UA Geoscientist Leads Team to Build Better Models of the Southern Ocean

With a $2.36 million six-year grant in hand, Associate Professor Joellen Russell has spent the past two years leading a team of scientists in assessing and improving computer model simulations of the uptake of heat and carbon by the Southern Ocean.

Russell's grant is part of a larger effort called the Southern Ocean Carbon and Climate Observations and Modeling program (SOCCOM), which strives to help scientists and the public better understand the Southern Ocean's role in climate regulation and the carbon cycle, and to reduce the uncertainty associated with projections of future climate.

“The oceans are taking up 93 percent of the human-caused warming. We need to understand where the warming is going,” Russell said. “We suspect a huge portion of it is going into the Southern Ocean.”

SOCCOM has three main components. The first is the deployment of two hundred robotic floats around Antarctica by 2020 to collect biogeochemical and physical information. Russell’s team, the second component, is using the information gathered by these floats to assess and improve the models that will help us understand climate change and make projections about future global warming. The third part of the program is sharing what SOCCOM learns with the larger scientific community and the public.

The floats provide Russell's modeling team with exciting new data. Ocean waves and strong winds and the expense of ship time make it nearly impossible for scientists to physically explore all regions of the Southern Ocean at all times of year. The floats, however, are able to provide continuous and nearly complete geographic coverage of the Southern Ocean as they measure temperature, salinity, (Continued on page 15)
Dear Geosciences Alumni and Friends:

Students and profs walking around wearing thick black robes in 100 °F (38 °C) means summer is here in Tucson again. It’s been a quite year for UA Geosciences. Although we miss our recent retirees and students who have moved on, we are delighted to have just landed five new star hires: three Assistant Professors, a Research Scientist, and a Lecturer. We are very excited about our new colleagues (about whom you can read on page 13) and the energy and expertise they’re bringing to our department.

Several of our faculty garnered impressive new awards including AGU Fellowships for George Gehrels, Jay Quade, and Jonathan Overpeck, Geochemical Society Fellow for Jay Quade, and a prestigious Packard Foundation Fellowship and the Schenck Award in Organic Geochemistry for Jessica Tierney. Joellen Russell is helping lead a major new oceanographic biogeochemical project (SOCCOM, which was just featured in *Nature*) making unprecedented measurements in and modeling of the Southern Ocean.

We have a near-record 250 undergraduate majors as well as a strong and vibrant cohort of about 85 graduate students, many of whom joined a fantastic joint UA-Geoscience-ConocoPhillips field trip to southern Utah in April that was generously supported by COP and featured this year’s Distinguished Alum Bob Krantz PhD ’86, and many Geos faculty. BP donated 32 high-end workstations to the department, many of which will become part of the soon-to-be Computational Geosciences Center that will host workshop/short-courses, academic-industry collaboration, and embed rigorous computational skills into student training at all levels.

Two of the six lecturers in the world-famous College of Science Lecture Series—this year called “Earth Transformed”—were our very own Joellen Russell and Jonathan Overpeck, each attracting several thousand attendees. Under the ambitious direction of our own Bob Downs, the UA Mineral Museum continues to expand its collections and influence, and there are whispers in the wind of a new exciting location for the museum and initiatives that will build on its collaborations with Geosciences.

A number of other initiatives are brewing in Geosciences that are poised to benefit our undergraduate and graduate programs in new and exciting ways and expand our impact in new and important ways, from new curriculum to advising and career counseling, to new degree minors and interdisciplinary capstone engagement opportunities to community outreach and field trips. But we really need your help to make these happen. We greatly appreciate your support for the George H. Davis Undergraduate Research Fund, whose endowment now totals more than $65,000 thanks to your strong backing over the past year. We need to keep building this fund to provide all our students with real research opportunities. And we need your help with all other initiatives, from the nascent Computational Geosciences Center to the ever-critical unrestricted support. Please continue to support one of the best and most distinctive Geosciences programs in the world—your UA Geosciences. And keep in touch with all these and more exciting new developments on with our Facebook and Twitter feeds, accessible from our website. Hope to see you in Tucson soon.

From The Department Head

Department Head Peter Reiners

1986 PaleoMag Lab Time Capsule Found!

In early June 2016, workers renovating the PaleoMag Lab (Gould-Simpson 519) found a time capsule hidden behind the wall with the following note:

Hello creatures of the future!

Enclosed in this capsule are mementos of our time – November 1986, when this room was built. The souvenirs include some of our research, some current events of our time, and a sample of our sense of humor. These are intended for your information and amusement.

Professor Robert F. Butler
Gary Calderone
Amy Ruf
Eric Eckstrand
Gary R. Scott

Joe E. Butterworth
Peter Wilczynski
Steve Naruk
Margaret Klute
Professor Denis Norton
Visitors to Senator John McCain's office in Washington, D.C. will find a bit of UA Geosciences on display in his lobby. In fall 2015, Geosciences' UA Mineral Museum loaned Senator McCain's office several minerals from the copper family, which will remain on display there indefinitely.

The copper minerals not only make for an attractive and informative display, but, as Shay Stautz, Associate Vice President for Federal Relations at the UA, notes, “One of the great effects of the loaned display is that visitors to Senator McCain's office are reminded of the University of Arizona's expertise in minerals, and in this case, copper.” Stautz adds that copper was the ideal choice for the display, as it ties in nicely with Senator McCain's attention to copper-related issues in Arizona.

Robert Downs, Professor of Geosciences and director of the UA Mineral Museum said, “I am encouraged by the reception we've gotten in Washington, D.C. indicating that minerals are seen as significant to the story of Arizona. They represent much, including beauty, industry, and history.”

Downs added, “Along with our national leaders, we are also seeing an interest in minerals from our city, county, and state officials with their offer of the Old Courthouse downtown as a satellite mineral museum, also to be run by Geosciences. There has never been greater support and awareness of the Mineral Museum. It is exciting to be part of this right now.”

The Department of Geosciences would like to thank the Mineral Museum Board for their hard work and support on behalf of the Museum and its goals.

The following Arizona minerals are on loan to Senator John McCain's office in Washington, D.C. from the UA Mineral Museum:

1. Copper cube, obtained from about one ton of copper-bearing ore.
2. Copper blister bowl, Smelter, Jerome, Yavapai County, Arizona
3. Copper, Ajo, Pima County, Arizona
4. Copper, New Cornelia Mine, Ajo District, Ajo, Pima County, Arizona
5. Bornite, Warren District, Bisbee, Cochise County, Arizona
6. Azurite, Copper Queen Mine, Warren District, Bisbee, Cochise County, Arizona
7. Malachite, Warren District, Bisbee, Cochise County, Arizona
8. Chrysocolla, Chloride, Mohave County, Arizona
New Petrology-focused Website Hopes to Introduce Students to the World of Unusual Rocks & Minerals

by Frank K. Mazdab

Several years ago, I taught a graduate-level seminar on the petrography of “exotic” igneous, metamorphic and metasomatic rocks. These are the unusual rocks that get little coverage in a typical undergraduate petrology course. Some of them, like carbonatite, kimberlite and jadeite, may be familiar by name to many geologists. Others, like kakortokite, melilitite and alnöite, seem entirely foreign (in some cases quite literally!)

It’s not surprising that these and other less well-known rocks often get overlooked in general petrology courses. Even while widespread, they do tend to be rare; they are typically composed of equally rare and equally unfamiliar minerals; and from a practical standpoint, they understandably end up low on the educational priority list because emphasis has to be first on mastery of the more common igneous and metamorphic rocks.

Certainly, those are all valid considerations. Nonetheless, exotic rocks are more than just scientific curiosities. The distinctive mineral assemblages in many of these rocks illustrate fundamental concepts in geochemistry and petrology, and many are of importance associated with strategic metals and gemstones. Plus, some of these rocks are downright beautiful (for example, Google images of “charoite” and imagine that rock as a bold kitchen countertop or memorable gravestone).

The reasons to study unusual rocks seem compelling. However, with all the competing interests for students’ limited time, busy students with a curiosity about these kinds of rocks need a way to explore on their own schedule and at their own pace. To accommodate this, I thought that outreach via a variety of e-media could be an effective platform. The core resource for this outreach would be my collection of exotic rocks in thin section... currently at about 208 samples, and growing by about 40 new samples every year.

