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## FEATURES



*On the cover: Folds and fractures at Dinosaur National Monument, northeast Utah, exhibit mountain-building processes from about 70 to 80 million years ago to perhaps 35 to 55 million years ago. They are exhumed examples of the same kinds of structures found in many subsurface reservoirs. Steve Laubach of the Bureau of Economic Geology led a research trip to the region for members of the Fracture Research and Application Consortium (FRAC). This photo by the Bureau's Chris Zahm is included in Earth's Art, a book of photographs and essays in honor of the Bureau's first 100 years, 1909-2009. See related story on the Bureau's centennial on pages 64-67.*

# WELCOME

Dear Alumni and Friends,

It is my pleasure to share with you the 2009 Jackson School Newsletter covering the 2008-2009 academic year. This was a results-oriented year where we began to see many exciting plans come to fruition.

For starters, we experienced a jolt of vitality (and truth be told a few logistical challenges) due to the addition of 17 new faculty members—a 50 percent increase in our size. This talented group of newcomers includes several of the established national research leaders profiled in the 2008 *Newsletter*, but also a great corps of young academics. You can read about six of them in our Scientists section—and you will also see their contributions to science reflected throughout this *Newsletter*, in our research briefs, national press mentions, and notices of major awards. We wanted a truly outstanding group of scientists, and we got them.

As always our feature stories give a taste of the exciting research going on across the school. The scanning of Lucy, the world's most famous fossil hominid, had been a career-long dream for Rich Ketcham. The project's success demonstrated once again the international value of our High-Resolution X-Ray CT Lab. While energy geosciences has always been one of our strengths, we are becoming a leader in energy policy. Both policy and science are in evidence in our feature examining Texas' future as an energy leader. Coastal research is another strength across all of the units of the Jackson School, and in this issue we take a close look at the Bureau of Economic Geology's coastal team. Planetary sciences was the research area for two major projects last year, Jack Holt's exciting collaboration with NASA to discover evidence of glaciers on Mars and Mark Helper's work on the geological training of astronauts.

In his work with NASA, Mark follows in the footsteps of William Muehlberger, who was inducted into our Hall of Distinction this year, along with Robert Folk and three posthumous inductees (see page 68). You can also read in these pages about the phenomenal success of our GeoFORCE program, which saw its first cohort of students move on to college this year in astonishing numbers. We are all extremely proud of GeoFORCE's impact, and grateful for its major supporters.

Finally, this was not just a year to celebrate the new, it was also a time to recall our past as the Bureau of Economic Geology enjoyed its Centennial. In honor of its 100th birthday, the Bureau created a beautiful book, *Earth's Art*, which you can purchase at the Bureau Web site. We include excerpts here—it would make a great holiday gift.

As these pages attest, we are on our way to becoming the best geoscience program in the country. To be the best, we need both strong annual support and visionary gifts that will take us beyond the Jackson endowment. I encourage you to consider a contribution using the form included with this newsletter. And of course, please update us on your activities and contact information so we can stay in touch and share your news with alumni and friends of the Jackson School.

Sharon Mosher

## RESEARCH HIGHLIGHTS

### Flying the ICECAP

Scientists from the U.S., U.K. and Australia have teamed up to explore two of the last uncharted regions of Earth, the Aurora and Wilkes Subglacial Basins, immense ice-buried lowlands in Antarctica with a combined area the size of Mexico. The research could show how Earth's climate changed in the past and how future climate change will affect global sea level.

Scientists believe the barely observed Aurora Subglacial Basin in East Antarctica could represent the weak underbelly of the East Antarctic Ice Sheet, the largest remaining body of ice on Earth. Until recently the East Antarctic Ice Sheet, which covers the two basins, had been considered a stable ice reservoir unlikely to contribute to rising sea level in the near future. Limited soundings of the ice upstream of Australia's Casey Station, however, reveal a vast basin with its base lying kilometers below sea level. The basin could make the sheet more vulnerable in a warming world.

The Jackson School has teamed up with the University of Edinburgh and the Australian Antarctic Division to study this vast area using multiple airborne instruments. Beginning this December, the ICECAP (Investigating the Cryospheric Evolution of the Central Antarctic Plate) team will fly an upgraded World War II-era DC-3 aircraft with a suite of geophysical instruments, including ice-penetrating radar, to map the thickness of the ice sheet and measure the texture, composition, density, and topography of rocks below the ice.

In the past, scientists surveying the Antarctic ice sheets relied either on heavy cargo planes with poor fuel efficiency but long range, or lighter planes with better fuel efficiency but short range. To fly lighter planes far into the interior of the continent, support planes have to fly in additional fuel from a coastal port, multiplying costs. With the upgraded DC-3, the ICECAP team gets a combination of efficiency and range.

*Inside the ICECAP research plane,"Legroom was minimal, and it was LOUD!" reports Jack Holt. "It took 7.5 hours, so lots of people tried to sleep."*

*The ICECAP team's upgraded DC-3 at Casey Station, Antarctica. Photo by Jack Holt.*

"We're getting much more science done with less oil using this old airframe with modern engines," said Don Blankenship, research scientist at the Jackson School's Institute for Geophysics and principal investigator for ICECAP.

The chemistry of the thick ice might solve a mystery about past climate. Antarctic ice cores have revealed aspects of Earth's climate dating back 800,000 years. Farther back, around one million years ago, Earth's climate changed in a way that caused ice ages to come and go much more rapidly than before. Scientists have long wondered what caused this shift. Australian researchers with ICECAP will search for sites to drill new ice cores with the potential to extend the ice core record to beyond one million years.

Funding for ICECAP is provided by the U.K. Natural Environment Research Council, the Australian Antarctic Division, the U.S. National Science Foundation and the Jackson School.

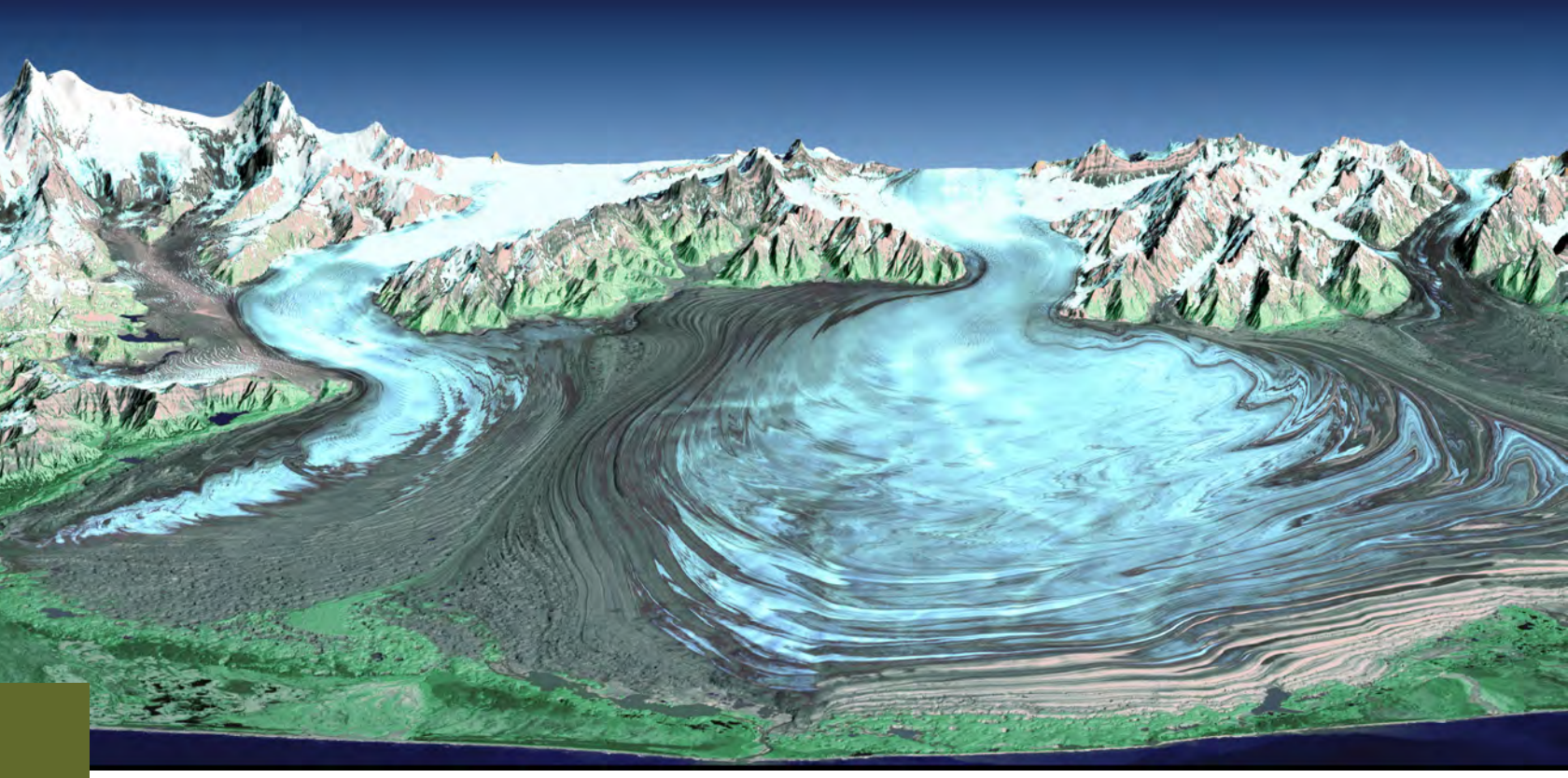
### CSI Alaska

The St. Elias Mountains of southern Alaska and northwestern Canada make up the highest coastal mountain range on Earth. They have been thrust up over the past few million years as a result of colliding tectonic plates and, at the same time, worn down by the world's largest mid-latitude glaciers that grow and shrink with climate change. Scientists are now investigating whether glaciers actually promote mountain growth too.

The St. Elias Erosion/tectonics Project (STEEP), a multi-disciplinary collaboration funded by the National Science Foundation, is designed to reconstruct the history of building up and wearing down of the St. Elias Mountains. The team, which hails from 10 different institutions including The University of Texas at Austin and resembles an earth science version of television's CSI team, is made up of geologists, seismologists, geodesists, glaciologists, geochronologists, and geodynamic modelers. Team members from the Institute for Geophysics include Sean Gulick, Gail Christeson, Harm Van Avendonk, Paul Mann, and graduate students Lindsay Worthington, Ryan Elmore, and Bobby Reece.

Like CSI, the STEEP team hopes to crack a few unsolved cases, including:

*1. Did changes in climate control how fast the St. Elias Mountains rose and create new faults in the crust?* Until recently, climate's role in helping grow mountains was not ap-



*While reconstructing the history of building up and wearing down of the St. Elias Mountains in Alaska and Canada, the STEEP team discovered climate plays a role in where and how quickly mountains form. Image: NASA.*

preciated. The STEEP team discovered that climate plays a role in where and how quickly mountains form. In October 2008, the STEEP team reported in an advance online version of the journal Nature Geoscience that yes, as they suspected, climate is responsible for the fast rate of exhumation (rise of rock from the subsurface to the surface) in the St. Elias Mountains, as well as the creation of faults near the mountains.

*2. What's pushing up these mountains?* A big chunk of rock called the Yakutat Block is colliding with the North American Plate and subducting beneath the continent. The pressure of that collision and the buoyancy of the subducting block, with help from climate change, are pushing up the St. Elias Mountains. But what exactly is this chunk of rock? Results from a seagoing cruise last October which are currently being written up for publication show Block to be over 30 km thick and likely some sort of oceanic plateau.

*3. As the Yakutat Block crunches into the continent, where does the collisional energy go?* During a collision like this, the energy can go two places—straight ahead, wrinkling the crust so mountains form, or off to the side, oozing crust out to the sides. Apparently, both processes are happening in the St. Elias range. Information from Alaska can be applied to other tectonic margins around the world to better evaluate earthquake risks to humans.

## Understanding Ike

Conducting a rapid response research mission after Hurricane Ike, scientists from the Jackson School surveyed the inlet between Galveston Bay and the Gulf of Mexico, discovering the hurricane significantly reshaped the seafloor and likely carried an enormous amount of sand and sediment out into the Gulf. The ongoing research could help coastal communities gauge the effectiveness of their sometimes controversial efforts to replenish eroding sand along shorelines while revealing the role storms play in building and eroding barrier islands such as Galveston.

"The big question is whether the sand was entirely removed from the system or if it's still close enough to the shoreline to get back into the system," said John Goff, survey team member and senior research scientist at the Jackson School's Institute for Geophysics.

Goff and Mead Allison, another research scientist at the Institute, used the 60-foot research vessel R/V Acadiana to conduct a seafloor survey of the Bolivar Roads inlet just a week and a half after Hurricane Ike made landfall on the Texas coast, and then a follow-up survey a month later offshore of the Bolivar Peninsula. The team used sonar to map the depth of the seafloor, seismic instruments to measure the thickness of sediments, and collected samples of the seafloor sediments. The researchers knew the area well having led a group of university students on a marine geology and geophysics

*Oblique aerial photography of Galveston on Sept. 9, 2008 (left) and Sept. 15, 2008 (right), two days after landfall of Hurricane Ike. Yellow arrows mark features that appear in each image. Hurricane-induced waves and surge destroyed a small walkway. Coastal-change impacts include beach and dune erosion, and the removal of considerable dune vegetation. Source: USGS.*

field class to Galveston in the summer of 2008, collecting the most recent pre-Ike seafloor mapping and sample data from Bolivar Roads.

"The timing of our previous study was fortuitous," said Goff, "adding to the practical and public benefit of our post-Ike data."

Comparing pre- and post-Ike surveys, the scientists determined the hurricane's surge and ebb significantly modified the seabed over broad areas. Ike either erased or substantially degraded large shell-gravel ridges up to 10 feet high, with the storm-surge ebb being the dominant transport direction. The storm gouged out sediments deposited hundreds of thousands of years ago to create "erosional pits" up to five feet deep in one area. Offshore, a thin ( up to 3 inches) event layer was discovered, extending at least 8 miles from the shoreline.

In conducting their post-Ike survey, the scientists are primarily interested in investigating the impact of the storm surges on the movement of sediment into and out of the beach barrier system. Maintenance of a barrier system requires an influx of sand, provided naturally by rivers such as the Mississippi. Human modifications to rivers by dams or levees disrupt the delivery of sand to the shore, which can cause the barrier system to degrade.

Until now, the transport of sediments during large storms was a poorly known quantity. Surges could potentially boost the barrier island sand budget by delivering sediments to the shore face, or they could subtract from it by moving sand too far off shore to be incorporated into the barrier system. The pre- and post-Ike survey work will also identify any storm-affected changes to the inlet channel that could affect navigation. Funding for the survey was provided by the Jackson School's Rapid Response Program.

## Dino Birds in Technicolor

For much of the 20th century, the popular view of dinosaurs was that of big, drab, bare skinned lizards. But new evidence from the past couple of decades has radically altered that view. It's now clear that some, if not many, dinosaurs had feathers and downy fuzz like birds. Unfortunately, fossil feathers don't preserve their original color.

Or do they? Researchers have developed a method for determining the color of feathers from an extinct bird using fossilized remains. In a new paper in the journal Biology Letters, a research team that includes Julia Clarke, a new hire in paleontology at the Jackson School, applies the technique to a 47 million year old fossil of an extinct bird. As reported in the New York Times, they determined the bird's feathers had a "dark, iridescent sheen found on starlings and other living birds."

"I really do think we are moving from dinosaurs in black and white to dinosaurs in Technicolor," Clarke told the *New York Times*.

"Although fossil feathers have been known for many years, determining their original color has not been done," said H. Richard Lane, a paleontologist and program director in the Division of Earth Sciences at the National Science Foundation, which sponsored the research.

For more than 25 years, paleontologists have found microscopic tubular structures on fossilized feathers and hair. These were long interpreted as bacteria that had digested the feathers at the time they were fossilized. This interpretation changed after Jakob Vinther, a graduate student at Yale University and the study's lead author, observed similar microscopic spheres in fossil squid that he interpreted as the melanosomes responsible for color in squid ink. The discovery allowed the scientists to use the melanosomes to document original color patterns.

Melanosomes are the molecules that give feathers their colors. The shape, quantity, and organization of melanosomes determine the color. By comparing the fossil melanosomes to those in living birds, the scientists can make educated guesses about the original colors of extinct birds. And since birds are cousins to dinosaurs, the method could work for them too.

"Discovery of a color-producing nanostructure in a fossil feather opens up the possibility that we may someday be able to determine such colors in fossil birds, as well as in feathered dinosaurs," said NSF's Lane.

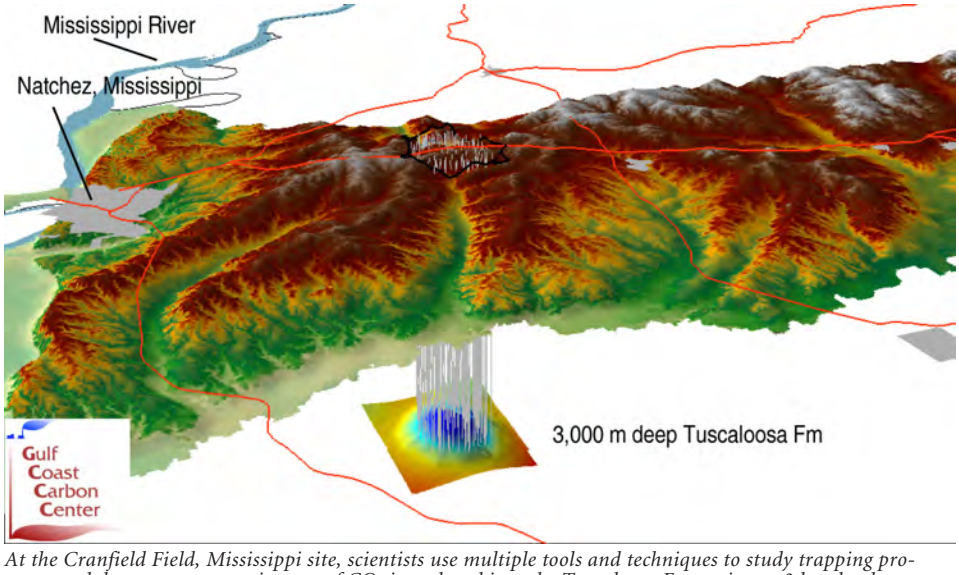
*Vivid iridescent colors existed in feathers more than 40 million years ago. Photo: Richard Prum.*

"The 'Holy Grail' is reconstructing the colors of feathered dinosaurs," said Vinther. "We are working hard to determine if this will be possible."

Clarke is continuing her work as the team's paleontology (and fossil bird) expert. She and her colleagues are excited by the possible applications of the new technique. The 21st century image of dinosaurs might be more like big, brightly colored parrots, flaming cardinals, or florid peacocks.

## Carbon Leadership

As the 2009-2010 academic year geared up, the Bureau of Economic Geology was rapidly expanding its already dominant position in carbon sequestration research by taking on more than a half dozen new projects (see sidebar), most funded with federal stimulus dollars. But 2008-2009 had already proven to be a highly productive year in carbon sequestration research for the Bureau with two




*At the Cranfield Field, Mississippi site, scientists use multiple tools and techniques to study trapping processes and demonstrate containment of $CO_2$ introduced into the Tuscaloosa Formation at 3 km depth.*

BRIEFS

major research projects underway.

Researchers at the Bureau's Gulf Coast Carbon Center are evaluating the practice of carbon dioxide ($CO_2$) enhanced oil recovery (EOR) to assess its efficacy in storing underground $CO_2$ over long time periods and to develop monitoring strategies required to validate these assessments. The SACROC study is looking at groundwater quality in an area where large volumes of $CO_2$ have been injected since 1972. The Cranfield study is quantifying the performance of tens of old wells in retaining $CO_2$ injected at high volumes. Initial results from both projects suggest EOR can be a safe and effective way to store carbon in the deep subsurface.

"It has a big significance for Texas because we have a lot of experience and need for EOR," says Sue Hovorka, research scientist and co-founder of the center. "The question we're trying to answer is whether or not this is the quality of storage you'd need to benefit the atmosphere. These studies decrease our anxiety and give increased confidence in our tools to see that the sites are performing well."

**SACROC**

The Dockum aquifer in the Texas Panhandle is one of the state's 21 minor aquifers, according to the Texas Water Development Board. About 225 miles due west of Dallas-Fort Worth and far beneath the Dockum aquifer—separated by about 5,500 feet of low-permeability rock—can be found one of the world's longest running $CO_2$ injection projects. Operators began $CO_2$ injection in the SACROC oil field in 1972. (The field's name derives from the Scurry Area Canyon Reef Operators Committee, formed by operators working under separate leases in the area when the field was unitized under one managing entity, which is now Kinder Morgan Production Company.)

Over the past 37 years, operators have injected millions of tons of $CO_2$ in SACROC field, mostly from naturally occurring underground deposits in Colorado and New Mexico. It's a mature field with thousands of production and injection wells, making it a textbook example for many other potential sites that could combine carbon capture and storage (CCS) and EOR.

"If there are going to be impacts to overlying groundwater, SACROC's the best place to look," says Rebecca Smyth, hydrogeologist and principle investigator and site manager of the research at SACROC funded by the Department of Energy's National Energy Technology Laboratory, through its Southwest Regional Partnership on Carbon Sequestration.

Starting in the summer of 2006, Smyth collected groundwater samples from 62 wells over a 1,500-square-mile area, both inside and outside the 90 square miles of SACROC. "At this point, we do not see widespread, significant impacts from $CO_2$ injection to water quality in the freshwater zones overlying SACROC versus those in the areas outlying SACROC," says Smyth.

**Cranfield**

Like SACROC, Cranfield is a venerable oil and gas field. Situated 10 miles east of Natchez, Mississippi, its heyday was in the 1940s and 50s. When production fell off in the 1960s, it was depressurized by production, and most wells were plugged and abandoned. Now Denbury Resources, out of Plano, Texas, is using EOR to breathe life back into the field.

Denbury produces $CO_2$ from Jackson Dome and pipes it 120 miles to Cranfield field. Because the pipeline infrastructure needed for large-volume injection is in place, the field has been unitized by Denbury, and excellent reservoir characterization data is available. Cranfield presented a unique opportunity for scientists to assess issues related to EOR and to large-volume injection.

Researchers from the Gulf Coast Carbon Center are monitoring ongoing injection of $CO_2$ to determine whether pressure is contained adequately in an area that is penetrated by many old wells. In addition, the team is developing a site for making the rigorous measurements needed to estimate how big a site would need to be to host injection of a typical power plant's output. Lastly, the project is developing monitoring strategies that can give operators and regulators confidence that any particular injection site is sequestering fluids properly.

The expertise of 15 organizations is tapped to conduct this experiment, including the Bureau, Denbury Resources, Sandia Technologies, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, USGS, and Schlumberger.

The overall goal is to test injections at power-plant-like levels, ultimately to help assuage concerns that carbon sequestration on such a scale would impact water and environmental resources.

"During the injection, $CO_2$ and brine fluids flow through the injection horizon, and we want to demonstrate that it isn't impacting the geology or groundwater above," says Tip Meckel, research associate at the Center. "That would prove geologic containment of injected $CO_2$."

The injection rate at the site is being increased to a million metric tons per year to simulate the output of a typical coal-fired power plant more closely. Two dedicated observation wells have been designed with a novel suite of instruments, which, combined with an array of far-field measurements, allow the team to gain a more quantitative picture

## Spate of Stimulus Grants Solidifies Bureau's World-Class Carbon Sequestration Leadership

The Bureau of Economic Geology has received or is a major partner in receiving a spate of new grants for carbon sequestration research under the American Recovery and Reinvestment Act of 2009 (aka the Stimulus). At press time, we knew of the following:

- Gulf of Mexico Miocene $CO_2$ Site Characterization Mega Transect, PIs: Tip Meckel and Ramon Trevino, $4.M (plus $1.2 M match from GLO).
- Developing Comprehensive Risk Assessment Frameworks for Geological Storage of $CO_2$, Ian Duncan, Eric Bickel, $2M.
- Improving the Monitoring, Verification, and Accounting of $CO_2$ Sequestered in Geologic Systems with Multicomponent Seismic Technology and Rock Physics Modeling, Bob Hardage, $1.3M.
- Alliance for Sequestration Training, Outreach, Research and Education (STORE), Hilary Olson, Sue Hovorka, Stephen Bryant, $1M.
- Five additional "Phase 1" squestration monitoring projects for the Department of Energy using carbon captured from commercial facilities. These projects total $325,000 and may lead to multi-year field deployments.

of high-volume injection.

Many advocates of carbon sequestration see it not so much as a magic bullet, but as a bridge to our energy future—a way to make current energy sources cleaner while scientists and engineers are developing something better.

"I think the major point to be made is that if a geological sequestration site is properly characterized and chosen, there should be very little chance of impact at the surface," says Hovorka. "The technology exists through all the tools developed by the oil and gas industry to characterize the subsurface. So it's not a hard thing to do.

## Earthquake Emissions

Mudslides that followed the May 12, 2008 Wenchuan, China earthquake, ranked by the U.S. Geological Survey as the 11th deadliest earthquake ever recorded, may release an amount of carbon-dioxide in upcoming decades equivalent to two percent of current annual global carbon emissions from fossil fuel combustion, a new study shows.

Mudslides wipe away plants and topsoil, depleting terrain of nutrients for plant growth and burying swaths of vegetation. Buried vegetable matter decomposes and releases carbon dioxide and other gases to the atmosphere.

The expected carbon dioxide release from the mudslides following the Wenchuan earthquake is similar to that caused by Hurricane Katrina's plant damage, report Diandong Ren of the University of Texas at Austin and his colleagues, who used a computer model to predict the ecosystem impacts of the mudslides.

What's more, the vegetation destruction will lead to a loss of nitrogen from the quake-devastated region's ecosystem twice as large as the loss of that nutrient from California ecosystems because of the October 2007 wildfires there, Ren says. And, as the biomass buried by the China quake rots, 14 percent of the nitrogen will be spewed into the atmosphere as nitrous oxide, a pollutant typically released from agricultural operations, automobiles and other sources.

The team published its findings on 4 March 2009 in *Geophysical Research Letters*, a journal of the American Geophysical Union (AGU).

Although landscapes devastated by the Chinese earthquake may re-green soon, the recovery will be cosmetic, says Ren.

"From above, the area will look green in a few years, because grass grows back quickly, but the soil nutrients recover very slowly, and other kinds of plants won't grow," he says.

*Mudslides accompanying China's May 2008 Wenchuan earthquake, such as this one near the epicenter, will contribute to substantial carbon dioxide emissions, according to Diandong Ren. Credit: Yaoping Yin.*



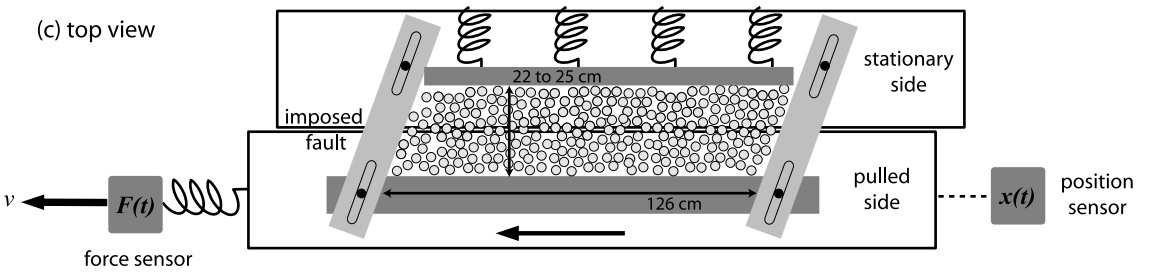
## Tabletop Earthquakes

As postdoctoral researchers at Duke University, Nick Hayman and Karen Daniels wanted to create miniature earthquakes in a lab to help solve mysteries about what factors cause earthquakes and control their size. Earthquakes occur as tectonic plates move past one another, but what happens in those interfaces between plates—the fault zones—is uncertain. There are many ways for faults to fail: fluids can build up pressure, small patches of high friction can slip creating small earthquakes, or entire plate boundaries can slip in one event, as happened in Sumatra in 2004.

Hayman and Daniels suspected a poorly understood factor—the size, shape and composition of tiny granular materials in the crust—might play a significant role in generating earthquakes. Proving this role might be critical in assessing earthquake hazards in places such as southern California.

So here is what they did. To represent the Earth's crust—the rocks and sand and other grains of material beneath our feet—they chose round plastic discs about the size of lentils. To mimic the motion of tectonic plates that generate stick-slip earthquakes such as those produced along California's San Andreas Fault, they arranged 8,000 of the discs in a single layer on top of two Plexiglas plates that were free to slide past each other.

To seal it all up in a closed cell, they added sidewalls and another layer of clear Plexiglas on top. They attached a spring to one bottom plate and hung a weight from it off the edge of the table. This pulled the plate at a




*Top view of Daniel's and Hayman's "tabletop earthquake" laboratory fault apparatus. The central region is filled with densely packed photoelastic disks. The pulled side is driven at constant velocity via a spring coupling (shown at left side). Boundaries parallel to the shear (dark gray bars) are rough on the scale of the particles; end boundaries (light gray bars) are smooth.*

constant velocity past the stationary plate. The friction of the discs rubbing past each other at the plate boundary produced a force on other nearby discs.

The whole thing sat on top of a light table so light passed through the cell and the grains. Having a clear top and bottom and just one layer of discs allowed them to film everything in minute detail with a high resolution digital camera. Polarized light effects even showed the variegated stress on different grains Watching one of their videos, the viewer gains an intuitive sense of how stresses are transmitted through grains near a fault.

Hayman, now a researcher at the Jackson School, envisions using this setup to communicate to the public what happens during a real earthquake. He's building a similar earthquake model at the Jackson School for experiments and courses in physics and earth science.

"What's particularly exciting about this project is that there are so few ways of getting an image of what's happening in earth science," said Hayman.

Hayman and Daniels discovered that in their setup, the sizes of slip events (analogous to earthquake magnitudes) followed a power law, meaning that the more energetic an event, the number of events with the same amount of energy dropped off rapidly. This was the same distribution discovered by Beno Gutenberg and Charles Francis Richter in real world earthquakes and forms the basis of the Richter scale. In most cases, this means that there are a tenth as many magnitude 5 earthquakes as magnitude 4's, a tenth as many magnitude 6's as magnitude 5's, and so on up the scale. They reported their findings in the Journal of *Geophysical Research* on November 26, 2008.

"What our experiment is showing is that some of the fundamental distributions of earthquakes that are known in nature can be mimicked using just granular materials," said Hayman. "And the fact that we can observe the state of stress enhances the point of view that these materials are important in faults."

## Guide to NOCs

In December 2008, energy analysts at The University of Texas at Austin's Center for Energy Economics (CEE) and the World Bank completed the first comprehensive database of 49 National Oil Companies (NOCs), titled "A Citizen's Guide to National Oil Companies." The database is complemented by a technical report containing a preliminary analysis and interpretation of the data on 49 NOCs and their home countries.

NOCs control a majority of worldwide petroleum reserves, produce a majority of the world's crude oil and own much of the world's oil and gas infrastructure. The way they are managed can have a large impact on the global energy supply. At the domestic level, critics have complained that developing countries with NOCs often miss out on their potential to strengthen economies and improve the quality of human life.

The guide is part of a larger effort to improve understanding of these organizations and the role each plays within its country's economic development trajectory. The Study on NOCs and Value Creation, begun by the World Bank in 2008, will analyze the factors that explain the creation of value, and test their relative importance on the basis of the experience of a selected group of NOCs. The objective of the study, which is expected to be completed in 2010, is to improve the awareness of the relative effectiveness and suitability of alternative policies for the management and oversight of the petroleum sector, with particular reference to the role and functioning of NOCs.

"The guide provides insights on NOCs, the challenges they face, and their ability and choice of strategies to respond to such challenges," said Silvana Tordo, lead energy economist in the Oil, Gas and Mining Policy Division at the World Bank. "This is an important first step toward understanding these complex organizations and their contribution to economic and social development in their home country and abroad."

"The critical question that pops out of the database and initial analysis is whether major oil producing and exporting countries—and their sovereign companies—will be able to meet the global demand for oil and gas post-economic recovery and going forward," said Michelle Michot Foss, chief energy economist and head of the CEE. "A key issue is modernization of NOCs. How is this best achieved? What are the most viable strategies? What adjustments do governments need to make?"

*Hugo Chavez, president of Venezuela, is one of the most visible leaders to exert influence over management of his country's National Oil Company.*

## Beyond Darcy

In parts of Australia and the western U.S., groundwater is being pumped from the ground for agricultural use faster than it can be naturally replenished. This leads to a falling water table, which means wells have to be deepened and more energy is needed to pump water. It also leads to compaction of the soil, which cracks roads, pipelines and building foundations, or massive slumps that swallow neighborhoods. That's not to mention the ecological impacts to fish and amphibians from the reduction of aquifer habitats.

Peter Cook is a senior principal research scientist with CSIRO Land and Water, a division of Australia's national science agency, Commonwealth Scientific and Industrial Research Organisation. Cook's research is aimed at groundwater sustainability.

"As water becomes more and more valuable, we need to make more accurate predictions about the future," he said.

To make groundwater use sustainable, the goal is to strike a balance between the rate of water going into the aquifer (recharge) and the rate of water being removed for human use (withdrawal). To find that balance, you have to know what the recharge rate is. And to accurately measure recharge, you have to know how quickly water moves through the ground, also known as the groundwater flow rate. Measuring that accurately, said Cook, can be harder than some hydrogeologists would care to admit.

The standard hydraulic technique involves drilling wells, measuring certain features of subsurface sediments, rocks and water, and estimating the location and slope of the water table (the top of the aquifer). This information is applied to the mathematical relationship discovered by French engineer Henry Darcy in the 19th century—Darcy's Law—to determine the groundwater flow rate. That technique works fairly well for simple groundwater systems where hydraulic conductivity—the ease with which water moves through sediments and rocks—varies little from place to place. But many systems are highly heterogeneous.

*Peter Cook*

*Don Blankenship. Photo: Ralph Barerra, Austin American-Statesman.*

"You could measure hydraulic conductivity in one spot, move over five feet and measure it again and get wildly different answers," said Cook. "There's no way you could drill enough wells."

Cook presented his prescription in a lecture at the Jackson School titled "Environmental Tracers in Modern Hydrogeology: Reducing Uncertainty in Ground Water Flow Estimation," during an international tour as the 2009 Henry Darcy Distinguished Lecturer sponsored by the National Groundwater Association.

Using a mix of man-made and naturally occurring environmental tracers, scientists can plot the age of water at certain spots, using this information to estimate groundwater flow rates. Tracers also have the useful property that they integrate information about water over a large area. So in a sense, they average out variations in hydraulic conductivity from place to place. In highly heterogeneous systems, this results in more accurate estimates of groundwater flow rates.

Another type of system where tracers could help are those where the rocks are highly fractured. This creates short cuts in the system so that old water and young water have a chance to mix, making flow paths very complicated. Used alone, tracers and the standard hydraulic technique each have an extremely difficult time characterizing such systems. But together, said Cook, the two techniques can be combined to reduce uncertainties, especially when multiple tracers are used.

"These are some of the most complicated systems we work in," he said.

Despite improvements in recent years, Cook said environmental tracers are not used widely outside of academic research. He said part of the problem is that hydrogeologists either aren't aware of, or would prefer to downplay, the uncertainties in their traditional hydraulic-based estimates.

"Unless you do uncertainty analysis," he said, "there won't be an incentive to look for newer or better ways."

## Closer to Europa

The possibility of life on another planet is one of the most intriguing questions about the universe. Don Blankenship, senior research scientist at the Jackson School's Institute for Geophysics, is working with NASA to find out if Europa, one of Jupiter's moons, could pos-

# 2008-2009 Commencement Address Excerpt

## One Family's Odyssey
## Victor Carrillo, Texas Railroad Commission


Victor Carillo

Some of you may wonder why the Chairman of the Texas Railroad Commission is addressing this graduating class of geoscience grads. In other words, what do TRAINS have to do with GEOLOGY? For those unfamiliar with our agency, the Railroad Commission has been referred to as "unquestionably, the worst-named state agency in Texas." Despite our name, we have nothing whatsoever to do with trains or railroads. Though established in 1891 to oversee the railroads, today, some 118 years later, we oversees the Texas Energy Sector. Texas remains the premier energy-producing state in the nation, producing more oil & natural gas than any other state and contributing mightily to our nation's domestic energy security.

I love my job and it's the perfect position to bring together my background and experience in geology, geophysics, oil & gas & environmental law, politics & policy. But who would have ever thought, that this shy Hispanic kid who grew up on the wrong side of the tracks in Abilene would one day be a statewide elected official leading the agency that oversees a sector that plays such an important role in the Texas economy .... Most of you don't know me at all so it's only fair to give you some personal background. And to really know someone, you should learn about their heritage (herencia)—that which is handed down from their parents. Mom is from Abilene though her parents were from Mexico. Dad is from Mexico. My parents still live in the house where I was raised in a poor neighborhood "en el Barrio."

Let me briefly share a personal story that begins in a small Mexican village where my dad was born in 1931 in Guanajuato, Mexico. Born into abject poverty. Lived in a 2-room mud-adobe house, dirt floor, no glass windows, no utilities. Several years ago, Dad and I traveled there and I saw with my own eyes where he lived – very house where my grandmother died when Dad was only 7. After her early death, my grandfather, a drunkard who only occasionally worked to support his family, was alone left to raise my Dad.

There was no school in the village until Dad was 9, when a church was built and the local priest encouraged parents to educate their children at church. Dad loved learning & excelled. He tells me that it broke his heart when he told his father that he would quit school because he could no longer take the ridicule from kids because he was dirty, had old & tattered clothes, & his daddy was a drunk.

So though Dad dearly loved learning, he quit school at age 10 and worked in the nearby hills tending cattle, sheep, and goats for two pesos a month (about a quarter or 50 cents). While tending flocks at night, Dad would stare up at the night sky and know that the light of the moon HAD to shine on a place far away where life was better than where he was. He'd heard a song entitled "El Paso Del Norte" that spoke of a place in the north where life was good and where it was said opportunity was unlimited—Los Estados Unidos.

My grandfather's drunkenness ultimately drove Dad to leave Guanajuato. One day, after looking for him for hours, Dad found his father face down and motionless along a dirt path—for a moment he thought he was dead. He wasn't dead, just passed out drunk. At that moment, Dad decided that anywhere was better than where he was. So at 14, Dad left Mexico alone for the U.S. with 18 pesos and the clothes on his back. That event some six decades ago left an indelible mark on Dad's memory, for when we visited, he showed me the very spot on that hillside where he made that fateful decision.

I don't condone the fact that Dad was "undocumented" and didn't come over legally—he swam the Rio Grande—but I understand his motivation and yearning for a better life. If I'm honest with myself, I thank God almost daily for Dad's bold decision to come to the U.S.—had he not, I'd certainly not be standing before you today!

Eventually, over many years, Dad worked as a farm worker and in odd jobs, met and married my Mom, served in the U.S. Army and later became a naturalized citizen. In the 1950s, Dad found a construction job, helping to build a new school—Abilene High School. Three decades later, I graduated fourth in my class of 450 from the very school Dad helped build. And, perhaps like some of you in this room, I became the very first in my family to attend college. In one generation, La Familia Carrillo went from practically no education to three college degrees. From status as a poor immigrant to statewide elected official in the second most populous state in the nation. My message to you: Anything is possible with a quality education, hard work, and God's help .... My parents ... had bigger dreams for me. Dad would always encourage me to place my faith in God and seek a quality education—an education like he was unable to obtain. "Mijo, solo quiero que tu vida sea mejor que la mia!" "I just want life to be better for you than it was for me."

Do you remember hearing your parents say this (though maybe not in Spanish)? This is EVERY PARENT'S dream! My parent's dream was fulfilled by virtue of a quality education, perseverance, faith in God, and lots of help and support from many. Education forms the foundation for a successful & rewarding career. It's the key that unlocks opportunity for future generations. It's the great social equalizer. Today you've reached a critical milestone on your path to future success .... From the bottom of my heart I congratulate each of you on achieving a critically important milestone in your life! Your achievement today can be the beginning of great things to come in your life and career. Nurture that dream because dreams can indeed become reality.

sibly have an ocean of life underneath its icy shell. Blankenship presented his research to packed auditorium during a Jackson School-Environmental Science Institute Outreach Lecture in November 2008.

"For all practical purposes, Europa is just like Earth with an icy layer on top," Blankenship said. "It has the same layers of materials as Earth does, but we don't know what's going on underneath the ice—at least, not yet."

Blankenship, a leading expert in using radar to penetrate the ice of Antarctica, has spent thousands of hours using radar attached to a plane to map out rocks, hills, and valleys in the water below the ice sheets. When asked by a committee of planetary scientists if the same radar techniques could work on Europa, Blankenship replied it could.

"Up until 2002, we could only see a little bit below the surface of planets," Blankenship said. "But now, based on orbital radar sound models, we should be able to see beautifully through the icy shell of Europa and completely through the ocean."

Many of Jupiter's moons have oceans, but Europa has a "high energy" and the greatest possibility of life, Blankenship said. Although the surface of Europa is negative 300 degrees Fahrenheit and has a high amount of radiation, the moon's icy shell shields the ocean from the harmful radiation and makes the ocean more hospitable to microorganisms.

Blankenship and his team want to send a probe to Europa that could provide definite answers about its composition. It could take about 12 years to build the probe, another five years for it to actually reach Europa and three years for it to explore the moon, Blankenship said.

Three months after Blankenship's lecture, in February 2009, NASA and the European Space Agency (ESA) came close to approving the Europa Jupiter System Mission, while calling for continued study of its feasability in tandem with a mission to Saturn's largest moon, Titan. NASA and ESA "agreed that the Europa Jupiter System Mission, called Laplace in Europe, was the most technically feasible to do first," reported NASA, but scientists wanted to explore further the concept of getting to both Titan and Europa.

If NASA and ESA finally commit to Europa, a robot could also be sent to the icy moon to penetrate its frozen shell and explore the ocean underneath for signs of microscopic life. The probe and robot would cost an estimated $3 billion each, Blankenship said.

## Au Revoir Freedom Fries

Speaking at a daylong symposium at UT Austin on European energy policy, Pierre Vimont, ambassador of France to the United States, called for closer cooperation on energy policy between France and the United States, saying concerns about energy supplies trump any lingering suspicions between the two countries from their dissent over the Iraq War.

"Changing the terms of the energy equation is a long and slow process," Vimont told an audience of energy researchers, students, and state politicians. His wide-ranging talk touched on Russia's natural gas riches and the complexities of encouraging emerging powers India and China to cut their emissions.

He said "climate change is clearly an area we need to work together to succeed," adding that the world needs "the dynamism" of American research and development.

As Asher Price reported in the *Austin American-Statesman*, France presents an unusual energy model for the United States. About 80 percent of its electricity comes from nuclear power, part of an ambitious, government-led project that began in the 1950s to make the nation energy independent. The United States gets about 20 percent of its electricity from nuclear power, according to the U.S. Energy Information Administration.

"We need to bring everyone onboard; otherwise, we'll sink together," said Andreas Ehinger, an officer in the sustainable development division of the Institut Francais du Petrole, a government-sponsored research center . Recalling the tense period of the Iraq War, when some Americans began eating "freedom fries," Vimont told Price, "From time to time, we go through controversies with very strong feelings on both sides. But the fundamentals of the relationship are true and sincere friendship."

## Fulbright Scholar Urges U.S.-Australian Cooperation

In spring 2009, the U.S. and Australian governments were both considering new cap and trade legislation for carbon emissions. Cameron O'Reilly, executive director of the Energy Retailers Association of Australia, said the debate on climate change often lumps developed countries in one group and developing countries in another, but it's not that simple. Reducing emissions will be more difficult for some economies. Europe, which relies on fossil fuels for about 53 percent of its electric power, will have an easier time than the U.S. (75 percent of its power from fossil fuels) and Australia (90 percent).

O'Reilly received a Fulbright Professional Australia-U.S. Alliance Studies Scholarship to explore ways in which Australia and the U.S. can reduce carbon emissions while maintaining strong economies. This past spring, he spent three months at the Jackson School's Center for International Energy and Environmental Policy.

An even better comparison, he said, is between Australia and Texas. The two share many features: high levels of fossil fuel production and consumption, similar energy markets, fresh water shortages, hot climates, and a transportation infrastructure that favors private over public transport. These are good reasons to work together.

Texas and Australia have advantages over Europe in the development of wind and solar capability: the availability of inexpensive land, strong winds, and greater solar exposure. Because both are such high fossil fuel users, improvements in efficiency could yield far more effective emissions reductions than in Europe. Carbon capture and storage could be yet another area for collaboration, yielding technology that can be marketed to China and India.

Ultimately, he said the U.S., Texas and Australia will need diverse portfolios and investment in technology development and research to both reduce carbon emissions and maintain economic health.

*Pierre Vimont, French Ambassador to the United States*

*Bureau of Economic Geology researchers, staff, and visitors who participated in the the Bureau's Indsutry Day.*



## OUTREACH

### Bureau Organizes First Annual Industry Day

On April 29, 2008, more than 45 representatives from 30 oil and gas companies attended the Bureau of Economic Geology's first Industry Day. The event was designed as an informal way for companies to become familiar with petroleum energy research being conducted at the Bureau. Some of the visitors were old friends and supporters, but a substantial number of the guests were less familiar with the Bureau and got a chance to learn about its mission and research in an open-house setting. Posters and talks covered a variety of topics:

- 3D-Seismic and Outcrop Research in Clastic Continental Margins presented (Lesli Wood, Dallas Dunlap, and graduate students Nysha Chaderton, Vishal Maharaj, Tricia Alvarez, Tiffany Hedayati, and Daniel Pinkston).
- Structural/Stratigraphic Architecture and Reservoir Quality in Deep Shelf Gas Play, Western Gulf of Mexico presented (Shirley Dutton).
- High-resolution Seismic Imaging of Stratigraphy and Facies presented (Honglui Zeng).
- Sandstone Trends and Depositional Systems of the Lower Atoka Group (Bend Conglomerate), Fort Worth Basin presented (Tucker Hentz).
- Barnett Shale, South Fort Worth Basin: Integrating Core Descriptions and Gamma-Ray Scans with Downhole Logs to Create Cross Sections Using Petra (Scott Hamlin and graduate student Dana Helbert).
- Natural Fractures in Tight-gas Sandstone (Peter Eichhubl).
- Mudstone Lithology and Permeability: Inputs for Basin Modeling (graduate students Derek Sawyer and Julia Schneider).
- Deepwater Gulf of Mexico Slope Stability (graduate student Hilary Strong).
- Scanning Electronic Microscope Demonstration (Dr. John Hooker).

The Bureau hosted its second annual Industry Day on April 15, 2009.

### TXESS Revolution Graduates First Cohort

On Feb. 20, 2009, the first cohort of 50 schoolteachers participating in the Texas Earth and Space Science Revolution (TXESS Revolution) program celebrated their accomplishments by presenting posters at the Institute for Geophysics. The TXESS Revolution is a five-year program to train minority-serving Texas teachers who will teach 12th grade Earth and Space Science. (See the 2008 Newsletter for a feature article on the program.)

Six teachers from the first cohort have earned three or more graduate credits in geoscience through an arrangement with the UT Division of Continuing and Innovative Education. Three have received AS-1 seismometers as part of the IRIS Seismograph in Schools Program. One has been selected to represent the United States at the Geophysical Information for Teachers (GIFT) workshop at the upcoming European Geosciences Union meeting in Vienna, Austria. And one will participate in an IODP expedition to the Canterbury Basin offshore New Zealand later this year.

The second cohort of 55 teachers completed the program later in 2009 and a third cohort started this fall.

Over the summer of 2009 a subset of TXESS Revolution teachers attended a summer institute on petroleum science and technology taught by faculty from the Department of Petroleum and Geosystems Engineering. The institute included a one-day visit to Houston for a close-up look at the energy industry. Funding for the TXESS Revolution comes from the National Science Foundation, Shell, and the Jackson School.

### Fort Valley Partnership Reaches New Milestone

Fort Valley State University (FVSU) and the Jackson School continued their partnership into its sixth year. The partnership reached a milestone in 2009 when Stanley Stackhouse (M.S., '09), a member of the first group of FVSU transfer students, completed his master's degree at the Jackson School. Four new FVSU undergraduates enrolled at the Jackson School this fall.

In addition to recruiting and admitting FVSU transfer students, the Jackson School hosted FVSU's 11th grade Math, Science, and

Engineering Academy (MSEA) for the sixth straight year. As usual the academy ended with a rousing closing ceremony that featured skits, musical performances, and awards. More than 20 people attended the ceremony including Dean Sharon Mosher, professors Leon Long and Peter Fleming, Erin Gandy from the Cockrell School of Engineering, and Mary Long from the UTeach Institute. Former MSEA students who were summer interns at the Institute for Geophysics also attended.

"The closing ceremony was a great way for the students to demonstrate and reinforce what they learned during their week at UT," said Doug Ratcliff, director of outreach and international programs for the Jackson School.

## GeoFORCE Trains Teachers, Reaches New Students

*For a detailed look at GeoFORCE, see the feature in this edition of the Newsletter, "Measuring Up: GeoFORCE Grads Go to College."*

GeoFORCE Texas, the Jackson School's K-12 pipeline program, continued its outreach to Houston and southwest Texas teachers with two earth science workshops in 2008-09. The fall workshop was attended by 44 teachers. The agenda included a cruise on UT Austin's Research Vessel Katy out of Port Aransas that allowed the teachers to identify flora and fauna netted from the bay. Representatives of the Deep Earth Academy in Washington, D.C led a seminar showing how teachers can use data from research cruises as the basis for math and chemistry experiments.

The spring workshop was attended by 35 teachers and included a field trip to Mt. Bonnell and Inner Space Caverns. Professor Emeritus Ernie Lundelius and Consulting Geologist Jim Sansom (B.S. '63) were the field trip leaders. Representatives from the Deep Earth Academy led another seminar for these teachers, in this case using deep ocean cores to demonstrate how much can be learned from shallow sediments.

Another major milestone was achieved this reporting period as Eleanour Snow, an adjunct professor at the Jackson School, began teaching a dual-credit, Web-based geoscience course to students in the southwest Texas high school network. The course is being taught in partnership with Southwest Texas Junior College in Uvalde. It uses the same textbook and syllabus as the Jackson School's GEO401 and GEO405 and includes a lab and a field trip. Demand was strong with 61 students registering even though the program got a late start.

## Latin American Forum Comes Home to Austin

After sojourns to Rio de Janeiro (2006) and Huatulco, Mexio (2007), the Jackson School's Latin American Forum returned to Austin December 7-9, 2008. The 2008 meeting emphasized transboundary issues of energy and the environment, with sessions on oil and gas resources, climate change, greenhouse gas mitigation, unconventional energy (gas hydrates), and nuclear energy.

Chip Groat began the session by recapping the successful projects and collaborations that have grown out of the previous three forums, including:

- Petrobras training and research agreement, a five-year, $7.5 million program.
- ITAM TIES partnership with Instituto Tecnológico Autónomo de México (ITAM).
- Hydrocarbon exploration in northern South America through the Institute for Geophysics and a consortium of oil companies.
- Scientific cooperation with the University of Chile to value environmental resources.
- Water resource studies agreement with Mexico's Comisión Nacional del Agua.
- JSG-organized transboundary energy conference between the U.S. & Mexico.

Dr. Ernesto Marcos, former chief financial officer of PEMEX, opened the presentations with a discussion of energy reform in Mexico. Recent reforms may appear slow to some critics, but Marcos believes these changes are historic in nature for Mexico and will lead to longer-term changes.

Several presentations covered shared energy resources. Dr. Ricardo J. Padilla y Sánchez, head of the division of earth sciences in the School of Engineering at the Universidad Nacional Autónoma de México (UNAM), discussed the geological potential of Mexico's transboundary hydrocarbon resources. Lourdes Melgar of the Jackson School outlined regulatory issues looming with regard to transboundary oil and gas resources in the Gulf of Mexico. Bob Hardage of the Jackson School offered an overview of the immense potential of deep-water hydrates as an energy source in Latin American waters. "Deep-water hydrates need to be incorporated into the energy and environmental strategies of every Latin American country that has offshore territory," said Hardage.

*Charles Kerans of the Jackson School teaches students from the GeoFORCE Houston 9th grade academy.*

On the environmental side, Eugenio Figueroa B., director of the Center of Environmental and Natural Resource Economics (CENRE) at the University of Chile, chaired a panel on climate change and its impacts in Latin America. Using Chile as an example, Figueroa showed projections climate change would reduce rainfall, hitting hardest at agricultural production and forestry. Considering efforts to mitigate climate change, Figueroa said Latin American countries faced a classic "prisoner's dilemma" where solutions depend on the cooperation of all. "If you do not have a cooperative solution," said Figueroa, "then no one will participate and the worst will happen." He took the U.S. to task in particular: "If the U.S. does not concur with the solution, then the solution is not going to happen, and the result will be very bad for the world."

Rong Fu of the Jackson School offered a sobering look at recent changes in the Amazon. An Amazon "die back" would massively increase carbon dioxide ($CO_2$) in the atmosphere, adding as much as nine percent to global $CO_2$ levels. Climate change appears to be delaying the onset of the Amazon's rainy season. Rong Fu's models suggest a strong possibility in the southeast Amazon and northeast coast of South America that drought will reduce the rainy season to seven months. This would change expanses of rainforest to savannah and seasonal forest.

On a more hopeful note, Allan Flores Moya outlined Costa Rica's efforts to become a carbon neutral tourist destination by 2021. The tourism sector accounts for about five percent of Costa Rica's greenhouse gas emissions, said Flores Moya. In keeping with the country's successful image as an eco-tourist destination, Costa Rica is moving forward with efforts to offset carbon emissions related to tourism while dramatically increasing energy use from renewable sources catering to the industry.

