Spring 2013

Department of Earth & Planetary Sciences
COLLEGE OF ARTS & SCIENCES

Terra Firma

EPS Newsletter

Inside this issue:

A "Strong" Home for EPS

Earth and Planetary Sciences is planning for a new home! Strong Hall, an unused Cumberland Avenue dormitory, will be gutted and completely renovated to house EPS and the Department of Anthropology. This multidisciplinary science building will also include laboratories for introductory biology and introductory chemistry. The building will retain its name, but little of its original structure will remain. The cost is expected to be $110 million.

Strong Hall will be rebuilt to house EPS.

EPS has been allocated 44,000 square feet in the new building, much more than the 34,000 square feet we have now. We are planning how best to use the space for offices, administration, teaching, research, and storage. Most of the additional space will be used for research laboratories, giving every faculty member a lab for the first time.

The new Strong Hall will have a modular design, with lots of open spaces and natural lighting; it will feel very different from the antiquated EPS Building. A limited number of permanent walls between labs will allow us to reallocate space as needs change. The building will retain several large lecture halls, but we are exploring contemporary classroom design concepts that will help modernize the way we teach.

Building design and construction will likely take four to five years, so the move is not imminent, but we're excited about the prospect of a new home. After spending many years near the top of the renovation list, we look forward to welcoming our alumni into a building of which we can all be proud.

The Future of Walls Hall

Many of our alumni fondly remember Professor James G. "Jimmy" Walls, who taught introductory geology at UT for almost 5 decades (1929 to 1976). Jimmy was a very popular teacher, and his courses were taken by tens of thousands of students. Our younger alumni never met Jimmy, but almost all of them have taken courses in "Walls Hall" which was named after Jimmy in 1992, based on a gift from his former student, Gil Boyd (BS 1951 & MS 1955).

Nancy Walls and Larry McKay (Head of EPS).

This fall, Mrs. Nancy Walls (Jimmy's widow) made a major gift to the department, to start the new "Nancy and Jimmy Walls Endowment." The agreement ensures that the largest lecture hall in our new building will be named after Jimmy. It will also provide the department with funds that can be used for a variety of purposes, including scholarships, research equipment, etc. It's reassuring to know that as long as the department exists there will be a Walls Hall, with a large photo of Jimmy welcoming students.

Faculty Update: Balancing Acts

From Associate Professor Annette Engel

Many research questions in geochemistry require scientists to balance rugged and challenging field work with sophisticated lab work. If there is too much field research, then there may be limited analytical resolution to apply the results to another field area. However, if too much lab research is done, then conclusions may not reflect the real world.

A current project in my research group exemplifies this need to balance field and analytical research; we want to understand how microorganisms change the composition of organic matter in groundwater from cave and karst regions. Microbes produce different metabolic products and influence the type of organic matter in water. These processes affect contaminant transport and other reactions.

Engel lab graduate students in Blue Spring Cave, Tennessee.

We collect groundwater and sediments and measure a range of field geochemical parameters on site, in caves in Kentucky and east Tennessee. Field work in caves is messy. It is relatively easy for students to learn careful, clean sample collection and analysis methods in a pristine lab setting, but it takes much more skill to collect and manipulate samples in caves without contamination from mud.

We then bring the samples back to the lab. We measure the microbial response to different organic matter over time and determine the microbial diversity by sequencing DNA. We evaluate how metabolic processes affect organic carbon and water geochemistry. We then computationally model the lab results to develop scenarios consistent with the results obtained directly from the cave field work.

This project is currently part of two PhD dissertations and one undergraduate research project. We plan to continue the work for the next few years, and I am excited to see where our research balancing act takes us in the future.

Faculty Update: No Mountain High Enough

From Assistant Professor Micah Jessup

I began researching the buildup and reduction of mountain ranges around the world over 10 years ago. I started in Colorado, studying the deformation and metamorphism of rocks in the Black Canyon of the Gunnison National Park. I then worked to quantify the thermal and kinematic history of rocks around the Mount Everest Massif, in Tibet and Nepal.

