributed Analytical and Experimental Laboratory Network would connect expanded Critical Zone observations with state-of-the-art laboratory facilities and a historical and long-timescale perspective available only by studying past conditions on Earth's surface preserved in sedimentary rocks.

Without such a vigorous and comprehensive approach to understanding Earth's surface, we will not be able to answer important and practical questions about our habitat. How do agricultural practices in Pennsylvania and Iowa impact coastal ecosystems? How well can Arizona's living filter scrub polluted water percolating just beneath the surface; does Washington's critical zone handle the task better? Is the balance of soil nutrients more stable in North Dakota or Alabama? How did Maryland's coastline and Colorado's rivers react to increasing temperatures and changing weather patterns during one of the most rapid climate-warming events in Earth's past? In light of historical changes and projected trends, would it more prudent to engineer protections for coastal communities or redesign and relocate developments facing rising seas?

Answers to these types of questions are necessary for responsibly and efficiently investing public and private resources into maintaining and protecting our habitat from the many stresses it currently faces. Targeted research-infrastructure investments would promote comprehensive and meaningful advances in Earth surface science.

Above: An Earth Surface Observatory would link high-resolution measurements from an "Earth Rover" campaign with state-of-the-art laboratories and analytical facilities and deep-time observatory efforts collectively aimed at understanding the past, present, and future of Earth's surface.
Image credit: Liz Hajek

Bachelor's Degree Student: Natasha Nagle

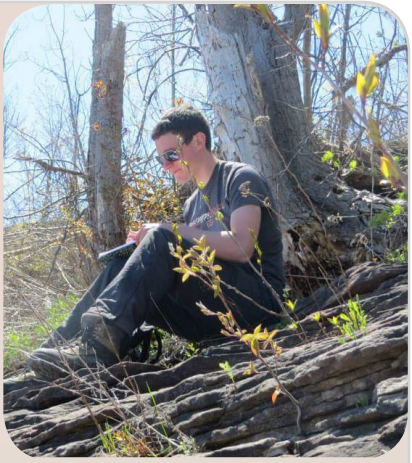
Our world's story is not seen in one light; there is no single way to interpret its trials and tribulations, victories or defeats. Individuals must supplement physical records with their own version of the story, utilizing their unique perspectives to do so. It was this fascination with the past that led me to pursue fields that would enable me to become a part of the search for understanding, regarding both the Earth's past and its environs, as well as of the people who live on it; thus leading me to my concurrent majors in Geosciences (B.S.), Classics and Ancient Mediterranean Studies (B.A.), as well as Anthropology (B.A.) here at Penn State. Since I was little, rocks, and what they are capable of telling us, have been intimately integrated with my interest in classical history and mythology, and have led to my hopes of being able to combine both fascinations in ways that may have, as of yet, eluded our imaginations.

I am proud to be a member of the College of Earth and Mineral Sciences here at Penn State, which houses one of the leading geosciences programs in the country. Thus far, I have participated in six study abroad programs, and am currently preparing for my seventh and eighth this summer, one with the geosciences program in Coldigioco, Italy and another in Tel Akko, Israel, for an archaeological excavation and archaeometallurgy classes. I am also a member of the Schreyer Honors College, a Paterno Fellow, and an Archaeological Institute of America 2016 Matson Fellowship recipient. In addition to my academics, I enjoy reading and writing, as well as being a member of Rince Na Leon, Penn State's Irish dance club, the Archery Club, the MMA club, a Global Ambassador, and advancing my knowledge of the French and Greek languages.

The incredible programs and staff within the College of Earth and Mineral Sciences, coupled with the amazing opportunities offered at Penn State, have truly enabled me to pursue multiple paths of study and integrate all that I have learned to form the bedrock of my educational experience, which I will build upon far into the future.

Ultimately, I hope to use my geosciences training on archaeological excavations in order to increase our knowledge concerning humanity's shared past, and what that past, when combined with the history of the Earth, can tell us about our future. For my senior thesis I am looking toward the possibility of analyzing the geological aspects of, and artifacts relating to, archaeological sites and hoping to connect them to what we know about trade routes throughout history.

Master's Degree Student: Peter Ilhardt



I grew up with a keen interest in math and science, but developed a passion for music in high school that I chose to pursue as an undergraduate at Northwestern University. Two years into my cello performance major, however, I began to realize that I was more enthused about the science electives I was taking than the recitals, and I promptly decided to add on a second major in a physical science. After consulting with several advisers and taking a few classes, it became clear that geosciences would be a great fit for me: it integrated chemistry, biology, and physics to solve real-world problems; it incorporated both laboratory and field work with unique travel opportunities and interdisciplinary collaborations; and it addressed fundamental challenges facing society today on a global scale, such as environmental pollution and resource management. I became directly involved in a research project focusing on microbially constructed rocks from a sinkhole in Mexico, which included three weeks of field work in the Yucatan Peninsula. The experience confirmed my interest in geosciences and curiosity about the natural world, and I graduated with a degree in Earth science and music in 2013.

Immediately following, I pursued several internships that allowed me to apply my newfound technical skills in the areas of storm water management, geospatial data integration, and watershed geochemistry. I spent four months working at Mammoth Cave National Park in Kentucky, contributing to ongoing studies on topics as diverse as road salt effects on karst water quality and torpor cycles of bat populations. After a six-week intensive geoscience field camp in Utah, I began my graduate studies at Penn State in August 2014, now a fully converted Earth scientist.

Students in the Spotlight

Peter Ilhardt (continued)

My research in the Department of Geosciences has brought me back to rocks built by microbes, but this time with deposits formed 2.5 billion years ago! In particular, I have been working with Christopher House to analyze small, micron-sized pyrite crystals formed in a stromatolite at a time when microorganisms were fundamentally transforming the Earth's surface through the production of oxygen. I have used a variety of microanalytical techniques such as laser ablation to measure geochemical properties of the pyrites that can shed light on how they were formed and under what environmental conditions. By analyzing concentrations of trace metals and the stable isotopes of carbon and sulfur, we are piecing together a history of this ancient rock that we can use to interpret broader geochemical cycles on the early Earth. It may also contribute to the development of biosignatures that can be used to identify signs of life in the rock records of other planets, such as Mars.

I plan to use the geochemical skills and methodology I have acquired at Penn State to inform environmental remediation efforts or continue conducting research in biogeochemistry at a national laboratory. I will also continue to perform as a cellist.

Doctorate Student: Kiya Riverman

I am a glaciologist who uses geophysical techniques to characterize subglacial and englacial hydrology. What a mouthful! When I talk to 6-year-olds, I like to tell them that I blow up dynamite and crawl around underneath glaciers in order to understand what makes ice move.

How did I come to care so much about the icy parts of the world? Growing up in the Pacific Northwest at the foot of the Cascades, I always looked forward to skiing and climbing adventures in the mountains. In my senior year at Oregon State University as an Earth science major, I studied abroad on the high Arctic archipelago of Svalbard. It was there that I learned that I could combine my enthusiasm for being in the mountains with my desire to understand how the earth works: through studying glaciers!

I am now entering my sixth (and final) year as a Ph.D. student at Penn State. Through my Ph.D., I have been lucky to work with Richard Alley and Sridhar Anandakrishnan of the Penn State Ice and Climate Exploration (PSICE) group. With the group, I've been able to work on ice in Antarctica, Greenland, Svalbard, Italy, Alaska, Iceland, and Norway. One thing I've loved about working with PSICE is the flexibility the group has afforded me to follow my own research interests.

Ice sheets and glaciers around the world are changing. My research is motivated by a desire to describe that change: How much ice from glaciers will flow into the ocean and contribute to sea level rise? How will increased melting on their surface impact overall flow dynamics? I address these questions using geophysical techniques like active seismics. My work in northeast Greenland has shown that the ice stream there is unique in Greenland and Antarctica and has the ability to grow and shrink because it is not controlled by topographic forcing.

When I'm not in the office or out on a glacier, I like to explore and map limestone caves across the eastern seaboard. Three years ago, I applied that caving knowledge to glaciology and started a project to better understand glacial hydrology through ice caving on Svalbard. In three different years I have mapped the path that meltwater takes from the surface of a glacier to its bed though ice caves, and have seen dramatic evolution of the system. I am particularly interested in how waterfalls form and evolve inside and beneath glaciers. I'm now also involved with the University Center on Svalbard, teaching graduate level courses on Glacial Hydrology. I have also spent three summers as a faculty member on the Juneau Icefield Research Program. Through the program, undergraduate and high school students from across the country spend ten weeks skiing across the Juneau Icefield. I teach them different techniques for studying glaciers and also keep them from falling into giant crevasses. It is brilliant fun.

