



Fall 2015

Geology of Strong Hall

W. Ros Kingery III, P.E., a local geotechnical consultant with GEOServices, LLC, attended the EPS Alumni Advisory Board meeting in April. He gave a presentation on the geotechnical exploration beneath the new EPS building.

In order to evaluate subsurface conditions, for designing the foundations and below-grade structure of Strong Hall, a geotechnical exploration was performed. The site is within the Knox Group bedrock, characterized by dolomite and inter-

bedded limestone. Hazards such as irregular weathering, caves, and sinkholes present challenges with building design and construction. The site has a thick residual clay overburden, with bedrock at depths ranging from 42-75 feet below the surface. NQ coring was performed to evaluate integrity and continuity of the bedrock. The Rock Quality Designation from the cores ranged from 33% (poor) to 90% (good/ excellent). Based on the structural loads of the building and underlying karst geology, the building was designed to be supported on drilled shafts extended into 10 to 15 feet of continuous, competent bedrock. Some of the drilled shafts exceed depths of 100 feet.



The foundation of the new Strong Hall (March 2015).

The site was initially categorized as Seismic Site Class D. GEOServices performed a site-specific shear wave velocity test, in hopes of improving the classification. The geophysical tests resulted in a Class C rating, which reduced the building costs for UT.

EPS Newsletter

Terra Firma

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Founding Father

Prof. Charles Henry Gordon started the Department of Geology at UT in 1907. He was born in 1857 and had a full résumé, even before moving to Tennessee. He was the first recipient of a PhD in geology at the University of Chicago, in 1895. Gordon held several academic and research positions before joining UT and published many papers on the mineral resources of Tennessee, the Midwest, and the southwestern US. He became professor emeritus in 1931.

The value that Gordon placed on college education is evident in the lives of his family members. At a time when it was very unusual for women to attend college, his wife Mary Ett Hydorn Gordon, all three of his daughters, and five of his grandchildren (three of whom were female) attended UT.

Gordon collected marble from regions across the state. He made a beautiful marble doorstep from these samples, and his family has donated this artifact to the department. We are excited to display this piece of EPS history when we move to Strong Hall in 2017.

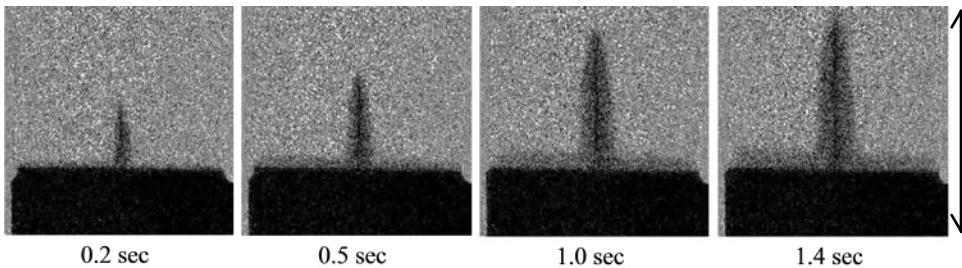


Gordon is remembered every year when the **Gordon Award for Professional Promise** is awarded to the top graduate student in the department. His contribution to the discipline was so outstanding that he was memorialized in the GSA Annals in 1935. We are proud to call him our “founding father.”

Faculty Update: Fluids, Fractals, and Neutrons

From **Edmund Perfect**, the David E. Jackson Faculty Achievement Professor.

Although I am in my 15th year as a faculty member in EPS, I am still actively involved in all aspects of departmental life: research, teaching, advising, and service. My research focuses on the development of new methods and models, particularly those based on fractal geometry, for characterizing the hydraulic properties of porous media. I also work on the use of neutron imaging to visualize the movement of hydrogen-rich fluids within soils and rocks at the sub-core scale. This year my group published two key papers: one dealing with a new method to extract fractal parameters from thin section images, and the other quantifying the rapid uptake of water in fractures within unsaturated sedimentary rock.



Sequence of neutron radiographs showing the rapid uptake of water in a dry fracture in Berea sandstone. The rock core is invisible to the neutrons; only the distribution of water at different times is shown.