My research group is united by the common theme of structural geology and tectonics. We integrate field- and laboratory-based techniques to quantify the thermal and deformation history recorded by rocks. These skills prepare students for jobs, both in academia and industry (e.g. **Jackie Langille**, PhD 2012, at UNC; **Liz Lee**, MS 2011, at ExxonMobil).

We continue to pursue research on the tectonic evolution of the Himalaya. Jackie Langille spent two field seasons in remote northwest India. **Tim Diedesch** is currently researching the deformation history that is preserved in a dome on the southern margin of Tibet. Funding from the National Science Foundation,

Jessup hiking near Lake Keushu, in the Cordillera Blanca, Peru.

the National Geographic Society, and a Sickafoose Faculty Achievement Award supports our work.

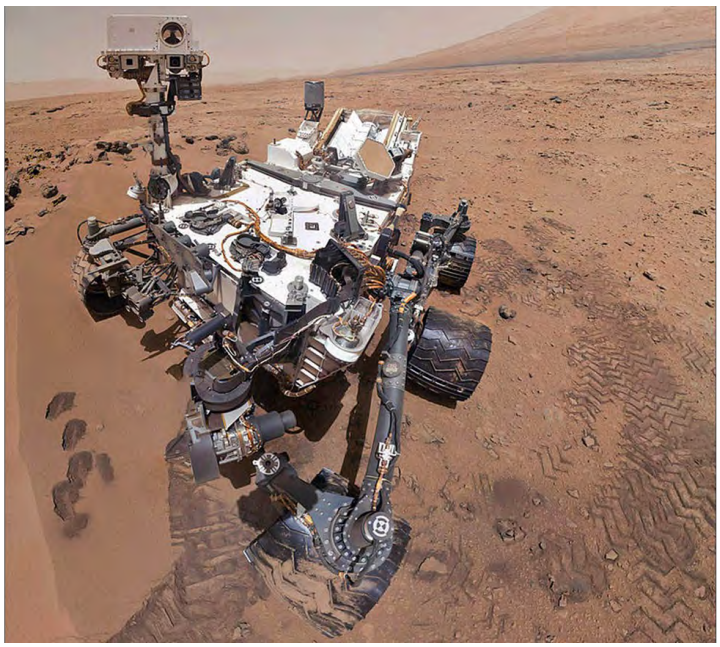
This summer, I will mentor incoming graduate students as they collect samples from an active fault zone bounding the highest peaks in the Peruvian Andes. I am looking forward to this exciting opportunity to study in the Andes and lay the foundation for future research projects.

Research: Curiosity

Associate Professors **Linda Kah** and **Jeffrey Moersch** are part of NASA's Mars Science Laboratory team, which successfully landed the Curiosity rover on the surface of Mars on August 6, 2012. Curiosity's mission is to explore geological environments within the 150 km wide Gale crater and to determine whether these environments have ever been capable of sustaining microbial life. These ambitious tasks require an impressive collection of on-board equipment and scientists who can operate, troubleshoot, and interpret results from the equipment remotely.

Linda Kah's science activities are primarily associated with cameras. She worked with Malin Space Science Systems for eight years to develop Mardi, MastCam, and Mahli, 3 of Curiosity's 17 cameras. During surface operations, Linda divides her time between ensuring that science objectives are properly commanded for the cameras and interpreting the spectacular local geology from the resulting images.

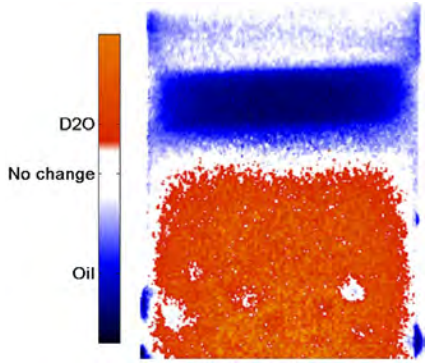
Jeff Moersch is working with the neutron detection team to determine how much water is present near the surface of Mars. Curiosity's DAN instrument measures the interaction of neutrons with the top meter of the subsurface. From this, we derive the abundance and depth distribution of H- and OH-bearing materials that might represent adsorbed water, ice, or hydrated mineral phases.



