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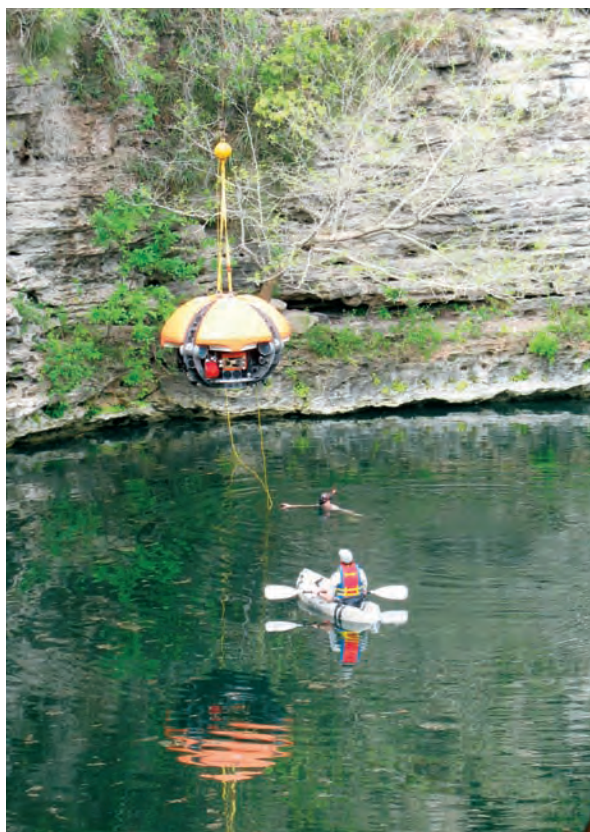

ON THE COVER: *Dawn strikes Fiftymile Mountain in Utah. The subsurface of this region on the western edge of the Colorado Plateau has been the scene of pioneering tomographic research by the Jackson School's Stephen Grand and colleagues reshaping the geologic understanding of the western U.S.* *See related story on page 60.*

The Newsletter, a tradition since 1950, is published annually for friends and alumni of the Jackson School of Geosciences at The University of Texas at Austin.

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WELCOME

Dear Alumni and Friends,

It is my pleasure to share with you this edition of the *Jackson School Newsletter* covering the 2006-2007 academic year, my first as dean. This has been an exciting time in the life of the school. In April we launched a new strategic plan, "Changing the World of Geosciences." This four-year plan, summarized on pages 78-81, charts an ambitious course to make the Jackson School the country's preeminent academic institution in the geosciences. The school-wide strategy emerged from outstanding unit plans, which are described in the Unit Overviews section (44-49).

One of our main goals under the plan is to hire 35 additional faculty and scientists over the next five years. We are focusing on emerging stars with the potential to shape the future of their disciplines. You can read about our new hires for 2007-2008 in the Scientists section (26-41). They are an outstanding group.

This is our second issue of the *Newsletter* in a new format that includes a series of feature stories highlighting the accomplishments and impact of the school. Whether Jackson School scientists are advancing the search for unconventional oil and gas (pages 50-55), deepening our understanding of the subsurface of the western United States (60-63), seeking a sustainable water future (64-68), or attempting to solve urgent questions associated with Antarctica's potential contribution to sea-level rise (74-77), they are making a tremendous impact on science and society.

Support is absolutely critical for the school to realize its full potential. You can read in these pages about major gifts from corporate partners, like Chevron and ConocoPhillips, and from generous individuals, like Decker Dawson. ExxonMobil is spearheading the expansion into Houston of our highly successful outreach program GeoFORCE Texas. Alumni and friends have responded generously to our new Friends of Student Field Experiences Endowment. And our new Development Team, under Director of Development Ann Flemings (see page 96), is gearing up for our next annual giving campaign, which will focus on support for student scholarships. We are offering matches from the Jackson funds to maximize the value of your contributions. They are absolutely essential to our success, and I offer a heartfelt thanks to all who contributed this year.

The Jackson School is an extraordinary institution and community. It has been an honor to serve this community over the past year. I have had the chance to meet a good many of you at our at our alumni functions. And with the official formation of our new Jackson School Friends and Alumni Network (JSG FANs), I look forward to meeting many more of you.

Together, we will create the greatest geoscience program in this country and change the world of geosciences.

Eric Barron

RESEARCH HIGHLIGHTS

Modeling Local Impacts

Researchers at The University of Texas at Austin will use a unique new computer model to study how global climate change will affect people on the local scale. The team is building the model with help from a new grant from NASA potentially worth $1.23 million.

Zong-Liang Yang, associate professor in the Jackson School, is principal investigator. His team will build a computer model that integrates climatic, hydrologic, ecological and atmospheric processes, from the global to the local scale. Initially, the team will use it to study two specific watersheds, the Nueces and the Guadalupe rivers. The real power of this model, though, said Yang, is that with some modifications it can be applied to many other places around the world, including developing countries struggling to sustain growing populations.


Yang

Semi-arid watersheds such as the Nueces and Guadalupe are common around the world. "We have similar areas in China, Africa, and South America," said Yang.

"This kind of environment is very sensitive to climate change. So this has big consequences for future adaptation of people living in these places around the world. When people are developing land or building irrigation systems in sensitive areas, this model would help them make intelligent, environmentally friendly decisions."

Yang said the model will not only generate forecasts for how watersheds might change in the future, it will also allow him and others to gain a deeper understanding of fundamental processes.

"No one has created this integrated model before," said Yang. The model will actually be a series of nested models, much like a set of Russian nested dolls, each smaller and more detailed than the one surrounding it. Global climate models will provide boundary conditions around North America. Nested within that will be a higher resolution domain covering the whole continent, enclosing the Gulf Coast region from Texas to Florida. Finally, within that will be a yet-finer resolution domain covering just two small watersheds of interest—the Nueces and Guadalupe rivers.

Yang and his team will feed the models a wide range of satellite data including rainfall, cloud cover, radiation temperature, aerosols, vegetation cover, albedo, and roughness of the surface (which affects wind speed). They will also use satellite measurements of ocean color (which indicate ecological activity of plankton and other microorganisms), temperature, and salinity.

The model will run on the supercomputers of the Texas Advanced Computing Center at The University of Texas at Austin, among the fastest in the world.

The team consists of six investigators: five from The University of Texas at Austin (Zong-Liang Yang and Guo-Yue Niu in the Jackson School, David Maidment in the Department of Civil, Architectural and Environmental Engineering, Paul Montagna and James McClelland in the Marine Science Institute) and one from the University of Texas at San Antonio (Hongjie Xie).

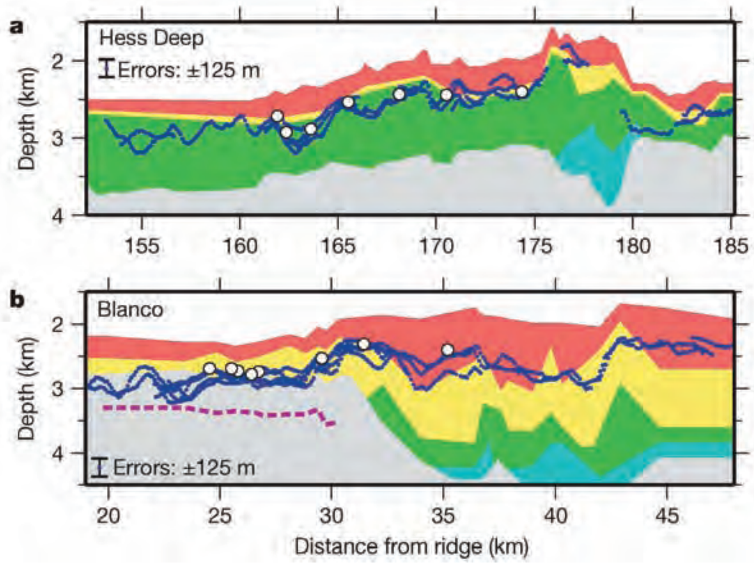
Seismic Limitations

Scientists Gail Christeson and Kirk McIntosh from the Jackson School's Institute for Geophysics, and Jeffrey Karson from Syracuse University, reported in the December 6, 2006 issue of *Nature* that an approach used for years to understand the structure of Earth's oceanic crust is flawed. As a result, geoscientists will have to reconsider the correspondence between seismic data and rock units when mapping formations of young oceanic crust.

Their research reveals that seismic data cannot reliably map the boundaries between rock units in young oceanic crust. The article, "Inconsistent correlation of seismic layer 2a and lava layer thickness in oceanic crust," is based on results of two geophysical research cruises to the Hess Deep rift and the Blanco transform fault in the Pacific Ocean, rare locations where young oceanic crust is exposed along steep scarps revealing the layered geologic units.

For years, geologists and geophysicists have been at odds over the basic definitions of oceanic crustal structure. Geophysicists divide oceanic crust (beneath any sedimentary material) into two basic layers, layer 2 and layer 3. Layer 2 is typically subdivided further into layers 2A and 2B. Layer 2A, the subject of the report in *Nature*, is a commonly imaged horizon in the seismic data, known as the 2A reflector, which numerous studies have mapped over extensive regions of young oceanic crust.

"Our work addressed the extent to which seismic boundaries within the crust correlate with rock units at the Hess Deep rift and



Geologic cross-sections of the Hess Deep rift and the Blanco transform fault in the Pacific Ocean. At the Hess Deep, the locations of the layer 2A reflections (in blue and white dots) correlate fairly well with the tops of the dykes (in green). At the Blanco fault, they do not. Lavas are indicated in red. The transition from lavas to dykes is in yellow.

The Jackson School's 20-year-old thermal ionization spectrometer is about to be upgraded.

BRIEFS

the Blanco transform fault," explained co-investigator McIntosh, "where nature offers a rare glimpse of what lies beneath the seafloor and the Earth's crust-making processes."

Because of the exposures at Hess Deep and the Blanco transform fault, the researchers were able to compare the seismic structure of upper oceanic crust with the known geology of the crust exposed and mapped by previous submersible dives.

"Prior to our study, there were no links between the geologic and seismological structure of oceanic crust except at a few deep drill holes," said Christeson.

The research shows that while the layer 2A reflector is imaged near the top of the sheeted dyke complex at the Hess Deep rift, it is imaged far above the sheeted dykes section at the Blanco transform fault—a finding that does not support the hypothesis that seismic reflector 2A represents a geologic boundary between two different rock units.

"Many researchers interpret seismic reflector 2A as the geologic boundary between the upper layer of lavas and the underlying sheeted dykes," said Christeson. "Our work shows that we can't reliably use seismic methods to map the boundary between lavas and dykes in young oceanic crust."

"However, the seismic data maps porosity," said Karson. "Microbes live in this pore space—a very exciting frontier of geology/biology."

The results also undermine an alternative hypothesis that the 2A reflector is associated with a chemical alteration boundary zone within the upper lava unit, raising the question: What are these seismic differences mapping?

"We propose that the 2A reflector corresponds to a chemical alteration front associated with a feature—possibly a crack where minerals can precipitate as a result of increased temperature and decreased porosity," said Christeson. "Such a hydrothermal alteration zone can occur either within the lava section or near the top of the sheeted dyke complex of oceanic crust." The research was supported by the National Science Foundation.

Bright Future for Geochemistry at JSG

Assistant Professor John Lassiter and Jackson School colleagues Todd Housh, Jim Connelly,

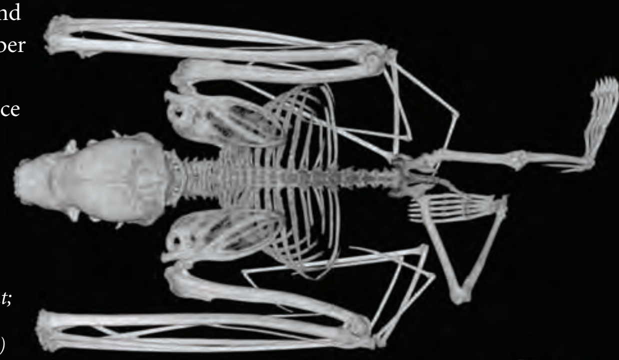
DigiMorph Milestones

The Digital Morphology Library (DigiMorph) reached a significant milestone in October 2006. Since going live in 2002, users have downloaded over 1 terabyte of data (equivalent to one thousand gigabytes).Tim Rowe, J. Nalle Gregory Regents Professor in Geological Sciences and project director for DigiMorph, said a second milestone was reached around the end of 2006: the one millionth person visited the site.

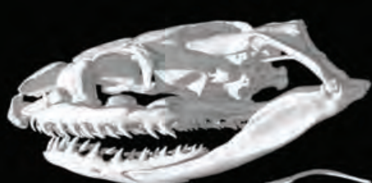
"DigiMorph was conceived and funded in 1998 as a prototype library for serving large 3D visualizations," said Rowe. "At thetime I had no idea that such a great appetite for this imagery existed, or that what has now become known as DigiMorph would ever be so popular. We are racing to keep DigiMorph at the technological forefront, and to feed what is proving to be an in-satiable hunger for great visualizations of Earth's biota."

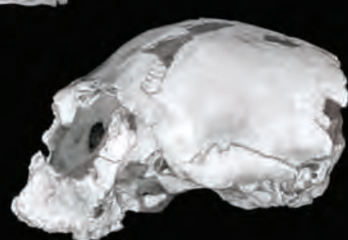
DigiMorph is a University of Texas at Austin based initiative that archives and distributes 2D and 3D visualizations of the internal and external structure of living and extinct vertebrates and a growing number of non-vertebrates. These visualizations, representing 464 specimens, are freely available online at http://www.digimorph.org/.

To date, 124 researchers around the world have contributed data to the library. DigiMorph visualizations are now in use in classrooms and research labs worldwide and can be seen in a growing number of museum exhibition halls. DigiMorph is a National Science Foundation-funded initiative.



From top to bottom: Euchilichthys royauxi, Suckermouth; Pygoscelis adeliae, Adelie Penguin; Carollia perspicillata, Seba's Short-tailed Bat; (bottom left) Lampropeltis getula, Common Kingsnake; (bottom right) Tremacebus harringtoni, Fossil Primate.





and Jay Banner were recently awarded an equipment grant from the National Science Foundation for the purchase of a new thermal ionization mass spectrometer (TIMS). The new instrumentation will possess measurement capabilities well beyond those of the almost 20-year-old mass spectrometer currently housed in the Department of Geological Sciences and will place the Jackson School squarely at the research forefront in the field of isotope geochemistry.

The new machine will have the ability to measure isotopic ratios of elements such as osmium or neodymium to a precision better than 10 parts per million. These measurement capabilities will open up several entirely new research opportunities within the Jackson School in the study of the origin, early differentiation, and evolution of the Earth and other planets, climate change, and hydrologic response on short (for example, decadal) time scales, time scales of early solar system processes, and many other research areas.