## IN THE NEWS 2008-09

*Links to complete articles, streaming audio and video files, and current In the News items can be found on the news section of the Jackson School Web site.*

### Rock Star: Bill Muehlberger, Professor to the Astronauts

***Austin American-Statesman*, Aug. 30, 2009**

Bill Muehlberger, professor emeritus at the Jackson School, has been talkin' rocks to astronauts for 45 years. He's taught geology to Gemini spacewalkers and Apollo moonwalkers, to the space shuttle crews, to the first astronaut classes of the 21st century. Muehlberger was already a renowned geologist when NASA contacted him to organize and lead a field trip for astronauts in West Texas, near Big Bend, in 1964. His job was to impart the basics of geology to the men who would eventually walk on the moon. "The only difference (in terms of the teaching) is that these guys were smart as hell," says Muehlberger, a cheerful guy whose conversation is peppered with science wisdom and desert wisdom. "They want to learn. They're competitive, highly competitive. And they were a lot of fun to be around." Muehlberger recently told NASA he has taught his last astronaut class, but Jackson School colleague Mark Helper will join the teaching group in his place.

### At Bureau Centennial, Ames Cautions Against Regulation

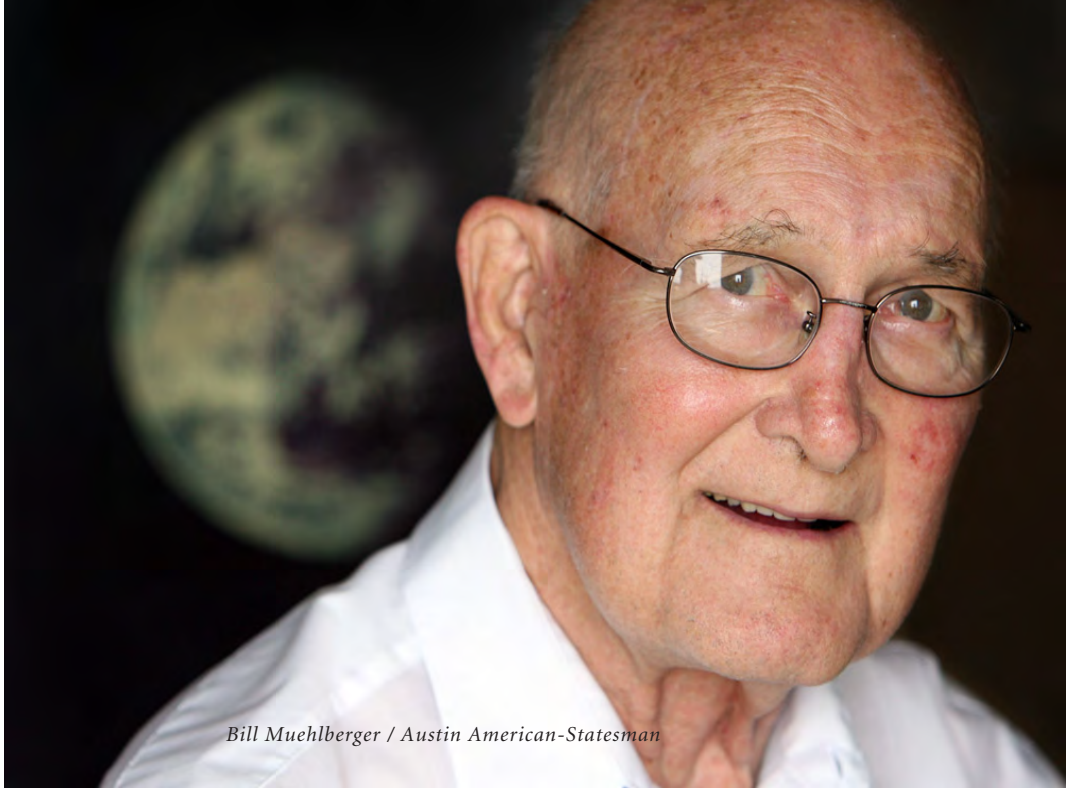
***Foster Natural Gas Report*, Aug. 14, 2009**

Speaking at the centennial celebration of the Bureau of Economic Geology, Railroad Commissioner Elizabeth Ames Jones said the dangers of overregulation by the federal government are growing. "The current cap and trade legislation is just one major hurdle to national energy security. This legislation will add to the cost of drilling for hydrocarbons, which will continue to play a major role in our energy mix for decades to come. Those added costs will be passed down from companies to consumers."

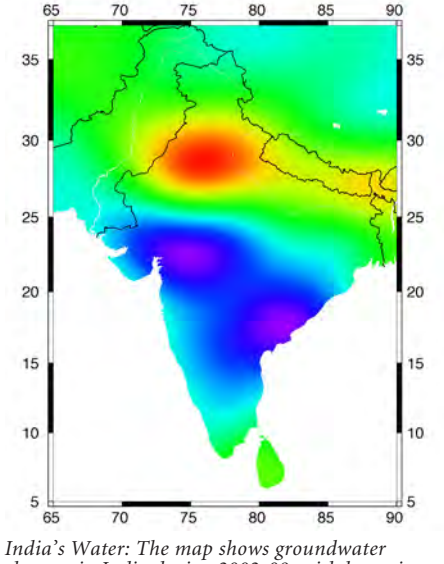
### Satellites Help Hunt for India's Vanishing Water

**States News Service, Aug. 12, 2009**

Where is northern India's underground water supply going? According to a study in the August 20 issue of Nature, based on observations from NASA's Gravity Recovery and Climate Experiment (GRACE), Northern India's water is being consumed at an unsustainable rate. "At its core, this dilemma is an age-old cycle of human need and activity—particularly the need for irrigation to produce food," said Bridget Scanlon, a hydrologist at the Jackson School. "That cycle is now overwhelming fresh water reserves all over the world. Even one region's water problem has implications beyond its borders."



*Bill Muehlberger / Austin American-Statesman*




*India's Water: The map shows groundwater changes in India during 2002-08, with losses in red and gains in blue, based on GRACE satellite observations. The estimated rate of depletion of groundwater in northwestern India is 4.0 centimeters of water per year, equivalent to a water table decline of 33 centimeters per year. "At its core, this dilemma is an age-old cycle of human need and activity—particularly the need for irrigation to produce food," said Bridget Scanlon. Credit: I. Velicogna/UC Irvine.*

### Can Geoengineering Slow Global Warming?

***Time*, Aug. 12, 2009**

What if slashing carbon emissions enough to make a difference in global warming is economically impossible? Do we need a Plan B? A small but growing number of researchers are beginning to say yes, proposing global-scale geoengineering ideas such as spraying sulfur particles into the atmosphere to spread cooling aerosols. Other methods include spraying seawater mist from ships toward low-lying clouds, which would reflect more sunlight. While potentially dangerous, such methods are comparatively cheap. According to a new paper co-authored by J. Eric Bickel at The University of Texas at Austin's Center for International Energy and Environmental Policy, the seawater-mist method could counteract a century's worth of warming for $9 billion.

### Indian Government Must Resolve Oil Dispute

***The Star of Mysore* (India), Aug. 6, 2009**

The legal and political battle waged by Ambani brothers, Mukesh and Anil, regarding Krishna Godavari (KG) gas reserves has become daily news in India, thanks to questions in the Parliament. In the ongoing gas pricing dispute, is the Government partial to either of the Ambani brothers, as claimed? No, avers Dr. Bhamy Shenoy, a senior advisor to the Center for Energy Economics at The University of Texas at Austin. "It is the bounden

duty of the Government to safeguard the interests of the taxpayers. Billions of dollars are involved in this deal and the Government cannot be a mute spectator," notes Bhamy Shenoy.

## Saving Energy Saves Money

***New York Times*, *International Herald Tribune*, Aug. 3, 2009**

A report from the consulting firm McKinsey outlined the enormous opportunities for reducing energy use in the United States. The country could reap $1.2 trillion in potential savings by 2020, the consultants found, after an initial investment of about $520 billion in measures like better insulation for buildings and energy-sipping appliances. That is not even counting the transportation sector. ''Efficiency and conservation have global benefits,'' said Michael Webber, an energy expert at The University of Texas at Austin, citing the economic, environmental and security advantages of reducing energy use. Throughout the world, he added, ''people at street level'' can partake of the gains. ''The main advantage to efficiency and conservation is that many of the technologies actually exist already,'' said Webber.

## Scientists Track Texas Droughts

**KUT Radio, July 31, 2009**

Water conservation plans across Texas are being put to the test during the state's two year drought. But we're still about six years away from matching the state's worst drought on record, from 1950-1957. Should that drought be the benchmark for state-wide contingency plans? Researchers at the Jackson School, including graduate student Richard Casteel and professor Jay Banner, are helping planners use geological history to answer the question. Casteel bores into tree rings, tracking conditions 200 to 500 years ago. Banner provides data from caves, which track conditions tens of thousands of years back. "Having a really long-term record of climate change for this region is an important complement to the shorter record that the tree rings provide." The research should yield an answer for lawmakers to consider by the 2011 legislative session.

## Green Energy Partnership Nears Launch

***Austin American-Statesman*, July 21, 2009**

After two years of preparations, an Austin-based coalition is poised to launch an initiative to reinvent the way electricity is generated and used. The Pecan Street Project seeks to make Austin an incubator for green energy technology. The plan calls for Austin to generate 30 percent of its electricity from renewable energy sources by 2020, much of it generated within the city limits. Ian Duncan, associate director at the Bureau of Economic Geology, said this concept, called "distributed generation," could improve energy efficiency.

## Oil and Gas Firms Account for Most 'Green' Dollars

***Platts Commodity News*, *Natural Gas Week*, June 15 & 29, 2009**

President Obama's plans to raise $31.4 billion over the next decade by ending tax breaks for the oil and natural gas sector to fund investment in green energy could penalize the green energy's biggest investors. According to data from a University of Texas at Austin report commissioned by the American Petroleum Institute, between 2000 and 2008 US oil and natural gas companies collectively invested $58.4 billion in research and development of technologies to mitigate greenhouse gas emissions, 44% of the total $133 billion invested in such technologies in the US during that period. Federal government spending accounted for $19 billion, or 14.5% of the pie. The study shows industry outspent government by a ratio of three-to-one. Funding for new incentives promised by the Obama administration will come in part from higher taxes on oil and gas companies, already the biggest financial backers of the research and development of green technology.

*In the Texas Hill Country west of Austin, Jackson School graduate student Richard Casteel collects a core sample from a tree to compare recent climate data to the geologic record reflected in regional caves. Picture by KUT.*

## Mosher Named JSG Dean

**Austin *American-Statesman*, June 19, 2009**

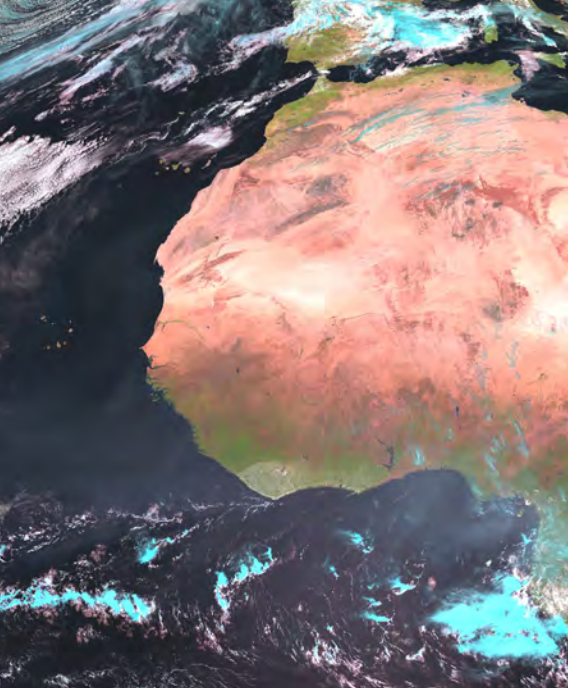
Sharon Mosher, chairwoman of UT Austin's Department of Geological Sciences since 2007, has been named dean of the Jackson School of Geosciences. The appointment comes at a time of growth for the Jackson school, thanks to a bequest of more than $240 million from the estate of oilman John Jackson and his wife, Katherine. Seventeen faculty members have been added in the past year, increasing the roster by nearly 50 percent. Student enrollment is rising as well.

## Temblors Rattle Texas Town

***Wall Street Journal*, June 12, 2009**

Cleburne, Texas, at the center of the North Texas natural-gas boom, has been shaken by another arrival from underground: earthquakes. Five small temblors this month have some people pointing the finger at technology that drilling companies use to reach deep into the earth to shatter rock. The industry says there isn't any evidence linking the quakes to gas production. Oil and gas production has been suspected of causing earthquakes in the past, including in Texas, particularly when it

*In April 2009, with Lake Travis at only 61 percent capacity, boats and docks were on dry land during one of the worst droughts in Texas history. Photo by Jay Janner/Austin American-Statesman.*





involves injecting fluids into the ground. "As a scientist I can't prove that they were caused by the disposal of frac brines, but I think most reasonable people would conlcude they were related," said Cliff Frohlich, a geophysicist at The University of Texas at Austin and co-author of a 2003 book on Texas earthquakes. In his book, Frohlich concluded 22 of the 130 Texas earthquakes he studied were "probably" caused by oil and gas production or other human activity.

## ConocoPhillips Grants UT $1M

***Austin American-Statesman*, May 15, 2009**

ConocoPhillips contributed $1 million in departmental grants to The University of Texas at Austin. The grants will benefit students in the McCombs School of Business, the College of Engineering, the Jackson School of Geosciences and the College of Natural Sciences. A portion of the gift supports GeoFORCE Texas, the nation's largest K-12 pipeline program in the earth sciences. The largest component in the donation is $275,000 to support the university's Spirit Scholars program, which sponsors scholarships, mentorships and other opportunities for students pursuing careers in the energy industry. The donation brings Houston-based ConocoPhillips' cumulative giving to the university to more than $23 million.

## Chevron Gives $1M for Geological Materials

**US Fed News, April 20, 2009**

Chevron has contributed $1 million to the Bureau of Economic Geology at The University of Texas at Austin's Jackson School of Geosciences. The gift will support the Bureau's core research facilities, where scientists study materials in the nation's largest publicly available storehouse of geological cuttings and cores. The gift comes in addition to $1.2 million Chevron donated to programs at The University of Texas at Austin last year and $3 million worth of core materials and support funding Chevron donated to the bureau in 2007. "Chevron's generosity will pay great dividends for all of us," said Scott Tinker, director of the Bureau of Economic Geology and the state geologist of Texas. "Their gift helps keep our collections publicly available. This opens the materials up to scientists tackling major environmental problems, seeking the energy we need today and building the bridge to our energy future."

## Study Shows Africa Subject to Cyclic Mega-Droughts

***New York Times*, *Los Angeles Times*, BBC, Associated Press et al., April 16-17, 2009**

Reeling from consecutive lengthy droughts for 3,000 years, sub-Saharan Africa faces an inevitable repetition of mega-droughts, according to a study published in the journal Science. A team of U.S. geoscientists and climate scientists found severe droughts lasting several decades and sometimes even centuries have been the norm in west Africa for the past three centuries. The study analyzed annual layers of mud and tree sediment in Ghana's Lake Bosumtwi, a crater lake. "What's disconcerting about this record is that it suggests that the most recent drought was relatively minor in the context of the west African drought history," said co-author Timothy Shanahan of the Jackson School. As global warming progresses, the temperature rise could make droughts more severe and prolonged, a potentially "devastating" development for Africa, warned the authors.

## Energy: Water Versus Wattage

***National Journal*, April 3, 20009**

Huge amounts of water drive the energy cycle. The federal government has yet to fully define its role in mitigating water-energy disputes or figure out how to hybridize the policies governing each resource. Both goals face pitfalls, said Michael Webber, associate director at the Center for International Energy and Environmental Policy at The University of Texas at Austin. Energy decisions generally come out of a handful of federal agencies, Webber said, while water decisions almost always fall under state or local authority. The challenge lies in reconciling these entrenched systems.

## Texas Oilmen Going Green?

***USA Today*, March 11, 2009**

The rough-and-tumble image of the Texas oilman may be turning "green." An increasing number of Texas oilmen and companies are swapping oil and gas production for cleaner, renewable-energy strategies. The exploration of renewable energy sources by Texas oil executives could have a significant impact on the budding industry, says Michael Webber of the Center for International Energy and Environmental Policy at The University of Texas at Austin. Texas oil companies have the distribution pipelines, deep pockets and subsurface technology needed to quickly ramp up the country's renewable energy supplies. "There's this Texas wildcatter attitude: these people 60 years ago would go out looking for oil and just find it," Webber says. "That attitude still exists and now they're trying to build wind farms and solar power pants and geothermal fields. It could really change things in this country."

## Chinese Mudslides Emit Greenhouse Gas

**Asian News Service, *Spiegel* (Germany), March 3-4, 2009**

Mudslides that followed the May 12, 2008 Wenchuan, China earthquake, ranked by the U.S. Geological Survey as the 11th deadliest earthquake ever recorded, may cause a carbon

*Michael Webber*

# Opinion: Texas Could Be the "Green Star State"

*Texas Monthly,* May 2009

*Michael Webber, associate director of the Jackson School's Center for International Energy and Environmental Policy, wrote "Green Star State" for* Texas Monthly*'s May round-up of big ideas to make Texas a better place. Below are excerpts from the 2,500 word opinion piece. The complete piece is on the* Texas Monthly *Web site.*

The world opinion of Texas as a laggard on modern energy priorities is true, partly. Our energy consumption and carbon emissions are off the charts, making us the country's leader in both dubious categories. While Texans constitute 8 percent of the U.S. population, we're responsible for more than 10 percent of the country's carbon dioxide emissions—and a whopping 2.2 percent of global emissions .... If Texas were a country, we would be eighth on the list of the world's biggest $CO_2$ emitters, ahead of the United Kingdom and barely behind Canada .... The real force behind our consumption is that Texas does the nation's dirty work—refining the country's oil and manufacturing many of its products. Industry consumes half the energy in Texas, a much larger proportion than in other states. Californians and New Englanders can criticize us all they want for our energy consumption and emissions, but at the end of the day, they want our products and our refined gasoline.

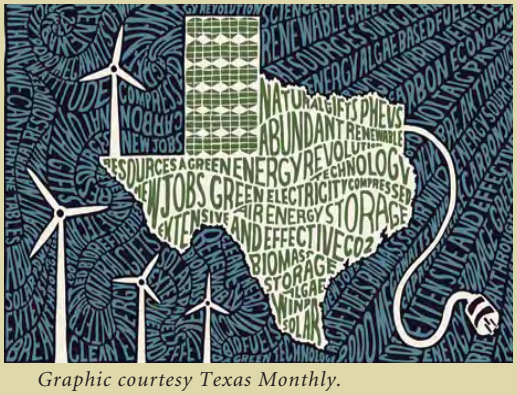
Despite the general perception of our energy consumption, Texas is already doing much more to promote clean energy than the world realizes .... Our biggest impact has been the aggressive use of renewable electric-

**Californians and New Englanders can criticize us for our energy consumption and emissions, but they want our products and our refined gasoline.**

ity—we were one of the first states to establish a renewable portfolio standard, which requires that a certain percentage of an energy company's power generation come from renewable sources .... The renewable portfolio has been a huge success, leading us to create the largest installed base of wind capacity in the nation, about 9,000 megawatts, nearly three times as much as second-place Iowa. Our quick ramp-up of wind farms has pushed the U.S. ahead of every other nation, including Germany, the former leader.

One of the ironies is that in Texas, our lack of concern about the environment enables us to do great things for the environment. You hardly need permission to build a wind farm here, and your neighbors cannot sue you for blocking their view. It's much more difficult in environmentally inclined states like Massachusetts or California, where activists worry about the impact of the turbines on wildlife and ocean vistas ....

Contrary to the fears of some politicians, our incipient greenness has not been bad for business. The clean-technology sectors are booming, creating jobs and revenues in many locations that needed them badly. But we've barely begun. Texas used its natural gifts to become the leader of the world's energy industry,




*Graphic courtesy Texas Monthly.*

and we can once again use them to lead the green energy revolution .... Here's how:

**Wind.** West Texas is already the world's fastest-growing wind producer. But we can do more. With our in-state expertise in aerospace engineering (from the defense industry) and oil platforms, we can create offshore wind farms to generate power even on the hot summer days when the West Texas wind dies down just as demand peaks....

**Solar.** Germany leads the world in installed solar power, which is preposterous since it is cloudy much of the year. Because we are a photon-rich state, with hundreds of hot, sunny days annually, we can bypass the competition to bring solar power onto the grid by building utility-scale solar-power plants in West Texas and slapping photovoltaic panels on every south-facing non-shaded roof in the state. In the process we could create a thriving local industry for solar-panel manufacturing ....

**Biofuels.** Despite the decades-long bipartisan fetish for biofuels from Washington, D.C., production today is expensive, limited, and possibly very damaging to the environment. That's because we make ethanol from corn,

**Texas is already doing much more to promote clean energy than the world realizes.**

which uses tremendous amounts of fossil fuel (for fertilizing and transportation). Because Texas hasn't invested much in an ethanol infrastructure, we are not trapped into legacy thinking about biofuels and can jump ahead to better solutions. Let Iowans have corn-based ethanol. We can leapfrog them and the world by going to next-generation biofuels made from cellulosic materials or algae ....

**Carbon sequestration.** Surprisingly, we might make the biggest contribution by helping the globe with carbon dioxide disposal .... To get a sense of scale, the world emits about 29 billion metric tons of CO2 each year .... To make a difference, we will need to inject two billion tons of CO2 into the ground annually, equivalent to cramming every single person in the world underground six times a year. There is only one industry with the capacity to move that much material around: the energy industry. If carbon trading becomes a reality in the U.S., states across the nation could send us their CO2 (in pipelines we build and control), which we would dispose of for a handsome fee.

It's clear we have the capabilities, resources, scale, and technical know-how. All we lack is the determination and political will to succeed .... The biggest thing we need is a new attitude. All too often we Texans treat low-carbon and renewable energy sources as if they are signs of weakness. This approach is backward. After all, the Roman Empire conquered several continents entirely on renewable energy. Imagine what we could do if we matched up our renewable resources with our technical abilities? Instead of being the country's number one contributor to global warming, we could be the leader in reducing air pollution and greenhouse gases. Environmental groups everywhere would lose their favorite whipping boy. And Texas entrepreneurs would laugh all the way to the bank.

dioxide release in upcoming decades equivalent to two percent of current annual global carbon emissions from fossil fuel combustion, a new study shows. The expected carbon dioxide release from the mudslides following the Wenchuan earthquake is similar to that caused by Hurricane Katrina's plant damage, report Diandong Ren, of the University of Texas at Austin, and his colleagues, who used a computer model to predict the ecosystem impacts of the mudslides. Although landscapes devastated by the Chinese earthquake may re-green soon, the recovery will be cosmetic, says Ren. "From above, the area will look green in a few years, because grass grows back quickly, but the soil nutrients recover very slowly, and other kinds of plants won't grow," he says.

## CT Scan of Famous Fossil Lucy Yields New Insights

**NPR, Reuters et al., Feb. 6-7, 2009**

Researchers at The University of Texas at Austin, in collaboration with the Ethiopian government, have completed the first high-resolution CT scan of the world's most famous fossil, Lucy, an ancient human ancestor who lived 3.2 million years ago. The Ethiopian government entrusted Lucy to John Kappelman, professor of anthropology in the College of Liberal Arts, and Richard Ketcham, associate professor of geological sciences in the Jackson School of Geosciences and director of the university's High-Resolution X-ray Computed Tomography Facility, one of the world's premier labs for this work. "We have more experience scanning natural history objects and dealing with the issues that can arise in scanning natural material than any other lab in the world," Ketcham said.

*It took Rich Ketcham and his colleagues 10 days to scan Lucy's 80 bone fragments, working nearly around the clock with two scanners—one for larger pieces and another for smaller ones.*

## Opinion: Base Energy Legislation On Reality, not Myths

***San Angelo Standard-Times*, Feb. 3, 2009**

As the new president and Congress get down to business, a key issue will be energy. Scott Tinker, director of the Bureau of Economic Geology at Jackson School, believes there are too many myths policy makers are using as a basis for future energy policy. Tinker took his presentation, "The Top 10 Energy Myths and Realities," to the nation's capital several times in 2008 in hopes lawmakers would understand the true realities as they debated energy legislation. The first myth, Tinker says, is that the U.S. can be energy independent in the next 25 years. In reality, independence requires realistic, scalable alternatives which do not currently exist but can be developed over several decades. Tinker notes fossil fuels can provide more than 200 years of use at current consumption rates.

## Denbury Launches Carbon Dioxide Pipeline

***Baton Rouge Advocate*, Feb. 1, 2009**

Texas energy company Denbury wants to transport up to 800 million cubic feet of carbon dioxide a day from Jackson Dome, an underground Mississippi reservoir, to the Hastings Field, an oil patch below Houston capable of producing $4 billion or more in crude oil with the aid of carbon dioxide injected underground. Denbury is promoting the project as the "Green Pipeline" since burying the gasified $CO_2$ will prevent its emissions to the atmosphere. Despite heavy capital costs, the project can be justified, said Ian Duncan, associate director at the university's Bureau of Economic Geology. "They're going to end up sequestering that carbon dioxide for long periods, I think thousands of years would be my guess, in the subsurface," said Duncan. "So it's not leading to an increase in the amount of carbon dioxide in the atmosphere. I think this is a prototype of the kinds of things we need to be doing in this country."

*Contractor works on a joint of the 24-inch carbon dioxide pipeline that will stretch more than 300 miles from near Donaldsonville to Houston. U.S. Source: Baton Rouge Advocate.*

## Obama Urged to Pursue Balance

***Upstream*, Dec. 12, 2008**

The American Association of Petroleum Geologists (AAPG) this week urged President-elect Barack Obama to take a balanced approach to energy policy. In a letter delivered to Obama and publicly disclosed this week, AAPG president Scott Tinker said fossil fuels such as oil, natural gas, and coal supply 87% of global energy demand and therefore "an abrupt, unilateral shift of our energy portfolio is both unwise and unnecessary." Tinker called instead for leveraging the predominance of fossil fuels as a bridge "to an alternate energy future."

## NOCs 'Need IOC Know-How and Deep Pockets'

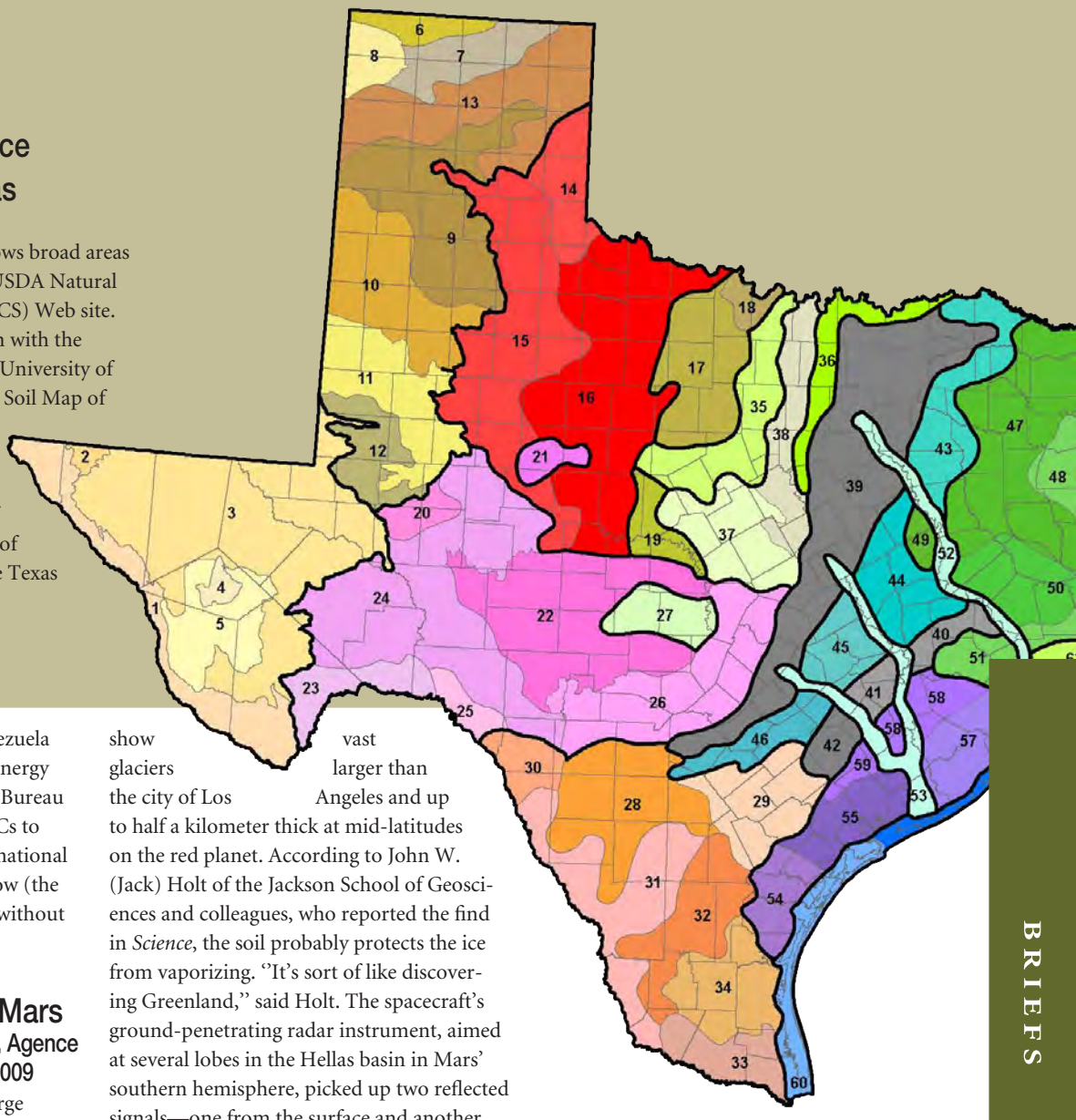
***Oil Daily*, Dec. 15, 2008**

The current downturn in the global petroleum industry will provide a test for the viability of the national oil company (NOC) model, says Luis Guisti, former chief execu-

## USDA and Bureau Produce General Soil Map of Texas

***US Fed News*, April 16, 2009**

A General Soil Map of Texas that shows broad areas of soil types is now available on the USDA Natural Resources Conservation Service (NRCS) Web site. The NRCS soils staff, in collaboration with the Bureau of Economic Geology at The University of Texas at Austin, developed a General Soil Map of Texas. The map is suitable to use as a teaching tool for students and the general public because it provides an overall view of the variety of soils in Texas. The General Soil Map of Texas is available to the public on the Texas NRCS Web site.




tive of state-owned Petroleos de Venezuela (PDV). Michelle Michot Foss, chief energy economist at the University of Texas Bureau of Economic Geology, called for NOCs to increase their cooperation with international oil companies (IOCs). "I don't see how (the NOCs) can do what they need to do without IOC participation," Foss said.

## Radar Finds Glaciers on Mars

***New York Times*, *Washington Post*, Agence France Presse, et al., Nov. 21-25, 2009**

Scientists have long suspected that large frozen reservoirs of water might exist on Mars outside the polar ice caps, but now they have more definitive proof. Images snapped by the Mars Reconnaissance Orbiter using ground-penetrating radar that can see through soils show vast glaciers larger than the city of Los Angeles and up to half a kilometer thick at mid-latitudes on the red planet. According to John W. (Jack) Holt of the Jackson School of Geosciences and colleagues, who reported the find in *Science*, the soil probably protects the ice from vaporizing. ''It's sort of like discovering Greenland,'' said Holt. The spacecraft's ground-penetrating radar instrument, aimed at several lobes in the Hellas basin in Mars' southern hemisphere, picked up two reflected signals—one from the surface and another from something underground. "That can really only happen with a limited number of materials," said Holt, and all the evidence pointed to massive sheets of ice.

*New radar images from the Mars Reconnaissance Orbiter have revealed huge glaciers of buried ice. NASA et al.*

## Antarctic Flights Could Show What Drives Climate Change

**CNN, Science Letter, Nov. 11, 2008**

A team of scientists will use a World War II-era plane to explore one of the last uncharted regions of Earth, in hopes of learning more about climate change. The four-year effort aims to unveil what lies beneath the thick Antarctic ice sheet known as the Aurora and Wilkes Subglacial Basins, an area about half the size of the United States. According to researchers at the Jackson School's Institute for Geophysics, Antarctic ice cores have revealed aspects of the Earth's climate dating back 800,000 years. The researchers will take three sets of flights out of Australia's Casey Station in an upgraded Douglas DC-3 aircraft. The team chose the DC-3 because it offers greater fuel efficiency than heavy cargo planes and better range than lighter planes. "We're getting much more science done with less oil using this old airframe with modern engines,"

*About 10 meters high and 1600 metric tons in weight, this is the largest of seven erratic boulders the UTIG scientists found on the western side of the island of Tongatapu. A paper in* Geology *(37: 131-134, 2009) by Cliff Frohlich, Matt Hornbach, and Fred Taylor presented the scientists' conclusions. Taylor and Hornbach are standing in the middle of the photograph.*

said Don Blankenship, a research scientist at the Institute for Geophysics.

## Hurricane Ike Sends Galveston's Beaches to Sea

***U.S. Fed News*, Oct. 30, 2008 & *Earth* Magazine, January 2009**

When Hurricane Ike roared across Galveston Island on Sept.13, the storm surge flooded the barrier island, washing away houses, roads and tons of beach sand. Now researchers have figured out where all that sand went. Galveston Island, like other barrier islands, has no hard rock foundation. From top to bottom, it's all sand and sediment, dumped into the Gulf of Mexico by the Mississippi River and transported by offshore currents to the Texas coast. Hurricanes and storm surges are part of the natural life cycle of such islands, but until now, the role storms play in building and eroding Galveston had not been well quantified, says John Goff, senior research scientist at the Jackson School of Geosciences at the University of Texas in Austin.

## East Texas Hopes to Avoid Repeat of 1980s Bust

***Longview News-Journal*, Oct. 26, 2008**

To many in East Texas, the recent drop in oil and natural gas prices is all too familiar. But despite the price drops, experts expect the region's oil and gas economy to remain viable during this downward cycle. Eric Potter, associate director of the Bureau of Economic Geology at the University of Texas, said he thinks East Texas' oil and gas reserves will continue to be profitable. "It wasn't that long ago that (oil and gas) prices were in the same range that we're in now, and operators were quite successfully pursuing both," Potter said. "Lower prices would certainly hurt activity in those stripper wells, but the reason I feel optimistic is a lot of those operators producing stripper wells were producing at a much lower price and still making a profit." It's not likely that the stripper wells or natural gas wells will stop producing anytime soon, Potter said.

## Tsunami May Have Dumped Tongan Boulders

***Washington Post*, *Boston Globe*, Reuters et al., Sept. 16-24, 2008**

Seven monstrous chunks of coral on the western shore of Tonga may be evidence of a powerful volcano-triggered tsunami, researchers said on Wednesday. The house-sized boulders appear to have been carried ashore several thousand years ago by a wave rivaling the tsunami generated by Indonesia's Krakatoa volcano in 1883. "These could be the largest boulders displaced by a tsunami, worldwide," said Matthew Hornbach of the Jackson School's Institute for Geophysics. The boulders are so unusual that tales of their origins appear in Tongan folklore. "We think studying erratic boulders is one way of getting better statistics on mega-tsunamis," Hornbach said. "There are a lot of places that have similar underwater volcanoes and people haven't paid much attention to the threat."

## AWARDS & HONORS 2008-2009

*All awards are for the 2008-2009 academic year unless otherwise noted.*

## Faculty & Researchers

### Jaime Barnes
Outstanding Woman in Science Award, Subaru and the Geological Society of America (2009)

### Chris Bell
G. Moses and Carolyn G. Knebel Distinguished Teaching Award, Jackson School of Geosciences

### Frank Brown
Sidney Powers Medal (2010), American Association of Petroleum Geologists

### Elizabeth Catlos
Fulbright Scholar Award, Middle East Technical University, Ankara, Turkey

### Julia Clarke
Outstanding Faculty Engaged in Extension Award, North Carolina State University

### Sigrid Clift
AGS Public Service Award, Austin Geological Society

### Mark Cloos
JSG Outstanding Educator Award, Jackson School of Geosciences

### Ian Dalziel
Honorary Fellow, The Geological Society, London
Cecil and Ida Green Distinguished Visiting Chair, Texas Christian University
Career Research Excellence Award, University Co-op Society

### Tim Dooley
Jules Braunstein Memorial Award (tie) for Best Poster, American Association of Petroleum Geologists Annual Meeting

### William Fisher
ABGP Distinguished Acheivement Award, Association of Brazilian Petroleum Geologists (ABGP)

### Peter Flemings
Distinguished Lecturer, Integrated Ocean Drilling Program (IODP)

## National Societies Confer Top Honors on JSG Scientists



As this edition of the *Newsletter* was being put to bed, three Jackson School scientists were notified they will receive major honors from national societies in the geosciences.

**William Galloway**, professor emeritus at the Jackson School, where he continues to serve as a research professor at the Institute for Geophysics (and was previously a senior research scientist at the Bureau of Economic Geology), will receive the Twenhofel Medal from the Society for Sedimentary Geology (SEPM). The medal is SEPM's highest award, given annually to a person for his or her "Outstanding Contributions to Sedimentary Geology." Past award winners from the Jackson School include Robert Folk and William Fisher.

**Frank Brown**, senior research scientist at the Bureau of Economic Geology, will receive the Sidney Powers Memorial Award from the American Association of Petroleum Geologists (AAPG). AAPG calls the Powers its "most distinguished award, given in recognition of distinguished and outstanding contributions to, or achievements in, petroleum geology."

**Martin Jackson**, senior research scientist at the Bureau, will receive another of AAPG's national awards, the Robert R. Berg for Outstanding Research Award, "given in recognition of a singular achievement in petroleum geoscience research."

Look for more on all three of these awardees in the 2010 *Newsletter*.

### Sergey Fomel
Honorable Mention for Best Poster and Top 30 Presentation, Society of Exploration Geophysicists (SEG) International Meeting

### Cliff Frohlich
IRIS-SSA Distinguished Lecturer, The Incorporated Research Institutions for Seismology (IRIS) and the Seismological Society of America (SSA)

### William Galloway
Twenhofel Medal (2010), Society for Sedimentary Geology (SEPM)

### GeoFORCE Texas
Silver Star Award, The Energy Collaborative Workforce Committee of the Greater Houston Partnership

### Omar Ghattas
Finalist, 2008 ACM/IEEE Gordon Bell Prize, Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE)
Winner, TeraGrid Capability Computing Challenge Award, 2008 TeraGrid

### Bob Hardage
Certificate of Appreciation, American Association of Petroleum Geologists

### Jack Holt
JSG Outstanding Research Award, Jackson School of Geosciences

### Sue Hovorka
Research Award, Division of Environmental Sciences

### Mike Hudec
Jules Braunstein Memorial Award (tie) for Best Poster, American Association of Petroleum Geologists Annual Meeting

*In 2008, the Greater Houston Partnership presented GeoFORCE with the Silver Star in recognition of its outstanding contribution to Houston.*

### Martin Jackson
Jules Braunstein Memorial Award (tie) for Best Poster, American Association of Petroleum Geologists Annual Meeting

### Charles Kerans
Excellence of Poster Presentation (tie), SEPM Gabrial Dengo Award, Best Paper at AAPG International Convention, American Association of Petroleum Geologists

### Jung-Fu "Afu" Lin
Lawrence Livermore Fellowship, Lawrence Livermore National Laboratory

### Bob Louks
President's Certificate for Excellence in Presentation, Energy Minerals Division, American Association of Petroleum Geologists

### Jerry Lucia
Excellence of Poster Presentation (tie), SEPM Monroe G. Cheney Science Award, Southwest Section, American Association of Petroleum Geologists

### Paul Mann
Leiv Eiriksson Fellowship (Visiting Researcher – University Stavanger), Norwegian Research Council
Top 10 Poster Award (Jiang et al) and Top 10 Poster Award (Contreras et al), American Association of Petroleum Geologists Annual Meeting

### Kitty Milliken
Bronze Award for Teaching with Technology, IITAP Program, The University of Texas at Austin

### David Mohrig
NSF Margins Distinguished Lecturer, National Science Foundation
G. Moses and Carolyn G. Knebel Distinguished Teaching Award, Jackson School of Geosciences

### Sharon Mosher
Honorary Fellow, The Geological Society, London

### Ian Norton
Career Achievement Award, ExxonMobil

### Steve Ruppel
Public Service Award, Austin Geological Society
President's Certificate for Excellence in Presentation, Energy Minerals Division, AAPG
JSG Outstanding Research Award, Jackson School of Geosciences

## Elizabeth Catlos Receives Fulbright Award

Elizabeth Catlos, associate professor at the Jackson School, was awarded a Fulbright Scholar grant to lecture at Middle East Technical University in Ankara, Turkey during the 2008-2009 academic year.

Catlos taught an introductory geoscience course and provided graduate seminars in the Department of Geological Engineering at Middle East Technical University while learning more about the geology of Turkey and collaborating with Turkish researchers and faculty.

In 2006, Catlos won the Geological Society of America Young Scientist Award, the Donath Medal, while she was an assistant professor at Oklahoma State University, in recognition of accomplishments beginning with innovative mineralogy research while on a Smithsonian Institution Predoctoral Fellowship in 1997. She taught classes in mineralogy and petrology at Oklahoma State before being recruited to the Jackson School (following a visiting professorship) in 2008.

Her other research interests include tectonic evolution of the Himalayas (Nepal and India) and the Menderes Massif (Turkey). Catlos also has a strong secondary interest in planetary science and has served on several Mars-related panels for NASA initiatives.

Catlos was one of about 800 U.S. faculty and professionals who travelled abroad through the Fulbright Scholar Program in 2008-2009. Established in 1946 under legislation introduced by the late Senator J. William Fulbright of Arkansas, the purpose of the program, which is sponsored by the U.S. Department of State, is to build mutual understanding between the people of the United States and the rest of the world.

### Jack Sharp
2008 Excellence of Poster Presentation (tie), SEPM
Outstanding Presentation, Water Down Under conference

### Jim Sprinkle
Gilbert Harris Award, Paleontological Research Institution
Second Place, Grover E. Murray Best Published Paper Award (co-author with McCall and Molineux), GCSSEPM/GCAGS

### Ron Steel
Joseph C. Walter Jr. Excellence Award, Jackson School of Geosciences
Best Paper (2nd Place), American Association of Petroleum Geologists Annual Meeting

### Lesli Wood
Honorable Mention, Best Paper, Journal of Sedimentary Research

## Leadership Positions

### Jamie Austin
Trustee Woods Hole Oceanographic Institution
Chair, American Geophysical Union Development Board

### Don Blankenship
Co-Convenor, International Symposium on Radioglaciology and its Applications, Madrid
Co-Chair, National Astrobiology Institute Selection Panel (NASA), St. Louis

### Kerry Cook
Trustee, University Corporation for Atmospheric Research (UCAR)
Fellow, American Meteorological Society

### Craig Fulthorpe
Co-Chief Scientist, IODP Expedition 317, Canterbury Basin, New Zealand
Associate Editor, Journal of Sedimentary Research

### Sean Gulick
Co-Convenor, STEEP (ST. Elias Erosion/Tectonics Project) Meeting, The University of Texas Institute for Geophysics

### Bob Hardage
Vice President, Society of Exploration Geophysicists

### Tucker Hentz
Co-Chair, Technical Advisor, American Association of Petroleum Geologists Annual Meeting

## Jaime Barnes Receives Outstanding Woman in Science Award

The Geological Society of America, in partnership with Subaru, has awarded Jaime Barnes, assistant professor at the Jackson School, its annual Outstanding Woman in Science Award. The award honors women who have "impacted the field of the geosciences in a major way based on their Ph.D. research." It is also given in honor of Doris Curtis, the first female president of GSA.

"I am exceptionally grateful to be a member of a community so supportive of its young members and am humbled to accept this honor," said Barnes.

For her Ph.D. research, Barnes studied serpentinites, rocks composed of minerals that contain large amounts of water and might be common in oceanic plates that are subducting, or diving below, other plates. These materials have become a hot area of research as scientists begin to appreciate their role in transporting water from the seafloor to Earth's interior and back to the surface again as volcanic gas. Some scientists have speculated that as the subducting materials release water in the interior, they might increase the explosiveness of volcanoes or trigger earthquakes.

Barnes recognized that any given sample of serpentinite carries a fingerprint that identifies the source of its water and the tectonic processes that formed it. That fingerprint comes in the form of isotopes of chlorine. She later demonstrated that the same chlorine fingerprints can be measured in volcanic gas to infer where its water came from. These insights also have the potential to alter scientists' understanding of the global chlorine cycle.

Barnes completed her Ph.D. at the University of New Mexico in 2006. She joined the faculty of the Jackson School this fall.

**Charles Jackson**
Associate Editor, Revie ws of Geophysics

**Lawrence Lawver**
Convener, Geological Society of American (GSA) Penrose Conference on Tectonic Development of the Amerasia Basin, Banff, Alberta, Canada

**Paul Mann**
Associate Editor, GSA Bulletin

**Sharon Mosher**
Chair, GeoScienceWorld

**Terry Quinn**
Associate Editor, Coral Reefs

**Mrinal Sen**
Co-chair, Technical Program Committee, Society of Petroleum Geophysicists Annual Meeting, Hyderabad, India
Associate Editor, Geophysics, Seismic Modeling and Wave Propagation Section
Associate Editor, Journal of Seismic Exploration
Associate Editor, Computational Seismology and Geodynamics, AGU

**Paul Stoffa**
Associate Editor, Journal of Seismic Exploration

**Scott Tinker**
President, American Association of Petroleum Geologists


## Slide Show Wins Grand Prize

*"Troubled Waters" is a multimedia online slide show that tells the story of Cuatrociénegas, a fragile desert oasis in Mexico that is drying up. (See the feature on Cuatrociénegas in the 2008 Newsletter.) Researchers think they know where the water is going thanks in large part to Jackson School graduate Brad Wolaver (B.S. 1995, Ph.D. 2008).*

*Marc Airhart, science writer for the Jackson School, co-produced the slide show with Wolaver and UT Austin photographer Marsha Miller. The Council for Support and Advancement of Education honored their work as the best multimedia production from a university in their region in 2008-2009. You can find it on the UT Austin and Jackson School Web sites—or just Google "troubled waters cuatrocienegas."*

## Students

**Steven Joseph Arauza**
Distinguished Scholar, The University of Texas at Austin

**Casey Leigh Corbin**
Distinguished Scholar, The University of Texas at Austin

**Edward Albert Cross III**
Distinguished Scholar, The University of Texas at Austin

**Jamie Levine**
Teaching Award, Texas Exes

**Laurent Longuevergne**
Grand Prix de Geophysique, French Committee for Geodesy and Geophysics, International Union of Geodesy and Geophysics

**Ellen Elizabeth Reid**
Distinguished Scholar, The University of Texas at Austin

**Elizabeth Anne Rinehart**
Distinguished Scholar, The University of Texas at Austin

**Audrey Sawyer**
Horton Research Grant, Hydrology Section, American Geophysical Union

**Derek Sawyer**
Outstanding Student Paper Award, American Geophysical Union Fall Meeting

**Marisa Vara**
BP's Transition to College Award

## Staff

**Marc Airhart**
Grand Award (First Place), Multimedia Programs, Council for Advancement and Support of Education, District IV

**Janet Everett**
Staff Excellence Award, Jackson School

**Jennifer Logan**
Outstanding Staff Award, The University of Texas at Austin

**Larry Mack**
Outstanding Service Award, Jackson School

## Quinn Becomes Director of Institute for Geophysics

Terry Quinn, associate director of the Institute for Geophysics at The University of Texas at Austin, has been named director of the institute. Quinn was interim director during the national search for a director this past year.


*Terry Quinn*

The Institute, one of two main research units within the Jackson School, has a nearly 40-year history as an international leader in geophysical studies, ranging from expeditionary field programs in the oceans and at the poles, terrestrial and lunar seismology, quantitative and exploration geophysics, and most recently, studies of ice sheets and of climate.

Since 2006 Quinn has held joint appointments as a senior research scientist at the Institute and professor in the Jackson School's Department of Geological Sciences. Among previous honors, Quinn was the Joint Oceanographic Institute's Distinguished Lecturer for 2006-2007. The Jackson School named him a Jackson Research Excellence Fellow in 2007.

Quinn's research focuses on the chemical makeup of marine sediments and coral reefs to investigate how climate has changed over the past 10,000 years. Most recently, he and his students have investigated past climate in the western Pacific Ocean, tropical Atlantic Ocean and the Gulf of Mexico. He is interested in developing tools to reduce uncertainties in geological records of climate and to help scientists use records of past climate to improve computer models that predict future climate.

Quinn received his Ph.D. in geological sciences from Brown University in 1989 and his master's degree from Wichita State University in 1984.

"As interim director, Terry showed firsthand he has the leadership abilities the Institute and Jackson School need for us to reach our goal of becoming a preeminent geoscience institution," said Sharon Mosher, dean of the Jackson School.

"I am honored to stand on the shoulders of the giants in the field that came before me to lead the Institute for Geophysics and to partner with the Jackson School to achieve our common goal of preeminence in the geosciences," said Quinn.

## Bennett Serves as First Associate Dean of Academic Affairs

Philip Bennett, professor and Jackson Centennial Teaching Fellow, has been selected as the first associate dean of academic affairs at the Jackson School.

Bennett received his Ph.D. in geology and aqueous geochemistry from Syracuse University in 1989. He came to UT Austin as an assistant professor that same year. His research focuses on the link between microbes and minerals, in particular the role of minerals and mineral-bound nutrients in subsurface microbial ecology and the role of microbes in rock weathering. He received a Faculty Excellence Award from the Houston Oil and Minerals Corporation in 1994. In 1997, he was selected the Henry Darcy Distinguished Lecturer by the National Ground Water Association. He served as the graduate advisor for the Department of Geological Sciences from 2003 to 2006.


*Philip Bennett*

"As chair of the Department I served unofficially as an associate dean for academic affairs, and through that experience recognized the critical need for the Jackson School to have someone to coordinate Jackson School education programs and interface with the UT Austin administration," said Sharon Mosher, dean of the Jackson School.

"Phil Bennett has demonstrated a strong commitment to educational excellence and will be an effective leader for us in this position," said Mosher.

"I am excited to take on the new job of associate dean for academic affairs for the Jackson School," said Bennett.

Bennett said he learned while working as the school's graduate advisor that he enjoyed working with students outside the classroom, helping them find funding opportunities and new educational experiences.

"My goal this year," he said, "will be to corral the various rules, guidelines, and secret tricks of the JSG graduate program into a handbook for faculty and students. My goal is for students and supervisors at each of the units of the JSG to have ready access to important information, and deadlines, no matter where they are."

## Grand Chairs Department of Geological Sciences

Stephen Grand, a professor of geophysics in the Department of Geological Sciences and senior research scientist at the Institute for Geophysics, has been named chair of the Department.

Grand received his Ph.D. in geophysics from CalTech in 1986. He was an assistant professor at the University of Illinois at Champaign-Urbana for two years before coming to UT Austin as an assistant professor. His research focuses on seismically imaging Earth's mantle. In 2001, he was elected a fellow of the American Geophysical Union and in the same year received a Teaching Excellence Award from the College of Natural Sciences. He served as the department's graduate advisor from 2006 to 2009.


*Stephen Grand*

"Steve Grand is an eminent scientist and dedicated teacher, whose opinion is respected by both faculty and students, as well as other unit leaders and UT administrators," said Sharon Mosher, dean of the Jackson School.

"Steve is committed to building a world-class department and will be a strong leader."

Grand noted that the Department has grown tremendously in the past couple of years, including hiring 17 new faculty members.

"My goal is to create an environment for them to succeed," he said.

He plans to establish a mentoring program for assistant professors (the Department went from one just a couple of years ago to ten) which pairs them up with senior faculty to help integrate them into the school and ensure they have the tools they need to attain tenure.

"The future of our department rests in the hands of our younger faculty," he said. "They are the ones who will bring us new ideas and cultural changes. The culture they create will be here a long time."

# LIBRARY REPORT


## By Dennis Trombatore

Despite the incredible financial news of the past year, Texas is weathering the storm better than many another state and most private schools. The UT Libraries have so far avoided the enormous budget cuts and layoffs that our peers like Michigan and Stanford libraries have endured. The Walter Library has scaled back some collecting efforts and digitizing projects to conserve funds and help us over the next couple of years, which promise to be somewhat more difficult. Nevertheless, we continue to acquire new print and online resources, focusing on research and curricular needs, and our other programs are still ongoing.

While there is a lot of press about the difficulties of institutional endowments at this juncture, these funds still give us the flexibility and strength to advance our goals even in tough times, and we are more than ever cognizant of their importance. Library use is now being counted (and funded) more in clicks than in checkouts, and folks are clicking away like crazy, so we continue to rely on all our funding sources to meet those needs. Special thanks this year to the Barrow's and our other regular contributors for their ongoing financial support!

Our Virtual Landscapes of Texas project, focused on the historical record of geology in Texas, now has more than 500 items, including the Geology Dept. Newsletters. We will use the coming year to do some reorganization and refreshing of the site to make it more consistent and easy to use. We also hope to add more Richard Owen materials in cooperation with Tim Rowe – to see our most recent products of these projects, go to:

http://www.lib.utexas.edu/books/britfossils/
http://www.lib.utexas.edu/books/landscapes/

Our GRA's and student workers from the School of Information, Caitlyn Lam, Claire Boetticher, and Betsy Young had a busy year ordering new materials, adding and upgrading catalog records, and processing gifts. Claire has graduated and accepted a position with the Exxon Library in Houston. Caitlyn did a capstone project with Ann Molineux in Non-Vertebrate Collections at TNSC, helping with creation of a web site about Helen Jane Plummer. See the site here:

http://www.utexas.edu/tmm/npl/nonvertebrates/locality_cards.html

Betsy will graduate in August, and is doing a capstone with the Austin History Center's photo archives.

Our new LAIII is Calla Smith-Dowling, who comes to us from the University of Michigan School of Information, where she recently completed a Master's. Calla is settling in with the staff and her new duties, is assisting with the Libraries' Chat Reference service, and has undertaken a review of our now extensive web pages for consistency and usability. This coming year she hopes to overhaul our thesis index, which is growing unwieldy.

Our GeoRef indexing arrangement with the American Geological Institute continues. Pat Dickerson remains in this role, with two additional assistants. Pat and the folks at AGI have also helped us bring in some gift materials from around the world to add to the collection.