The field-based teaching programs in Svalbard and Alaska have fueled my desire to pursue a career as a teacher and researcher at the university level. I love getting a group of students as excited as I am about glaciology! I hope, in my steps beyond Penn State, that my work will continue to motivate young researchers to get out and explore the world around them.

Jacqueline Huntoon Awarded the 2016 Charles L. Hosler Alumni Scholar Medal

by Kevin Furlong, professor of geosciences

Dr. Jacqueline Huntoon, who received her Ph.D. in geosciences in 1990, was awarded this year's College of Earth and Mineral Sciences Charles L. Hosler Alumni Scholar Medal. The Hosler Medal is awarded to "recognize high achieving alumni who have made outstanding contributions to the development of science through research, teaching, or administrative leadership." Jackie has made outstanding contributions in all three arenas that this award recognizes.

Jackie Huntoon is currently the provost and vice-president for academic affairs at Michigan Tech University, having moved to that position in 2015 after serving as dean of the Graduate School at Michigan Tech since 2005. Although Jackie has spent the past decade in key administrative roles at Michigan Tech, this did not diminish her continued contributions to both research and education.

Jackie came to Penn State after completing her M.S. at the University of Utah, as a highly proficient, field-focused sedimentary geologist. Although she probably considers herself to be a card-carrying field geologist, during her time here, she completed the geophysics Ph.D. curriculum. By melding the geophysical and quantitative side of our science with her keen field observational skills, Jackie helped define what became a revolution in sedimentary geology–quantitative basin modeling and analysis. At the time, Jackie represented a small group of individuals with expertise in geology, geophysics, and quantitative modeling–the importance of that suite of complementary skills has become recognized as critical in basin studies. Jackie has had a very successful research career, supervising numerous M.S. and Ph.D. students at Michigan Tech. Her research contributions have been recognized with election as a Fellow of the Geological Society of America (GSA) in 1999, and the Levorsen Memorial Award for outstanding contribution to petroleum geology by the American Association of Petroleum Geologists in 2002.

Jackie's success at Michigan Tech is clear. Throughout her career, she has been entrusted with critical responsibilities and has excelled. She has developed her leadership skills throughout her career. When she elected to go to NSF to lead the Diversity and Education Program in the Directorate of Geosciences, she was stepping into a complicated and fraught situation. There was the recognition of the importance for enhancing geosciences education and broadening its diversity, but the program was in the doldrums. During her two-year tenure she revamped the program, instituted fundamental changes, and built what has become a fundamentally important program within the Directorate of Geosciences (NSF's largest).

Some of her greatest impact has been in improving geoscience (and science) education nationally. She brings her combination of quantitative rigor and science excellence to these education activities. She seeks evidence that new approaches are improvements for learning. She is open to new ideas but also willing to acknowledge when they aren't working. Jackie 'walks the walk' when it comes to science education–she is in the classroom (or the field as appropriate) testing and implementing her initiatives. Her contributions have been recognized with (among other awards) elected membership in the Michigan Tech Academy of Teaching Excellence, and service as the National Association of Geology Teachers Distinguished Lecturer in 2005-08. She has received significant education research funding from the NSF, NASA Space Grant, and most recently a $5 million grant from the Dow Foundation to develop integrated middle school science curricula aligned with the Next Generation Science Standards.

As she was finishing her Ph.D., and beginning to look for her first academic position, an opportunity arose at Michigan Tech for a sedimentary geologist. Michigan Tech is an engineering school, with a department that was heavily weighted towards geophysics. They had a hard time filling the position because it was difficult to find a top-notch sedimentary geologist who could work quantitatively with their students. To me, it seemed that Jackie was the perfect candidate, but there was the issue of whether a born and bred Californian could find happiness in the below-zero winters of the Michigan upper peninsula. Jackie interviewed for the position, they wanted her, and the rest is history. Later I heard that one of the things about Jackie that was icing on the cake for them was that on top of her expertise in geology, numerical modeling, and geophysics, she could also manage a UNIX computing system! Never had they seen that breadth of talent in a job candidate. *Continued on page 9.*

Spotlight:

Timothy Watson Recipient of the 2016 Penn State Alumni Association Alumni Achievement Award

by Andy Nyblade, professor of geosciences

Tim Watson has over ten years of oil industry experience in an array of geologic and geophysical positions predominantly focused on shore in the lower forty-eight states. He began his career in 2005 with ConocoPhillips and in 2008 moved to Rosetta Resources, seeking a smaller, fast-paced environment with a greater breadth of responsibility. At Rosetta, Tim gained experience in both conventional and unconventional asset development, exploration, and new ventures, as well as acquisitions and divestitures. He served as asset geoscientist for Gates Ranch, Rosetta's core asset in south Texas until Rosetta was acquired by Noble Energy in July 2015. He currently serves as a senior reservoir systems geoscientist for the Texas and Marcellus Business units at Noble.

Tim credits his success in industry to the broad background in the geosciences that he obtained through B.S. (2002) and M.S. (2005) degrees at Penn State. For this senior thesis, co-supervised by Tim White and Andy Nyblade, Tim imaged a Cretaceous inliner in southern Pennsylvania using seismic data to determine if it was sufficiently thick to core for paleoclimate studies. This introduction to geophysical methods led Tim to pursue an M.S. degree in geophysics with Andy Nyblade working on imaging upper mantle structure in Antarctica. Tim participated in two field seasons on the "ice" to collect seismic data, one of which included a 1,000-km-long traverse with a tractor-sled caravan across the top of the polar ice cap in East Antarctica. After living in the warm climate of southern Texas for more than ten years, Tim says he has finally recovered from the months of frigid (-30 C) temperatures he endured in Antarctica. Tim's M.S. thesis work on the upper mantle structure of the Transantarctic Mountains, East Antarctic Craton and Ross Sea, which was published in Geophysics, Geochemistry, Geosystems in 2006, has been cited more than fifty times.

In addition to his role as a geoscientist in industry, Tim has served as a mentor to multiple summer interns, participated as an on-campus recruiter and was a member of a corporate contributions committee while at Rosetta. He often shares his knowledge of and experience with the energy industry during frequent visits to the department, which the faculty and students find invaluable. As a life member of the Penn State Alumni Association, Tim has established gifts that support the Department of Geosciences Field Camp and the AfricaArray program. He serves on the College of Earth and Mineral Science's Development Council as the youngest member and is involved with the Department of Geosciences on several different levels. Department head Lee Kump notes that "Tim's support of Penn State students in his first decade as an alum has been invaluable. It's remarkable that he finds as much time as he does for his alma mater while garnering so much success in a highly competitive industry." In recognition of his accomplishments and engagement with the university, this past spring Tim was awarded the Penn State Alumni Achievement Award. When asked recently about his commitment to supporting Penn State, Tim commented that "Penn State, and specifically the Department of Geosciences, has provided me with a breadth of knowledge and life experiences that have instilled in me great pride and have provided for me clear goals in life. I hope to now help enable other students and young alums so they may achieve their own success."

Huntoon (continued from page 8)

Provost Jacqueline Huntoon is a great example of how talent, hard work, commitment, and adherence to excellence leads to huge impact. She is proud of her Penn State roots (she has continued to provide us feedback as a member of the geosciences department's advisory board), and truly represents the importance of what we do as a department, a college, and a university. Jackie Huntoon's career exemplifies the criteria of the Hosler Medal; her combination of excellence in research, education, and service exemplifies the attributes that Charlie Hosler demonstrated throughout his career at Penn State.