The NSF review panel and program manager cited the strong research programs of Lassiter and colleagues, along with the Jackson School's demonstrated support of geochemistry research, reflected in the commitment of matching funds toward the purchase of the new mass spectrometer, as reasons the school was selected for this highly competitive equipment grant.

Electricidad Mexicana

Over the past decade, Mexico has had a steadily expanding electricity sector. Total electricity sales in Mexico grew at an average rate of 4.5 percent between 1994 and 2004 compared to a 2 percent rate in North America. With residential and agricultural customers paying some of the lowest electric rates in the world, the sector faces a host of questions in the coming decades.

Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) and the Center for Energy Economics (CEE) at the Bureau of Economic Geology released the *Guide to Electric Power in Mexico* in October 2006. "The guide serves to begin public education on Mexico's energy sector and critical issues," said Francisco García, emeritus professor of economics at ITESM and one of the lead authors.

The guide provides information on the structure and operation of electric power in Mexico including types of generation and participating entities. It also addresses future trends and issues such as fuels for

External directors from the Nigerian Petroleum Development Company/Nigerian National Petroleum Corporation during a study tour in Houston of the upstream oil and gas industry.

generation, investment, policy and regulatory issues, environment, technology, and other considerations. The authors see certain constraints, such as pricing electricity below cost of production and delivery, that must be addressed for Mexico's electricity sector to continue on a sound footing.

"We also point to areas of cooperation between Mexico and Texas with respect to grid management, and between Mexico and the U.S. on reliability," said Michelle Michot Foss, also a lead author and head of the CEE.

The new publication presents electric power basics as well as a history of the sector from 1879 to the present. The authors discuss the evolution and environmental impacts of fuels, including renewables, for Mexico's electricity generation. The report also analyzes linkages between the electric and hydrocarbon sectors in Mexico.

Copies of the guide in English and Spanish can be obtained from both ITESM and CEE. To download the guide, access the CEE's web site, www.beg.utexas.edu/energyecon.

African Energy Markets

Under the auspices of its $3.5 million cooperative agreement from the U.S. Agency for International Development (USAID), the Bureau of Economic Geology's Center for Energy Economics (CEE) continued collaborative work with Ghana while building on its Ghana model to foster the capacity of energy markets in seven African and two Latin American nations.

In May 2007, CEE launched its 7th annual international capacity-building program "New Era in Oil, Gas & Power Value Creation." This year's session welcomed 24 delegates from Angola, Benin, Cote D'Ivoire, Ghana, Kenya, Mexico, Nigeria, Peru, Tanzania, and Togo. The two-week program concluded May 18 with participant team project presentations and award of the certificates at the graduation dinner. In May, CEE also welcomed a group of the external directors from the Nigerian Petroleum Development Company/Nigerian National Petroleum Corporation. The group was in Texas for a three-week study tour on the upstream oil and gas industry.

In July, CEE's Chief Energy Economist Michelle Michot Foss and Senior Energy Economist Gürcan Gülen led the West Africa Regional Natural Gas Workshop in Accra, Ghana. The event was organized by the Resource Center for Energy Economics and Regulation and supported by the Nigerian National Petroleum Company and Kumasi Institute of Technology, Energy, and the Environment. The workshop welcomed delegates from Ghana, Nigeria, Togo, Benin, and Cote d'Ivoire. It is the next in the series of training programs for capacity-building of energy professionals and public education on energy issues in West Africa, undertaken by CEE through the Smart Development Initiative for Energy Sector Governance Grant from the U.S. Agency for International Development (USAID).

Foss and Gülen also led the third annual Natural Gas Value Chain Workshop in Abuja, Nigeria. CEE and The University of Texas at Austin collaborated with the Gas Research Group at the University of Port Harcourt to deliver this five-day course on energy value chains. The course was attended by over 25 industry professionals, regulators, industry representatives, and university colleagues.

Sediment Wedge Key to Glacial Stability

A wedge of sediment, pushed up by glacial movement, may be a buffer against moderate sea-level rise, pointing to ocean temperature rise as the key factor in glacial retreat, according to two papers published in *Science Express* drawing on data gathered by Ginny Catania, a research associate at the Jackson School's Institute for Geophysics.


Catania

"Sediment beneath ice shelves helps stabilize ice sheets against retreat in response to rise in relative sea level of at least several meters," said Richard Alley, co-author on both papers and a professor of geosciences at Pennsylvania State University. "Large sea-level rise, such as the more than 325 feet at the end of the last ice age, may overwhelm the stabilizing feedback from sedimentation, but smaller sea-level changes are unlikely to do the same."

Catania used a snowmobile-towed radar to gather data in the region where ice from the Whillans Ice Stream in West Antarctica begins to float in the Ross Sea, forming the Ross Ice Shelf. She and her colleagues, including first author Sridhar Anandakrishnan, associate professor of geosciences at Penn State, then identified a sediment wedge beneath the ice, as reported in the *Science Express* article "Discovery of Till Deposition at the Grounding Line of Whillans Ice Stream."

The grounding line is where ice sheet transitions from resting on the Antarctic land mass to floating over water on the ice shelf. "In the past there has been very little information about grounding lines and how they control ice flow," says Catania. "New studies reveal that grounding lines have greater control over ice flow than previously realized."

The discovery may help scientists predict how Antarctic ice responds to rising ocean temperatures and contributes to rises in sea level. "Our results suggest that the grounding line is well above the point at which the ice floats and will tend to remain in the same location even though sea level changes, until sea level rises sufficiently to overcome the effect of the sediment wedge," says Anandakrishnan. Calculations indicate that a sea-level rise of more than 33 feet may be required to force the ice to retreat from the wedge.

The National Science Foundation and the Gary Comer Science and Education Foundation supported portions of the work.

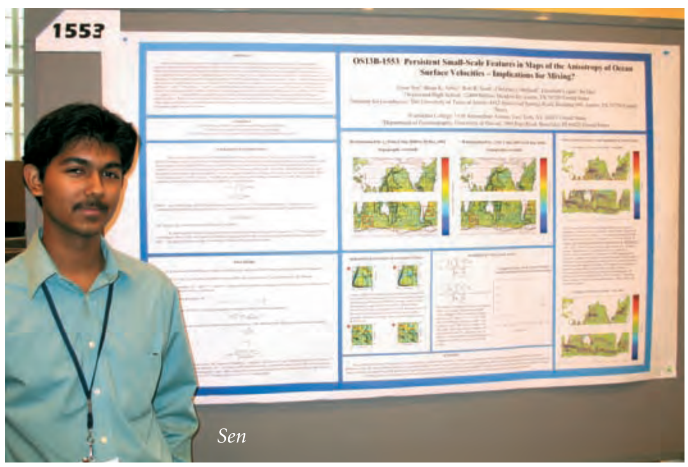
Head of the Class

Over the last two summers Ayon Sen, a student at Westwood High School in Austin who happens to be the son of Institute scientist and Jackson School professor Mrinal Sen, has worked on two separate research projects with researchers Brian Arbic and Rob Scott from the Institute for Geophysics. Now he's awaiting three possible milestones in his nascent science career.

Two papers relating to the projects—one featuring Sen as co-author, the other as lead author—have been submitted for publication to leading scientific journals. Sen also plans to enter his work in the Intel Science Talent Search, a national research competition primarily for high school students with a top prize of $100,000.

Both of Sen's summer projects focused on ocean eddies, which are the oceanic equivalent of atmospheric weather systems, spinning systems on the order of a hundred kilometers in diameter that impact marine biology and climate. In summer 2006, Sen studied the isotropy of ocean eddies—the degree to which eddy flows tend to be east-west versus north-south. Arbic and Scott posed the problem to Sen and guided him as he did some of the basic calculations. Sen reported on the results in two posters at the fall 2006 AGU meeting in San Francisco, a rare honor for a high school student.

In summer 2007, Sen estimated the dissipation of ocean eddies in bottom boundary layers. This is a quantity of great interest to oceanographers since the way the ocean loses energy is still relatively unknown, yet of great importance for understanding ocean circulation. Sen is the lead author of the 2007 paper, which has also been submitted for publication.



Sen

Sen was the first student Arbic had had the opportunity to work with. He was impressed with his ability to keep track of many separate, complex calculations while working under time pressure.

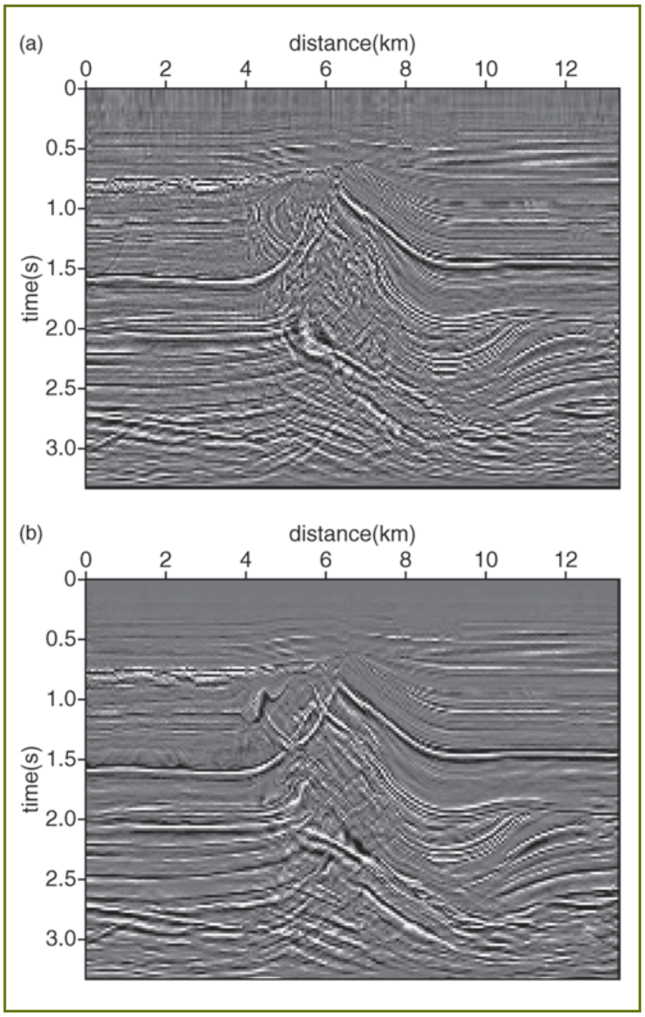
"That's something that even experienced scientists sometimes have a hard time keeping track of," said Arbic. "Then he wrote the first draft of our paper, a remarkable accomplishment for a high school student."

"During the summer 2006 project, it was hard to keep up with him," Scott added. "Every time we suggested he do a calculation, he did it so quickly we had a hard time absorbing the results and coming up with another idea for what to do next."

Quantum Seismic

Despite decades of improvements, seismic imaging—one of the geosciences' key methods for visualizing the subterranean world—remains a tad blurry. Sergey Fomel, a research scientist at the Bureau of Economic Geology, and colleagues Evgeny Landa of Organisme Pétrolier de Recherche Appliquée and Tijmen-Jan Moser of Zeehelden Geo-services set out to to improve this critical tool used for oil and gas exploration, examination of soil and water contamination, and study of Earth's internal structures. Scientists interpreting seismic data still have to guess what kinds of rocks the emitted sound waves are passing through and the velocities of those waves. They make their best guesses using computer models but uncertainties lead to grainy images. Some geologic features are obscured and phantom artifacts appear that don't actually exist.

"The key idea in this paper, which was actually the idea of the first author, Landa,



(a) Conventional (optimized) time-migrated image of North Sea data, obtained by velocity continuation; (b) path-integral time migrated image of North Sea data.

was that one should not try to find the unique velocity because it is uncertain," said Fomel. "So instead, you try many different velocities at once."

The idea came from quantum physics. In classical physics, when something moves—say, a ball is dropped from the top of a skyscraper or a spaceship blasts off into space—there is only one path that the object takes. You can draw an arc in the air, point to it and say, "That's the path it took."

But in quantum physics (which is better for describing the actions of very small and very fast things, such as electrons or photons of light), things aren't so cut and dried. An object moving from point A to point B actually takes multiple paths to get there, all simultaneously. Not only that, but there are different degrees of taking a path, so that it might mostly take one or two paths, but only slightly take a few other paths.

It might all sound counterintuitive, but quantum physicists have used these ideas to develop a mathematical way to manage uncertainty. In this case, uncertainty about the path an object took. And it works. (Richard Feynman, a brilliant and eccentric physicist, won the 1965 Nobel prize for his creation of this "path integral formulation.")

Fomel and his colleagues applied the path integral technique to uncertainties in seismic velocities. And the images they produce of the subsurface are clearer than those made with conventional seismic imaging.

The researchers won the European Association of Geoscientists and Engineers' 2006 Loránd Eötvös Award for their paper, "Path-Integral Seismic Imaging." The award is presented to the authors of the year's best paper published in the journal "Geophysical Prospecting." The collaboration was sponsored by Total, the French oil and gas company.

Fomel said that their proposed method is not yet fully practical, so don't expect to see it used directly. "I think the value of the paper is in provoking new ideas and emphasizing the idea of uncertainty in our knowledge about the subsurface," he said. "I think that's why the paper was recognized. Not because it proposed a new practical method, but because it opened a new area of ideas around the uncertainty."

DOE Supports Structural Diagenesis

The U.S. Department of Energy's (DOE) Office of Basic Energy Sciences (BES) has awarded the Structural Diagenesis Initiative, a research program at the Jackson School, more than $750,000 to continue its award-winning research for another three years. The initiative, which began with support from the Jackson School and a matching BES grant, won praise early on, earning a "Best University Research" award from DOE in 2004 and spawning a distinguished lecture tour.

Steve Laubach, a senior research scientist at the Bureau of Economic Geology who is lead principal investigator on the project, collaborates with co-PI's Peter Eichhubl, Rob Lander, and Linda Bonnell (all at the Bureau), Jon Olson (Department of Petroleum & Geosystems Engineering), and Randy Marrett (Department of Geological Sciences).

Excerpts from the 2006-2007 Commencement Speeches

Lasting Community

Elizabeth Dunn, B.S. '07

I bet that most of the students sitting in this room have been told at least once by others "I would never want to go to UT, it's so big!" The truth is, as a member of the Jackson school, the size of UT seems significantly smaller. We start off as freshmen, not knowing anybody in our classes, but within a few semesters we are matching our schedules with three of our closest friends to make sure we all have the same classes with all the same lab times. The sizes of our classes are just the right size that our professors are able to know us by name. Dr. Carlson made a point the first few weeks of the semester to go around the class and say everybody's name until he knew us all. It's the little things like that that makes our department special. We have our own geology community where we work together and help each other. Once we graduate this community will only continue to grow. No matter which side of the earth you end up on, I can guarantee that there is another Longhorn nearby.

Spring Commencement speakers (left to right): Pryor, Thomas Fanning of the Jackson School Advisory Council, Dlubac, and Dean Eric Barron.