I started my efforts by offering a three-volume set of optical mineralogy photo atlas e-books (available on the Apple iTunes bookstore for Mac, iPad and/or iPhone users). These volumes feature in total over 100 mineral species, both familiar and obscure, which comprise my unusual rocks. To complement the e-books, I then took high-resolution scans of all of the thin sections, in both unpolarized light and under crossed polarizers, and uploaded all of the images to my website at https://www.rockptx.com. But the paired scanned thin section images were only the first step towards a much more ambitious goal. To accompany these images, each sample was captioned with locality, rock type, and mineralogy information (a work in progress), and these have been indexed for easy searching. I recently started adding tables of mineral composition data, culled from my ongoing microprobe work, with the hope that eventually every major mineral in every sample will be compiled (as time and my microprobe budget allow). To make the scanned thin section images even more user friendly, I’m planning to highlight distinguishing optical features so that viewers will have an easier time identifying specific minerals of interest in the scans. Finally, I’m also adding X-ray maps and BSE images for some samples, as well as adding video of advanced optical microscopy techniques.

The value of all of this content should be two-fold. In some part it will be scientific, providing a resource for researchers who may wish to compare and contrast their rocks to my rocks. But in large part the site is intended to be educational. Toward this end, I plan to integrate images, video, tabulated data and other resources into self-paced tutorials and projects that will highlight a variety of concepts in mineralogy and petrology. It is my hope that such content can effectively supplement a traditional classroom course for those students who want to further explore what other “exotic” geological wonders are underfoot.

That earlier seminar I mentioned at the start of this article unfortunately didn’t draw a large enrollment. But what I wasn’t able to accomplish in the classroom then, I may now have a chance to accomplish on a much larger scale with web-based outreach. “Exotic” rocks may yet find their following... online.

Frank K. Mazdab is an adjunct researcher with the UA Geosciences Economic Geology group.
The 44th Annual GeoDaze was another big success. Thank you to David Bercovici, the Frederick William Beinecke Professor of Geophysics at Yale University, for his keynote address, The Origin of Plate Tectonics.

Mark your calendars for GeoDaze 2017: March 30 - 31!
Many thanks to the following alumni, friends, and corporations for their generosity and support.  
(Gifts listed below were received between 5/1/15 and 4/30/2016.)

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Why do I Donate?

By Kathleen Devaney, BS ’82, generous supporter of the George H. Davis Undergraduate Research Fund

Why do I donate? I was inspired by my dad, who paid back his scholarship to MIT. Just as I was considering giving to UA Geosciences, the George Davis Undergraduate Research Fund was started. Perfect timing! George Davis was my advisor at Arizona and I was lucky and privileged to take structure from him. I work as an advisor for undergraduate research at a different institution, so I know how valuable this experience can be. When I started my position, I knew where to turn: my experience at UA! I am happy to give back to University of Arizona Geosciences and to undergraduate research there.

About the George H. Davis Undergraduate Research Fund: While undergraduate research experience is highly correlated with graduate and job success, at present, UA Geosciences can only provide at small fraction of our undergraduate majors with real research experience. This endowment for undergraduate research will elevate the education of many more deserving students, allowing them to engage in a rigorous research experience.

For more information and to donate, please see geo.arizona.edu/support.

Thank you for helping to build a strong UA Geosciences!
In December, the GEOS 306 Mineralogy class went on a field trip to San Carlos, AZ to examine and collect mantle-derived rocks and minerals. San Carlos is famous for olivine and gem quality peridot, found in xenoliths that were brought to the surface by volcanic eruptions. While we were there, the owner of the mine educated us on mine operations as well as life on the reservation. A beautiful landscape and wild horses complemented the scenery around the open pit mine.

-By Kim Fendrich, MS student

In October, a group of graduate and undergraduate students went to northern Utah and southwest Wyoming to study the Sevier Thrust Belt in the U.S. Cordillera. This classic geologic location was instrumental in developing many of the foundational concepts in thrust tectonics. The field trip was led by Peter DeCelles who has worked in the Sevier Thrust Belt for ~30 years. We covered a lot of ground and touched on topics including syn-tectonic sedimentation, growth strata, orogenic wedge mechanics, frontal and lateral ramps, foreland basins, duplexes, triangle zones, depositional environments, and much more. We discussed the broader implications of thrust belts and foreland basin systems on the distribution of natural resources including local natural gas and coal deposits. Despite world-class exposures, this is a difficult trip to take because of the distance and time required to transect the thrust belt. Without the support from the Dickinson Fund, many students would not have been able to attend. This trip was particularly poignant in light of Dr. Bill Dickison’s passing in July 2015, but we felt that he would be glad to know we were out in the field exploring and learning about the geology of the Western U.S.

-By Jay Chapman, PhD student

The William R. Dickinson Field Trip Support Fund allows us to develop future leaders in the geosciences and maintain the strong component of field work and field-based education that distinguishes Arizona Geosciences alumni.

Mineralogy students on a Dickinson Fund-supported field trip to San Carlos, AZ in December. Photo: Kim Fendrich

BP Donates 32 Workstations to Geosciences

By Kiriaki Xiluri-Lauria

In early March 2016, BP America generously donated 32 high-end workstations to the Department of Geosciences to enhance our computational capabilities and support undergraduate and graduate student research and training.

Five of these workstations have already been integrated into the Global Seismology and Tectonics Lab, where they are used for graduate and postgraduate research, complementing the existing server facilities. The added computing power has already boosted the on-going research productivity of the group.

Five more workstations are in the process of being integrated into the Reflection Seismology Lab, where they are used for graduate research and for teaching principles and practices of exploration seismology using sophisticated industry-leading processing and interpretation software.

An additional five workstations will be used to upgrade the capabilities of the Geodesy Lab (satellite-based GPS), enhancing access to undergraduate students to the cluster capabilities of the group as well as adding research power to the graduate and post graduate research.

Many of the other workstations will be used in a significant departmental computing resource center that is under development for undergraduate and graduate student training and research. This initiative has been hailed with enthusiasm by the faculty, and the workstations will be valuable assets in supporting our research and teaching mission.
In April, two ConocoPhillips geoscientists—Robert Krantz (PhD ’86) and Simon Kattenhorn—joined several UA Geosciences faculty members, researchers, alumni and graduate students on a ConocoPhillips-sponsored field trip to southern Utah.

Geosciences Department Head Peter Reiners calls the trip, “definitely one of the best field trips I’ve ever been a part of.” The trip's focus was an integrated view of the geology of the Colorado Plateau, structural interpretation, fluid flow and mineralization. “It was amazing to see how folding and faulting controlled the distribution of bleaching, sulfidization, relict hydrocarbons, and redistribution of Fe in the sandstones, and how that set up some of the units for later U and Cu mineralization,” Reiners said.

The trip made a variety of stops, with presentations from several participants:

- **Raising the Colorado Plateau** led by Professor George Davis
- **Introduction to the Moab Fault and Paradox Basin** led by Bob Krantz and Simon Kattenhorn of ConocoPhillips
- **Canyonland Grabens** led by Bob Krantz and Simon Kattenhorn of ConocoPhillips
- **Mn- and Fe-Oxide Mineralization and Geochronology** led by Graduate Student Victor Garcia
- **Brines, Metal Mobility and the Role of Magmatism: Lisbon Valley** led by Research Scientist Isabel Barton and Professor Mark Barton
- **Geomorphic Features and Archaeology of the Colorado Plateau** led by Professor George Davis

For more photos and highlights of this trip, please see our galleries of recent field trips at geo.arizona.edu/fieldtrips.
To understand the distribution and origin of mineral deposits in the earth’s crust, one must understand the tectonic, igneous, sedimentary and metasomatic processes that control the movement and concentration of the elements. There are many tools in a geologist’s kit to study these controls. Although research within the UA economic geology group spans these diverse disciplines, I’d like to focus specifically on recent exciting progress we’ve made in the field of trace element analyses. With access to a modern five-spectrometer Cameca SX100 electron microprobe housed in Planetary Sciences, the workhorse Isoprobe multi-collector inductively-coupled plasma mass spectrometer (MC-ICP-MS) operated by the department’s geochemistry group, and our own new Thermo Element 2 laser-ablation ICP-MS system, our students and faculty have worked to “push the envelope” in geochemical research applied to ore deposits.