Department Passings

Wayne at the 1999 Goldschmidt Conference in Boston Photo credit Hu Barnes

C. Wayne Burnham

by David "Duff" Gold, professor emeritus of geosciences

C. Wayne Burnham was born in Elsinore Valley, the youngest of five boys in a farming family. He worked on the family farm until he finished high school in 1940, and then apprenticed as a machinist in Santa Monica before entering U.S. Naval Flight School in 1942. The machining experience prepared him well for his later scientific endeavors at Penn State. He married Estelle Comington in June 1943, the same day he received his wings. He was posted to the escort carrier USS Bismarck Sea in the Pacific theater, flying a variant of the F4F Wildcat rather than the newer F6F Hellcats assigned to larger fleet carriers. The USS Bismarck Sea was at Leyte Island in support of military operations and later took part in the Lingayen Gulf landings (January 9-18, 1945). On February 16, she arrived off Iwo Jima to support the invasion. On February 21, 1945, despite heavy gunfire, two Japanese kamikazes hit the Bismarck Sea, at dusk, and she sank two hours later with a loss of 388 lives. Wayne, wounded from exploding ordinance, was rescued from the water and after convalescing in San Diego joined his elder brother in establishing a successful "rocks and minerals" business Burminco, California. To learn more about the minerals, Wayne enrolled at Paloma College, graduated magna cum laude in 1951, and wrote his thesis on contact metamorphism at Crestmore, California, where more than 110 individual mineral species were recognized. Next step was Cal Tech under the tutelage of James A. Noble and Richard H. Jahns. He graduated in 1955 with a thesis, "Metallogenic Provinces of the Southwestern United States and Northern Mexico." He spent part of the summer with Hugh Taylor on a U.S. Steel project in Alaska before moving to Penn State to set up a laboratory with large-volume, internally heated pressure vessels designed to determine the pressure-volume-temperature properties of fluids and melts to 10,000 bars and 1,000° C. During the next thirty years, until his retirement in 1986, he explored the thermodynamic properties of igneous petrology, producing crucial insights of metamorphic and igneous petrologic processes.

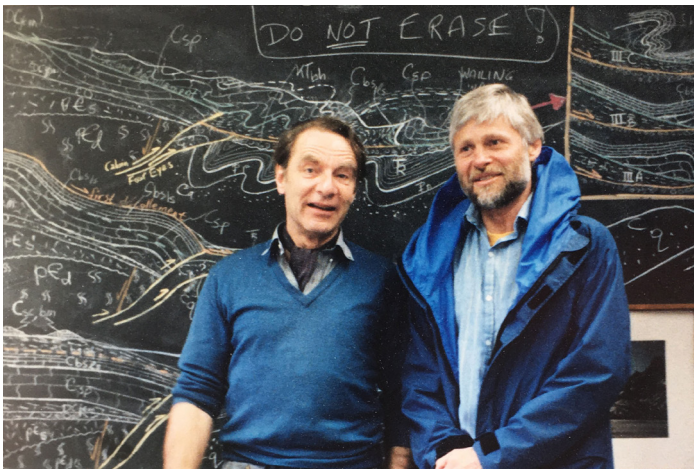
Cooperation with Richard H. Jahns was especially stimulating because of Dick's perspicacious conviction of the role of aqueous fluids in forming of pegmatites. This hypothesis, along with other related queries on the nature of hydrothermal fluids and magmas at high temperatures and pressures, required experiments in large volume, internally heated pressure vessels. Fundamental to Wayne's investigations were his precise, intricate measurements of the P-V-T properties of H_2O. These measurements resulted in a widely valued publication, "Thermodynamic Properties of Water to 1,000°C and 10,000 Bars" (1969; C.W. Burnham, J.R. Holloway, and N.F. Davis, GSA SP132).

Wayne considered his greatest accomplishment to be the discovery that if the moles of non-volatile melt components are chosen on the basis of equal numbers of oxygen atoms (eight in the present case), a close approach to ideal mixing thermodynamically would occur among these eight oxygen atoms per mole species of melt components. As a consequence, it became a relatively simple matter to develop a thermodynamically based model to calculate phase equilibrium relationships in magmas ranging in composition from peridotites and basalts to granites and rhyolites. Many consider his chapter, "Magmas and Hydrothermal Fluids," in the second edition of `*Geochemistry of Hydrothermal Ore Deposits*, edited by H.L. Barnes, to be one of the seminal papers in geology for the 20th Century: one that caught the attention of the Nobel Committee, and highlighted his contributions into the nature of silicate melts. He was awarded the Roebling Medal of the Mineralogical Society of America in 1998.

During his twelve year tenure as department head, he directed the integration of the geosciences department. Wayne's laboratory at Penn State became the Mecca of large-pressure vessel technology. I remember him as a keen golfer, a kamakazi-style squash player, and a crusty colleague, who did not suffer fools lightly. He mellowed considerably as department head, and a mission of excellence characterized his tenure. However, he was not the same after Estelle died in 1982. He retired from Penn State in 1986 with professor emeritus status and accepted a position of adjunct professor of geology at Arizona State University to work with his former graduate students and since professors John R. Holloway and Stanley N. Williams. His post-retirement mission was to evaluate through the latest thermodynamic model, the sulfur-dioxide producing potential of volcanoes around the world.

Der Fliegender Hollander: Affectionate memories of Rob Scholten

by Barry Voight, professor emeritus of geosciences



Left to right: Dr. Robert Scholten and Dr. Barry Voight
Photo credit MaryAnne Voight

Something woke Rob up very early on the tenth of May of 1940, that day when everything was going to change. Rob had been studying for high school exams, and waking at this hour was exceptional. What was it? His brother Jack said, "Planes. Germans on the way to bomb England." *"Holy smokes, there had to be zillions of them,"* Rob thought. But Jack had been only half right, for paratroops were dropping at the great bridge south of Rotterdam. And then Rob discovered that despite a war, life goes on. He studied geology at the University of Amsterdam, got mixed up with resistance activities and was nabbed by the Nazis, but providentially avoided a hanging judge, pretended (against his nature) to be contrite, and was awarded years of hard labor. A year and a half later, war over, Rob returned to the Geology Institute to finish up, and traveled to the New World. After few years at Ann Arbor, he was teaching at Penn State.

At Penn State, Rob got heavily involved with his Northern Rockies field project and camped there with his gracious wife Marcia and a cadre of smart grad students that remained loyal to him to the end. I arrived at Penn State in the 60s and found a lot in common with Rob; we worked like the devil but insisted on having plenty of fun doing it. Gene Williams was already his great pal and the three of us became regular lunch partners at the Rathskeller.

Rob co-wrote a popular intro lab manual, edited a well-accepted book on gravity tectonics, taught a variety of courses including one with Gene linking tectonics and sediments, and another on the geology of the Alps that included field adventures. Rob was program chair in geology when he stepped away in 1985, happy to leave administrative academia behind. He escaped to France, where he reported: *"Condemned to loiter the banks of the Seine I hold up my tin cup and a sign in 5 languages and English saying 'Look at me and weep: I used to be a Professor'—causing sweet shopgirls to stroke my graying hair and invite me up for tea, and with my earnings I buy flowers for Claire. This is my life…"*

His old pal Gene reminded him of life in the States with *"reams of essays and marvelous letters filled with bitter venom mixed with laughing gas."* Rob took classes at Sorbonne, had time to read, write, and travel, did a bit of teaching at Marseilles and some field work in the Pyrenees – *"though a Late Triassic rift has now opened up between me and geology, and I rather look forward to the Jurassic."* The metaphor implied that geology was no longer Rob's primary interest.

He devoted his time to literature and began work on an autobiography. It was ready by 1991, then entitled *"Echo"*-- the sounds and senses of the past reflected down the walls of his memory. Rob was a brilliant writer and his was a rare story of Holland in those stormy days of the World War. Rob was, of course, a product of those formative war years, and *"Upheavals"* goes far to explain his strength, resistance to injustices, and compassion. He was fearless, as shown throughout his life and especially in his 'Last Act.'

Early last summer he told me: "*The Doctors tell me -- The game is up! I'm on the way out."* He saw this as an unseemly end for 'The King of the Mountain,' and reported the bad news with a wry smile, without bitterness or complaint. Despite the gravity of news, his mind was fine in his final months and days. It was sharp as it was in the 1960s. He was witty, interesting, logical, wise, the possessor of a remarkable vocabulary. He was creative and still ambitious. The zaniness and sense of humor were as before. He had bounced back from his dire condition in May and got back into his poetry work, astounding his physicians. An example is this delicate translation of a nineteenth century poem by the international Käryn B Pörtwöd-Lüünd:

Un prof hollandais qui tente
D'embrasser une etudiante
Regardez bien mon charm
Mais elle sonne fort l'alarm
Detestant ces vieilliards qui mentent

He was aware that the Grim Reaper was back on his trail, but had no intention of walking into his arms. He wore a broad happy grin telling me that sixteen (he had counted them) former students had contacted him, and with whom he exchanged long and detailed correspondence. This response of his former students is the great thing, a genuine tribute to Rob of course, for he had loved them and it was returned, but also to their collective character. Rob delighted in observing this and in reconnecting with them. The inevitable end came in August. And yet Rob had had good fortune. He had good innings and unlike the tragic fate of our friend Gene, Rob was blessed that his great brain remained in good working order so that he could continue to enjoy the finer things in life like music and literature, creative writing, and of course his family, his companion Antoinette, grandchildren, great-grandchildren.