No Accountants on the Moon

Katherine Dlubac, B.S. '07

Sir Edmond Hilary said, "It is not the mountain we conquer, but ourselves." Congratulations, in graduating from college, each of us has done that. And though we may not have conquered the mountain, as geologists we sure understand a little more about how the mountain came to be …. In studying geology, we are in a unique position to discover and better understand our valuable resources. We are obligated to ensure a more sustainable future for ourselves and for our children. We are educated and we can help the world understand the reality of our environment: that our natural resources are indeed limited. Living so close to Houston, we are familiar with the oil and gas industry, but there are other areas of geology that need attention. There may not be big money in global warming and clean water, but they are nonetheless important topics. We need to work on getting clean water to places in the world that need it for survival and global warming could drastically change the face of our Earth on an unnatural time scale. It is a part of our obligation to humanity to address these concerns. When I graduated from high school, my parents gave me a book: Oh the Places You'll Go by Dr. Seuss. I had such a sense of adventure and knew there was so much more for me out there: school, of course, but also traveling and seeing the world…. And isn't this sense of adventure the main reason why we've all decided to study geology. When a fellow graduating geologist, Mike Pickell, told a friend he was going to study geology, his friend replied, "That's awesome, because they don't take accountants to the moon."

Computing the Future

Omar Ghattas, Director, Center for Computational Geosciences, Jackson School

Of particular note is the arrival next year to the University of Texas of what will be the world's largest supercomputer. Many of you have heard about the National Science Foundation's awarding of a $59 million contract to the Texas Advanced Computing Center to deploy and support a 420 teraflops Sun supercomputer .... This supercomputer will help make Austin the world capital of high performance computational science. There are unprecedented opportunities for the Jackson School to build on the considerable talents of its researchers, the strong programs in applied mathematics and computer sciences at UT, and TACC resources to become the leading center in the world in advanced modeling and simulation of complex earth systems. The coming years will be tremendously exciting, and I hope some of you will chose to come back to the Jackson School and contribute to this effort.

From the Fall 2007 Commencement (left to right): Dean Eric Barron, Dunn, Ghattas, Leon Long.

For the Benefit of Humankind

David Pryor, Vice Chancellor for Academic Affairs, UT System

It is the final phrase in a mission statement for the Jackson School, "for the lasting benefit of humankind," that aims to energetically engage the quest for new knowledge of the geosciences—while using new ideas and concepts to underpin teaching excellence. I believe you will agree that, as we embark on the opening years of this 21st century, there most probably has never been a greater need for new geoscience contributions .... As you graduate from the Jackson School, keep faith with the mission of the school. Share what you have learned—and truly serve "for the lasting benefit of humankind."

The research strives to further the understanding of how fracture and fault growth and chemical diagenetic processes interact to govern the attributes of structures in the Earth. Laubach sees great potential: "The best science is yet to come in this area. There are many exciting research leads with important societal implications."

Graduate students make significant contributions to the initiative. Meghan Ward, M.S. '06, completed a study of the structural diagenetic evolution of fractured Jurassic sandstones in northeastern Mexico. Her mapping of microstructures within fractures is the basis for insights into fracture opening rates and timing, in many ways the 'holy grail' of fracture analysis, reports Laubach.

Kira Diaz-Tushman, M.S. '07, completed master's thesis work in northwest Scotland using structural diagenesis to unravel a hitherto unknown part of the tectonic history of this classic region. She has demonstrated this area is a remarkable outcrop analog for unconventional tight gas sandstone reservoirs. Leonel Gomez, Ph.D. '07, studies spatial arrangement of fractures in the context of structural diagenesis. His main field area is in the mountains of northeastern Mexico, where he studied fractures and diagenesis of Cretaceous Cupido dolostones. Gomez, his advisor Marrett, and collaborator Julia Gale have made a significant breakthrough by devising a new method to characterize the spatial arrangement of fractures. Current graduate student Aysen Ozkan is undertaking a structural diagenesis study of the Piceance and Uinta basins of Colorado and Utah, among the most important natural gas producing basins in the continental U.S. Her work with the Bureau of Economic Geology's Lander and Eichhubl has already demonstrated that structural diagenetic processes govern how fracture patterns evolve in this area.

Carlson, Cloos Edit Volume on Convergent Margins

Mark Cloos and William Carlson of the Jackson School co-edited a new compilation of 13 data-rich syntheses from world experts that shed light on the geologic record created where tectonic plates come together. Areas analyzed range from California to New Caledonia and from the depths of Death Valley to the planet Venus.

Convergent Margin Terranes and Associated Regions: A Tribute to W.G. Ernst, published by the Geological Society of America, is a collection focusing on processes at many scales of observation. Most of the papers concern linkages among sedimentary, metamorphic, magmatic, and deformational processes that occur in and near subduction zones. Collectively they focus on how plate tectonic processes are petrologically and geochronologically recorded.

Most of the papers were presented at the 2003 Annual Meeting of the Geological Society of America in a theme session about petrology and plate tectonics in honor of Professor W. Gary Ernst. Ernst taught at the University of California, Los Angeles (1960-1989), and at Stanford University (1989-2004). He received the Geological Society of America Penrose Medal in 2004.

"The papers in this volume, like the session that inspired it, reflect the diverse interests and prodigious publications of Gary Ernst," said Cloos. "They are a fitting tribute to an outstanding scientist who has enriched the lives of thousands of students."

Co-editors in addition to Cloos and Carlson were M. Charles Gilbert of the University of Oklahoma, J.G. Liou of Stanford University, and S.S. Sorensen of the Smithsonian Institution.

Individual copies may be purchased through the Geological Society of America online bookstore or by contacting GSA Sales and Service, gsaservice@geosociety.org.

SPEAKERS & LECTURES

Energy Insecurity

John Hofmeister, president of Shell Oil Company, told an audience at The University of Texas at Austin that the time for debate over the science of climate change is past. Citing a "linkage" between greenhouse gases and climate change, Hofmeister called for a national strategy to reduce carbon dioxide emissions. "The nation needs a public policy," he said. "We'll adjust."

Hofmeister

"We have an obligation to pass on to future generations the energy security we've known for most of the last century."
—John Hofmeister

Hofmeister spoke during an international energy security symposium co-hosted September 20, 2006 by the Jackson School and the LBJ School of Public Affairs. He cited weaknesses in the U.S. oil supply chain as a threat to energy security.

"We are as vulnerable today as we were a year ago," said Hofmeister, referring to supply disruptions from Hurricanes Katrina and Rita, which knocked out 30 percent of crude oil and gas production in the Gulf of Mexico, causing a spike in energy costs. The problem, he said, is that oil is produced just barely fast enough to meet global demand.

Hofmeister offered five solutions: Open more federal lands to oil and gas drilling, such as parts of the U.S. Outer Continental Shelf; use unconventional fossil fuels, such as oil shales and oil sands; develop more efficient ways to use fossil fuels, such as coal gasification; diversify the energy supply to include alternatives such as wind and solar energy; promote a culture of conservation.

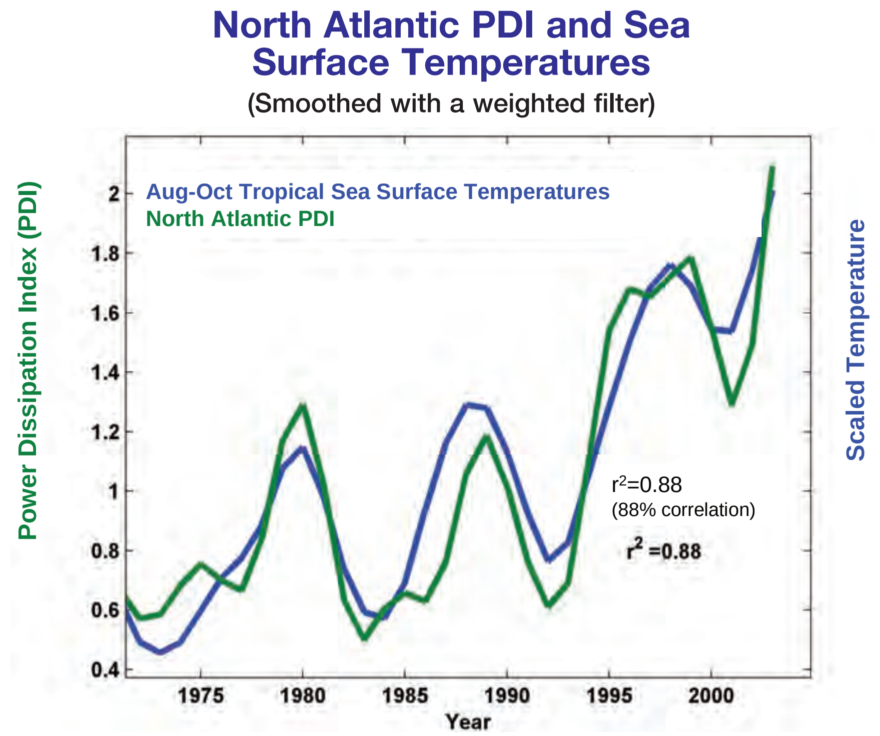
Like BP, Hofmeister said, Shell is exploring alternatives to fossil fuels, such as biofuels, solar, wind, and hydrogen.

Hurricane Warning

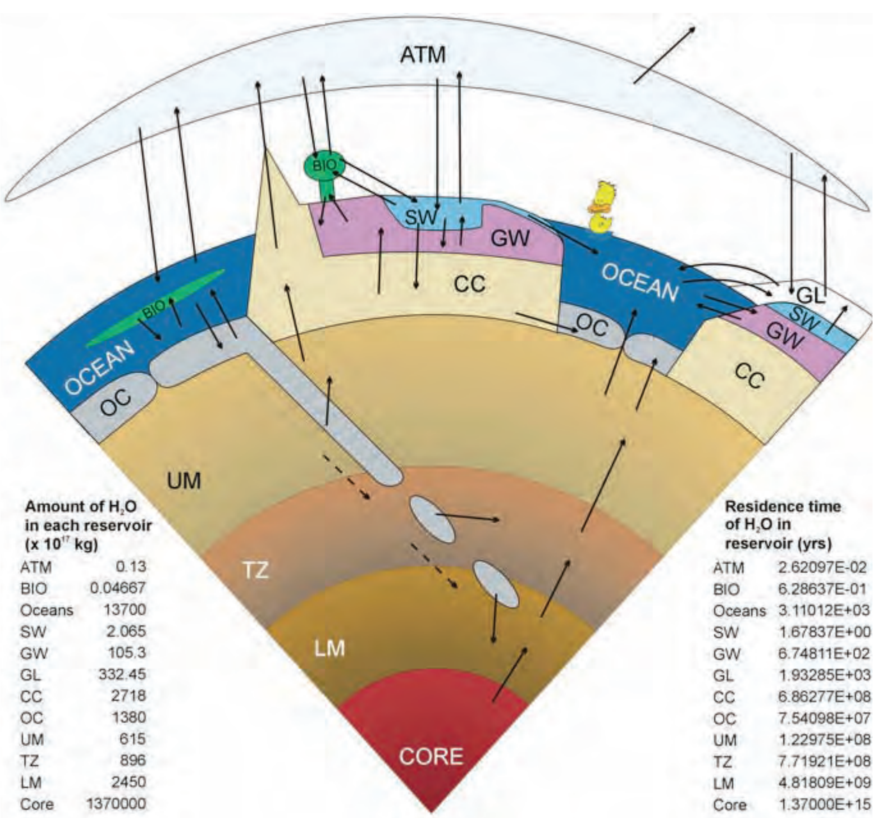
Kerry Emanuel, one of the world's foremost experts on hurricanes and climate, told a packed house at The University of Texas at Austin that global warming is increasing the intensity of hurricanes in the Atlantic.

Drawing on a series of graphs and data stretching back to the 1860s, Emanuel, a professor of meteorology at the Massachusetts Institute of Technology, illustrated his contention that intensities of hurricanes have been stair-stepping their way upward in close correlation with rising sea surface temperatures in the Atlantic for at least the past 35 years.

The sea surface warming seen in recent decades, said Emanuel, "has been almost



Graph shows the Power Dissipation Index (PDI) of hurricanes in the North Atlantic to represent the change of hurricane intensity since 1970, correlated with North Atlantic ocean surface temperature. The curves have been smoothed. Courtesy of Kerry Emanuel.



Cartoon depiction of Bodnar's water cycle model. Grey slabs of ocean crust carry water down into the mantle.

certainly due to man-made influences." Emanuel stopped short of attempting to attribute individual hurricanes to recent climate change. "I think it's a mistake to think that Katrina was a result of global warming," he said. The majority of tropical storms never reach land, dissipating over the oceans. "A lot of this is just bad luck, in terms of [which storms make] landfall," said Emanuel.

Emanuel has been at the eye of the media storm since his August 2005 paper in the journal *Nature* correlated global warming with the increasing destructiveness of tropical cyclones over the past 30 years. His October 5, 2006 lecture, part of the Hot Science-Cool Talks series organized by the University's Environmental Science Institute and the Jackson School of Geosciences and co-sponsored by the SBC Foundation and ConocoPhilips, drew on materials from the paper and his new book, "Divine Wind: The History and Science of Hurricanes."

An Ocean Within

Earth is covered in so much water, alien astronomers spying us from light years away would likely call our planet their equivalent of "Ocean." Now, some scientists say, that's not the half of it. They have come to suspect that most of Earth's water is not out in plain sight, but actually deep below ground.

Robert Bodnar, Distinguished Professor of Geosciences at Virginia Tech, is one of them. He and colleagues are developing a new computer model that attempts to represent the entire water cycle. Their model contains oceans, ice caps, surface water, clouds, and all the water that resides in the exosphere, but also all the water in the geosphere, hidden deep inside Earth, from the rocky crust through the mantle and perhaps right down to the molten iron core. This "interior ocean," as some have called it, doesn't exist as a liquid ocean, but rather locked up as countless molecules of hydrogen and oxygen inside the crystals that make up rocks.

Bodnar, selected as the Jackson School of Geoscience's Allday Endowed Lecturer, presented his ideas to the school over a series of talks in March. He called his water cycle model a "steady state" model in that the water that goes in to each domain (say, the oceans) equals the water that goes out.