Dennis Trombatore continues to serve on the GeoRef advisory Committee and the Geoscience World Advisory Committee for AGI. With Rusty Walter's help, he has completed a new feature for the Walter Library Web site: Joe Walter– an appreciation. You can see it here:

http://www.lib.utexas.edu/geo/geolibabout-pages/walter.html

A Walter Library History project is also 'on the back burner,' and we are still looking for a photo of the old geology library from the building now known as WC Hogg, or pictures of Thelma Guion, Barbara Chappell, or Martin Smith at work.

# From Austin to the Poles

## GINNY CATANIA CONTINUES UT TRADITION OF LEADING POLAR RESEARCH

Austin, Texas, generally evokes images of live music, barbecue, and sweltering summers, not cutting-edge arctic research. And yet it's home to Ginny Catania of the University of Texas at Austin's Institute for Geophysics (UTIG), a promising young polar scientist at the forefront of glaciological research.

"Not only is the polar landscape unusual, the environment is a little more on the edge and I like that," she says. "Because of the remoteness of my field areas, when I am there I feel like I'm living my life every day in the moment much more so than any other time in my life."

For the last several years (minus a break this past year) she has spent between two and four months out of the year living in a tent on an ice sheet. In 2007, she and Tom Neumann (University of Vermont) completed the second of two field seasons in western Greenland. They used ice-penetrating radar to understand how the Greenland Ice Sheet is responding to climate warming, particularly along the periphery where notable changes over the last decade in the amount of seasonal surface melting and ice-sheet velocity increases are causing scientists like Catania and Neumann concern.

"When surface melt reaches the bottom of the ice sheet, the ice sheet's movement seems to speed up," she says. "We want to refine our observations of seasonal speedup so that we can better predict ice sheet behavior."

She's now writing up the results of that work and hopes to publish them soon. Just as nature abhors a vacuum, she has had no trouble filling her time with new research.

One project that's just beginning involves drilling boreholes in Greenland to place instruments at the bed below the ice sheet and measure water pressure, temperature and strain on the ice. She and her colleagues will correlate this data with GPS measurements at the surface to better understand how the surface of the ice sheet moves in response to subglacial hydrology.

For another project, she was inspired by other scientists in the Jackson School who use physical models to simulate salt tectonics and sediment transport in rivers. She's developing a physical model of ice sheets in which a clear silicon material represents the ice sheet and a more fluid material dyed blue represents liquid water beneath. She doesn't know of any other scientists doing this kind of modeling. In fact, she hasn't been able to attract funding for it yet.

"My funding agencies said, 'What? you want us to fund what?'," she says. "So I'm trying to do it as a seed project to show them that it's worth their dollars."

The model will help her decide where to drill in the Greenland borehole project. She also hopes to gain insights that can improve ice sheet models.

*Ginny Catania*

### New Frontier

Catania decided she wanted to pursue glaciology after taking part in an international field project in Switzerland during her senior year at the University of Western Ontario. The mountains and glaciers provided a tempting frontier and she was setting foot, perhaps, where no one had before.

"Initially I loved the adventure and the remoteness of the places," she says. "I also really liked the people I was working with so I kept looking for similar experiences. Now I am genuinely motivated by the science questions rather than just a fondness for the place. I also

## New Faculty Hires, 2008-2009

The Jackson School hired 17 new faculty members for the acaddemic years starting in 2008 and 2009. We profiled the first batch in the 2008 *Newsletter*, six more in theis edition, and will feature the final six in 2010.

### Climate Systems Science

Dan Breecker* / Assistant Professor

Rose Came / Assistant Professor

Kerry Cook / Professor

Robert Dickinson / Professor and Jackson Scholar

Rong Fu / Professor

Tim Shanahan / Assistant Professor

### Earth Surface and Hydrologic Processes

Ginny Catania / Assistant Professor

Joel Johnson* / Assistant Professor

Wonsuck Kim / Assistant Professor

### Crust, Mantle & Core Dynamics

Jaime Barnes* / Assistant Professor

Liz Catlos* / Associate Professor

Rich Ketcham / Associate Professor

Luc Lavier / Assistant Professor

Afu Lin / Assistant Professor

### Energy Geoscience

Marc Hesse* / Assistant Professor

Kyle Spikes* / Assistant Professor

### Paleontology

Julia Clarke / Associate Professor

* To be profiled in 2010 *Newsletter*

like that there are no bugs in my field areas."

Catania came to the Jackson School's Institute for Geophysics in September 2005, following the completion of her Ph.D. at the University of Washington and a postdoctoral position at the University of Santa Cruz. She quickly developed a research program centered on the study of ice sheet dynamics. This has meant finding the funding for state-of-the-art radar equipment and amalgamating like-minded scientists and graduate students to her team.

## Professor Catania

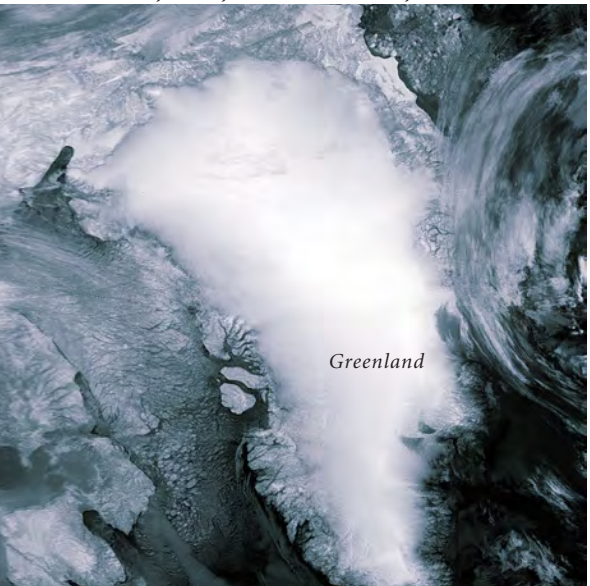
In addition to all her research efforts, Catania has just begun a new joint appointment as a faculty member in the Department of Geological Sciences.

"I love what I do," she says. "They give you a tremendous amount of freedom to design your own courses and make your own schedule. Not a lot of people have that in their jobs."

She's preparing to teach a graduate course in glaciology in the spring and a signature course in the fall on the science (or non-science as the case may be) of disaster movies. Between supervising two post docs, managing several research projects of her own, and teaching, she is grappling with not enough hours in the day or days in the week. One of the things that keeps her going is the hope that her work will encourage the public to take more responsibility for their actions.

"I want people to understand that what they do as an individual affects what happens at the poles and, ultimately, has an effect on everyone," she says. "Even though they may not see the changes tomorrow in Austin, Texas, I want people to understand that, because they are part of a global system, they will eventually be affected. Things are happening beyond the expectations of our existing models so we really need to increase our understanding of the Arctic." ✷

*By Marcy Davis, additions by Marc Airhart.*



*Greenland*

# Ancient History

## JULIA CLARKE EXAMINES THE MYSTERIOUS ORIGINS OF BIRDS

From the earliest days of the discovery of dinosaurs up to the present, birds have been at the center of scientific controversies in paleontology and evolutionary biology. Julia Clarke, an associate professor of paleontology at the Jackson School since the fall of 2008, explains part of the reason. Because birds are so apparently distinctive, explaining their emergence as a clade (a group consisting of a single common ancestor and all its descendants) was considered problematic.

"Birds possess feathers, complex song and, flight, the last of which is known only in a handful of vertebrate clades," says Clarke. "They are also species-rich—there are many more species of birds than of mammals." Explaining their origins involves approaching complex questions, such as when and how did feathers evolve? (If you think the answer is closely linked to flight, keep reading.) "Even today they present challenging questions for scientists," says Clarke.

Birds were major points of contention in the earliest days of Darwinian theory. Religious critics thought only a divine creator could explain the unique features seen in Aves. The announcement of the first complete specimen of *Archaeopteryx* in 1861 was a major boost to Darwin's theory, suggesting a bridge between extant (living) birds and other dinosaurs, perceived as fundamentally "reptilian." Yet even today, critics of evolution seek out new arguments and recirculate old ones trying to question the affinities of birds.

Since at least the late 1970s, most paleontologists have accepted that birds are theropod dinosaurs. As Clarke wrote in "Bird Evolution" (Current Biology 16:350-354, 2006), "During the past 30 years novel methods and abundant new data have ever more firmly established the evolutionary relationship between birds and other dinosaurs. In this time, paleontology has largely moved beyond debate on the broad scale location of birds in the tree of life to more nuanced questions," such as where birds fit in the dinosaur family and what morphological details mark the transition from non-flighted dinosaurs to extant birds.

Morphological details were in the spotlight recently, notes Clarke, with the discovery this year of yet another Chinese feathered dinosaur fossil, this one slightly older than *Archaeopteryx*. With elongate feathers on its limbs, including its feet, the specimen yet again strongly affirmed the affinities of birds supported by earlier data from boney features. Not only do the feathered dinosaurs that have emerged over the past 10 years reverse the once accepted notion that feathers evolved as flight evolved, they force us to consider new questions such as the origin and function of hind-limb "wings" also present in dinosaurs closely related to birds. Feathers pre-date birds, meaning they also pre-dated flight's origin.

"New fossils still have the capacity to come along and challenge accepted ideas," says Clarke.

Clarke's research on fossil penguins is a case in point. For several years she has studied early penguin evolution in equatorial regions. Her descriptions of two new species from the Eocene of Peru overturn the idea penguins only arrived in equatorial climes at or after global cooling around the Eocene-Oligocene boundary. Instead, she's found evidence that multiple radiations of penguins—including large, five-foot tall species—occurred earlier in the Paleogene, during one of the warmest periods of Earth history. She has also had the opportunity to approach major shifts in the diversity and distribution of bird groups alive

*Julia Clarke*

today in one of her major research projects. Funded by the National Science Foundation, the project involves documenting the best data for the North American avifauna some 50 million years ago. Clarke and her colleagues are finding a sub-tropical forest that was filled with relatives of bird species today found only in sub-Saharan Africa and Asia.

Another of Clarke's research projects was recently in the news when collaborators at Yale University announced in *Biology Letters* the discovery that evidence of melanosomes, color-producing organelles filled with melanin, survived for 47 million years in the fossil of a feather. Based on the shape and packing of these melanosome remains, they inferred that a fossil specimen from Germany displayed the kind of dark, iridescent sheen Austinites often see on the common grackle. The team's method may allow researchers to reconstruct the color of both fossil birds and other feathered non-flying dinosaur relatives. As Clarke, who is a co-PI on the project, told the *New York Times*, "I really do think we are moving from dinosaurs in black and white to dinosaurs in Technicolor."

## Understanding Origins

Clarke became interested in avian evolution at the same time she got hooked on paleontology, during a class she took as an undergraduate at Brown University on the Cretaceous/Tertiary (K/T) boundary. The K/T mass extinction event is still central to studies of the origin of avian biodiversity. For years paleontologists have debated whether living bird lineages emerged after the extinction of the non-avian dinosaurs, or whether living birds pre-date the K/T in significant numbers. As Clarke puts it, "Do we have penguins alongside triceratops?"

As fate would have it, Clarke's research on a rare Cretaceous Antarctic fossil first brought her to the Jackson School, to scan the specimen at the High Resolution X-Ray CT Lab. The fossil, a waterfowl relative, was the first Cretaceous specimen definitively placed within the extant bird radiation. From the research, Clarke authored a paper in Nature (the Jackson School's Rich Ketcham was a co-author) confirming that "at least duck, chicken and ratite bird relatives were coextant with non-avian dinosaurs."

While Clarke is passionate about her specific areas of paleontology, she sees many good reasons for general geoscience students to study the discipline. For one, she says, "I do believe evolution is pretty fundamental." Paleontology offers a hands-on view of the wealth of evolutionary data scientists have accumulated. The field is also essential to efforts to understanding the impact of long-term changes in Earth's system. Combining evidence for shifts in the earth's biota from the fossil record with paleo-environmental indicators, she points out, offers the only evidence we have to inform how life has responded to major global change including major long-term warming or cooling events or other shifts in climate.

Reflecting on *Archaeopteryx* in 1866, Darwin wrote that "hardly any recent discovery shows more forcibly than this how little we as yet know of the former inhabitants of the world." Uncovering yet more of these former inhabitants will almost certainly prove essential to our own future. ✷

*Rich Ketcham in the X-Ray CT Lab*

# Code Talker

## RICH KETCHAM GETS WITH THE PROGRAM

Richard Ketcham had a knack for computer programming, but didn't want a career that would keep him stuck inside. Computers didn't seem terribly fulfilling, especially since his main experience with them had been writing programs for things like balancing a company's books. During his senior year at Williams College, a professor asked him to stay for the summer and help him model heat flow during thrust faulting.

"He thought the big wigs were wrong about how it worked," he says. "I spent this bucolic summer in the Berkshires figuring out how to do it."

In just the first couple of weeks, he had a working model that was already proving out the professor's alternative theory.

"It showed me that I was pretty good at doing something that was out and out new," he says. "I could program a computer to do something and as a result, I would know something that no one else knew before. That was my first experience with scientific discovery and that's what had me hooked."

He graduated with a bachelor's in geology and computer science, a marriage that has lasted more than 20 years.

## Shake & Bake

One of the areas in which he's applied these two fields to great effect is low-temperature thermochronology, a set of tools for reconstructing the thermal history of rocks based on the rate at which different radioactive

isotopes decay and their daughter products are incrementally lost due to heating. The tools can help reveal when mountains were built, erosion occurred, faults shifted, and petroleum traps formed, among other things.

Ketcham developed a computer program that combines data from two of these tools—apatite fission-track and (U-Th)/He—to create a range of likely thermal histories for a particular sample. His program, called HeFTy, has become the standard tool used by researchers everywhere for interpreting those data. He was surprised when a researcher from Florida used it to examine a Martian meteorite discovered in Antarctica.

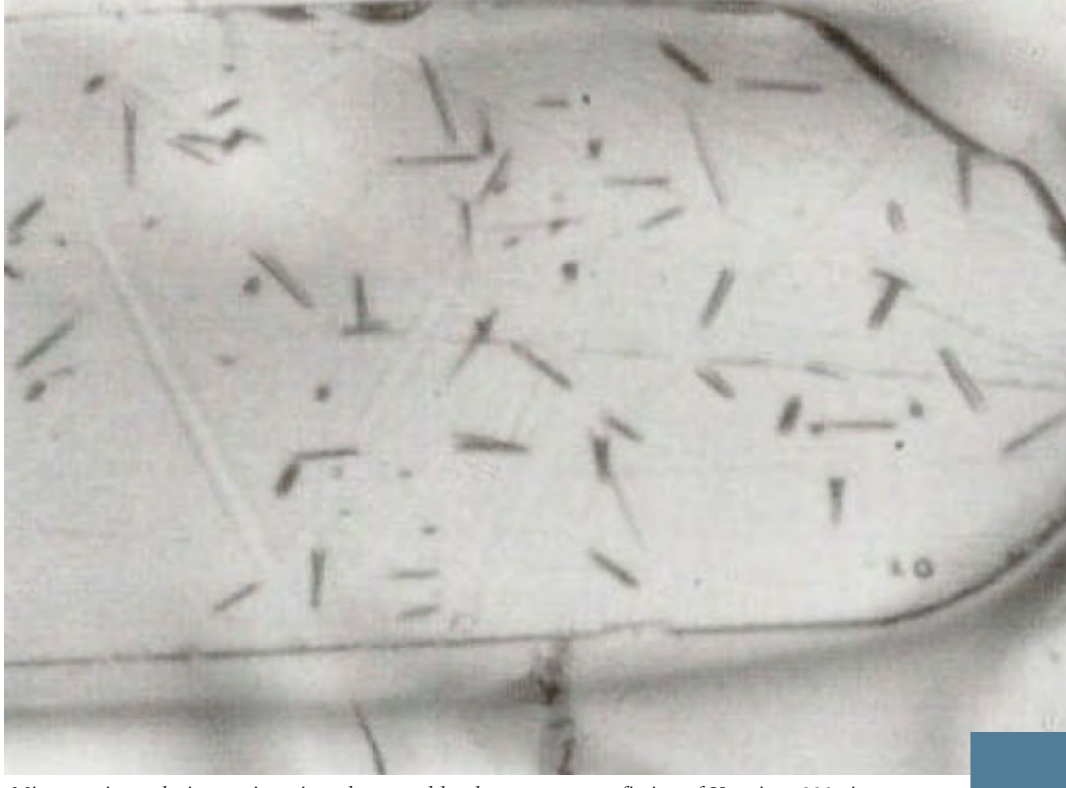
"This was a rock sitting around on Mars for billions of years, getting hit by a meteorite, being ejected into space, sitting around in space for a while, heating as it falls to Earth, hits Antarctica and sits there," he says. The researcher used his program to infer temperatures on the surface of Mars at the time of ejection, the timing of major events in its odyssey, and what the entry in our atmosphere was like.

"I never had a clue that anyone would do anything remotely similar to that," he says. "It actually made me improve the program in a number of ways, for example so that it could handle billion-year time scales and seconds-long events at the same time. I re-derived the equations and put everything on a much sounder basis and it actually made the program more robust."

Ketcham is also intensely interested in what goes into his software—part of the reason he calls his program HeFTy (think: trash bags) is to remind himself and others of the computer truism "garbage in, garbage out." He created a more accurate means of estimating fission-track annealing rates at geological time scales from laboratory-time-scale experiments, which has become the international standard. More recently, he also helped create a new model for helium diffusivity that accounts for radiation damage in the apatite grain, a leap forward for the (U-Th)/He technique.

## Slice & Dice

Another area in which Ketcham has applied his computer programming prowess is in CT scanning geological and other natural and manmade specimens. As a graduate student at The University of Texas at Austin, he worked with Bill Carlson studying how crystals grow in metamorphic rocks. They took samples to a local company to have them scanned with a computed tomography (CT) scanner. The device uses an x-ray source to collect a series of slice images which can be combined into a 3D image revealing internal structure without cutting into the sample. Ketcham processed the raw CT data, reconstructed where crystals were within the rock and developed models of crystal growth during metamorphism. Because it was unrelated to his Ph.D. work, he says it was like doing a second degree.



*Microscopic tracks in apatite minerals created by the spontaneous fission of Uranium 238 give clues about the thermal history of a sample.*

Several years later, Carlson, paleontology professor Tim Rowe, and anthropology professor John Kappelman began seeking funding to buy an industrial-grade CT scanner for the university. It would be the first such device dedicated to scientific research at a university. They invited Ketcham to run the new High Resolution X-ray CT Facility.

Since then, they have scanned thousands of objects, many of them one-of-a-kind and irreplaceable, such as the braincase of *Archaeopteryx* (the oldest and most primitive bird known), one of the first books printed in the New World, a Martian meteorite believed by some to contain signs of alien life, space probe thrusters, and diamond-encrusted rocks from deep inside Earth. This groundbreaking work has established UT Austin as the leading center for scientific CT scanning. In September 2008, the team secretly scanned Lucy, a fossil skeleton of an ancient human ancestor. (See feature article on page 38.)

## Candy Man

After 11 years running UTCT, Ketcham has become an associate professor. He's handed most of the day to day managing of the lab over to a colleague while continuing in his role as one of three directors of the lab.

"Working in the CT lab is like being a kid in a candy store," he says, referring to the continual flow of world-class specimens to be scanned and interesting problems to be solved. "And 11 years in a candy store is not necessarily healthy."

He wanted a way to impart his practical research experience to students. He was also bursting with research ideas that he realized he would never have time to complete on his own.

"Instructing students in research, you get young energetic minds to follow up on stuff that you just don't have time for or stuff that you're just not going to learn well enough yourself," he says.

One of his favorite experiences so far has been to co-teach an introductory geology course with Leon Long, a legend in the department who has inspired students for several decades.

"Leon has much to teach us about being an effective instructor," he says. "Teaching is an art and I'm just getting started." ✷

# Studying Detachment

## LUC LAVIER UNEARTHS CLUES TO FORMATION OF MOUNTAINS AND OCEANS

As a boy, Luc Lavier grew up in the Burgundy region of France, spending days searching for ammonites among the rocks of ancient oceans and beaches. His explorations sometimes unearthed meter-wide specimens of the fossilized marine shells, so local farmers had to help him remove them.

Lavier has honed his youthful curiosities into an academic career focused on geodynamics, the study of the processes that help shape the formation and structure of continents and oceans. He now holds dual posts at the Jackson School as a research professor in the Institute for Geophysics and an assistant professor in the Department of Geological Sciences.

But Lavier still knows to ask French farmers for help. In 2007, Lavier and Gianreto Manatschal, from the University of Strasbourg, France, were working in the Pyrenees, searching for "detachment faults." Composed of rocks exhumed from dozens of kilometers deep in the Earth's crust, the faults provide clues to the formation of mountains and oceans, but the forested terrain offered few outcrops to study. The researchers found what they were looking for one day when they stopped to buy some goat cheese at a farm. The scientists noticed a barn wall consisting of deformed rock with mixed sediment—signs of detachment fault structures. The farmer pointed them to a nearby quarry where they collected samples for their research.

The computer model developed by the scientists based on their findings changed what we know about the formation of the Pyrenees. More broadly, the modeling, published in the journal *Nature* in 2006, represents a significant step forward in our understanding of the complex formation of oceans and landmasses through rifts and "extreme thinning" of the planet's crust.

"It's not a simple physics project," Lavier says, of computational models based on applied fieldwork. "Once you want to model these processes, you need to develop new numerical techniques."

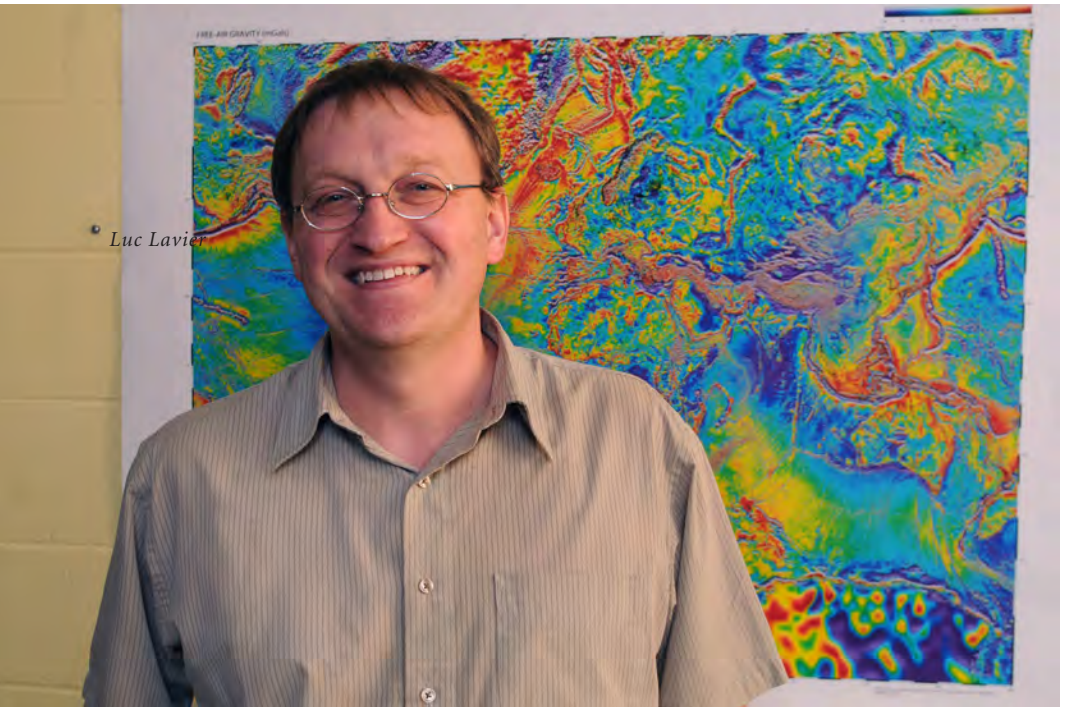
Despite his childhood rockhounding, scholastic influences originally directed Lavier away from the geosciences. Since he excelled at math, his teachers in France encouraged him to study the highly theoretical subjects of quantum mechanics and astrophysics as an undergraduate student. As a graduate student in France, he began concentrating on geophysics, working on oil exploration projects. After dealing with equations and numerical analysis for years, the descriptive nature of geosciences forced him to combine critical thinking with analytical modeling.

"I had to learn a lot of geology really fast," Lavier says. His background served him well, but he also realized that the geosciences require interpretation—and even a little guesswork—compared with the rigid focus of physics.

"You have to have a very broad knowledge base, and it's hard to do that when you're very specialized," Lavier says. "Slowly, you get more than just a descriptive understanding. You get a quantifiable understanding."

The young fossil hunter had found his adult passion, studying how tectonics and other geologic processes influence the evolution of landmasses and oceans. In 1991, he began attending Columbia University and working at the Lamont-Doherty Earth Observatory. Over nearly a decade, he would earn a second graduate degree and his doctorate, becoming an expert in the field of geodynamics.

For several years, Lavier worked at the California Institute of Technology, developing a three-dimensional model that could simulate tectonic processes and the impacts on plate boundaries. He came to The University of Texas at Austin in 2003 as a researcher with the Institute of Geophysics, and joined the Jackson School's faculty in 2008.



*Luc Lavier*

### Critical Detachment

His work studying detachment faults is a prime example of how he continues to use computational assessments to more accurately assess field observations. Detachment faults allow scientists to look at rocks that correspond with formations that are otherwise underground and difficult to study. In the case of deep-ocean rifts, Lavier and colleagues can find and analyze pieces of the former ocean floor thrusted into the mountains to learn more about their origins and compositions.

"Luckily, some of these pieces are now on top of mountain belts," Lavier says. "That's why geology is so important."

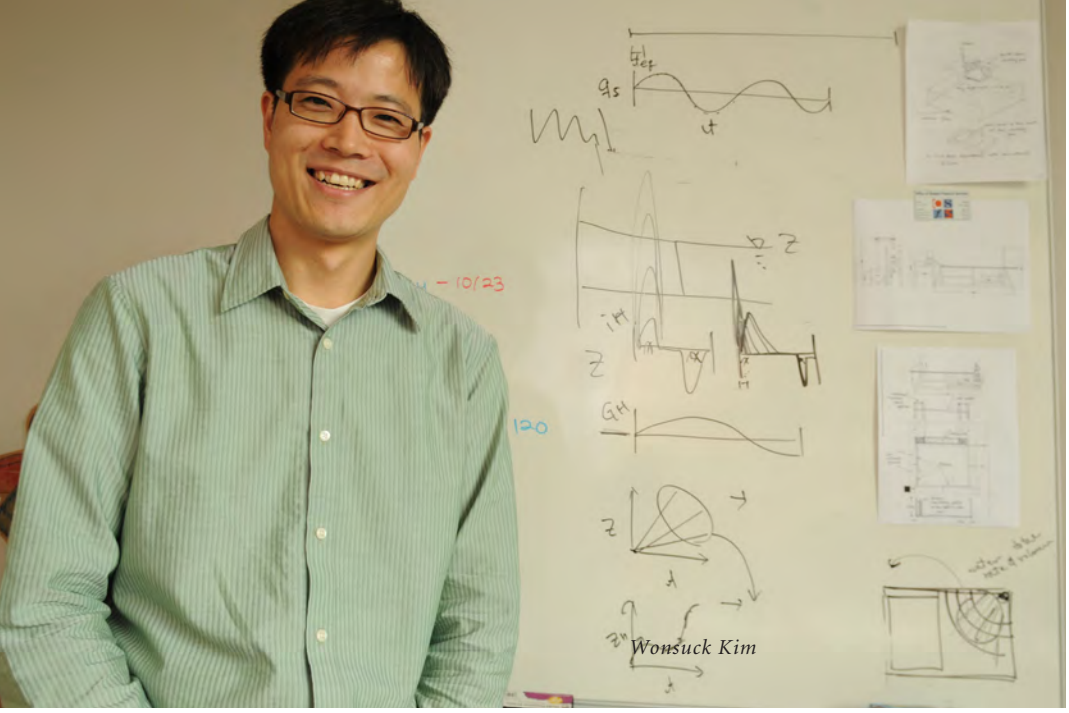
In developing a more detailed picture of past processes and geodynamics, Lavier's work has several applications. Oil geologists can use models of deep-ocean structures and rifts to guide future energy exploration. Lavier and Manatschal now develop models to describe and predict the geological context of potential oil reserves for areas, such as deep-water ocean basins, which are difficult to access through drilling and testing.

Modeling is also helping to reduce seismic hazards. Lavier is part of TAIGER, an international team of scientists looking at how Taiwan formed—and deformed—to better understand recent earthquake activity. Lavier's models for the large-scale project help show how geologic history dating back millions of years connects with current seismic rumbles.

At UT Austin, Lavier has teamed with scientists from the Cockrell School of Engineering to create 3-D models that can help show major and minor fault lines and zones, and simulate their strength over time. He is also a board member of the Computational Infrastructure for Geodynamics, a professional group funded by the National Science Foundation, to advance software modeling for geophysics.

And every now and then, he still gets to go home and collect rocks in Burgundy. ✷

*By Joshua Zaffos*


Wonsuck Kim

# Simulating Nature

## WONSUCK KIM MOVES FROM VIRTUAL TO PHYSICAL MODELING

At the J.J. Pickle Research Campus, a few miles from the main University of Texas campus, Wonsuck Kim is ready to set up a grand, new scientific toy. The Jackson School of Geosciences is funding the construction of a flume tank, a large experimental fluid container that will be roughly the size of half of a volleyball court. Once it's completed in summer 2010, Kim and his colleagues will be able to fill the flume tank with water and sediment to simulate how shorelines and deltas take form. Consider it the geoscientist's equivalent to playing in a really big bathtub.

Kim says the tank at the Pickle Research Campus will be one of just three in the world with computer controls that can move and manipulate the unit's floor to replicate tectonic subsidence and its impacts on river basins.

"I think the Jackson School is one of only a few schools that can support such huge experiments," says Kim, an assistant professor and a research fellow with the university's Institute of Geophysics.

Kim started in his career in geosciences in front of a computer. As a master's student in South Korea, he completed a three-dimensional computational model for sediment transport. The project involved spending two years of reading computer code, and when he was done, Kim was ready for a new challenge—away from a computer.

He found a new spark after he was introduced to physical modeling when he started his doctoral program at the University of Minnesota in 2002.

"Once I saw the physical experiment, I just loved it," Kim says. "Even a supercomputer cannot model these kinds of things yet."

Experiments with flume tanks and physical modeling put Kim and others at the controls of geologic simulations. Using basic variables that simulate tectonic subsidence, sea level, and sediment input, scientists can observe patterns, like the migration of shorelines, the infill of deltas, and the morphology, or changing patterns, of stream channels.

The results are a sort of bird's eye view of these different geologic processes, what Kim refers to as the "evolutionary architecture of sedimentary basins." The models allow Kim to read the stratigraphy, or rock layering, of a landform, while also applying quantitative methods from computational assessments.

### What's Inside Counts

Previous flume experiments by Kim have produced a "striking" revelation about the role of "autogenic," or internal, processes, such as river avulsion (the shifting of a stream's path) or the natural cutting and filling of a valley, on the formation of deltas. Stratigraphic scientists have studied the impacts of "allogenic" forces—subsidence, sediment and sea level—but Kim's work has demonstrated that the internal elements are essential to correctly deciphering the impacts of forces in sedimentary records.

"One of the very difficult problems we have in traditional basin interpretation using outcrop studies or seismic lines is it's very hard to distinguish the signature of external forces from internal processes," Kim says. "We have a lot to do to understand how the autogenic processes are working in delta systems."

Kim is hoping his tank experiments will help clarify the level of influences from different factors. His work with the new flume tank should produce measurements of the timing and speed of autogenic processes, in a manner we could never observe through field experiments. The results should add to the pool of scientific knowledge on stratigraphy and could have applications for petroleum exploration.

Flume experiments, and their detailed measurements, could also help bridge a division in the field of sedimentology, says Kim. Within the discipline, researchers recognize that siliciclastic (weathered or eroded) materials will form dendritic, or branching, river patterns; formations from carbonate materials will form terraces and cascading dams. Kim is expanding his research with flume experiments to study carbonate sedimentology: He recently has done initial laboratory experiments simulating limestone precipitation in Yellowstone National Park. Once the flume tank is functional at the Pickle Research Campus, Kim wants to model for the emergence and formation of both types of sedimentary structures through tank simulations. The results may even add a new chapter to the sedimentology textbooks.

"I'm very excited about what we can learn from these experiments," Kim says. ✷

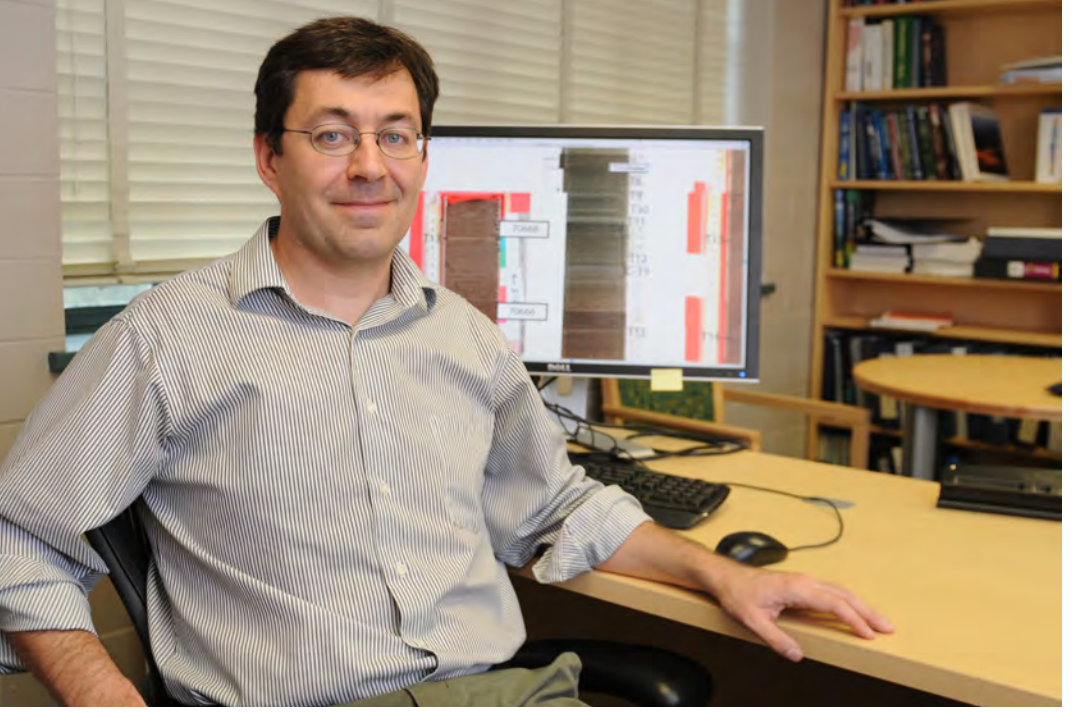
*By Joshua Zaffos*



### Cuts to Levees Could Help Rebuild Mississippi Delta

***Eos*, Oct. 20, 2009**

As this edition of the *Newsletter* was going to press, Kim was in the news for a study he led suggesting that diverting sediment-rich water from the Mississippi River below New Orleans could generate new land in the river's delta in the next century. Kim led the research project and co-wrote an article on its finding with fellow research team member David Mohrig of the Jackson School. Look for a complete write-up on our Web site and in the 2010 *Newsletter*.



SCIENTISTS

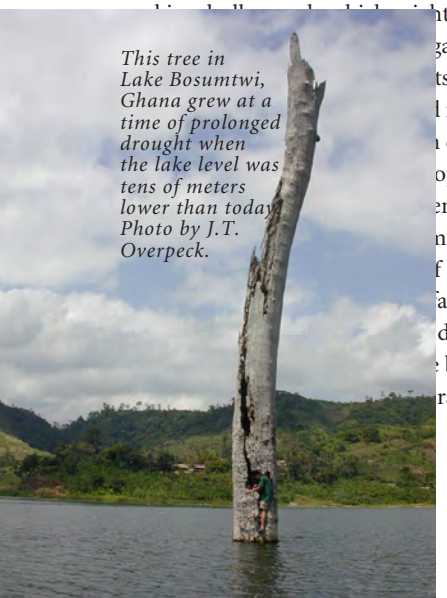
# Paleoclimate Sleuth

## TIM SHANAHAN USES ORGANIC GEOCHEMISTRY TO UNCOVER THE PAST

Tim Shanahan is a paleoclimate detective. He collects sediment samples from lakes and seas to reconstruct what ancient environments and climates were like. The techniques he uses, collectively known as organic geochemistry, trace back to the oil industry where they were used to characterize different types of oils and to better understand the environments in which their source materials formed. Since then, the field has exploded and the techniques have been applied to a broad range of questions in the earth sciences.

Organic geochemistry uses compounds called biomarkers produced by living things and left behind in the environment that provide clues about what those places were like at specific times in the past. Shanahan and others use mass spectrometers to measure the abundances, ratios and flavors of various biomarkers in ancient sediments.

Until very recently, the techniques were limited by the complexities of organic materi- ht include com- gae, bacteria, ts, and aquatic l in a chaotic compound opic composi- emely difficult nation about f organism or factor. More developed that by just one ratios of differ-



*This tree in Lake Bosumtwi, Ghana grew at a time of prolonged drought when the lake level was tens of meters lower than today. Photo by J.T. Overpeck.*

ent isotopes within those compounds.

"We can separate out a tree compound and we can look at the carbon isotopes in that," he said. "This can give a wealth of information about the types of organisms that grew in these systems, what kinds of metabolism they used, and what conditions they lived under."

As a doctoral student at the University of Arizona in Tucson, Shanahan traveled to Ghana in West Africa to study sediments at the bottom of a deep water-filled meteorite impact crater called Lake Bosumtwi. He and his colleagues reconstructed the year-by-year history of droughts and monsoons in the region going back 3,000 years. They found numerous droughts that lasted 30 to 60 years, some comparable to the devastating Sahel drought of the 1970s and 80s, which killed more than 100,000 people and displaced many more. Surprisingly however, these decades-long droughts were dwarfed by far more severe megadroughts lasting three to four times as long.

He and his colleagues suggested that human induced climate change might speed the arrival of the next megadrought in West Africa. They warned such a shift in climate would be extremely hard for people to adjust to. Many top national and international media outlets covered the story, giving him his first taste of intense media attention.

Shanahan received his Ph.D. from the University of Arizona in Tucson in 2007 and took a position as a post doctoral researcher at Woods Hole Oceanographic Institution (WHOI) in Massachusetts where he continued the analysis of his Lake Bosumtwi samples and learned additional organic geochemistry techniques.

Scientists have discovered that certain microbes change the structures of the organic molecules that make up their cell membranes to adjust to changes in environmental conditions such as temperature. Shanahan used a technique based on changes in the cell membranes of a widespread microbe called *Crenarchaeota* to estimate past temperatures of ancient lakes in Africa and South America.

Shanahan came to the Jackson School as an assistant professor in January 2009. He is now setting up an isotope mass spectrometry lab where he plans to analyze biochemical markers from lake sediments at new research sites, continuing to answer questions about how environments have changed in the past. He said he came to the Jackson School because of its strong reputation in geoscience research and education and the diversity of researchers across the school's three units. His wife, a UT Austin alum working in the oil industry, was also a big influence in his decision.

Shanahan is starting work on a new project to determine at what times in the past the Arctic ocean had sea ice or not. The technique was developed by researchers in the U.K. who observed that diatoms living in sea ice exhibit a unique structural change in their membrane lipids, fatty molecules that provide structure to their cell walls. These changes come about because of temperature stress and a change in nutrients. Shanahan and a colleague at Woods Hole Oceanographic Institution have applied for funds from the National Science Foundation to look at a series of sediment cores from the Bering Sea and the Chukchi Sea and use the abundances of these compounds to reconstruct past changes in sea ice cover in the region over the past 6,000 years.

"Recent changes in sea ice over this region have been dramatic and this work would help us to better understand how anomalous the rate and amount of sea ice change over the past few decades actually is, in comparison with the last few thousands of years," he said. ✷

# Media Monsoon

## Africa + Mega-Droughts + Climate Change = Lots of Media Experience for Tim Shanahan

*Boys from nearby villages practice traditional fishing methods on Lake Bosumtwi. Large tropical trees submerged in 15-20 meters of water provide evidence that severe, long-lasting droughts occurred just a few centuries ago. Photo by J.T. Overpeck and W. Wheeler.*

In the 1970s and 80s, a devastating drought hit the Sahel region of Africa, a semi-arid band along the southern edge of the Saharan desert. According to a 2002 report by the United Nations Environment Program, the drought killed more than 100,000 people and displaced many more. The population, mostly farmers and ranchers, is particularly vulnerable to drought because they rely on three months of summer rainfall to survive.

As a doctoral student at the University of Arizona in Tucson, Tim Shanahan collected evidence from a West African lake to reconstruct the past 3,000 years of that region's climate. He and his colleagues determined that far worse droughts are within normal climate variation for the region. In that period, droughts lasting 30 to 60 years were common. Surprisingly, however, these decades-long droughts were dwarfed by far more severe megadroughts lasting three to four times as long.

"What's disconcerting about this record is that it suggests that the most recent drought was relatively minor in the context of the West African drought history," said Shanahan, now an assistant professor in the Jackson School of Geosciences.

As global warming progresses, the increases in temperature may exacerbate the normal climate pattern, producing even more severe and prolonged droughts than those of the past.

Shanahan and his colleagues reported their results in the April 17, 2009 issue of the journal *Science*. The story garnered extraordinary media attention. Perhaps it was because the record of past climate recasts this recent catastrophe as a small taste of what might be in store in the future, not just in Africa but in other already water stressed parts of the world such as the Southwestern U.S.

The discovery and its implications for the people of sub-Saharan Africa were reported by a wide range of media outlets including the *New York Times*, *New Scientist*, Associated Press, BBC News, BBC World Service (radio), *Discover*, Voice of America, *Los Angeles Times*, and Reuters. A public affairs representative at the National Science Foundation (NSF), which funded the research, was so enthusiastic about the study's results that he organized a rare teleconference for reporters to call in and ask questions of the paper's authors.

*The New York Times*' top climate reporter, Andy Revkin started an email discussion between the authors and several climate and policy experts, including prominent climate skeptics, at one point discussing whether or not a paleoclimate study such as this has value in making policy decisions. Revkin posted the whole discussion online in a blog format. Shanahan said a couple of his university colleagues used the discussion in their classes to illustrate healthy scientific debate.

As a young scientist who hadn't made much of a name for himself yet, it was Shanahan's first time dealing with such intense media attention. He worked closely with the public affairs staffs at the Jackson School and University of Arizona to prepare a press release and participate in the NSF teleconference. He spent a lot of time thinking about how he would frame his research and answer reporter's questions, especially the hard ones. He even canceled a planned research trip so that he could be in town during the week of the announcement to talk with reporters.

"I learned how proactive you are or are not can make a big difference in whether you get good coverage or whether you get any coverage at all," he said.

He acknowledged that scientists tend to shy away from self promotion, but he said it's worth all the hard work to collaborate with the media. And not just because it can help bring in more research dollars, although it can help.

"It's important for the people who are paying for this work with their tax dollars, who are not going to read *Science*, to actually see what we're doing with the money," he said. "Also, I think it's important that our alumni see that we're doing interesting and impactful research that makes a difference."

He learned to be flexible when the BBC World Service interviewed him remotely for a radio broadcast. President Obama had just made a major announcement about a new policy regarding prisoners at Guantanamo Bay and so they had a hard time finding a reporter who was available to interview him.

"They were very nice about it and they were apologetic and they did find someone and did do the interview," he laughed. "But obviously things come up. They can't skip the news release on Guantanamo Bay prisoners for my African climate story."

# SUMMER FIELD CAMP

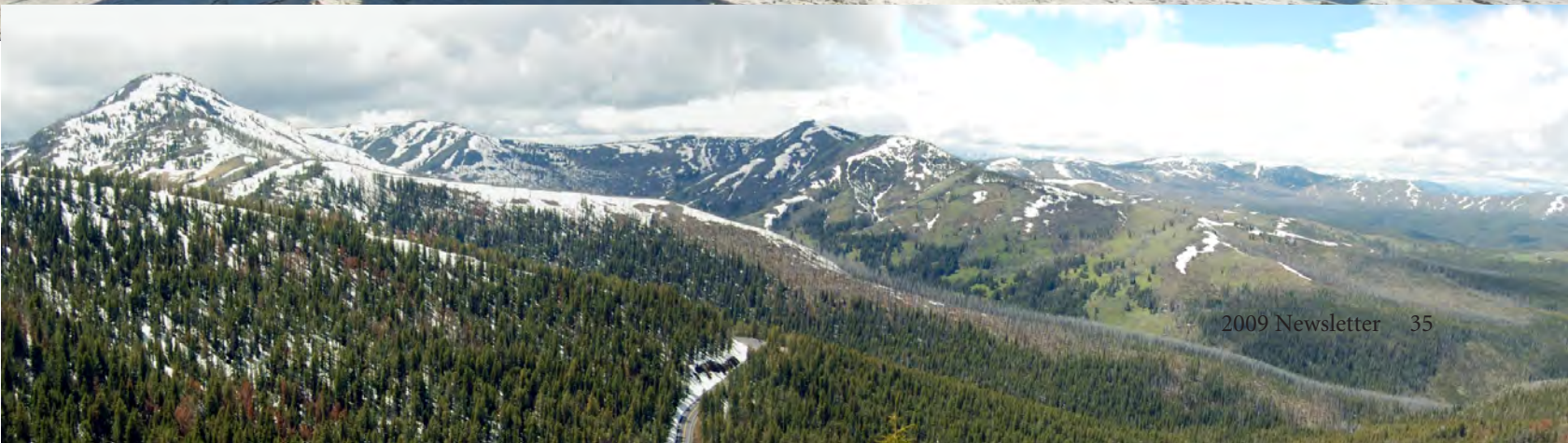
## GEO 660 Summer Field Camp 2009

*Clockwise from top left (both pages): Jessica Schilling striking and sippinig, Goose Egg Dome, Greybull, Wyoming; Mark Helper (second from left) and Randy Marret (far right) talk to students at Sandy Hollow, Dillon, Mountana; David Mohrig leads a discussion at White Sands, New Mexico; Yellowstone National Park as seen from Washburn Mountain, Wyoming; Lesli Wood discusses the subtledties of the Sego Sandstone, Book Cliffs, Colorado; Nick Perez strikes a pose, Dark Canyon, Carlsbad, New Mexico.*

*Center (top to bottom): Carlsbad Caverns, New Mexico; desert cactus flower.*

*All photos by Miriam Barguero-Molina.*

SUMMER FIELD CAMP



# Evolutionary Treasure

## University Scientists Scan Lucy, World's Most Famous Fossil

By Marc Airhart

An estimated 210,000 people came to the Houston Museum of Natural Science to glimpse the world's most famous fossil, Lucy, the remains of an ancient human ancestor who lived 3.2 million years ago. It was the first time Lucy had left Ethiopia in 30 years.

*By combining 800 CT slices through Lucy's jaw bone and teeth, scientists can now fly through a 3-D reconstruction and see interior details such as tooth enamel thicknesses. Dark colored material represents the glues and plasters originally used to reconstruct the fossil. Images: Rich Ketcham and Jessie Maisano.*

She lay in a glass case on a pedestal in the center of a dim room, each bone fragment cradled by recesses in a black foam bed and glowing in the beam of accent lights. Her place of honor in the museum befitted her scientific significance, having revealed key insights into how humans evolved. Her new surroundings would have been completely alien to her, like Joan of Arc beamed up to the Starship Enterprise. One visitor commented that it seemed like a miracle that these fragile pieces of fossilized bone survived for millions of years and were ever discovered,

**"It's the most famous fossil in the world," said Ketcham. "Everybody's going to see the scanned data and everyone is going to know it got scanned here. It doesn't get bigger than that."**

sitting in the dirt in the harsh environment of northeast Africa where one good rainstorm can scatter fossils across the landscape and wind and sand can polish them to oblivion.

In September 2008, after a year on display, Lucy was carefully packed up and shipped off to Seattle for the second public stop on a grand tour of the U.S.

What most people didn't know is that after leaving Houston, this ancient and irreplaceable fossil took a little detour along the back roads of Texas. For 10 days, in a non-descript basement on the University of Texas at Austin campus, scientists carefully analyzed the fossil fragments with equipment that would have made television's CSI team jealous.

## Slice by Slice

Most people are familiar with the medical instrument known as a CT (computed tomography) scanner, a device for making three-dimensional images of the inside of the human body. The patient lies inside a cylinder and an x-ray source rotates around their body, shining a beam through the patient to a series of detectors. A computer collects a series of "slice" images and combines them into a 3D image that can reveal—without surgery—tumors, blocked arteries, kidney stones, and other features of medical interest. Scientists also use specialized CT scanners to investigate the insides of geological, paleontological, and cultural objects without cutting into and damaging them.

Scientists at The University of Texas at Austin's High Resolution X-ray CT Facility (UTCT), which is housed in the Jackson School, have scanned thousands of objects, many of them one-of-a-kind and irreplaceable, such as the braincase of *Archaeopteryx* (the oldest and most primitive bird known), one of the first books printed in the New World, a Martian meteorite believed by some to contain signs of alien life, space probe thrusters, and diamond-encrusted rocks from deep inside Earth. The UTCT, a National Science Foundation shared multi-user facility, houses the first industrial CT scanner in a science department anywhere in the world.

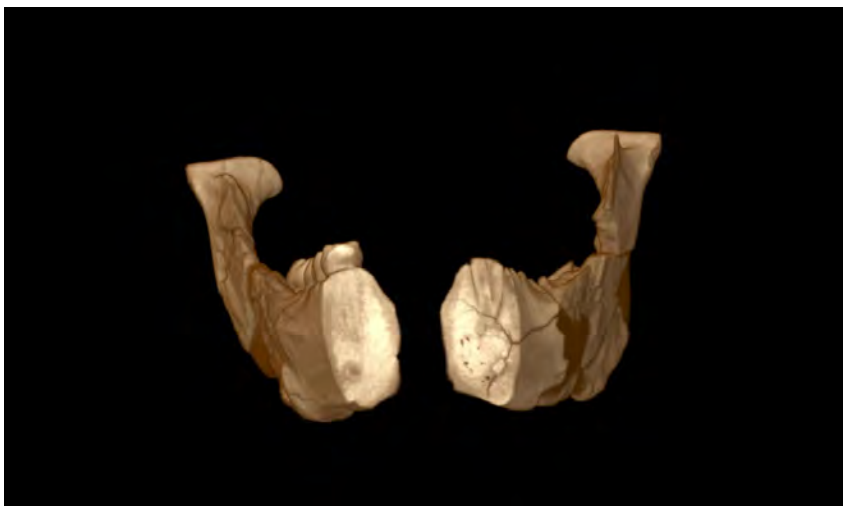
Rich Ketcham, an associate professor in the Jackson School of Geosciences and director of the UTCT, headed the technical team that scanned Lucy.

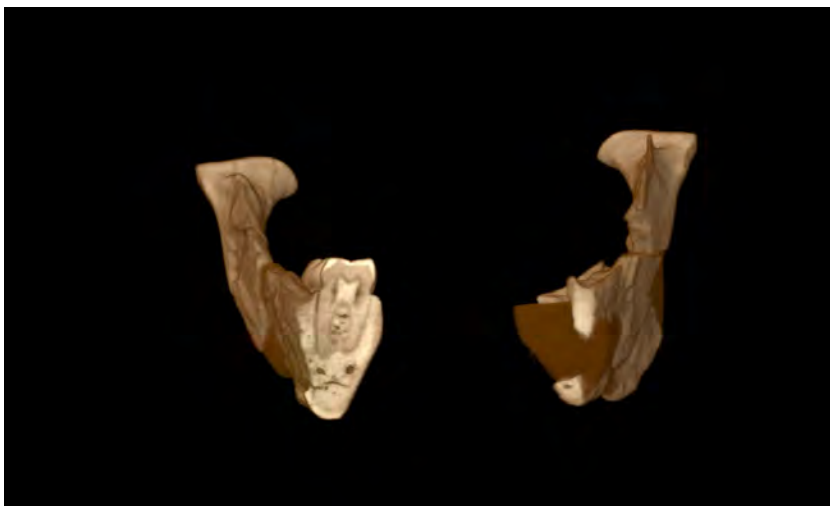
"We have more experience scanning natural history objects and dealing with the issues that can arise in scanning natural material than any other lab in the world," said Ketcham. "The equipment is constantly updated and we've created a large, specialized toolkit to process the

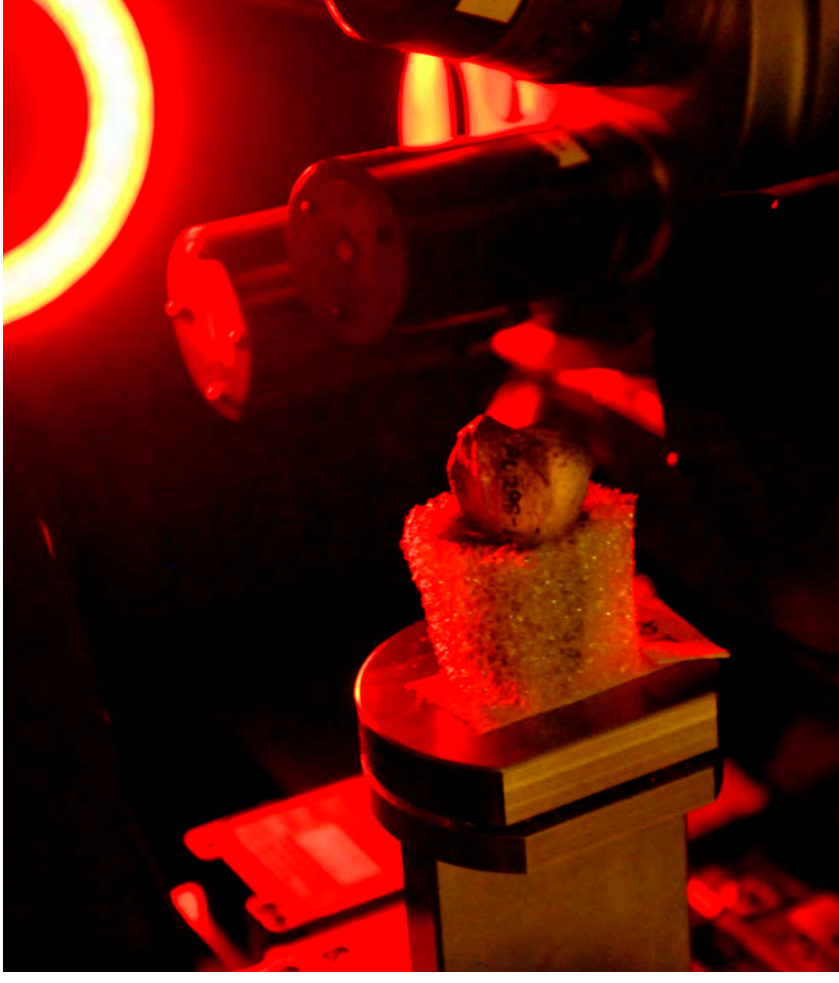

Top: *Members of the scanning team included (from left) Ron Harvey, conservator, Lincolnville, Maine; Alemu Admassu, curator, National Museum, Addis Ababa, Ethiopia; John Kappelman, UT Austin; and Richard Ketcham, UT Austin.* Bottom: *Casts of Lucy's bones used for teaching.*

scan data and to extract the maximum amount of information from it. There's no other place the Ethiopian government could have sent Lucy to get better imagery or to acquire it more safely."