We won't see the likes of him again.

Department Passings:

Photo credit: Department of Geosciences

Alfred Traverse

by: William Chaloner, emeritus professor, Royal Holloway University of London

Excerpted from the Paleobotanical Section of the Botanical Society of America Membership Mailing, 2016

With the death of Professor Al Traverse on September 15, 2015, the science of palynology lost what many of us would regard as the single most productive and influential of contemporary workers in this field. The topics of his research papers, over 200 in number, range from acritarchs of the Pre-Cambrian to angiosperm pollen from the Tertiary, together with papers dealing with process and ecology in palaeopalynology, with problems of nomenclature, and a range of other papers relating to broader issues of plant evolution. Undoubtedly his most important publication was his great book, *Paleopalynology,* of which the second edition was published eight years ago. As he said himself "It offered most of the information necessary to teach a good course in palynology, and as a handy, one-volume reference to palynological subjects." This 600-page book formed the core of a course that he ran from 1966 until the year after he retired, and undoubtedly played a similar role in the hands of many other teachers of palaeopalynology in universities in other parts of the world.

Alfred Traverse was born on Sept. 7 in Prince Edward Island, Canada, the son of an Anglican priest, the Rev. Freeman Traverse, and Pearle Traverse, dietitian and school-teacher. In 1928 the family moved to Allegan, Michigan, and later Al became a naturalized U.S. citizen. He went to public schools in St. Joseph Michigan, graduating from high school in 1943 as valedictorian of his class. He was awarded a freshman scholarship at Harvard, where he majored in biology and graduated magna cum laude in 1946. His honors thesis dealt with a problem in corn genetics. On graduation Traverse won a fellowship to study in England, and spent 1946-47 at Kings College Cambridge, studying palaeobotany in the Cambridge Botany School. He returned to Harvard in 1947 with an Anna C. Ames scholarship and was awarded a master's degree in palaeobotany in 1948. Then coming under the influence of his supervisor Elso Barghoorn, he embarked on palynological research in the Tertiary Brandon lignite of Vermont, on which he published a very seminal paper in 1951. In that same year he married Betty Insley (a Harvard Botany graduate) and was hired by the U.S. Bureau of Mines to work on the Tertiary lignite in Grand Forks, North Dakota. During his period in North Dakota he stopped by in the autumn of 1953 at Ann Arbor, Michigan, to meet Chester Arnold, one of the leading palaeobotanists of that time. I was working with Arnold on Carboniferous megaspores, and the three of us went out on a collecting trip to a very productive Pennsylvanian quarry near Ann Arbor. Our meeting on that occasion started a friendship with Al that lasted some sixty years.

In 1966 Al (accepted) the position of associate professor of geology at Penn State University, and in 1970 became professor of palynology. Concurrently, he held positions as priest and vicar in several Episcopal churches in Pennsylvania. Al was a founder member of the American Association of Stratigraphic Palynology (now the Palynological Society) of which he was secretary-treasurer in the 1960s, and president in the 1970s. Later, he was awarded the Medal for Excellence in Education of that body, and for a time was their archivist. He was secretary-treasurer and (twice) chairman of the Palaeobotanical Section of the Botanical Society of America. On the international stage, he was for many years secretary of the International Association for Plant Taxonomy's Committee for Fossil Plants. He was also a Fellow of the Geological Society of America and a member of many other scientific societies.

Despite his international standing as a palaeopalynologist, Al was always at heart a botanist, and one who enjoyed 'country life.' When he and Betty acquired their rural estate outside Penn State, he named it the "Alphabet Arboretum", with good cause, as it was wooded land of some diversity of content. But of course the label appealed to him in combining his and Betty's names – a point he always liked to make! His real commitment as a botanist came when after his formal retirement he took on the assignment of voluntary curator of Penn State's Herbarium, initiated by its first President, Dr. Evan Pugh, who acquired much of the original material in Germany, where he was living in Gottingen and elsewhere at the time. In the retirement years that he devoted to rearranging and updating that herbarium, and incorporating his and other material into the original collection, the number of specimens rose from 95,000 to 107,000. No small achievement in retirement!

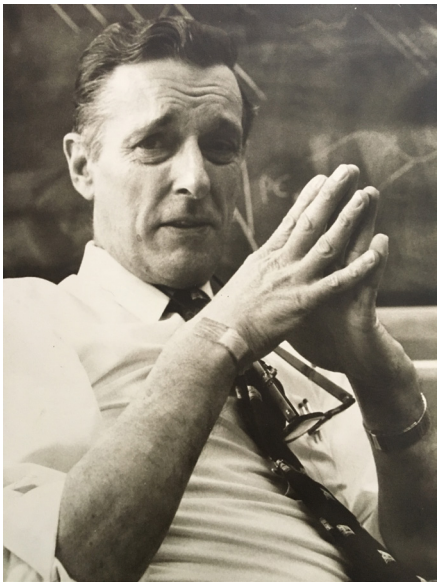


Photo credit MaryAnne Voight

Gene Williams: Soldier-Moral Philosopher-Scientist-Writer-Athlete

by Barry Voight, professor emeritus of geosciences

As an infantryman in WW II, Gene personally experienced the horror of the concentration camps. *"The event that influenced me most was the war…we came upon Nordhausen....This is where I first learned about this form of mass murder…in almost all the bunkers and buildings, the living were found lying among the dead. In one corner was a pile of arms and legs. We were battle-tired and combat wise soldiers, blood and death were daily routine. But Nordhausen showed us another dimension."*

He came to Penn State in 1952 (after Lehigh, B.A. 1950, and University of Illinois M.S. 1952) to pursue a Ph.D. in the Department of Mineralogy led by PD Krynine, and JC Griffiths. For his thesis research Gene studied coal-bearing rocks of the Appalachian Plateau in western Pennsylvania, and by 1957 completed his Ph.D. His partner-in-crime during that period was the irreverent John Ferm, who worked on related rocks nearby. They published germinal papers in the early 1960s, with the main contribution a predictive genetic model that made order out of the seemingly random rock variation in the coal measures of western Pennsylvania.

By the end of the 1960s, Gene and John were gaining reputations in sedimentary geology through the introduction of deltaic depositional models and an approach that would later be termed basin analysis. And both guys became experts in sketching simplified figures that could synthesize years of research and a confusion of data. Such cartoons and clever classification diagrams became hallmarks of their later scientific contributions and notes for classroom teaching.

Gene stayed on at Penn State, teaching courses like stratigraphy, one shared with Rob Scholten that linked tectonics and sedimentation, and another called the *History and Philosophy of Science*, which took advantage of his vast knowledge of the classic literature, Descartes, John Stuart Mill, Melville, Thoreau, Darwin, Pasteur, et al.

In those halcyon days when thinking for thinking's sake could still be a valued commodity, many students felt that Gene freed their minds of dogmatism and certainty, replacing it with a healthy skepticism. Gene's 'training' could start with long chats in his office, but might be continued elsewhere. Tony Prave recalls himself becoming *"zealot-like with enthusiasm to learn wisdom at the foot of the oracle."* Gene: *"We're alone on Earth, there's a little cinder spinning around here, our lives are short….Life is constantly changing, we can't recreate the past. It's gone and the future is limited. Life is short, much of it painful. The hospital, the nuthouse – all are parts you see. How does one make his way in this dimension?"*

The history course attracted many students although not all were comfortable with all the serious classical and philosophical stuff. Bob Ryder was one of these, although he much valued the basics Gene had taught him:

"For me, he was one of the "Big Three" geoscience professors during my tenure at Penn State. Although I could never quite connect with his philosophical approach to geology…he clearly had a positive impact on my student career as well as my professional career."