Faculty Update: To Mars and Back

From Professor **Jeffrey Moersch**.

It's hard to believe I'm now in my 16th year at UT! Since coming here, I've gotten married, bought a house, and had a son (now six). I progressed from being a non-tenure-track researcher on "soft money" to a full professor. I'm on faculty development leave this year, which I am using for research and to work on a new planetary geology textbook, with Hap McSween, Bill Dunne, and Josh Emery.

I research the evolution of the surface environment of Mars. I am particularly interested in compositional clues that suggest potentially habitable environments on early Mars, such as minerals that form in the presence of liquid water. My group uses a variety of remote sensing techniques, including infrared spectroscopy and active neutron probing. I serve on the science teams for three NASA Mars missions: Odyssey, Opportunity, and Curiosity. I also study terrestrial analogs, geologic features on Earth that share characteristics with features found on other planets. Analogues help us understand how features are shaped by different environmental conditions, and they allow us to practice robotic exploration techniques. I have used unmanned aerial vehicles



Moersch (right) and PhD student Chris Tate at NASA's Jet Propulsion Laboratory for the landing of the Mars Science Laboratory ("Curiosity") rover mission in 2012.

("drones") in Iceland to create high-resolution image mosaics and 3D terrain models of rootless cones. These volcanic features, which form when lava interacts with near-surface water, have also been identified on Mars. My group has plans to work in the Andes and the Canadian Arctic to establish thresholds of detectability in remote sensing data for small, habitable environments found around hydrothermal springs. This will help establish measurement requirements for future Mars missions.

Research: Clamming Up

Associate Professor **Annette Engel** recently received an NSF Dimensions of Biodiversity grant worth over \$1.6 million, with colleagues at two other institutions.

Engel and her team are examining the impact of clams on sea water and sediment chemistry in modern and ancient environments. They study lucinids, a diverse group of clams that live in a range of marine systems, including shallow coastal areas. The bacteria in their tissues can metabolize sulfur compounds and potentially methane gas. The bacteria generate and supply the clams with energy and nutrients, as well as detoxify the habitat from compounds like hydrogen sulfide gas. This chemosymbiotic relationship is interesting, because some of these clams are found only in shallow coastal environments, not in the better-studied hydrothermal vents and cold seeps of the deep sea. Studying lucinids and their chemosymbiotic bacteria in modern environments will help us understand how ancient systems persisted following sea level changes.

Engel, her students, and colleagues are focusing on lucinid habitats in the Caribbean and Pacific Oceans. In 2014, they did work in two places in Florida that became the field sites for two MS students: **Thomas “Walt” Doty**



Collection of sediment and the clam *Phacoides pectinatus* in Fort Pierce, FL.

and **Aaron Goemann**. Earlier this year, Engel went to The Bahamas, with lab manager **Audrey Paterson** and Prof. Anderson (South Dakota School of Mines and Technology). They collected samples and did reconnaissance for a field course they are developing. The samples are being processed and analyzed by two undergraduate students: **Abigail Harmon** and **Paxton Parker**. In the next year, Engel plans to travel to The Bahamas with students, as part of the field course she will help lead, to Florida for more research, and potentially to Hawaii.

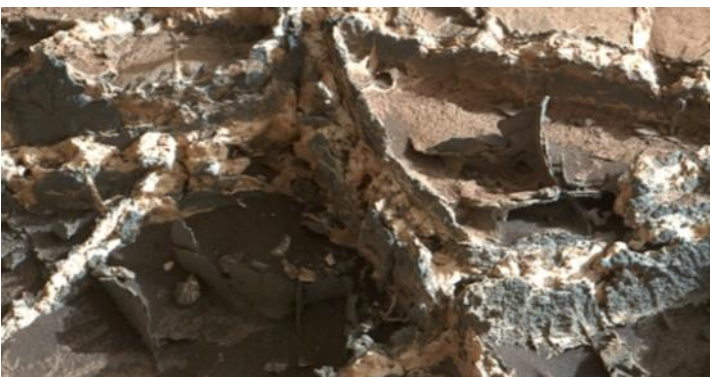
Research: Carbonates and Evaporites and Shales, Oh My!