The set of fossils making up Lucy are about 40 percent complete, and for years she has been considered the oldest and most complete fossil skeleton of any adult, erect-walking human. (As this article was going to press in fall 2009, scientists published their evaluation of a comparably complete fossil skeleton of an even more ancient and primitive human ancestor nicknamed Ardi.) Lucy represents a distinct species of human ancestor, known as *Australopithecus afarensis*, meaning "southern ape of Afar," referring to the region in Ethiopia where the fossils were discovered. The hominid fossil record is patchy, but it's thought that *A. afarensis* thrived from about 3.7 to 3 million years ago. Since then, several hominid species emerged and died out leaving only us *Homo sapiens*. Seeing Lucy in person, many people make an emotional connection. She becomes a tangible part of our own history.







*Above left: Cast of Lucy's skull on display at the Houston Museum of Natural Science. Above right: Several of Lucy's skeletal elements, including the right distal radius (arm bone) were scanned with an ultra high-resolution Xradia MicroXCT scanner. Custom-built foam mounts were constructed to safely hold the specimens in the scanner. Photo: Marsha Miller.*

Evidence from fossils and DNA suggest that modern humans and our closest living relatives, the chimpanzees, evolved from a common ancestor around 6 or 7 million years ago. Two of the characteristics that set us apart from chimps are our relatively big brains and our ability to walk upright for long periods. Before Lucy, anthropologists debated which came first in human evolution. Lucy turns out to have been an upright walker with a relatively small brain, which indicates that larger brains came later.

Ketcham and others hope the latest scans of Lucy will reveal even more about how she used her arms and legs and what she ate. They've combined the slices into three dimensional models of each fragment. They can rotate those models on a computer screen, fly through them, and measure different features. They can start to answer questions that weren't possible before. Plus, they can safely make castings—often a dangerous process—without touching the originals.

Even with the great track record of the UTCT and all the amazing items that have come through the door, Ketcham said Lucy just might top them all.

"It's the most famous fossil in the world," he said. "Everybody's going to see the scanned data and everyone is going to know it got scanned here. It doesn't get bigger than that."

## If Bones Could Talk

Ketcham has collaborated for several years with John Kappelman, a professor of anthropology at the university. Working on a range of primates, they've studied trabecular bone, spongy material inside bones that makes them both light and strong.

"If you're a meat eater and you've ever cut through a piece of steak with a bone on it, chances are you've seen spongy bone in the middle of a bone cross section," said Kappelman.

Its orientation varies depending on how the bone is used during life and what forces it experiences. The two researchers have studied spongy bone in a wide range of primates learning, for example, how it looks in the arms of an animal that spends lots of time swinging from tree branches or how it looks in the legs of animals that leap.

"The high resolution CT scan permits us to look at those orientations of the spongy bone in three dimensions and we can then estimate the forces and orientations of the forces that passed through those limbs," said Kappelman.

Lucy clearly walked on two legs, which suggests she spent a lot of time on the ground. But her bones reveal some traits more similar to tree-dwelling primates. Now, by looking at the spongy bone in Lucy's arms and legs, Ketcham and Kappelman have a rare opportunity to better understand how she used her limbs. Kappelman said even more clues can be derived from studying the thickness of denser cortical bone in the long bones of the arms and legs.


"So we can learn whether she was doing more pulling up when she was climbing or hanging somewhat when she was in the trees and also the kinds of forces transmitted through the leg when

she was walking," said Kappelman.

Ketcham said Lucy's teeth might also reveal clues about what she ate. He noted that each tooth has now been scanned in three dimensions at a resolution of about 30 microns, roughly the thickness of a human hair.

"We've given Lucy the best dental x-ray in history," he said.

## Handle With Care

The UTCT is on the bottom floor of the Jackson Geological Sciences Building on the main university campus in Austin. Its location among other labs and storage rooms is so discrete that visitors sometimes have a hard time finding it. A special alarm system and safe were installed and security guards were hired just for Lucy's visit. The fossil's presence was a secret to all but a handful of people involved with the project.

It took Ketcham and his colleagues 10 days to scan Lucy's 80 bone fragments, working nearly around the clock with two scanners—one for larger pieces and another for smaller ones. To scan each piece was an elaborate process:

First, they measured, weighed and compared a piece to reference images to be sure that it had not been damaged in transit. The fossils were only directly touched by an Ethiopian handler.

Second, they made a custom foam mount for each piece, or sometimes a set of smaller pieces, so it could safely sit and rotate in the CT scanner without being damaged and to dampen vibrations that would blur the images.

Third, they placed the fossil fragment in the scanner and shut the heavy lead-shielded door. Inside, an X-ray source shines a beam through the sample to a detector on the other side. The detector receives a thin slice of information about structures within the sample. The sample rotates so that over time, thousands of slices are collected.

Fourth, the specimen was reassessed to be sure it wasn't damaged during scanning. Then they packed it up, retrieved another specimen, and started the whole process over again.

Ketcham said that for years, he and Kappelman and his students have compared CT scans of different kinds of monkeys to see if they could tell ones that were leaping from ones that were swinging from trees from ones that were walking on all fours.

"We always joked that we did this because some day Lucy would come through the door and we could scan her and compare her to the others," Ketcham said. "It was just a joke because there was no chance that Lucy would ever be brought out of Ethiopia to get scanned. It was just impossible." Well, now the impossible has happened. ✷

# The Girl with Kaleidoscope Eyes: The Beatles' Role In CT Scanning

It's widely known that Lucy got her name from a Beatles song, "Lucy in the Sky with Diamonds." It's the song that paleoanthropologist Donald Johanson and his collaborators were listening to around the campfire in a remote Ethiopian field camp the night of the fossil's discovery. Its upbeat and surreal vibe must have matched the mood of the discoverers. Less well known is the way in which the song also helped make it possible to CT scan Lucy 34 years later.

The Beatles recorded their studio albums for Paralophone, a record label owned by EMI (Electric & Musical Industries Ltd.). Fans gobbled up millions of copies of their records. EMI, a British corporation founded in 1931, in addition to producing records, also conducted basic scientific research and developed electronic devices including audio recording equipment, radar instruments, guided missiles, computers, television cameras, and broadcast equipment. Sir Godfrey Hounsfield, an engineer working at EMI's Central Research Laboratory near London, invented the first commercially viable CT scanner.

In 1971, a patient suspected of having a brain cyst of unknown location became the first medical patient to be scanned with the new device. Miraculously, the CT image clearly indicated the cyst's location. (In earlier trials, Hounsfield practiced on the head of a cow that a colleague brought him from a slaughterhouse.) The CT scanner has gone on to become an indispensible tool in hospitals and clinics around the world as a way to safely look inside the body of a living person without the risks and suffering associated with surgery. Hounsfield shared the 1979 Nobel Prize in Medicine for the invention.

However indirectly, the astronomical profits EMI gleaned from the Fab Four's record-setting career helped create the technology that would one day make possible entirely new discoveries about the world's most famous fossil.

Thank you John, Paul, George and Ringo!

# FLY ME TO THE MOON

## GEOLOGISTS WORK WITH NASA TO SIMUATE LUNAR EXPLORATION

BY MARC AIRHART

Mark Helper looked out the windshield of his pressurized lunar rover at a gray otherworldly landscape that stretched in every direction as far as he could see. With time running short, he and his teammate drove on across the rubble strewn floor of a vast impact crater. They stopped and Helper used the vehicle's robotic arm to pick up a rock and hold it in front of the windshield to examine with a flashlight. He quickly decided it wasn't what he wanted and moved on. Occasionally, when he found something especially interesting, he would don a pressurized spacesuit and step out onto the surface for a closer examination.

Along with his numerous field geology skills, Helper had to use a dash of imagination. The crater was not actually on the moon, but instead an island in the Canadian High Arctic. The lunar rover was actually a Humvee and the spacesuit a non-pressurized mockup. The robotic arm was a guy following along who bent down, picked up a rock, and held it in front of the windshield.

It was, as Helper described, a "low fidelity" simulation of a real moon mission. Yet experiments like this are invaluable as scientists try to understand what preparation will be required for astronauts to live and work on the moon and eventually on Mars. Sure, he could have just opened the door of the Humvee and leaned out to pick up a rock, but he wouldn't have learned half as much.

"I had much more of a sense of what those guys on the moon faced during Apollo and what these astronauts are going to face compared to what I was used to as a field geologist," said Helper.

### ROBOTS ARE YOUR FRIENDS

Haughton Crater, a 20 kilometer wide depression on Devon Island, was created by a meteorite impact about 39 million years ago. Because it's cold, dry, dusty, and lacks any significant vegetation, scientists consider it a good analog for Mars and the moon.

In 1997, planetary scientist Pascal Lee started the Haughton-Mars Project (HMP), an international field research project focused on Earth processes, impact cratering and life in extreme environments, as well as evaluating technologies and strategies for future missions to the moon and Mars. Each summer, scientists from around the world participate in studies at the HMP Research Station.

Helper, a field geologist in the Jackson School of Geosciences, was invited by NASA to fly to the HMP research station this past July to simulate geological traverses on the moon. He had never visited the site or read the scientific literature. He went in with blinders on. The goal was to imagine himself as an astronaut visiting a site on the moon for the first time and try to conduct a realistic geological survey with only some basic remote sensing data, such as might be available for the moon from orbiting spacecraft. As on the moon, there would be constraints on how long he could spend driving around on the surface, how far he could drive, how long he could spend out of the vehicle in a spacesuit, and a whole laundry list of other restrictions.

In addition to having a pressurized rover, one big difference between the Apollo missions and a future lunar mission is that astronauts will be able to deploy robotic rovers with a suite of geophysical and geological instruments to help with the work. The three year research project Helper is part of is largely aimed at figuring out how best to use robots to follow up on human exploration in a way that boosts the efficiency of scientific research.

"Along the way, I tried to think about the kinds of things you could set aside for a robotic rover if you didn't have time to do them," he said. "And then next year, we'll go back with a rover and try to check things off the list."

On the moon, humans might do the initial scouting, looking for interesting clues about the geology, and then based on that, give a robot instructions to go out and do the slower, more tedious "clean-up" work. Much of that could be done after the humans have headed back to Earth.

NASA's Constellation program is designed to create a new spacecraft system for low Earth orbit, return humans to the moon, and eventually make that first historic footfall on the red planet. A panel convened this year by President Obama found that without increases in funding or new partnerships with other countries or private com-

*Top: When humans return to the moon, they'll have a new tool for exploration: robots. Mark Helper is trying to better understand what humans do best and what can be left for robots to do. Middle: Haughton Crater, a meteorite impact site in the Canadian high Arctic, is cold, dry, dusty, and lacks any significant vegetation, making it a good analog for Mars and the moon. Photo by Pascal Lee. Bottom left: Next summer, the team will use K10, a robot equipped with cameras, 3-D laser scanners and other instruments, to conduct a robotic follow-on to Helper's geologic traverse. Bottom right: "I had never tried to do field geology sitting in a vehicle," said Helper. "I was actually quite surprised at what I could accomplish."*

panies, the agency would be forced to delay a return to the moon. Still, scientists continue to prepare for what they feel is an inevitable return.

### STUCK BEHIND THE WHEEL

Helper said as with any field work there were setbacks. The team got the vehicle stuck up to its axles in a part of the permafrost that had melted and softened up. They were forced to "break the sim" for a few hours as they struggled to release it from the muck. Helper's experience with numerous stuck vehicles on field trips eventually paid off. In addition to his own field research, he's led dozens of student field trips, including more than 20 years of the annual multi-week undergraduate tour of the western U.S. known as GEO 660.

The next day, rain forced cancelation of a full day's work out of safety concerns. Video crews from media outlets also proved distracting at times. But through it all, he managed to learn some valuable lessons. Following protocols already developed for Constellation, Helper could spend no more than a total of three and a half hours out of an eight hour field day in the spacesuit. On top of that, he had to allot 20 minutes to don the suit and another 20 minutes to doff it.

"There's a lot of overhead to put the suit on," he said. "So the question becomes well, how much do I really need to get out and do this stuff and how much can I do from within the vehicle and preserve that 40 minutes of observation time?"

As it turns out, the geology of Haughton Crater, like much of the lunar surface, lent itself to less direct observations.

"That's largely because most rocks aren't in place," he said. Impact craters leave only a partial record of the impact process - much rock is destroyed or ejected great distances. In addition, Haughton Crater was later glaciated, and modern periglacial processes such as annual freezing and thawing have weathered the rocks even further.

"Most of the interior of the crater is rubble-covered and can only be sampled by scooping rocks up from the ground," he added. "Outside the crater, there's not much utility in banging a rock out of an outcrop when you can pick one up from the ground that has already fallen off."

For Helper, it meant doing geology in an entirely different way.

"I thought, I'm a field geologist, I've got to get out and touch the rocks, I've got to be out there thinking about where I'm going to go next," he said. "But in fact, I was pretty amazed at what I could do from inside. I had never tried to do field geology sitting in a vehicle. After having done a detailed plan knowing I was going to be sitting in a vehicle, I was actually quite surprised at what I could accomplish."

He said that bodes well for a mission that integrates humans and robotic rovers.

"That was the big revelation for me, just how much you can do without ever putting a suit on," he said.

### THERE IS ORANGE SOIL!

The only geologist to walk on the moon was Harrison "Jack" Schmitt on Apollo 17 in December 1972. He knows firsthand what it's like to explore a new world on a tight schedule. He and commander Gene Cernan had just begun exploring an impact crater when Schmitt looked at the dust his feet had stirred up.

"Oh, hey," he said excitedly. "There is orange soil!"

Cernan quickly confirmed that his eyes weren't playing tricks on him. It was a strange sight in the midst of a world painted in dusty shades of gray and white. Unfortunately, everything was tightly scripted. Planners back in Houston had only allotted the astronauts 34 minutes before they had to begin their return of more than 4 kilometers to the lunar module.

Schmitt quickly dug a trench revealing additional soil layers of red and black. The two scrambled to take samples and photographs for future study. Then they were off to the next stop, never to return.

"He's often said if he just had a little more time, we'd know much more about the site," said Helper. "The idea of robotic follow up was born from that experience."

Based on the samples they did collect, scientists were able to determine that the colored soils were actually made of tiny beads of volcanic glass spewed out by an ancient fire fountain. Different colors indicated different rates of cooling. They turned out not to be a sign of water as Schmitt had first supposed, but they did hint at a fascinating history.

Scientists thinking about how to make the next generation of lunar exploration more productive believe robotic rovers following up on promising leads is one part of the solution. Another idea is to give the astronauts more autonomy in the first place.

"Geologists don't just go out and methodically pick up rocks, they try to make sense of what they see around them," said Helper. "To do that, you have to have some latitude about where you're going to go next, integrating new discoveries into your thinking and decision making. Even though he was a Ph.D. geologist from Harvard, Jack had very little latitude. If the moon is to be a training ground for Mars, then there has to be a greater degree of freedom for those doing science on the surface. Pressurized rovers and robotic follow up are two ways to provide it." ✷

*Below left: Helper and his team prove that whether you're on Earth or the moon, some things about field work never change. Below right: Able to spend only three and a half hours in the spacesuit, Helper had to figure out "how much do I really need to get out and how much can I do from within the vehicle?"*


# A TRADITION OF TRAINING ASTRONAUTS

For more than half his life, Bill Muehlberger has trained astronauts. He started in 1964 when he took a group of Apollo astronauts to the Marathon Basin in West Texas for a geological field trip. Later, he was asked to be principal investigator for Apollo 16 and 17, the final two manned missions to the moon and the ones in which most of the intense geological work was to be done.

"I didn't even know the size of the moon," he laughed.

To his surprise, almost none of the Apollo astronauts had had even an introductory course in geology. He and his team presented the crews with geologic lectures and took them on field trips to various sites in northern New Mexico, Hawaii and elsewhere, prepared geologic maps of the lunar landing sites, and designed lunar traverses to collect samples and data. While the astronauts were on the moon, the team worked at mission control offering assistance as needed. Taking a two-year leave of absence from the University of Texas where he was a professor, Muehlberger immersed himself in the Apollo missions. In just one year, he estimated that he flew 250,000 miles on commercial flights to attend meetings and other events, or about as far as a one way trip to the moon.

"That's as close as I ever got," he said.

The work was intense, but he said he enjoyed working with extremely bright and enthusiastic people.

After Apollo, Muehlberger trained Skylab and Shuttle astronauts in basic geology so they could take scientifically useful photos from low Earth orbit. While the astronauts are in orbit, scientists on the ground request photos of everything from active volcanoes to forest fires in the Amazon to cities such as Los Angeles to study growth patterns.

Pat Dickerson (Ph.D. '95) began briefing Shuttle crews as a contractor for NASA in 1996. She and Muehlberger collaborated for many years on various projects together and had co-led many field seminars. He invited her to participate in his astronaut field training trips starting in 1997. Soon, NASA began more actively planning for an eventual manned mission to Mars. Dickerson suggested they add geophysical data acquisition to the field trainings to build experience in the kinds of scientific investigations that could be conducted on the surface of Mars.

The geophysical component of the trips, which began in 1999 and has continued with each trip since, has been hugely successful. Each group of astronaut candidates (AsCans) now collects gravity and magnetic data from new sites, and they have revealed subsurface faults that either obstruct the flow of water or act as conduits. This information is helping residents of the Taos valley, including Native Americans of Taos Pueblo, find and manage their water resources.

"One of the most gratifying things for the astronauts, as for us, has been to help real people address real-world problems," said Dickerson.

Dickerson, who is now based at UT Austin's Walter Geology Library, works for GeoRef, the world's largest geoscience database, and continues to co-lead the geological field trips.

In 2006, Muehlberger and Dickerson invited Mark Helper to join them in future astronaut field trainings and to be part of a new organization called FEAT, Field Exploration and Analysis Team, a group of scientists and engineers promoting the role of field geology in the exploration of the moon and Mars. Through his work with FEAT, Helper was invited to be the guinea pig geologist in this past summer's moon mission simulations at Haughton Crater.

And astronaut field training continues. NASA recently selected its latest class of AsCans. Dickerson and Helper are planning field trips for the 13 AsCans for June and August 2010. Those will be similar to past trips, with the addition of a geological mapping exercise in the Jemez Mountains north of Albuquerque, which will be led by Kirt Kempter (Ph.D. '97). Muehlberger is still active in the training, but is glad to see a new generation take the lead. He noted that Helper has done geological field work in northern New Mexico, has taught an undergraduate field course for years, and is adept at geologic mapping.

"He's a great field geologist and teacher," said Muehlberger. "So he was the obvious choice. And besides, I wanted to be selfish and keep it at UT and when I retire not have it banished off to some other place."

*Bill Muehlberger (right) and John Powers (center) examine the largest rock ever returned from the moon, dubbed "Big Muley," at the Lunar Receiving Laboratory in Houston. Photo: NASA.*

*Entering freshmen now start their Jackson School experience with field trips to Enchanted Rock and other central Texas geological sites during the NeoGeo Orientation.*

# Transforming the Geosciences:

## Q&A With Dean Mosher On Her Vision for the Jackson School

In July the university selected Sharon Mosher, chair of the Department of Geological Sciences, as the new dean of the Jackson School. The selection of Mosher, who holds the William Stamps Farish Chair, culminated a national search for a new dean after Eric Barron left to become director of the National Center for Atmospheric Research in July 2008.

Mosher is past president of the Geological Society of America, past chair of the Council of Scientific Society Presidents, and a founder and current chair of GeoScienceWorld, an international journal aggregation for geoscientists. Among her awards and honors she is a fellow of the Geological Society of America, from which she received the Distinguished Service Award in 2003, and an honorary fellow of the Geological Society of London.

"As dean, my goal is to create a cohesive geoscience community that balances academic and research excellence and the broader societal mission of the geosciences," said Mosher. "I believe the Jackson School has the opportunity to make a lasting and transformative impact on the geosciences, becoming a preeminent geoscience institution and meeting the full potential envisioned by Jack Jackson."

This fall, Mosher shared her vision for the school in town meetings on the main UT Austin campus and the Pickle Research Campus, and in meetings with alumni and friends. Below are answers to several of the most popular questions about the school's vision and progress moving forward.

**Q: What is your vision for the Jackson School?**
A: I believe the Jackson School should be doing transformative research that advances the geosciences and we should be providing a world class education for our students. This vision is very similar to what we collectively decided two years ago when we got together as a school and created our current strategic plan. I focus on two main areas, research and education, and everything else comes with it.

As a school, we together agreed on four frontier areas where we wanted to concentrate our efforts, and I don't think they've changed::

- Earth Surface and Hydrologic Processes
- Crust, Mantle, and Core Dynamics
- Climate System Science
- Energy, Environment, and Policy Research

These are major areas of future advances, areas of research where we can make a significant impact and can make transformative changes in the way people view these disciplines, as well as benefit society. They're also areas that build very definitely on the strengths we already have.

**Q: What will it take to move to the forefront in research?**
A: I believe strongly that the Jackson School should be involved in truly transformative research. Most of the major advances in the geosciences are going to occur at the interfaces between traditional disciplines—in research focusing on the interactions and couplings between physical, biological, chemical, and geological processes, and research focusing on the interactions between the Earth's interior, the Earth's surface, the hydrosphere, biosphere, and atmospheric systems. To make major advances in these areas we need to build collaborative groups of faculty, research scientists, post docs, and students working together to address significant problems—fundamental questions

of intrinsic scientific interest as well as problems whose solution will benefit society.

The important thing we've done so far is hire a lot of new, very talented people. The idea behind the hiring was to have catalysts for these sorts of advances in research, people who would work to integrate research across a broad variety of disciplines while building strong collaborations within the school and across the university. The approach is working. You can already see a lot of excitement and new research that's happening—not just from the new people but also from established people working together for the first time. Sometimes these are people at different units who did not even know about each other before.

With all these new people, one area we need to improve is our research infrastructure. The essential underpinning of any premier research institution and graduate program is the research infrastructure. We need world-class facilities, state-of-the-art laboratories, equipment, and computational capabilities that meet the needs of today and tomorrow. We're better off than many peer institutions, but we need to get better, and we need the technical support, the people who are dedicated to managing world-class research facilities.

If we do all these things, our research truly will transform the geosciences. We can make a positive impact on society, and we certainly have the resources to do so.

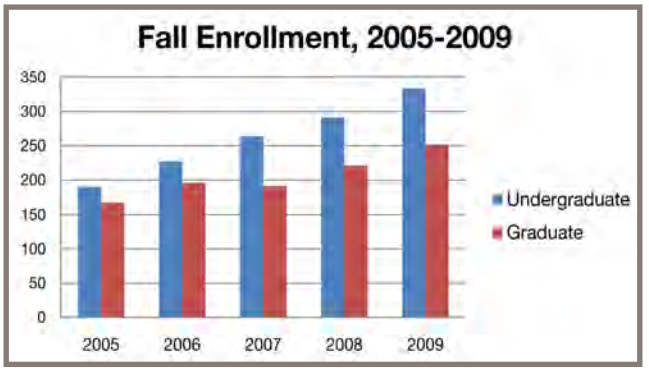
**Q: How can we reach the forefront of education?**
A: Well for starters, by moving to the forefront of geoscience research, we will provide a world-class education for our students. We have already done many things at the school to move to the forefront of education. (See the related sidebar, "Implementing the Strategic Plan: Education.") Here are some areas where we need to continue to focus on improvements:

- Foster research for all of our students, starting at the undergraduate level all the way through the graduate level.
- Strengthen our growing PhD. program.
- Maintain our strong master's program that prepares so many professionals for the workforce.
- Provide a superior undergraduate education.
- Prepare our students for the future with the professional and leadership skills that will allow them to become successful leaders in their field.

**Q: How is the school doing on implementation of its strategic plan?**
A: We are about halfway through the three-year plan. I went through the plan and looked at every single goal, and it's amazing how many of them we have already accomplished.

In terms of research, we had a major hiring initiative. Most people in the school were involved in one way or another. Out of that we had nine theme hires (people in our four major research areas). We had four opportunity or spousal hires, and all but one of those people fit into one of our themes. We changed the appointments of another four people, bringing three research scientists from our units into the faculty and one from the department to the BEG. We had a number of unit specific hires. And through all of these hires, we also ended up increasing our strengths in computational geosciences.

Something that's not well recognized but which we should be proud of is that we went from having one female faculty member, me, to having seven. We did that between last fall and this fall. That has to be a record. And trust me, having been the only female role model for every student coming through this place for many years, we needed it.




The other thing is, if you looked at the Department, you saw a lot of gray hair. We had one assistant professor. Now we have ten. That's made an enormous difference in the dynamics of the Department.

The other thing people don't recognize unless you travel a lot is we made an incredible splash when we put our ads out recruiting all of these new people. And we did it in a very positive way. We had full page ads in *EOS*, *GSA Today*, *AAPG Explorer*—pretty much all the journals in the geosciences. And what did we say? Did we say we're looking for people who specialize in very specific, narrow research areas? No, we said here are four major areas in which we are going to focus our research. These are the fundamental scientific questions we're going to address. If you're interested in these, we want you to apply. It was very broad. That did two things. One, it made it possible for us to add so many young people and so many females. But the other thing it did was to tell the world who we are, what we want to do, and that we're going to do it.

People who come to visit us all have this sense, "Hey this is a great place, this must be an exciting place to be." People who come to inter-

view for jobs, who come to give talks, they all think this is the place to be. Big name people, young people. Well, it is the place to be, and now we have to accomplish what we set out to do.

**Q: Beyond the hiring, how else is the school implementing the plan?**
A: We're in the process of building research facilities at the Pickle Research Campus and the main campus. We have made an effort to retain research scientists and faculty. We've provided baseline support for all Ph.D. scientists. And we have a sabbatical leave policy now for faculty. We've set up a matching policy for research assistants, post docs, and equipment. We've set up new awards for Jackson School accomplishments. The Rapid Response program has been initiated. We've increased collaborations and synergies across the school.

In terms of education, we've increased the field experiences at all levels. We've hired a placement coordinator, and she has really changed the way students look at placement. We've started a career fair which many companies attend. We now have workshops with students on professional skills. Some of our alums come in and help with mock interviews and reviewing resumes. We've built a stronger community with more leadership opportunities across the school. We've made it easier for research scientists at the Bureau and Institute to teach and supervise students. And we have definitely increased alumni involvement. We have our FANs, Friends and Alumni group, and they're incredibly active. They're helping recruit freshman students. They're helping them get internships. And they're very very involved.

**Q: Do you think you will focus more on education or research?**
A: If you want to be at the top in geoscience education, you have to be at the top in research, so I don't think it's a question of one area versus the other, so much as the two areas working together. I know some people are concerned I am very education oriented. I am. There's no question about it. For the last two years it was my responsibility to implement as much of the strategic plan as I could, as a unit leader. And I was the chair of the Department, the Jackson School unit responsible for education, so naturally I focused a lot on education.

I'm really happy that I will now have the opportunity to transfer much of my attention to the research end of our school and the university.

**Q: What are some of the immediate steps forward for the school?**
A: We need to increase philanthropy so that we have more money to accomplish our goals and continue investing in the future. We need to increase youth, in terms of students, in terms of post docs, in terms of younger colleagues, and we need to continue increasing diversity.

But the very most important thing we need to do is invest in the big transformative things.

In terms of some concrete steps we're taking right now, we've hired our first associate dean of academic affairs, to interface with the UT Austin administration and coordinate Jackson School education programs. We are in the process of hiring an assistant dean for business and administrative affairs, an MBA-type who can oversee our finances while helping unite us as a school by streamlining our financial, administrative, and IT functions across all of the units.

I am asking our Strategic Planning Council to do a mid-plan review, to assess what we have and haven't done and what are the transformative investments we can make going forward. Similarly the Endowment Committee will evaluate our spending priorities and assess where we should make development efforts and where we should pursue other sources of funding.

**When we're the place people look to for everything related to the geosciences, we will be successful.**

Lastly, the thing that binds us is our science, so I will have a series of science retreats around topics of interest. Anyone will be able to go and find out what other people at the school are doing and want to do. This is a great way to build collaborations. We recently had a good example of this when Jack Holt organized a planetary science conference for people across campus. Planetary science is not in our strategic plan but it's something people are passionate about, so they do it. We need to continue to have groups of people like this coming together around their common scientific interests.

**Q: As the school moves forward, how will we know when we've succeeded?**
The Jackson School should be the place that everybody looks to in terms of the geosciences. If someone is helping a prospective undergraduate or graduate find the best program in the geosciences, the first place they should send them is the Jackson School. If someone is looking for a new faculty member, a new hire in an earth science industry or in government, they should look to the Jackson School. The same if they need national leaders in the geosciences, whether it's in science or policy. If they have a geoscience problem that is intrinsically important scientifically or important to society, they should look to us first. When we're the place people look to for everything related to the geosciences, we will know we have succeeded.. ✷

## Implementing the Strategic Plan: Education

Since 2007, the school has taken a number of steps to advance its leadership in education:

- Increased field experiences at all levels
- Hired a placement coordinator and started a career fair
- Created workshops on professional skills
- Built stronger community and more leadership opportunities
- Increased teaching by UTIG and BEG research scientists
- Increased alumni involvement

**Undergraduate Level**
- Redesigned curriculum and added inter-college Environmental Science B.S. degree
- Added tutors in calculus, physics, and chemistry
- Started Neo Geo Orientation Field Trip and Critical Thinking Contests
- Started visiting program for prospective students
- Added recruiting scholarships and automatic scholarships for academic achievement
- Increased quantity and quality of students (Fall 2009: 333 students)
- Strengthened Honors Program
- Started Smart Start internship program

**Graduate Level**
- Implemented new graduate student support policy
- Recruited graduate students more effectively
- Increased quantity and quality of graduate students (Fall 2009: 252 grad students, including 127 Ph.D. students)
- Increased professional development and funding opportunities
- Increased graduate supervision by UTIG and BEG research scientists
- Started new student orientation field trip
- Started M.S. Thesis Day and evaluation of Ph.D. tech sessions

*Where pump jacks once sparked the imagination of wildcatters, wind turbines now dot the landscape in West Texas. Both forms of energy, and the science behind them, will be integral to the future of the country's leading energy state.*

# State of Energy:

## With Sound Policy, Green Industry, and Research from UT Austin, Texas Can Remain the Nation's Energy Leader

**By J.B. Bird**

Before there was Saudi Arabia, there was Texas. As the world's original swing producer of crude oil, Texas was able to influence global commodity prices before there was an OPEC. The state loaned its named to the first global benchmark crude, "West Texas Intermediate," and became synonymous with oil and energy. Texas oil production peaked in 1972, and the world long ago began looking elsewhere for its major oil supplies. And yet Texas remains an energy powerhouse. According to the U.S. Energy Information Administration, Texas ranks No. 1 in the U.S. for total energy production from all sources combined, just ahead of Wyoming with its vast stores of coal.

Texas' geology has blessed the state with an array of resources—not just oil, onshore and off, but conventional and unconventional natural gas, coal, even geothermal resources. Houston remains the global energy center, home to more energy companies, and more geologists, than any city in the world.

But what will the future hold? U.S. oil production in the lower 48 states peaked about the same time as Texas production. Natural gas production is expanding in the state, thanks in large part to the Barnett Shale play in north central Texas. But new shale gas finds outside Texas offer stiff competition. Meanwhile concerns about global climate change fuel a political atmosphere proving highly favorable to renewable forms of energy and, it sometimes seems, any forms of energy but oil and gas.

At a time when the state's oil resources are flat or waning and public support is building for carbon-curbing legislation, can Texas remain the leading energy state? Absolutely, believe a core group of researchers at The University of Texas at Austin.

For decades, researchers across the university have contributed to the scientific understanding that has helped so many Texans prosper in energy. Despite its reputation for oil production, Texas became the national energy leader because of its diversity of resources. Today, working in the Jackson School of Geosciences, the Cockrell School of

Engineering, and the College of Natural Sciences, a cadre of researchers are pioneering innovations that will keep Texas at the forefront of energy for decades to come. From wind to solar to better biofuels and cleaner hydrocarbons, they are building the bridge to our energy future.

## Lean and Green

Texans like to think of themselves as the best. Over the past decade, environmentalists have rated the state No. 1, but not in a good way: number one for per capita energy consumption, major environmental complaints, and emission of air pollution and greenhouse gases.

What if the state could add a new ranking: No. 1 in green energy. Sound far fetched? It's not, according to Michael Webber, an energy specialist at the Cockrell School of Engineering and Jackson School of Geosciences, where he is associate director of the Center for International Energy and Environmental Policy. In "Green Star State," an essay Webber wrote for the May edition of *Texas Monthly*, he explains how close Texas already is to becoming the country's green energy leader. (You can read excerpts from the article on page 17 of this *Newsletter*.)

"Texas is already doing much more for clean energy than the world realizes," writes Webber. "I wrote the article to break a myth that the green energy transition will somehow be bad for Texas," he says. "The myth comes in part from our long relationship with the traditional energy industry. We assume that what worked in the past will work in the future, and nothing else will."

In fact, despite its strong connections to the traditional oil and gas industry—and in some ways because of those connections—Texas is already a major player in the emerging economy of clean energy.

The state's early adoption of renewable energy portfolios (requiring utilities to draw certain percentages of their power from renewable sources) helped set the stage for the current success. Today, Texas leads the nation in wind energy by a large margin and has the greatest combined potential of any state for renewable energy from wind and solar sources.

*The Brazos Wind Farm, also known as the Green Mountain Energy Wind Farm, near Fluvanna, Texas. Photographer: Leaflet.*

Most analysts expect traditional fossil fuels to continue to be the dominant form of energy for several decades. In 2007, energy derived from hydrocarbons (coal, oil, and natural gas) accounted for 79 percent of U.S. production, according to the Energy Information Administration. Renewables, mainly hydroelectricity and biofuels, accounted for just under 10 percent. Wind and solar are the fastest growing forms of energy, in terms of annual production, but together they still account for only about 5 percent of the country's renewable portfolio, and half a percent of U.S. energy production overall.

And yet concerns about climate change, pollution, and volatile energy prices have fueled the search for new forms of energy that are less carbon-intensive. Far from being a threat to Texas' traditional strength in energy, the rise of green energy should reap windfalls for the state as new industries generate jobs, wealth, and a more diversified tax base.

California is the country's unofficial green energy leader, based on its No. 1 ranking for installed solar energy, No. 3 ranking for wind energy, and track record of high environmental standards for everything from building codes to vehicle mileage requirements. (California's universities also dedicate substantial funds to research and development of new energy technologies in joint ventures with industry, such as the BP-funded Energy Biosciences Institute at the University of California at Berkeley.)

With the right combination of policy, business strategy, and public support for research, argues Webber, Texas could readily overtake California. Webber identifies five areas where Texas can be or already is a leader in green energy: wind, solar, carbon capture and storage, biofuels and plug-in hybrid vehicles. Researchers at The University of Texas at Austin play leading roles in each area.

## Power of the Plains

Just as Texas was blessed with natural resources in oil and gas, another natural bounty—the wind of the Southern Plains—has placed the state at the forefront of renewable energy. According to the American Wind Energy Association, Texas has more than three times the installed wind power capacity of any other U.S. state. And Texas continues to add capacity at a breakneck pace, installing more wind power in 2008 than any country except China and the U.S. If Texas were a country, notes the association, it would rank sixth in the world in installed wind power, just behind Germany. Texas' recent growth in wind is the main reason the U.S. just passed Germany as the country generating the most energy from renewable sources.

West Texas has considerable room to expand wind power, a necessity if the U.S. expects to approach some of the more ambitious goals put forth by wind advocates, such as achieving 20 percent of the nation's power generation from wind by 2030. Whether or not this lofty goal can ever be reached, the good news, reports Webber, is that Texas has ample room to expand wind power—offshore. While the coastal areas of other U.S. states extend three miles offshore, Texas (and Florida along the Gulf of Mexico) extends three marine leagues offshore, or about nine miles, under its original terms of statehood. So in addition to having a lot of wind in the Gulf, Texas has exceptional room to place turbines. Offshore wind farms could generate power during the peak energy days of summer, when the West Texas breezes tend to die down.

Research on wind power takes place in several departments at the Cockrell School of Engineering. One important resource is the Laboratory for Advanced Studies in Electric Power and Integration of Renewable Energy Systems under the leadership of Surya Santoso, an assistant professor in the Department of Electrical and Computer Engineering.

# University Names Director of New Energy Institute


Raymond Orbach

Dr. Raymond Lee Orbach, the U.S. Department of Energy's first undersecretary for science, has been appointed director of The University of Texas at Austin's Energy Institute, a multi-disciplinary institute combining the strengths of the university's schools and colleges to advance solutions to today's energy-related challenges. The Energy Institute is developing multi-disciplinary research programs and educational materials to overcome the scientific and technological barriers to a secure and sustainable energy future, while helping policy leaders make the informed decisions required to reach this goal.

Orbach has joint appointments as a professor in the Cockrell School of Engineering (Department of Mechanical Engineering), College of Natural Sciences (Department of Physics), and Jackson School of Geosciences. The Energy Institute will integrate the most advanced expertise from these three schools and also the McCombs School of Business, School of Law, LBJ School of Public Affairs, School of Architecture, and the College of Liberal Arts, as well as expertise from the private sector.

Orbach sees the institute as a unifying collaborator to help mobilize faculty and academic resources, as well as talent from other universities in the UT System, to make "transformational changes in energy production and usage" of fossil fuel, renewable, and nuclear energy resources. He said these changes would address threats to the economic future of Texas, the nation, and the world. Initial priorities include:

- Fossil fuel production and use operating in a carbon-constrained environment. The lack of economical technology, combined with an absence of a legal and policy framework, could put Texas' energy resources at risk.
- New concepts and technologies in wind and solar energy for the development of electrical energy storage for these resources.
- Recycling spent fuel from carbon-free nuclear energy. The university has the opportunity to recreate a robust radio-chemistry program to extract the energy contained in spent fuel and to substantially reduce its toxicity and heat load for subsequent storage.

"These three areas combine to form the nexus of the future of energy production and use in the State of Texas requiring game-changing transformational research and development," said Orbach. "With success in this endeavor, our state will enjoy an economy and quality of life in the future comparable to that which it has enjoyed in the past."

Orbach was sworn in as the Department of Energy's first undersecretary for science in June 2006. He was responsible for planning, coordinating and overseeing the Energy Department's research and development programs and its 17 national laboratories, as well as the department's scientific and engineering education activities.

From the time of his Senate confirmation in 2002, Orbach also was the 14th director of the Office of Science at the Department of Energy. He managed an organization that was the third largest federal sponsor of basic research in the United States, the primary supporter of the physical sciences in the country, and one of the premier science organizations in the world.

Orbach received his Ph.D. in physics from the University of California, Berkeley and is a fellow of the American Physical Society and the American Association for the Advancement of Science.

Santoso works on making wind farms more efficient at generating electricity. As an offshoot of that research, he develops models that simulate wind farms and wind power plants so researchers can predict their performance in the field. The model development is funded by the National Renewable Energy Laboratory of the Department of Energy.

Students from around the world come to the university to work in Santoso's group, yet many alumni are finding post-graduate employment right in Texas—a natural result, given the size of the state's wind market. These alumni could become a valuable commodity. Just as, in the 20th century, Texas exported scientific and engineering expertise to petroleum markets around the world, the state could soon be training and exporting scientific and engineering expertise for wind energy.

Santoso believes Texas will continue to be a major force in wind power for a long time to come, but to solidify its position, the state should continue to invest in research, especially in methods to make power from renewable sources less intermittent, and hence more reliable and economic. "These research initiatives will in the end have huge beneficial societal impacts in emissions, energy security, and trade deficit reduction," says Santoso.

**Texas wind is the main reason the U.S. just passed Germany as the country generating the most renewable energy.**

## Solar Potential

Where Texas dominates in wind, California dominates in solar, with the most installed capacity, biggest industrial base and largest incentives for new installation. Texas does not even make the list of top 10 states for installed photovoltaic capacity tied to the power grid, according to the Interstate Renewable Energy Council. But according to Webber, because Texas is a "photon-rich state," it should be able to leapfrog cloudier and smaller states like New Jersey by installing utility-scale power plants in West Texas "and slapping photovoltaic panels on every south-facing non-shaded roof in the state."

Webber also believes the state could form a consortium (similar to Sematech, which works for the semiconductor industry) to take on some of the research challenges facing the solar energy industry. Researchers at UT Austin are at the forefront of resolving several of these challenges.

With $15 million from President Obama's American Recovery and Reinvestment Act, a group of 18 faculty members from the College of Natural Sciences and the Cockrell School of Engineering will focus on the molecular processes that underpin nanomaterials for solar energy and batteries.

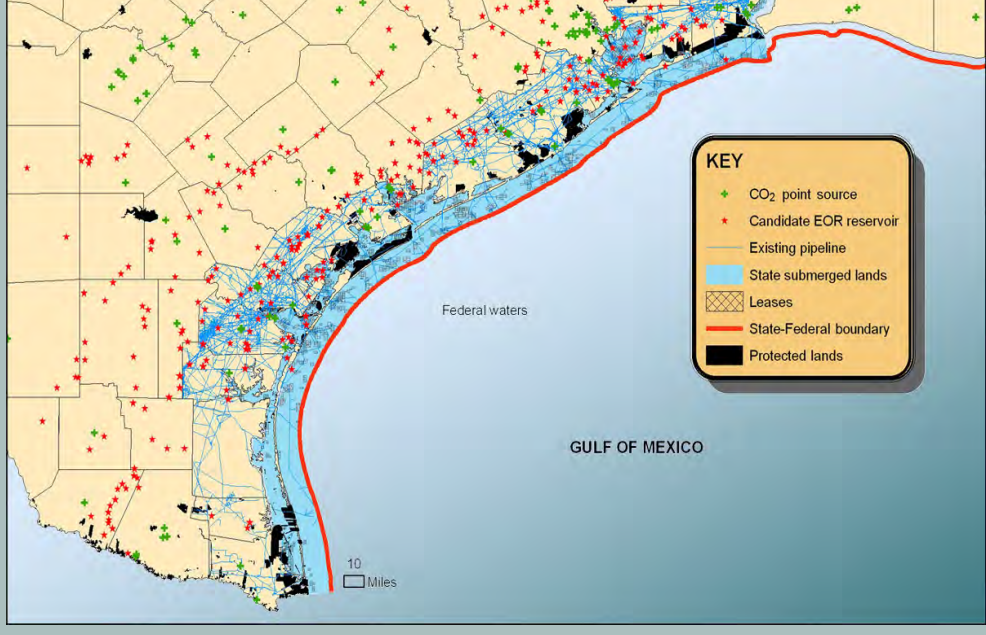
"The current pace of industrial research and development for solar energy and battery technologies is not fast enough to address society's energy needs, which are growing more critical every day," said Paul Barbara, the Richard J. V. Johnson Welch Regents Chair in Chemistry In October 2008, the university's Center for Electrochemistry received a $5 million grant from the Houston-based Welch Foundation to start the Renewable Energy Initiative, a multi-disciplinary, collaborative effort to promote advances in renewable energy technologies.

Two of the center's major projects relate to solar energy: an effort to develop new kinds of photovoltaic and photoelectrochemical

materials that could make solar power competitive with fossil fuels, and the pursuit of better batteries that can store energy over long periods of time. Better storage is needed to counter the intermittence of renewable energy sources, such as wind farms and solar panels.

Mack Grady, associate chairman of the Electrical and Computer Engineering Department in the Cockrell School, where he is the Jack S. Josey Professor in Energy Resources, leads another group working on technological problems and national outreach for renewable energy. In solar energy, Grady works closely with Austin Energy, operating solar radiation monitoring stations in Austin and West Texas to assess the performance of photovoltaic cells, predicting their power output based on orientation toward the sun. Austin Energy is a recognized leader in solar energy, "perhaps the top utility on the subject," says Grady.

Grady also organizes and chairs the university's renewable energy workshop, which annually draws about 150 participants to campus. He sees a bright future for solar in Texas because of the state's sun potential and because the widespread use of wind energy sets a precedent for working with renewable power. But if solar is to proliferate, he says, the cost must be more in line with energy from other sources.




*Luck of the draw: The same geology that made Texas an oil giant in the 20th century could make it an ideal location for storing carbon dioxide in the 21st, as this map from the Gulf Coast Carbon Center shows. The state combines multiple point sources of $CO_2$ in proximity to candidate reservoirs for both carbon sequestration and enhanced oil recovery (EOR). And there are additional potential locations on state lands in the Gulf (offshore behind the red line).*

## Dealing with $CO_2$

According to Webber, Texas might make its biggest contribution to green energy "by helping the globe with carbon dioxide." One proposed solution for reducing levels of carbon dioxide is carbon capture and sequestration (CCS)—the process of taking carbon dioxide from power plants and industrial sources and injecting it into geological formations for permanent storage.

As fate would have it, many of the same geological formations that created Texas' vast oil wealth in the 20th century could turn out to be ideal locations, or "sinks," for storing carbon dioxide in the 21st century. With the looming prospect of federal regulation of carbon dioxide, states across the country could be looking for ways to offset their emissions of the greenhouse gas. Texas has both the geology and, thanks to its energy industry, the network and experience with gas transmission to build a carbon storage industry.

*Dr. Susan Hovorka looks through a sample of a 5.5-inch-long string casing for a well the Bureau of Economic Geology had constructed. The well allows researchers to test measurement techniques and validate numerical model predictions of the changes resulting from the injection of nearly 2,000 tons of $CO_2$ 5,050 feet underground. The test site is in Liberty County, south of Dayton, Texas, about 30 miles east of Houston.*

The state also happens to be home to the top academic research group working on carbon sequestration, led by Susan Hovorka, a senior research scientist at the Jackson School's Bureau of Economic Geology. Hovorka's group led the country's first small-scale test of carbon sequestration, pumping 1600 metric tons of carbon dioxide a mile below ground in east Texas in 2004. In 2007 the group received $38 million from the National Energy Technology Laboratory of the U.S. Department of Energy to conduct the country's first intensively monitored, long-term project in carbon sequestration, injecting carbon dioxide at levels comparable to the emissions from a power plant.

This fall, stimulus funding and the Obama administration's interest in carbon sequestion brought a string of new funds to the Bureau for more carbon research. Among more than $20 million of new projects, Hovorka's group is involved in the Center for Frontiers of Subsurface Energy Security, focused on understanding the movement of carbon dioxide and other greenhouse gases in geological systems.

Sequestration projects are essential to the development of any carbon storage system. "If a carbon sequestration market is going to develop, then you have to have monitoring to make sure the $CO_2$ is going to stay there," says Ian Duncan, associate director for environmental programs at the Bureau of Economic Geology.

## The Right Kind of Biofuels

Corn-based ethanol is the most popular biofuel consumed in the U.S., but Webber, drawing in part on research from his group at the Center for International Energy and Environmental Policy, believes corn ethanol does not deserve the "green" label. In fact, it's possibly "very damaging to the environment," he writes, because producing ethanol from corn uses tremendous amounts of both water and fossil fuel.

Texas is fortunate it is not a major player in corn-based ethanol, says Webber: "Since we're not trapped in doing things the wrong way, we can leapfrog other states and do biofuels the best way."

Researchers at The University of Texas at Austin are pioneering

one of the most promising technologies for biofuels: algae. R. Malcolm Brown Jr., the Johnson & Johnson Centennial Chair in Plant Cell Biology in the College of Natural Sciences, and David Nobles, a research associate, announced the development in 2008 of a new microbe that produces cellulose that can be turned into ethanol or other biofuels.

The researchers believe the microbe, a cyanobacteria (also known as blue-green algae), could provide a significant portion of the nation's transportation fuel if further tests show production can be scaled up. The algae uses sunlight as an energy source and can grow in salty water unsuitable for human consumption. Unlike corn and sugarcane, the world's two leading crops for biofuel production, algae will not require the dedication of huge expanses of arable land that would otherwise go to food production.

"It's likely that Texas, with its never-ending acres of sunlit nonarable land sitting atop saline aquifers, has greater potential to produce algae-based fuels than any other state," writes Webber. And biofuels from algae are likely to be much more efficient than corn or sugarcane in gallons of fuel produced per acre, "so despite our late start, we can make up ground quickly."

## Better Hydrocarbons

Amid the promise surrounding renewable energies, some seem to forget the world runs overwhelmingly on hydrocarbons—and will continue to do so for decades to come. As director of the Bureau of Economic Geology, state geologist of Texas, and the 2008-2009 president of the American Association of Petroleum Geologists, Scott Tinker has dedicated many hours to educating the public about balanced approaches to energy.

"The bridge from a fossil-energy present to an alternate-energy future will span many decades," says Tinker. Noting that fossil fuels today account for about 87 percent of the global energy mix, Tinker forecasts that number dropping slowly in years to come, reaching 80 percent by 2030, down from 91% in 1980. The economic reality, he points out, is that the world has vast affordable reserves of natural gas, coal, and less conventional forms of oil. It will be very hard for new forms of energy to displace them quickly, not because of lack of political will, but because of thermodynamics, economics, infrastructure, and scale.

"The university can play a 'staged' role to help build the bridge to our energy future," says Tinker. In the geosciences, he sees roles for the university in three phases.

"In the near term, we will see increasing use of natural gas and also some development of unconventional oil," says Tinker. Research from programs such as the BEG, UTIG, and DGS Industrial Associates consortia will be vital for the exploration and extraction of these resources.

Coal will remain a very important contributor going forward, relying on carbon capture and storage to mitigate emissions of carbon dioxide from power plants. The same storage approaches could be used to curb emissions from natural gas-fired plants. Because of this, research on carbon sequestration will be critical, along with education to train the carbon sequestration workforce.

"Fortunately, the combined UT Austin effort at the Bureau, in Petroleum and Chemical Engineering, in policy, economics, business, and beyond represents one of the nation's top academic research efforts in carbon capture and storage," says Tinker. "At the Bureau alone we have well over $50 million in committed research funding," he adds.

In the mid term, as renewable energy become more viable, geoscientists will need to look at how geology impacts all forms of energy, not just fossil fuels. To this end, Bureau scientists are working on geothermal

*Dr. R. Malcolm Brown Jr. of the College of Natural Sciences, stands next to the Santa Rita #1 oil rig on the UT Austin campus. In their research, Brown and Dr. David Nobles find, "Old or less productive oil lands can now have a new life, continuing to produce viable energy for Texas and the [U.S.,] but this time will be renewable and sustainable fuels from the power of the sun through photosynthesis."*

energy and were recently awarded nearly $3 million in federal grants in three different programs. They are also exploring compressed air storage, a form of geologic energy storage that can moderate the challenge of intermittent electricity generation when the wind is not blowing or sun is not shining. And there are important geoscience issues related to nuclear energy: "Uranium exploration and waste isolation and disposal are very important challenges geoscientists can be involved in," says Tinker.

Looking at the longer-term, Bureau scientists in the Advanced energy Consortium are working on solutions in nano- and microtechnology. "We need to better understand how chemistry, biology, and physics interact, and how we can use micro- and nanosensors to illuminate the subsurface better and extract resources with less impact on the environment," says Tinker.

## So, Who Cares?

Between wind energy, solar resources, algae, and hydrocarbons, Texas should be No. 1 in U.S. energy for decades to come. Residents of other states may ask, however, who cares if Texas is a leader in energy? Sure, it may benefit Texans, but will it help anyone else?

In green energy at least, Webber believes it will, without a doubt.

"The great thing about Texas being a leader in green energy is we'll move the needle in ways other places cannot," says Webber. "Thanks to our grounding in the traditional energy industry, with its refining channels and networks of pipelines, we have the scale of industry required for energy distribution. We have the expertise. And we have the business and regulatory culture it takes to get things done in the energy business."

Ironically, the state's tradition of not being preoccupied with environmental problems could be one of its greatest strengths in green energy. Unlike North Atlantic states, which have struggled to accept offshore oil development and offshore wind farms, Texas has a tradition, notes Webber, of trading blight for development.

"Because we don't care as much as some other states about the environmental impacts of developing energy businesses, there are fewer obstacles in Texas," says Webber. As a practical result, the wind industry has met little resistance in its phenomenal growth.

Finally, even Texas' reputation as an environmental laggard may prove beneficial to the country as a whole.

"Because we're seen as laggards," says Webber, "when we change direction, it sends a strong message to other states and even countries that it's time to get on board." ✷

# Eye on the Texas Coast

## From Hurricanes to Whooping Cranes, Bureau Researchers Have It Covered

**By Marc Airhart**

Here in landlocked Austin, Texas, we don't hear too much about the Texas Gulf Coast, at least not until a major storm wallops homes and businesses. It's perhaps more than a little ironic then that some of the people with the best perspective on the coast—what it was like in the past, how it's changing, what threats it faces—are at The University of Texas at Austin, a good three or four hours' drive from the nearest point on the shore.

"The Bureau of Economic Geology serves as the state's geological survey, so it's a natural role for us to monitor the state's coastline," says Tiffany Caudle, head of a Bureau program that works with high schoolers to monitor the coast.

From the 1970s through the 1990s, Bureau coastal scientists studied historical gulf and bay shoreline changes using topographic charts published in the late 1800s and sequences of aerial photographs dating to the late 1920s and early 1930s. Results of these studies, disseminated to the public through numerous Bureau publications, established the Bureau as the prime provider of data and scientific analysis on the changing Texas coast. After major storms such as Hurricane Alicia, which struck the Houston and Galveston area in 1983, integrated field and remote-sensing investigations at the Bureau analyzed the effects of tropical storms and the prospects for recovery.