***

In the 70s Gene was dragged from the Alleghenies by Lauren Wright, who needed help with his Death Valley work. So Gene went along in the bearable winter seasons, reporting to me in 1971: *"One big consolation: no telephone, just us'uns and the cold dead stones. Seldom Seen Gene."*

Gene also had taught at Al Guber's Wallops Island marine sciences course, and Beth Moore recalled *" late nights discussing philosophy of great minds."* Gene also looked back at his days of Field Camp teaching as enjoyable interludes. *"Peering once again through the mists of the past, I see myself in the basement of the Alta Peruvian Lodge, making drawings on large sheets of brown wrapping paper. Ah!! Now it's all coming back.... I am transcribing my field notes and diagrams to be put on exhibit that evening.... In effect, the diagrams said, this is what you should have seen today so that you may see more tomorrow."*

In spring 1985 Gene and his great pal Rob Scholten retired, and he devoted his time to literature and more intensively wrote essays, short stories, and poems, not for publication but to illuminate his thoughts to himself: *"I have certain problems as a thinker that I want to solve…larger problems I work on – these are all moral, not scientific. Mainly, why man behaves so badly. Most of this comes from my war experiences. I think about those practically every day."*

He took piano lessons, and with his wife Phyllis he spent many years as a volunteer with Meals on Wheels. He liked nature and indeed all animals and helped out at Paws. He taught himself to make fine furniture based on famous classical designs. And he focused on competitive running, biking, and throwing a ball a very long distance -- unsurprising to those who remember him winning virtually all rock-throwing contests against students on field trips. (But… Christine Onasch had bested him, and he didn't like that.)

Continued on page 19

48th Annual Graduate

Owens River, Sierra Mountains, California
Photo by Joanmarie DelVecchio

Himalayan Mountains
Photo by Tarun Luthra

Grand Teton National Park, Wyoming
Photo by Zachary Richard

Photo by Emily Doyle

Storurd, East Iceland
Photo by Maeva Pourpoint

Colloquium Photo Contest

Last Chance Canyon, Guadalupe Mountains, New Mexico
Photo by Garett Brown

Lake Wakatipu, Queenstown, New Zealand
Photo by Nana Xu

Porgera, Papua New Guinea
Photo by Beth Hoagland

Hallett Peak, Dream Lake, Rocky National Park
Photo by John Leeman

Rye, New Hampshire
Photo by Elizabeth Denis

Halema'uma'u Crater, Kilauea Volcano, Hawaii
Photo by Sarah Moore

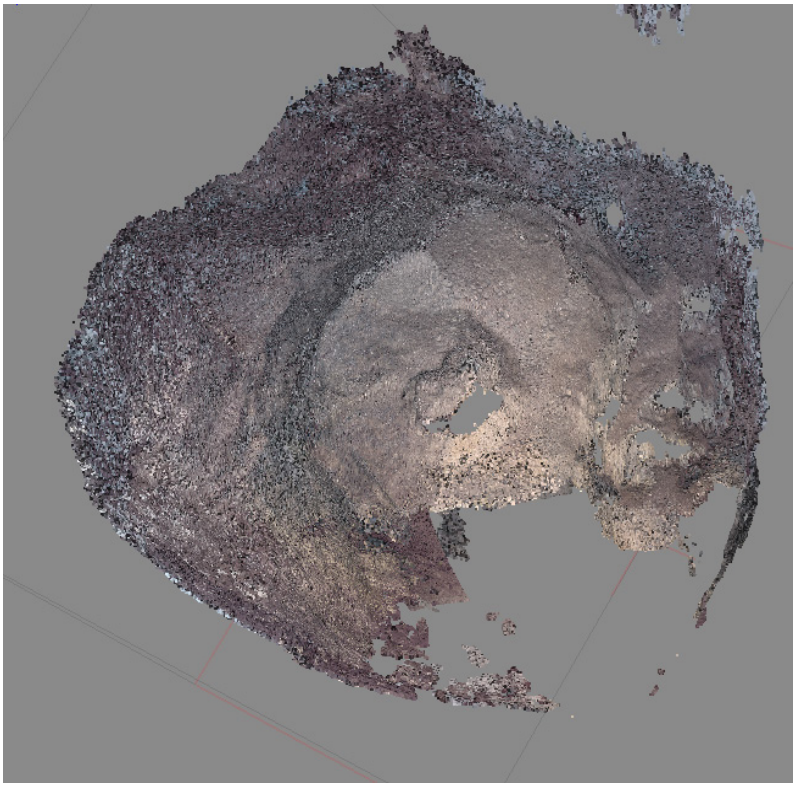
Bird Island Research Station, South Georgia
Photo by Rosie Oakes

Visualization and Early

by Peter LaFemina, associate professor of geosciences

On any given day there can be more than a dozen volcanoes on Earth experiencing unrest or eruption. This activity may include the emission of volcanic gases, high rates of seismicity, displacement of the surface of the volcano, and eruption of ash and lava flows. Volcanologists, geoscientists who study volcanic processes, come from such fields as geology, geochemistry, petrology, and geophysics. Studying volcanoes, therefore, provides an exciting and dynamic way to engage students in Earth science research and build a solid foundation in the geosciences. Furthermore, investigation of time series of geochemical or geophysical data and the study of volcanic processes allows for quantitative learning in the geosciences. This is the premise behind Peter LaFemina's Pulse of the Earth course titled, Visualization and Early Response to Volcanic Eruptions (VERVE). Beginning in spring 2016 and continuing in fall 2016, this 2-credit course has allowed students to investigate volcanic processes through the utilization of data and observations collected by. LaFemina, his students, and collaborators at active volcanic systems in Latin America and Iceland, as well as open and crowd-sourced data, while tracking global volcanic activity. These studies aid the students in learning physical and chemical processes and improve our understanding of active volcanic processes.

LaFemina has been studying active volcanoes for over two decades. In Iceland, he explores the relation between plate boundary deformation across the Mid-Atlantic Ridge and central volcano magmatism at two active systems, Hekla volcano and Torfajökull caldera. Global positioning system (GPS) data collected as part of this project, including data from a Penn State-funded continuously operating network on Hekla volcano, provide a wealth of data for students to investigate the mechanisms by which volcanoes and plate boundaries deform the surface of the earth. In Nicaragua, LaFemina has investigated the tectonics of the Central American forearc, and the interplay between forearc tectonics and magmatism and volcanism. This research combines geophysical and geochemical observations to investigate the dynamics of phreatic explosions, the triggering of eruptions by local and regional earthquakes, and the long- and short-term interaction between plate tectonics and magmatism and volcanism. His current research projects include investigating persistent geophysical unrest and phreatic explosions at Telica volcano and a recent NSF RAPID award to study the 2015-16 eruption of Momotombo volcano. This study is in collaboration with geosciences colleagues Maureen Feineman and Christelle Wauthier, colleagues at University of South Florida, including Penn State graduate Rocco Malservisi, and the Instituto Nicaragüense Estudios Territoriales (INETER). These research projects and years of collaboration with INETER scientists provide a wealth of geophysical and geochemical data for the students to study volcanic and magmatic processes.



Above: Dense point cloud of the inner crater of Telica volcano, Nicaragua. The point cloud was generated using photographs taken from the rim of the crater and analyzed using Structure-from-Motion. The image shows the small vent deep in the crater. Geoscience B.S. major Catherine Hanagan produced this image as part of her study of morphologic changes due to phreatic explosions at Telica.

The main goal of VERVE is to engage students in Earth science research by investigating volcanic processes through the analysis of visual observations and time series of geophysical and geochemical data. Projects that students have worked on or are working on include: (1) Investigating change in crater morphology and eruption volume estimation through the production of digital elevation models from optical imagery using structure-from-motion (SfM) techniques; (2) Investigating changes in eruptive activity and the dynamics of eruptions through the correlation of time series of images of volcanic explosions with seismic data; (3) Studying volcano and tectonic deformation using GPS Geodesy; (4) Studying magma-tectonic interactions and eruption triggering; and (5) Documenting changes in volcanic activity. Another goal of this course is for the students to develop skills in scientific writing. In addition to studying volcanic processes, students are developing volcanic activity summaries for their volcanoes.

Response to Volcanic Eruptions

The students were first introduced to the field of volcanology through lectures, reading assignments, and class discussions. They were then introduced to volcano monitoring techniques and practices. As one of the goals is to investigate active volcanoes using open data, the students have explored the current state of volcano databases. The Global Volcanism Program at the Smithsonian Institution (http://volcano.si.edu) is one of the oldest and most extensive databases on Holocene volcanic activity on Earth and provides a wealth of data. Students are using this database, as well as research articles, as a starting point of their investigations into individual volcanic systems. They will have the opportunity in fall 2016 to visit the Smithsonian and meet with scientists of the Global Volcanism Program.