Professor **Linda Kah** was one of just four faculty in the University to receive a Chancellor's Award for Research and Creative Achievement in 2015.

My lab group's research interests are incredibly diverse. My students study different rock types (e.g. shale, microbialites, evaporites, carbonates, and chert), from different eras (Paleozoic and Mesoproterozoic) and locations (Argentina, Mauritania, and Arctic Canada). Each of these studies focuses on the evolution of the Earth's

biosphere. I am thrilled to see my students' success after graduation. **Cara Thompson** (MS 2006, PhD 2011) has a tenure-track position at Santa Monica College, California. **Geoff Gilleaudeau** (PhD 2013) is at the University of Copenhagen and is moving to a postdoctoral position at Arizona State University. **Joy Buongiorno** (MS 2014) is a PhD student in Microbiology at UT. **Ashley Berg** (MS 2014) is working on her PhD in my lab. Ashley is joined by fellow PhD students **Miles Henderson** (MS 2010) and **Rachel Kronyak**.

I am still working on the Mars Curiosity rover mission, concentrating my efforts on understanding early-to-late diagenetic crystal growth. I also continue collaborative efforts in India and in China, using isotope chemostratigraphy to understand relative age and depositional setting of Proterozoic basins, and using petrographic and geochemical techniques to understand formation of unusual carbonate microfabrics. These projects provide opportunities for our undergraduates to get hands-on experience in geologic research. Undergrads **Robert Bales**, **Abigail Anders**, **Hannah Davis**, and **Jesse Ash** are all currently working on projects in my lab.



A hydrofracture vein network with precipitated minerals, imaged by the Curiosity Rover in Gale Crater, Mars.

Environmental Studies

Since its establishment at UT, the Environmental Studies and Sustainability Programs (ESS) have grown rapidly. Presently, UT is one of the only universities in the United States to offer a degree in Sustainability. During the last year, the Environmental Studies and Geology programs have become more integrated; there are more course options shared by both programs. These improvements will help undergraduates develop additional skills to make them more marketable.

Undergraduate research is a key focal point of the program, with an emphasis on practical field experience. Students are required to engage in an internship or undergraduate research project. Many students intern with local organizations such as the City of Knoxville or Oak Ridge National Laboratory. ESS often works closely with UT's Office of Sustainability and Zero Waste to train students in sustainable development practices such as zero waste food events. Students involved with research are expected to assist with papers and submit posters to various conferences. **Prof. Mike McKinney's** current labs focus on using landsnails, aquatic snails, and freshwater mussels as biological indicators. Snails are studied to determine the kinds of pollutants they absorb from their microhabitat. In 2015, the McKinney Lab authored a paper positively identifying the non-native Rosy Wolfsnail, a highly destructive predatory snail, in Tennessee for the first time. Other students have been



studying the health of freshwater Asian clams in local creeks and rivers. These clams are filter feeders that absorb material from their environment. Samples of these clams are collected and compared to other samples from pristine bodies of water, to demonstrate the effects pollution can have on organisms living in creeks and rivers.

The program is also supported by the Environmental Studies and Sustainability Club. Over the last year, the ESS Club has engaged in a number of activities to increase environmental awareness, from Neyland Stadium cleanups to river cleanups along the Tennessee River. The club is now accredited at UT, meaning it can fundraise on campus and is listed on the Center for Student Engagement website. This will greatly improve the club's ability to promote environmental awareness on and around campus.

GeoClub

GeoClub has had a busy start to the semester! We planned a successful annual Fall Welcome Party, went to see *The Martian*, took a trip to a local pumpkin patch, and started a monthly potluck dinner. It's not all social; the GeoClub has also been heavily involved in community outreach. We prepared "rock kits" for students in GEOL 101. The graduate students prepared a panel discussion for the benefit of undergraduates, about applying to graduate school and attending conferences. We had a large presence volunteering at the McClung Museum's annual "Can You Dig It?" event and at the Knoxville Gem and Mineral Show. Students have been volunteering to lead short lessons at the McClung Museum for elementary students. We hope to continue our close relationship with the museum in the future. Moving forward, GeoClub hopes to continue creating bonds between EPS graduate and undergraduate students, and between EPS and non-EPS students who are interested in geology. It's been a fun term so far, and we are looking forward to the rest of the year!