In the 1970s, the Bureau produced the landmark Environmental Geologic Atlas of the Texas Coastal Zone, which for the first time mapped in great detail the state's entire coastal zone.

"It really made a name for the Bureau at that time," says Tom Tremblay, a specialist in wetland mapping at the Bureau.

In 2000, due to its historical strength in this research, the Bureau signed an agreement with the state's General Land Office (GLO) to supply coastal information for policy making. Bureau scientists use instruments on aircraft to map coastal topography, shorelines, plant and animal communities, wetlands, dunes and beaches. They also enlist hundreds of high school students each year to make direct observations on the ground in a few targeted, long-term sites. The information they gather and interpret helps inform sensible policies for protecting people and the natural environment. The process is never-ending because the coast itself is constantly evolving.

Below are four snapshots of the Bureau's recent and ongoing work along the coast.

### Photographic Memory

For the past decade or so, scientists studying the coastal environment have had access to airborne lidar instruments and other techniques to

# Coastal Research Across the Jackson School

In addition to the team at the Bureau of Economic Geology, a number of researchers at the Jackson School conduct coastal research, including:

**Mead Allison, UTIG:** Sedimentary processes of river-dominated continental margins, coastal and shelf seafloor evolution, sediment radiochemistry.

**John Goff, UTIG:** Seafloor morphology and bathymetry, stratigraphy of the shallow seabed.

**Chip Groat, DGS & CIEEP:** Coastal energy and environmental policy, coastal restoration, fluvial and deltaic systems.

**Wonsuck Kim, DGS:** Shoreline dynamics, morphodynamcis, sediment transport, deltaic sedimentation, river delta restoration.

**David Mohrig, DGS:** Coastal energy and environmental policy, geomorphology and stratigraphy of coastal and fluvial systems.

**Jack Sharp, DGS:** Subsidence and coastal land loss.

measure topography. By taking a set of measurements before and after a storm event for example, they can accurately determine where and how sand has moved around in the system. But what about long term change? What if you want to study how the coast has evolved over several decades? No lidar or other remote sensing data exist that far back.

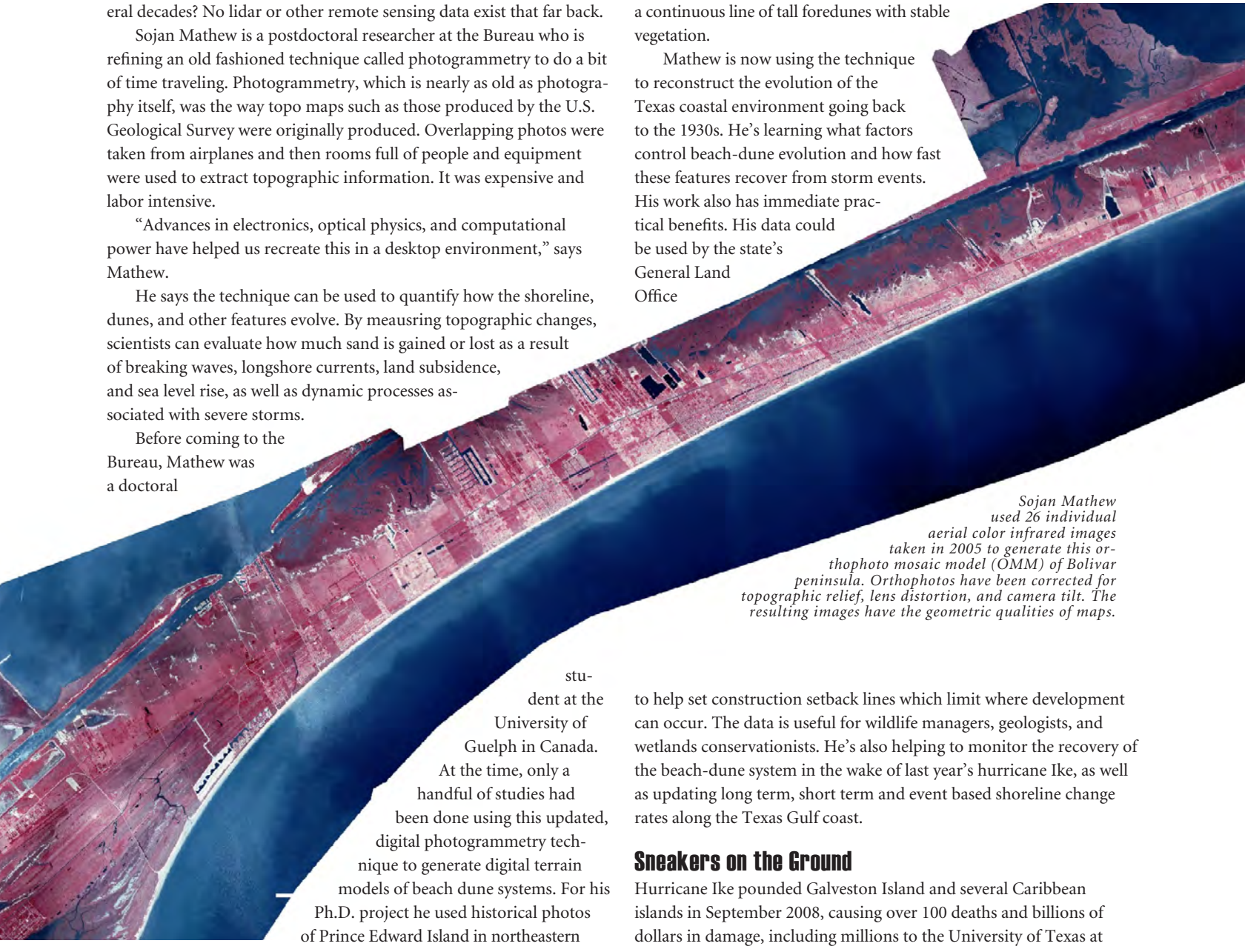
Sojan Mathew is a postdoctoral researcher at the Bureau who is refining an old fashioned technique called photogrammetry to do a bit of time traveling. Photogrammetry, which is nearly as old as photography itself, was the way topo maps such as those produced by the U.S. Geological Survey were originally produced. Overlapping photos were taken from airplanes and then rooms full of people and equipment were used to extract topographic information. It was expensive and labor intensive.

"Advances in electronics, optical physics, and computational power have helped us recreate this in a desktop environment," says Mathew.

He says the technique can be used to quantify how the shoreline, dunes, and other features evolve. By meausring topographic changes, scientists can evaluate how much sand is gained or lost as a result of breaking waves, longshore currents, land subsidence, and sea level rise, as well as dynamic processes associated with severe storms.

Before coming to the Bureau, Mathew was a doctoral student at the University of Guelph in Canada. At the time, only a handful of studies had been done using this updated, digital photogrammetry technique to generate digital terrain models of beach dune systems. For his Ph.D. project he used historical photos of Prince Edward Island in northeastern Canada dating back to the 1930s. A storm a few years earlier had washed much of the island away. Using a sediment budget approach, he was able to reconstruct the stages and duration of recovery processes over seven decades and better understand how the island rebuilt a continuous line of tall foredunes with stable vegetation.

Mathew is now using the technique to reconstruct the evolution of the Texas coastal environment going back to the 1930s. He's learning what factors control beach-dune evolution and how fast these features recover from storm events. His work also has immediate practical benefits. His data could be used by the state's General Land Office to help set construction setback lines which limit where development can occur. The data is useful for wildlife managers, geologists, and wetlands conservationists. He's also helping to monitor the recovery of the beach-dune system in the wake of last year's hurricane Ike, as well as updating long term, short term and event based shoreline change rates along the Texas Gulf coast.



*Sojan Mathew used 26 individual aerial color infrared images taken in 2005 to generate this orthophoto mosaic model (OMM) of Bolivar peninsula. Orthophotos have been corrected for topographic relief, lens distortion, and camera tilt. The resulting images have the geometric qualities of maps.*

## Sneakers on the Ground

Hurricane Ike pounded Galveston Island and several Caribbean islands in September 2008, causing over 100 deaths and billions of dollars in damage, including millions to the University of Texas at

Top photo: *Tiffany Caudle works with students from south Texas high schools to monitor sites along the coast.* Middle: *Jeff Vincent's hyperspectral imaging will help managers at the Mission-Aransas National Estuarine Research Reserve track habitat changes for the endangered Whooping Crane. Photo: Joe Duff, Operation Migration.* Bottom: *Black mangroves on South Padre Island are experiencing a northward shift in range as a result of climate change. Photo: Bill White.*

Austin's Medical Branch. It also destroyed a state park that Tiffany Caudle used to take students to as part of the Bureau's High School Coastal Monitoring Program.

"We're just taking a hiatus this year," she says, "We would like to remain in the same locations because of our history of monitoring from those sites. Also we need to keep the safety of students as our first priority and right now our monitoring sites do not have safe accessibility."

So instead, this past spring, she met with students from Ball High School ("Home of the Golden Tors," as in tornadoes) in their classroom. She took students from the other five schools to sites on Must-ang Island, South Padre Island, and Matagorda Peninsula.

Caudle takes students to the same coastal sites three times a year, every year. At each site, they measure the vertical profile of the beach using basic surveying equipment: Emery rods, a metric tape, and a hand level. By starting at the same Global Positioning System (GPS)-surveyed datum stake and following the same path to the shore each time, they insure that the profile overlaps with previous profiles at that site. They also map the vegetation line and shoreline by walking along the edges of these features with differential GPS units. The data is loaded into Geographic Information System software for display as interactive digital maps.

The data they collect allows scientists to track changes to beaches, dunes, and vegetation following storm events such as Ike.

Because measurements are taken in the fall, winter, and spring (students are on break in the summer), scientists can also study seasonal patterns that shape a beach. Such patterns might go unnoticed if the observations were taken less frequently.

Caudle came to the Bureau in 2000 and became principal investigator of the monitoring program which was started in 1997 with the goal of offering students who live on the coast an inquiry based learning experience.

"It's amazing how much the kids who live in the coastal environment don't know about the coast," says Caudle. She says it's barely covered in the typical Texas high school curriculum.

Students learn good note taking, observation skills, and the importance of precise measurements in science. They make a connection with the concepts in a fresh way because they are out in the real world, getting their hands dirty, working on a real science project.

"The data is important to their communities," says Caudle. "Also," she adds, "the students typically enjoy having a field trip to the beach."

## Out of Sight

Jeff Vincent, a recent post doctoral researcher at the Bureau, used a technology called hyperspectral imaging to map different vegetation types in a nature reserve near Port Aransas. In this technique, a sensor on an orbiting satellite or airplane detects light bouncing off Earth's surface in dozens or even hundreds of colors, or frequencies. The frequencies span the light spectrum, including those too high (ultraviolet) or too low (infrared) for the human eye to see. Different types of vegetation reflect light in distinct signatures that can be teased out of the hyperspectral data. Even when two different plants look the same color to the human eye, this technique can tell them apart.

Vincent's maps will serve as a baseline for comparison with future maps to help track changes in the Mission-Aransas National Estuarine Research Reserve.

One of the reserve's star residents is the endangered whooping

*Before and after Hurricane Ike. In this satellite image combining visible and thermal infrared light, vegetation is displayed in red and inundated areas are in blue-green. Source: NASA.*

crane, one of the rarest birds in North America with a total population of only a few hundred. The only self-sustaining migrating flock breeds in Canada and overwinters in the reserve. Vincent says black mangroves, which are not native to the area, have been moving in and altering the habitats the cranes prefer. There is evidence that as global temperatures rise, tropical plants such as mangroves are increasingly moving northward into such sub-tropical areas. Some experts are concerned about the impacts this will have on the cranes.

Many parts of the reserve are hard to cover on foot due to mud, dense vegetation, snakes, and alligators. A mapping technique that combines the relatively fast, large scale view of an aerial survey with the precision of targeted ground surveys is indispensible for this kind of work.

## Declining Tidal Flats

Texas is losing its tidal flats, those open, muddy flatlands between the sea and dry land that are periodically inundated with freshwater and saltwater. They look barren, but are actually biologically rich habitats for crabs, shorebirds and a host of other less glamorous creatures (yet critical in terms of ecosystem services), such as worms and algae.

"Tidal flats are a component of the larger wetland ecosystem," says Tom Tremblay. "The tidal flat is the habitat for many species that live and feed in the intertidal zone. These species are part of the food web that includes economically important resources such as fish and culturally important resources like the whooping crane."

The flats are also the interface for nutrient cycling into bays and lagoons. "Tidal flats are an important part of estuaries or wetlands," says Tremblay. "If you lose a component of that system, then the system doesn't work."

In this era of rising global temperatures and sea levels, they also play a vital role as release valves for marshes. As sea level rises, tidal flats are the most likely place for marshes to move. Tremblay warns that if there were no flats, marshes would be restricted and eventually die off.

Tremblay first became aware of the decline in tidal flats a few years ago when he was conducting a barrier island wetland "status and trends" study. He says it became clear that tidal flat loss was common along much of the Texas barrier system.

"The loss of flats was not a surprise, but the magnitude of the loss in certain places was alarming," he says.

He says no one knows for sure why they're disappearing, but a possible answer is that flats have a longer response time to a rise in sea level. They already experience occasional saltwater flooding, so they might not respond to more frequent flooding very quickly. On the other hand, marshes are stimulated to grow by more frequent flooding. So marshes move in pretty quickly. "If sea level reaches a critical height, flats may begin to spread," he says.

Having completed the barrier island work, Tremblay is now in the middle of a five year status and trends study of coastal wetlands on the Texas mainland. He uses aerial photographs to create high resolution maps of wetland locations and compares these to earlier maps going back half a century to see how they've changed. The maps will also serve as useful snapshots for researchers years from now.

In addition to the decline in tidal flats, Tremblay has noticed a north-south trend in overall wetland change. The upper Texas coast is losing wetlands while the lower Texas coast is gaining them. In the upper region, near Houston, the loss stems from a combination of rising global sea levels and subsidence of the land caused by removal of groundwater, oil and gas. The rate of subsidence has slowed from a peak in the 1970s. On the lower Texas coast, subsidence occurs at a much lower rate and as sea level rises, new wetlands develop farther up on land to replace those that are lost to the sea. The drier, warmer climate also affects the types of plants that can grow there and enhances the formation of tidal flats.

While the decline of tidal flats has impacts, the loss of entire wetlands along the upper coast could have enormous consequences. They provide protection from damaging storm surges, support shrimp and other large fisheries, provide recreational opportunities, and support rare plant and animal communities. To remain healthy, wetlands have to evolve along with a physical environment that is constantly evolving.

"On Galveston island and elsewhere along the coast, there is a lot of development," says Tremblay. "If you develop an area, you may preclude the movement of wetlands into that area. And if they can't move somewhere, they could drown." ✷

# Measuring Up

## GeoFORCE Grads Go To College


*Graduating GeoFORCE class of 2009 visits Canaveral National Seashore, Atlantic Coast of Florida, to study coastal geology.*

### By Marc Airhart

This fall, thousands of students are beginning their college careers at The University of Texas at Austin, among them 23 talented young people who have already completed an extraordinary journey. They are some of the first graduates of the GeoFORCE Texas program, one of the nation's largest geosciences pipeline programs. It's a significant moment in their lives and in the life of GeoFORCE.

GeoFORCE takes high school honor students from predominantly minority regions of southwest Texas and the Houston area on geological field trips across the country to educate and excite them about science. Each summer, they travel to sites as close as Austin, Uvalde, and Port Aransas and as far away as Florida, Washington, DC, and Oregon. The first cohort of students came from southwest Texas. The program is designed to increase the number and diversity of students pursuing degrees in math and science, especially the earth sciences. The program has two tracks: the GeoFORCE Academy and the Young Geoscientist Field Courses. Students in the academy travel mostly outside of Texas and the Young Geoscientists travel mostly inside Texas.

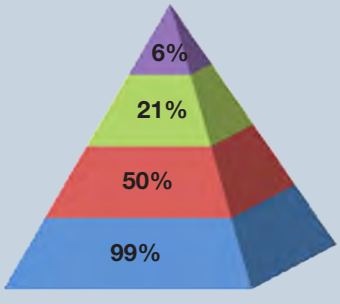
The first cohort of academy students began their odyssey in the summer of 2005 with a visit to the UT Austin campus. For most, it was their first extended time on a university campus. They stayed for several days in Jester dorm and participated in a series of introductory geology seminars with professor Leon Long. Staying on campus, sharing meals and stories with current students, interacting with student teaching assistants, and meeting professors gave them a unique perspective on college life.

"That was the first time I'd been to UT and Austin," said Elyana Barrera, a GeoFORCE Academy graduate from Del Rio, Texas (population 37,000) and incoming freshman in geosystems engineering and hydrogeology, a joint degree program between the Jackson School of Geosciences and the Cockrell School of Engineering. "I was overwhelmed, it's a big campus, but I liked it a lot. That had a big influence on me being here right now."

For four summers, the first cohort of students visited sites as diverse as the Grand Canyon, the Florida Everglades, Zion National Park, and Mount St. Helens. In Arizona and Utah, they studied extensional environments and fluvial systems. In Oregon and Washington state, they saw the effects of compression along a plate margin and learned some aspects of coastal geology. In Florida, they explored

### Pyramid of Success

Out of 77 students who started GeoFORCE in 2005:




5 are in the JSG

16 are at UT Austin

38 are majoring in science, math, or technology

76 are attending college

more aspects of coastal geology including coral reefs and the processes that shape and reshape beaches. At the USGS headquarters in Washington, DC, they learned about careers in the geosciences.

Many students pointed to the Oregon and Washington trip as the most memorable. For some, it was their first time to experience snow. The field sites, including Crater Lake, Mount St. Helens, and Mount Hood, are as significant scientifically as they are breathtaking.

"Up until that point, I didn't know what I wanted to do," said Katie Bales, a GeoFORCE Academy graduate from Sabinal, Texas (population 1,600) and incoming freshman in geosystems engineering and hydrogeology. "And that summer I knew that I was going to be in geology for the rest of my life."

While not every student found their calling in the geosciences, it did influence their views on higher education and career paths. Of 77 students tracked by the time of this article, an impressive 99 percent of GeoFORCE graduates were accepted into junior colleges, colleges, and universities, with 50 percent majoring in science, engineering, or math.

In the last decade, no student from the southwest Texas high schools making up the GeoFORCE network went on to graduate with a geosciences degree from the University of Texas at Austin. This year, 16 GeoFORCE graduates are attending UT Austin, five of them are pursuing majors in the Jackson School.

### Not Just a Number

Mike Loudin, manager of ExxonMobil's Global Geoscience Recruiting & Early Career Program and long time supporter of GeoFORCE, said one of the great strengths of the program is how it helps students navigate the process of getting into college. Many of the students don't have family members who have gone to college. As a result they have a harder time getting crucial advice.

"You have to work with the families and students to demystify the whole process," he said. "The way the system works, if you don't have any role models and nobody in the family has ever done it before, there's no one to tell you how to do it or what not to do. There's nobody to help you get through the applications."

*Elyana Barrera, GeoFORCE Academy graduate from Del Rio, Texas*

**"I want to learn everything the professors can throw at me," Barrera said. "That's what I'm here for. I'm ready to soak it up like a sponge."**

## Super Size Me

The GeoFORCE program, which began in southwest Texas, has passed yet another milestone, adding a whole new pool of students from Houston and in the process nearly doubling student enrollment over the past two summers to 520. The Houston students are ethnically diverse with African Americans and Hispanics making up the majority, two ethnic groups that are vastly underrepresented in math and science fields.

ExxonMobil's Mike Loudin approached Doug Ratcliff, director of outreach for the Jackson School and head of GeoFORCE Texas, about the possibility of expanding the program to Houston with his company's support. Loudin, manager of the company's Global Geoscience Recruiting & Early Career Program, has long worked to expand diversity among new recruits.

"We have a huge challenge with respect to the participation of minorities in the geosciences," said Loudin. "The 2000 census shows 30 percent of the US population are Hispanic, African American or Native American. But only 5 percent of students awarded geoscience bachelor's degrees are from these groups. That's a tough place to be."

Loudin said it was an easy sell to get his company's support for the expansion to Houston, where several factors make it an especially good fit.

"We're here in Houston, Texas, energy capital of world," he said. "We have more geoscientists per capita than any other place. We have the employers, the role models, and a large minority population. Plus, we've got some top universities nearby: Rice, Texas A&M, and UT Austin. So why shouldn't we have this happen in Houston?"

*Mike Loudin*

Loudin noted that for many students, this is their first time to travel out of the state, see geologically rich sites, spend time on a university campus, and learn university-level material. He said some minority students feel out of place in a university. GeoFORCE helps demystify it and enables them to picture themselves in that environment.

Ultimately, Loudin supports the program because he was so fortunate in his own life.

"I had a lot of opportunities and there was an expectation that I would go to college and I would graduate and get a good job," he said. "Without GeoFORCE, these students weren't going to have opportunities like this. It makes you feel very good about it."

*Graduating GeoFORCE class members Jairo Chavez, Carlos de la Torres and Schaefer Edwards, take measurements of the beach profile at Canaveral National Seashores.*

In fall 2008, GeoFORCE staff and volunteers offered a college admissions and financial aid presentation for the inaugural cohort of students from southwest Texas and their parents. They introduced them to Apply Texas, an online tool for applying to public universities and some community and private colleges in the state. They gave an overview of the many costs associated with attending college, discussed financial aid options, and described internship opportunities. They also introduced families to the FAFSA (Free Application for Federal Student Aid) form and gave them contact information for people who could help fill it out. General information was provided (in English and Spanish) for students considering attending universities across the country, as well as information specific to UT Austin and the Jackson School. Presenters came from a range of institutions including the Hispanic Scholarship Fund, UT Outreach, and the U.S. Geological Survey.

At a separate event, students were taught strategies for taking the SAT test used by many colleges and universities in selecting applicants. The GeoFORCE staff have continued to stay in touch with the program's graduates over the past year, emailing them updates on scholarships and reminding them of important deadlines. All of this attention and encouragement has not gone unappreciated.

"We go to these little high schools," said Bales. "It's like everyone is there to just pass a class and get out. And on these trips, we were with teachers and sponsors who cared, who wanted us to succeed in life. That's what pushed us the most, there was finally someone in our lives besides our parents who wanted us to get a good education and have the opportunities that were out there."

With the strong bonds forged between the students and the Jackson School's scientists, faculty and staff, it should come as little surprise that 23 students decided to come to UT Austin this fall and that five are geoscience majors.

**"There was finally someone in our lives besides our parents who wanted us to get a good education and have the opportunities that were out there," said Bales.**

"I love the people at the Jackson School," said Bales. "I've known Dr. [Leon] Long for four years. He was my dad's professor when he was at UT 40 years ago. The people who have cared about me and my future for five years are there and the resources are endless. Plus I'm comfortable in this environment. I feel like I fit in."

Barrera is majoring in geosystems engineering and hydrogeology. She said she considered a couple of other colleges.

"I looked at their geology schools and what they offered and it just didn't compare at all," she said. "The Jackson School is really outstanding with so many people that are extremely experienced in their field of work. Other colleges didn't offer geosystems engineering as a major and that influenced my decision."

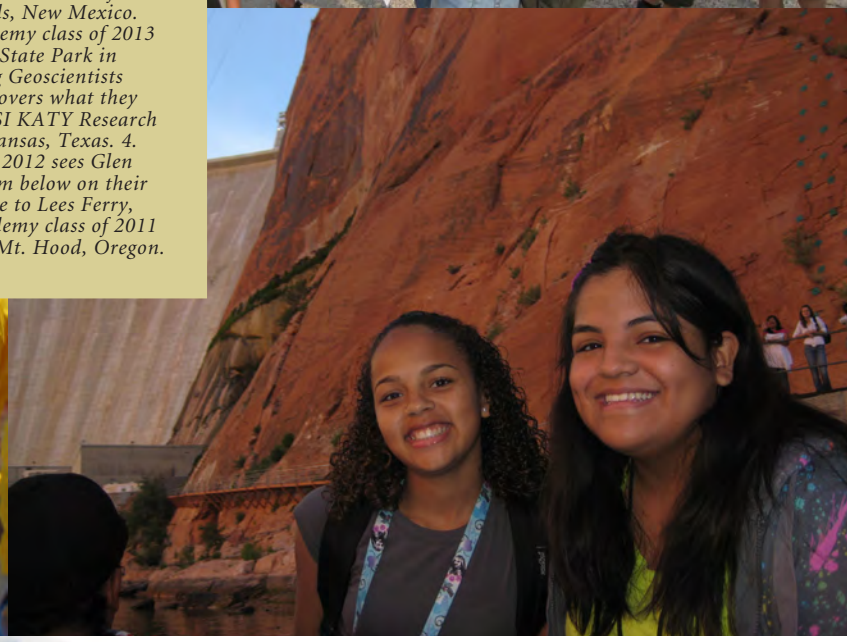
Barrera, who had an internship on the UT campus this summer in a genetics lab, said what she is most looking forward to as she begins her college life are the classes.

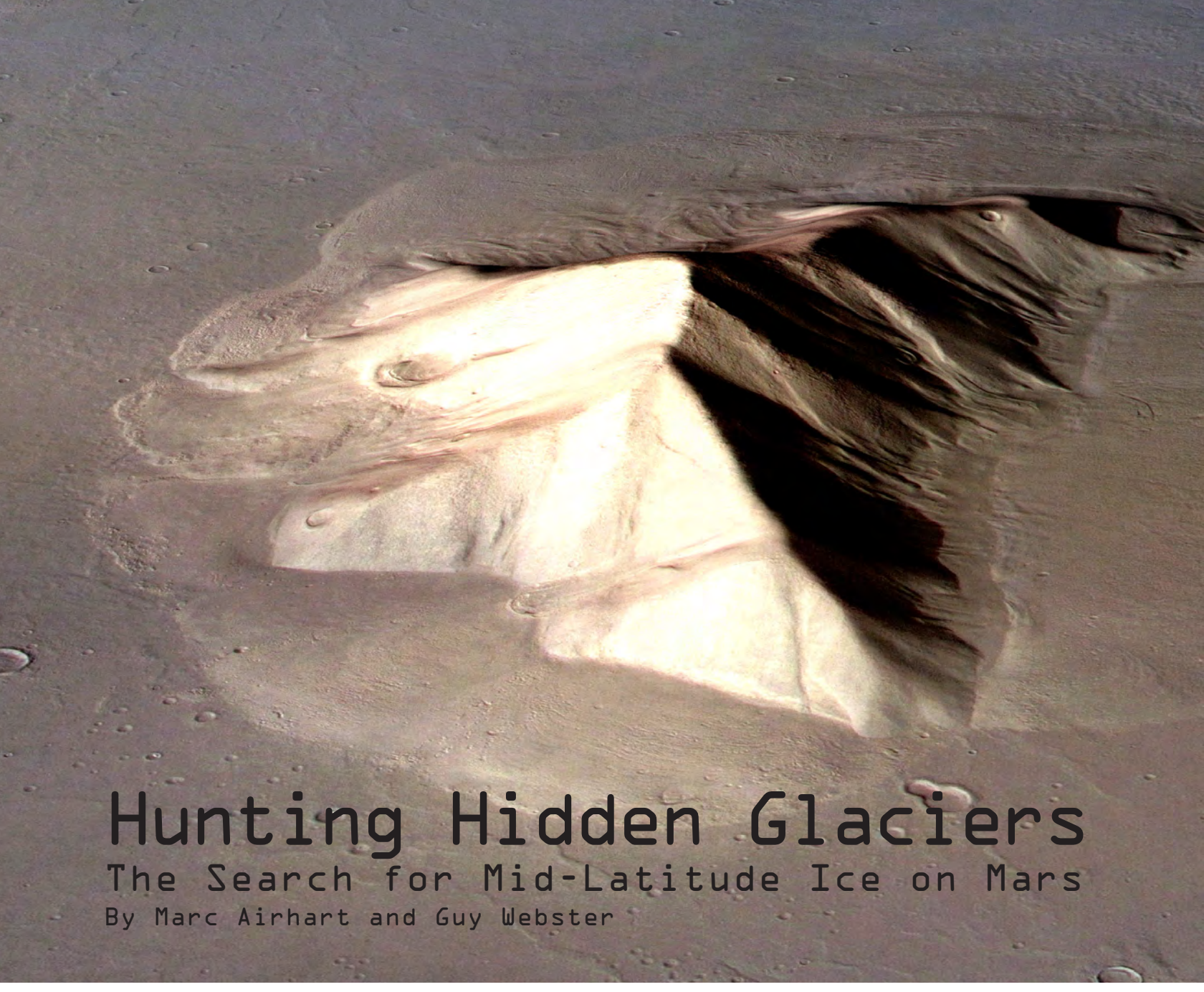
"I want to learn everything the professors can throw at me," she said. "That's what I'm here for. I'm ready to soak it up like a sponge."

"I'm very excited to be a part of the Jackson School family," said Bales. "That's what I'm looking forward to the most. I'm not a number, I'm me, and I'm part of the family." ✷

# Scenes from GeoFORCE Texas 2009

*Left to right, top to bottom: 1. Young Geoscientists class of 2010 visits White Sands, New Mexico. 2. Incoming academy class of 2013 visits Lovers Key State Park in Florida. 3. Young Geoscientists class of 2012 discovers what they caught on the MSI KATY Research Vessel in Port Aransas, Texas. 4. Academy class of 2012 sees Glen Canyon Dam from below on their Colorado raft ride to Lees Ferry, Arizona. 5. Academy class of 2011 poses in front of Mt. Hood, Oregon.*





# Hunting Hidden Glaciers

## The Search for Mid-Latitude Ice on Mars

By Marc Airhart and Guy Webster

Scientists reviewing images of the surface of Mars transmitted to Earth by the Viking orbiters in the 1970s were puzzled by mountains and cliffs surrounded by gently sloping deposits of rocky material. In some cases these deposits, called lobate aprons, extend tens of miles. For three decades, scientists have debated how these features formed and what lies beneath the surface.

One theory contended they were flows of rocky debris lubricated by a thin layer of ice. The features reminded Institute for Geophysics researcher Jack Holt of massive ice glaciers detected under rocky coverings in Antarctica, where he has extensive experience using airborne geophysical instruments such as radar to study ice sheets. If correct, it would indicate much larger deposits of water ice. But using radar to look for buried ice is notoriously tricky.

In August 2005, NASA launched the Mars Reconnaissance Orbiter (MRO), designed in part to probe beneath the surface for evidence of subsurface layering, water and ice. Holt was selected to be on the SHARAD team in early 2007. With its Shallow Subsurface Radar (SHARAD) instrument, scientists finally had the tool to help solve the mystery.

### Titanic Discovery

Members of the science team, scattered around the world, propose regions of Mars where they would like to acquire radar data with SHARAD. Limitations of computer storage on the satellite and bandwidth for sending data back to Earth make it impossible to collect data 24/7. In weekly teleconferences, the researchers decide when and where new data will be collected. Holt selected "target boxes" that included some of these lobate aprons in the mid-latitudes of the southern hemisphere.

The SHARAD instrument sends out pings, short bursts of radio waves, straight down to the surface where some reflect back up and others penetrate into the subsurface and reflect from deeper layers of rock, dust or even water ice. As they pass through different materials, the waves change. They speed up or slow down and, like the distorted image of a straw in a glass of water, the waves refract, or bend their path. The nature of the return signals—when they arrive, how strong they are, and how their properties change in transit—can reveal much about the surface and subsurface. Once the data are collected and transmitted back to Earth, engineers process them to reduce noise and boost the true signals before passing them on to researchers.

*Holt and his colleagues discovered that lobate aprons (similar to the one surrounding this mountain) in the eastern Hellas region of Mars are actually debris covered glaciers. Image is 63 km (40 miles) across. Image by Ernst Hauber (DLR) based on topographic data from the High Resolution Stereo Camera on the ESA Mars Express spacecraft.*

In early 2008, the SHARAD instrument collected data from three separate orbits that crossed over one of Holt's target boxes with lobate aprons. Colleagues at NASA's Jet Propulsion Laboratory working on processing the data and aware of the potential to settle the long-standing debate, took a sneak peek before sending them on to Holt for his analysis. They were excited to find evidence suggesting the aprons might actually be vast glaciers of water ice lying beneath protective blankets of rocky debris.

Holt wasn't so sure. He knew that a type of noise called surface clutter could mimic features in the subsurface. He and a student were developing a computer simulation that could help differentiate this type of noise from true subsurface features. Holt had developed such a tool for radar sounding in the Dry Valleys of Antarctica, but applying it to Mars meant major changes to the algorithm. The possible discovery spurred them on to get the simulator working with the precision needed to make that assessment.

Eventually, the simulator confirmed that surface clutter was not responsible for the apparent water ice. The discovery of glaciers was real.

Because water is one of the primary requirements for life as we know it, finding large new reservoirs of frozen water on Mars is an encourag-

## Separated at Birth

It turns out that the newly discovered deposits of water ice on Mars, called lobate debris aprons, are very similar to rock covered glaciers in Antarctica.

In 2000, Jack Holt and Don Blankenship, also an ice sheet expert at the Institute, were in Antarctica testing a new radar developed by NASA as a prototype for a future mission to Europa. They installed the radar in an aircraft with other aerogeophysical instruments and flew the system over Antarctica's Dry Valleys. Holt hoped to detect buried ice deposits in Beacon and Taylor valleys. In Beacon Valley there are features that appear to be either rocky debris flows lubricated with a small amount of ice, or possibly rock-covered glaciers.

When he analyzed the radar data, Holt was disappointed to find that surface clutter, a kind of noise caused by reflections from the rough surface of the valley floor and from surrounding walls, made it virtually impossible to make out true features below the surface. That experience spurred him to begin developing techniques for discriminating between this noise and the subsurface signal, techniques that he more fully developed with the Mars radar data that led to the discovery of vast new glaciers.

When Holt conducted this work at Beacon Valley, scientists generally thought the deposits were mostly rock with a little ice. More recently, though, seismic studies, ground-penetrating radar and drill cores have revealed that glaciers lie below the rocky surface.

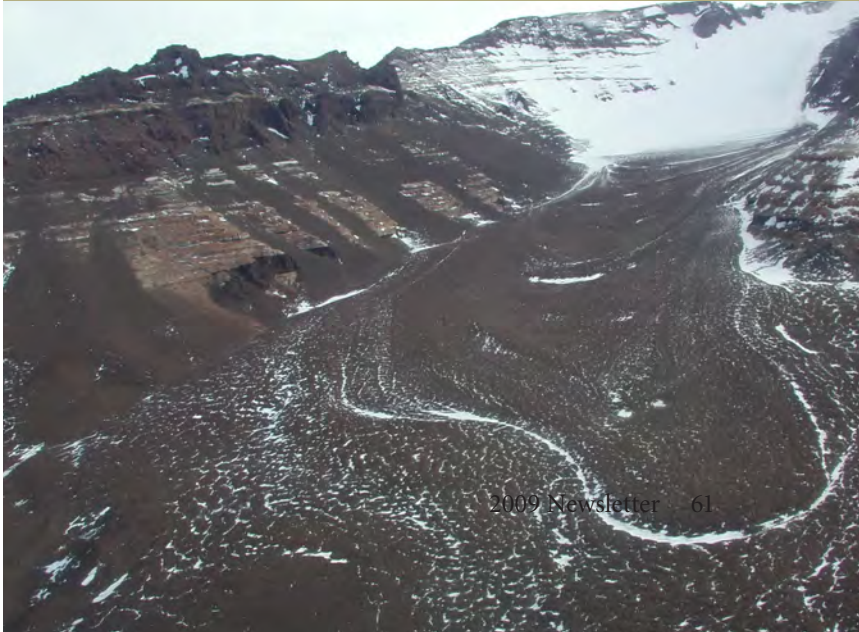
"Kind of odd that people figured out what Beacon Valley 'rock glaciers' really were about the same time as we discovered what the 'lobate debris aprons' really are on Mars," said Holt.

Ironically, he said, it's actually much easier to study ice on Mars than on Earth.

"I can basically choose where to acquire new radar data at my desk, maybe with a teleconference follow up, then I can analyze it and write up the results all in my office, with perhaps a few students helping out," he said. "Of course many people are involved in the data acquisition, all over the world, but I personally don't have to go anywhere or do anything special other than choose and justify the targets."

"For Earth, I have to get a comprehensive physical exam, spend months planning with about a dozen other people to deploy an instrument-filled aircraft in Antarctica, and spend a long time away from home in difficult conditions," he continued. "That is just to get the data. So Mars is far and away a better payoff on the time investment."

Still, he noted that to fully understand Mars you have to understand Earth. And there are many excellent reasons for studying ice on Earth, including the potential for sea level rise as climate changes.



*Jack Holt*

ing sign for scientists searching for life beyond Earth.

The concealed glaciers extend for tens of miles from edges of mountains or cliffs and are up to one-half mile thick. A layer of rocky debris covering the ice may have preserved the glaciers as remnants from an ice sheet covering middle latitudes during a past ice age.

"Altogether, these glaciers almost certainly represent the largest reservoir of water ice on Mars that's not in the polar caps. Just one of the features we examined is three times larger than the city of Los Angeles, and up to one-half-mile thick, and there are many more," said Holt, lead author of a report on the radar observations in the Nov. 21, 2008 issue of the journal *Science*.

"In addition to their scientific value, they could be a source of water to support future exploration of Mars," said Holt.

## Show Me the Water

"These results are the smoking gun pointing to the presence of large amounts of water ice at these latitudes," said Ali Safaeinili, the SHARAD Instrument Scientist with NASA's Jet Propulsion Laboratory in Pasadena, California.

**"Altogether, these glaciers almost certainly represent the largest reservoir of water ice on Mars that's not in the polar caps," said Holt.**

The radar's evidence for water ice came in multiple ways. The radar echoes received by the orbiter while passing over these features indicated that radio waves pass through the apron material and reflect off a deeper surface below without significant loss in strength, as expected if the aprons are thick ice under a relatively thin covering.

The radar did not detect reflections from the interior of these deposits as would occur if they contained significant rock debris. Finally, the apparent velocity of radio waves passing through the apron was consistent with a composition of water ice.

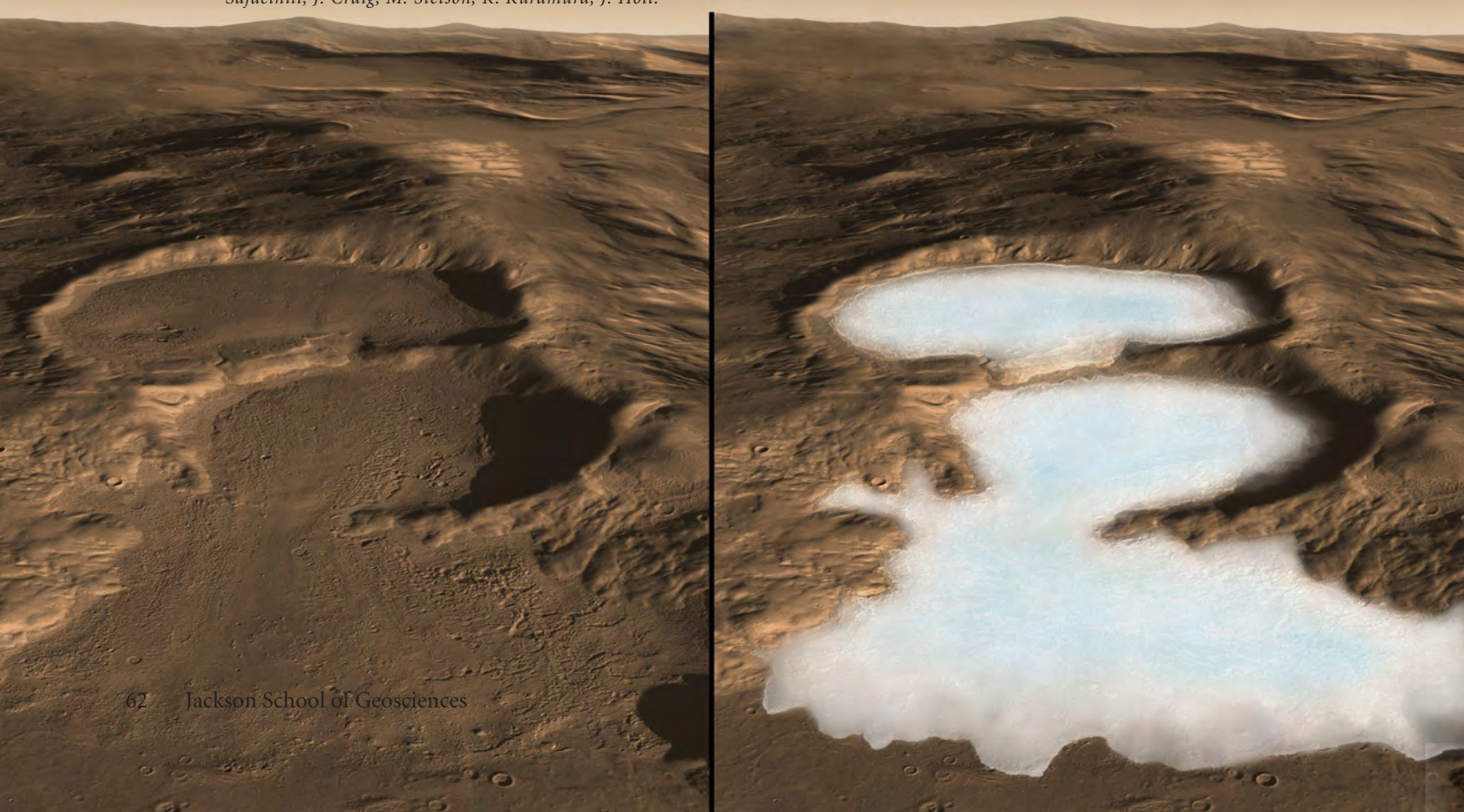
Developers of the SHARAD instrument had the mid-latitude aprons in mind, along with Mars' polar-layered deposits, long before the instrument reached Mars in 2006.

"We developed the instrument so it could operate on this kind of terrain," said Roberto Seu of Sapienza University of Rome, leader of the instrument science team. "It is now a priority to observe other examples of these aprons to determine whether they are also ice."

## How Did It Get There?

The buried glaciers reported by Holt and 11 co-authors lie in the Hellas Basin region of Mars' southern hemisphere. The radar has also detected similar-appearing aprons extending from cliffs in the northern hemisphere.

*These three craters in the eastern Hellas region of Mars contain concealed glaciers detected by radar. On the left is how the surface looks today, on the right is an artist's concept showing what the ice may look like underneath. The ice is about 250 meters thick on the upper crater and about 300 to 450 meters on the middle and lower levels respectively. Each image is 20 km (12.8 mi.) across and extends to 50 km (32 mi) in the distance. Credit: NASA/Caltech/JPL/UTA/UA/MSSS/ESA/DLR, E. De Jong, A. Safaeinili, J. Craig, M. Stetson, K. Kuramura, J. Holt.*



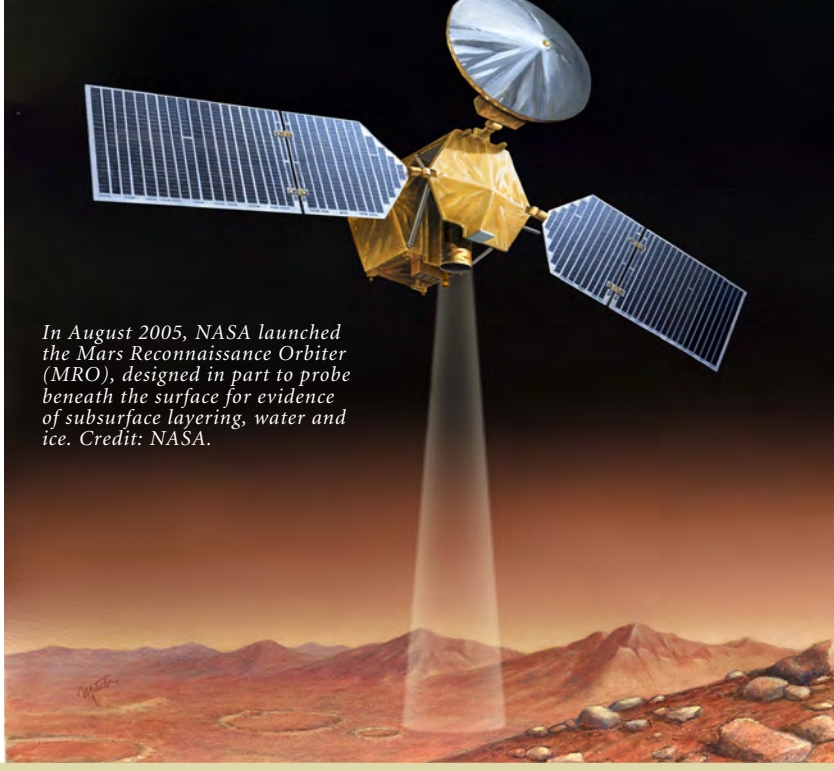
"There's an even larger volume of water ice in the northern deposits," said the Jet Propulsion Laboratory's Jeffrey J. Plaut, whose paper on that discovery was later published in the journal Geophysical Research Letters. "The fact that these features are in the same latitude bands—about 35 to 60 degrees—in both hemispheres points to a climate-driven mechanism for explaining how they got there."

The rocky-debris blanket topping the glaciers has apparently protected the ice from vaporizing as it would if exposed to the atmosphere at these latitudes.

"A key question is, 'How did the ice get there in the first place?'" said James W. Head of Brown University.

"The tilt of Mars' spin axis sometimes gets much greater than it is now, and climate modeling tells us that ice sheets could cover mid-latitude regions of Mars during those high-tilt periods," said Head. He believes the buried glaciers make sense as preserved fragments from an ice age millions of years ago.

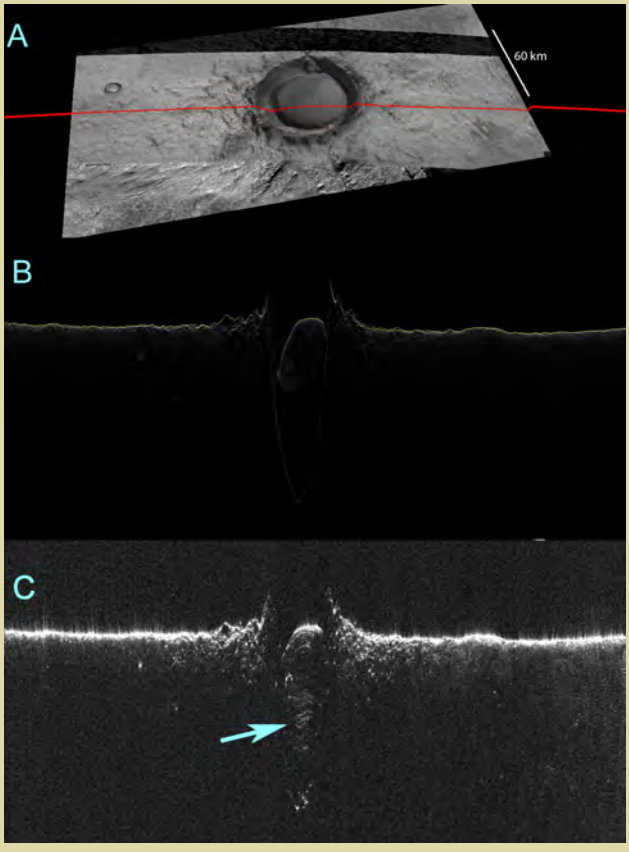
"On Earth," said Head, "such buried glacial ice in Antarctica preserves the record of traces of ancient organisms and past climate history." ✷



*In August 2005, NASA launched the Mars Reconnaissance Orbiter (MRO), designed in part to probe beneath the surface for evidence of subsurface layering, water and ice. Credit: NASA.*

## Cut the Clutter

Interpreting what's below the surface of Mars is no easy task. There are many potential sources of noise in radar data received by the Shallow Subsurface Radar instrument onboard the Mars Reconnaissance Orbiter. The prime troublemaker is surface clutter, which occurs when some of the waves reflect from surface features off to the side of the spacecraft's ground track. These spurious reflections can be misinterpreted as having come from real features in the subsurface.




*A: Data from two orbiting spacecraft were combined to create a digital elevation model of the 60 km wide Korolev Crater on Mars. B: The radar simulator estimated the surface clutter one would expect from the radar track indicated by the red line in section A. C: The actual radargram obtained from the SHARAD instrument shows both the expected surface clutter from B and sub-surface reflectors in the middle of the crater that cannot be explained by clutter (blue arrow), suggesting a large body of layered ice. Credit: P. Choudhary/J. Holt/A. Safaeinili/JPL/NASA/ASI.*

Prateek Choudhary, an undergraduate student majoring in physics and electrical engineering at the university, has worked with Jack Holt to develop a computer simulation that predicts surface clutter to differentiate it from actual subsurface features. Their radar simulator takes information about the surface topography beneath the spacecraft, previously mapped by Mars Global Surveyor, and predicts how radio waves should reflect from the surface.

"Until we developed this tool, people who looked at Mars radar data argued about how to interpret them and had five different opinions—it's ice—no, it's noise—it could be something else," said Choudhary. "It was very rare that they would reach a consensus really fast. Now, we show them the simulator and that ends the argument."

The radar simulator was a critical tool in last year's discovery of buried glaciers on Mars at mid-latitudes. Specifically, it confirmed that what appeared to be water ice in the subsurface was not a phantom created by surface clutter.

Choudhary, who continues to work with the team on other projects involving Mars radar data, is fortunate as a undergraduate to have the experience of working on such high profile research and to be a co-author on a paper in Science. He credits his success to his double major in electrical engineering, where he gained computer programming experience, and in physics, where he studied electromagnetic wave propagation.

"I'm grateful that I had the background I had because I couldn't have done it without it," he said.

Choudhary said the SHARAD team is interested in making their simulator a standard output alongside the Mars radar data that they process. He plans to continue improving it by adding more functionality and generating visualizations that are more intuitive for the user. The researchers are applying the tool to investigations of other parts of Mars, particularly the north polar ice cap.

1909-2009

# Century Mark

## Bureau of Economic Geology Going Strong After 100 Years of Service

By Steve Laubach and Scott Tinker

The Bureau of Economic Geology was established by the Board of Regents of the University of Texas as a research unit of the university and the State Geological Survey on October 21, 1909. Then University President Sidney E. Mezes had urged the board to establish a unit within the university that would safeguard the mineral interests of the state. With Mezes' support and the leadership and experience of William Battle Phillips—director of the short-lived Texas Mineral Survey, a precursor to the Bureau—the Bureau was born, and Phillips was named the first director. Phillips had a background in mining engineering and focused on the mineral-rich region of Trans-Pecos Texas, hiring Johan August Udden as the first field geologist at the Bureau in 1911. Udden succeeded Phillips as director in 1915 upon Phillips' departure to accept the position of president of the Colorado School of Mines.

The Texas oil industry was beginning to emerge during Udden's tenure. Udden is credited with having convinced the regents that lands owned by the University in West Texas held large quantities of oil. His prediction of the potential for oil in the Permian Basin led directly to the drilling of Santa Rita No. 1 in 1923—the first discovery on University Lands. Royalties from these oil-rich lands continue to bring income to the University. Udden was also the first to recognize the scientific utility of well cuttings. A pioneer in subsurface exploration, he studied driller's logs and demonstrated the importance of laboratory examination of drill cuttings in the exploration for oil, gas, and water. He developed the first applied micropaleontology lab, and his work led the major oil companies to hire their own micropaleontologists. Udden was also among the first to recognize the value of applied seismology in oil and gas exploration.

Elias Howard Sellards, who joined the Bureau as a geologist in 1918, became the third director of the Bureau in 1932 upon Udden's death. Sellards served as a professor of geology and member of the graduate faculty at the University of Texas from 1926 until his retirement. Sellards also served as director of the Texas Memorial Museum from 1938 to 1957. In 1945, he stepped back from full-time administrative duties at the Bureau and became director emeritus of the Bureau. Sellards published works dealing with structural, stratigraphic, and economic aspects of geology. He is the author of one of the Bureau's classic publications—the two-volume compilation *The Geology of Texas* (Bulletins 3232 and 3401, published in 1933 and 1934, respectively)—which became a standard reference on the stratigraphy, structure, and economic geology of Texas.

In 1945 John Tipton Lonsdale became the director of the Bureau and was also appointed a professor of geology. He served on the department's Budget Council and was charged with recruiting top-notch faculty to the department. Among his scientific contributions, Lonsdale studied the groundwater resources and geology of Big Bend National Park. He also focused his interest on the economic geology of mineral systems. As director of the Bureau he instituted an investigation of the state's mineral resources, exclusive of oil and gas.

Lonsdale died unexpectedly in 1960, and Peter T. Flawn, who had joined the Bureau in 1949, was tapped to take over as director. Flawn's early research at the Bureau focused on the structural and economic geology of Trans-Pecos Texas. He also conducted an exhaustive study of basement rocks and the ancient Ouachita System that led to publication in 1961 of *The Ouachita System*, a volume still of interest to exploration geologists working in the area. Flawn was also a pioneer in the application of geology to solve environmental problems. During his tenure as director, Flawn encouraged scientists at the Bureau to publish results of their research. He also instituted the publication of the Bureau's first annual report (covering 1960, published in 1961) as a way of further spreading news of Bureau work and providing information to legislators and decision makers who were charged with solving problems dealing with natural resources and the environment. *The Geologic Atlas of Texas*, a series of 38 geologic map sheets detailing the geology of the state, was begun under Flawn's term as director. Virgil E. Barnes, a prolific scientist who spent his long career at the Bureau, led the project. Flawn left the Bureau in 1970 to assume the position of Vice President for Academic Affairs and Executive Vice President at The University of Texas. He served as president of The University

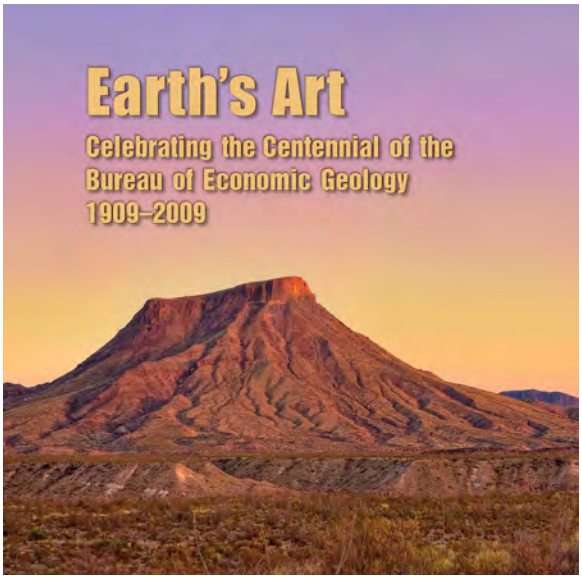
## Bureau Directors

*William Battle Phillips*
*Director, 1909-1915*

*Johan August Udden*
*Director, 1915-1932*

*Elias Howard Sellards*
*Director, 1932-1945*

*John Tipton Lonsdale*
*Director, 1945-1960*




# Earth's Art, Richly Illustrated Book, Celebrates Bureau Centennial

In honor of its centennial, the Bureau of Economic Geology published *Earth's Art*, a collection of stunning geologic images selected by current and former Bureau staff and accompanied by brief essays. The images range from post-card perfect shots of majestic scenes to computer-generated, three-dimensional models of reservoirs and microscopic views of porosity and permeability. Together with the text, they tell part of the Bureau's history in a manner that will delight many geologically inclined readers. Contact the Bureau or visit their online publications site for information about obtaining a copy. Excerpts follow on the next two pages. *Cover photo by David Stephens.*

of Texas at San Antonio from 1973 to 1977 and president of The University of Texas at Austin from 1979 to 1985, when he was named president emeritus.