Second year geosciences B.S. majors Catherine Hanagan and Callan Glover have been utilizing data collected as part of LaFemina's Telica and Momotombo projects. Catherine Hanagan is investigating morphologic changes of the active crater at Telica using photos and structure-from-motion, which correlates features observed in multiple photographs to produce a three-dimensional point cloud of the crater. Callan Glover has been analyzing the chemical composition of ashes erupted during the initial stages of the Momotombo eruption and has been studying the dynamics of the eruption using web cam images. The Pulse of the Earth Lab and VERVE course are providing an opportunity for students to become involved in research and build a solid foundation in the Earth sciences.

photo credit: Webcams maintained by INETER

Left: Web camera image from a geophysical monitoring site 400 meters from the active crater of Telica volcano run by INETER, Penn State, and Carnegie Science Center. No one was killed in this vulcanian explosion but a dozen horses and cows were killed. VERVE students used images like these to track changes in volcanic activity.

Right: The eruption of Telica volcano on November 22, 2015 as imaged by a web camera located in the city of Leon, roughly 20 kilometers from the volcano. The web camera is maintained by the Instituto Nicaraguenses de Estudios Territoriales (INETER).

photo credit: Webcams maintained by INETER

Leaf mysteries revealed through the computer's eye

by A'ndrea Elyse Messer for Penn State News

Image by Shengping Zhang

A computer program that learns and can categorize leaves into large evolutionary categories such as plant families will lead to greatly improved fossil identification and a better understanding of flowering plant evolution, according to an international team of researchers.

"Paleobotanists have collected many millions of fossil leaves and placed them in the world's museums," said Peter Wilf, professor of geosciences. "They represent one of the most underused resources for understanding plant evolution. Variation in leaf shape and venation, whether living or fossil, is far too complex for conventional botanical terminology to capture. Computers, on the other hand, have no such limitation."

When botanists identify living plants, they look at the leaves, but rely mostly on the associated fruits, seeds, and flowers to categorize the specimens. In fossil collections, fruits, seeds, and flowers are usually much less common than leaves. Even with modern leaves it is a slow process figuring out which features are botanically informative. If a computer vision approach works on modern leaves, it could help in the classification of fossil leaves as well.

About nine years ago, Wilf learned of an article in the *Proceedings of the National Academy of Sciences* on a computer vision program that could determine whether or not an animal was in a photograph.

"A bell rang in my head," said Wilf. "Instead of an animal, tell me if the image is of an oak leaf or not, or pick among several categories."

He contacted that article's lead author, Thomas Serre, now Manning Assistant Professor of Cognitive, Linguistic and Psychological science, Brown University. The method worked well initially, and after several years of experimental development using different vision algorithms on several thousand cleared leaves, the team published their first paper from this work earlier this year, in the *Proceedings of the National Academy of Sciences.*

Cleared leaves are specimens that have been chemically bleached, stained and mounted on slides to reveal venation patterns.

The researchers currently have a 72 percent accuracy rate over nineteen leaf families, compared to about 5 percent for random chance. Their work is the first to analyze cleared leaves or leaf venation for thousands of species from around the world, to learn the traits of evolutionary groups above the species level such as plant families, or to directly visualize informative new characteristics. The variation among the hundreds to thousands of species in a family is many times greater than within a species, and yet, the computer algorithms could learn a set of features and apply it successfully. Because nearly all leaf fossils are of extinct species, family-level identification is usually the first target for paleobotanists.

The researchers provide the computer program with half the photos already identified so that it can automatically learn a dictionary of special features such as vein intersections and tiny bumps and asymmetries that turn out to matter quite a bit in identifying leaves. The system also learns to disregard the typical problems of low image quality, insect bites, and mounting defects. Then the algorithm receives unlabeled test photos and uses its dictionary to identify them. The researchers repeated this procedure ten times, randomly choosing the training and test images. The results agreed with only 1 percent difference between the runs.

"It normally takes a trained person a few hours to describe one leaf according to the standard protocol, which uses about fifty terms," said Wilf. "The computer program is thousands of times faster, automatically generates a dictionary of more than 1,000 elements and then actually shows us what parts of the leaf are diagnostic."

Instead of producing only a black box of results, the computer generates a "heat map" directly on the leaf image, identifying and rating areas of importance for correct identification. This approach generates a flood of previously hidden botanical information.

As examples, Wilf notes that leaf teeth in the rose family have always been considered distinctive, but the heat maps highlight previously unknown features of their tips. Leaves of the coffee family, with 13,000 living species, are very hard to identify when not attached to twigs, but the computer program found it one of the least problematic at 90 percent accuracy.

The ability of computer vision to classify leaves quickly and to generate vast quantities of new botanical knowledge will allow scientists to develop more accurate evolutionary pedigrees for plants and plant fossils.

Also working on this project were Shengping Zhang, Harbin Institute of Technology, China; Sharat Chikkerur, Microsoft; Stefan A. Little, Université Paris-Sud; and Scott L. Wing, Smithsonian Institution.

This and That...

International Barrel Award Team brings home 2nd Place

by: Jesse Westbrook for Penn State News

A team of five Penn State geosciences graduate students finished in second place in the international Imperial Barrel Award (IBA) competition, held June 17 and 18 in Calgary, Canada. This is the second year in a row that a Penn State team placed second in the contest, taking home the Selley Cup and $10,000.

The students — Seyi Ajayi, James Neely, Nana Xu, Benjamin Madara, and Martin Jimenez — competed against ten other teams at the international level after winning first place in the Eastern Section of the IBA competition.

Organized by the American Association of Petroleum Geologists (AAPG) and the AAPG Foundation, the IBA program pits more than 100 university teams against each other in a rigorous exercise to assess the petroleum potential of a given geographic basin. Each team is given eight weeks to analyze a provided dataset and then recommend a "drill" or "no drill" plan for future exploration based on prevailing technical and economic conditions.

Gene Williams Obituary Continued:

He was very good at the track sports and also found in them an antidote to the depression of aging -- on reaching 70 years, say, he no longer had to compete against those Senior Games youngsters in the 60s, and his chances to medal were thereby enhanced. Gene: "*The more I see the impossibility of solving more complex problems, the more I need some other form of problem solving, and the running is one of these.... The idea is that in running I'm trying to conquer time, to have these so-called peak experiences. Thoreau had them every day -- The Rat!* "

Gene believed *"every day is a new opportunity in some fashion, for me to create, no matter how bad off I am. You have to remember, the sun is but a morning star. The first bird you hear in the morning, and I wake up and hear this bird in the Spring, it's like the First Bird in Paradise. It sings for you, and it says there is an opportunity here, if somehow you can seize it…"*

Both Gene and Rob had many good innings, but Rob had luck that his great brain remained in good working order. It was more difficult for Gene, who had been dealt the harder hand of Alzheimer's to play. Gene was such a great guy, unique really, and we are going to really miss him. We are going to miss both of them. When the great trees fall, the bell should be tolled.

photo credit: The photographs of Gene Williams and Rob Scholten were taken by MaryAnne Voight. Rob's blackboard drawing of cross-sections of northern Idaho, made around 1980, was sprayed with plastic and preserved in honor of Rob for 20 years by Barry Voight, who inherited his office, and since 2005 by Terry Engelder who was next in line. It can be observed today in Room 334A, Deike Building, and hopefully its preservation will be continued by future occupants.

Memorial to Rob Scholten

by Jeffrey Parsons, 1961

By the time he was in his mid-20s, Rob Scholten had already lived through some of the most extraordinary times of the 20th century. As recounted in his compelling autobiography, *Upheavals*, his early life in Holland had been abruptly transformed by the tumult of World War II and the unsettled conditions of the early post-war years. He confronted, and survived with body and mind intact, Nazi military conquest, Gestapo interrogation, deadly wartime imprisonment, and the overwhelming post-war dislocations. Some of this he related in spell-binding tales he spun in the evenings around our campfires in the mountains of Montana and Idaho during the summer of 1960 when I worked as his field assistant. Despite everything, he completed his undergraduate studies in Amsterdam during the war, and afterwards pursued post-graduate studies at the University of Michigan. From Michigan he went on to a long-term faculty position at Penn State, where I first met him, my freshman adviser, in September of 1957. His introductory geology course that I took that semester was my academic introduction to Penn State.

Rob was a tireless field worker as he sought to understand, as he used to say, "what made the mountains." This interest in the dynamics of mountain building took him from the flatlands of his native Holland on to his doctoral and post-doctoral investigations focused on the some of the world's major mountain systems in the North American Rockies, the Anatolian uplands of Turkey, and the Central European Alps.