A self-portrait of Curiosity, taken with the MaHLI camera, showing imprints of scooping activities in the sand.

So far, Curiosity has travelled about 600 meters from its landing site, outside the region it contaminated during landing. It has scooped, sieved, and analyzed soil from a drift of wind-blown silt and is currently exploring the region called Yellowknife Bay. By early February, Curiosity should be on its way toward the spectacular layered strata of Mount Sharp. For more information on MSL, please visit mars.jpl.nasa.gov/msl/.

Research: Neutron Imaging of Rock Cores



Neutron radiography image showing changes in the distributions of oil (blue) and heavy water, D_2O (orange), in a Berea sandstone rock core. The oil was initially uniformly distributed throughout the core and has been forced upwards by the capillary uptake of D_2O. Small drops of expelled oil can be seen on the sides of the core. The red line at the bottom is the top of the D_2O reservoir.

Professor **Edmund Perfect** is working with scientists at Oak Ridge National Laboratory (ORNL) to study displacement processes involving hydrogen-rich fluids in porous media, which are important to our energy economy:

- Water-oil displacements in petroleum reservoirs and enhanced oil recovery;
- Methane-water displacements in unconventional shale gas extraction and methane clathrates;
- Carbon dioxide–water displacements in geologic carbon sequestration and enhanced geothermal systems;
- Air-water displacements in geothermal reservoir engineering.

Neutrons are strongly attenuated by hydrogen-rich fluids and much less attenuated by hydrogen-poor substances (including the rock matrix). Thus, neutron imaging enables scientists to visualize any displacement process involving at least one hydrogen-rich fluid.

Professor Perfect uses the neutron imaging facility of the High Flux Isotope Reactor at ORNL. He collects 2-d and 3-d data on fluid displacement processes over time. By quantitatively analyzing the resulting images, he obtains the parameters needed to improve computer models and simulations of energy-related flow and transport processes in porous media.

EPS Graduate Students Around the World

Our EPS graduate students have had an exciting year! Graduate students have been traveling worldwide to attend workshops and conferences, to conduct their research, and even to teach.

Several of our graduate students attended conferences and workshops in 2012; the meetings they attended are as diverse as their research. Meetings ranged from planetary to microbial, from geophysical to geochemical to structural. Students attended large, international annual meetings and intimate one-time workshops; they traveled as far as San Francisco, CA; Sudbury, ON, Canada; the Yucatan Peninsula, Mexico; and Krakow, Poland.

EPS graduate students travel the world to do research. ***Tim Diedesch*** *measured the orientation of intersection lineations in a sandstone that flanks the Lhagoi Kangri gneiss dome in Tibet [left].* ***Latisha Brengman*** *collected samples from the 2.7 Ga Banded Iron Formation in the Abitibi Greenstone Belt in Ontario, Canada [right].*

Sarah Keenan, one of our PhD students, was invited to lecture at Cambridge University, UK, on alligator metagenomics; she also wrote a chapter for the Encyclopedia of Metagenomics (Nelson, K. (Ed.), 2013, Springer-Verlag). **Mike Lucas**, another PhD student, is the Team Leader for the UT Moonbuggy Team, which is designing and building a lunar rover to compete in the NASA Great Moonbuggy Race in Huntsville, AL. Despite their globetrotting, our students are still active here in Knoxville. Many have been involved in outreach at UT's McClung Museum, presenting the Geology and Fossil History of Tennessee exhibit to local elementary and middle school students.

The Hatchery

Professor **Bob Hatcher** has had a prolific career; some 45 geologists have completed MS degrees and 15 have completed PhD's with Bob at three universities during almost four decades. His graduates are employed in academia, petroleum companies, federal agencies, state geological surveys, and engineering and environmental consulting firms.