William L. Fisher was named the sixth director of the Bureau in 1970 and became the longest serving director in Bureau history. Fisher's tenure as director marked a period of remarkable growth at the Bureau, which further enhanced its stature as a premier geological research institution. A major mapping project authorized by Flawn and completed during Fisher's term was the seven-volume *Environmental Geologic Atlas of the Texas Coastal Zone*. As the Bureau prospered and outgrew its space on campus, Fisher oversaw the development of new research and core storage facilities at Balcones Research Center (now Pickle Research Campus) that have been the Bureau's home since 1984. In 1975 Fisher accepted a Department of Interior appointment as deputy assistant secretary of energy. In 1976 he was appointed by President Ford to assistant secretary of energy and minerals.

While Fisher took a leave of absence to focus on national policy issues, Charles G. Groat, an associate director at the Bureau, served as acting director. Groat led the Bureau in research projects dealing with environmental issues and strengthened the Bureau's programs in geothermal, lignite, and uranium resources. He also secured funding for the first investigation of high-level waste storage in the Panhandle.

Fisher returned to the Bureau in 1977 to resume his directorship. In 1984 he took on added responsibility as chairman of the Department of Geological Sciences and director of the Geology Foundation. The Bureau's industrial associates program began under Fisher's leadership. Both the Applied Geodynamics Laboratory and the Reservoir Characterization Research Laboratory were established during his term. In 1994, he stepped down as director of the Bureau to pursue his long-deferred plans to teach full time. Fisher served as director of the Geology Foundation from 1984 to 2006, the longest term in that organization's history, and increased the assets of the Foundation from $10 million to $423 million. It was through this organization that Fisher met and developed a lifelong friendship with Jack Jackson, whose donation made possible the establishment of the John A. and Katherine G. Jackson School of Geosciences in 2001, which comprises the Bureau, the Department of Geological Sciences, and the Institute for Geophysics.

Noel Tyler became the Bureau's seventh director in 1994. Under Tyler's direction in 1995 the Bureau conducted reservoir characterization and related research studies in Argentina, Australia, Brazil, Colombia, and Venezuela. In addition to expanding the Bureau's international research during his tenure as director, Tyler broadened the Bureau's industrial associate programs, helping to establish the Exploration Geophysics Laboratory in 1997 and the Fracture Research and Application Consortium, a collaborative effort within the University, in 1998. Both of these programs continue to thrive. Tyler stepped down as director in 1999 and focused his attention on international


*Peter T. Flawn*
*Director, 1960-1970*


*William L. Fisher*
*Director, 1970-1994*
*Interim Director, 1999-2000*


*Noel Tyler*
*Director, 1994-1999*


*Scott W. Tinker*
*Director, 2000-present*

research before leaving the University to pursue a career in consulting in the private sector. At the request of the University administration, William L. Fisher stepped in to serve as interim director until a new director was hired.

In January 2000, Scott W. Tinker became the Bureau's eighth director. During Tinker's term, the Bureau's operating budget has tripled in a decade, international diversity in the research ranks has grown substantially, the percentage of women scientists has doubled, and permanent and long-term funding has grown substantially. At the industry level, Tinker has strengthened the Bureau's industrial associate research programs, now supported by more than 70 companies worldwide. He conceived of the Advanced Energy Consortium in 2004 and led its development to open in 2008 as a 10-company, $30 million alliance committed to developing advanced micro- and nano-scale subsurface sensors to boost production of oil and gas. Tinker has also strategically expanded the Bureau's facilities and strengths during his tenure. He helped establish the Houston Research Center through a major facility donation from BP supplemented by private donations and federal funds. He also negotiated the affiliation of the Center for Energy Economics with the Bureau. Tinker has engaged decision makers involved in natural resource issues and has organized Bureau field trips and workshops to provide a forum for discussion and exchange of information. He has also been a leader in supporting K–12 education, helping Earth Science Week organizers host career fairs for area students, and served as president of the Association of American State Geologists and American Association of Petroleum Geologists. Upon his arrival, Tinker inspired a family atmosphere at the Bureau and continues to encourage a collaborative spirit.

The pages of Bureau history during its first hundred years have been rich and varied, as the pages in our centennial book attest. The eight directors have guided the Bureau through lean and prosperous times, always mindful of the next opportunity for exciting research. If there's any key to the Bureau's longevity, perhaps it lies in the dedication and adaptability of its leaders and the hearts of the scientists and staff who practice and appreciate the art of geology—Earth's art. ✷

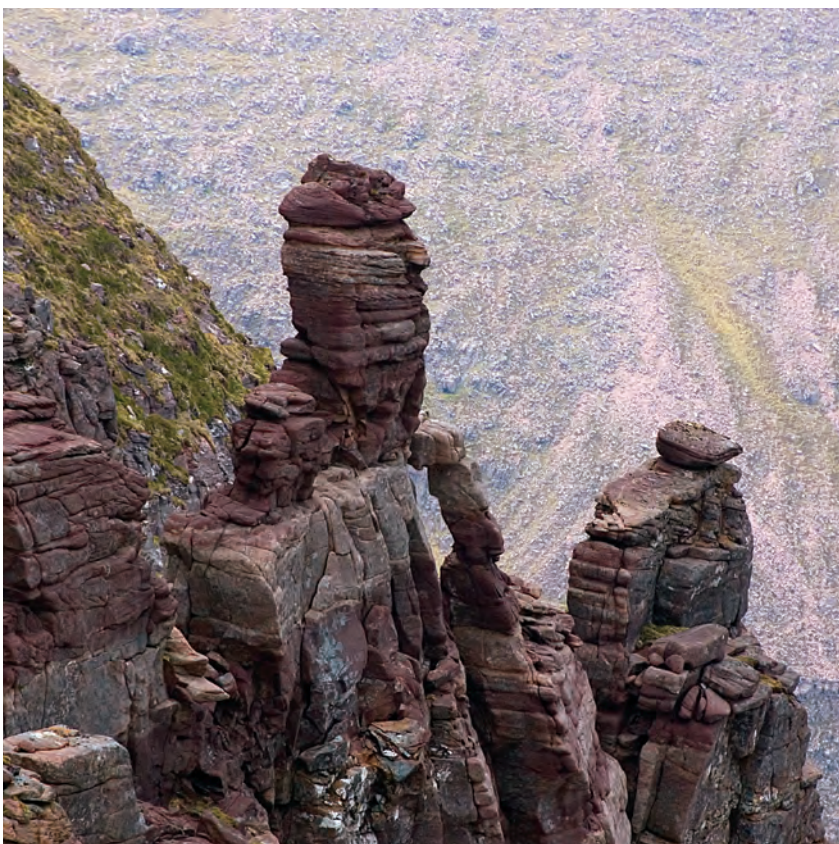
## Excerpts from Earth's Art

This page, bottom left: Southeastern Iceland, photo by Bureau alumnus Kirt Kempter, who writes that the region's Pleistocene volcanoes, formed under a large ice sheet, "resulted in explosive eruptions of water and basaltic magma. The resulting deposits, also known as palagonite, contributed to many of the bizarre and Tolkienesque landforms that for centuries have influenced Icelandic folklore of trolls and other beings now set in stone."

This page, bottom right: Northwest Highlands, Scotland, photo by Steve Laubach of the Bureau, who writes: "The scenic mountains of the western Scottish Highlands seem far removed from exploration and development of natural gas deposits, but this area has extraordinarily large exposures of a type of fracture that is very common in reservoirs but is rarely preserved in rocks at the surface." Laubach has led several research trips to the region, but stresses that "documenting fracture patterns in this isolated and mountainous area is not all scenery and single malt. Students may camp in remote locations for months, in all weather and insect conditions."

Opposite page, bottom left: Harbor Island, Texas. Image from U.S. Geological Survey. Bureau scientist Tom Tremblay writes: "Harbor Island is a geographic locale that exemplifies several of the environmental issues addressed by Bureau wetland studies. Of utmost concern is the effect of climate change on coastal environments, specifically wetlands. We encounter climate change in the form of relative sea-level rise, global sea-level rise, and subsidence. Harbor Island is a good example of where habitate changes have occurred as a result of a relative rise in sea level," causing since 1950, he explains, a strong encroachment of salt  water and sea grass over the island's wetlands.

Opposite page, bottom right: Westcave Preserve, western Travis County, Texas. Photo by Bureau alumnus, UT Engineering and GeoFORCE teacher Charles M. "Chock" Woodruff, Jr., who writes: "The Hill Country of Central Texas is a classic limestone terrain that comprises a remarkable section of Lower Cretaceous strata. These carbonate rocks have been scoured and dissolved by water, and such processes created, over time, astonishingly diverse landforms."



This page, top: Valley of Fire, Nevada, photo by Peter Eichubl of the Bureau, who writes: “Although geology is, in many ways, a historical science ... it is also a predictive science. Geologists predict the shape of an oil accumulation at depth, the capacity of an aquifer, or the recurrence times of earthquakes .... To understand these processes, we study evidence of the occurrence of these phenomena in the geologic past, examining outcrop and core for vestiges of these processes, and carefully reconstruct the conditions under which they occur. The desert Southwest is exceptionally well suited for outcrop-based studies: largely devoid of covering vegetation, the landscape reflects a multitude of depositional, tectonic, and erosional processes. Valley of Fire near Las Vegas, Nevada, provides unique insight into the complex interplay among sandstone deposition, faulting and fracturing, and chemical alteration of rock by flowing groundwater. Erosion by the nearby Colorado River has removed the strata that otherwise keep these geologic processes hidden ... bringing a 140-million-year-old sandstone aquifer to the surface.”


# Jackson School Inducts Five Legends Into *Hall of Distinction*

***The Jackson School established its Hall of Distinction in 2005. Election of future members is reserved for nominated individuals who are or were strongly affiliated with the Jackson School and who acheived exceptional standing in industry, government or academia. If you would like to nominate someone for the Hall of Distinction, contact the Jackson School Development Office to request a nomination form.***

On October 23, 2008, the Jackson School of Geosciences inducted five geoscience legends into its Hall of Distinction at a ceremony at the new AT&T Conference Center on the university campus. While many of the 16 previous recipients made their mark in industry, four of this year's recipients achieved distinction teaching at the university. The inductees include a scientist who trained Apollo astronauts, the oldest employee of the state of Texas, and a geologist known for shaking up the biology world with theories on fossil nannobacteria. Three of the new members received the honor posthumously.

**Robert L. Folk** was born on September 30, 1925 in Cleveland, Ohio. He obtained all three of his degrees from Pennsylvania State College, completing his Ph.D. in 1952. From 1953-1988 he taught sedimentary geology at The University of Texas at Austin. He has won two national teaching awards and two medals for his work in sedimentary petrology, including the Penrose Medal , the Geological Society of America's highest honor. He developed a widely adopted classification system for carbonate rocks based on the types of particles present and the types and proportions of the matrix and/or cement holding them together.

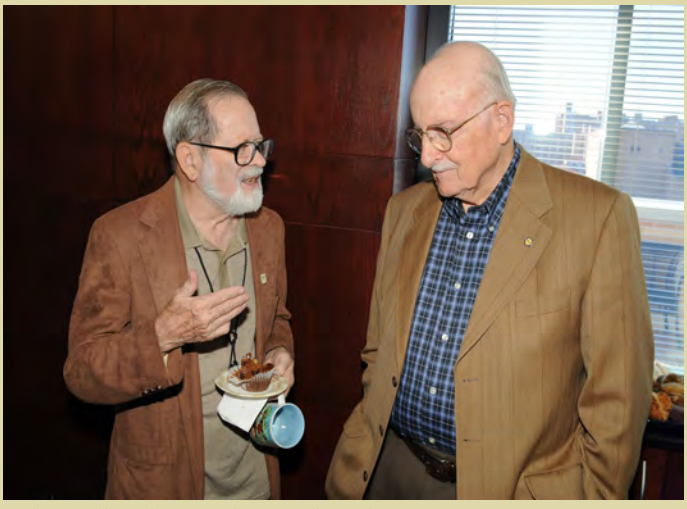
In 1980, Folk first become interested in the role of bacteria in forming materials and in 1990 discovered the first mineralized nannobacteria, or dwarf bacteria, in the carbonate hot springs of Viterbo, near Rome, Italy. This evidence was later used by some NASA scientists to interpret features in a Martian meteorite as being biological in origin, an evaluation that remains controversial to this day. Folk is currently professor emeritus in the Jackson School.

**William R. Muehlberger** is a structural geologist who received his bachelor's, master's, and doctoral degrees from the California Institute of Technology. He has conducted field investigations all over the world and published the definitive Tectonic Map of North America, for which he received the 1998 Best Paper Award from the Structure/Tectonic Division of the Geological Society of America.

During his tenure as professor and chairman of UT Austin's Department of Geological Sciences, Muehlberger supervised more than 80 master's and doctoral students. He has also served as principal investigator of the Field Geology team for the Apollo 16 and 17 moon landings. His team was involved in landing site selection and analysis, traverse design, astronaut training, real-time mission support, and post-mission data analysis and debriefing. He continued this work with NASA on the Skylab and Apollo-Soyuz missions and presently teaches geology to Space Shuttle astronauts.

For his work over the years, he has received the Medal for Exceptional Scientific Achievement and the public service medal from NASA, as well as the Houston Oil and Minerals Corporation Faculty Excellence Award. Muehlberger is currently professor emeritus in the Jackson School.

*Below, left: William Muehlberger surrounded by friends and family at the induction ceremony. His loving wife Sally passed away shortly after the ceremony. See her obituary in our Memorials section. Right: Muehlberger with Louise Barnes.*

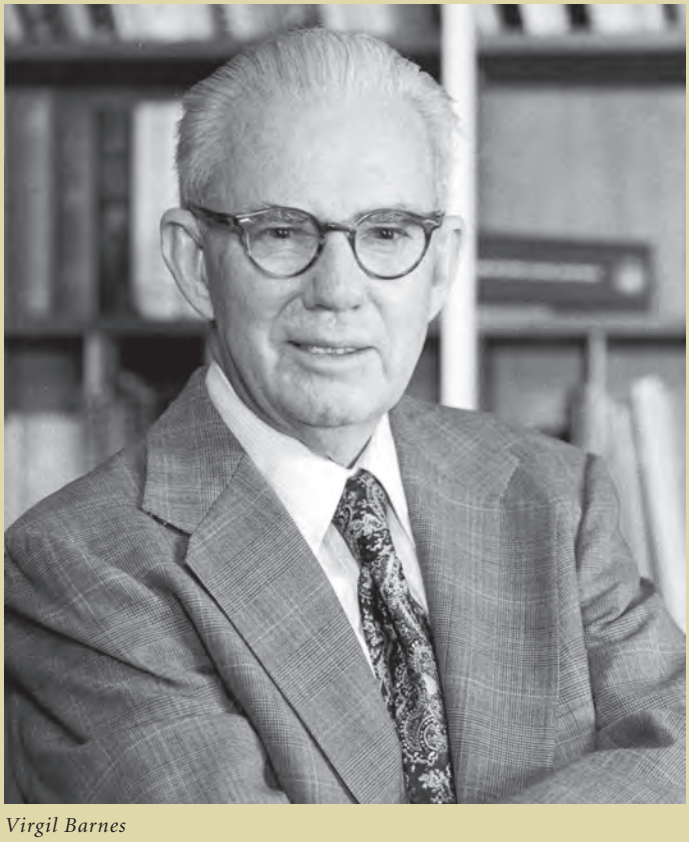


*Robert Folk with Peter Flawn at the induction ceremony.*

**Virgil E. Barnes** was born June 11, 1903, in Chehalis, Washington and became one of the world's leading experts on glassy objects known as tektites. After obtaining his Ph.D. in geology at the University of Wisconsin in 1930, he came to Texas, where he worked for the American Petroleum Institute in Austin and the U.S. Geological Survey before joining the Bureau of Economic Geology in 1935.

At the Bureau, Barnes's prolific work encompassed Paleozoic stratigraphy, economic geology, Precambrian stratigraphy, gravity and magnetic surveys, earth temperatures, tektites and meteorites, geologic mapping and petrology. He put together the monumental Geologic Atlas of Texas, which took a quarter of a century to compile. Barnes was the first to recognize that tektites, which were originally thought to be pieces of meteorites, were in fact terrestrial in origin and were generated during meteorite impacts with the Earth.

In 1988, he was named Distinguished Texas Scientist of the Year by the Texas Academy of Science. He received the Barringer Medal from the Meteoritical Society in Vienna in 1989. He also received the American Association of Petroleum Geologists Public Service Award in 1993. Barnes remained professionally active and was known as the oldest University of Texas at Austin faculty member and oldest employee of the state of Texas until his death at 94.



*Virgil Barnes*

**Hedwig T. Kniker** was born on November 13, 1891 in Gay Hill, Texas. She graduated from the University of Texas in 1916 with degrees in German, psychology and geology. Her graduate work included a master's program and research at the university, as well as further studies in the Northeast and Midwest.

Kniker's professional career began in 1920. She worked for Texaco in Houston, Phillips Petroleum in San Angelo, and United Geophysical Company in Chile. She established Texaco's first paleontology laboratory. She spent about twenty years in Patagonia developing an oil field for Gulf Oil, gaining international recognition for her work. She retired to Seguin in 1950, remaining active as a consultant and writer. Her estate financed 39 bells for the university's carillon. A renowned paleontologist and geologist at a time when few women entered these fields, Kniker left a scientific legacy and carved a path for professional women throughout the world. She died on October 12, 1985.

**Henryk B. Stenzel** was born in the small Polish textile town of Pabianice on February 7, 1899. In 1918, he entered Schlesische Friedrich Wilhelms Universität at Breslau, where he majored in paleontology and geology and minored in physics and mathematics. He was granted his doctorate in geology with high honors in 1922. In 1934, he joined the Bureau of Economic Geology where he subsequently became a professor in 1948. In 1954, he joined the University of Houston as chairman of its geology department.

A heart attack ended his tenure there, but after recovery, he resumed studies of Lower Cenozoic stratigraphy with Shell Development Company. A few of Stenzel's 92 published works are on petrology, but more are on the paleontology and stratigraphy of the Lower Tertiary of the Gulf Coast. His contributions published by the Bureau are nearly all classics. Stenzel moved back to Houston, where he died after a long illness on September 5, 1980.

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# FACULTY UPDATES

## Elizabeth Catlos

Elizabeth Catlos, associate professor, organized a month-long field expedition this past summer to western and north-central Turkey with students and researchers from UT Austin, Oklahoma State University, Middle East Technical University and Pamukkale University. The students conducted field projects to examine the dynamics of the earth's lithosphere with support from the National Science Foundation-International Research Experiences for Students program. Dr. Catlos returned to the Department of Geological Sciences this year after spending the last academic year as a Fulbright Senior Lecturer in Ankara, Turkey. While in Turkey, she taught Introduction to Geological Engineering, Mineralogy, and Petrography to Turkish students at Middle East Technical University's Dept. of Geological Engineering.

*Liz Catlos with some of her students standing on columnar basalt outside of Ankara, Turkey. Left to right: Nilay Yagcioglu (Middle East Technical University), Tim Shin (UT Austin), G. Okan Yildiz (METU), Catlos (UT Austin), and Jessica Magers (Oklahoma State University).*

## Kerry Cook

Professor Kerry Cook traveled to Ouagadougou, Burkina Faso, in July for the Third International Conference of the African Multidisciplinary Monsoon Analysis Program where she presented an invited talk on the potential for abrupt climate change in West Africa. Professor Cook also presented an invited paper at a workshop on the Implications of Climate Change and Regional Climate Variability on Water Resources in Africa at the University of Cambridge, UK, in September. The Climate System Science group collaborated to present a two-part series on The Science of Climate Change in tech sessions this fall. Cook and Dr. Charles Jackson of UTIG explained the basic science, and discussed common misunderstandings and questions about climate change physics. Professors Rong Fu and Ginny Catania then presented the latest observations of our changing climate, relating the observations to our basic understanding of climate change physics and explaining how we know that the observed changes in climate can be attributed to increasing greenhouse gas levels in the atmosphere.

Kerry H. Cook has also been elected as a fellow of the American Meteorological Society.

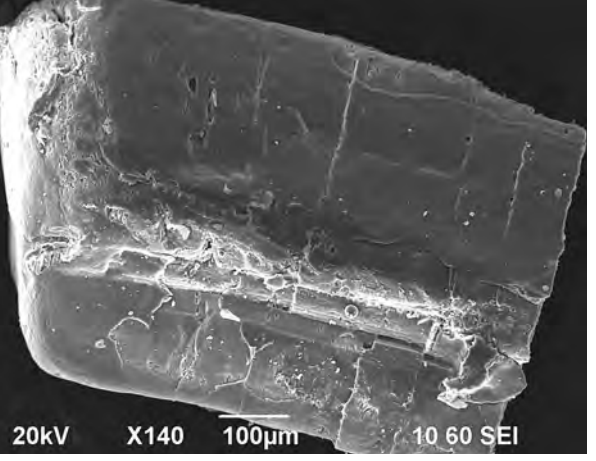
*Kerry Cook drumming in Ouagadougou, Burkina Faso, where she attended the Third International Conference of the African Multidisciplinary Monsoon Analysis Program.*

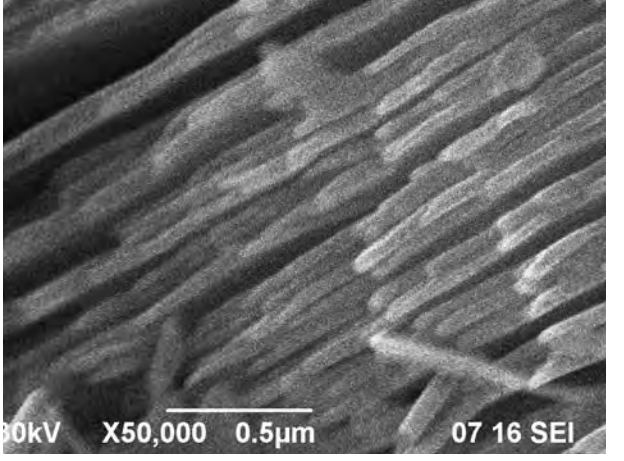
## Jung-Fu Lin

Jung-Fu "Afu" Lin continued his research on the quest to understand the mineral physics of Earth's inner core. As Lin writes, "Earth's inner core is the most remote place of the planet. Seismic wave and free-oscillation studies of the Earth's inner core revealed that compressional waves along the rotation axis travel ~3% faster than those in the equatorial plane—this is called seismic wave anisotropy of the inner core." To decipher the origin of this anisotropy, Dr. Lin and co-workers have recently measured sound velocities of hexagonal close-packed iron, the most abundant constitute of the core, at Earth's core pressures. "The results at an unprecedented pressure of 1.6 millions of atmosphere," writes Lin, "strongly indicate that shear wave anisotropy would also exist in the inner core, though such anisotropy will be extremely difficult to detect because of its intrinsic weakness."

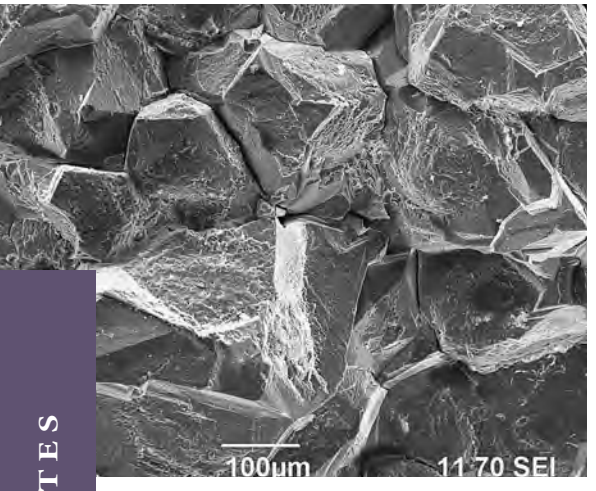
## Earle McBride

Earle McBride continues to study the diagenesis of the Ordovician Eureka Quartzite (a quartz-cemented sandstone) in Utah and Nevada. He made an additional sampling trip to the field area in August following a three-week trip to Italy with family members. Unlike most quartz-cemented sandstones, the Eureka in places is dominated by many microcrystal overgrowths instead of single megacrystal overgrowths (see top two photos,




Images from Earle McBride: *Top left: Microcrystals of quartz overgrowths on a detrital quartz grain: Eureka Fm., Millard Co., Utah. Top right: Normal megaquartz overgrowth facets on detrital quartz grains, Millard Co., Utah. Bottom left: Sandwiches of kaolinite, Simsboro Fm., Limestone Co.*






page 74). The reason remains obscure. Earle, with Luigi Folk and Tom Yancey (Texas A&M), is also investigating the distribution and origin of the clay mineral kaolinite in Eocene sedimentary rocks of the Texas coastal plain. Sand-sized grains of kaolinite, most with puzzling grooves along their length, occur in both sandstones and volcanic ash deposits. Kaolinite also occurs locally as pervasive matrix/cement in sandstones, such as the Eocene Simsboro, where it is mined for industrial uses. The latter kaolinite displays a variety of textures, several of which have not been previously described. These textures can be imaged only under high magnification using the scanning electron microscope. Many kaolinite flakes occur as doublets or sandwiches. The two sheets of the sandwich are composed of well-aligned plates separated by a domain of minute poorly aligned flakes 0.1 micrometers long (see bottom left photo in group above). And many plates are composed of or are bordered by spherical objects 50 nanometers in diameter that resemble nanobacteria.

In Salt Lake City on his sampling trip mentioned above, he also conferred with long-time collaborator Duke Picard on several ongoing projects and searched for some family roots at the LDS Family History Library.

## Yosio Nakamura

Yosio's after-retirement life has been a busy one in 2008-2009, mostly assisting young scientists advancing our knowledge of the Earth as well as our planetary neighbors. He served as a member of the Science Definition Team of the International Lunar Network (ILN) to plan for future robotic missions to the Moon in collaboration with several other countries, and is currently working as a member of the Lunar Geophysical Instrument Package (L-GIP) team to develop a package of geophysical instruments to be deployed on the surface of the Moon, and also as a member of the Mars Science Analysis Group (MarsSAG) in planning to establish a geophysical network on Mars. Back on Earth, he also spent a few weeks on board R/V Marcus Langseth as a Co-Chief Scientist to assist young researchers retrieve a set of broad-band ocean-bottom seismograms, which we deployed a year earlier offshore of Taiwan, and is currently working with a student to process and analyze the acquired data.

## Doug Smith

Doug works in the department in much of the winter puzzling out relationships between tectonics in the southwestern US and processes in the mantle. He is preparing a paper about how xenoliths provide insights into low-angle subduction, mantle evolution, and the Laramide orogeny. Access to research facilities and colleagues in the department has been of tremendous value.

In most of the last few summers he has been in Durango, Colorado. Opportunities to learn and enjoy geology in the Rocky Mountains and Colorado Plateau have provided great pleasure, and of course there have been climate-related advantages. In addition, granddaughters are there. Also, in good years a host of interesting mushrooms have appeared, some of which have proven to be edible. Mushroom identification features, however, are more challenging than those of amphiboles in thin section. Moreover, consequences of misidentification can be severe. Perhaps if faculty had to face life-threatening consequences of petrographic mistakes, then the retired hardrock faculty pictured here would not appear so healthy.

## Scott Tinker

Scott Tinker writes, "I completed a very rewarding year as president of the AAPG; a year that saw global growth of the organization from 31,000 to 35,000 members and the opening of new offices in the Middle East and SE Asia. Along the way I presented 50 keynote and invited lectures globally on various energy, environment, economy and education topics and to a broad spectrum of audiences within and outside of the geosciences, including some dozen universities. In the broad theme of education, I am working with a known documentarian to produce a feature length film on global energy. Filming has begun with 'shoots' to date of premier energy facilities in seven countries (solar, wind, nuclear, hydroelectric, geothermal, biofuels, and natural gas) and interviews with leading CEOs, ministers, engineers, and scientists. The AAPG Foundation created a dedicated fund called "The Bridge" to accept private and corporate donations to support this major project. http://foundation.aapg.org/thebridgefund.cfm.

"The Bureau continues to thrive, winning several multimillion grants to continue our nationally recognized carbon sequestration research program, and also leading the $10 million per year Advanced Energy Consortium, which is funding research at worldwide institutions to develop advanced micro and nano sensors for subsurface oil and gas applications."

## Chris Bell

On 9 September, 2009 as the Bell lab gathered for their weekly meeting, we ran into Department photographer Joe Jaworski. He was waiting patiently in the hallway to take pictures of the new faculty that joined the Jackson School this Fall, but was unoccupied when we passed. We quickly assembled ourselves for an impromptu photograph. The result is above, and was sufficiently decent of all of us that it served as inspiration to file an update on our collective work over the last year.

We are a rather eclectic bunch, with research projects spanning the Late Paleozoic through the Holocene, and study organisms than include many of the major vertebrate lineages. In spite of those differences, we are united by an interest in evolutionary morphology of the vertebrate skeleton, and by efforts to integrate study of the modern biota with the fossil record.


*The Bell lab group on 9 September, 2009. Standing, left to right: Christian George, Sebastian Egberts, Kerin Claeson, Chris Bell, Katie Criswell. Seated, left to right: Jen Olori, Robert Burroughs, Michelle Stocker. Not pictured: Yomi Olufowoshe.*

**Chris Bell** is continuing his research program on evolutionary morphology of Australian lizards. He made another trip to Western Australia in Fall of 2008, and recently completed a study of the cranial osteology of the bizarre thorny devil, Moloch horridus. He also recently initiated a new research program investigating the impacts of World War II on the study of natural history and zoology.

**Robert Burroughs** is now a fourth-year undergraduate who joined our lab in December, 2007. He is working on an extensive study of skeletal variation within the only aquatic North American box turtle, Terrapene coahuila. He also is in preliminary phases of a study of a remarkably well preserved fossil box turtle from west Texas.

**Kerin Claeson** is a Ph.D. candidate. Her research is focused on the emergence of skeletal anomalies in relation to taxonomic and ecological diversity within various groups of fishes. For her graduate work, she focused specifically on groups of fishes that possess anomalies such as miniature size, loss of individuated teeth, and fusions within the vertebral column. Her dissertation integrates the fields of paleontology, comparative anatomy, developmental biology, evolutionary morphology, and functional morphology to elucidate evolutionary history with skates and rays (relatives of the sharks). Kerin plans to graduate in Spring, 2010.

**Katie Criswell** is pursuing her MS degree. She has a passion for fish, and her thesis research focus is on the evolutionary morphology of the skull of extant lungfishes. She amassed a large collection of skeletal material, and is utilizing high-resolution X-ray CT data to investigate detailed cranial osteology of these strange fishes, and reinterpret them in light of the fossil record of the group. Katie is planning to complete her thesis research in May, 2010.

**Sebastian Egberts** completed his MS thesis and graduated in May, 2009 (but he still joins our lab group meetings occasionally, and was captured in the photo). His thesis involved a detailed description of an exquisitely preserved skull of the Permian reptile Captorhinus aguti. His analysis of a high-resolution X-ray CT data set of the specimen generated new anatomical data for Captorhinus and insights into aspects of its biology. He is now working in the fossil preparation lab at the Vertebrate Paleontology Laboratory on the Pickle Research Campus.

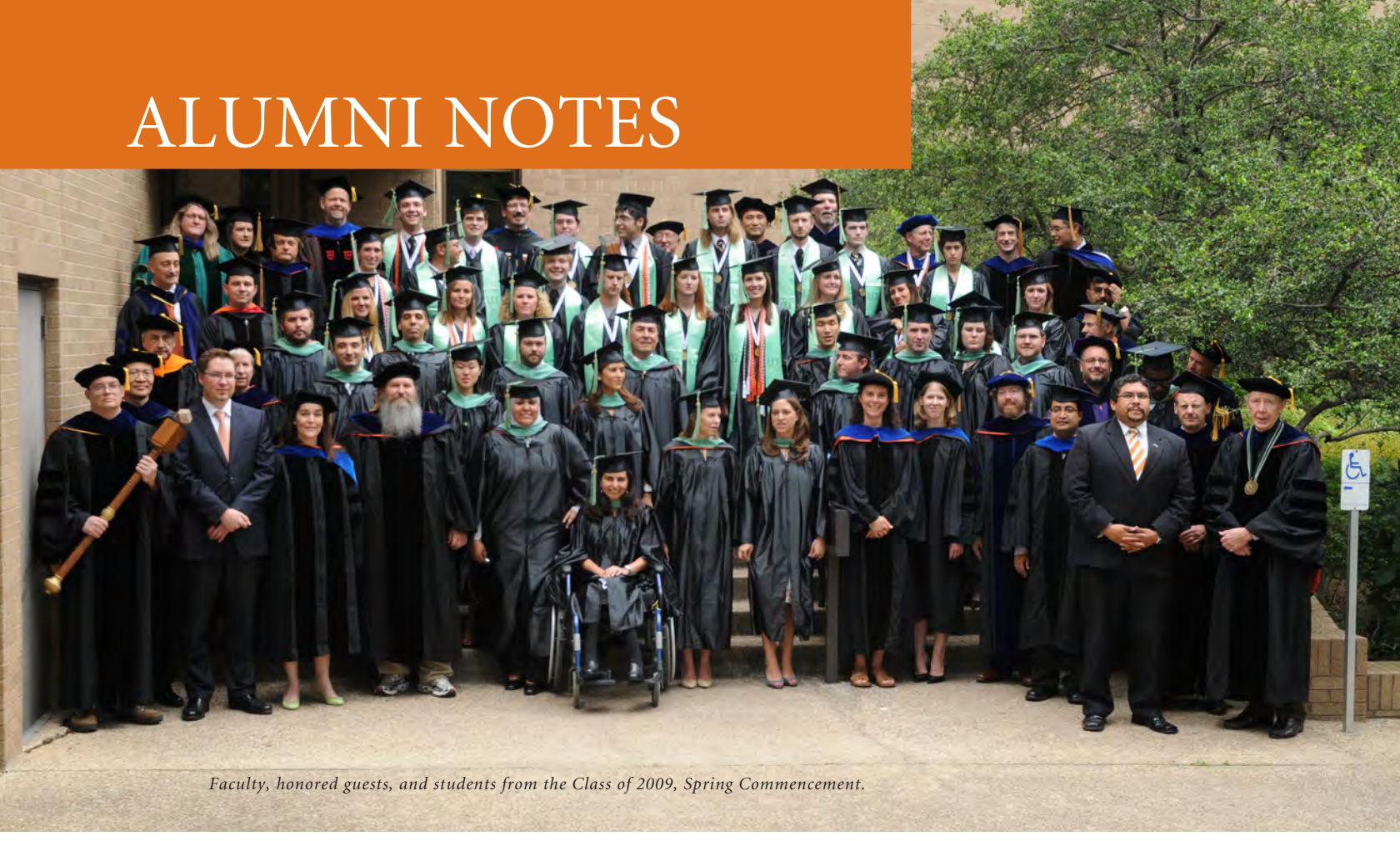
**Christian George** is a Ph.D. candidate. He is primarily interested in Pleistocene mammals, and his dissertation research is bringing new approaches to their study. He is exploring new methodological and philosophical approaches to the identification of Pleistocene mammals, developing new quantitative methods to assess the relationships of Texas mammal communities over the last 50,000 years, and using GIS applications to visualize their spatial and temporal relationships. Christian plans to complete his studies in 2010.

**Jen Olori** is a Ph.D. candidate. Her current research projects center on two primary areas of interest that are united by investigation of the influence of patterns of variation on our understanding of morphology and evolution. Her dissertation research involves integration of developmental data from extant amphibians and reptiles with new developmental data she generated for the extinct Paleozoic group Microsauria. Her second area of research is aimed at uncovering the interplay between miniaturization and fossoriality, and is centered on the cranial morphology and evolution of small, burrowing snakes, especially of the poorly known Uropeltidae (a group restricted to Sri Lanka. and southern India). Jen is concluding her doctoral work now, with plans to graduate in May, 2010.

**Yomi Olufowoshe** (not pictured) is a senior undergraduate who just joined our lab in the summer. Yomi is working on a nearly complete fossil baleen whale specimen that was recovered from the Miocene Eastover Formation in Richmond, Virginia. The specimen was salvaged from an active landfill site, but remains in remarkably good condition.

**Michelle Stocker** joined the Ph.D. program in Fall, 2008. Her research is centered on investigation of the diversity and faunal dynamics of tetrapods in the early Late Triassic of western North America. She is currently working in the Dockum Group of Texas and the Chugwater Group of Wyoming. She is applying new methodological and philosophical approaches to specimen identification and evaluating the consequences of those approaches for the understanding of taxonomic diversity, biogeographic distributions, and faunal dynamics in the Late Triassic.

# ALUMNI NOTES



*Faculty, honored guests, and students from the Class of 2009, Spring Commencement.*

## 1940s

**Annabelle R. Bannahan Friddle**, B.A. 1945, M.A. 1950, Just finished one of the great courses on "Introduction to Geology". It was quite interesting as I had Geology 101 sixty-eight (68) years ago! Always enjoy the newsletter.

**Thomas D. Barrow**, B.S. Eng. 1945, M.A. 1948, is living in Houston, Tx.

**Wallace E. Brunson**, B.S. 1942, M.A. 1954, after retiring from Amoco in 1980, became an Independent. Still active at 90 (Sept '09).

**Fred A. Ealand**, B.S. 1948, 59 years have passed since graduating in 1948. Still enjoy reading about class mates!

**James B. Furrh**, Jr., B.A. 1947, B.S. 1950, I still go to my office on a daily basis and am primarily involved in co-managing family minerals in Harrison and Panola Counties in Texas where the Haynesville Shale Play had been extremely active. I am also a co-owner in a nine-rig drilling company. I hope that the price of gas will improve in the near future.

**Thurman B., Geddie**, B.S. 1945, received his BS in Geology in 1945.

**Clem E. George**, B.A. 1947, M.A. 1948, still in Midland, TX. Participated in several wells the last few years, wife Betty is okay. Just traveled the USA.

**Nolan Hirsch**, B.S. 1944, Still in Geological Field, investing in and turning prospects. Have 4 wells that are in the process of being drilled. Still in the West Texas Area.

**Gene Keyser Jones**, B.S. 1948, Thank you for the opportunity to catch up on former friends/classmates. I look forward to hearing about old friends. I still live in Midland, TX in the same home (for 53 years), same phone number and an ever-increasing amazing family. My five "remarkable" children and their spouses, 13 grandchildren and their spouses and as of June 2009, thirteen great grandchildren. I am truly blessed with family, reasonably good health, and the ability to keep up with two Family Partnerships, my own oil and gas interests as well as some work with Hospice. The oil industry is always interesting if not especially stable at the moment--the most fascinating of occupations!

**Edward R. Kennedy, Jr.**, B.S. 1948, M.A. 1949 — Mostly retired but still keep an office.

**Eugene Lipstate**, B.S. 1949 — Certified Petroleum Geologist 1983 - When I graduated UT, there were few, if any, of our Professors that had seen an electric well log. I was fortunate to have worked the summer of 1947 for Schlumbeger as a helper on a logging truck. At 81, I attempt to understand the newer techniques of oil finding - but sometimes the lectures put me to sleep.

**Howard R. Lowe**, B.S. 1948 — Have closed office and moved home. Not retired yet, but working on several overseas projects—Iraq and Kazakhstan—in consulting capacity. Talk with several of Advisory Council—Burke, Brand

and Weiner to keep up with activities. Have not completely hung it up, but can no longer run fast. Now over 60 yrs in the business.

**Jule J. Moon**, B.A. 1940, M.A. 1941, M.S. Social Work 1963 — Still singing and drummer in choir and folksingers band, writing my memoir, poetry, and ghost stories at age 90.

**Al Nelson**, B.S. 1947 — At age 87, going to sit on a well for first time in 4 years (3days). Still have coffee with my 1947 classmate, John Osmond.

**Jack L. Phillips**, B.S. 1949, is the owner of Jack L. Phillips, Co in Gladewater,TX.

**Charles Porter**, B.S. 1949, M.A. 1949 — I have been reading the Geologic Newsletter and am amazed at how few of my group are in there -- age is really taking its toll. Due to a belated "staff reduction" by Shell in 1961, I left the petroleum geology field for the data processing field, but I have never lost my love for geology. I always feel like I'm "home" when I return to Texas on periodic visits. After all, the surface geology here in peninsular Florida (my home now) is like Pablum when compared to that of Texas' -- filet mignon. And I'm doing my best to educate these transplanted Yankees (snowbirds and permanents) as to geology and the petroleum industry. And am having a ball doing volunteer work for the U.S.G.S. in this area, even if it is only working with their maps and a GPS receiver. At my age, one does what one is able to do.

**Jess P. Roach**, B.A. 1941 — As comes to us all, I lost my wife on May 28, 2009. I have wonderful help that took care of my wife and continues to help me stay in my home. Friends help also.

**John E. Seale**, Jr., B.S. 1941 — Not involved in any geological businesses but have an interest in reading about new methods of exploration and production.

**Wilford Lee Stapp**, M.A. 1946 — Still working at age 91 and getting my prospects drilled-getting another book with John Long (University of Texas at Austin MA in 1978) as editor, I'm associate editor this time. The book is published by So.Tex.Geol.Soc. of large size, 500 pages on geology of South Texas-Enjoy!

**George W. Taylor**, B.A. 1949, is retired from Exxon and is living in Georgetown, TX.

**Daniel L. Ward**, B.A. 1949, M.A. 1950, is living in Grand Junction, CO.

**Charles Weiner**, B.A. 1948, is Chairman of Westerly Exploration, Inc. in Houston, Texas.

## 1950s

**Peyton O. Abbott**, B.S. 1950 — My grandaughter is enrolled in UT Geology, when she graduates she will be the 4th generation UT Austin graduate. Agnus Weed Abbott BS (Home Ec), Peyton O. Abbott (M.A. Geology), James T. Abbott (M.A. Geography), and Samantha K. Abbott (Ph.D. Geology Student).

**Edwin V. Acker Sr.**, B.S. 1956, Bev and I are still going strong- She with new knees and me with 4 bypasses- She still goes to New York and I'm offshore fishing—what's with this Eagle Ford play? Hope it gets to me.

**G. Baxter Adams, Jr.**, B.S. 1951, M.A. 1953, is the owner of Love Creek Orchards in Medina, TX.

**Gene Ames Jr.**, B.S. 1955, still working the same old areas digging deeper, looking for bright specs & digging sideways!

**Roy Beckelhymer, Jr.**, B.S. 1952 — For the last seventeen years I have been residing in Lakeway, Texas with my wife Eddy- we are enjoying Austin and the Hill Country ambiance. I also enjoy the Wednesday morning Plethora of Speakers, mostly from the faculty of The University of Texas - Naturally we are rooting enthusiastically for the Horns-Hook'em!

**Don G. Bilbrey**, B.S. 1953, M.A. 1957 — I fly to Seattle once or twice a year to visit my daughter and grandkids. Beautiful country but too rainy during the winter. Still play a lot of golf and shoot my age more often then not, but it's easier at age 80.

**Norman G. Bishop**, B.S. 1957 — After graduation in 1957 I spent my next 30 years working in the Iron and Steel Industry, where I was able to specialize in developing technologies involving the production of molten metals and their associated slags. My geological training at the University of Texas enabled me to better understand how original earth matter was formed; thus, also provided me with valuable insight into how such matter can also be decomposed and reformed. My efforts in this field led me to author several U.S. Patents for inventions in the field of direct-reduction of metal oxides. Direct Reduction of metal oxides involves removal of the oxygen without having to melt the raw material.

**Walter Boyle,** B.S. 1954, M.A. 1955 — Vada was elected Vice President - Membership for the Houston Symphony League 2009-2010. In 2008, Vada received the Ellen Kelley Volunteer of the Year Award and in 2009 she received the Ardyce Tostengard Crystal Cello Education Volunteer of the Year Award in the Houston Symphony League. Vada and I enjoy "Traveling The World."



## Stay in Touch!

Use the enclosed envelope or our online form (linked to the JSG alumni Web site) to let us know what you've been up to and to update your contact information.

*Dean Callender, B.S. 1956, M.A. Lib Arts 1958, passed along this photo of his grandson Taylor Callender. Taylor is now a student at the Jackson School. Callender writes: "I'm glad school has started and his free time is limited."*

**Philip Braithwaite,** M.A. 1958 — Barbara and I are still enjoying retirement in Dallas, TX and do the occasional cruise and road trip. I do a little part time consulting to keep my hand in at sequence stratigraphy & other than that I enjoy gardening & trap shooting. Barbara spends her time writing and doing genealogy. We have been married now for over 50 years! We are slowing down some but still enjoy life together.

**Robert F. Brandt**, B.S. 1957 — Really enjoyed the FAN's gathering at the Houston Museum of Natural Science last year. I retired from Houston Community College in May 2007. Spent an even 20 years in the oil industry and about the same in education. Both areas were quite interesting and enjoyable in different ways.

**Ben Buongiorno,** M.A. 1955, on hold until the markets (financial and oil & gas) recover. I continue to generate oil & gas prospects.

**William M. Burnet**, B.S. 1950, is the owner of W. M. Burnet in Tyler, TX.

**Bill C. Butler**, B.A. 1953, is retired and living in Tyler, TX.

**Leon G. Byerley**, Jr., B.S. 1952 — Still maintaining an office, but don't get down as often as I would like.

**Susan K. Cage**, B.A. 1950 — Still in Sun City, Texas enjoying the relaxed life style of a retirement community. Am Considering a trip to Egypt next Spring.

**Donald M. Campbell**, B.A. 1955 — I've been retired as a geophysicist-geologist for twenty-one years and currently work part time at the public library in Abingdon, MD. I enjoy my work in the geoscience fields of seismology, gravity, and geomagnetism. My work took me all over Alaska, most of the lower 48 states, many pacific and Caribbean Islands and most countries in South and Central America. My wife Carol and I live about 2 miles from our only daughter, son-in-law and wonderful granddaughter, currently 16 years old and a junior in high school. She is a part time model.

**A.T. (Toby) Carleton**, B.S. 1951, M.A. 1952 — I continue to be active in the oil and gas business - although I don't seem to get as much done as I used to. Also, am in the ranching business and I divide my time between these two endeavors. Corinne and I celebrated out 56th wedding anniversary on June 20th of this year. We have 3 children and 6 grandchildren. We are content with our lives.

**Calvin A. Chimene**, B.S. 1950 — I graduated January 1950 from UT with a B.S. in Geology, and still have a group of pictures from all 1949 summer field trips. I retired in 1985 when my company was purchased by Exxon, and have been living happily ever after except that my first wife died after 44 years of marriage and now # 2 is in the hospital after only 12 years. Now almost 82 I find that I haven't known where any of my fellow grads are. If you know send me a list if possible.

**Bill C. Cotner**, B.S. 1953 — Is self-employed and lives in Midland, Texas.

**C. Paul Crumpler**, B.A. 1957 — I'm still married to Barbara (56 years), I can't seem to retire. I'm still farming & ranching and as you can see, my 3 boys now own the company. We deal in cattle, Quarter Horses (for cutting) and wheat & hay. Life is good as we are healthy!

**Harris P. Darcy**, B.S. 1951, is retired and living in Houston, TX.

**Melvin R. Dixon**, B.S. 1959 — Big Bend NP mapping for the Park Service with Bill Muehlberger (DGS) and Eddie Collins (BEG) has been most satisfying. Our Glenn Spring quad is published (BEG Misc. Map Series) and the Mariscal Mt. quad is nearing completion. My first time to map via canoe – Mariscal Canyon is magnificent, fascinating! Presented our work at the GSA annual meeting in Houston – more glad reunions!

**H.L. (Dutch) Dodd**, B.S. 1956 — I appear to have talked a lot last year: Invited lectures on West Texas research and on dynamic processes as recorded by NASA astronauts orbiting Earth – AAPG-Southwest, Earth Week talks for the Chihuahuan Desert Research Insitute at Sul Ross (1st public radio interview); Scholia in Austin; Smithsonian Associates in DC. Was also invited by one of "my" students to view the launch of Space Shuttle mission 124 – splendid!

**Samuel Yandell Dorfman, Jr.**, B.A. 1957 — After graduating, went into the Navy, then went to UT Southwestern where I earned a MD and was AOA. Then practiced for 17 years in Dallas and was retired when I went back to the family business of drilling oil and gas wells in various places in Texas, Ohio, etc.

**Robert E. Doyle**, B.S. 1955 — We are re-developing oil and gas fields, primarily in Texas and Louisiana onshore. We are also doing development drilling with oil and gas end users. Owing to geopolitical problems, we stopped our Russian operations in August, 2008.

**Donald Frye**, B.A. 1955 — Still prospecting in South Louisiana after all these years, but find time for lots of other activities. Will keep at it as long as it continues to be fun.

**Fred M. Gibson**, B.A. 1951, is retired and living in Austin, TX.

**Wyeth L. Goode**, B.S. 1953 — All is well in Midland. I continue to do consulting work. Family is the same and everyone is well. The welcome mat is always out.

**Willard (Will) R. Green**, M.A. 1955 — Completed year as president of AAPG 7/1/09. Met a lot of interesting geologists and have many good memories.

**S. Dave Hixon**, M.A. 1959, is semi retired and living in Friendswood, TX.

**David S. Holland**, Sr., B.S. 1957, is the President of Holland Holding Inc. in Houston, Texas.

**Eleanor (Ellie) M. Hoover**, B.S. 1956 — ExxonMobil retired. Just got back from a family reunion in Seymour, TX where the dinosaurs roamed in the Permian according to recent studies. Brought back some red rocks-everyone needs a few more rocks. I still have my season tickets- Hook 'EM Horns!

**Jack M. Howard**, B.S. 1951, UT System 1985-1992 — Shirley and I, in mid July this year, will celebrate out 60th anniversary. Our son Robert and our daughter Judy Butler (both UT grads) have planned an Austin party with out families and friends.

**Gerhard C.J. Jansen**, M.A. 1957, is retired and living in San Clemente, CA.

**Howard W. Kiatta**, B.S. 1958 — I'm still enjoying oil and gas exploration mostly in the Texas Gulf Coast area. Am proud to have a grandson enrolled in the Jackson School.

**Mary Lou Chaddick Klatt**, B.A. 1951 — Still enjoy belonging to AAPG (1952) Still interested in the business of geology. Jack died in 1997. Thanks for keeping me informed. I'm so proud to be a Longhorn!!

**F. B. Lacy**, B.S. 1950, is president of F. B. Lacy Inc. in Houston, TX.

**Leon M. Lampert**, B.S. 1951, M.A. 1953 — Not retired yet but getting close to it. Still working in west Texas where a Devonian prospect will be drilled in 2010. have an interest in Eddy County where several more wells will be drilled. Still have same wife, Barbara, Dallas daughter Gail-2 girls; daughter Ellen-Denver-3 boys; same Wayne-Oakland-2 girls. I'm always happy to meet with UT alums.

## Clabaugh's Class Convened Again

Dr. Steven E. Clabaugh and a group of his former students and friends met for their annual lunch and field conference. Attendees were Bob Pickens, Ann Molineaux, Uel Clanton, John Dietrich, Clabaugh, Don Haynes, Les White, Jim Underwood and Walt Haengi. White writes: "After lunch we gathered under the live oaks at Pace Bend Park to discuss meteorites, capture of space dust and an array of medical matters. The class will assemble again next year somewhere around April 2, Steve's birthday. If you would like to join us, call Les at 512-301-3700 or email lesndianne@yahoo.com."

**Barry N. F. Layton**, B.A. 1954 — Graduated in 1954, LISAF 1954-1978, Pilot Commercial Staff Private Industry Shipping Center Development 1979-1988 Retired 1998 to present.

**Nancy (Green) Lister**, B.A. 1955 — Ray is still managing his real estate development projects along with 2 of our sons. We love to go to Rockport (all sons too) for fishing. My favorite is going to Estes Park, CO to hike & see the beauty of Rocky Mt. National Parks. We stay busy with our grandchildren ages 10(girl) 7(boy) and (girls) 2 years. They are so wonderful! Best wishes to all!



## Alumnus Chuck Williamson Becomes Chairman of Weyerhauser

Weyerhaeuser Company, one of the world's largest forest products companies, announced Jan. 5, 2009 that the board of directors elected Charles R. "Chuck" Williamson, Jackson School Ph.D. 1978, to become non-executive chairman following the planned retirement of Steven R. Rogel in April. Williamson joined Weyerhaeuser's board in 2004, serving as the lead director since 2006.

"Since joining our board, Chuck has played an essential role in the development of the significant strategic decisions we've made to position Weyerhaeuser for future growth," Rogel said. "I am pleased that the Board has chosen a successor whose leadership and expertise will complement the diversity of backgrounds and skills of our board and senior management team."

"I am honored to succeed Steve as chairman," Williamson said. "For more than a decade, Steve has guided Weyerhaeuser through a unique period of change as its CEO and chairman. We are indebted to his vision and commitment to make Weyerhaeuser a stronger company. Along with the rest of the board, I look forward to working closely with Dan Fulton and his team as we continue to position Weyerhaeuser for the future and enhance the value of our shareholders' investment."