It is thought that slabs of rocks and minerals subducted by the collision of tectonic plates carry water down into Earth's mantle and perhaps as deep as the core.
In 1987, Joseph Smyth, a geologist from the

Selection of other 2006–07 speakers:

David W. Scholl (Stanford/USGS)
Paradigm Altering Drilling Discoveries: The unanticipated documenting of upper plate crustal thinning at subduction zones and the movement (non-fixity) of Pacific hotspots

Fei Chen (NCAR)
Land Surface Modeling In Numerical Weather Prediction Models

Seth Stein (Northwestern University)
Ultralong Period Seismic Study of the Indian Ocean Earthquake and Implications for Tsunami Hazards

John H. S. Macquaker
(University of Manchester)
Sedimentary Processes and Myths About the Optimal Environments of Source Rock Deposition

Julio Friedman
(Lawrence Livermore Nat. Lab)
Tackling Subsurface Uncertainty: Stochastic Integration and Inversion of Geological and Geophysical Data Sets

Robert Dalrymple (Queens University)
Where Does the Mud Go? The Dispersal of Mud from Rivers and the Stratigraphic Implications

Christopher Kendall
(University of South Carolina)*
The Exploitation of Oil: A History of the Entrepreneurs Who Made it Happen Mike Payne (DOE/NETL) Opportunities and Challenges of US Gulf of Mexico Deepwater Operations

John Drake (Oak Ridge Nat. Lab)
High Performance Computing and Modeling in Climate Change Science

**Distinguised Visiting Scientist JSG*

University of Colorado at Boulder, published a paper in *American Mineralogist* suggesting that a type of mineral containing magnesium and silicon, residing in a 100 kilometer thick rind within Earth's mantle, could hold an enormous amount of water. Smyth believes the mantle might hold as much as five times as much water as Earth's oceans.

Bodnar said even if minerals inside the mantle contain just 10 percent of their capacity for water (a conservative estimate), the mantle would hold three times as much water as there is above ground.

Understanding how much water is below our feet, as well as how it got there and how it changes over time, might help scientists better understand other important processes that make our planet such a dynamic and vivacious place, such as plate tectonics. Take away water and plate tectonics, said Bodnar, and Earth would be unrecognizable.

"Earth is blue and alive looking, the moon looks grey and dead," said Bodnar. "The difference is water."

Course Correction

Roger Pielke, Sr. is something of a lightning rod in the climate science community. He says that current climate models are not reliable enough to accurately forecast future climate and he doesn't believe greenhouse gas emissions are the main driver of climate change.

Pielke, a senior research scientist at the Cooperative Institute for Research in the Environmental Sciences at the University of Colorado at Boulder, spoke to a group of scientists and students in Boyd Auditorium at the Jackson School January 23.

"People spend lots of time and money trying to estimate how temperature and so on will change," said Pielke. "I think it's almost irrelevant because we don't live in a globally averaged world, we live in a specific place."

He has ruffled the feathers of some mainstream climate scientists who say that despite uncertainties in climate models and observations, the vast preponderance of evidence supports the notion that burning fossil fuels is a major driver of climate change and that the amount of change in this century will be large.

Pielke said climate scientists need to move in a different direction: Stop focusing on Earth's surface temperature and look instead at the heat content of the oceans, which some research suggests has experienced a short period of cooling recently. And stop obsessing over greenhouse gas emissions. Instead, recognize that climate change has multiple causes including land-cover changes and start thinking about how to address societal and environmental vulnerabilities.

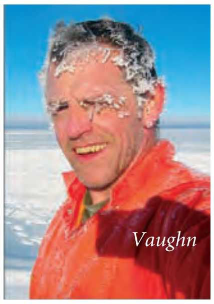
While at times out of step with his climate colleagues, Roger Pielke, Sr. is hard to dismiss. A fellow of the American Meteorological Society since 1982 and the American Geophysical Union since 2004, he has published prolifically in the leading scientific journals.

"The thing I like about Roger and respect is that he publishes in the peer-reviewed literature as a standard way of communication," said Terry Quinn, a climate researcher at the Jackson School. "He is a highly regarded scientist with a strong track record. So I take what he says seriously."

"We shouldn't ignore the fact that there's increasing CO_2 in the atmosphere," Pielke said. "I don't think it's a good thing. But if you're basing a policy on that, I think you're leaving out some important things."

David Vaughn: Race to Foretell Antarctica's Future

Vaughan, a principal investigator with the British Antarctic Survey, addressed a packed house in Welch Hall as part of the public day culminating a three day work-shop on West Antarctic Links to Sea-Level Estimation. Vaughan said there is reason to worry that Antarctic melting might boost sea level rise much higher than the recent estimates projected over the next century by the Intergovernmental Panel on Climate Change. He pointed out that the West Antarctic Ice Sheet is resting on rock that's 2,000 meters below sea level. Some scientists have theorized that this makes the WAIS inherently unstable:


Vaughn

"We have this really very plausible theory that if you kick this part of the ice sheet hard enough-cause that instability to start feeding back on itself and a retreat to begin-then you could lose that whole area quickly," said Vaughn. "Now 'quickly' probably means centuries, but if you lose all of the West Antarctic Ice Sheet, you're talking about five meters of rising sea level."

See the related story on page 74.

BRIEFS

Teacher participants from a fall 2006 TXESS Revolution workshop visit Inner Space Caverns.

BRIEFS

OUTREACH

Earth Science Revolution

After playing a lead role in restoring earth sciences to the curriculum of Texas public schools, researchers and staff from the Jackson School are taking on the next challenge—training teachers to inspire the next generation of earth science students.

In November 2006, the Texas State Board of Education yielded to years of entreaties from the geoscience community and allowed for the creation of a new capstone earth science class that, while an elective, would carry the same credit as other high school science courses. Current and former Jackson School leaders played key roles in persuading the board to make the change. (See "Earth Science Education Gets Boost in Texas," from the 2006 *Newsletter*.)

But after almost a decade without consistent earth sciences in Texas schools, the state faces a dearth of experienced teachers. At the same time, Texas has an extremely diverse public school population. The state presently has a "minority" school-age population of over 50 percent.

Fortunately, three institutions have committed to find innovative ways to address both situations. The National Science Foundation's Opportunities to Enhance Diversity in the Geosciences, Shell Oil Company, and the Jackson School of Geosciences are together providing $2.38 million to fund the Texas Earth and Space Science (TXESS) Revolution, a rigorous five-year geoscience professional development program for minority-serving science teachers and teacher mentors working in grades 8-12 in Texas.

Led by Kathy Ellins at the Institute for Geophysics, the Jackson School is teaming up with the Texas Regional Collaboratives for Excellence in Science and Mathematics Teaching, the Department of Petroleum and Geosystems Engineering at UT Austin, TERC (a not-for-profit company in Massachusetts with 30 years of experience designing science curriculum), the University of South Florida, and GeoFORCE Texas to carry out the ambitious project.

The goal is to prepare teachers for Texas' new capstone Earth and Space Science (ESS) course. Given Texas' present and projected demographics, the TXESS Revolution has the potential to impact hundreds of thousands of minority students over many years, while benefitting all students who pursue the earth science elective.

Key elements of the TXESS Revolution include a suite of professional development academies offered to teachers and teachers mentors; immersive summer institutes aligned with the Texas educational standards for the new capstone course; field experiences in Alaska and Texas; a Petroleum Science and Technology Institute; training on how to implement Earth Science by Design, an innovative program of professional development for teachers developed by TERC and the American Geological Institute (with NSF funding); and an online learning forum designed to keep teachers, teacher mentors, and project facilitators in contact between and after training.

For more information contact Kathy Ellins at 512-471-0347, kellins@ig.utexas.edu.

Graduate Teaching Fellows

The National Science Foundation's Graduate Teaching Fellows in K-12 Education (GK-12) is a national program that partners graduate students in the sciences with K-12 teachers. At The University of Texas at Austin, NSF sponsors collaboration between the Jackson School and the Environmental Science Institute to enhance science education through new classroom activities, workshops, and field projects. Funds provide annual fellowships for six graduate fellows in the environmental sciences over a three-year period.

An overall goal of GK-12 is to provide K-12 teachers and students with recent knowledge and innovative learning activities in the areas of biology, environmental science, aquatic science, geology, meteorology, and oceanography, and to relate these topics to the impacts of environmental change on Texas habitats and residents.

Student populations in the school districts served range from 1 to 17 percent limited English proficiency, 23 to 47 percent economically disadvantaged, and 12 to 65 percent minority.

The project emphasizes field research for students and teachers and builds connections between researchers at the university and local school systems from the Texas coast to the state's interior. For more information contact Jay Banner in the Department of Geological Sciences, 512-471-5016, banner@mail.utexas.edu.

Heading to Houston

After three straight years of academic success and resounding support from sponsors, GeoFORCE Texas, the Jackson School's college preparatory program for the geosciences, is set to expand. GeoFORCE is a summer college-prep program designed to inspire students to pursue university studies in the geosciences. In 2007 GeoFORCE started its third straight year serving the predominantly Hispanic region of Southwest Texas, sending 245 students into the field in seven states at geologic sites across the country. The model of experiential education has proven so successful that sponsors, led by ExxonMobil, have asked the Jackson School to replicate GeoFORCE for the Houston public schools. The program launches in 2008.

See related article on page 82 of this issue.

FACES OF EARTH SCREEN SHOT COURTESY OF AAPG EXPLORER.

Faces of Earth

Jackson School faculty and scientists speak to thousands of potential students each year, but this summer, three of them expanded their reach into the millions.

In July, the Discovery Channel premiered the four-part series *Faces of Earth*, a production of the American Geological Institute (AGI) and Evergreen Films. A number of Jackson School scientists participated as advisers and preliminary interview subjects while the series was in development. Three appeared in the first episode, "Building the Planet," which initially aired on the Science Channel July 23.

Charles Kerans, the Robert K. Goldhammer Chair in Carbonate Geology in the Department of Geological Sciences, discussed carbonate analogs. Martin Jackson, a structural geologist and senior research scientist at the Bureau of Economic Geology, discussed salt tectonics. His colleague from the Bureau, research scientist Tim Dooley, talked about salt modeling.

As in any television series, only a few of many interviewees made it on screen. According to Chris Keane, director of communications and technology at AGI, 40 of the 120 scientists interviewed for *Faces* ended up in the final series.

One of seven sponsors of the program, the Jackson School contributed more than expertise. The school joined the Association of Petroleum Geologists Foundation, Discovery Communications, ExxonMobil, Rive Gauche International Television, and the United States Geological Survey to fund the production. As a sponsor, the Jackson School received an extended cut from AGI that included material from all JSG participants. The school has the right to show the series or the extended cut at public events and in classrooms.

AGI describes the program as "a 4-hour high-definition television series about the ever-changing planet we live on. The only thing constant on Earth is change and Faces of Earth examines this phenomenon through the eyes of those that know it best—geoscientists. Explore how through time the forces of nature have continuously remade Earth—giving it many distinct faces through history, and many new ones into the future." Faces of Earth is shot in high-definition with extensive use of aerial photography and cutting-edge animations.

As this edition of the Newsletter went to press, copies of the series were scheduled to go on sale on the AGI Web site.

National Call for Top Undergrads

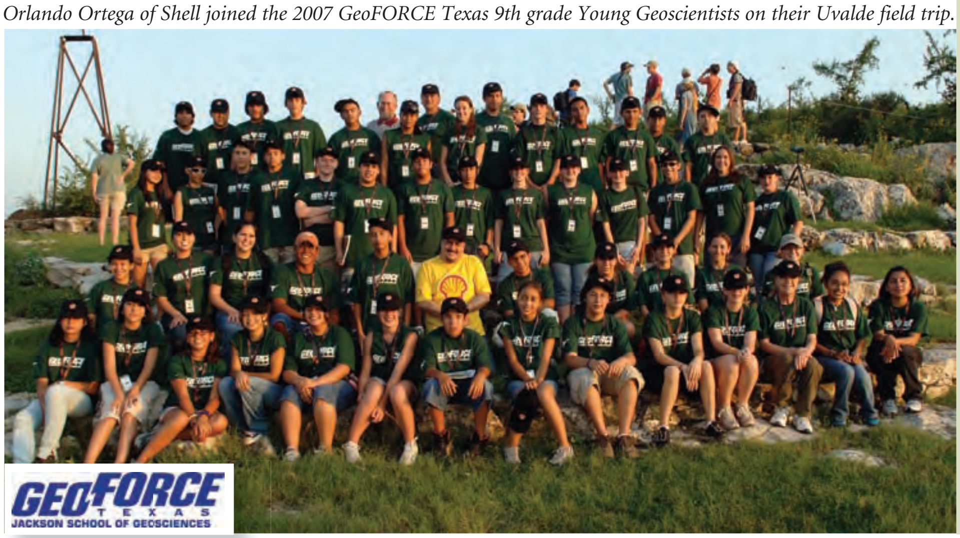
Each summer, the Environmental Science Institute invites undergraduates from around the country to come to the university for a ten-week program called Research Experiences for Undergraduates (REU). Accepted students get to take part in environmental research that cuts across disciplinary boundaries.

Students spend the summer learning how to do research, participating in group research projects, designing their own short projects, and presenting their work in an end-of-summer symposium. The program

After visiting the Jackson School as an undergraduate at Slippery Rock University while attending the summer REU program, Megan Andring applied for graduate school. She is currently a JSG master's candidate in hydrogeology.

Dawne Ballard, REU student from Bryn Mawr: "I wouldn't have been able to do this kind of work as an undergrad at my university."

Orlando Ortega of Shell joined the 2007 GeoFORCE Texas 9th grade Young Geoscientists on their Uvalde field trip.



also includes seminars on environmental science topics, career development workshops, and four outstanding field experiences that trace the path of water through a watershed and aquifer from recharge in central Texas to discharge into Gulf coast estuaries.

Andrew Brouwer is a math student at the State University of New York at Potsdam who came to Austin this past summer for the REU program. He studied hypoxic events, or "dead zones," in Corpus Christi Bay.

"I had never been in the field," he said. "It was surprising how real it is. When you read journal articles, you tend to forget that someone had to go out and collect that data. Someone got dirty, sweaty and grimy. They might have been working on a boat at all hours of the day and night."

He got a taste of the ups and downs of field research when his boat ran out of gas in the bay and needed a tug back to shore.

Dawne Ballard is a student at Bryn Mawr College in Philadelphia, one of the country's top liberal arts institutions. "I wouldn't have been able to do this kind of work as an undergrad at at Bryn Mawr," she said. "I would have had to wait until grad school."

"Science is becoming more and more interdisciplinary," said Bayani Cardenas, an assistant professor in the Jackson School who advised some of the visiting students. "REU is one of the few programs for undergrads that actually promotes that. For example, we had a mathematician looking at hydrology and biology and we had geologists looking at biology and engineering issues."

Megan Andring, a student from Slippery Rock University in Pennsylvania, worked with Jack Sharp, professor in the Department of Geological Sciences, and Brad Wolaver, a Jackson School doctoral student, during the 2006 REU. Fired up by the chance to take part in a study at Cuatro Cienegas, a unique hydrological system in northern Mexico, she presented a poster on the research at the annual GSA meeting in fall 2006 and recommended REU to her fellow students at Slippery Rock.

"I liked the combination of field and analytical work and that it was related to geochemistry," she said. "It was also a great way to meet people who were working in the field." She was so enchanted that she returned to the university this fall as a graduate student. Her new research will relate to hydrogeology and urbanization in central Texas.