Undergraduate student **Chad Melton** witnessed history in July as NASA's New Horizons spacecraft conducted a flyby of Pluto, giving humankind its first-ever up-close look of the dwarf planet and its five moons. Two other EPS folks were involved in the mission: **Asst. Prof. Josh Emery** and postdoc **Noemi Pinilla-Alonso**. Chad was the only UT participant at the Johns Hopkins University Applied Physics Laboratory in Columbia, MD, during the week of July 14 (Noemi gave up her spot to let him go).



Alumni Focus

TW Garrett, MS 1973

In the early 70s, TW Garrett sought a master's degree, because Exxon promised him a job if he got one. He considered other universities, but one of his undergraduate professors at Birmingham Southern University recommended UT. He came to work on field mapping and stratigraphy with George Swingle, but he finished with Don Byerly due to Swingle's untimely death. TW is grateful for the education he received at UT with world-class professors, colleagues from around the world, and the fabulous geology of east Tennessee.

After graduating, TW worked as Geological Operations Supervisor for all of Exxon's exploratory wells, worldwide. Although he retired in 2000, he hasn't slowed down. He volunteers with several charities, including Meals on Wheels, Rotary Club, National Wild Turkey



TW Garrett with Larry McKay at an Alumni Dinner in 2014, where Garrett received the Accomplished Alumni Award.

Federation, and the Health Center of Southeast Texas. He is an avid outdoorsman and serves on the National Board of Directors for the Rocky Mountain Elk Foundation, which reintroduced elk to Tennessee. TW and his wife, Claire, recently started a graduate fellowship at EPS. TW has fond memories of grad school, and he wants to support others who do not have the same resources he had.

David Jackson, BA 1978, MS 1982



As an undergrad, every aspect of geology interested David Jackson. He studied as broadly as he could. After graduating, he worked as a field geologist before starting law school at UT. After a year, he transferred to the MS program in Geology with advisor Larry Taylor. But his brief experience in law school stayed with him and influenced his later career.

After his MS, Jackson became an oil and gas geologist, working to identify drilling locations for production wells. In the mid-80s, Jackson took up environmental geology. He is the principal owner of BDY Natural Science Consultants, specializing in private sector clients with regulatory problems.

Jackson attributes to UT the breadth of his geological knowledge and his ability to synthesize data to tell a compelling story. He is a generous supporter of EPS and founded a faculty achievement award. When asked why, he responded, "I love using geology to achieve a practical end. I've had great fortune in my career and that wouldn't have been possible without my parents' support or the training I got at UT. I wanted a way to recognize that."

Jackie Langille, PhD 2012

I came to UT to work with Micah Jessup on two extensional shear zones in the Himalayas: the Ama Drime detachment and the Leo Pargil shear zone. As I finished my PhD, I sought faculty jobs where I could pursue my passions for both research and teaching.

I am now in my fourth year as an Assistant Professor at UNC Asheville. I enjoy teaching Structure and Field Methods, Environmental Geology, Regional Field Geology, and more. I've received NSF funding to constrain the temporal and spatial patterns of Quaternary dextral faulting in the central Walker Lane of Nevada.

I use the teaching and research skills that I learned at UT every day. I am thankful for the support and preparation that EPS provided, especially the course on Academic Careers and Micah's professional development opportunities.



Langille (front center) and her 2015 Regional Field Geology class on a glacial erratic in Lamar Valley, Yellowstone NP.

Alumni Gossip

Steve Bennett (BS 1976) and **Alan Crockett (BA 1979)** visited the department in July. Steve is semi-retired from the oil and gas industry but still helps companies recruit senior geologists for oil and gas exploration (“upstream recruiting”). He lives in Katy, TX. Alan is a teacher in Rose Hill, VA. They talked about Strong Hall, old professors, and more.

Mark Stock (BA 1977) received the 2015 Benefactor Award for the Environmental Division of the national Society for Mining, Metallurgy, and Exploration. Mark owns Global Hydrologic Services Inc. which focuses on mining hydrology and water supply issues. He and his wife, Charlotte, live in Reno, NV.