Williamson was the executive vice president of Chevron Texaco Corporation when he retired in December 2005. Previously, he had served as chairman and chief executive officer of Unocal Corporation until its acquisition by Chevron Texaco. He also is a director of Talisman Energy Inc. and PACCAR Inc.

**Allen C. Locklin**, B.S. 1954 — To all "old" friends. Nancy & I logged in 55 years of marriage in August 09. She is still pretty. Our joy is our greatgrandson Owen Cash Shaver. --As the shale plays broaden I only regret that I'm not 40. It is exciting-but big dollar. We must enjoy the oil bizz as we know because if Pres. Obama does as indicated & strips away all tax incentives to drill its over. He speaks in contradictive bursts- Let's become energy independent yet discourage drilling?--Hang in folks it's just the beginning.

**Laddie Long**, B.S. 1952 — We find being confined to a fenced-in retirement village isn't all that bad. You get lots of help and attention. Have stopped going to reunions, having outlived a lot of the old gang.

**Ernest Lundelius**, Jr., B.S. 1950, Ph.D. 1954, Professor Emeritus, Jackson School — Although I am retired, I am still active in research on Pleistocene vertebrate faunas. Projects include the FAUNMAP database, a database of the Plio-Pleistoscene mammal faunas of North America, a study of the dental anomalies of Pleistoscene horses, and a continuing study of the fauna from Madura Cave in Western Australia. I was fortunate to be invited to take part in work in a cave on the Nullarbor Plain of Western Australia in April 2009. The vertebrate fauna from deposits in this cave promises to add a great deal to our knowledge of the faunal history of that region. In addition we visited Madura Cave where I first worked in 1955 and again in 1964. In a return to teaching, I have been involved in GeoForce, the program sponsored by The Jackson School for high school students interested in science. It has been very rewarding to see these young students in the classroom and in the field absorb new ideas and ask very good questions. My wife and I also continue to enjoy watching our grandchildren grow up. They have varied interests that include earth science and biology in addition to classical literature.

**Bill Mantinband**, B.A. 1959 — When one is retired, every day is a weekend. Theres no better satisfaction than volunteer work in a field that strikes your fancy.

**Sabin W. Marshall**, B.S. 1952, is retired and lives in Houston, TX.

**William J. Meek**, Jr., B.A. 1955 — Still active with Fincial Services along with number one son. Managing partnership of properties scattered throughout Tarrant, Johnson, and Burnet Counties. In May 2009 elected to City Council, Place 7 for City of Highland Village, Texas. Council work is very enchanting and is increasing my knowledge base of City Government. Enjoying life to the fullest!

**Wayne D. Miller**, M.A. 1957 — Continue to keep busy consulting full time and trying to get a few wells drilled. Never thought I would still be working after 51 years in the oil business or still be living in Midland after moving here after graduation from UT 51 years ago. Look forward to the newsletter each year.

**Richard A. Mills**, B.S. 1950 — Consulting work in Honduras. Give lectures on geologic history of Cordillera. Writing geologic novels.

**James H. Nienaber**, Ph.D. 1958, is living in Evergreen, CO.

**John F. O'Donohoe**, B.S. 1950, is the president for Coastline Exploration Inc. in Houston, TX.

**James Frank Patterson**, B.S. 1952, is retired and living in Bellaire, Texas.

**George B. Pichel**, B.S. 1951 — One year in the Amazon working for the Brazilian Government. 36 years with Union Oil Co. Retired Chief Geologist. I would like to see UT fighting Green Laws, look what happened to Spain ,18.3% unemployed.

**August Leo Pugh**, B.S. 1952 — Worked in Geology Dept. in 1952 and 1953 under Dr. Samuel Ellison the head of the Geology Dept. at that time. Also worked for Dr. Hal P. Bybee.

**Walter K. Rainbolt, Jr.**, B.A. 1957, is the manager for Dynamic Exploration Partners, LLC in Lafayette, LA.

**James V. (Jim) Richards**, B.S. 1956 — Continuing as a consultant for Genesis in Houston. Having my best year. Enjoying being on the Friends and Alumni JSG Board in 2008. Still playing in the Longhorn Alumni Band.

**Griff Robason**, B.S. 1957 — Is self-employed and lives in Gonzales, Texas.

**E. C. Robinson**, B.S. 1950, is retired for 23 years now.

**Lowell T. Rogers**, B.S. 1956, M.A. 1960, is retired and lives in Austin, TX.

**Robert Rosebrough**, B.S. 1957, is living in Penfield, NY.

**Jimmie N. Russell**, B.A. 1952, M.A. 1954 — I'm looking forward to commencing my 13th? (Wow, how time flies when your having fun!) year as an assistant teacher of "special needs" (Emotionally Disturbed) mid & high school students in the Round Rock ISD. The Gibson guitar I gave my fraternity brother John $20 for the last day I was at UT was in bad shape; one of my fellow teachers traded me a new Gretch (like John Lennon's) 3 years ago; he had the Gibson fixed and sold it for $2,750 last spring to a dealer and the dealer said he will make $1,000 off of it. I think I got a good deal! In June of '08 my wife and I joined a friend on a trip to Mexico, Veracruz, Puebla, and San Miguel de Allende. After a few margaritas, in the plaza at Vera Cruz, a Mariachi group allowed me to borrow one of their guitars, and join them playing and singing "Cielito Lindo". My friend preserved this event on a DVD; come visit us and be entertained. Not to be morbid, but I was remembering that my roommate Jerry and Bill are gone, as now are "Brick" and Norman; the circle is getting smaller. Is your glass half empty, or half full? Mine is half full, but is a heck-of-a-lot smaller! Let's all stay in touch.

*Field trip to Big Bend, 1973. From the archive of Earle McBride.*

**Floyd F. Sabins**, B.S. 1952, is the President of Remote Sensing Enterprises, Inc. in Fullerton, CA.

**George W. Schneider, Jr.**, B.S. 1958, is a retired independent geologist living in Maddisonville, LA.

**Eugene P. Scott**, B.S. 1957, is still a Consulting Petroleum Geologist in Corpus Christi, Texas.

**George Sealy**, M.A. 1953, is a consultant in Houston, TX.

**Robert T. Sellars**, Jr., B.S. 1957 — Still living, and working, in Denver. Enjoying both.

**Jerry M. Shelby**, B.S. 1957 — My wife Gay (B.A. 1957) and I still enjoy reading the newsletter though we are not active in our geologic professions. The new shale plays and offshore Brazil discovery give us hope for the fossil fuel industry and those who are geology professionals in that field. Hiking, fly-fishing and snowshoveling at our Colorado home fill much of our recreational desires. Our best to all.

**William Parker Slater**, B.A. 1950 — Seeing much more Cretaceous geology as Canyon Lake evaporates and goes down the Guadalupe. Experimenting with selling prospects by correspondence while wishing for a geologist son/daughter to do the leg work. Many wildcat prospects/few wildcat tankers.

**Marriott Wieckhoff Smart**, B.S. 1957 — John and I continue to be in good health. We are able to enjoy Colorado with winter snowshoeing and summer hiking. Last year was our time to go to Italy. We went to Rome for a week and were in awe of what the Romans accomplished 2000 years ago. In September we spent three weeks touring Cinque Terre, Florence, Tuscany and Venice. We walked a lot. Generally we prefer to be away from large cities but we did like Florence and Venice, especially Venice. We hiked the Italian coast and walked through vineyards in Tuscany. This year we stayed in the US. There is no place better. We spent ten days hiking and sightseeing in Washington and Oregon. Highlights were Mt. Rainier and Crater Lake but we also spent time at Mt. St. Helens and saw many, many waterfaills. Best wishes to all.
Additional Update sent later this year: "The years continue to fly by. John and I marked 50 years of marriage this year. We celebrated by taking a family vacation to Mexico. The lovely resort was located about an hour south of Cancun. John is still volunteering a lot and working some. I'm volunteering some but not working for money. Our younger daughter, Holly, and her family live in Whitefish MT. She completed training in Radiation Technology in May. Our other daughter is a Physical Therapist in Tulsa, OK.

**Daniel (Dan) L. Smith**, B.S. 1958 — I continue doing petroleum exploration mainly onshore of the Gulf of Mexico Basin. In addition to Sandalwood, I continue with managing my own exploration investment company. I enjoy working with the Jackson School Foundation Advisory Council and being President of the Jackson School Friends and Alumni Network (FAN'S).

**Glenn C. Smith**, B.S. 1953, is a retired Geophysicist/Geologist.

**Ted Stanzel**, B.S. 1956 — Exciting times for the Earth Scientist as demand once again has increased for our invaluable expertise. It's wonderful to stay in contact with UT alumnus and the Jackson School of Geosciences

**James R. Underwood, Jr.**, M.A. 1956, Ph.D. 1962 — Austin continues to be an exciting and pleasant place to live, especially if you like hot summers! Margaret Ann and I enjoy frequent visits to and from out three daughters and the children (7 grandchildren), who live in Kansas City and in Plano. The little ones, especially, enjoy the many interesting things to do and see in Austin (Barton Springs, the Capitol, Mt. Bonnell).

**Harry A. Vest**, M.A. 1959 — Last year (2008) my legs sort of just gave out on me- could barely make it from the stadium to the parking lot (1 mile away). Doubt if I make many of the football games this year. This year I have arthritis real bad in my wrists- just over the hill I guess.

**Bernie Ward**, B.A. 1955 — We still travel, about once a year. All family doing well. Grandkids into baseball and we manage to see a few games in Longview and Tyler. Was honored with a visit from Kimberly Kassor Rose, Assistant Director of Development at the Jackson School. Her pleasant personality was enjoyed by several of the old alumni.

**Leslie P. White**, B.S. 1956 — Back to FANs, I can't express how rewarding it has been these past couple of years being involved in the organization of the group and its involvement in some very worthwhile programs. For all of you who have not yet participated in a FANs event, I highly recommend attending the next one scheduled in your area. Great fun, great socializing, and great plans for future activities!

# Who's in this Picture?

We got excellent responses to our "Who's in this Picture" request from the last issue. See the answers on page 88. So now help us identify some of the people in this picture, taken in 1968 during Geo 660 summer field camp, and we'll send you a Jackson School cap and polo shirt. We'll even throw in a free subscription to the Jackson School *Newsletter*. Send answers to communications@jsg.utexas.edu or call us 512-471-6048.

**Robert R. Williams**, B.S. 1954 — I am attending SIPES meetings and Dallas Geological Society meetings and enjoy keeping in touch with friends in the oil business. I'm interested in the Chesapeake and Haynesville plays. I leased some of my interests in the Haynesville play. Hope for a successful well. Robin and I celebrated our 53rd anniversary this June. Can you believe she has put up with me for 53 years!

## 1960s

**Lynn S. Beeler**, B.S. 1962, retired in 2002, and lives in The Colony, TX.

**Donald H. Campbell**, M.A. 1962 — Semi-retired, but still doing petrographic work. Long live microscopy! Campbellpetro.com

**Mary Beth Cooper-Fons**, B.A. 1967, M.A. 1969 — I'm looking forward to retirement in early 2010. I continue to work half-time as a pediatric nurse doing telephone triage at Children's Hospital. I'll probably continue some volunteer nursing after retirement.

**Frederik E. Dekker**, M.A. 1966 — After several years of acquiring assets in the United Kingdom (onshore), in Guyane and in the Mozambique Channel, we have a private placement for Wessex exploration and will seek a listing on the junior PLUS market in London during the next few months.

**David Dunn**, Ph.D. 1964 — Southern Arizona remains fascinating to us. We never tire of the mountain views, spectacular sunsets and warm climate. Each evening we watch the Santa Ritas turn pink - and when the mountains turn pink its time to drink.

**Ronald M. Gieger**, B.S. 1963, M.A. 1965 — Part-time geological consulting to oil & gas exploration, mainly East Texas, North Louisiana. It is amazing to monitor a drilling well, run logs, run tests and complete, all on my computer, even in my pajamas, if I wish. Well sitting has certainly changed, for the better, I might add.

**Robert Gross**, B.A. 1963, is President of Keystone Oil Co, Inc. in Dallas, Texas.

**Weldon W. Hammond**, Jr., B.A. 1960, M.A. 1969, Ph.D. 1984 — Still working in water resources in Mexico, Honduras and Guatemala. Lots of challenges but I still enjoy it. My spanish is getting better than my English.

**Charles M. Hoskin**, Ph.D. 1962 — The most important thing you can do for those who are going to pursue a career in academia is to have a class-or two on writing research proposals—and the probable consequences of losing funding support from granting agencies. Teaching limit counts for very much.

**J. Phil Jones**, B.S. 1964 — Greetings from Oklahoma City. Still with Devon working the Granite Wash in Wheeler Co. Currently the number of rigs working has drastically curtailed awaiting decreased supply aand increase in the price for natural gas. As you are aware, the current administration is doing everything possible to totally eliminate any drilling for hydrocarbons, which will decrease supply thereby provide us with the increased price needed to resume drilling. In the meanwhile, we are continuing to enjoy watching our grandchildren grow. Best to all at the Jackson School of Geosciences.

**Milo Kearney**, B.S. 1962, is a Professor Emeritus of history at the University of Texas at Brownsville.

**Don Kerr, Jr.**, B.S. 1960, is retired and lives in Houston, Texas.

**Don Kirksey**, B.S. 1960 — After a 30-year career in geology which included Alaska and Holland and 16 years as a waste management consultant, life for BJ and me is taking a significant change. At 72, we're selling the house and all our stuff and moving into a 38' RV. We plan to travel, enjoying the beauty of America for who knows how long. While we expect a lot of R&R, we'll also be developing a manual on waste management for large companies. We plan to sell it on the internet. BJ plans to do some writing as well. Our 5 kids have given us 3 grandkids. We'd like more, but were not in control of that. We've lived in OKC 33 years where BJ and other OU fans turn Bevo's horns (Sigh). Would be nice to hear from anyone if our new manual can help you. 405-802-4247. We remain healthy and hope ya'll are too.

*Alumnus William Feathergail Wilson sent us this photo of three UT geologists taken at the mouth of Santa Elena Canyon around 1967. From left to right: Douglas Hord Wilson, B.S. '80, M.S. '82, Clay Hill Wilson, B.S. '83. M.S. '85, William Feathergail Wilson B.S. '60, M.A. '62. Douglas received his M.S. from UT Dallas and B.S. at UT Austin. Clayton and William received both degrees from UT Austin. Douglas is the Exploration Manger for Alaska with Anadarko. Clayton is working for Esso in Melbourne Australia and William is President of Strata Geological Services working in the groundwater arena. Note the hand lens.*

**Susan Longacre**, B.S. 1964, Ph.D. 1968 — Retirement continues to be busier than when I was 'working'! Still consulting with Chevron, and as a Chevron Fellow, very involved in mentoring technical high potential employees. Four grandchildren now- 2 to 18 years. Very active with Kerrville's Riverside Nature Center, the Texas Master Naturalist Program and my new career in designing and making art quilts-I'm trying to get geologic images in these quilts/wall hangings. Now working on Grand Canyon slot canyons.

**David F. Martineau**, B.S. 1962 — Enjoy serving on the University of Texas System Chancellor's Council Executive Committee. Glad to hear my son, David T. Martineau, is a new member of the Advisory Council of the Geology Foundation.


*Robbie Gries (center), M.A. 1970, catches up with Dean Sharon Mosher at the Jackson School alumni event during the 2009 Geological Society of America meeting in Portland.*



**Jereld E. McQueen**, B.S. 1961, M.A. 1963, lives in Kingwood, TX and is the President of Medallion Oil Company in Houston, TX.

**Joe N. Meadows**, B.A. 1962 — Practicing law in McGregor. Some oil and gas activity in area- hope someone hits something. Enjoying golf, scuba diving and U.T. sports.

**Bill Oliver**, B.S. 1968, M.A. 1970, is a geological consultant for Petroquest Energy in Lafayette, LA.

**Tom Poe**, B.S. 1962 — Still in Luling with my gunsmith business. Knew there were lots of firearms in texas, didn't know half of them needed work. Enjoyed the 60's reunion on campus.

**Peter D. Rowley**, Ph.D. 1968 — I continue working full time in my consulting business. Mostly working to site well fields and provide geologic framework for ground-water flow models for Southern Nevada Water Authority (Las Vegas), make geologic maps for Utah Geologic Survey, and site production water wells for water districts and land developers. Wife Dawna continues as an administrator for BLM. In November I received the 2008 Lehi Hintze Award for Outstanding Contributions to the Geology of Utah, presented by the Utah Geological Survey and Utah Geological Assn.

**Francis Carlton Sheffield**, B.S. 1963, lives in Magnolia, Texas.

**Stephen V. Smith**, B.A. 1964 — I retired from the University of Hawaii, as an oceanography professor, in 2002 and have been working at a Mexican government research laboratory in Ensenada, Mexico since that time (CICESE; http://www.cicese.edu.mx/), where I am presently in the Geology Department. I will probably retire from here within the next year and move back to the US.

**Herbert Sam Travis**, B.S. 1960 — I entered the School of Geology in 1957, a transfer from Arlington State College (now UT Arlington) and graduated in August 1960. I attended UT all year long until I received my degree. After graduation I joined Pan Geo Atlas Corp as an electric logging engineer and worked in Oklahoma and North Texas. In 1962, I joined the Geotechnical Corporation located in Garland, Texas and worked on the Vela Uniform Program, a research project involved with detection and monitor of above and underground nuclear explosions. After nine years, I left Geotech and joined Control Data Corporation and spent the next 35 yeas working in the Computing Field in Dallas, Texas. Good paying jobs as a Geologist were in 1972 still hard to find. After 35 years in computing, I now work developing real estate projects and manage my stock and bond investments. Oil and Gas Consulting and Lease Evaluations are performed on a limited basis for Technical Software and Engineering a Dallas Reservoir and Engineering Firm.

**Don Urbanec**, B.S. 1960, M.A. 1963 — Trying to retire but all those undrilled prospects won't let me.

**Gerald E. Weber**, M.A. 1968 — Partially retired but still working as an expert witness in the field of Engineering Geology. I find the work challenging and interesting. Traveling a lot - mostly in SW Africa and still running rivers.

**Frederick Wiegand**, B.S. 1969, M.S. Eng. 1970 — Slow year. Worked in Egypt Gulf of Suez on exploration well. Rest of the time on ranch. Wiegand Brothers getting older, too.

**Michael A. Wiley**, B.S. 1957, M.A. 1963, Ph.D. 1970 — Just returned from AAPG in Denver. It was great seeing so many old friends, many of whom I only see at annual AAPG meetings. I continue consulting part time, mostly writing graphic software for the environmental remediation and monitoring folks that use our data management package. After numerous treatments and physical therapy, the back injury suffered more than a year ago is finally responding favorably. Mobility has been hindered but seems to be improving as well. After AAPG in Denver, I went on a trip out to Grand Junction to sample and buy some of the good Colorado wine. The wine rack is now very well stocked. If in the area, call and come by. The beer is always cold.

**William Feathergail Wilson**, B.A. Lib Arts 1957, B.S. 1960, M.A. 1962—Sill working as a professional geologist across the state of Texas. Primarily engaged in hydrogeology. Purchased a new polarizing microscope and reviewing thin sections from the Bee Bluff impait site- lots of PDF's and melted quantz.

**William C. Young**, B.A. 1961, B.S. Eng 1962, is retired and living in Shreveport, LA.

## 1970s

**Patrick L. Abbott**, Ph.D. 1973, is living in San Diego, CA.

**Chris A. Barker**, B.S. 1978 — Chris Barker teaches structure and summer field camp at Stephen F. Austin State University in Nacogdoches (www.geology.sfasu.edu). "Field camp is great because our students get to see some truly spectacular geology in New Mexico, Arizona and Utah. Between mapping projects, we also take them to the Grand Canyon and other national parks in the Southwest. Actually, just seeing rocks at the surface is impressive to east Texas students!" Dr. Barker's research has been mostly in Proterozoic mylonites and accreted terrains in South Carolina, the Llano Uplift and the Burro Mountains of southwest New Mexico. He urges his friends to write and say hi, and mentions that there are great opportunities for graduate students at SFA, too. And, yes, he says, he still bangs on the bongos!

**David Birsa**, Ph.D. 1977 — Enjoying retirement in the Texas Hill Country.

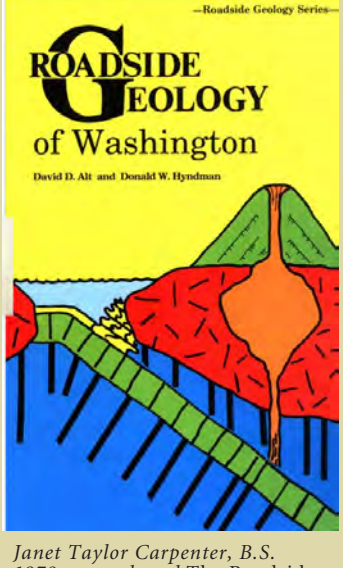
**Walter E. Bloxsom**, M.A. 1972 — After leaving the Iron and Steel Industry I spent the next 22 years working in the field of Organic Waste Recycling where I was able to utilize my iron and steel experience to find environmentally safe ways to convert waste organic matter directly into valuable high quality synthesis gas composed primarily of hydrogen and carbon monoxide. From this experience I authored several U.S. Patents involving gasification of organic matter and vitrification of associated non-organic matter.

**Silverio "Sil" Bosch**, B.S. 1974, M.A. 1975 — Now after retiring at age of 77, I spend my days watching the Longhorns on TV, walking our dogs around the lakes of Sun Lakes, and fooling around on my computer or in my workshop where I build working models of "gadgets" with which to obtain mass flow data involving the movement of free solids—mostly sieved sand. With such data, I can check out the mechanical practicality of my ideas. I do this type of work: just for the fun of it, to keep my mind occupied, and to hide from my wife and her "honey-do" projects—when she is not at the Mall. And my wife, who also graduated from the University of Texas, and I celebrate our 55th Wedding Anniversary this year.

**Neil C. Brooks**, B.S. 1978, is living in Houston, TX.

**Janet Taylor Carpenter**, B.S. 1978 — (Husband proposed as I returned home from 660 field camp) Graduated, married, worked as a lime burner, went back to get teaching certificate, reared 2 girls, still teaching. Last August, we spent out 30 year anniversary sight seeing in Washington and Canada. We had more fun than I could have imagined with our Roadside Geology of Washington book; really enjoyed seeing the Grand Coulee, Mt. St. Helens, and the Comax Glacier, not to mention all those trees. At airport security the office asked, "Ma'am, are you carrying... ROCKS?" Of course I am.

**Chuck Caughey**, B.S. 1969, M.A. 1973 — Still working the Middle East for ConocoPhillips in Houston and active in the new GeoFORCE program in Houston as well as the Jackson School FANs.




*Janet Taylor Carpenter, B.S. 1978, co-authored* The Roadside Geology of Washington.

**Robert Cobb**, B.S. 1977, M.A. 1980 — Have worked the last three years on the Fayetteville and Brunett shoals as consulting geologist. Regards!

**Pat Dickerson**, B.A. 1970, Ph.D. 1995 — The International Geological Congress in Oslo was a particular highlight of the past year – rousing reunions with friends from Norway, Netherlands, New Zealand, Argentina. Presented my latest field research there on Ordovician magmatism in the Marathon region – results of stimulating collaborations with colleagues from Australia, Argentina, Scotland, and Texas. Another talk at South-Central GSA opened the door to possible paleomagnetic studies of newfound volcanic rocks in the basin.

**John, Drake**, B.S. 1974, M.A. 1975 — Grandkids, golf and drilling wells: life doesn't get much better than this.

**Robert F. Goodrich**, B.A. 1973 — Graduated May 26, 1973 BA Geology, attended University of Texas under the G.I. Bill, after serving as a Platoon leader (1st LT.) in Vietnam with the 25th infantry division and the 101st air borne division retired from IMC-Global Corp. in 2003 as the Reclamation Manager for the Phosphate Minerals Division, Mulberry, Florida. Hook Em Horns!

**Dan Gorski**, M.A. 1970, is President & CEO of Standard Silver Corp in Tyler, TX.

**Edwin R. "Win" Goter**, M.A. 1973 — Hard to believe, but I'm going on 32 years at Shell (and at least the 9th reorg). Highlight this year was our older daughter getting married in June. Enjoyed seeing UT friends this year at get-togethers and events. Hope to do more of this. Now working on international tight gas, basin center gas and shale gas projects; quite different from 10 years of working deepwater exploration!

**John H. Hansen**, B.S. 1978 — Help! I'm a rock! Who could imagine?

**Ann Hoadley Leist**, B.S. 1979 — Hello to classmates. Life is good, still living in Austin. I am curently heading the Austin branch of the Subsurface Library. We provide well logs from State files to Texas libraries, majors, minors and individuals. I enjoy researching the historical areas, as well as the current hot areas. Still bookeeping for Conans Pizza, too. Email or drop by the Bureau of Economic Geology if you are in town.

**Logan Irvin**, B.S. 1979, is the owner of LAMA Energy LLC in Midland, Texas.

**Russell W. Jackson**, B.S. 1976, is a partner and geologist for Tyler Oil & Gas in Tyler, TX.

**Alan Joyce**, B.S. 1973, is a Geologist for Joyce Associates in Richardson, Texas.

**Peter C. Keller**, M.A. 1974, Ph.D. 1977, is the President for Bowers Museum in Santa Ana, California.

**Bob Kent**, B.S. 1972 — Retired in Granbury, living on the Brazos River. Still do some consulting work in environmental or water supply.

**Robert A. Levich**, M.A. 1973 — Retired from US Dept. of Energy, Yucca Mountain Project at the end of 2004. Stella and I divide our time between Las Vegas and Ghana, where we have built a retirement home on a 4 acre property, above a seacliff on the Gulf of Guinea, 30 miles west of Accra. Editor of 2007 GSA Memoir #199, *The Geology and Climatology of Yucca Mountain and Vicinity, Southern Nevada and California*. Currently provide consulting services on diamond and gold deposits of West African Precambrian Shield, and associated environmental and engineering geology.

**Mark W. Longman**, Ph.D. 1976, is living in Denver, CO.

**R. Michael Looney**, B.S. 1971, M.A. 1977, is President of Black Pearl Exploration in Houston, Texas.


*Alumni Brad Wolaver, B.S. 1995, Ph.D. 2008, his wife, Sally Holl, M.S. 2004, and Robin Gary, B.A. Spanish 1995, M.A. Geography 2005, reunite at the Jackson School event during the 2009 Geological Society of American meeting in Portland.*

**John C. McBryde**, M.A. 1979 — After nearly 30 years in the oil & gas business, half of that spent as an independent geologist, I decided it was time for a change. In the spring of 2008 I opened Prairie Thunder Baking Company, an artisan bakery located in the booming Midtown area of Oklahoma City. We feature artisan breads and European style pastries. Our cafe serves breakfast and lunch and features bakery items. We also provide baked goods to a growing number of restaurants in the city. Reviews, customer comments and business are all great! Come visit if you are in Oklahoma City.

**Richard W. McGlathery**, B.S. 1976, is a Geologist for Bankhandle Oil and Gas, Inc. in Oklahoma City, Oklahoma.

**John Preston**, B.S. 1970 — Still scratching for grease in South Texas with Hard Enterprises and the way my 201K plan looks, I'll be picking seismic squiggles until I die at my desk.

**Donald Rae**, B.A. 1976, is retired and living in Rockport, Texas.

**Donald F. Reaser**, Ph.D. 1974 — I enjoyed reading Bill Fisher's memoir, Leaning Forward! Bette and I recently took a transatlantic cruise on the Queen Mary II to Ireland (Sept. 2008).

**John Roberts**, B.S. 1973 — I retired in 2005 from Weatherford Int'l as VP of Intervention Services. After spending 30+ years in the oil service industry and traveling all over the globe, I now travel with Lexie, my wife of 37 years, just for fun. We also train dogs for Bark Busters home dog training, and I play lots of golf. The three daughters are grown and gone. One serves in Germany in the US Air Force.

**Stephen L. Shaw**, B.S. 1971, M.A. 1974 — Nancy and Steve enjoyed their trip to the AAPG Convention in Denver last June where Steve received the Distinguished Service Award from AAPG. Steve is President of First View Resources in Midland where he continues to do oil & gas and ground water work; along with running the family ranching operation.

**Brian Smyth**, B.S. 1976 — Is shale gas drilling a loser for the non promoting investor? Is it possible to listen to seismic records rather than just look at them?

**Cynthia G. Talbot**, B.S. 1976, is living in Annandale, VA and working for Hogan & Hartson LLP.

**Brian Trask**, M.A. 1972 — Having completed 30 + years of service to the people of

Illinois at the Illinois State Geological Survey, I retired in June 2008. My wife and I spent the summer and fall looking at houses in the central coast of Maine and purchased a house in Rockland. Our Champaign house sold faster than we expected, and we moved to Maine (back to Maine for me) in February between snow storms. We are now occupied in volunteering—so far with the Friends of the Rockland Breakwater Lighthouse and Puffin watch.

**Noel B. Waechter**, M.A. 1972 — I sold Entrada GeoSciences to Core Laboratories at the end of 2007. Managed Englewood office for Core Lab until retirement in May, 2008. Currently working on oil prospects and investing in oil deals. Sue and I have one granddaughter, Kiana, who lives in Atlanta.

**Bonnie R. Weise**, B.S. 1974, M.A. 1979, BEG 1974-1981 — Greetings to all of my classmates, former co-workers, and the rest of you whom I've had the pleasure of associating with through FANs events and professional society activities. To update, I'm still happily working as a geological consultant in San Antonio and also partnering with a couple of my long-time business associates, Tom Ewing and John Ames, in Yegua Energy Associates, LLC.

**Steven White**, B.S. 1978 — I'm still enjoying generating oil and gas prospects in the East Texas area and working for myself.

**Chuck Williamson**, Ph.D. 1978 — Cathy and I are enjoying living in Sonoma, staying busy tending a small vineyard and gardens. I currently am serving as Chairman of Weyerhaeuser and Talisman Energy, already looking forward to "real retirement" in a few years.

**James C. Willrodt**, B.S. 1977 — Hello to all the old classmates of 1977, I am still bouncing around the globe poking holes in the ground for ExxonMobil. Recently I've been in Indonesia with a new 6th generation semisubmersible, a new rig and with it the challenges that come with all high-tech equipment. Best wishes to everyone.

## 1980s

**Elaine Marie Allan**, B.S. 1983, J.D. 1990 — Still live in Austin with husband Chris Campbell and son Adam Campbell,14. Daughter Erika Allan, 24, will be making me a grandma in September. Still retired, I spend my time with literacy projects; teaching free Asian kids' ESL classes in the summer; helping take care of refugees from Asia & Africa; taking thousands of free kids' books to east & northeast Austin, and tutoring English.

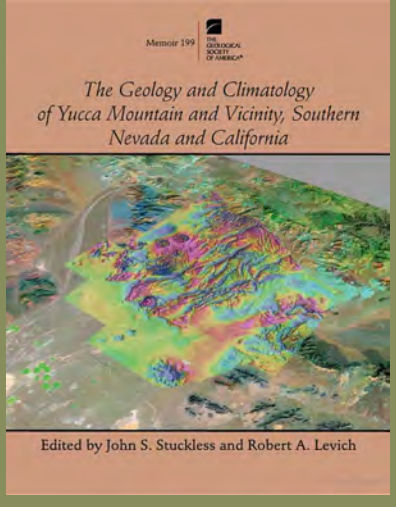
**David M. Angstadt**, M.A. 1983 — I have been working for over a decade in West Africa hydrocarbon exploration as an interpreting geophysicist. Thank you U.T. for giving me the opportunity to see the world! Still working offshore West Africa (since 1994!). I've moved from Nigeria to Chad to Equatorial Guinea to my current job in the Angola-Congo's exploration team at Chevron. I'm having the great pleasure of working with UT 1957 grad Larry Littlefield - a legend here who discovered many of the first Angola fields in the 60s and 70s. Now living in Houston with Valeria and our three teenagers.

**Walter Ayers**, Ph.D. 1984 — Teaching integrated reservoir studies, unconventional oil & gas reservoirs, and well logging classes; research in $CO_2$ sequestration and enhanced oil & gas recovery.

**Mark Berlinger**, B.A. 1982, M.A. 1984, is working as an Environmental Director for BP Products.

**Patricia Bobeck**, M.A. 1985 — In October 2007, I took early retirement from the State of Texas to pursue other interests. I now work as geologic consultant and technical translator, in addition to serving on the board of the Friends and Alumni Network of the Jackson School. One of my major post-retirement projects has been the French to English translation of Aurèle Parriaux's Geology Basics for Engineers. Prof. Parriaux teaches at the Federal Polytechnic School of Lausanne, Switzerland, and his book had won the prestigious Roberval Prize in 2007. I continue to give presentations on Henry Darcy and The Public Fountains of the City of Dijon (my award-winning translation) throughout the US. I am






## Levich Helps Boil Down 20 Years of Research on Yucca Mountain

The scientific community can now take a long-awaited look at the research behind the selection of Yucca Mountain, Nevada, as the nation's high-level radioactive waste repository. *The Geology and Climatology of Yucca Mountain and Vicinity, Southern Nevada and California*, published by the Geological Society of America, presents important results of a significant part of the U.S. Department of Energy (DOE) Yucca Mountain site characterization study. The study was conducted by the U.S. Geological Survey (USGS) and the DOE National Laboratories.

Retired DOE scientist and Jackson School graduate Robert Levich, M.A. 1993, co-edited the GSA Memoir with John Stuckless of USGS. The book includes discussion of the mountain's tectonic setting and detailed structural geology and stratigraphy, evaluation of tectonic models that have been proposed, and a study of the climate history and possible climate change that could affect the mountain's ability to isolate radioactive waste.

According to the editors, more than $6 billion has been spent thus far to study geologic, engineering, and transportation issues associated with Yucca Mountain. The site characterization study contained results of more than 20 years of scientific research and analysis by hundreds of scientists. Stuckless and Levich are now at work on a second volume. It will summarize current understanding of the hydrology and geochemistry of the Yucca Mountain area.

currently organizing another hydrogeologic and cultural tour to Dijon and other French sites of interest in May 2010. To see photos of the 2006 tour, and to learn more about Henry Darcy, visit my website: www.pbobeck.com.

**Julie Bonner**, B.S. 1983, B.S. Eng 1992 — I just got back from the UT 1980's Geoscience Reunion in Austin. Couldn't remember anyone or anything except some foggy memories from GEO660! I had a good time, though, and the improvements to the Geo department make me want to come back to school! After working as the multilateral well expert for Chevron on a global basis for the past 11 years, I made a change in January of this year to deepwater drilling in the Gulf of Mexico and am loving the new challenge. The only downside is that the international projects and travel I enjoyed so much is no more, but that's fine...for now. I've been in about 40 countries, including Bangladesh, so, I'll sit tight a while and just escape the country on vacation from time to time.

**C. Douglas Brown**, B.S. 1984 — It has been fantastic to reconnect to the University as President of the Jackson School Friends and Alumni Network ("FANs"). There are many opportunities to enhance your professional, academic and personal contacts through various FANs programs. It has been especially gratifying to mentor current students through brown bag seminars and the FANs summer student jobs program "SMART Start". It has been a lot of fun so please get involved!

**Randy Alan Brown**, B.S. 1985, is a Geologist for Endeavor Energy Resources L.P. in Midland, TX.



# Who's in this Picture? We Found Out.

We received four responses to our request in last year's newsletter for information about this 1973 picture from Earl McBride's Geo 660 Sumer Field Course archive. Through the fog of time, the respondents recollected that it was probably taken in the Marathon Basin. The instructors were Jim Sprinkle (far right with canteen on hip) and Wulf Massel. Randall Scott Rosenberger (B.S. 1973) identified himself as the "student in the upper central area of the photo … wearing glasses and a white helmet liner with chin strap, I am also carrying my Estwing geologist hammer." Bren Sidereas (B.S. 1973), who is now a senior geologist with Denbury Resources in Rockwall, spotted himself "standing looking down, between the two hats top row center." Jack St. John (B.S. 1974), now based in Cairo, recognized himself bending over the boulder in a striped shirt and cowboy hat. Other students tentatively identified: Carolyn Shattock (in back with red bandana), John Pigott (in front with long blond hair and cutoffs), Jim West (above St. John with cowboy hat and shades), Gary Weber (back far left with hand on hip), Joe Stevens (bending over boulder with headband), and Chris Clear (top right, shirtless with white socks) . Rosenburg, who became a physician and now lives in Temple, also recalled that Dr. Massel "became a father during that course, and briefly returned to Austin." The reason they are tipping the boulder has been lost to history.

**Richard F. Carroll**, B.S. 1980 — I am still in Houston, still employed as an exploration and development geologist and still living in The Woodlands. Recent trips have included the Iquitos, Cusco, Machu Picchu, Punta Arenas, Santiago, Prague, Krakow, Budapest and Paris. My two boys, Ian and Austin, went with me to Europe and we will be going to the Canadian Rockies this summer. Ian will be a junior next year and is working hard toward getting into UT when he graduates. Austin will be starting high school and still hasn't decided where he wants to go (UT). I am very proud of both of my boys, they are fine young men and I am still wondering where they got that from. Always happy to hear from old classmates, so don't be a stranger.

**Karen Carter Krogh**, M.A. 1985, Ph.D. 1990 — Still in N.C. Kenzie is in 7th grade, continues her 4.0 in school, and is quite the volleyball player! I continue to do an annual week-long Rocky Mtn. backpacking trip. Come visit if you're in the area!

**Richard Chuchla**, M.A. 1981 — A time of transition for me—new assignment in new location with the last of our children headed to college. Spent the last three years managing ExxonMobil Exploration's unconventional resources effort. It was a great learning experience made more fulfilling by the success we enjoyed. Just moved to Dallas and the corporate headquarters where as a senior corporate strategic advisor, I work at the pleasure of our corporate management team and CEO. A new prospective and lots of learning but I'll look forward to getting back to the business of finding oil and gas.

**Joel Coffman**, B.S. 1984 — Susan and I just moved into our new home we had built in Vacaville. Everything is in boxes, so we will miss the 80's reunion as we have to unpack. Best wishes to classes of 81-84.

**Tom Connally**, M.A. 1981 — Been out of touch with the Foundation lately. Nice website and a way to get connected. More or less retired now after stints in Qatar and Holland the past 4 years. Live in western Tuscany now and would love to hear from any of you fellow alums if you pass this way.

**Jeff Corrigan**, M.A. 1986, Ph.D. 1990 — Took awhile, but we finally made it back to the Austin area!

**Ross Davis**, B.S. 1980, MBA 1982, works for the Davis Brothers company.

**Gary Donnan**, B.S. 1984 — When not in the field or dancing Argentine tango, I continue as a visiting research fellow in JSG, working for AGI on the GeoRef project. The geology library is the loveliest office I've had – best part is that someone else keeps the books organized! Am also planning a research symposium – most probably here in Austin – recognizing Bill Muehlberger's countless scientific and professional contributions. Would welcome your ideas and suggestions. Onward!

**Keith D. Edwards**, B.S. 1984, is a Physics teacher at Ponchatoula High School in Ponchatoula, LA.

**Patricia Mench Ellis**, Ph.D. 1985 — This year I traveled to the Kingdom of Bhutan, an absolutely beautiful country with wonderful, friendly people .... Bhutan is a small country wedged between Tibet and India .... We were lucky enough to attend the Para Tsechu, a multiple-day Buddhist festival with colorful costumed dancers, held within the monastery. Archery is the national sport, and they can hit a target on a windy day from a distance where I can hardly see the target. Bhutan is trying to preserve traditional arts, so we also had a chance to visit papermakers, silversmiths, basketweavers, woodcarvers, and thanka painters. One of the highlights of the trip was an excursion to Taktsang Monastery, otherwise known as the Tiger's Nest. The country has an interesting national philosophy called Gross National Happiness which seemed to be working as people everywhere seemed to be happy, proud of their country and culture, and extremely friendly. Visit Bhutan if you get a chance!

**Kent England**, B.S. 1982 — Have moved to the Upstream Technology team at Marathon afer many years of exploration. Daughters age 16 (just driving - my stress level is on the way up!) and 6 (keeps you young). I keep in touch with a few former classmates and would love to hear from more. Hook 'em.

**Sterling (Chip) Fly III**, B.S. 1980, M.S. 1985 — Enjoying life in Roswell, NM D'nese and I are both back in the 'grease game', after several years of ranching, retailing, water managing and environmentaling. Kind of like the Prodigal Oil Pig. Hope to see some of you at NAPE.

**Gretchen Gillis**, M.A. 1989 — Life is good as I continue employment with Schlumberger and look forward to finishing a 3-year term as AAPG Editor.

**Stephen Glahn**, B.S. 1980 — Still drilling in 7B and thinking about the ancient Chinese? Curse: "May you live in interesting times." I also wonder about the whereabouts of Chip Heald, Jamie Fulcher, Nathan Hackstraw, and Jeffrey Hildebrand.

**Charles Goebel**, B.S. 1980 — Working Domestic properties for Merit Energy in Dallas. Two heirs now UT grads!

**Dalia (Gonzales) Niederer**, B.S. 1980 — Graduated in 1980 and went to work for Mobil Exploration in Dallas, Texas as a geophysicist. Worked for Mobil for 20 years as a seismic interpretation geophysicist in various domestic (Texas, Colorado, California and Louisiana) and international (England and Australia) locations concentrating in onshore and offshore 2D and 3D workstation exploration. Retired in 2000 when Mobil and Exxon Merged to Jackson Hole, Wyoming. Currently, volunteering at local schools for geology instruction and field trips.

**Susan Williams Haas**, B.S. 1986 — Still enjoying the Pac NW, raising 3 children, 2 who are teenagers, and playing the harp professionally while runing a private teaching studio for

*Brian Hunt, B.S. 1996, M.S. 2000, & Brian Smith, Ph.D. 1986, at their well site.*

harp and piano students. I get outside and ride my bicycle as much as possible.

**Paul A. Hardwick**, B.S. 1983, is working as Vice President of Biology at Smith Interest in Houston, TX.

**Rev. Larry R. Hensarling**, M.A. 1981 — I am currently working on my doctoral dissertation entitled "The Significance and Impact of the Bible in the Spiritual Renewal of a Congregation." Congratulations on your fruitful efforts.

**Gary Hummel**, M.A. 1982, is living in Houston, Tx.

**Daniel C. Huston**, M.A. 1987 — 2008 was a good year for Holly and I and the kids. In January we took delivery on a 1986 Grand Bank 42 motor yacht. It's a great boat, very table and comfortable with lots of interior teak woodwork. We are slowly bringing her back from several years of sub-standard care and maintenence. No damage from Hurricane Ike and missed most of the death and destruction in the financial markets. Hunter 3-D, Inc. our geophysical consulting business, is still going strong after 12 years, knock on wood. Hello to Tracy, Jim, Chris, Gaylen, Leigh and all the other Project SEER grads.

**Leslie (Les) A. Jeske**, B.S. 1984 — Life in East Texas remains good. The environmental industry continues to hold its own even in the face of challenging economic conditions. This year we join the ranks of families with college-bound children. Our oldest daughter will be attending Letourneau University in Longview, majoring in engineering physics. Our other few children keep us busy with school and activities. Other than that, not much else to report.

**Charles G. Johnson**, B.S. 1983, is working as an Acquisitions Manager for McGowan Working Partners, Inc. in Jackson, Mississippi.

**Jennifer Kraft**, M.A. 1984, is living in Houston, Tx.

**Jonathon Leason**, M.A. 1983, is Geology and Geophysics Manager at Anadarko Petroleum in The Woodlands, Texas.

**Dave Martens**, B.S. 1984 — After 21 years with Unocal and briefly with Chevron after the takeover, I have been with Marathon Oil Company for more than 3 years. I'm now managing our Marcellus exploration efforts. Quite a change from the asset work I had been involved with for years. Between UT football games and hunting trips, I still keep up with a few of the folks from the Geo Department ( Woody Pace, Tom Kirkpatrick, Brian Mosley and George Livesay). Can't complain about my family life either. My wife, Autumn, and I have been married 25 years. My daughter is at Texas Tech (OK, I guess there is something to complain about) and my son is a Junior in High School.

**Jeffrey G. Martin**, B.S. 1984 — I hope that all is well with my 1984 Classmates. We are active as an operator in S. La. I live in Covington, La. & have two precious girls, Jillian age 6 and Ava age 4. All well here with the exception of concerns about the potential Cap & Trade and Energy Plans.

**Jude McMurry**, M.A. 1982 — I continue to work at the CNWRA, where I am a technical advisor for the U.S. Nuclear Regulatory Commission. Currently part of a group of earth scientists who are reviewing the U.S. Dept. of Energy's license application for a geologic repository for used nuclear fuel at Yucca Mountain, Nevada.

**Marshall Merritt**, B.S. 1984 — Is a Patner at Merritt Capital Partners in Dallas, Texas.

**Mary Nelis**, M.A. 1984 — In anticipation of being an "empty-nester" in September of '09, I have returned to my most beloved niche in geology - I now get to do petrography on sandstones from the world over, and have been assigned all the work we get on the Monterey Fm of California. There is much variety and challenge!

**Dalia Gonzalez Niederer**, B.S. 1980 — Graduated in 1980 and went to work for Mobil Exploration in Dallas, Texas as a geophysicist. Worked for Mobil for 20 years as a seismic interpretation geophysicist in various domestic (Texas, Colorado, California and Louisiana) and international (England and Australia) locations concentrating in onshore and offshore 2D and 3D workstation exploration. Retired in 2000 when Mobil and Exxon merged to Jackson Hole, Wyoming. Currently, volunteering at local schools for geology instruction and field trips.

**Jamie Nielson**, Ph.D. 1986, J.D. 1989 — My wife Mary and I have been married 12 years and we have a nine-year-old son. Big news of late was my rookie season as coach of my son's little league team. Despite my efforts we were season champs. Our family spends a lot of time enjoying the outdoors and we are all trying to hone our fishing skills. I've been a lawyer in Austin for 20 years. However, I still deal with geoscience issues because I represent oil and gas companies before the RR Commission.

**Elliott Pew**, M.A. 1982 — Having fun with unconventional directed start-up. Drilling. Lots of Haynesville & Eagle Ford horizontals. Hope gas prices come up! Lots of gas out there now ....

**Loren Phillips**, B.S. 1982 — Enjoying life around the Chesapeake Bay. Older son, Adam is 20 and living on his own. Younger son, Daniel, is 8 and is a martial arts orange belt. I am occupied at work doing watershed protection projects for the army. Turns out military land use is unique and requires special attention to protect the land.

**Gene Pisasale**, M.A. 1980 — After working for the last 14 years as a portfolio manager and analyst covering the energy, basic materials and power/utility industries, I've moved back to the sell side to take advantage of a great opportunity just minutes from my home (compared to my previous 3-hour plus round trip drive each day to Baltimore). I also published my first novel- "Vineyard Days"- a story of a murder and the financial market collapse, which takes place on Martha's Vineyard. The book is now available on Amazon and Barnes & Noble. All the best to the Master's Class of 1980!!

**Cory Richards**, B.S. 1985 — Recently started our newest E&P company, Plano Petroleum, LLC. We are active in horizontal drilling in low perm reservoirs in the Mid-Continent. Family is great; one daughter is a senior in high school and the other daughter is a sophomore at Tech. Amy is active in tennis. Look forward to seeing everyone this summer at the reunion.

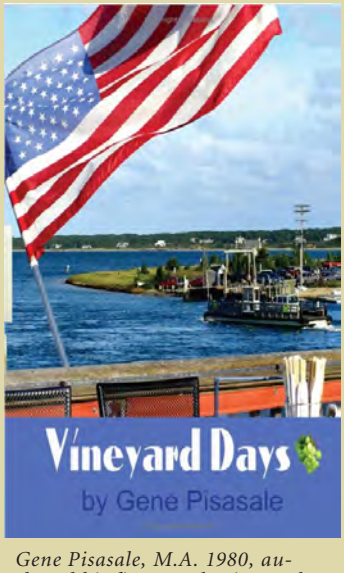
**Robert Barrett Riess**, B.S. 1986 — "Barry" Working with the Core Lab team characterizing reservoirs from west Africa, Europe, and the Gulf of Mexico. Still ranching with the wife,Meggie, and coaching baseball/softball with kids Cameron 10, and Julie 14. See you at AAPG ICE in Brazil.

**Jerry Schwarzbach**, B.A. 1983 — Loved studying Geology at UT. Still practicing medicine in Tyler. My son started at UT Austin this fall.

**Robert L. Sherrill**, B.S. 1980 — This has been a year of life-changing events. In September 2008, a week before our 25th anniversary and just as we were realizing the joys of empty nest, my wife Jan suddenly died at work from a heart condition. Even after 10 months it is still hard to either realize or accept. My youngest son Michael just completed his freshman year at WTAMU and made the Dean's list. My oldest son Charlie still grows his web design company for clients throughout the world. Work is going good despite the economy. Our venturing into Wind and Solar and expanding our environmental market outside the US a few years ago is now paying off. I hope that all is going well both personally and professionally for the DOGS grads of 1979-1980.

**Mark Shield**, B.S. 1988 — Life is good! Splitting time between Austin and Lake Livingston, Geo. Consulting and semi-retirement.

**Scott Simmons**, B.S. 1987 — The family and I continue to enjoy our active lives in Fort Collins. Emma and Tommy love to reorganize Ronda's and my 30 years of collected rocks that litter our beds in the backyard. I am keeping the major mountain bike accidents down to one per year. Work has mostly been focused on multiphysics simulation of natural and man-made disasters on buildings and other structures. Gotta love blowing things up in a computer.




*Gene Pisasale, M.A. 1980, authored his first novel,* Vineyard Days, *a story of murder and financial mayhem.*

**Stephen W. Speer**, BEG research assistant, 1981-1982 — Life is still good for Therese and I...and interesting as always. Still doing O&G but have diversified what with all the "cap & trade" and other great ideas out there designed so as to wean us from our dependency of those evil hydrocarbons....just can't quite figure out what will replace them in the immediate future, especially when it becomes "obvious" that we will have great need to heat our homes when "they" finally figure out that we're entering a new ice age....LOL!!! All kidding aside, hope everyone is surviving this serious economic situation we find ourselves in and doing their best to keep your priorities and life in perspective. There's a silver lining in every situation that is generally obvious after its over....you do remember grad school don't you??? Hi to the Dirty Dozen...cheers mi amigos!! Zaz

**Burgess Stengl**, B.S. 1985 — I am still in the Houston area. The family and I survived Hurricane Ike, with no real damage to the house...just nine days without electricity. It's amazing what the wind and water can do! In December 2008, Allied Waste and Republic Waste have merged, so I am now working for Republic Services at the McCarty Road Landfill Office. Angela is teaching second grade at Frank Elementary for her fourth year in the Klein School District. Our daughter Shara is teaching sixth grade in Austin, and is expecting our second grandchild. Susan graduated from UT Tyler in December 2008, and is working in the Hosuton area. Kyle is starting sixth grade, and is not eagerly awaiting the first day of school. I missed the Class of the 80's reunion last summer, but I hope everyone from the Class of 1985 is doing well.

**James Stimac**, M.A. 1983 — I'm still in Jakarta Indonesia working on geothermal reservoirs for Chevron. The family enjoys hiking volcanoes and beach vacations. Visitors welcome.

**Ted Stout**, B.S. 1985 — Going on 6 years as Chief of Interpretation at this national park. Outside of Hawaii, this is one of the best places in the U.S. to view young lava features.

We are huge on the geology field camp circuit. Stop by and visit sometime.

**Michael Stowbridge**, B.S. 1982, is continuing to consult in the slowly rebounding oil field.

**Bruce Swartz**, B.S. 1982, is the owner of Swartz Oil Company in San Angelo, TX.

**Sterling Thomas**, D.V.M., B.A. 1982 — Live on a Cherry Orchard in the Pacific Northwest. Split time between Oregon and Hawaii working as a veterinary consultant. All hard rock geology out here. 1982, Geo 660, and days at Bureau of Economic Geology seem so long ago. Enjoy reading the newsletter every year.

**Joseph Versfelt**, B.A. 1984 — Since the last update, I have been continuing in my role as International Exploration Manager at El Paso Corp. in Houston. Main projects have included 1) exploration, appraisal, and development in 13 concessions in offshore Brazil. And 2) strengthening 2006 new country entry in Egypt to 4 concessions totalling ove 2.5mm acres. In Egypt, an active 3D and drilling program is underway.

**David A. Wallace**, B.S. 1986, MBA 1999 — The last year has been uneventful compared with the previous year when I switched jobs, industries and locations. The family has finally settled into a routine in The Woodlands, north of Houston, and the wonderful skin rejuvenating moisture (also known as humidity). My daughter Zoe (4.5) and son Zander (3) are doing well, attending pre-school and spending lots of time at the pool - something they did not do much of in Colorado. I am consulting to the oil and gas industry and enjoying $80 a barrel oil. Please let us know if you are in the area - dawalace@yahoo.com.

**Leslie Leland Warren**, B.S. 1985 — Happily married since 1986 to college sweetheart! Have a wonderful son who is so much fun to be around. I have worked in the Petroleum Industry since graduating from UT in 1985 with a Geology degree. Started working for Schlumberger in 1990 as a consulting geologist but more recently as project manager. Today I work in one of our headquarters groups managing part of our knowledge management system and managing special projects. I have been back to campus for Schlumberger recruiting trips and then this past spring for the UT Discover Day with my son - who of course wants to be a Longhorn next year. Hi to Tatiana – glad we found each other on Facebook! Any other 1985 Summer GeoDogs out there?

**Doug Wilson**, B.S. 1980 — I'm working Alaska for Anadarko and enjoying the diverse geology and commercial challenges. Thirty years ago this month Rebecca and I met and we'll celebrate our 29th wedding anniversary in July. We were married right after 660 in 1980 in the Travis County Courthouse. Our daughter Rachel is a high school senior this fall. I'm still running calls in the Klein Volunteer Fire Department as a District Chief.

**Anthony (Tony) Yates**, B.S. 1988 — Nine years now in the IT industry and still enjoying new challenges, but sure miss being "out in the field" at times.

**George Zemlicka**, M.A. 1988, Happily Living in the piney woods of Texas and working exploration projects for BHP Billiton in the deepwater Gulf of Mexico.