Fluid Compositions

Hydrothermal fluids play a major role in the evolution of the earth’s crust, perhaps most notably in the formation of many types of mineral deposits, from how metals are transported and ultimately precipitated, to the nature of the broader alteration assemblages that widely accompany mineralization and that can help to delineate it. The characterization of fluid composition, temperature, and other parameters, and the evolution of these variables over time, is thus a critical component of the understanding of the rocks themselves. Ancient fluids leave behind many clues for geologists, from the familiar directly observable fluid inclusions trapped in some minerals, to the more subtle changes seen in the chemistry of minerals that have grown from the fluid. Active research on both topics is being pursued in the Economy Geology group, and with the addition of new analytical capabilities, these efforts are already yielding tantalizing results.

With respect to fluid inclusions, although heating and freezing experiments have been a mainstay in ore deposit research for many years (and are still an important component of our group’s work), our researchers have more ambitious goals. For example, PhD student Wyatt Bain, Matt Steele-MacInnis (one of our new faculty members), and Pilar Lecumberri (one of our new research scientists) are using laser-ablation ICP-MS to directly probe the chemistry of fluid inclusions in minerals from a variety of ore-forming environments. The laser ablates the sample, opening individual fluid inclusions, and thereby allowing their vaporized contents to be taken into the mass spectrometer for multi-element analysis. This type of challenging analytical work is only being done at a handful of institutions around the world, and adds a new dimension to UA Geosciences’ reputation as a leader in economic geology.

Complementary studies of trace elements in minerals to fingerprint fluid sources and infer fluid compositions are also an important area of research in our group, and some of the techniques we have developed push the routine operating limits of our instrumentation. One of my own projects in this area involves measuring low-ppm levels of bromine in scapolite by electron probe microanalysis (EPMA). The minor halogen content of scapolite has been shown to directly reflect the composition of the fluid from which it formed, which can then be used to identify fluid sources.

Petrologic Applications

Of course, magmatic and metamorphic processes also play an important role in ore formation, and hence fluids alone are not our only focus of analytical research. The applications of trace element research to broader mineralogical questions also elicits a wider range of interest from colleagues outside of economic geology, including students and faculty in the mineralogy/petrology group, the tectonics group, in material science and in planetary science.

These mineral chemistry studies span the “A-Z” range of interesting trace elements, from arsenic to zirconium. MS student Jenny Dabbs and PhD student Shelby Rader, both under the direction of Mark Barton, are each focusing on better understanding the geochemistry of their own favorite(?) famously toxic elements. Jenny’s research is on relating arsenic in igneous apatite to associated hydrothermal systems, and she is doing so in part by developing an EPMA analytical protocol optimized for the detection of arsenic at low-ppm levels. Shelby’s work is on thallium in a variety of minerals. She is using MC-ICP-MS (and some intense wet chemistry) to develop perhaps the most advanced understanding of the mineral-specific distribution of thallium (and its isotopic fractionation) in silicates and sulfides to date. Although relevant to ore deposits, Shelby’s and Jenny’s results are also applicable to igneous petrology, geochemistry, and environmental science.

Research scientists Isabel Barton and Pilar Lecumberri, along with Mark, Matt, and I, have devoted considerable time to optimizing trace element analysis protocols in zircon, epidote, and other accessory minerals. Although this type of work is
Cutting-edge Trace Element Analysis Techniques Advance Research in Economic Geology, and Beyond

now relatively routine in many labs, we have taken extra effort to evaluate the most appropriate matrix-matched standards to achieve the best analytical precisions, to identify and mitigate potential interferences that could otherwise lead to undesirable lower quality data, and to offer the nominal set of mineral-appropriate elements that would be of value for both basic research and applications to mineral exploration. With igneous zircon, for instance, the trace elements patterns can potentially discriminate between “productive” and “barren” intrusions by revealing if the magmas generated a fluid with ore-forming potential. This and related development work in our labs is supported by gifts from Freeport-McMoRan and Newmont. It is exciting to be working on this mix of projects with a wide range of industry and university partners.

This highlights just a few of the many ongoing projects in the Economic Geology group. Interested readers should see our webpage (geo.arizona.edu/mineral_resources) for more information on these activities and our many other projects where there are opportunities for both cooperative and contract work.

Rock it My Way

By Anson Cheung (Senior, Geosciences)

“One, Two, Three, push!” The fog is coming in. I feel the tickling in my boots, probably because leeches are biting me. This is crazy. “One more time, ready?” Surrounded by a dense forest somewhere in New South Wales Australia, my partner and I are trying to push a D-section core into a bog and retrieve some mud for analysis. I am sure this is a familiar scene to most geologists, as we travel and study places around the world. As an undergraduate majoring in Earth System Science, though, this is a rather rare opportunity for me.

As an Earth System Science major, I believe it is also important to know about the interactions among different systems on Earth and have a global perspective on current global issues, such as global climate change. A global mindset can be developed through various ways, and I chose an option that is less popular to geoscience students – study abroad.

With the help from three different major scholarships (UA Study Abroad Office’s scholarship, Benjamin A Gilman Scholarship, and an Honors College Scholarship), I am currently studying abroad in Australian National University (ANU). I am taking two geoscience-related (more specifically Earth Systems) courses – Paleoecology; Geodesy and Climate Change – and working on a mini research project in ANU.

A major difference between the earth system courses offered by ANU and here at UA is the heavy emphasis on practical work. For instance, the scene I mentioned above was actually one of the field trips in the Paleoecology class I went on where we got to collect core samples and analyze different proxies in the record. Developing a global mindset is not only limited to classroom experience. I also had the opportunity to get involved in a paleoclimate project in ANU and had the chance to meet one of my research collaborators at University of New South Wales that I was introduced to through the summer Research Experience for Undergraduates (REU) program last summer.

Apart from the intense academic work, I also spent some time exploring Australia and New Zealand. I also had the chance to socialize with different people from different backgrounds. Incorporating this exchange experience into my undergraduate life will definitely help me develop a wider mindset and prepare to face one of the most daunting global challenges in the coming century.

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GeoPathways

GeoPathways, a partnership started in fall 2015 between Geosciences and Pima Community College, is recruiting, mentoring and providing paid internships for transfer students from two-year colleges in Arizona. The goal of the program is to improve the academic performance, time to graduation and job prospects of geosciences transfer students, who tend to trail non-transfer students in these areas.

GeoPathways will attract transfer students from Arizona community colleges to the geosciences and provide them with mentoring and internship opportunities. Here, the undergraduate Historical Geology class takes a field trip to Petrified Forest and the Grand Canyon. Photo courtesy of Barbara Carrapa.

“We need to attract more students to the geosciences, give them the skills to succeed and get them the job experience they need,” said project director and Geosciences professor Karl W. Flessa. GeoPathways is designed to increase the number of under-represented minorities in geosciences and also increase the total number of students entering the geoscience workforce. Flessa and Noah Fay, a PCC geology instructor, received a National Science Foundation grant to fund the project.

GeoPathways takes a three-part approach: recruiting at community colleges, mentoring new UA transfer students, and providing internship opportunities for the transfer students. As part of recruitment, current UA Geosciences undergraduates reach out to prospective transfer students by leading field trips and participating in PCC classroom activities.

“GeoPathways is off to a great start for both UA and PCC students,” said Fay. “We’ve had two joint UA-PCC student field trips, three engaging visits by UA students to lead lab activities and field trips in PCC classes, and six UA undergrads are preparing for summer internships. So far, so (very) good.”

To read the UA News story about GeoPathways, please see uanews.arizona.edu/story/partnership-connects-transfer-students-geosciences.

Accessible Earth

Geosciences, the UA Disability Resource Center and UA Study Abroad & Student Exchange have joined forces to create a new capstone field course opportunity called Accessible Earth. The first course of its kind, Accessible Earth will make earth sciences more accessible to students of all physical abilities and provide international research experience. This course will satisfy the “field camp” requirement for many geosciences bachelor’s programs.