"The Jackson School is up and coming, so it felt like a great place to be," she said. "Also, knowing Jack [Sharp], I felt like I had an in. When you move to a new place, it's important to know people."

The REU program is funded by the Department of Defense and contracted by the National Science Foundation.

From Texas to the Poles

The International Polar Year (IPY) is a large scientific program focused on the Arctic and Antarctic. In the tradition of many past scientific "years," IPY lasts more than 12 months, from March 2007 to March 2009. Organized through the International Council for Science and the World Meteorological Organization, IPY is the third polar year, following those in 1882-83 and 1932-33. The 2007-09 edition involves more than 200 projects, with thousands of scientists from more than 60 nations examining a wide range of physical, biological, and social research topics.

As a leading organization in research at the poles, the Jackson School's Institute for Geophysics put together a Web portal of its IPY-related work. "From Texas to the Poles" documents the Institute's history of successful polar field campaigns and active international collaborative research programs in the polar regions.

The site offers research recaps, with links to relevant data and publications, of UTIG's work in ice & the ice-covered lithosphere, marine geophysics, and plate reconstructions related to the poles. Educators can download lesson plans, classroom activities, and a classroom poster on IPY. Students and teachers can also log on with international polar scientists in the field using IPY's Polar Trek Web site. Or they can visit Wired Antarctica, where Ginny Catania, a research associate at the Institute, presents news, images, and reflections documenting the experience of living and working at the South Pole.

Opening Up the World of Geosciences

As part of its outreach mission, the Jackson School offers financial and logistical support for GeoScience World (GSW), the leading online portal for research and communications in the geosciences. GSW is a nonprofit corporation formed by a group of leading geoscientific organizations to make geoscience research and information easily and economically available via the Internet. The project is an unprecedented collaboration of six leading earth science societies and one institute.

GSW is built on a core aggregation of high-impact, peer-reviewed journals that are indexed, linked, and interoperable with the GeoRef bibliographic database. With the recent addition of the European Journal of Mineralogy, GSW now offers access to 33 of the world's leading geoscience journals, including the publications of its founding organizations, AAPG, AGI, GSA, GSL, MSA, SEPM, and SEG.

As part of its ongoing support for GSW, the Jackson School sponsored GSW's first users' group meeting October 29, 2007, at the GSA Annual Meeting & Exposition in Denver. The Walter Geology Library also houses Pat Dickerson, an employee of AGI who compiles materials for the GeoRef database, helping this core element of GSW grow by more than 90,000 references a year.

GeoScienceWorld (GSW)

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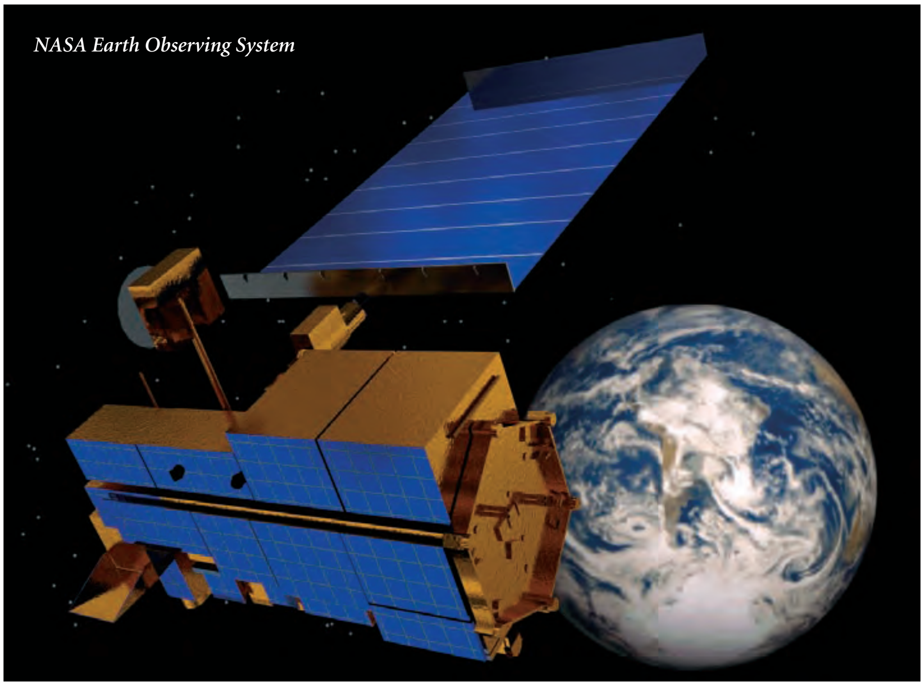


NASA Earth Observing System

IN THE NEWS 2006–2007

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

Bureau Teams Up with Big Oil on Nanosensors

Houston Chronicle, Aug. 23, 2007

A consortium of energy companies, working with The University of Texas at Austin, plans to research the use of nanotechnology to help produce oil and gas. The Advanced Energy Consortium is working on developing subsurface nanosensors that could be injected into oil and gas well bores, collecting information to evaluate the oil and gas potential of a reservoir. The Jackson School's Bureau of Economic Geology will lead the collaborative research. Resulting inventions will be owned by the university, while the right to make and sell any patented technology belongs to the seven major companies funding the multimillion dollar venture.

Concerns Voiced Over NASA Earth Science Funding

American Institute of Physics, SpaceRef.com, Aug. 17, 2007

"We will enter the next decade with an [Earth] observing system that is substantially less capable than we had at the start of the 21st century," testified Eric Barron, dean of the Jackson School, during a June 28 hearing of the House Science and Technology Committee's Subcommittee on Space and Aeronautics. The hearing explored whether NASA's 2008 budget request of $1.497 billion for earth science and applications programs would enable the space agency to implement the recommendations of the National Academies' decadal survey. "It strikes me," Barron said, that the nation "is in worse shape, not better," in terms of designing an effective observing system without gaps in data continuity.

LNG Developers Meet Resistance in Northeast

Christian Science Monitor, Aug. 7, 2007

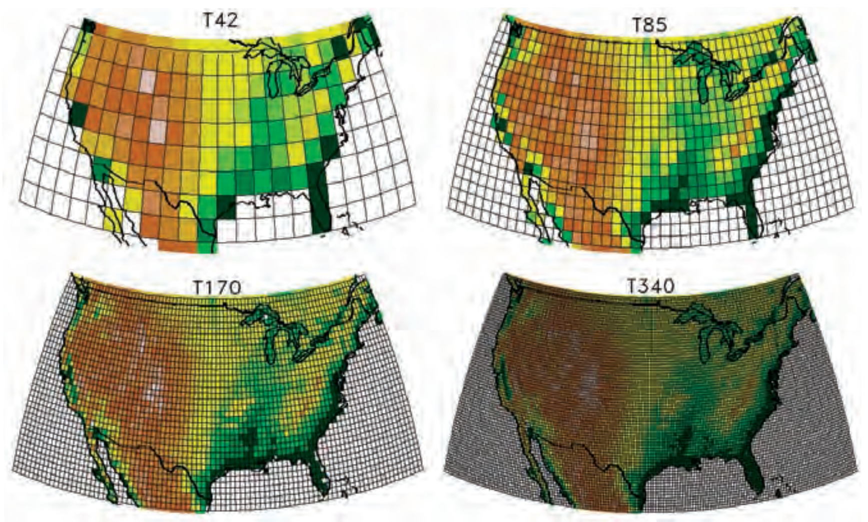
On the Pleasant Point Indian Reservation on Passamaquoddy Bay, with a view of forested Canadian islands on the far shore, U.S. liquefied natural gas (LNG) developers are clashing with Canadians eager to preserve a pristine wilderness. The dispute highlights the challenge of finding places to build safe LNG facilities without meeting local resistance. Critics question whether any of the new terminals are needed. But building excess capacity helps respond to unexpected demand, says Mariano Gurfinkel of the Center for Energy Economics at The University of Texas at Austin. "Terminals can cost upwards of $500 million. I doubt that their proponents are going to do this if they don't think they would make money."

Can the World Bury Carbon Dioxide?

Christian Science Monitor, July 31, 2007

Can nations bury their greenhouse gases? If so, they may buy a decades-long respite as they search for less carbon-intensive energy sources. Scientists working on carbon sequestration are cautiously optimistic. "I grew up near Love Canal, so I know the problems of putting stuff underground," says Sue Hovorka, a research scientist at the University of Texas at Austin tracking the movement of carbon dioxide underground in the nation's first deep-sequestration experiment, in the old Liberty oil field south of Houston. Perhaps America's best hopes for geologic sequestration lie with the sandstone formations holding super-salty groundwater on the Texas coast—as well as the dwindling oil fields across its vast breadth, says Ian Duncan, associate director of the Bureau of Economic Geology. Together, these two geological assets could hold all of America's CO_2 emissions for at least the next 40 years, he estimates.

CO_2 trucks at the frio injection site



The detail in climate models has increased in recent years, largely because of the calculation power of newer supercomputers. In the 1990s, high-resolution climate models operated on the T42 resolution scheme (upper left) tracking temperature, moisture, and other features in grid boxes spanning about 200 by 300 kilometers at midlatitudes (120 x 180 miles). Higher resolution T170 and T340 models are now the norm. Courtesy of the University Corporation for Atmospheric Research.

BRIEFS

Opinion: Support America's Oil Companies

Houston Chronicle, July 29, 2007

As we wait for emerging energy forms to develop, we should create policies that support oil companies, wrote Scott Tinker, director of the Bureau of Economic Geology, in an op-ed for the *Houston Chronicle*. Tinker debunked a number of energy myths, such as the ideas that American energy independence is possible and "Big Oil" companies control gasoline prices. "While emerging energy forms take shape, we still need to run the planes, trains and automobiles of the modern era," wrote Tinker. "Until we define and can produce at scale the next major transportation fuel, we owe it to ourselves to develop national energy policy with a mind toward supporting the major oil companies that provide the energy required for a healthy economy, which is in turn required for a healthy environment."

Barron Offers Overview of Climate Modeling

The Oil and Gas Journal, July 9, 2007

As industries and governments pay greater attention to climate change, interest in climate models has been on the rise. Eric Barron, dean of the Jackson School, offered a wide-ranging perspective on the state of climate modeling. For oil and gas exploration, climate modeling has recently regained currency, with scientists reporting great strides in their ability to generate simulations that accurately examine specific time periods and basins. In general, climate models can be applied to geological information in two ways: studying Earth's history and improving knowledge of climate change so scientists can better project the future. "If you have confidence that these models can predict the past, it starts to give you more confidence that they can predict the future," said Barron.

Agriculture Consuming World's Water

Geotimes, June 2007

Amid all the talk about climate change, a more immediate issue can be forgotten—how land-use changes can affect the quantity and quality of water supplies. A recent study by Bridget Scanlon, a hydrogeologist at the Bureau of Economic Geology, and colleagues aims to throw this issue into the spotlight.

Going Underground for a Greenhouse Gas Solution

Houston Chronicle, June 9, 2007

While world leaders made pledges to cut greenhouse gases at this week's G8 Summit in Germany, Sue Hovorka was in the backwoods of East Texas working to help them keep those promises. Hovorka is a geologist at the Bureau of Economic Geology. She and colleague Tip Meckel, also of the Bureau, recently tested the soil around two wellheads to see if CO_2 injected last fall during a carbon capture and storage test had crept up to the surface. Apart from a small leak in one well, they found that the CO_2 hadn't migrated to the surface.

More Hurricanes Only Partly Tied to Warming

KLBJ-AM Radio, June 8, 2007

A researcher from the Jackson School's Institute for Geophysics says we could see more major hurricanes in the near future, but global warming may not be the only cause. Terry Quinn says that tying the increase in the number of storms to global warming is not as simple as it seems. A study he co-authored in *Nature* reveals rising water temperatures could play a role in hurricane activity, but vertical wind shear makes it more difficult for storms to form and get stronger. Such was the case last year, when El Niño produced strong wind shear.

Opinion: U.S. Lacks Direction in Climate Change Fight

Austin American-Statesman, June 6, 2007

According to Michael Webber, associate director of the Center for International Energy and Environmental Policy at the Jackson School, it's time for the U.S. to take the lead in combating global climate change, if for no other reason than our economic and political self-interests. "Countries like France, the world's leader in CO_2-free nuclear power, and Denmark, whose companies dominate the global wind turbine market, will reap significant economic gains while trying to stave off disaster," writes Webber. "It sure would be nice if the United States was making those profits …. The world cannot tackle this problem alone. It needs our know-how, our can-do spirit and our sophisticated technologies—and it's willing to pay for them."

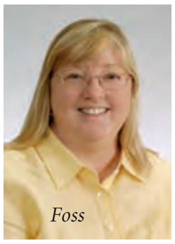
Crumbling Footholds

Deutschlandradio, May 31, 2007

In current climate models, the large ice sheets of Greenland and Antarctica are relatively immune to climate change. But the models do not match recent observations. For one thing, it appears the melting and seaward sliding of Greenland's ice sheets have sped up. Ginny Catania of the Jackson School's Institute for Geophysics tried to find out why. "[Lakes on the surface of the ice] fill up in the summer, until they overflow towards the valley," Catania told German radio listeners. "Some time later the water reaches a glacier crevice, where it can seep to the base of the ice. We assume that the water can form a thin film, over which the ice sheet glides."

Can Uncle Sam Cut Gas Costs?

ABC News, May 23, 2007


Foss

With U.S. gas prices at record highs, is there anything that the government can do to help lower the cost of gasoline? An ABC reporter asked Michelle Foss, chief energy economist at the Bureau of Economic Geology, and others about the feasibility of a range of government interventions from standardizing the types of gasoline refined in the U.S. to allowing oil drilling in the Arctic National Wildlife Refuge and in offshore areas that are currently off limits.

DepthX Mission Draws Widespread International Media Coverage

Washington Post et al., May 14-19, 2007

Marcus Gary, a hydrogeologist at the Jackson School, and colleagues from Carnegie Mellon University, Colorado School of Mines, Southwest Research Institute, and Stone Aerospace culminated months of preparation when they deployed an autonomous robot known as DEPTHX to explore the world's deepest water-filled sinkhole, Cenote Zacatón, in northeastern Mexico. The technology from the $5 million NASA project may someday be used to search for life in space. The robot is semi-autonomous. As it swims down the limestone cave of Zacatón, 367 feet wide and at least 1,000 feet deep, DEPTHX probed locations where temperature, oxygen levels, and other characteristics change, suggesting something is happening biologically, said Gary. The story of the successful mission drew international attention, with original reporting by the *Washington Post*, *Earth & Sky Radio*, *Reforma Newspaper* (Mexico City), *Discovery News*, *ABC News*, *NASA-TV*, and the major newswires, among other outlets.


Bill Stone of Stone Aerospace being interviewed by NASA-TV at Zacatón.