Bob Hatcher with a few of his former students at the Geological Society of America meeting in Houston, TX, 2008.

Bob's students undertake multidisciplinary research projects to address complex processes related to the construction of mountain chains and continental crust. While students use a wide variety of laboratory techniques to solve problems, they are trained primarily as field geologists. They make detailed geologic maps that serve as their primary, quantitative data sets and collect various kinds of structural, stratigraphic, and petrologic data for additional analysis.

Bob's graduates are well-prepared for a variety of professions. Although students in the lab do basic research, being trained in a broad array of techniques allows graduates to be successful wherever they are employed. Skills learned in the lab readily translate to applications in engineering, hydrocarbon (and mineral) exploration, earthquake and landslide hazards, and waste disposal problems.

Environmental Studies

The Environmental Studies (ES) major continues to grow within EPS; there are currently over 60 students in the major! Our students graduate with a BS in Geology and Environmental Studies. Many students are active on campus and in the community; some worked with Professor **Mike McKinney** to build composting bins at local schools (photo).

ES students do quality undergraduate research. **Mackenzie Hodges** and **Cassie Henegar** presented posters at the Tennessee Academy of Science meeting in Nashville, TN. Mackenzie's paper was on an endangered land snail, and Cassie looked at snail taphonomy. **Kristen Corrier** and **Andy Pigg** gave papers at the Geological Society of America meeting in Charlotte, NC. Kristen's presentation was on the controversial topic of "fracking" for natural gas in East Tennessee. Andy's paper was on freshwater mussel taphonomy Andy has also been leading a project to reintroduce some mussels into the Pigeon River.

ES graduates are well-positioned for success, with many entering graduate programs or working for environmental organizations, private companies or government agencies.

Ryan's mother, Margaret Edwards, personally gave out the first scholarships to ***Jordan Norton*** *and* ***Maria Rosales.***

Undergraduates ***Ben Wolfe*** *and* ***Sarah Flower*** *helped build compost bins at local middle and high schools.*

Despite its many successes, ES also experienced great loss this year. While in Florida over Spring Break 2012, ES major Ryan Edwards, suffered a traumatic injury and died. This was a tragic loss for all who knew him. His family and friends quickly established the **Ryan Edwards Memorial Scholarship for Environmental Service**, a fitting tribute for Ryan "Cardboard Eddy," who was well known for his commitment to recycling. The Dean posthumously awarded Ryan a BS degree. The Scholarship will ensure that our students remember Ryan's commitment to service. Additional donations to the fund can be sent to EPS.

Geology Club

On October 6-7, undergraduate students from the Department of Earth and Planetary Sciences competed in the annual GeoConclave event held at Fall Creek Falls State Park. GeoConclave is an intercollegiate undergraduate competition between geoscience departments across Tennessee. Historically, the University of Tennessee has not fared well because other schools take this competition very seriously, training their students for the event. This year, we had a nail-biter finish. We were ahead going into the final event, the Rock Bowl Geology Quiz, and only needed to place ahead of Tennessee Tech to win the overall event. Both schools made it to the final round, but we won handily. This is the second year in a row that we have won GeoConclave, a real testament to the quality of our undergraduates!

UT's 2012 GeoConclave Team:
Top: Logan Combs, Scott Beeler, Emily Lea, Michael McConnell
Bottom: Alissa Phillips, Richie Ness, Sean Blackwell, Michelle Pewitt, Tim Paton.

Alumni Gossip

Tom Worsley (MS 1967), one of Lawrence Larson's students, is co-author of the recent *GSA Today* article, "A Human Induced Hothouse Climate?"

Bill Krispin (BA 1977) is working in the Solid Waste Management group at the Tennessee Department of Environment and Conservation in Nashville. Bill's son was considering coming to UT to study Theatre.

Fred Stanin (BA 1977, MS 1979) started out with Gulf Oil, then joined an environmental company, ARCADIS, in Emeryville, CA. He visited Prof. L.A. Taylor and asked him to repeat his mnemonic for the Periodic Table, an old favorite from Geochemistry class.