I suspect that Rob may have been unusual amongst "old school" field geologists for his deep interest in fine literature. I was so impressed to see him–during our occasional breaks from fieldwork in Montana and Idaho–reading poetry and prose in the original Dutch, German, or French. His highly regarded post-retirement translations of the French poets Baudelaire and Rimbaud – each of which took him years to complete – are monumental tributes to the depths of his humanistic feelings and his great skill as a translator. Truly a renaissance man.

Geosciences Field Camp2016

by Donald Fisher, professor of geosciences

The class celebrates at the top of Flagstaff Mountain in Alta, Utah.

In late May 2016, the Penn State Geology Field School began the annual trip out west for a six-week investigation of the geology of the intermontane Western U.S., with thirty-six students. The group was led at different times by Rudy Slingerland, Erin Dimaggio, Roman DiBiase, Don Fisher, and Kevin Furlong and assisted by graduate teaching assistants Max Christie, Jason Boettger, Gabrielle Ramirez, Erica Pitcavage, and Alex Neely. The first three weeks included stratigraphic analyses in the Book Cliffs in eastern Utah, where the students used sequence stratigraphic concepts to interpret the sedimentary rock record. In keeping with a Penn State tradition, we then moved our base of operations to the Yellowstone-Bighorn Research Association (YBRA) facility in Red Lodge, Montana where we completed an exercise at Elk basin, familiar to many alumni, where students use aerial photography and field mapping to develop a three-dimensional characterization of the structure of the basin. For the second year in a row, we moved to Teton Village in Wyoming where we reconstructed the Quaternary glacial geology and the active faulting along the Grand Teton mountain front. In the second half of the course we travel to east-central Utah to evaluate the history and landscape evolution of a volcanic province (i.e., the Challis Volcanic Series). We finished the course in the Alta, Utah, area where we used maps and cross sections to estimate fault slip and shortening in the overthrust belt and to characterize the thermal history of the contact aureole of the Alta Stock.

Roman DiBiase leads a discussion on the history of river incision that produced Yellowstone Canyon.

Students traverse the slope of Flagstaff Mountain.

Wood collection for discussions around the campfire at Wildhorse Campground, Challis National Forest, Idaho.

Students begin returning to the vans while mapping the Challis volcanic series in the White Knob Mountains, Utah.

Students measure stratigraphic sections and interpret the Cretaceous sedimentary history of the Great Western Interior Seaway.

Appeal from Professor Emeritus Duff Gold: Russ Dutcher Dorm at YBRA

I address this note to all Field School attendees who spent part of their summer at the YBRA Camp in Red Lodge, Montana. There is a plan to build a log cabin to house twelve students as a memorial to Russell R. Dutcher, the Penn State Field School Director from 1965-70. Russ taught part time in the Princeton Field Course at YBRA from 1961-68. He saw the potential as the base for Field School, and established Penn State as a permanent member in 1965. Although he moved on the become dean of sciences at Southern Illinois University in 1971, he remained a benefactor to the Penn State program. Students may recall the "cherry-bomb" incident that left a permanent dent into his shiny gray land rover, or the snowball fight that saw his snowball take out a window in the carryall. Russ was committed to YBRA from the beginning. In 1966 he began his duties as YBRA camp manager, and spearheaded the construction of the study hall during the early 1970s. He served in many capacities over fourty years including on the Field Course Committee, and as council member, vice president, treasurer and president (nine terms).

I address this appeal in particular to the cohort from 1965-70 who knew and interacted with Russ, to honor his lifelong commitment to YBRA by making a tax deductible donation to YBRA – Dutcher Dorm. Please contact or send donations to Denny McGinnis, P.O. Box 20598, Billings, MT 59014-0598 (dbmcginnis@ outlook.com).

Undergraduate Scholarships & Awards

Baker-Hughes Scholarship Award: *Audrey Dunham, Jennifer Taylor*

Thomas F. Bates Undergraduate Research Enhancement Fund: *Ziyad Almaimoni, Luis Torres Pascuas*

Joseph Berg Award for Undergraduate Research in Geosciences: *Rachel Miller, Nicholas Riqueros*

Barton P. Cahir Award: *Rachel Miller*

Frank Dachille Memorial Award in Geochemistry: *Huiwen Chen*

David M. Demshur Undergraduate Research Endowment: *Mazen Al-Angari, Mia Baresse, Jordan Bell, Jordan Chapman, Lisa Glendinning*

Edwin L. Drake Memorial Scholarship: *Christain Falzone, Tori Garman, Johnathan Guandique, Joshua Harter, Tyler Heffner, Zachary Hordeski, Allizon Krieder, Jessica Kruzan, Daniel Lapikas, Aileen McNamee, Elizabeth Meyer, Allison Miler, Natasha Nagle, Andrew Pickett, William Sampson, Quentin Seydoux, Michael Sickler, Jennifer Taylor, Anthony Tedesko, Sara Tomko, Kyle Veloski, Peter Wolfe, Mary Yesko*

General Scholarship Endowment in Geosciences: *Elizabeth Meyer, Robert Miles*

David P. "Duff" Gold Undergraudate Scholarship Fund: *Safiya Alpheus, Priyanka Bose, Elizabeth Meyer, Rachel Miller, Ian Wolfe*

John C. and Nancy Griffiths Scholarship: *Safiya Alpheus, Kyle Sherbine*

James and Nancy Hedberg Scholarship: *Zachary Czuprynski, Tongzhang Qu, Gina Sarkawi, Anna Whitaker*

Arthur P. Honess Memorial Fund: *Safiya Apheus, Priyanka Bose, Ceccilia Cullen, Audrey Dunham, Natasha Nagle, Jennifer Taylor*

Benjamin F. Howell, Jr., Award: *Taylor Hochbein, Anthony Tedesco*

Kappmeyer-Isaacs Field Camp Award: *Jordan Chapman, Amaresh Chukkapall*

Ronald A. Landon Endowment in Hydrogeology: *Cecilia Cullen, Natasha Nagle*

Earle S. Lenker Fund for Field Studies in Geology: *Jacob Cipar, James Deflumeri, Chelsea Eyer*

Reif Undergraduate Summer Field Camp Award: *Tyler Betz, Pedro Faria, Tori Garman, Karl Gerstnecker*

Robert F. Schmalz Award: *Jonathan Guandique, Yonghaui Huang, Cole Messa, Erin Redwing*

Dr. David E. Vaughan and Mrs. Julianne Vaughan Field Camp Fund: *Adam Benfield, Cecelia, Cullen, Dalton Fantechi, Tori Garman*

External Awards and Scholarships

Association for Women Geoscientists Undergraduate Excellence in Paleontology Award: *Anna Whitaker*

Charles A. and June R.P. Ross Research Award: *Allison Karp*

Erickson Discovery Grant: *Chelsea Eyer*

Evolving Earth Foundation Student Research Grant: *Claire Cleveland*

Geological Society of America Student Research Grant: *Claire Cleveland, Evan Greenberg, Beth Hoagland, Allison Karp, Sarah Moore, and Kendall Wnuk*

Geological Society of America Quaternary Geology and Geomorphology Division Research Award: *Joanmarie Del Vecchio*

NSF Graduate Research Fellowship: *Claire Cleveland*

Paleontological Society James M. and Thomas J.M. Schopf Student Grant Award: *Claire Cleveland*

Penn State Graduate Exhibition Awards: *John Leeman and Nick Holschuh*

William Grundy Haven Memorial Award for excellence in scholarly writing: *Cecilia Cullen*

Graduate Scholarships & Awards

Alley Family Graduate Scholarship: *Rosie Oakes*

Chevron Scholarship: *Benjamin Madara, Abby Kenigsberg*

Hess Corporation Exploration & Production Technology Scholarship: *Shelby Lyons, Kiya Riverman, Kerry Ryan*

Charles E. Knopf, Sr., Memorial Scholarship: *Allison Karp, Kyeong Kong, Shelby Lyons, Virginia Marcon*

Krynine Memorial Award:

Fall 2017:

Spring 2016: *Jason Boettger, Zena Cardman, Christian Clark, Claire Cleveland, Michael Donovan, Emily Doyle, Sonny Harman, Heather Jones, Allison Karp, Kyeong Kong, Amanda Labrado, John Leeman, Florence Ling, Tarun Luthra, Shelby Lyons, Muammar Mansor, Virginia Marcon, Uyen Nguyen, Erica Pitcavage, Kerry Ryan, Kiya Riverman*