**Suzane Zick**, M.A. 1984, works as and ajunct geology instructor for Lone Star College in Tomball,TX.

## 1990s

**Audrey Wohlford Adams**, B.S. 1996 — Matthew and I added a second future longhorn to our family last fall. Ashley (5 1/2 years) just adores her baby sister, Megan. We are still living in Houston and working as petroleum geologists. Audrey has been with Sandalwood Oil & Gas for over 12 years and focuses on generating and drilling prospects in South Texas.

**Kenneth B. (Keg) Alexander**, M.A. 1990 — In March 2008, I moved to New Zealand for a new job with SKM as a geothermal exploration geologist. I've been able to apply my hydrogeology training and experience to a related field while I learn the intricacies of harnessing energy from high temperature geothermal fields in Nicaragua, Indonesia, Guatemala, Chile and NZ. Cheers!

**Amy L. Campbell**, B.S. 1997, sends in her URL: http://www.morganstanleyindividual.com/fa/amy.campbell.

**David DeBalko**, M.A. 1991 — Diana & I have 2 awesome little boys (ages 5 & 3) who keep us very busy. We also run 2 businesses (Siren-Bookstand and Logic Approach). We travel extensively for pleasure and are very content.

**Christi Gell**, B.S. 1996, is working for Halliburton in Houston and sent in a photo of her new baby. (The background appears to be a drilling rig.)

**Kathleen Howard**, B.A. 1990 — I am currently cataloging specimens at the Pickle Research Center. I work about 2-3 half days a week. There are approximately 4.6 million uncataloged items in three "cages". More than half of these are fossils and I am the only person who is collecting data on the minerals. There are ore samples, core samples, building stone samples, volcanics from the US and Mexico and other things too numerous to list. It is the most interesting thing I have ever done. The next drawer is always an adventure.

**Brian B. Hunt**, B.A. 1996, M.S. 2000, is a Senior Hydrogeologist at Barton Springs/Edwards Aquifer Conservation District in

Austin, Texas.

**Eugene Kim**, M.A. EMR 1994, Ph.D. 1998, is working as a Q R Analyst for Citadel Investment Group in Chicago, IL.

**John Kuehne**, M.A. 1989, Ph.D. 1996 — After 11 years in Maine at Colby College, my mid-life crisis has taken me back to Texas, this time to the McDonald Observatory. Working on big telescopes is great fun, and Far West Texas is a fine place to live, but occasionally I feel a twinge of homesickness for Maine. When you come out here, call me. See https://webspace.utexas.edu/kuehne.

**M. Tim McCoy**, B.S. 1991, is Senior Project Manager for Aecom Environment in Houston, Texas.

**Mary Lynn, Musgrove**, M.A. 1993, Ph.D. 2000, is a Research Hydrologist for US Geological Survey and lives in Austin, TX.

**Garner Peterson**, B.S. 1999 — Currently the project manager on a storm drainage infrastructure mapping project for the City of Austin's Watershed Protection and Development Review Department. Last year collected over 40,000 surface drainage features using handheld GPS.

**Brad Reid**, B.S. 1998, M.S. 2002 — Happy to report that Kate Herrell(BS GEO, 1997; MS Geo, 2002) and I have a beautiful 2 1/2 year old daughter, Liliana Reid. Still living in Santa Fe and both of us are doing environmental-geology. We miss Austin but visit often to see Kate's parents and will be there in October during the weekend of the CU-UT game - hope to see many geo alums then!

**April Wild Richardson**, B.S. 1990 — Never left Austin! My husband, Jeff, and I have 2 beautiful daughters, ages 10 and 12. I'm enjoying my work as a chemistry teacher at Westlake High School…I'm REALLY enjoying my summers. A friend and I just returned from a 3 week road trip to reconnect with family and friends. There is nothing like 2 women, 4 kids, and a minivan to give you a new perspective on life!! It was great fun.

**Philip Rowell**, Ph.D. 1993 — After 20 years at Marathon Oil Company. I have elected to take early retirement. I am heading to Thailand to teach geophysics and seismic interpretation at Chulalongkorn University. Drop by the geology department if you are in the area.

**Richard H. Sams**, Ph.D. 1991 — Richard H. Sams, a first time novelist creates a fictional novel with a very accurate historical background, Atlanta Is Ours: The Plot to Capture Sherman. He was inspired to write this novel after learning that Sherman's July 19, 1864, temporary headquarters were located very close to his great-grandparents' home, Katie and Wash Houston. The story begins as Katie Houston, who lives just north of Decatur, Georgia, finds herself in the path of Sherman's advancing army. When Katie accidentally encounters him near her home and conveys the critical information of Sherman's whereabouts, she triggers a chain of events that would have altered the course of history.

**Alice Teagan Henning**, B.S. 1994, M.A. 1997 — Hi fellow longhorns! I live in Houston, working at Rice University as a lecturer. I teach courses for K-12 teachers, as well as the occasional undergrad course. Tod and I have two boys, ages 6 and 3 - they love rocks and the Texas Longhorns!

**Doris L. Tischler**, B.A. 1992, is a retired science teacher and lives in Albuquerque, NM.

**Beth Truelove**, B.S. 1996, is working as a strategic planner for Encana Oil & Gas in Dallas, Texas.

**Thomas A. Warren**, B.S. 1993, is living in Troup, Texas.

**Chris Williams**, B.S. 1996 — Still working at TNRIS - Love my job. My wife, Angela, and I welcomed a new addition to the family this year. Jacob Paul was born on 9/13/08. He's such a joy at this age. It's been an amazing experience so far and I'm sure there's more to come. When able, I still enjoy playing basketball, woodworking, and gardening. Hook 'em.

## Bilich Receives Bradford Parkinson Award

The Institute of Navigation presented its Bradford Parkinson Award for the year 2007 to Dr Andria Bilich of the National Geodetic Survey. This award is given annually to honor an outstanding graduate student in the field of Global Navigation Satellite Systems. Andria, who earned her B.S. from the Jackson School in 1999, received her Ph.D. from the Department of Aerospace Engineering Sciences at the University of Colorado Boulder in 2006. Her dissertation was titled, "Improving the Precision and Accuracy of Geodetic GPS: Applications to Multipath and Seismology."

## 2000s

**Saleh Al-Saleh**, M.S. 2001 — I am currently heading the Depth Imaging and Mapping Group. I am working with my group to produce accurate images of the subsurface.

**Bryan Bailey**, B.S. 2002, is working for KB Wellbore Solutions, LLC and living in Crosby, TX.

**Carrie Beveridge**, B.S. 2001, M.S. 2004, is living in Vancouver, WA and working as a Geophysicist for GeoPotential, Inc.

**Bradley Cey**, Ph.D. 2008 — Brad began working with Chevron in Houston in August 2008 as a basin modeler.

**Stephanie Cox**, B.S. 2008, is a support geologist for Schlumberger in Houston, TX.

**Yann Curtis**, B.S. 2002, is living in Austin, TX and the owner of SPA Skateparks.

**Shanna Evans (Former Last Name) Banner**, M.S. 2005 — My husband and I welcomed twins to our world on May 10, 2009!

**Blair Avant Francis (formerly Stanley)**, B.S. 2007, M.S. 2009 — Blair Avant Stanley, B.S. 2007 and M.S. 2009, married Luke Kenneth

Francis, B.S. 2007, at the Hofmann Ranch in Castroville, Texas on the 15th of August, 2009. These two geologists met while attending UT for their bachelor degrees, and were surrounded by friends, family, and as many geologists as possible during their most joyous of days.

**Emilio Garciacaro,** M.S. 2006, is living in Katy, TX and is a principal geophysicist for Statoil hydro.

**Sally L. Holl**, M.S. 2004 — Started working as a Geographer at the USGS Texas Water Science Center in September 2007. Taught high school Earth Science in Los Angeles county for two years from 2005-2007 and in May 2007, I completed my California Teaching Credential from Call State Fullerton.

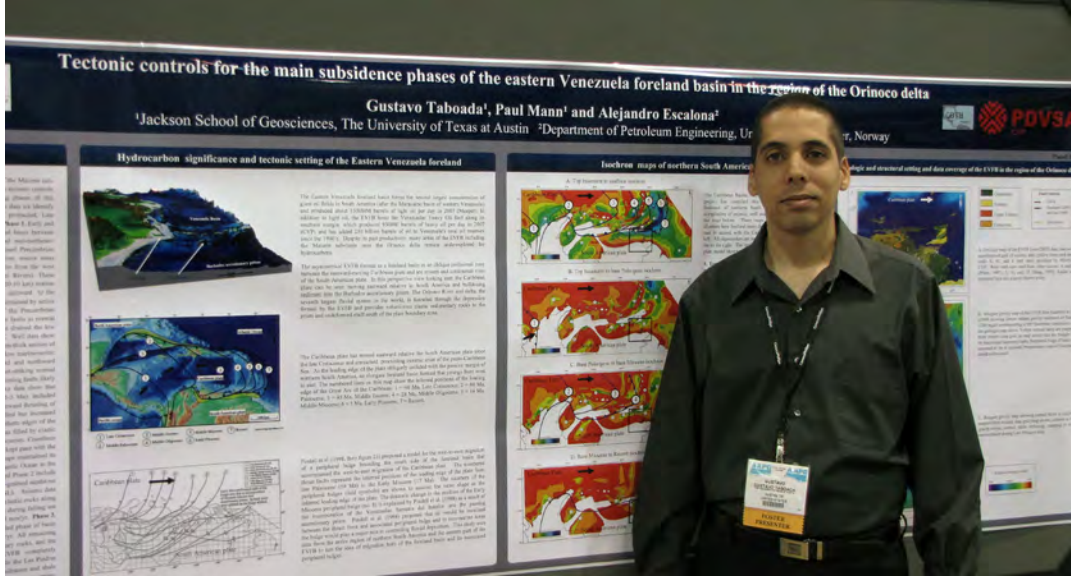
**Kelly Iaocono Daniel**, B.S. 2004 — Kelly Iacono married fellow Longhorn Darryl Daniel (mechanical engineering, '02) on May 2, 2009 in Bee Cave, Texas. Kelly also started working as a hydrogeologist at Kleinfelder in Austin in January 2009.

**James Lyons**, ABD on his Ph.D. — My dissertation on the Mesozoic of Northern Mexico is mostly in the writing stage now although the temptation to add one more thing keeps tripping me up.

**Karen I. Mohr**, Ph.D. 2000 — I accepted position as a research scientist in the Laboratory for Atmospheres, Mesoscale Atmospheric Processes Branch at NASA-Goddard Space Flight Center, MD in February. I am on the precipitation science team of the Global Precipitation Mission satellites to be launched in 2013. I was formerly affiliated with the University of Albany, SUNY.

## HGS Honors Miskelly With Rising Star Award

Tom Miskelly, M.S. 2002, received the Houston Geological Society's Rising Star award for 2008-2009. The award honors individuals "who are relative newcomers to the HGS who have made significant and promising contributions to the enhancement and success of the HGS." He has organized and run the HGS Central Texas Field Trips for two years. His enthusiastic teaching style not only educated students, but in some cases drew them towards pursuing a degree and/or career in geology. Miskelly is an instructor at San Jacinto College in Pearland, Texas.




*At the 2009 AAPG Meeting in Denver, Gustavo Taboada, M.S. 2009, presented "Tectonic controls for the main subsidence phases of the eastern Venezuelan foreland basin in the region of the Orinoco River," co-authored with Paul Mann of the Institute for Geophysics and Alejandro Escalona, Ph.D. 2003, who worked at the Institute from 2003-2007.*

**Fabienne Rambaud**, B.A. 2001, M.S. 2005, is a permit coordinator for Texas Commission of Environmental Quality in Austin, Texas.

**Dennis R. Ruez**, Jr., Ph.D. 2007 — I joined the University of Illinois at Springfield in 2008, after three years at Auburn University. Beginning Fall 2009, I will be Chair of the Department of Environmental Studies.

**Nathan A. Simmons**, Ph.D. 2007, is working as a seismologist-ground-based nuclear explosion monitoring for Lawrence Livermore Nat'l Lab in Livermore, CA.

**Bonni Taylor**, B.A. 2005, is living in Alvarado, TX.

**Thomas Thacker, III**, B.A. 2008, is a geologist for 3-T Exploration Inc. in Wichita Falls, TX.

**Joy Griffin Thomas**, M.S. 2001, lives in Shawnee, KS.

**Donald Tomlinson**, B.S. 2006, is living in Houston, Texas.

**Randi Ashburn Wiley**, B.A. 2005 — Married Mark L. Wiley (UT graduate 2006; Masters Colorado School of Mines, 2009). Married Dec. 13, 2008 in St. Kitts, W.I.

## Friends, Staff, and Former Faculty & Staff

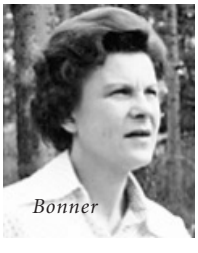
**Christopher Heubeck**, UTIG staff, 1986-1988 — I keep enjoying life as a geology faculty member, full with teaching, travelling, administration and (some) research.

**Bill Woods**, former staff member in the Department of Geological Sciences — This past year has been one of ups and downs. My family suffered the loss of my younger brother to pancreatic cancer in Feb. On the brighter side, I spent 3 weeks in El Salvador with my partner, Francisco, and two friends and had a wonderful time. I have been working as a temp again at UT for the first 6 months of the fiscal year, basically 3 months for the Center for Community College Student Engagement and then for ICC (out at the MCC building). This work both keeps me busy and provides additional income for another vacation: this summer I will spend time at Glacier, Yellowstone, and Grand Tetons National Parks. It was a pleasure to see some of my friends in the Geo Sci during the year when I visited campus. I hope everyone will keep in touch.

## Alumni

**Robert Harwood Alexander**, M.A. 1956, died Feb. 26, 2006, in Columbus, Ohio, where he lived with Frances, his wife of 52 years. Bob graduated high school from the John Burroughs School in St. Louis and attended Princeton University as an undergraduate, completing his degree in 1951. He studied geology and belonged to Charter Club. Following graduation, he served two years as an ensign in the Coast Guard, and then earned a master's in petroleum geology from the University of Texas at Austin. After nine years working in Texas, he moved to Columbus, where he was involved with drilling and producing oil and gas wells for 25 years. As Bob wrote, he "took the big step from management to ownership" in 1991 and formed Absolute Energy. In 1997 he turned operations over to a partner, though he still enjoyed going into the field to follow exploration progress. He remained president until his death. Professionally, Bob served three governors on the Ohio Oil and Gas Board of Review. When not in the field, he played golf and boated in Michigan, near a cottage that had been in the family for more than 70 years, and in Florida.

**Dorothy Shaw Bonner**, 88, B.A. 1941, died at her home in Lakeway, Texas on February 27, 2009. She graduated from Alamo Heights High School in San Antonio in 1937 and from the University of Texas at Austin in


*Bonner*

1941 with her bachelor's degree in geology. In 1942 she married Zora David Bonner, from whom she was never separated until his death in December 2008. She accompanied him and made homes in Port Arthur, Chicago, Alexandria, Pittsburgh, Tokyo, London, Cleveland, Houston, and San Antonio, until they retired to their last home in Lakeway, Texas. Dorothy was an accomplished cook. She was also a skilled gardener and flower arranger, and honed her native talents in Japan. She loved being with children and watching children. She had a vibrant sense of humor. Dorothy was the cohesive force within her immediate family and sometimes her extended family - especially in times of stress. She was at ease with people of many cultures - equally with heads of state, maids, and gardeners. Her intelligence, understanding, human kindness, and sincerity shone through to all. She had a fiery independence and grit which she generally subordinated to her family's needs but which came to the rescue many times when a tense situation needed resolution or egos needed taming temporarily. She was a member of the Episcopal Church. Dorothy is survived by her two children, David Calhoun, and Julie Ann, and her sisters Grace Ellen and Constance. She has two grandchildren, David Frank and Marisa, and six great-grandchildren.

**Doris Walker Gayle**, B.A. 1948, died in Austin, Texas on May 13, 2009 at the age of 83. She was a fiercely independent lady with a keen intellect. She had a zest for life, learning, the arts, social causes, and for meeting and befriending people. With her stylish attire and hats, she always stood out in a crowd. Gayle was born on Nov. 27, 1925, to Solon and Grace Walker. She was among the top graduates of her class at Austin High School. She graduated from the University of Texas with a major in geology after taking leave to work in Houston during World War II. Later, she worked for the Tennessee Valley Authority and held other positions on both the east and west coasts of the country. In 1978, she joined the Public Utility Commission of Texas, where she did research and handled inquiries. She retired in 1995 but continued to research and report on the PUC as a consultant, always maintaining her interest and loyalty to the agency. With a grandfather who served as land commissioner of Texas, Doris gained an interest in politics at an early age. One of her proudest achievements was to be selected as a delegate for Barack Obama to the 2008 Texas Democratic Convention. Survivors include Terry and Ann Jackson of Austin, TX and Adrian Anderson of Denton, TX. Among her many friends, Peggy Dimery of Austin was especially close. Thanks are extended to caregivers at the Lighthouse at Altheim Hospice in Round Rock, TX.

**Georgette Elaine Covo Browder Goble**, B.A. 1944, passed away Monday, March 9, 2009. A 1944 graduate of The University of Texas at Austin, Georgette received her


*Goble*

B.A. with a major in geology, Summa Cum Laude. Georgette and her dear sister, Jackie, loved the University of Texas, where friends affectionately referred to them as "the Covo Twins." In 1944, Georgette married Ensign Jack Forrester Browder, also a UT graduate. From 1946 to 1957, Georgette and Jack lived in Groesbeck. In 1957, the family moved to Pecos, Texas, where Jack started a large irrigated cotton farming operation. Jack and Georgette moved to Waco in late 1969, when Jack became a vice president of Waco's Lake Air National Bank. Again Jack and Georgette became very active in the community and their church. Georgette's first love, Jack, died of a heart attack at the age of 49, on April 15, 1973. Three years later, Georgette was blessed with a wonderful second husband. On July 17, 1976, Georgette married widower, John Edward Goble. They enjoyed traveling, the symphony and playing couples' bridge. He was very supportive of her many community activities and was a loving husband, stepfather and grandfather. Georgette participated in many endeavors everywhere she lived, but her primary focus and joy were derived from her family and the activities of each member of her family.

**James J. Halbouty**, B.A. 1942, M.A. 1943, an accomplished violinist and composer, securi-

ties salesman and petroleum geologist, died Saturday, December 13, 2008 in a Houston hospital. He was 96. As a musician, Halbouty was concertmaster of his high school orchestra, briefly a member of the Houston Symphony Orchestra, and composer of violin solos and other compositions, including hymns. As a petroleum geologist, Halbouty served the United States during World War II by helping find new fields of petroleum, a task vital to the war effort. He was born on Jan. 6, 1912, in San Antonio. His parents, Tom Constantine Halbouty and Sodya Manolly Halbouty, were immigrants from Lebanon and Greece respectively. Their son James R. Halbouty grew up in Beaumont, where he and his brothers worked in their father's store, the Royal Market and Grocery Co. Halbouty began violin lessons at age 11 and showed exceptional talent. He was concertmaster of the orchestra at Beaumont High School, where he graduated in 1929. In that same year, Halbouty joined a stockbrokerage in Houston during the days of the Great Depression. In 1937, he went to work for the oil company of his older brother, the late Michel T. "Mike" Halbouty, a famed Texas wildcatter who became an internationally known geoscientist. In 1939, he joined the first violin section of the Houston Symphony Orchestra, a part-time job. In that same year, at age 27, Halbouty enrolled at The University of Texas at Austin, where he earned bachelor's and master's degrees in petroleum geology. After the war, Halbouty joined Standard Oil and helped discover several oil and gas fields. He also rose to the position of district geologist for South Texas. In 1964, Halbouty returned to Mike Halbouty's firm, where he remained until he retired in 1995 at age 83.

**Louis Haring Jr.**, B.S. 1938, passed away Sunday, April 12, 2009 at the age of 92. Born in Beaumont, Texas, Louis graduated from Jefferson High School in 1934 and received his Bachelor of Science degree in geology from the University of Texas at Austin in 1938, where he was a member of the Pi Kappa Alpha fraternity. He served his country as a second lieutenant with the 61st Field Artillery Battery of the First Calvary Division and then transferred to the Army Air Corps serving as an Aerial Gunnery instructor. Immediately following World War II, he served two years in Karachi, India. After 38 years of active and reserved serve, he retired as a Lt. Col. in the U.S. Air force Reserve. Louis married Isabel Hill Haring of Laredo, Texas in 1943. He went on to become an active independent petroleum geologist for 60 years. In addition, he was a member and president of the South Texas Geological Society. He was also a member of the American Association of Petroleum Geologists, an Emeritus member of the American Institute of Professional and Certified Geologists, a member of the American Association of Petroleum Landmen, Independent Producers Association of America, and the San Antonio Association of Petroleum Landmen. Louis is survived by his sons, Travis Hill Haring, Howard Lee Haring, and Frank Boyd Haring and wife Michelle; granddaughters Conner Campbell Haring and Isabel Oliver Haring; grandson, Hunter Hill Haring; daughters-in-law, Molly Conner Haring and Elizabeth Skewes Haring; dearly loved nieces and nephews; and special friend, Patricia Begeman.

**Edward Ringwood Hewitt**, M.A. 1951, died on August 16, 2006, at age 80. He was the son of the late Louise Schieffelin Hewitt and Abram Stevens Hewitt and great-greatgrandson of New York philanthropist Peter Cooper. He was a graduate of Harvard College and The University of Texas at Austin and served in the U.S. Navy in World War II. He was a geologist in the fields of oil, gas, and mining, and a member of the American Association of Petroleum Geologists. He served for many years as a trustee of The Cooper Union for the Advancement of Science and Art. He also served on the vestry of Trinity Episcopal Church, Newtown, Connecticut. He is survived by his wife, Sigrid Nauen Hewitt; his children, Luisa Hewitt Prichard, Andrew Hewitt, Catherine Hewitt (Paul Parcellin), James Hewitt (Susan), and Peter Hewitt (Deborah); his grandchildren, David Prichard, Rachel Prichard, Sarah Hewitt Lueck (Benjamin), Stephen Hewitt, Michael Hewitt, and John Hewitt. He was preceded in death by a grandson, Calvin Hewitt, a sister, Camilla Hewitt and a daughter-in-law, Sandra Hewitt. He is also survived by a sister, Mary Hewitt Harshman (Richard) and four brothers, Stephen Hewitt, Jonathan Hewitt, Nicholas Hewitt, and Adam Hewitt, and numerous nieces, nephews and cousins.

**Paul F. Hoffman**, B.S. 1975, died in Plano, Texas at the age of 57 on June 15, 2009. He was born Jan. 21, 1952, in Madison, to Louis and Amy (McCytchin) Hoffman. He married Mary Rolli in 1973, in Madison; Mary preceded him in death in 1988. Paul later married Cynthia Arrington in 1994 in Plano. Paul was a mortgage broker and owner of FCMC, Inc. He is survived by his daughter, Tara Hoffman; sons, Kevin, Alan, and Brian Hoffman; brothers, John of Milwaukee, Karl of Marion, La., and Glenn of Madison; and several other relatives.

**Ruth Waldrop Hord**, B.A. 1939, remembered as a thoughtful, persevering, and adventurous soul with a wide range of interests , died at age 92 in Midland, Texas, on November 27, 2008. While mourning her loss, her family and friends give thanks for the joy that her wit, intelligence, goodness, generosity and grace brought to their own lives. Ruth is survived by her children Elaine Hutchinson, Melinda Reaves and Thomas Alan Hord and their spouses Frederick O. Hutchinson, Charles B. Reaves, and Nancy Cavnar Hord; seven grandchildren; six great grandchildren; her sister Molly Waldrop Lara and her brother Thomas Coleman Waldrop. Her husband John Alan Hord preceded her in death.

**Evan Cramer Jenkins**, M.A. 1959, of Denver, passed away on Feb. 16, 2009. Evan received his B.S. from the University of Colorado and his M.A. in geology from the University of Texas at Austin. He was an ROTC member and a lieutenant in the U.S. Army. A career geologist with the U.S. Geological Survey,. Evan was a lifetime member of the JEFFCO Aeromodeler's Club and spent many years as

a judge for national Radio Control airplane (AMA) competitions. Evan was a Kentucky Colonel and an avid lover of music and ballroom dancing. He is survived by his wife, Mary Ann Jenkins; his sister, Carol Ishikawa, of Woodland, CA; a daughter, Elizabeth Campbell, of Beaufort, SC; a son, Geoffrey Ferrell of Washington, DC; and two grandchildren.

**Gale Thompson Leslie**, B.S. 1949, died on November 24, 2002 at the age of 78. He was the beloved husband of the late Vera Burns Leslie by 1st marriage and the late Darlene Dupslaff Leslie by 2nd Marriage. He was also father of John Andrew Leslie and James Edward Leslie, father-in-law of Brenda Canale Leslie, and step-father of Denise Harris, Linda Gunnell, and Debbie Dillion. He was a member of The American Association of Petroleum Geologists, Aurora Methodist Church and Aurora Country Club. A native of Warren, Arkansas and a resident of New Orleans, Louisiana for the past 35 years.

**Dr. Francis Leo Lynch, III**, Ph.D. 1994, passed away at North Mississippi Medical Center in Tupelo on February 24, 2009 at the age of 49. He was a professor of Geology at Mississippi State University. He earned his bachelor's degree from Tufts University in Boston, his master's degree from Dartmouth University in New Hampshire, and his Ph.D. from the University of Texas at Austin. He was a member of Sigma XI, SEPM and the American Association of Petroleum Geologists. He was known for his gift for humor, his passion for irreverent teaching, his love of good science, and his enthusiasm for working with students. He is survived by his wife, Brenda L. Kirkland of Starkville, MS; daughter, Billiejean Insinna Kirkland of Starkville, MS; step-daughter, Margaret Jean W. George of Starkville, MS; and son, Anthony Insinna Kirkland of Starkville, Mississippi.

**John Carl Meyer, Jr.**, B.S. 1941, 90, of Littleton, Colorado, most recently of Highlands Ranch (but always a Texan at heart), died July 6, 2009. At UT Austin he was a member of Phi Gamma Delta fraternity. He interrupted his education to serve in the Army Air Corps during WWII, serving as a navigator for B-17s and B-24s. He was honorably discharged as a major. Upon his return to UT Austin he received his degree in geology. He spent a rewarding career as a geologist for several major oil companies and retired with Phillips Petroleum. After spending several more years in Texas, he and his wife moved to Littleton, Colorado. Having a lifelong love for UT, John took great pride in having passed his Longhorn legacy on to his son and two grandchildren.

**Sally Joan Muehlberger,** 81, passed away on October 28, 2008. Sally was born on June 3, 1927 in Seattle, Washington to Russell and Olive Provine. Sally graduated from Scripps College in Claremont, California with a degree in English literature and received a Masters of Arts in library science from The University of Texas at Austin. While attending Scripps, she met William (Bill) R. Muehlberger, now a professor emeritus in the Jackson School of Geosciences. They were married on September 8, 1949. Sally was a loving wife, mother, grandmother, and friend. She was one of the original group of ten docents at the LBJ Library and served as a docent for 25 years, where she met many interesting people and experienced the fascinating process of working with the library. She served as President of the University Ladies Club and was active in the University of Texas Faculty Wives organization. Her passion was traveling with Bill around the world. It was common for them to take multiple trips in a single year. They shared their passion for travel with their four grandchildren by traveling with them individually to a destination of each grandchild's choice. Sally and Bill utilized their love of travel and geology to co-author two New Mexico geologic and cultural travel guides, one of which won the New Mexico Best Travel Book Award for 2007. She is survived by her husband of 59 years, Bill, of Austin; daughter, Karen Erickson and her husband Paul of Albuquerque, New Mexico; son, Eric Muehlberger and his wife Edie of Austin; grandchildren, John and Kristen Erickson of Albuquerque, New Mexico, and Hahna and Olivia Muehlberger of Austin, Texas; cousins, Bob and Tom Kuebler, (who were like brothers to her) of the Seattle, Washington area; and, numerous nieces and nephews. In lieu of flowers, the family requests that contributions be made to the LBJ Foundation, 2313 Red River Street, Austin, Texas 78705, in honor of the Sally J. Muehlberger Memorial Fund, to benefit the LBJ Library volunteer program, or to a charity of your choice. Please share your fond memories with Sally's family by visiting the online obituary guestbook at www. http://wcfish.com.


*Muehlberger*

**Rose Marie Ballerstedt Olander**, wife of A.M. "Red" Olander, B.S. 1948, died Nov. 27, 2008. Rose was the only child born to Rose Maude and Gilbert Bruce Ballerstedt on November 19, 1927, in Austin, Texas. She graduated from Austin High School, attended Queens College in Charlotte, NC, and graduated from The University of Texas in Austin with a B.A. in Business Administration and a minor in music. On August 6, 1949, Rose married A.M. "Red" Olander of Hutto, Texas. Rose and Red's four children are Rosellyn Olander McIver, Gary Olander, Maribeth Olander Story and David Olander. "Red" and the family extend their heartfelt thanks for the love, compassion, and support of Rose and they feel richly blessed with the generous, steadfast care and support from friends, medical personnel, nurses aids including Gladys and Phyllis, and especially the pastors and families of Westminster Presbyterian Church.

**Eric Ottman**, B.S. 1951, died on Saturday, March 21, 2009. Eric was born April 16, 1927, in Longview, to Hans and Ella Ottman. He is survived by his wife, Barbara; son, Eric

Nathan Ottman and wife, Lori; and daughter, Candiss Haugen and husband, Mike. Eric is also survived by stepsons and their wives, David and Ernie Motley, Mitch and Sheree Motley, Neil and Susan Motley and Jim and Marsalyn Motley. Also surviving are 14 grandchildren, three great-grandchildren; one great-granddaughter-in-law; sisters-in-law, Nelda Ottman and Jo Ann Dulany; brothers-in-law, Don Dulany and wife, Mary, and Frank Cobb. He is also survived by numerous nieces and nephews. Mr. Ottman graduated from Longview High School and The University of Texas at Austin. The Longhorns provided many hours of entertainment, some good, some not so good. He served as a U.S. Navy corpsman during World War II and worked for Lone Star Steel as a geologist for more than 30 years. Eric had been a member of First Baptist Church since 1941. He loved to work in the yard, travel, and play golf. He was a member of the Pythian Lodge and served as Post Chancellor Commander. Eric also loved volunteering for Meals on Wheels.

**Robert Donald Ottmann**, B.A. 1951, died May 8, 2009 at the age of 81. He was born July 3, 1927 in New Orleans, Louisiana, son of Harold G. and Lucy Waddell Ottmann. He served in the U.S. Army during World War II and upon his return, enrolled at The University of Texas at Austin, where he received his B.S. in Geology. He met and married the love of his life, Ora Del Schmitt on September 23, 1950. He enlisted in the U.S. Air Force in the active reserves and served as a 2nd Lieutenant stateside during the Korean War. He later joined Exxon as a geologist, where he worked for 39 years. His job took him and his wife Ora all over the nation, and they enjoyed traveling together. Robert enjoyed hunting, fishing, golf and playing bridge. Surviving to cherish his memory are his loving wife of 58 years Ora Ottmann; son Jeff Ottmann and his wife Margaret; daughter Judi Ottmann; grandchildren Kaitlyn and Robert Ottmann; brother Harry Ottmann and his wife Nadine; sister-in-law Mozelle Howton and her husband Jack, and many other family members and friends.

**Rufus R. Rush Jr.**, B.S. 1956, died October 19, 2008 in Houston at age 80. He was born April 4, 1928, in Austin, to Rufus Rondeau and Marie (Hartman) Rush. He is survived by his wife, Bobbie Rush of Houston; two daughters, Leslie Rush of Miami, Fla. and Christina Rush of France; brother, George Rush and wife Dorothy of Seabrook; three grandchildren, Maite' Lepape, Daniel Gruen and Matias Gruen and great-grandchild Yanis Lepape. He is buried in the San Marcos Cemetery.

**Charles Edwin Sandidge**, B.S. 1978, of Tyler died Saturday, March 28, 2009, in Birmingham, Ala., at age 53. Mr. Sandidge was born on May 21, 1955, in Rockdale, Texas. He was a geologist and had graduated from the University of Texas at Austin. He was a member of Green Acres Baptist Church in Tyler and was a member of NETX Geological Society. He is survived by his wife, Joy (Oslin) Sandidge of Tyler; son and daughter-in-law, Mat and Rachel Sandidge of College Station; daughter and son-in-law, Sarah Beth and Rusty Humphrey of Edmond, Okla.; stepdaughter, Christi Hood; grandchild, Avery Hope Humphrey of Edmond, Okla.; his parents, Edwin and Anita (Page) Sandidge of Mount Pleasant; and sister and brother-in-law, Deborah and Royce Carr of Mount Pleasant; and numerous aunts, uncles, and cousins.

**William (Bill) Schomburg**, 68, died at home in Katy, Texas on Tuesday, September 26, 2006 surrounded by his loving family. Schomburg, a native Houstonian, was born on October 27, 1937 to Willie A. and Evelyn Glaser Schomburg. He was a renowned geophysicist who started his career with Schlumberger as a logging engineer in Midland, Texas. He spent 19 years with Mobil Oil where he played a key role in the largest prospecting effort Mobil had ever undertaken when China opened the Pearl River Basin for exploration. He worked primarily in offshore Louisiana and Texas as well as China, Australia, Honduras, Nicaragua, Trinidad, and Aruba.He spent 7 years with Elf Aquitaine where he was responsible for the largest discovery for Elf. He produced three additional discoveries, and had no dry holes working two major areas in the Gulf of Mexico. Besides his passion for exploration in the Gulf of Mexico, he was an avid outdoorsman who enjoyed hunting and fishing. Two of his favorite places included his land in Pittsburg, Texas and his cabin in Port Bolivar. He leaves to cherish his memory his devoted and loving wife Linda Schomburg; mother Evelyn Schomburg; his loving children daughter Kelly Manzano and her husband Tony; daughter Karen Gorman and her husband John; step-son Daniel Scheuermann and his wife Jennifer; his sister Peggy Fisher and her husband Walter; several grandchildren; a niece; and a nephew.

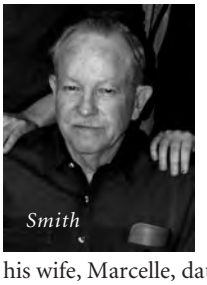
**John S. Shambaugh,** B.S. 1949, M.S. 1951, of Corpus Christi died at the age of 79 on March 29, 2008. He was employed by Humble Oil and later ExxonMobil in Kingsville, Corpus Christi and Houston for 29 years. His Parkinson's disease led to early retirement in 1983. While at Texas, he was a member of Kappa Sigma Fraternity and the Texas Cowboys. He was also chosen to be a Bluebonnet Beau and a Goodfellow.

**Norma Simmons Newton**, M.A. in Fine Arts 1962, wife of Robert Stirling Newton, M.S. 1963, passed away November 2, 2008 in New York City after a brief illness. She lived in Houston for a number of years before relocating to New York City. One of the premiere artist /teachers in her field, Norma

*Norma Simmons Newton in* Showboat*, 1963, Theatre Sandy Shores, Corpus Christi, Texas.*

trained over 50 singers who have gone on to have major careers. At the time of her death Ms. Newton was on faculty at Hunter College New York City and Westminster College of the Arts-Rider University in New Jersey, the Amalfi Coast Festival in Vietri sul Mare, Italy as well as maintaining a full private studio. She had previous affiliations with Rice University, Catholic University, The Academy of Vocal Arts, The Houston Opera Studio, Houston Baptist University, Opera in the Ozarks, Glimmerglass Opera, the American Institute of Vocal Studies in Graz, Austria and the National Opera Teheran. During her operatic and concert career spanning two decades, in the U.S. she performed with New York City Opera, Dallas Civic Opera, Chicago Grant Park, Houston Symphony, and with the late Beverly Sills, Norma Treigle, and James King as well as Regina Resnick and Placido Domingo. Norma grew up in Little Falls, New York, where she met her childhood sweetheart and future husband. She received her bachelor's in music from Syracuse University and her master's degree in music from The University of Texas at Austin. Her son Christopher Newton, of Katy, Texas, daughter-in-law Jennifer and grandson, Jack survive her.

**Harry Lee Smith**, B.S. 1951, M.A. 1956, 81, of Boerne died Saturday, December 6, 2008, following a massive stroke. He was born in Port Arthur, Texas, and served in the Army Air Force before he was honorably discharged in 1946. After earning his bachelor and master's degrees in geology from The University of Texas at Austin, he worked as a petroleum geologist in Corpus Christi, where he raised his family. Smith is survived by his wife, Marcelle, daughter Sheryl Smith-Rodgers and husband James Hearn of Blanco, son Steven Smith and wife Laura of Katy, and grandchildren Patrick and Lindsey Rodgers, and Brandon Smith.


*Smith*

**Thomas W. Stern**, M.A. 1948, died of complications from a stroke at a hospice in Bend, Oregon on May 23, 2009. He received a bachelor's degree in 1947 from the University of Chicago and a master's degree in 1948 from The University of Texas at Austin, both in geology. He served in the Navy during World War II in the amphibious forces in the Pacific. He participated in the initial occupation of Hiroshima, Japan in 1945. He worked for the U.S. Geological Survey for 41 years, studying the origin of the Colorado Plateau uranium deposits as well as determining the age of rocks by the uranium-lead method, an isotopic dating system. He received the Interior Department's Meritorious Service aware in the 1980s and during his career published more than 75 papers in scientific journals on rock dating and uranium deposits. Stern retired as the Chief of Isotope Geology at the U.S. Geological Survey in 1989. He moved to Bend from Chevy Chase in 2007. He was a member of the Cosmos Club and the American Geophysical Union and a fellow of the Geological Society of America and the Mineralogical Society of America. During retirement he worked as a docent at the Smithsonian's National Air and Space Museum. Survivors include a stepdaughter, Julia Kennedy, of Bend, OR; a brother, John Stern, of Palo Alto, CA; and a sister, Nancy Warner, of Buffalo, NY.

**Harlan R. Wolff**, B.S. 1960, of Hondo, Texas, died on October 7, 2004. He was born in Hondo in 1937, the son of Raymond Frank & Mary Katherine (Lutz) Wolff. Harlan was a Land Surveyor and a member of the the D'Hanis Lions Club. Harlan is survived by his son Harley Wolff of Austin; daughter Mylinda Swierc and husband David of New Braunfels; three grandchildren, brother Raymond A. Wolff and wife Dorothy of D'Hanis; sister Adalene Marquart of San Antonio, Norma Rothe and husband Robert of D'Hanis.

## Faculty & Staff

**Jules R. DuBar**, 85, whose scientific works dealing with geological and environmental evaluations of the Atlantic and Gulf Coastal Plains achieved international recognition, died March 17, 2009, at his home in Charlottesville, Va. DuBar was former head of Morehead State University's Geoscience Department. He came to Morehead State University in 1967 and was the 1980 recipient of the University's Distinguished Researcher Award.

Prior to coming to MSU, he held faculty positions at Duke University, University of Houston, Southern Illinois University and the University of Kansas. After leaving MSU in 1981, he was exploration manager for the International Resource Development Corporation before accepting in 1982 the position of Research Scientist and Technical Editor for the Bureau of Economic Geology at The University of Texas at Austin.

A World War II veteran, he is survived by his wife, Susan, his two children Nicole and Scott, and two grandchildren, Selena and Ariana. A dedicated researcher, he was the author or co-author of more than 60 publications and an additional 25 unpublished contract reports. He was a member of numerous professional organizations and a fellow of both the Geological Society of America and the American Association for the Advancement of Science. In addition to his scholarly works, he is the author of a much loved memoir, *Never Piss Into the Wind*, recounting his rough-and-tumble childhood, personal life, and career as a field geologist and academic.
Contributions to the Dr. Jules R. DuBar Academic Geology Scholarship Fund at the MSU Foundation, Inc., Palmer Development House, Morehead State University, Morehead, KY 40351, have been suggested as appropriate memorials.

*Housh*

MEMORIALS

**Todd B. Housh** died on Saturday, May 30, 2009 at the age of 47. He died at his residence in Round Rock after a prolonged illness. Born January 19, 1962, in Kansas City, MO, Housh was the son of the late Henry Berton Housh II and Nancy Lauer Frerer. On May 19, 1984, he married Cara Louise Sheldon in Carthage, MO. The couple just celebrated their 25th wedding anniversary earlier this month. Todd earned his B.S. from the University of Missouri at Rolla in 1983, his Ph.D. in Geology at Washington University in St. Louis, MO in 1989, followed by post-doctoral work at MIT from 1990-1992. He came to the University of Texas at Austin in 1992 and most recently held the position of Senior Research Scientist in the Department of Geological Sciences.

Todd was a life-long student: he enjoyed the study of theology, going so far as to learn Greek and Hebrew, in addition to the Latin and Spanish he learned as a college student. He was a world traveler collecting rocks and other artifacts along the way. Todd was part of the team that discovered the oldest known rock in the world. His love of reading was evident in the breadth of his study and his journaling, as well as his interest in bookbinding and repair. He was involved in his children's activities in several capacities: as a swim dad where he served as president of the swim team, as a scout dad serving as a den leader and Cub Master, and as a baseball dad where he served as treasurer of the baseball organization.

Todd is survived by his wife, Cara; and twelve children, Ty (24), Josh (22), Shane (21), Grace (19), Kurt (18), Tina (15), Faith (14), Mercy (12), Patience (10), Elijah (8), Nadya (6), and Malachi (3). Additionally, he is survived by his mother and step-father, Nancy and James Frerer of Carthage, MO; his brother, Clint Housh of Ridgecrest, CA; and his sister, Susan Slade of Naperville, IL.

**Rizer Everett,** B.A. 1937, died at the age of 92 on December 15, 2008, after a brief illness. He was born on June 9, 1916, in Belmar, New Jersey. He attended elementary, junior high, and high school in Austin. Rizer graduated Phi Beta Kappa from UT Austin.

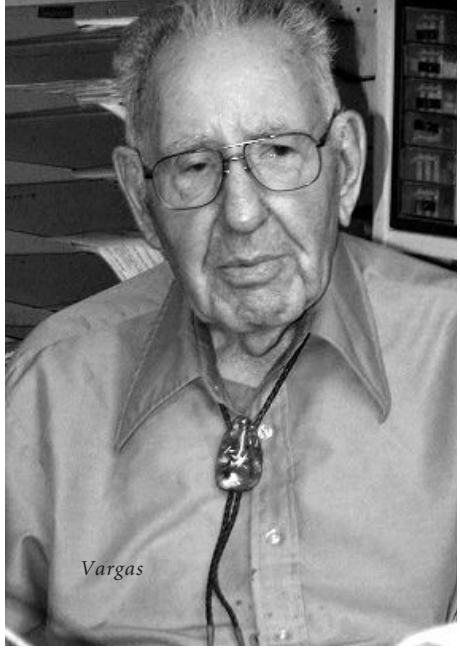
In 1937 he was employed by the Carter Oil Company and began his professional career as a field geologist in Wichita, Kansas. In 1938 Rizer was married to Hildegard Kuehne at the Congregational Church in Austin. Everett worked for the Carter Oil Company in Kansas, Illinois, Indiana, Kentucky, Louisiana, Wyoming, Oklahoma and Mississippi until 1954. He then transferred to the Standard-Vacuum Oil Company operations in Indonesia where he was Chief Geologist and later Exploration and Production Manager. He retired in 1966 while working in Djakarta and returned to Austin. Rizer then obtained his Master's Degree in Geography in 1969 at UT Austin. Until 1982 he worked as a consulting geologist and geographer. He also taught Applied Geology of Energy Resources at UT Austin from 1978 to 1982.

Rizer had an insatiable curiosity and a great sense of adventure. During their long, happy marriage he and his wife traveled extensively in the U.S. with children and grandchildren. They visited Asia, Europe, South America and Africa. Rizer inherited his love of woodworking from his father who was an artist and an architect. He volunteered with several organizations including radio station KMFA. He was a member of the Geological Society of America, The American Association of Petroleum Geologists, and the Austin Geological Society.

He is survived by his son and daughter-in-law, John and Barbara Everett of Ft. Collins, CO; by his daughter and son-in-law, Dot and Bryan Waldrip of Albuquerque NM; by six grandchildren and 14 great-grandchildren; a nephew and two nieces. All will miss his exuberant enthusiasm for life and the sound of his resonant baritone voice.

**Robert Sanchez**, retired staff member of the Bureau of Economic Geology, died on Friday, July 17, 2009, at age 57. Beginning at the Austin Core Research Center in February of 1986, Robert was a licensed forklift operator, commercial vehicle driver, and field worker for many Bureau research projects. He was promoted to Warehouse Manager in 1998. Retired for medical reasons since January, Robert was an accomplished amateur photographer, fisherman, and gardener. He is survived by his wife of 40 years, Susie Sanchez, his sons Mark and Robert Jr., and five grandchildren, as well as many cousins, nieces, and nephews. A memorial service was held in Bastrop on July 20. Director Scott Tinker said "Robert was a special part of the Bureau family, a key member of the core research center staff, and above all a gentleman. He will be missed by all of his Bureau friends." Donations in Robert's memory can be made to Hospice Austin.

*Robert Sanchez receiving a staff recognition award from Scott Tinker, director of the Bureau of Economic Geology.*


Vargas

**Glenn E. Vargas**, died on March 15, 2009 in Palm Desert, Calif. after a long illness. Vargas was born on July 3, 1914 in Hayward, Calif. He and his late wife, Martha were well known throughout the world for their faceting and the books they wrote about faceting. He taught all the way from high school in the 50's, then adult education, then on to teach geology at College of the Desert. Upon retiring from COD, he went on to teach at The University of Texas in Austin for almost 33 years, teaching over 4,000 students the fine art of faceting. He left his gem collection to UT Austin which encompasses over sixty years of gem collecting and faceting. Even after retiring from teaching, he held classes at his home in Thermal, Calif. for students to learn the fine art of faceting, even leaving the rest home often to teach his students from all over the world.

Vargas and his wife married in 1953. She passed away in 2000. The two of them roamed the world looking for gems in Africa, South America, Australia, China, and Mexico.

Vargas was active in forming many wildlife preservation programs in the California deserts and was honored with having a grove of palms named after him, located in Snow Creek, above Palm Springs.

He leaves behind his son, Conrad; daughter in law, Renee; nine grandchildren; 32 great grandchildren; brothers, Norman and Larry; and countless friends. He will be missed by all his friends around the world to whom he made such an impact. He wished to have his ashes spread in the desert he so much loved in the same area Martha's were spread in 2000.

**John A. (Jack) Wilson**, professor emeritus of geology at The University of Texas at Austin died, October 21, 2008, at the age of 93. Wilson received a B.A. degree in 1937 and a Ph.D. in 1941, both from the University of Michigan. He taught geology and paleontology at the Idaho School of Mines until he joined the U.S. Navy in 1943. He served on the aircraft carrier USS Hancock in some of the great naval battles of the Pacific Theater.

In 1946, Jack joined the geology faculty of UT Austin. During the next 30 years, he taught a variety of courses, including historical geology, stratigraphy, history of geology, and a two-semester graduate course in vertebrate paleontology.

Upon his arrival in Texas, he had the opportunity to work on the extensive and largely unstudied collection of fossil vertebrates amassed by the Works Progress Administration (WPA). The large collections of mid-Cenozoic mammals from the Gulf Coastal Plain soon claimed his attention. This material came from several stratigraphic units that enabled him and his students to set up a biostratigraphic sequence for Miocene units of this region.

Wilson was among the first vertebrate paleontologists to explore the fabulous fossil deposits of Big Bend National Park in Texas, finding remains of ancient mammals in Paleocene, Eocene, and Miocene rocks that had long been declared barren of fossils by other paleontologists.

When Professor Ronald DeFord began his extensive mapping of the geology of the Tierra Vieja, or Rimrock country in Trans-Pecos Texas, Wilson seized the opportunity to obtain fossil vertebrates from well-documented stratigraphic contexts and to obtain radiometric dates for the fossiliferous deposits. In cooperation with Steve Clabaugh, Fred McDowell, and a number of students,

Wilson was able to establish an Eocene faunal sequence in that region. One of the more interesting discoveries was the finding of a well-preserved skull of an early primate, which he named Rooneyia after the rancher on whose land the fossil was found. Because of its excellent preservation, well-established age, and Old World affinities, it attracted worldwide attention. All told, Wilson's research produced some 24 scholarly publications on the fossil vertebrates from the Big Bend region.

During the 1970s Wilson, with parties of colleagues and students, was the first to collect fossils from the still poorly accessible drainage of Alamo de Cesario Creek in the Agua Fria country, north of Big Bend National Park. The sequence of Eocene faunas he recovered, and accompanying radiometric age determinations, allowed useful correlations between the Vieja and the National Park, and correlative rocks to the north in Wyoming and Montana.

One of Wilson's most important contributions to vertebrate paleontology was the establishment of the Vertebrate Paleontology Laboratory at The University of Texas at Austin. This involved the merger of three separate collections and acquisition of proper storage, staffing, laboratory space, equipment, and technicians for the care, preparation and study of the fossils. This has resulted in one of the preeminent research collections of fossil vertebrates available for study in the U.S.

Wilson was an American Association of Petroleum Geologists (AAPG) distinguished lecturer for 1960–61 and an American Geological Institute (AGI) visiting lecturer, 1960–63. He was a member of the Texas Academy of Science, the Society of Economic Paleontologist and Mineralogists, Society for the Study of Evolution, the Geological Society of America, Paleontological Society, the American Association of Petroleum Geologists, and the American Association for the Advancement of Science. He was a charter


Wilson

member of the Society of Vertebrate Paleontology (president, 1952). In October 2000, he was awarded the highest honor of the society, the Romer-Simpson Medal, for his many contributions to vertebrate paleontology.

He will be remembered for his hospitality at the house on Lake Travis. His margaritas were legendary, the barbecue exceptional, and the swimming in the lake was good.
Wilson is survived by his second wife, Ruth Moore Wilson; three sons, Ken, Steve, and Chris; and their wives, Verena, Kay Nell, and Carol; seven grandchildren and five great grandchildren; and his two brothers: Sid Wilson and Bob Wilson.

**J. Lamar Worzel**, died at the age of 89 on December 26, 2008 of a heart attack at his home in Wilmington, N.C. Worzel was a pioneering geophysicist and engineer who helped shape human understanding of how sound travels through the oceans, cofounded Columbia University's Lamont-Doherty Earth Observatory and directed the University of Texas at Austin's Institute for Geophysics from 1974 to 1979.

A frequent sailor in submarines and ships, Worzel improvised complex measuring instruments out of spare parts and household objects in the 1930s, a time when scientists had only primitive concepts of deep marine seabeds and acoustics. He and colleagues investigated the makeup of sediments in the Atlantic by exploding homemade bombs in the depths and reading the echoes Their discoveries helped World War II submarines elude enemies, guided Cold War sub detection, and provided tools for charting earth's crust and climate.

It was Worzel's longtime boss at Lamont-Doherty, William Maurice Ewing, whose seminal ideas drove early systematic mapping of the world's oceans in the 20th century. But it was Worzel's energy and ingenuity that brought many ventures to fruition.

On the brink of World War II, the Navy funded their work, and Worzel and Ewing quickly made fundamental discoveries. One was the existence of "shadow zones"—underwater regions in which sounds from the surface refused to travel. With this information, Worzel coauthored a manual that enabled many a World War II sub commander to hide from enemy ships above. Conversely, they identified the "deep sound channel"—a narrow horizontal zone about 3,000 feet down that transmits low-frequency sounds thousands of miles with fantastic clarity, like a natural telephone line. They showed they could blow up a few pounds of TNT off South America and pinpoint the source on the deep channel from as far off as West Africa. This discovery became the basis of the Navy's vast Cold War SOFAR (sound fixing and ranging) program and its successors—secret weapons that girded


*Worzel*

the world with underwater listening devices to identify and track Soviet subs by their engine noise. After the nuclear-powered sub USS Thresher mysteriously disappeared in 1963, an acoustic investigation marshaled in large part by Worzel helped locate the remains, 8,400 feet down off New England. For this, he received a Navy Meritorious Public Service Citation.

In 1948, Ewing and a handful of his grad students including Worzel moved to Columbia University and founded Lamont Geological Observatory (later renamed Lamont-Doherty Earth Observatory). Ewing became director and Worzel, deputy.

Starting in the early 1950s, Worzel arranged to obtain a series of research vessels that crisscrossed the oceans on a variety of missions. These made Lamont a global powerhouse in marine research. Worzel perfected a system to efficiently remove cores of sediment from depths of over 12,000 feet, and the institution assembled the world's largest collection of such samples. He initiated the use of satellite navigation in research ships. One of his most important advances was his design of a system that could take precise measurements of earth's gravity field from surface vessels, which had been hampered by the constant rolling and pitching on ships.

In 1972, Worzel and Ewing left Columbia together for the University of Texas at Austin. When Ewing died two years later, Worzel succeeded him as director of the university's Institute for Geophysics. He retired in 1979.

Wurzel's contributions to science were many. Pictures from his early deepwater cameras were the first to overturn the notion that ocean abysses were lifeless. Thousands of gravity measurements conveniently taken from surface ships helped chart the deep crustal structure of the earth, including features like continental margins

These measurements eventually helped prove the overarching modern theory of plate tectonics that control the surface of the earth—which Worzel for a time poohpoohed, until confronted with growing evidence compiled in part using his own techniques. Much of the Navy's surveillance technology was declassified in the 1990s; acoustic techniques have since been used to study ocean biology, underwater earthquakes and volcanoes, and to find archeological artifacts. Since sound travels faster or slower in water depending on its temperature, techniques pioneered by Worzel and his coworkers have also proved key in studying the oceans' interaction with climate.

In addition to Howard, Worzel is survived by his wife of 67 years, the former Dorothy Crary; daughter Sandra Lee Browne; son Richard Worzel; son William; eight grandchildren; and two great-grandchildren.

• • •

*The staff and members of the Jackson School of Geosciences would like to convey our respect to the families of the following alumni:*
**George Lewis Keprta,** B.A. 1952
**Smith Wade Leonard**, B.A. 1958
**James Wolleben**, Ph.D. 1966

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This form can be used both for updating information in our alumni records and for submitting news to the next edition of the Jackson School *Newsletter*. All information submitted is confidential and will not be shared outside of The University of Texas at Austin. All fields are optional but we appreciate your effort to help us keep your information accurate and current.

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