Ed Ossi (MS 1979) met with Larry McKay (EPS Head) and Michelle Geller (Development) this summer, at his office in Nashville. Ed works with ERM consulting on contaminated site cleanup, site forensics, etc., across the southeast. Ed was very interested in the plans for Strong Hall and on our new courses in career planning.

Danny Reeves (BA 1986, MS 1991) is working with the TN Dept. of Transport in Knoxville. He contacted EPS and reminisced about his former supervisor, Otto Kopp, who died in 2005. Danny said “It’s a rare week that I don’t think of Otto at least a couple of times. His kind doesn’t come along very often.”

Chris Olson (MS 1993) moved from Miami to Los Angeles in June, for a new position overseeing construction at LAX. He met up with two other EPS alumni in July for a California mini-reunion: **Greg Yanagihara (MS 1994)** lives in Long Beach and **Keith Roberson (PhD 1994)** in Danville. Keith has been working as a geologist for the San Francisco Bay Regional Water Quality Control Board for 15 years. For the past 3 years, he has been the Land Disposal Program Manager, overseeing disposal to municipal landfills and industrial disposal sites in the Bay Area.

Dave Remley (MS 1999) and wife Abby had a boy, Reed Auberon Remley, in June. This gives them a great pair of kids, with daughter Rowan. Dave works for the Kentucky Dept. of Environmental Protection.

Brett Hayzen (BS 2000) worked for 5 years as a geologist in Knoxville before starting medical school. He now works as an emergency medicine physician in Dallas, TX. He likes to keep tabs on the new building and the current research and activities in EPS.

Arthur Merschat (MS 2003, PhD 2009) and his wife, Carrie, had a second child, August Jacob Merschat, in August. Arthur has been a geologist at USGS since 2006.

Daine Wright (BS 2010, MS 2013) has been working at Oak Ridge National Lab developing user interface tools for the ORNL Distributed Active Archive Center, which is the NASA terrestrial ecology data archive. In his off-work hours, he continues refining his home-brewing skills and winning awards at competitions. Daine and his wife, Courtney, bought a house in Knoxville a couple of years ago, where they live with their two-year-old son, Samuel.

Mary Grace Jubb (née Varnell, MS 2010) gave birth to Thomas William Jubb in August. Mary is currently a staff geologist at Occidental Petroleum.

Craig Hardgrove (PhD 2011) is now a tenure-track assistant professor at Arizona State University. Craig is PI on a NASA planetary-science mission which will design, build, and operate a satellite that will orbit the moon.

René A. Shroat-Lewis (PhD 2011) was recently hired as a tenure-track Assistant Professor at the University of Arkansas, Little Rock campus. She joins one of her classmates, **Mike DeAngelis (MS 2005, PhD 2011)**, who is also an Assistant Professor there.

Sarah Drummond (MS 2012) is an Adjunct Faculty at Pellissippi State Community College, where she teaches geology. She spent the summer at Craters of the Moon National Monument in Idaho, working for the National Park Service as a “geology educator.” She gave geologic talks, guided hikes, and created educational material for the park rangers.

Andrea Hughes (MS 2012) participated in a NASA Robotics Academy in Huntsville, AL, in summer 2012. She then spent 5 months as a research scientist at the German Aerospace Center in Berlin and 5 months as a research intern at the AAAS in Washington, DC. Andrea is currently a PhD student at Embry Riddle Aeronautical University in Arizona.

Driss Takir (PhD 2013) did a postdoc at Ithaca College, where he worked on NASA’s OSIRIS-REx mission, developing image processing plans for data the spacecraft will obtain of the near-Earth asteroid Benu. This spring, he received the prestigious Shoemaker Fellowship from the USGS Astrogeology Branch in Flagstaff, AZ. He, his wife Michelle, and their son Masen, moved to Flagstaff in June.

Matt Chojnacki (PhD 2013) moved to the University of Arizona where he is participating as a postdoctoral research associate with the High-Resolution Imaging Science Experiment, which provides sub-meter scale images of Mars. Matt is also assisting NASA’s OSIRIS-REx mission, due for launch in 2016.