Traditional field camps typically involve physical work in difficult terrain: an insurmountable barrier for many students, particularly those with disabilities, said Geosciences professor Richard Bennett, the lead instructor for Accessible Earth.

Accessible Earth starts this summer and will be based in Orvieto, Italy. The location was chosen for its geologic and cultural history and to help provide all students with the academic and social benefits unique to study-abroad experiences.

Technology such as satellites permits some earth sciences research to be done solely by analyzing data with a computer. “With modern Internet and remote sensing technologies,” Bennett said, “anyone can download data and make substantial contributions to our understanding of the Earth system from just about anywhere using a common laptop computer. There are literally petabytes of data out there just waiting to be analyzed and interpreted.”

To read the UA News story on Accessible Earth, please see: uanews.arizona.edu/story/ua-creates-accessible-study-abroad-geosciences-course.

Geosciences’ new capstone class, Accessible Earth, will be based in the city of Orvieto, Italy. The Orvieto Cathedral is the most prominent feature of the skyline. Orvieto was chosen for its geologic and cultural history and to help provide all students with the academic and social benefits unique to study-abroad experiences. Photo: Rick Bennett
Introductions: New Faculty and Researchers for Fall, 2016

Chris Harig joins UA Geosciences as an assistant professor. Chris will teach courses in geophysics, the cryosphere, and numerical methods. He comes to the UA from Princeton where he studied the Greenland and Antarctic ice sheets.

Eric Kiser comes to UA Geosciences as an assistant professor of geophysics. Eric earned his PhD from Harvard and recently completed his postdoctoral work at Rice University.

Amanda Hughes is joining Geosciences as a research scientist. She earned her PhD from Harvard and comes to the UA from the Chevron Energy Technology Company, where she was a structural geologist specializing in petroleum exploration.

Luke McGuire will be an assistant professor of geomorphology. Luke comes to Geosciences from his Mendenhall Postdoctoral Fellowship at the USGS Landslide Hazards Program in Golden, CO.

Ji Yeon Shin will be joining Geosciences as a lecturer in paleobiology/geobiology. Ji Yeon comes to the UA from University of California, Davis, where she earned her PhD in geology (paleontology) and where she has been a lecturer since 2013.
Students

Jordan Abell, BS ’16, received the Geosciences department Excellence in Undergraduate Research award.

Muhammad Nur Addeen Amran, BS ’15, received the Geosciences department Outstanding Senior award in the graduating class of December, 2015.

Rachel Cajigas, PhD student, received a Scholar Award from the Philanthropic Educational Association (PEO) and a grant from the Society for Sedimentary Geology (SEPM).

Enrique Chon, BS ’16, received the Geosciences department Outstanding Senior award in the graduating class of May, 2016.

Kathleen Compton, PhD student, was selected to participate in the Presidential Management Fellowship program.

Gloria Jimenez, PhD student, received a Scholar Award from the Philanthropic Educational Association (PEO).

Phillip McFarland, PhD student, received the ARCS Scholar Award and the UA College of Science Service Award.

Kate Metcalf, PhD student, received the UA College of Science Teaching Award.

Shaunna Morrison, PhD student, received the ARCS Scholar Award.

Andrea Stevens, PhD student, received the Harriet Evelyn Wallace Scholarship from the American Geosciences Institute (AGI) and a Student Research Grant from the Society for Sedimentary Geology (SEPM).

Kevin M. Ward, PhD student, received the UA College of Science Scholarship Award.

Shana Wolff, PhD student, received a Student Research Grant from the Society for Sedimentary Geology (SEPM).

Emma Reed, MS student, received a UA/NASA Space Grant for her work focusing on K-12 ocean science outreach at Biosphere 2 (B2).

Faculty

Susan Beck, Jon Pelletier, Jay Quade, and Peter Reiners were all named 2015 Fellows by the Geological Society of America.

George Davis received the Distinguished Alumni Award from the College of Wooster.

George Davis and Peter Kresan both received the Superior Teaching Award ($1000 prize, each) from the College of Humanities, for their course, Colorado Plateau Beauty: Rocks, Structures, Landscapes, and People, which they taught to 95 adult learners in the Humanities Seminar Program.

Karl Flessa was a visiting professor at the University of Vienna in April 2016. He taught a workshop on Conservation Paleobiology.

George Gehrels, Jonathan Overpeck, and Jay Quade were named 2015 American Geophysical Union Fellows and were recognized at the annual AGU fall meeting in San Francisco.

Jay Quade was named a 2016 Geochemical Fellow by the Geochemical Society and European Association of Geochemistry. The award goes to scientists who have made major contributions to the field of geochemistry.

Randall Richardson received the 2016 Outstanding Faculty Award from the Geosciences advisory board. Please see Randy’s response to the award in the next column.

Jessica Tierney was awarded one of 18 2015 Packard Science and Engineering Fellowships. She will receive a grant of $875,000 over five years to pursue her research. Tierney is the first member of UA Geosciences to be awarded a prestigious Packard Fellowship and the ninth UA faculty member to receive the award. Tierney also received the Pieter Schenck Award from the European Association of Organic Geochemists at the International Meeting on Organic Geochemistry in Prague.

Staff

Michelle Garcia, Program Coordinator in the Geosciences front office, won an Award of Excellence from the College of Science Staff Advisory Council.

Susan McDonald retired in August 2015. Susan worked in the Radiocarbon and Meteoritics scientific journal publication offices and was with the Geosciences Department since 2004.

I am deeply honored, and humbled, to have received the Geoscience Advisory Board’s Outstanding Geoscience Faculty Award for 2016. I am humbled to join those who have received the award before me, including giants in the department like Peter Coney, George Davis, and Bob Butler. The more recent awardees also set very high standards. I am also humbled when I think about those whose contributions to the department have been so significant, in so many dimensions, who have not yet received this award.

I am honored because I know what an important role the graduate students play in the nomination/selection process, and would like to thank them personally. To be valued by the current graduate students, whom it has been my pleasure and honor to work with closely in courses and on degree committees, is a source of great satisfaction and reward to me.

It’s too early to reflect on my career in the department. There will be time enough to do that in the future. For now, I am happy to continue contributing to a great department. Knowing that my efforts are appreciated and valued makes it all the more pleasurable.

- Randall Richardson

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Pamela A.K. Wilkinson, education outreach coordinator with the Lowell Institute for Mineral Resources, received the Ivan B. Rahn education award during the Society for Mining, Metallurgy and Exploration national meeting in Phoenix Arizona, February, 2016. The Ivan B. Rahn award recognizes distinguished contributions to the educational activities within SME. Pam received the award for “years of dedicated and passionate effort to educate school children and adults of Arizona about the facts of responsible mining and the role minerals play in their daily lives.” It is humbling to her to have received this prestigious award, given that Mary P. Poulton PhD., the Lowell Institute Director and University Distinguished Professor received this award in 2015.

Pam develops and implements educational programs at the Lowell Institute for Mineral Resources that cover the methods of modern mining, from exploration through development and production to reclamation. One of her goals is to convey how important the mining industry is to our state, our country and our livelihoods. She is also responsible for recruiting students into both the UA Mining/Geological Engineering and Geosciences Departments. Funding for the program comes predominately from the Mining Foundation of the Southwest.

Pam’s background as a K-6 volunteer teacher, and, prior to this, as an industrial minerals geologist with Duval Corporation and U. S. Borax and Chemical Corporation, provide the basis for creating the current program. Through her efforts these past 8 years, over 60,000 students in classrooms and another 10,000+ children and adults outside of the school day have learned how modern mining provides for their quality of life. “Mining: it’s in EVERYTHING.”

Pam has also been recognized by the National Mining Hall of Fame and Museum of Leadville Colorado, having received the 2014 Prazen Living Legend Award for “excellence in educating the public about the importance of mining and minerals.” A detailed article by Alex Schauss about her program appeared in the Friends of Mineralogy October newsletter: friendsofmineralogy.org. For more information about the Lowell Institute’s education outreach program, see imr.arizona.edu/content/k12-education-outreach.

Pam’s favorite question that stumps most people: Name something you use in your modern lifestyle that is NOT made with or touched by the products of a mine? (Hint: there are only two!)