DEPTHX

Tinker discusses Opportunities with FutureGen

Odessa American, May 16, 2007

The next four to six weeks will be extremely important in the quest to bring FutureGen to Texas, Scott Tinker told a crowd of Odessan and Permian Basin residents at a program on FutureGen opportunities in Odessa on May 15th. "We have about a month before the FutureGen Alliance is going to call for our proposals," said Tinker, who leads the FutureGen Texas Team and also serves as director of the Bureau of Economic Geology. Tinker strongly urged local residents to send letters of support to the chief executive officer of FutureGen Alliance.


Tinker


FutureGen rendering

Global Warming Possibly Added to Missouri Floods

Bloomberg, May 13, 2007

According to climatologists, the heavy rainfall that caused the Missouri River to rise as much as 13 feet above its flood stage in some areas may have been exacerbated by global warming. Global warming may lead to more extreme weather events and may also increase the intensity of storms, as water vapor increases the amount of energy available to a weather system, said Charles Jackson, a climate researcher at the Jackson School's Institute for Geophysics: "You have more damage per storm to release all that energy."

Drillers Target Earthquake Zone

BBC News, April 18, 2007

Researchers are preparing to drill down into an earthquake zone at the Nankai Trough off the coast of Japan, which will cost hundreds of millions of dollars over the next 10 years. The program, coordinated by the Integrated Ocean Drilling Program, seeks to understand the causes of deadly quakes and tsunamis by pulling up cores for study and putting down sensors to monitor changes in the rock. "We'd like to know something about what fluids do at that position," said Nathan Bangs, a senior research scientist at the Jackson School's Institute for Geophysics. "If there are a lot of fluids there that are under very high pressure, they can essentially act like lubricants and not allow stresses to build up. But if the fluids are not present, the rocks can build up big stresses that can eventually rupture as an earthquake."

Decade May Be Third Best for Oil & Gas Giants

Platts Oilgram News, April 2, 2007

After 20 years of relative silence, the world's exploration landscape is quaking again to the sound of giants, but interpretations of recent activity are hardly harmonious. While some experts argue a new era for giant field discoveries may be emerging, peak oil advocates only hear echoes of the past. At the very least, however, it's clear a number of factors have occurred in the last few years to get experts discussing the subject once again. Most immediately, Jackson School research scientist Paul Mann of the Institute for Geophysics is preparing to release an academic paper predicting this decade will rank as history's third most prolific for discovery of giant oil and gas fields, trailing only the 1960s and 1970s.

Mann

Antarctic Ice Workshop & Statement Draw Global Attention

Reuters, MSNBC, et al., March 27-29, 2007

Ice in a 700-square-kilometer region of Western Antarctica known as the Amundsen Sea Embayment has thinned over the last few decades, with potentially significant contributions to sea level rise, climate scientists and polar experts said at a meeting at the Jackson School of Geosciences. At a meeting coordinated by Institute for Geophysics scientists Don Blankenship and Jack Holt, experts from the United States and Britain met to discuss the fate of the world's largest fresh water reservoir, the West Antarctic Ice Sheet, and concluded that there is evidence to show "surprisingly rapid changes" occurring in Amundsen Sea Embayment, a region the size of Texas. A joint statement issued at the end of the meeting was covered by media outlets around the world, including *Reuters*, *Scientific American*, *ABC News*, *MSNBC*, *Radio Australia*, *Hindustan Times* (India), and *TVNZ* (New Zealand), among many venues.

Holt

Water and Climate Decisions Can't Depend on Certainty

Houston Chronicle, March 27, 2007

Four of the state's foremost climate scientists briefed Texas state lawmakers on what climate change might mean for Texas and what can be done about it. "How is it that I can make a decision about Texas when the things I need to know most...are uncertain," said Eric Barron, dean of the Jackson School of Geosciences. "We are going to have to make decisions with uncertainty." The scientists agreed that Texas should focus its efforts on water resources, since a warmer climate is expected to increase evaporation and decrease precipitation in the state.

Climate Watch Features JSG Scientists

KXAN-TV, Feb. 22, 2007

Austin weatherman Jim Spencer's Climate Watch, a recurring feature on the Austin NBC affiliate, featured several researchers from the Jackson School, including Ginny Catania of the Institute for Geophysics. "Whether or not you believe that global warming is due to human-induced forcing or not, you can't really rgue with the fact that we're warming," said Catania. Other scientists appearing included the Institute's Brian Arbic, Don Blankenship, Charles Jackson, and Terry Quinn.

Climate Models Need More Precision

Austin American-Statesman, Feb. 3, 2007

Predicting the effect of climate change on Texas, let alone Austin, is tricky. "It's like trying to catch a fish in a lake," said Zong-Liang Yang, a professor in the Jackson School who is building models that link climate phenomena from the global to local scale. "If you use big nets with big spacing, you catch big fish, not small fish. We need to use a smaller net. The global warming models have big spacing and are very coarse."

Governor Allots $20M for FutureGen

Houston Chronicle, Dallas Morning News, et al., Jan. 30-31, 2007

Texas Governor Rick Perry announced that if Texas is selected to host the FutureGen project—a $1 billion initiative to build the world's first near-zero emissions coal power plant—he will include an additional $20 million in the state budget for the project. "Governor Perry has once again demonstrated his leadership and Texas' firm commitment to bringing FutureGen to Texas by making this a budget priority in 2007," said Scott Tinker, director of the Bureau of Economic Geology, working with state government to bring the project to Texas.

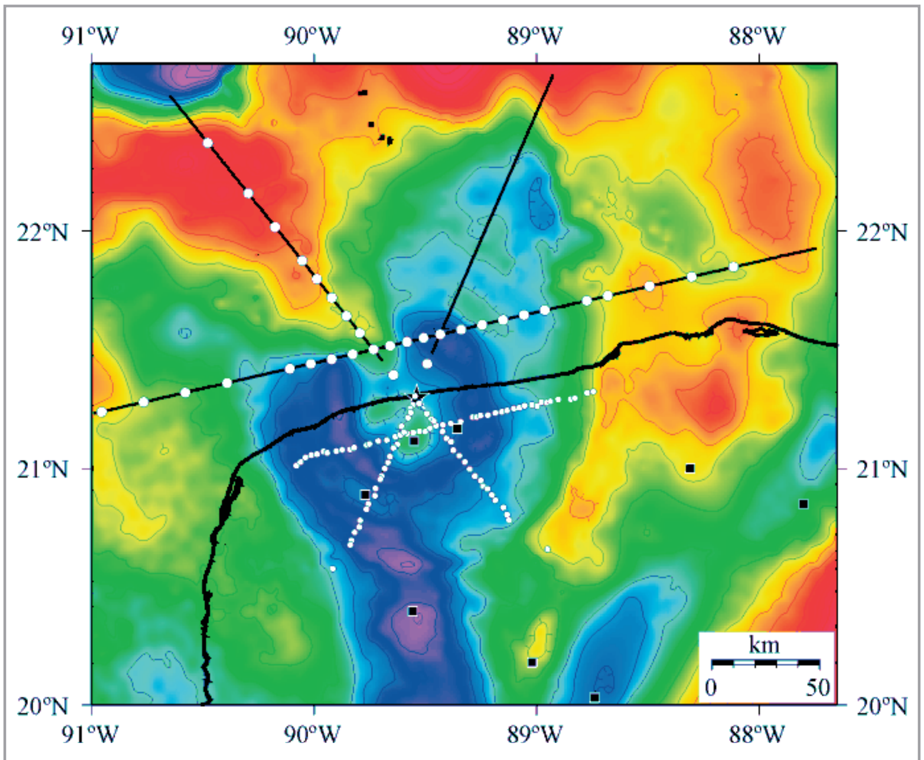
BRIEFS

Research Reveals Limits of Seismic Data

Nature, Physorg.com, Jan. 25 & 30, 2007

Researchers report in this week's journal Nature that an approach used for years to understand the structure of Earth's oceanic crust is flawed. "Prior to our study, there were no links between the geologic and seismological structure of oceanic crust except at a few deep drill holes," said Gail Christeson, researcher at the Institute for Geophysics and the study's co-author. "Our work addressed the extent to which seismic boundaries within the crust correlate with rock units at the Hess Deep rift and the Blanco transform fault," explained Kirk McIntosh, co-investigator from the Institute.

Christeson



Chicxulub impact crater

Opinion: Conservation Is America's Oil Weapon

San Antonio Express News, Jan. 11, 2007

"Iran and Russia are once again acting like bullies on the international stage, with threats to wield the 'oil weapon' against the West," writes Michael Webber, associate director of the Jackson School's Center for International Energy and Environmental Policy. "It's time the West fought back by playing our own oil weapon." Webber proposes a "high profile crash program of oil and gas savings" on the order of the Manhattan Project.

Coal Gasification: Middle Ground in Energy Debate

Austin American-Statesman, Jan. 6, 2007

Electric utilities say they should be allowed to meet the growing energy appetite of a booming population by building more plants, while environmentalists argue more coal-fired plants would send tons of pollutants into the air. Coal gasification technology could offer Texas a middle ground in the debate. "It's the first real radical departure from the boil-water-make-steam-make-power technology," said Ian Duncan, associate director for environment at the Bureau of Economic Geology. "You can gasify chicken manure, literally. Anything with carbon you can gasify.

Duncan

President of the Graduate Student Executive Committee Andy Dewhurst presents gifts to executives of Chevron in recognition of their donation to the school.

Opinion: Opportunity for Energy Policy

Austin American-Statesman, *Dallas Morning News*, Nov. 22 & 27, 2006

"By giving us divided government, the 2006 midterm elections may produce a unique opportunity for bipartisan and sensible action on energy policy," opines Michael Webber, associate director of the Jackson School's Center for International Energy and Environmental Policy. "For once, our politicians even appear to get it. Within a day of the polls' closing, leaders from both parties (President Bush and Gen. Wesley Clark among them) emphasized the need for urgent action on energy. It's about time."

Burying Greenhouse Gas

ABC News Affiliates, Nov. 20, 2006

Research teams throughout the U.S. have been testing what they believe could be one of the viable long-term solutions to global warming: geologic carbon sequestration.

Graduate student Jen Olori (left) and undergraduate Rebecca Comeaux (right) worked with Chris Bell (center) on a project studying the anatomy of the head of uropeltid snakes, an obscure group of snakes found only in southern India and Sri Lanka.

Economic factors will play a big part in any decision to start implementing carbon sequestration. "The cheapest thing to do when you burn fossil fuel is to do what we're doing now—put the waste products up the smokestack. In order to capture carbon we need a policy decision," says Susan Hovorka, a geologist at the Jackson School's Bureau of Economic Geology and lead researcher on the Frio Brine Pilot Experiment.

Hovorka

Debate Continues over Dinosaur Demise

Geotimes, Oct. 26, 2006

Many paleontologists consider the cause of the extinction of most of the dinosaurs to be a closed case: about 65 million years ago, an enormous extraterrestrial object struck Earth, creating the Chicxulub impact crater in Mexico, leading to worldwide mass extinction at the boundary between the Cretaceous and Tertiary periods (K/T). Not so, according to Gerta Keller, a geologist at Princeton University. She believes core samples from Texas support her findings that the Chicxulub meteor struck about 300,000 years prior to the K/T extinction event. Sean Gullick, a geologist at the Institute for Geophysics, vigorously disputes Keller's conclusions.

Lawsuit Jeopardizes Texas Coal Plants

National Public Radio, Oct. 24, 2006

New York-based Environmental Defense filed a suit to attempt to block a series of coal-fired electricity plants planned by TXU for construction in Texas. Some have called on TXU to embrace cleaner technologies for coal-fired electricity generation. Ian Duncan, associate director at the Jackson School's Bureau of Economic Geology, says the few existing plants that use the new technology aren't perfect, but they offer a cost-effective way to reduce the emission of greenhouse gases. "It's clear-cut that gasification is a great technology for the future. It's not clear what one would do if one was in charge of a power company at the moment having to make this decision. It's a pretty hard decision."

AWARDS & HONORS 2006–2007

All awards are for 2006-2007 unless otherwise noted. Awards and honors earned after Sept. 1, 2007, will be covered in the 2008 newsletter.

Faculty & Researchers

Jay Banner (DGS)
Award for Excellence in Teaching, Division of Instructional Innovation and Assessment, UT Austin
G. Moses and Carolyn G. Knebel Distinguished Teaching Award for Excellence with Introductory-Level Courses, Jackson School

Chris Bell (DGS)
Outstanding Teaching Award, Chancellor's Council, UT Austin
FAST Tex Faculty and Student Team Grant, Division of Instructional Innovation and Assessment, UT Austin, 2007
Teaching Award, Texas Exes, 2007

Bayani Cardenas (DGS)
G. Moses and Carolyn G. Knebel Distinguished Teaching Award for Teaching Under-graduates, Jackson School

Ginny Catania (UTIG)
Jackson Research Excellence Fellow, "2007-08

Shirley Dutton (BEG)
Joseph C. Walter Jr. Excellence Award

William Fisher (DGS)
Marcus Milling Legendary Geoscientist Medal, American Geological Institute, 2007

Sergey Fomel (BEG/DGS)
Loránd Eötvös Award (co-author) European Association of Geoscientists and Engineers, 2007
Top 30 Presentations at Annual International Meeting (two times), Society of Exploration Geophysicists
Jackson Research Excellence Fellow, 2007-08

Peter Flemings
Distinguished Lecturer, Joint Oceanographic Institutes, 2007-2008

Michelle Foss (BEG)
Senior Fellow Award, U.S. Association for Energy Economics, September 2006

Ghattas

Omar Ghattas (DGS/UTIG)
Winner, Analytics Challenge SC06, International Conference of High performance Computing

Chip Groat (EER/DGS)
Teaching Award for Best Managed Policy Research Project, LBJ School of Public Affairs, UT Austin

Sean Gulick (UTIG)
Jackson Research Excellence Fellow, 2007-08
Distinguished Lecturer, Joint Oceanographic Institutes, 2007-2008

Bob Hardage (BEG)
Certificate of Merit American, Association of Petroleum Geologists, 2007

Brian Horton (DGS/UTIG)
Exceptional Reviewer, GSA Bulletin, Geological Society of America, March 2007

Susan Hovorka (BEG)
Jackson Research Excellence Fellow, 2007-08

Michael Hudec (BEG)
Distinguished Lecturer, American Association of Petroleum Geologists, November/ December 2006
George C. Matson Memorial Award, American Association of Petroleum Geologists, 2006
Jackson Research Excellence Fellow, 2007-08

Xavier Janson (BEG)
Best Poster Award (co-author, tie), Society for Sedimentary Geology, April 2007

Charles Kerans (DGS/BEG)
G. Moses and Carolyn G. Knebel Distinguished Teaching Award for Teaching Graduate Students, Jackson School