Alumni News

Department Head Larry McKay enjoyed a special UT alumni event in August, hosted by ExxonMobil Vice President Jim Flood (BS Civ. Eng. 1980) at their attractive new campus in the Woodlands of north Houston, Texas. McKay joined the Deans of the College of Engineering, Wayne Davis, and the Haslam College of Business, Steve Mangum, at a reception attended by several dozen UT alumni. VP Flood gave a great talk on the important role UT alumni play at ExxonMobil and showed some slides from one of his biggest projects, an enormous poured-concrete drilling platform, which will be floated to Newfoundland. Geology alumni at the reception included **Kim Sickafoose (MS 1979)**, **Wesley Diehl (MS 1982)**, **Chris Howard (MS 2012)**, **Steve Welch (MS 2005)**, and **Liz Lee (MS 2011)**. McKay also had separate visits with Claire and **TW Garrett (MS 1973)**, **Brent Lockhart (BS 1980)**, Helen Sestak and **Tom Cronin (BA 1980, MS 1983)**, and **Mike Allison (MS 1984)**, making for a busy and very sociable trip.

EPS was fortunate to have not one but two alumni come to town to give Thursday afternoon Klepser Seminars this semester. **Dibs Sarkar (PhD 1997)** gave a seminar on urban sprawl and 'green' remediation of arsenic-



Larry McKay awards Shan Shanmugam the Alumni Appreciation Award.

contaminated soils. He is a professor at Montclair State University in New Jersey.

Ganapathy "Shan" Shanmugam (PhD 1978) gave a seminar and several additional talks on landslides. Shan is active in oil resource consulting and has an adjunct appointment at the University of Texas, Arlington.

Giving Opportunities

The Department of Earth and Planetary Sciences acknowledges the generous financial support of our alumni and friends. Your contributions, no matter what size, play a critical role in supporting academic achievement and research by students and faculty. Suggested areas for contributions include:

Strong Hall Fund

This new general-purpose fund will allow the department to flexibly respond to urgent needs. This is our highest-priority fund, and special recognition opportunities are available for major gifts to the Strong Hall Fund.

Donors are also welcome to give to one of our other established funds, many of which are in honor or memory of former faculty or students. Priorities this year include:

Kula and Geeta Misra Fund (a general-purpose fund)
Otto Kopp Undergraduate Research Fund
Ryan Edwards Memorial Scholarship Fund

To contribute online,
please visit eps.utk.edu.

Near the bottom of the webpage, click
Contribute to a big idea. Give to EPS.

The EPS Enrichment Fund is selected by default.
To give to other EPS funds, select "Other," and
indicate the name of the fund.

George W. Swingle Graduate Fellowship Fund
Don W. Byerly Field Camp Scholarship Fund

If you would like more information about any of these funds or would like to discuss a major gift or bequest, please contact Prof. Larry McKay, Head of EPS, at lmckay@utk.edu (865-974-5498) or Andrew Sheehy, College Development, at asheehy@utk.edu (865-974-4321).

To mail your donation to EPS, make your check payable to the UT Foundation, with a note indicating the fund to which you would like to contribute.

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Tell us about yourself! Let us know about your new job, recent accolades, etc.

GSA Fellow

Professor Emeritus **Don Byerly** was named a fellow of the Geological Society of America in July. The appointment recognizes his distinguished contributions to the field of geoscience. He is an authority on the impacts of acid drainage and sulfide oxidation.

Byerly, who was nominated for the honor by colleague Bob Hatcher, will be honored at the Geological Society of America's annual meeting in Baltimore, Maryland, in November.

Byerly, an alumnus of UT (MS 1957, PhD 1966), is an engineering geologist. He is active in K—12 teacher education. His honors include being named Outstanding Teacher at UT and the 1999 Neil Miner Award from the National Association of Geoscience Teachers.



Byerly taught "Ancient Environments: Geology of the Smokies" for the Smoky Mountain Field School.

He is author of the book *The Last Billion Years: A Geologic History of Tennessee* (University of Tennessee Press, 2013). This popular book is written for a broad audience and is accessible by geologists and non-scientists, alike.