**Building Better Models of the Southern Ocean (continued from page 1)**

and indicators of seawater chemistry and biological activity. The floats take observations as deep as 2,000 meters and then surface to transmit the information to a satellite every five to ten days. After only 18 months, the SOCCOM float program has already collected more pH measurements in the Southern Ocean than had been collected previously. All SOCCOM float data are on the web and are freely available to the public in real time without restriction.

Exciting new results include: the first ever measurements under the sea ice in the winter; the first ever measurements inside a polynya – a short-lived crack in the sea ice; and for the first time, a complete record of the physical and biogeochemical changes that occur during an entire summer bloom.

Russell and her team are using the new data to design metrics for carbon, temperature, nutrients, salt, wind stress and more to help them evaluate the computer model simulations in order to better understand the complicated circulation and chemistry of the Southern Ocean.

In collaboration with senior scientists at Princeton University, Scripps Institution of Oceanography, the Monterey Bay Aquarium Research Institute, the University of Washington and Climate Central, Russell’s team here at the University of Arizona includes research scientist Paul Goodman, graduate student Zach Naiman, and undergraduate student and geosciences major Jack Johnson.

SOCCOM is funded by a $21 million federal grant from the National Science Foundation’s Division of Polar Programs, with additional support from the National Oceanic and Atmospheric Administration (NOAA) and NASA.
A new effort led by the education and outreach committee of the Geosciences advisory board strives to engage the UA and greater Tucson communities in the importance of the geosciences in society. The Geosciences Education and Outreach Series (or GEOS) features speakers twice per semester presenting on diverse geoscience topics of general interest. A reception prior to each presentation invites attendees to join the speaker and geosciences faculty and students for refreshments and conversation.

The initiative kicked off in February with a presentation by Associate Professor Joellen Russell, “Opportunities in Climate and Earth Science are Heating up!” Geosciences advisory board chair Ray Leonard (BS ’75) gave the second presentation in April, “OPEC’s Dilemma: The world oil cycles of 2003-2023,” which was sponsored by Hyperdynamics.

“Our goal with the series is to support the department by providing opportunities for students and community members to learn about geosciences and to foster interaction with geoscientists, students, alumni, faculty, and staff,” said Nancy Beckvar (MS ’86), chair of the advisory board’s education and outreach committee.

In addition to Nancy Beckvar, members of the advisory board’s education and outreach committee include Stanley Hart, John Pekala (BS ’93), Marc Sbar, Elena Shoshitaishvili (PhD ’02) and Will Wilkinson (PhD ’81).

The Global Seismology and Tectonics group hosted a workshop on Ambient Noise Tomography for UA students and collaborators from Ecuador, Peru, Chile, Argentina, Brazil and Turkey in January 2016. Graduate students Kevin M. Ward and Jonathan Delph, and faculty member Susan Beck organized the week-long workshop with hands-on computer applications of ambient noise analysis. Participants brought seismic data from their national seismic networks to process, and all participants left with operating codes and preliminary seismic phase velocity maps. The workshop was funded by an NSF grant to Susan Beck and was part of the broader impacts to help improve seismology in Latin America.
Jibamitra Ganguly

By Jonathan Patchett

Professor of Petrology Jibamitra Ganguly retired in January 2016. First appointed at the University of Arizona in 1975, Jiba is one of the longest-serving members of the Department, and was always the bedrock foundation of hard-rock research and teaching.

Jiba's PhD at the University of Chicago dates to 1967. At that time, the conditions of metamorphism in orogenic belts were very poorly known, and in his thesis and subsequent papers Jiba contributed crucial stability experiments on minerals like staurolite and chloritoid. The hallmarks of his work were always that no experiment was too difficult, that one should always understand the thermodynamics of what was occurring, and that students should also rise to these twin challenges. His long-running exploration of the garnet mineral family ranged from stability relations and solid solution in the 1970’s all the way through to the significance of garnet isotopic ages after 2010. His work in meteorites was a major application of his diffusion parameters to rates of cooling in extraterrestrial bodies. One might think that a rock shows readily whether it cooled from a magmatic state, was metamorphosed at depth, or was cooled from a rapid impact heating event, but in fact many pieces of asteroids or Mars do not show these things clearly, and Jiba's constraints based on phase petrology and compositional gradients made a major impact. Jiba was more or less continuously funded by NSF, and by NASA after his move into extraterrestrial geology.

For Jiba Ganguly, the most important community (apart from the Departmental one) is the worldwide fraternity of petrologists and geochemists. His national and international dimension is marked by his research visits and collaborations in countries like Italy and Sweden, by the dispersal of his students to other groups in the USA and foreign countries, and by his Humboldt Prize to finance his work in Germany in 2002. Jiba became a Fellow of the Mineralogical Society of America quite early in his career, and a Fellow of AGU in 2014. He is the first or sole author of two books, and the editor of two others.

Jiba's endurance is exemplified, among other things, by his youthful posture. At his son's wedding celebration ten years ago, greybearded senior Indian professors from other North American schools described how Jiba's appearance was essentially unchanged from the time when he was a postdoctoral fellow in 1970. We are fortunate that Jiba plans to continue the threads of his research and writing for one or two years yet.

Jonathan Patchett

By Peter Reiners

Professor P. Jonathan Patchett, one of the outstanding giants of UA Geosciences faculty, recently retired, leaving an important legacy not only for our program but on the international geochemistry community. Jon came from the Max-Planck-Institut für Chemie in Mainz, Germany in 1984 to become a faculty member in UA Geosciences. Prior to that he received his undergraduate and graduate degrees from the Universities of Oxford and Edinburgh, and represented and brought international panache to our program through visiting scientist positions in some of the most prestigious research institutes in France, the UK, and Germany, including as a Humboldt Fellow. Jon also was made Fellow of AGU in 2009, GSA in 1996, and won the Geochemical Society's Clarke Medal in 1982.

Jon is an exceptionally versatile and rigorous isotope geochemist who made important discoveries across a wide range of problems in Earth and planetary science. Some of his most important contributions were in experimental development and application of radiogenic isotope systems to solid Earth problems, particularly as a leader in the development of now extensively used Lu-Hf system, for which he and his students and postdocs are particularly well-known. Jon demonstrated versatility throughout his career, turning more recently to U-series methods and a series of cutting-edge paleoclimate and paleohydrology studies. He authored a huge number of papers, earning an h-index well over 50, showing the range and depth that a strong foundation in geochemistry and a commitment to rigorous analytical practices make available to curious scientists, touching on topics ranging from the tectonics of ancient cratons and the world’s great active orogens to magmatic processes to geoarcheology to fundamental

In retirement, Jonathan Patchett is pursuing his interest in astronomy.

(Continued on page 18)
Degrees Awarded Summer 2015, Fall 2015 and Spring 2016

Bachelor of Science

Ahmed Alhawaj  Jeffrey Cox  Thomas L. Marsh  Westin Skillings
Abdulrahman Alnoaim  Brian Richard Drozdowicz  Patrick Mazzone  Zachary Alan Smith
Ghada Alshaikhmubarak  Michael Fritz  Clarke McCleave  Stephen Sobansky
Muhammad Nur Addeen Amran  Eduardo Garcia  Scott Mesich  Amanda Tack
Mariah Armenta  Nathan Hendler  Juan Munoz  Hunter Tek
Isaac Borrego  Casey John  Kevin David Ortiz  Joseph Valachovic
Jade Bowers  Kristen Joyse  Jeremie Pfister  Kaitlynn Walker
Patrick Boyd  Zhe Lin  Julia Richter  Leon Wells
John Carroll  Trecee Margaret  Delaney Robinson  Anastiaza Wiens
Jie Ming Chong  Jacob Marker  Emily Ryan  Patrick Wood

Master of Science, Professional Science Master, & Doctor of Philosophy

To see this listing with research topics, please see www.geo.arizona.edu/grads1516.