Rich Ketcham (DGS)
Jackson Research Excellence Fellow, 2007-08

Steve Laubach (BEG)
Jackson Research Excellence Fellow, 2007-08

Luc Lavier (UTIG)
Jackson Research Excellence Fellow, 2007-08

Leon Long (DGS)
G. Moses and Carolyn G. Knebel Distinguished Teaching Award for Excellence with Introductory-Level Courses, Jackson School

Marcus Milling (BEG)
Alumni Award, Jackson School

Terrence Quinn (DGS/UTIG)
Distinguished Lecturer, Joint Oceanographic Institutes
Jackson Research Excellence Fellow, 2007-08

Bridget Scanlon (BEG)
Birdsall-Dreiss Distinguished Lectureship, Geological Society of America, Hydrogeology Division, 2007

Robert Scott (UTIG)
Jackson Research Excellence Fellow, 2007-08

Mrinal Sen (UTIG/DGS)
Joseph C. Walter Jr. Excellence Award

Scott Tinker (BEG/DGS)
Member, Interstate Oil and Gas Compact Commission, May 2007

Wayne Wright (BEG)
Best Poster Award (tie), Society for Sedimentary Geology, April 2007

Liang Yang (DGS)
Joseph C. Walter Jr. Excellence Award

Leadership Positions

William Ambrose (BEG)
Vice Chair, Astrogeology Committee, American Association of Petroleum Geologists, 2006-2009

Eric Barron (JSG)
Chair, Consortium for Ocean Leadership, 2007-2008

William Fisher (DGS)
Chair, American-Association of Petroleum Geologists Foundation

Charles Groat (EER/DGS)
President, Divsion of Environmental Geosciences, American Association of Petroleum Geologists, 2007

Sharon Mosher (DGS)
Chair, GeoScience World, 2007-2008

John Sharp (DGS)
President, Geological Society of America, 2007-2008

Scott Tinker (BEG/DGS)
President-Elect, American Association of Petroleum Geologists, 2007-2008

Students

Steven Arauza
Winner, Petrography Contest (Undergraduate), Jackson School

Jen Aschoff
SPIRIT Scholar, ConocoPhillips
Miriam Barquero-Molina
Teaching Award (Graduate Instructor), Texas Exes, 2007

Chris Berg
Winner, Petrography Contest (Graduate), Jackson School

Will Burnett
SPIRIT Scholar, ConocoPhillips
Tech Sessions Best Speaker (M.S.), Jackson School, Spring 2006

Andy Dewhurst
SPIRIT Scholar, ConocoPhillips

Alejandro Escalona
Sproule Memorial Award (best paper on petroleum geology by author 35 years of age or younger), 2007

Ryan Ewing
Student Service Award, Geology Graduate Student Executive Committee

Ned Frost
Tech Sessions Best Speaker (Ph.D.), Jackson School, Spring 2006

Christian George
Outstanding T.A. (tie), Jackson School

Lindsay Gulden
Outstanding T.A. (tie), Jackson School


Hixon

Jad Hixon
SPIRIT Scholar, ConocoPhillips

Stephanie Mills
Winner, Petrography Contest (Undergraduate), Jackson School

Sarah Milewski
SPIRIT Scholar, ConocoPhillips

Julie Mitchell
Winner, Petrography Contest (Undergraduate) Jackson School

Aysen Ozkan
SPIRIT Scholar, ConocoPhillips
Research Fellowship, GDL Foundation

Emily Pangborn
SPIRIT Scholar, ConocoPhillips

Kat Robertson
Outstanding T.A. (tie), Jackson School

Christopher Sine
Tech Sessions Best Speaker (M.S.), Jackson School, Fall 2006

Wesley Schumacher
Estwing Hammer Award, Jackson School

Christina Skelton
George H. Mitchell Award for Academic Excellence, University Co-op, April 2007

Abena Temeng
Undergraduate Scholarship, Chevron, 2006

Nina Triche
Tech Sessions Best Speaker (Ph.D.), Jackson School, Fall 2006

Staff

Amy Baker (JSG)
Thelma Lynn Guion Geology Library Staff Award, Jackson School

Jamie Coggin (BEG)
Staff Excellence Award, Bureau of Economic Geology

Sheree Courney (JSG)
Staff Excellence Award, Dean's Office, Jackson School

Pat Dickerson (JSG)
Thelma Lynn Guion Geology Library Staff Award, Jackson School

Ty Lehman (DGS)
Staff Excellence Award, Department of Geological Sciences

Glynis Morse (JSG)
Staff Excellence Award, UT Austin, 2007

Don Yarbro (UTIG)
Staff Excellence Award, UT Austin, 2007

Joseph Yeh (BEG)
Staff Excellence Award, UT Austin, 2007

Kudos to Brown, Gibbs, Ratcliff

As the *Newsletter* was going to press, the American Association of Petroleum Geologists recognized three members of the Jackson School community with major awards.

L. Frank Brown Jr., emeritus professor, presently a research professor in the Bureau of Economic Geology, received the Pioneer Award given to long-standing members who have made significant contributions to AAPG but have been unrecognized. Brown has been instrumental in expanding understanding of the geology and coastal dynamics of the Gulf Coast.

James Gibbs received the Michel T. Halbouty Outstanding Leadership Award, in recognition of exceptional leadership in the petroleum geosciences. Gibbs is a long-time member of the Jackson School Advisory Council and chairman of the Board of Managers of Five States Energy Company LLC.

Doug Ratcliff, currently the school's director of international programs and outreach, received the Public Service Award recognizing his contributions to public affairs, in particular his work as the leader and driving force behind GeoFORCE Texas, the Jackson School's highly successful outreach program gearing up for expansion to Houston.

Joseph C. Walter Jr. Excellence Awards, 2006-07

The Joseph C. Walter Jr. Excellence Award is the most prestigious internal award in the Jackson School of Geosciences. It carries a cash award of $2,000. This award was provided for in an endowment created by Mr. J. C. Walter, Jr. and approved by the Board of Regents in 1977. It was originally titled the Houston Oil and Gas Corporation Excellence Award and was designed to provide annual awards to faculty "in recognition of outstanding service and special contributions to teaching and research programs."

With the creation of the Jackson School of Geosciences, and with the thorough endorsement of Mr. J. C. Walter III, the award has been renamed the Joseph C. Walter Jr. Excellence Award and is now extended school-wide. Walter awards are made based on demonstrated excellence in any or all of the areas of the school—research, teaching, service, professional activity, and administration.

The school had three recipients for 2006-2007. The following excerpts are from Dean Eric Barron's citations at the annual Jackson School awards ceremony.

Shirley Dutton, Bureau of Economic Geology

"Shirley is internationally known for her work on sandstone diagenesis and reservoir quality. Her contributions have a great deal of breadth, from fan deltas to deep-water sandstones, organic geochemistry, basin analysis, resource assessment, and the origin of salt dome cap rock.

"She has received three A.I. Levorsen Memorial Awards for the quality of her research. Her publications span key journals such as the *AAPG Bulletin* and the *Journal of the Geological Society of London*, but she also directs her efforts toward outreach, regional societies, and corporations. She is currently PI on a $1.5 million consortium investigating deep reservoir quality in the Gulf of Mexico.

"Shirley represents the Bureau with distinction—name an important JSG activity, from leadership searches to the appointments committee and there is Shirley. She was senior technical advisor to the director of the Bureau in 2003-2004. Her service to the profession is equally noteworthy—from program chair to AAPG delegate, to associate editor, to service in three societies, we find Shirley sharing her time and wisdom to enable the geosciences. She has mentored 36 Research Assistants in their professional development.

"Her nomination letter included the following words all in the same paragraph—instinctive, unafraid to voice opposing points of view, level-headed, good judgment, unfailingly responsible, non-self-centered, acts for the good of the university. Those words don't always go together, but together they represent a significant compliment. I am pleased to honor Shirley with the Joseph C. Walter, Jr. award for 30 years of excellence."

Mrinal Sen, Institute for Geophysics

"Mrinal is widely known as an authority on two subjects: seismic anisotropy and inverse theory. His work is important in basic and applied research topics, and his nomination cites both the development of highly practical computer programs and methods to cutting-edge research with diverse implications.

"Mrinal is an author or coauthor of about 100 UTIG contributions, including 7 in *Geophysical Prospecting*, 6 in *Geophysical Journal International*, 5 in *Geophysical Research Letters*, 4 in *Geophysics*, and 3 in the *Journal of Geophysical Research*.

"Even before joining the UT faculty, Mrinal worked closely with students; indeed, 37 of his UTIG publications have students as first authors. He has been the supervisor/co-supervisor of 13 students who received Ph. D. degrees and 4 who received M.S. Degrees.

"That is a great record—but what has he done lately? Mrinal's record shows an astounding 29 publications with publication dates of 2005, 2006, and 2007. In 2006, he published his second full-length book (*Seismic Inversion*, published by the Society of Petroleum Engineers). Meanwhile, he serves as an associate editor for *Geophysics*, the *Journal of Seismic Exploration*, and *Computational Seismology and Geodynamics*. During this same period he taught a half-dozen or so industry short courses. And he currently supervises/co-supervises 8 UT graduate students. Clearly, Mrinal richly deserves the Joseph C. Walter, Jr. award."

Liang Yang, Department of Geological Sciences

"Can someone with primary interests in the exchanges of momentum, energy, water, carbon dioxide, and other materials between the atmosphere and the Earth's surface find happiness and true success in a department of geological sciences?

Barron and Yang

"Probably only if you are dedicated, talented, and gifted as a scientist. And I say that even if your department has a sense of vision and commitment to the broader future of the geosciences. But here is Liang with 60 peer-reviewed articles and with a strong record of funding from EPA, NASA, and NOAA. The breadth of his publications are noteworthy from remote sensing to land surface modeling to snow studies to flood modeling.

"Perhaps many of you don't recognize how competitive NASA earth sciences and NOAA atmospheric sciences funding is today. NASA has lost about a third of its Earth Sciences budget. Many funded proposals are having after-the-fact budget cuts. So, when Liang went forth for a new NASA interdisciplinary team proposal and a new NOAA proposal, my first reaction was this is a great deal of work with a very low probability. Only the truly excellent will survive. It is noteworthy to see that both were funded. NASA funded his project entitled 'Using Satellite Data and Fully Coupled Regional Hydrologic, Ecological and Atmospheric Models to Study Complex Coastal Environmental Processes,' at the requested 1.2 million dollars.

"Finally, stop by on Wednesday afternoon and get a sense of how vibrant Liang's research group truly is. You will witness a collection of postdoctoral fellows and graduate students deeply engaged in research scholarship. Liang, I am honored to provide you with the Joseph C. Walter, Jr. award."

New Tradition Enhances Geology Library Collection

The Jackson School has created a new tradition, recognizing promotions by adding to the Walter Library a book, chosen by a newly promoted faculty member or research scientist, with a name plate in their honor as a lasting contribution to future scholarship. For 2007, each individual receiving a promotion effective during the 2006-07 academic year was invited to select a book. The individuals are listed below along with their books and explanations.

James Connelly

Promoted from associate professor to professor

Modern Isotope Ratio Mass Spectrometry
by I.T. Platzner

Stable and radiogenically-produced isotopes underpin much of our understanding of Earth and planetary geology—this includes both the tracing of small- and large-scale geochemical systems and geochronology.

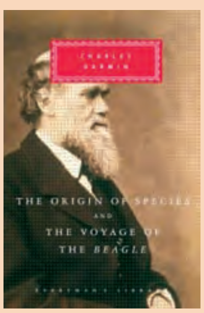
At the heart of this field lies the basic ability to make reproducible, accurate and precise measurements of a diverse suite of elements by a wide range of mass spectrometric methods. Important discoveries will be made by those who best understand and push the limits of the analytical methods available—this requires a thorough knowledge of basic and advanced mass spectrometry as well as the different approaches to data reduction and error treatments. The book *Modern Isotope Ratio Mass Spectrometry* by I.T. Platzner represents a comprehensive review of all available mass spectrometric methods that will serve both new and old students of isotope geochemistry.

Craig Fulthorpe

Promoted from research scientist to senior research scientist

The Origin of Species and *The Voyage of the Beagle*
by Charles Darwin, with an introduction by Richard Dawkins

Charles Darwin is best known today as a naturalist and, in particular, for his work on the origin of species, but he was also an expert geologist. I was impressed by this when I first read *The Voyage of the Beagle*, an account of his five-year expedition around the world aboard HMS Beagle.



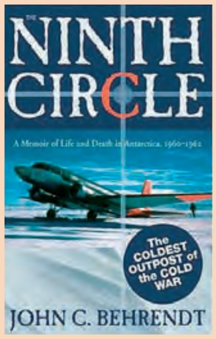
He was an outstanding observer and, recognizing the limits of contemporary knowledge, was cautious about advancing theories that would not stand the test of time. The answers to many of the questions he raised (for example, about the origin of the Andes and the significance of earthquakes) had to await the advent of plate tectonics. However, it is fascinating to see how close he was able to come to modern ideas on topics ranging from the significance of accommodation space to the effects of climate change on the distribution of Inca ruins.

Jack Holt

Promoted from research associate to research scientist

The Ninth Circle: A Memoir of Life and Death in Antarctica, 1960-1962
by C. Behrendt

I believe it is important to put my own work in the proper context of those who came before me, since I am just one element of a long and slow scientific process. This book provides a unique insight into the experience of scientific discovery in Antarctica soon after the International Geophysical Year (1957-58).

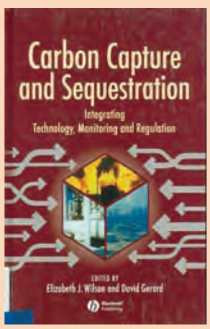


While the IGY itself started a new era of Antarctic science, it has been the dedicated work of people such as the author, John Behrendt, over many decades that has brought about our current understanding of this unique piece of Earth. The early aircraft-based geophysical work he describes helped set the stage for UTIG's airborne studies which began in the early 90s and my own role in these efforts starting in 1998. This was also an era of pure discovery in Antarctica, and that remains an important motivating factor for my own work. The experience of Antarctic fieldwork has certainly changed in many ways, but in some ways it is nearly the same. This book provides an important window into our scientific heritage and I think that others will find it interesting.

Sue Hovorka

Promoted from research scientist to senior research scientist

Carbon Capture and Sequestration
by Elizabeth Wilson and David Gerard



Reduction of emissions of carbon to the atmosphere while increasing available energy is one of the grand problems of the 21st century. Students at the Jackson School of Geosciences need to be trained to work in multidisciplinary fields such as carbon emissions reduction, and this book will provide a data source for entry into this type of study.

How do we increase quality of life for humans, which includes both human-engineered (for example coal to electricity) and ecosystem (for example avoidance of extreme rates of change and preservation of ecosystem services) elements? This book examines how geotechnical assessments such as those conducted at the Jackson School interact with political and policy decisions.