G. "Shan" Shanmugam (PhD 1978) published a new book in 2012: "New Perspectives on Deep-water Sandstones: Origin, Recognition, Initiation and Reservoir Quality," volume 9 in the series "Handbook of Petroleum Exploration and Production."

Janet Hopson (BA 1982, PhD 1994) is a research scientist for UT's Transportation Research Program.

Christopher Wallen (BA 1985) is a partner at Dynamic Solutions, a Knoxville company that develops software for sediment transport modeling and water quality compliance models.

Beth McClellan (MS 1988, PhD 1993) is on the faculty of Radford University in Virginia.

Mark Fischer (MS 1989) is Assistant Chair in the Department of Geology and Environmental Sciences at Northern Illinois University.

Mike Quinn (MS 1991) is Exploration Manager for Hess Oil Company in London.

Steve Martin (BS 1992, MS 1997) is a geologist with the Kentucky Geological Survey and is doing research on natural bridges.

Pete Lemiszki (PhD 1992) is Chief Geologist with the Tennessee Division of Geology and is responsible for their Knoxville office.

Tim Davis (PhD 1993) is a geologist with Apache Oil Company in Houston.

Mark Carter (MS 1994) is a geologist with the U.S. Geological Survey in Reston, VA.

Jim Heller (MS 1995) is doing well at the Alabama Department of Environmental Management.

Joe Hill (BS 1996, MS 1999) is in his 4th year as an Assistant Professor in the Department of Geography and Geology at Sam Houston State University, TX.

Camilo Montes (MS 1997, PhD 2001) is a structural geologist in the Department of Geology at the Universidad de los Andes, a new university in Colombia.

Amitabha Ghosh (PhD 1997) is heavily involved in operations for the Mars rover, Opportunity.

Doug Curl (MS 1998) is a geologist with the Kentucky Geological Survey and works in GIS.

Valerie Reynolds (MS 1998, PhD 2005) is lecturing this year in the Dept. of Geography and Earth Sciences at the University of North Carolina, Charlotte.

Scott Giorgis (MS 1999) is department chair at SUNY Geneseo.

Dave Remley (MS 1999) works for Kentucky's Dept. of Environmental Protection, as an "Environmental Inspector" in the Division of Waste Management.

Melanie Mayes (MS 1999, PhD 2006) has a joint faculty appointment between ORNL and UT. Her husband, **Gray Dean (MS 1997, PhD 2003)** works part-time in EPS as a lecturer.

Scott Williams (MS 2000) is a geologist with the Virginia Geological Survey.

Sara Bier (MS 2001) is on the faculty of Emory and Henry College in Virginia.

David Settles (MS 2002) works on mineral resource assessments for Southern Ionics in Jacksonville, FL.

Stephanie Drumheller (BS 2005) completed her PhD at the University of Iowa and has returned to EPS to teach Geology 102 in spring 2013. She also works at the McClung Museum.

David Teal (BS 2005) has nearly finished his master's thesis on Martian middle-latitude atmospheric stationary waves at New Mexico State University.

Bryan Schultz (MS 2005) teaches in Knoxville at South Doyle Middle School. His students competed in the Science Olympiad at UT last spring. They finished second in the Chattanooga regionals.

Karen Stockstill-Cahill (PhD 2005), a postdoc at the Smithsonian Institute, and **Josh Cahill (MS 2003)** welcomed Finnegan "Finn" Timothy Cahill to their family on Jan. 25, 2013. Big sisters Maggie (4) and Emma (20 months) welcomed him home.

Darren Schnare (MS 2006) is a Laboratory Manager at Corning Glass in Schenectady, NY.

Jonathan Evenick (PhD 2006) is a geologist with BP in Houston, TX.

Vijay Vulava (postdoc 2001-06) was awarded tenure at the College of Charleston, SC. Vijay teaches an undergrad field course that follows the Ganges River from the Himalayas to the Bay of Bengal.