Elizabeth Balgord, PhD 2015  Andrew Early, PSM 2016  Kendra Murray, PhD 2016
Barbara Carrapa, advisor  Eric Seedorff, advisor  Peter Reiners, advisor
Rebecca Beadling, MS 2016  Juan Fajardo, PSM 2015  Sean O’Neal, PSM 2015
Jianjun Yin, advisor  Eric Seedorff, advisor  Mark Barton, advisor
Christy Caudill, PSM 2015  Daniel Favorito, MS 2016  Jill Onken, PhD 2015
Eric Seedorff, advisor  Eric Seedorff, advisor  Vance Holliday, advisor
April Chiriboga, PhD 2015  Kim Fendrich, MS 2016  Devon Orme, PhD 2015
Paul Sheppard, advisor  Robert Downs, advisor  Barbara Carrapa, advisor
Jennifer Dabbs, MS 2016  Jhon Sebastian Jimenez, PhD 2015  Christian Rathkopf, PSM 2015
Mark Barton, advisor  Joaquin Ruiz, advisor  Mark Barton, advisor
Hayley De Witt, PSM 2015  Clinton Koch, PhD 2015  Intan Yokelson, MS 2016
Mark Barton, advisor  Roy Johnson, advisor  George Gehrels, advisor
Hend Ali Ahmed ElSherbiny, MS 2015  Ryan Leary, PhD 2015  Peter DeCelles, advisor
Ronald Towner, advisor

Jonathan Patchett Retirement (continued from page 17)

experimental development to global chemical geodynamics to sedimentary provenance to paleoclimate and paleohydrology to planetary sciences.

Jon mentored a series of impactful graduate students and postdocs at UA, many of whom continue to make important contributions. He taught a wide range of courses conscientiously and rigorously, including core major courses (Physical Geology, Petrology), Gen Eds (Nats, Hazards), and his trademark Chemical Evolution of the Earth, from 1985 to 2011, a foundational course for many graduate and upper-level undergraduate students. He also served the department with impeccable precision and reliability in roles ranging from Associate Department Head to co-manager of a state-of-the-art geochemistry clean lab appreciated by many.

Jon continues to explore the secrets of the universe through astronomy, as well as enjoy his retirement in both Arizona and Colorado with his wife Kaye.
Fall Scholarships

Wyatt Bain, PhD Student
Economic Geology Scholarship
$4,601

Drew Barkoff, MS Student
Economic Geology Scholarship
$4,170

Alejandro Blanco-O’campo, PhD Student
Geosciences Graduate Scholarship
$4,727

Marie De los Santos, MS Student
Chevron Diversity Scholarship
$4,000

Marie De los Santos, MS Student
Geosciences Graduate Scholarship
$170

Kim Fendrich, MS Student
Sulzer Scholarship
$4,601

Brendan Fenerty, PhD Student
Sulzer Scholarship
$668

Phillip McFarland, PhD Student
Sulzer Scholarship
$4,727

Andrea Stevens, PhD Student
Sulzer Scholarship
$4,727

Kevin M. Ward, PhD Student
Sulzer Scholarship
$4,727

James Worthington, PhD Student
ConocoPhillips Scholarship
$4,727

Chad Yost, PhD Student
Paul S. Martin Scholarship
$4,727

Brendan Fenerty, PhD Student
Chevron Summer Scholarship
$900

Saba Keynejad, PhD Student
Chevron Summer Scholarship
$900

Jennifer Kielhofer, PhD Student
Wilson Thompson Scholarship
$841

Andrew Laskowski, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
ConocoPhillips Scholarship
$4,727

Chad Yost, PhD Student
Paul S. Martin Scholarship
$4,727

Dominik Kardell, MS Student
Chevron Summer Scholarship
$900

Saba Keynejad, PhD Student
Chevron Summer Scholarship
$900

Jennifer Kielhofer, PhD Student
Wilson Thompson Scholarship
$841

Andrew Laskowski, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
ConocoPhillips Scholarship
$4,727

Chad Yost, PhD Student
Paul S. Martin Scholarship
$4,727

Jonathan Delph, PhD Student
Chevron Summer Scholarship
$900

Katherine Guns, PhD Student
Spencer R. Tittle Scholarship
$900

Susana Henriquez, PhD Student
Spencer R. Tittle Scholarship
$900

Dakota Isaacs, MS Student
Chevron Summer Scholarship
$900

Gloria Jimenez, PhD Student
Bert S. Butler Scholarship
$900

Jhon Sebastian Jimenez, PhD Student
Spencer R. Tittle Scholarship
$900

Dominik Kardell, MS Student
Chevron Summer Scholarship
$900

Saba Keynejad, PhD Student
Chevron Summer Scholarship
$900

Jennifer Kielhofer, PhD Student
Wilson Thompson Scholarship
$841

Andrew Laskowski, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
Chevron Summer Scholarship
$900

Phillip McFarland, PhD Student
ConocoPhillips Scholarship
$4,727

Chad Yost, PhD Student
Paul S. Martin Scholarship
$4,727

Cheryl Peyser, PhD Student
Geosciences Graduate Scholarship
$4,601

Spring Scholarships

Wyatt Bain, PhD Student
Spencer R. Tittle Scholarship
$4,601

Brandon Bishop, PhD Student
ConocoPhillips Scholarship
$4,727

Jordon Bright, PhD Student
$4,727

Paul S. Martin Scholarship
$4,170

Marie De los Santos, MS Student
Chevron Scholarship
$4,170

Galileo Circle Scholarships

The following students received $1,000 scholarships from donors to the College of Science Galileo Circle.

Nicollette Buckle, MS student
Michelle Dafov, BS student

Mason Gates, BS student
Susana Henriquez, PhD student
Jordan Krcmaric, BS student
Phillip McFarland, PhD student
Kojo Plange, MS student
Shelby Rader, PhD student
Susan G. Earl Scholarship
Emma Reed, MS student
Carson Richardson, PhD student
Melissa Schwan, BS student

Zachary Williams, MS Student
Spencer R. Tittle Scholarship
$900
Shana Wolff, PhD Student
Chevron Summer Scholarship
$900
Hector Zamora, PhD Student
Chevron Diversity Scholarship
$900

Join us at GSA and AGU!

Alumni, Friends, Faculty, and Students Receptions

GSA: Monday, September 26
6 - 8 pm
Hyatt Regency Denver Convention Center
Capitol Ballroom 5

AGU: Monday, December 12
6 - 8 pm
ThirstyBear Brewing Company
661 Howard St.
San Francisco

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Ray Brady (BS ’70) retired in October after 40 years at BLM and the U.S. Geological Survey. He put a renewables pre-screening and fast-track permitting system into place that, since 2009, has resulted in the agency approving 57 commercial-scale solar, wind and geothermal power projects covering more than 305,000 acres of federal lands across the West. None of that would have been possible without Brady and the national renewable energy team he led, building a renewable energy program from the ground up, observers say. They had to figure out how to screen and review project applications, develop rental rates and fee structures, and establish a system to identify suitable sites for development. Former Interior Secretary Ken Salazar called Brady “a visionary” who “served a keystone to opening up our public lands for renewable energy development.” “What we’ve achieved has been a major accomplishment,” Brady said. “It’s contributed significantly to the clean energy needs of our country as part of our new energy frontier that Secretary Salazar established when he was here. I’m very proud of what we have accomplished.” (Excerpted from “BLM: ‘Unsung hero’ of renewable energy heads for the exit”, by Scott Streater, Environment and Energy News.)

Sumit Chakraborty (PhD ’90) will receive the Mineralogical Society of America’s 2017 Dana Medal. The Dana Medal recognizes sustained outstanding scientific contributions through original research by a mid-career scientist in the fields of mineralogy and petrology. The award will be presented at the 2016 AGU meeting in San Francisco.

Keith Meldahl (PhD ’90) has a new book called Surf, Sand, and Stone: how Waves, Earthquakes, and Other Forces Shape the Southern California Coast (University of California Press). Surf, Sand, and Stone tells the scientific story of the Southern California coast: its mountains, bluffs, beaches, islands, waves, earthquakes, and related phenomena. It takes readers from San Diego to Santa Barbara, revealing the evidence for how the coast’s features came to be and how they are continually evolving. With a compelling narrative and clear illustrations, Surf, Sand, and Stone suggests how the coast will change in the future and how we can best prepare.