LeBlanc Fellowship: *Erica Pitcavage*

Marathon Alumni Centennial Award: N/A

NASA Earth and Space Science Fellowship: *Matt Herman*

NSF Fellowship Recipient: *Claire Cleveland*

Hiroshi and Koya Ohmoto Graduate Fellowship: *Helen Gall, Nell Hoagland, Muammar Mansor*

Richard R. Parizek Graduate Fellowship: *Curtis Kennedy*

Scholten-Williams-Wright Scholarship in Field Geology: N/A

Shell Geoscience Energy Research Facilitation Award: *Ben Madara, Victoria Fortiz, Xin Gu, Shelby Lyons, Kerry Ryan, John Leeman, Sheila Trampush, Evan Greenberg, Robert Valdez, Uyen Nguyen, Abby Kenigsberg, Rosie Oakes*

Richard Standish Good Graduate Scholarship: N/A

Donald B. and Mary E. Tait Scholarship in Microbial Biogeochemistry: *Leah Brandt, Zena Cardman, Beth Hoagland, Uyen Nguyen*

Teaching Assistant Award:

Barry Voight Endowment: *Muammar Mansor*

2016 Graduate Colloquium Awards

Oral Presentation by a Ph.D. Student
(Post-Comprehensive Exam)
First: Rosie Oakes
Second: Elizabeth Denis

Oral Presentations by a Ph.D. Student (Pre-Comprehensive Exam)
First: Allison Karp
Second: Judith Sclafani

Oral Presentation by an M.S. Student
First: Seyi Ajayi
Second: Peter Ilhardt

Poster Presentation (M.S./Ph.D)
First: Shelby Lyons
Second: Virginia Marcon

Energy Related (M.S./Ph.D)
First: Ellen Chamberlin
Second: Xin Gu
Third: Sheila Trampush
Fourth: Benjamin Madara

These candidates were selected from an impressive group of participants. We want to thank Shell Corporation for the continued support of Colloquium with prize funds and general support.

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2016 Endowments

Alley Family Graduate Scholarship in the Department of Geosciences
Arthur P. HonessMemorial 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
Cannon Family Graduate Symposium Award in Geosciences
Charles E. Knopf, Sr. Memorial 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
Earle S. Lenker Fund for Field Studies in Geology
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
Geosciences Research Fund in Honor of Hiroshi Ohmoto
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
Kappmeyer-Isaacs Field Camp Award
Kent and Helen Newsham Geosciences Endowment in the College of Earth and Mineral Sciences
Open Flow Gas Supply Corporation Endowed Program Fund in Geosciences
Petroleum Geosystems Enrichment Fund
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
R.J. Cuffey Fund for Paleontology
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 Enrichment Fund
Thomas Kenneth (T.K.) Reeves, Jr. Family Scholarship
Timothy B. and Cindy Lynch Mullen Scholarship in Geosciences
Timothy D. Watson Fund in Geosciences

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JoAnn Zacharias

Alumni News

Rick Abegg '83
Rick's devotion to the Department and College, including twelve years on the Graduates of Earth and Mineral Sciences (GEMS) Board and current service as a member of the Geosciences Alumni Advisory Board, has been recognized by the University with the 2016 Philip Philip Mitchell Alumni Service Award. This award acknowledges Rick's significant contributions in the area of public service, volunteering his talent, time and resources on behalf of the University.

Keith Carlson '85
In February, Keith took a plant manager position for Air Liquide Large Industries in Charleston, South Carolina. He's been with Air Liquide for ten years as plant engineer then zone engineer.

Irena Gorski '13
Irena will be moving forward on a nontraditional path for geosciences. Irena is now pursuing an M.P.H. from the number 1 public health school in the world, Johns Hopkins Bloomberg School of Public Health. Irena will be focusing her studies and research on the intersection of environmental and nutritional health, applying her environmental geosciences knowledge directly to public health.

Mark Hainsey '83
Mark is currently the Deputy Chief Knowledge Officer for the US Army Corps of Engineers (USACE), headquartered in Washington, D.C. Currently standing up a Knowledge Management Program in USACE, a 36,000-employee-strong federal government agency. The goal for USACE is to be a mature, knowledge sharing, collaborative, learning organization capable of meeting the engineering demands as the premier public engineering organization in the nation and the world.

Garry Kramchak '73
Garry is semi-retired after working forty-three years in the oil and gas industry. His initial area of responsibility was the U.S. and ending his career in South America (Brazil). All but two years were spent based in Houston, Texas. He is currently enjoying his free time with his many hobbies.

Jim Murowchick '84
Jim's dedication and outstanding job in mentoring students has led the University of Missouri-Kansas City (UMKC) to name a scholarship after him. The James B. Murowchick Award will be reserved for individuals or groups from the campus or community whose contributions to UMKC's undergraduate research program are truly transformative.

Rens Verburg '90
Rens was elected to the board of directors of Golder Associates, a global employee-owned organization with approximately 6,500 employees that provides consulting, design, and construction services in the specialist areas of earth, environment, and energy. Rens is a principal geochemist based in Golder's Redmond, Washington, office.

Krista Walter '95
After spending thirteen years overseas, including Egypt and Australia, utilizing her geosciences degree as a wireline engineer and an investment analyst, Krista will be expanding her research consulting business to the U.S. and hopefully relocating back to the states shortly thereafter.

Sue Waters '81
Sue retired from Shell Exploration and Production Co. in March after 34.5 years of service. She was instrumental in directing Shell support to the department for many activities over the years including support for graduate student field trips, student groups (AAPG and AWG), the AfricaArray summer field course, summer research experience for high school students from under-represented groups (SEEMS), and the graduate student colloquium.

Tim Watson '05
Tim was a recipient of the Penn State Alumni Association's Alumni Achievement Award. The Alumni Achievement Award recipients are nominated by an academic college or campus and invited by the president of the University to return to campus to share their expertise with students and the Penn State community.

David Wesolowski '84
David joins the ranks of the Oak Ridge National Laboratory (ORNL) Corporate Fellows. Currently, there are only twenty-six Corporate Fellows at ORNL, so he is joining a very elite group of scientists.

Alumni Passings

Frederick S. Beltowski '69g
Edwin W. Biederman Jr. '58g
Paul N. Bossart Jr. '54
Gerald L. Gable '74g
Philip W. Holbrook '73g
Darrell I. Leap '74g
Rigel L. Lustwerk-Dudas '90g
Bruce K. McEuen '61
James D. Smith '49
Edward A. Stanley '60g
Gene C. Ulmer '64g
Nellie A. Vukovich '70g
Stanley R. Wasilewski '73g
Dr. Eugene W. White '58g
Mr. Alfred E. Williams '57
Dr. Eugene G. Williams '57g

Faculty Awards and Recognitions

Richard Alley

Climate Communications Prize, AGU Honors Program

Sue Brantley

Wollaston Medal of the Geological Society of London

2017 Geochemistry Division Medal by the American Chemical Society

Terry Engelder

Gordon H. Wood Memorial Award from the Energy and Mineral Division of the Eastern Section of AAPG

Katherine Freeman

Penn State Evan Pugh Professor

Elizabeth Hajek

College of Earth and Mineral Sciences' Wilson Award for Excellence in Teaching

Peter Heaney

College of Earth and Mineral Sciences' Faculty Advising Award

Chris House

Member of the current NASA Mars Science Laboratory Curiosity Rover team

Geological Society of America Fellow

James Kasting

Stanley Miller Medal of the National Academy of Sciences (The NAS Award in Early Earth and Life Sciences)

Michael Mann

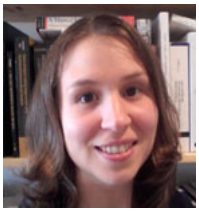
Vice Chair, Topical Group of Physics and Climate, American Physical Society

Fellow of the American Association for the Advancement of Science

Honorary Doctorate of Humane Letters, Le Moyne College

Andy Nyblade

Appointed Co-Director of Marcellus Center for Outreach and Research



Tess Russo

Rudy L. Slingerland Early Career Professor

Peter Wilf

Geological Society of America Fellow

Paul F. Robertson Award for the EMS Breakthrough of the Year

Department of Geosciences
The Pennsylvania State University
503 Deike Building
University Park, PA 16802

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Photo caption: Field Camp in the early days.