Alumni News

The past year has been very busy for department–alumni relations. In March, EPS faculty hosted a dinner in Houston, TX, for UT students and alumni attending the Lunar and Planetary Sciences conference. In November, the department hosted an alumni reception at the Geological Society of America conference in Charlotte, NC, with over a hundred faculty, students and alumni in attendance.

In October, the EPS Board of Advisors met to discuss plans for the new building and ways to improve communications, especially with young alumni. The meeting was led by **Mike Maitland** (BS 1977, MS 1979) and included meetings with a large group of students to talk about career mentoring and other student needs. The College is helping us develop a "branding" plan, as well as an upgrade of the department website and a presence in social media. Highlights of the meeting included a tailgate party, as well as presentation of the "Accomplished Alumni Award" to **Michael Allison** (MS 1984) and the "Young Alumni Award" to **Syreeta Dickerson Vaughn** (MS 2005). Syreeta also received the Knoxville Business Journal's 40 under 40 award for young professionals who have demonstrated success in their careers and service to the community.

The recipient of the "Distinguished Alumnus Award" in 2012 was **Ebreham "Abe" Shekarchi** (MS 1951, PhD 1959). Abe received the very first PhD awarded by the UT Geology department. EPS Head Larry McKay and John Dinkens (College of Arts & Sciences) visited Abe at his home in Bethesda, MD, to present the award last spring.

Professors McKay, McSween and Byerly at the tailgate party, with Chris Olson (MS 1993), Brendan Bream (MS 1999, PhD 2003) and Brent Couzens-Schultz (MS 1992).

Finally, the department lost a good friend this year, with the passing of **Don Jones** (BA 1950). Don and his wife Flo were long-time supporters of the department. They funded or co-funded professorships in hydrogeology, aqueous geochemistry and geophysics and served on many department and college boards. Larry McKay attended the funeral in Louisiana, where Don was laid to rest wearing an orange tartan tie, with a Smokey mascot in his hand, and the sound of Rocky Top playing as the pall bearers carried him away.

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 the academic achievement and research of students and faculty. We hope that you will continue to remember us when deciding on your charitable giving. Suggested areas for contributions include the

EPS Enrichment/ Professor's Honors Fund.
This fund is our primary discretionary account. It supports departmental activities such as

- Teaching,
- Research,
- Field/Conference Travel,
- Student Awards.

If you have specific philanthropic goals, you may wish to consider one of EPS's other funds, a few of which are listed here.

To contribute online, please visit:
www.artsci.utk.edu
and click on
Give to The College of Arts & Sciences.
Be sure to designate the EPS Enrichment Fund or type the name of fund for your gift.

George D. Swingle Graduate Fellowship Fund
Kula Misra Fund
Don W. Byerly Field Camp Scholarship Fund
Nancy and James "Jimmy" G. Walls, Sr. Fund
Ryan Edwards Memorial Scholarship Fund

If you would like more information about any of these funds or would like to start a new fund or bequest, please contact the department head at eps@utk.edu (865-974-5498) or the Office of Development (865-974-2365).

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.

THE UNIVERSITY of TENNESSEE KNOXVILLE

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

Distinguished Service

Several EPS faculty and staff received UT service awards in 2012, including office manager **Melody Branch**, who received an award for 35 years of service. Melody started in what was then "Geological Sciences," when staff used typewriters, computers were the size of classrooms, and Johnny Majors was a first year football head coach. Over the years, Melody has helped approximately 300 MS students, 100 PhDs and many hundreds of undergraduate majors.

Melody Branch with Chancellor Jimmy Cheek and Department Head Larry McKay at the Service Awards Lunch.

Hap McSween will represent the college in the spring and fall 2013 commencements as College Marshall.

Professor **Harry "Hap" McSween** was named the 2013 College Marshal, the highest honor bestowed upon a faculty member by the College of Arts and Sciences. He also received the J. Lawrence Smith Medal from the National Academy of Sciences this year for his pioneering studies of meteorites and his work on the geological history of Mars.