Lujendra Ojha (BS ’12) received the 2016 Honorary Council on Undergraduate Research Fellowship award for his collaborative work in discovering water on Mars, which he did as a UA Geosciences undergraduate student. Lujendra is currently a PhD candidate in Planetary Science at Georgia Institute of Technology.

Devon Orme (PhD ’15) writes, “I am currently doing a field season in Patagonia with Stanford PhD student Zach Sickmann. We are studying the foreland basin stratigraphy in the Austral-Magallanes basin. The days are filled with long hikes and a lot of vertical elevation gain! Thinking of UA and some of the department’s work farther north in Argentina!”

Jeff Pigati (PhD ’04) has received a 2016 Presidential Early Career Award from President Obama. This is the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers. Jeff is currently with the USGS.

Jeffrey Reck (BS ’85) stopped by Geosciences in March for a visit. He writes, “This was my first visit since graduating. My undergrad advisor back then was John Sumner, but I also had a lot of geophysical mentoring from Randy Richardson, Terry Wallace, and Bob Butler. Thus, it was a happy circumstance to bump into Randy on my tour of the building. Randy even showed me my geophysical field camp grades from 1984! He keeps everything.… “Part of the reason that it took me so long to return was that my UA Geosciences training took me all over the world as a geophysicist: first to a Master’s degree in Geophysics at Stanford and then to a career as an expat seismic interpreter living and working in Thailand (eight years), Egypt (six years), and Argentina (six years).”

“I am now living in Houston, TX working for Apache Corp. with the title of Senior Advising Geoscientist. My role in industry geophysics has changed a lot in the last five years. Decades of prospect structure mapping has been replaced mainly by reservoir characterization, especially for shale plays all over North America. It’s been an amazing journey, and I remain ever grateful for the outstanding education I received from the Geosciences faculty in Tucson.”

John Schloeder (MS ’74) writes, “I am still doing field work currently in Armenia and in the disputed territory of Karabagh between Armenia and Azerbaijani. I’m about to return to Park City in September where I have a home and
time to hang up the boots. More time for skiing, hiking, tennis, bike riding and maybe some volunteer work at the Park City Mining Museum.

Gene Suemnicht (MS ’77) received the 2015 Joseph W. Aidlin Award from the Geothermal Resources Council for outstanding contributions to the GRC and to the development of geothermal resources. Gene is the CEO and Chief Geologist at EGS, Inc.

Kim Tait (PhD ’07) received a 2016 Discovery Accelerator Supplement from the Natural Sciences and Engineering Research Council of Canada. Discovery Accelerator Supplements provide resources to researchers who have a superior original and innovative research program and who show strong potential to become international leaders within their field.

Roger N. Weller (MS ’72) was inducted into the Cochise College Hall of Fame in May, 2015. Roger taught geology and physics full-time at Cochise College for 36 years and has been part-time for the past five years. He created a geological education website with over 16,000 pages that has had visitors from more than 25,000 cities world-wide. Included are large photographic collections of minerals, crystals, rocks, fossils, gemstones, meteorites, and virtual geology field trips that are copyright free for educational purposes. Also on his website is an illustrated physical geology vocabulary for teaching introductory physical geology. Find the website by searching “Cochise College Geology Home Page.” Roger also recently created an organized collection of more than 4,300 views of Mars, emphasizing landforms and named features. Search on “Cochise College Mars Explored.”

Gathering at the Vancouver Exploration Roundup Conference in Vancouver in late January were the following 24 Wildcats: Front row, l to r: Daniel Maus (MS ’88), John-Mark Staude (PhD ’95), Chris Osterman (MS ’84), Eric Jensen (PhD ’03), Brigette Martin (BSm’97), Moira Smith (PhD ’90), David Maher (PhD’08), Brooke Clements (MSm’91)
Second row: Andy Swarthout (BS ’74), Hayley De Witt (MS ’15), David Johnson (PhD ’00), Kitt Marrs (MS ’79), David Lowell (PhD ’99), James Lang (PhD’91), Clancy Wendt (MS ’74), John Balla (PhD ’72), Eugene Schmidt (MS ’75), Lance Miller (PhD ’94), Bill McClelland (PhD’90)
Back row: Louis Lepry Jr. (MS ’81), Joe Piekenbrock (MS ’83), Doug Kreiner (PhD ’11), David Lajack (94-96), Peter Megaw (PhD ’90)

Robert Krantz, 2016 Geosciences Advisory Board Distinguished Alumnus

After completing his PhD (1986) in structural geology at UA, supervised by George Davis, Bob Krantz continued his study of fault systems during a post-doc at the Universite de Rennes, in northwest France. Upon his return to the US, Bob started work in the petroleum industry with ARCO. His first position was in the R&D division, joining a team of 10 young structural geologists in Plano, TX, all eager to apply their skills to exploration and production geology. Still with ARCO, Bob later transferred to international exploration and pursued new ventures opportunities in South America, especially Colombia and Brazil. Another transfer took Bob to Anchorage in 1998, and the chance to work on the giant Prudhoe Bay field, where he helped develop new techniques for predicting and managing risks encountered when drilling through fault zones.

When merger mania swept through the oil business, Bob’s group in Alaska first became part of BP, then Phillips Petroleum, and finally ConocoPhillips. Bob played the role of structural advisor for all Alaska operations.

In 2003, Bob moved to ConocoPhillips Technology in Houston, to reprise his career in R&D. Since then, he has traveled the globe contributing to exploration and production efforts in Norway, Scotland, Australia, China, Indonesia, Malaysia, and Canada, while continuing to support teams in Alaska and the Lower 48. Best of all was a chance to re-engage with geoscience training, leading dozens of classroom and field course and workshops.

Through all this, Bob’s wonderful wife Shirlee, who earned an honorary degree in geology by acting as his PhD field assistant, has cheerfully moved along while developing her own teaching career. They raised two kids in Texas, Alaska, Texas, Norway, and... Texas. And they are looking forward to semi-retirement soon, and occupying a new house in Durango, CO.
Memorials

William R. Dickinson, UA Geosciences professor emeritus, died in his sleep on July 21, 2015 while on an archaeological field trip in Nuku’alofa, Tonga. He was 83.

“Bill Dickinson was a bigger-than-life guy in a bigger-than-life place,” said UA Regents’ Professor Emeritus George Davis. “Bill helped in the whole discovery and introduction of plate tectonics — and then proceeded to so tightly integrate tectonics and sedimentology that he created a new field of endeavor. … I’ve never known anyone who had such focus when he was going after the solution of the problem — I mean never. Professor Emeritus Bill Dickinson.

This guy was able to put field work faculties into just assaulting a geological problem and bringing it to its knees.”

A member of the National Academy of Sciences, Dickinson made key contributions to several subdisciplines of geosciences and also to the archaeology of the South Pacific. Not only was he a significant contributor to the “plate tectonics revolution” in the 1960s, he later studied ancient sedimentary rocks to reconstruct past movements of the Earth’s plates and envision ancient landscapes.

“Bill Dickinson left few areas of geology untouched. He used the mineralogy of sand grains to give great insight into how tectonic provinces on Earth differ from each other. His work provided a unifying theme that could be applied across the entire globe and in very different geological settings,” Thure Cerling, chair of the Geology Section of the National Academy of Sciences, wrote.

Dickinson was an expert on the formation of the North American part of the Cordillera. In addition, he and colleagues figured out that the sand that forms the scenic red rocks and canyons of the American West originated in the Appalachian Mountains.

The Geosciences Department received an outpouring of memories about and tributes to Bill Dickinson that are now posted on our web site at geo.arizona.edu/Dickinson. On October 23, Geosciences held a celebration of the lives and accomplishments of Bill and his beloved wife and constant field companion, Jackie, who passed away only weeks before Bill. We were grateful to be able to bring together family, friends and colleagues from all over the US for this special event.

Joseph F. "Joe" Schreiber, Jr., UA Geosciences professor emeritus, passed away June 8, 2015 six days after his 90th birthday. Schreiber grew up in Baltimore and joined the military directly after high school. The US Navy sent him to intensive wartime training programs in navigation and radar at Stephens Institute of Technology and Cornell University. After training, he served on a minesweeper, clearing mines in the southwest Pacific and Japanese home waters during the final years of World War II.

After the war, Schreiber found that much of his Navy-provided education was transferrable toward an eventual degree from Johns Hopkins University, where he remained to earn a master’s degree in geology. He earned his PhD in geology from the University of Utah, did postdoctoral work at Florida State University, and worked for several years in petroleum exploration and in academic jobs in Louisiana and Oklahoma. Schreiber joined the faculty of the UA Department of Geosciences in 1959.

Schreiber was readily accessible to his students and was devoted to helping and guiding them. Up to the time of his death, he continued to stay in touch with many of his former students and took great pride in their accomplishments. In addition to serving on more than 200 thesis and dissertation committees for graduate students, he administered an undergraduate advising program and organized and taught the Geosciences summer field camp for undergraduates for 28 years.

“Dr. Schreiber provided guidance and mentorship to a generation of U of A Geoscience students at a crucial point in their lives. That is one of his legacies and we were privileged to share with him in his later years how much his leadership meant to us,” said Ray Leonard, Geosciences BS ’75 and chair of the Geosciences Advisory Board.

Schreiber’s chief enthusiasm during retirement was boosting recognition for the US Navy. He was a past officer and program director of the Tucson branch of the Navy league. For many years, he served as an officer and historian of the Naval Mine Warfare Association. He particularly enjoyed researching historical articles for the organization’s newsletter and aiding families who sought information about relatives who served on minesweepers during World War II.
Charles F. “Chuck” Kluth (PhD ‘82)  

By George Davis

In 2015 we lost one of the special PhD graduates of our department: Chuck Kluth, who personified how to play geology as a team sport. Though his career was with Chevron, it was clear to the geological community as well as to his employer that Chuck was a born teacher! It was his love of learning that made Chuck one of those rare individuals who connected structural geologists across industry and academia. UA Geosciences benefited in many ways. He actively recruited and mentored our students. As the principal lecturer and coordinator of Chevron’s Structural Geology School, Chuck opened opportunities for participation in sensational Kluth-led flyovers, tracking the transition from the Wyoming Province to the Canadian thrust belt. As Adjunct Professor in Geosciences, Chuck ‘delivered the goods,’ quite literally. During his balanced-cross-sections short course, he rolled into the classroom a dolly piled 5-ft-high with boxes of handouts: real data sources—wells, seismic reflection profiles, regional cross-sections, regional geologic maps, and more. For this kind of service, plus his record of scientific contributions, UA Geosciences awarded Chuck the 2001 Distinguished Alumni Award.

Chuck’s leadership qualities were apparent the moment he entered Geosciences in 1977 to begin his PhD program. It was my good fortune to be Chuck’s PhD advisor. He had a centered, warm demeanor and a clear sense of purpose. He had experience, having worked in the Permian Basin and the Wyoming Province after earning his B.S. and M.S. degrees in Geology from Northern Arizona University. Chuck’s 1982 PhD dissertation addressed mid-Mesozoic tectonics of southeastern Arizona. His life-long geological passion (only exceeded by the love of his wife, Mary Jo, and daughters, Mary Anne and Becky) focused on ingenious geometric and kinematic insights. Chuck’s eyes lit up when he talked about the Ancestral Rockies, the subject of the classic Kluth and Coney paper (1982).

Chuck and Mary Jo moved to Denver in 2002 following Chuck’s ‘retirement’ from Chevron. There he established a consulting firm, Kluth and Associates, and was recruited as a Distinguished Scientist at Colorado School of Mines. Steve Reynolds and I persuaded Chuck to become a fellow author for the 3rd edition of Structural Geology of Rocks and Regions, where he contributed insights into the interrelationships of regional-scale folding and faulting, a new chapter of the textbook. In 2015 the Rocky Mountain Association of Geologists conferred upon Chuck, posthumously, its Outstanding Scientist Award.

I will miss the Kluth-Davis tradition of cookie-and-coke lunches at the student union, the wonderful times in the field, Chuck’s repertoire of winsome stories, and our pleasure in using the expression ‘sick fun’ to describe some especially-tedious methods in detailed structural analysis that we felt compelled to carry out for the greater good!

Harald Drewes passed away in July 2015 in Colorado. John Dreier (PhD ‘76) writes, “Harald was a career USGS scientist, well known to Arizonans for his many years of geological mapping in southern Arizona. I remember going on a Drewes-led field trip to the Empire Mountains when I was a grad student back in the early 1970’s. In later years after he retired, he mapped the Golden, CO area. Connie Knight (MS ‘73) invited him to our Front Range alumni functions and he took us on a walking field trip of the Golden area as we were threatened by the gigantic September 2013 storm that caused so much flooding in Colorado. Harald was oblivious to the imminent danger and led on without pause or concern. He was remarkably spry and mentally agile. We will miss him.”

Richard Allen Laidley (PhD ‘66) passed away in December 2015. He was Lieutenant Colonel Unites States Air Force Retired; a Combat F-86 Jet Fighter Pilot in the Korean War; a NASA test pilot; and a NASA Lunar Geology Instructor to Apollo Astronauts who visited the Moon. Richard was a pilot in the Arizona Air National Guard from 1957 to 1966 when he moved to Houston, Texas to work for NASA. Later in his career with NASA he was the Chief Flight Instructor for the Johnson Spacecraft Center pilots and astronauts and Chief Test Pilot at JSC NASA Houston. He was also the initial Chief of the Shuttle Chase Program at The NASA Dryden Flight Research Center, Edwards Air Force Base, California. He was Professor Spencer Titley’s first PhD student.

Francis “Frank” Nelson (MS ‘63) passed away in May, 2016. Frank worked for the Anaconda Company before spending 30 years with Freeport Exploration, both as an employee and later, a full-time exploration consultant. He is credited with the discovery of two world-class mineral deposits, the Mount Keith nickel deposit in Western Australia and the Ertsberg East (GBT) copper deposit in Papua, Indonesia. Although a longtime resident of Tucson, work and travel took him to more than 50 countries, often accompanied by his wife and geologist partner of almost 55 years, Eleanor (Brown) Nelson (MS ’66). In 2001, Frank became a founding partner in Nu Vu Assoc. LLC, and in 2002, AVEN Assoc, Tucson-based exploration companies.

David Sackenheim, retired Geosciences staff member, passed away at home in February. David worked in the UA Geosciences business office for more than 22 years, from September 1985 through December 2007. Prior to coming to Geosciences, David worked at UA Payroll Office and Steward Observatory. David was an important part of the department and member of the business office. Former Department Head Susan Beck recalls that David was a fixture in the Geoscience business office for decades, keeping track of our accounts. David always brought in homemade cakes and cards to celebrate birthdays and special occasions in the front office, even for those who did not want to admit they were getting older.

Saw Clarance Thacpaw (MS ‘60) passed away in March. Thacpaw spent his career as a geology professor at Rangoon University, Myanmar. After retiring, he worked with professor friends from the English, botany, engineering, and law departments at Rangoon University to translate the English dictionary into the Karen language. Thacpaw stayed in touch with Geosciences through email from Myanmar, and we will miss hearing from him.
UA Geosciences is real scientists training real students in real time, face-to-face in the classroom, in the field, and in the lab, discovering knowledge that changes fields and lives.

We teach, do research, and serve our community in important ways that matter to our state, our country, our disciplines, and our partners. We don’t take shortcuts, and our students know that they can be proud of the rigorous training they receive. With your help we can maintain the legacy and impact of UA Geosciences. Please consider your own positive impact on our program with a special gift this spring in one of these areas.

Greatest Need
Funding for mission-critical needs such as staff or IT support, field trips, and graduate student research opportunities.

George H. Davis Undergraduate Research Fund
Honor the legacy of a living-legend of UA Geosciences by helping our undergraduates engage in real research projects alongside faculty and graduate students.

William R. Dickinson Field Trip Support Fund
Honor the memory of Bill Dickinson, and help ALL of our students benefit from a field-based education.

Student Scholarships and Fellowships
Student support is particularly important right now. Consider helping a student with research or summer assistantships.

Petrographic Microscopes
We very much need new quality microscopes for mineralogy, petrology, economic geology, and sed/strat class use.

For more information on giving to UA Geosciences, please see www.geo.arizona.edu/support

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