Sustaining a Planet: Banner Co-Creates University's First Signature Course

Jay Banner teaching "Sustaining a Planet," the first of the university's new signature courses, points out the weaknesses in the scientific method by demonstrating his psychic abilities to be able to determine geographic connections between people and bodies of water.

Before becoming president of The University of Texas at Austin, William Powers chaired a task force examining the university's undergraduate core curriculum. The task force issued sweeping recommendations to enhance student-teacher interaction, rigor, and academic community.

One of the first recommendations to be tested was a suggestion undergraduates take mandatory "signature courses," interdisciplinary classes that connect freshmen with the university's most engaging professors and provide a common academic experience.

Jay Banner, a geochemistry professor in the Jackson School and director of the Environmental Science Institute, and Dave Allen, a chemical engineering professor with expertise in air quality and energy efficiency, won the honor of creating the university's first signature course. "Sustaining a Planet" debuted in the fall of 2006 with 210 students. The course was a hit, and Banner and Allen have teamed up again to teach it this fall.

"Dave comes at sustainability from the engineered world," said Banner. "I come at it from the natural world—how our water resources can be made sustainable, how natural water systems work, and how the climate system works, all from a geological perspective."

The course went beyond traditional lectures and exams to keep students interested and get them to think more deeply about the material. Students went on field trips, produced a portfolio on an environmental topic, played games that highlighted key concepts such as the tragedy of the commons, and tracked how the media reports on environmental issues.

For one activity, students were asked to find a song that relates to an environmental, geological, or sustainability issue. Each student played their song for the class and gave a presentation on the issues it addressed. Some even composed and performed their own original songs.

"I really like the hands on activities. In fact, I'm thinking about going into environmental sciences or geological sciences."

"I was really surprised at how many hip hop songs talk about the environment," said Banner. "My favorite that a student came up with is from Mos Def. He wrote a song called New World Water. It's about how we're running out of water, how there's going to be a whole new landscape, that everyone is going to have to have their own private water tank."

"When the hip hop community, which seems to me is very inward looking, starts singing about a water crisis, this is a sign that we may not be in very good shape," said Banner.

Victor Camacho was a sophomore economics major in the Sustaining a Planet pilot course. "My path coming into UT was going to be economics all the way, just business stuff, but I really like the hands on activities [in this course]," said Camacho. "In fact, I'm thinking about going into environmental sciences or geological sciences."

Banner and Allen had the students create portfolios on a theme or topic, such as sustainable management of the oceans or how to make the university campus more sustainable. The students followed their topics through the news media, took field trips, read books, and attended special lectures to build up a portfolio. At the end, they wrote reflection essays to summarize what they had learned and how the experience might have changed their views of an issue.

"The students design this themselves and it gets them to think that they need to be active participants in their own education at the earliest possible stage in their academic career here at the university," said Allen.

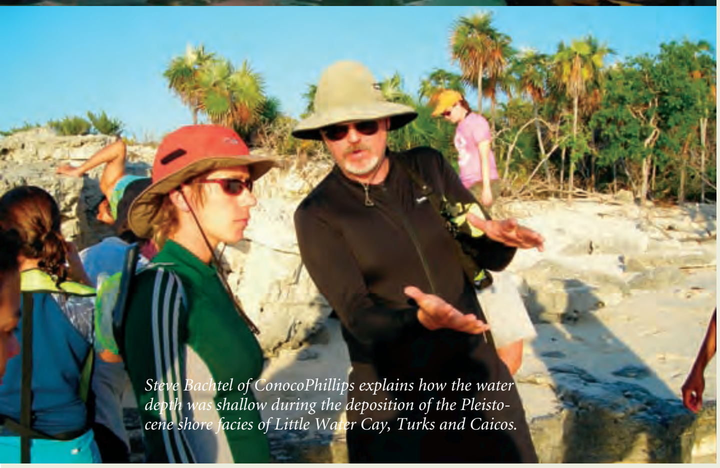
Another activity was the Greenhouse Gas Experiment, where students learned about the greenhouse effect in class, then in discussion section predicted the impact on the temperature of a model Earth atmosphere when carbon dioxide was introduced into it. A group of these students then demonstrated the experiment to the public at an Outreach Lecture by climate scientist Kerry Emanuel of the Massachusetts Institute of Technology. Local television news station KXAN covered the demo, which used vinegar and baking soda to produce CO_2, a lamp, a temperature probe, and a terrarium.

Science and technology are the primary lenses that the course uses to look at sustainability. But the students also explore it from the standpoint of public policy, the media, and economics through guest lectures from professors in those disciplines and group discussions.

"If there's a single most important thing that students come away with from this course it may not be details and the facts and figures about how the Earth works and the environmental challenges we face," said Banner. "It would be even more valuable if they came away from this course instilled with this critical way of asking questions, collecting data, and finding out for themselves where to find data that can answer their questions."

A full slate of signature courses will begin in 2010, with all incoming freshmen required to take two such courses before graduation.

Charlie Kerans directs offshore drilling south of the North Caicos Tidal Flats. Another wet reservoir?



Steve Bachtel of ConocoPhillips explains how the water depth was shallow during the deposition of the Pleistocene shore facies of Little Water Cay, Turks and Caicos.

ConocoPhillips Sponsors Field Course to Caicos Platform

In February 2007, a group of graduate students, research scientists, and faculty from the Jackson School of Geosciences participated in a unique field course to study modern carbonate depositional environments of the Caicos Platform. The trip was coordinated with Charlie Kerans and led by Steve Bachtel, a carbonate reservoir specialist with ConocoPhillips, with help from Kerans and other participating UT Austin faculty and scientists, including Dave Mohrig, Chris Kendall, Jerry Bellian, and Xavier Janson. It was a spectacular learning experience, reported Kerans. The group visited tidal flats, ooid shoals, grapestone shoals, barrier, fringing and patch reefs, and their direct Pleistocene counterparts. The trip was preceded by a series of lectures on satellite imagery analysis of modern carbonate systems, modern sediment transport dynamics, and geologic history of the platform. “Both UT Austin students and staff were extremely fortunate for the opportunity to attend such a first-rate modern carbonates course,” said Kerans, who expressed gratitute to ConocoPhillips for support and leadership.

Energy & Earth Resources Program Prepares Resource Managers for 21st Century

When graduate students accepted their diplomas at the Jackson School’s second spring commencement in May 2007, a small group collected the first degrees issued by The University of Texas at Austin in Energy & Earth Resources (EER). The program, formerly housed in the Department of Petroleum & Geosystems Engineering, where it has been known since 1981 as Energy & Mineral Resources, moved to the Jackson School in 2005 under the leadership of the JSG’s inaugural dean, Bill Fisher, and program director Charles Groat.

Groat has revitalized EER, raising enrollment to about 40 graduate students for 2007-2008 and expanding the program’s professional development portfolio. The program’s curricular portfolio has also expanded, as expressed by the name change. “Energy and Earth Resources retains an emphasis on energy and substitutes for mineral a term that encompasses both minerals and water,” wrote Groat.

EER gives students the opportunity to prepare themselves in management, finance, economics, law, and policy leading to analytical and leadership positions in resource–related fields. Private sector and government organizations face a growing need for professionals who can plan, evaluate, and manage complex resource projects, commonly international in scope, which often include partners with a variety of professional backgrounds. This program is especially well suited for those looking towards 21st century careers in energy, mineral, water, and environmental resources.

“These are areas where society truly needs capable, well informed leaders,” said Dean Eric Barron. “They are also areas that closely relate to core themes for our school.”

The university has backed the expansion of EER, approving in 2006 a new dual graduate degree between the Jackson School and the LBJ School of Public Affairs. Under the auspices of EER, students can now earn a double Master of Public Affairs degree and Master of Arts in Energy & Earth Resources. “This is another success for EER and will no doubt continue to enhance the program’s appeal for students,” said Barron.

Representative EER Students

Anne-Melaine Burgot
Interests: Energy economics and geopolitics
“UT is one of the best universities in the world to accomplish a master’s degree in economics of energy.”

Cengizhan Yenerim
Interests: Risk and portfolio management, hedging strategies and business development plans of multinational natural gas, LNG, and power generation/distribution companies.
“UT is a global university right in the center of the energy capital of the world with a proud history, talented professors and students, a strong alumni network, and it offers lots and lots of career opportunities upon graduation.”

Kimberly Krause
Interests: Water Resources, Alternative Energy, and Environmental Policy
“The Energy and Earth Resources Program tied together all my interests in Earth processes, environmental protection, and the world’s energy crisis. I feel I might really be able to make a difference in the world when I come out of this program.”

Prajit Ghosh
Interests: Electricity markets, deregulation
“I chose UT because it is the foremost name in academic circles for training in the energy industry.”

Swept Away:
PETER FLEMINGS WORKS BEST UNDER PRESSURE

BY MARC AIRHART

Researchers working on geofluids and pore pressure in deep ocean sediments generally do not wind up at the center of media storms, but in the summer of 2000, that's where Peter Flemings found himself.

"Tidal Waves Called Threat to East Coast—Study Says Continental Slope off New Jersey Critically Unstable" read a July 14, 2000, *New York Times* headline. *USA Today*, Discovery Channel, and other major outlets quickly jumped on the story.

The article was based on research Flemings and his graduate student, Brandon Dugan, published in *Science* suggesting that portions of the seafloor off the northeastern U.S. coast are more geologically active than once thought and have the potential to spawn underwater landslides and tsunamis.

"Suddenly little old ladies who owned shorefront property in New Jersey were calling me worried about it," said Flemings. At the time a geoscientist at Pennsylvania State University, he started as a professor and research scientist at the Jackson School this fall.

Peter Flemings (right) worked with an engineer to create a pore pressure penetrometer, a needle-like device for measuring pore pressure at great depths. Photo by William Crawford.

"If you dug out the article, you'd find it's actually reasonable," said Flemings. The writer made it clear the research did not suggest that "strollers on the Atlantic City boardwalk are in imminent danger of being swept away by a tidal wave." Yet many readers couldn't get past the headline.

Flemings used the resources of the Ocean Drilling Program (ODP) to drill from the continental slope off the coast of New York, an area where sediment was rapidly deposited hundreds of miles from the present day shoreline. As it turns out, the rocks over the water-logged sediments are squeezing them like a foot stepping on a water balloon. Eventually, the sides of the continental slope could blow out, spawning underwater landslides and tsunamis.

Before Flemings' work, the continental slope in this region was considered relatively stable. "It changed our view of why you see submarine landslides where you do," said Flemings. That work led him to more projects with the ODP in the Gulf of Mexico. He is currently a distinguished speaker for the ODP's successor, the Integrated Ocean Drilling Program (IODP).

He cautioned that the threat to coastal residents in the Northeast is not imminent, yet there is some potential. Rates of sedimentation are much lower now than they were 12,000 years ago when sea level was lower. At that time, according to the geologic record, landslides did occur in this region.

"What we have done is describe a new method to 'pre-condition' a slope for failure such that a small event such as a large storm or a small earthquake can cause slope failure," said Flemings. Recent work suggests that a massive landslide that occurred off the coast of Norway thousands of years ago may have been driven by high pore pressures in the manner that Flemings describes.

The petroleum industry now uses the model he developed to evaluate sea floor stability. Deep see drilling platforms can cost billions of dollars. "So if you don't understand how stable the sea floor is and you've made that big of an investment, you've got a big problem," said Flemings.

Pore Boy

As a postdoctoral researcher at Lamont-Doherty Earth Observatory at Columbia University, Flemings became convinced that studying how fluid moves through pores in rocks and sediments, especially where it goes and why, was important.

"It underlies how oil migrates and where hydrocarbons are and why landslides occur on continental margins," he said. It also relates to two frontier areas of research actively pursued at the Jackson School: methane hydrates, a possible new energy source, and carbon sequestration, the storing of carbon dioxide underground to help reduce atmospheric greenhouse gas emissions.

Flemings felt that the process of sedimentation plays a key role in porous media fluid flow.

"As sand and mud pile up on the seafloor, they try to squish or compact what's below them," he said. "But the only way it can compact is if the fluid gets out of the way." He created three-dimensional computer models to link sedimentation to fluid flow. He found that fluid moves laterally along confined aquifers, which indeed can drive submarine landslides, hydrocarbon migration, and seafloor venting.

"I used industry data to demonstrate that some of the largest active seafloor vents in the Gulf of Mexico lie above reservoirs that are critically pressured by flow focusing," he said.

Pore pressures also relate to how much hydrocarbon is trapped in reservoirs. The oil industry uses his models to assess exploration targets.

Later, on an ODP expedition, he documented high pore pressures beneath a zone of large submarine landslides in the Gulf that spans hundreds of square miles. For that work, he used a novel device that he and an engineer at the Massachusetts Institute of Technology designed and built called a pore pressure penetrometer, essentially a large needle for measuring pore pressure at great depths. The device is lowered down a drill pipe on a cable and then pushed down into the sediment. He hopes it will eventually become a standard tool in the field.

Peter Flemings (right) and Brandon Dugan (left) analyze pore pressure data recovered during an IODP expedition in spring 2005. Pore pressure is a key factor in submarine landslides. Photo by William Crawford.

"These studies may allow us to predict in what locations around the world submarine landslides are more likely," he said, "and hence what structures and local populations are at greater risk."

Gone to Texas

When Flemings announced he would leave Penn State to take a joint appointment at the Jackson School of Geosciences—half time in the Department of Geological Sciences, quarter time at the Bureau of Economic Geology, and quarter time at the Institute for Geophysics—some colleagues said he was crazy for taking on triple duty.

> "These studies may allow us to predict where submarine landslides are more likely and hence what structures and local populations are at greater risk."

But the arrangement meshed well with his interests and talents. Part of his research is in marine geophysics, part involves working with the oil industry, and part is fundamental research in the lab. He is also passionate about teaching. The ability to pursue all the things he loves was one of the main attractions of the Jackson School. Another attraction was his wife Ann Flemings' interest in becoming the school's first development director, a job she accepted when it became clear the two of them could both find professional homes at the Jackson School.

His new title in the Department is Jackson Chair of Geosystems, which emphasizes the fact that his job will integrate different disciplines to foster understanding of system level processes. He also sees the projected growth of the Jackson School as a great opportunity and a responsibility.

"Geosciences has never been more critical to society," he said. "We face great challenges in climate, energy, and geohazards. If we do our jobs right, the Jackson School will be a leader in tackling all these problems and we will find new and better ways to train the next generation to tackle new problems."

"To be part of that, to get in on the ground floor of that, I think is fantastic," he said. "We're going to hire some extraordinary people and I want to work with them."

What's the Problem?

Flemings said in college, too often he was required to memorize too much and was not challenged to understand how things worked. As a teacher he has taken a different approach, emphasizing problem-based learning. "Everything I do involves problem-based learning," he said. "What I enjoy is not the formal lecture or the presentation, but designing projects where students have to dig in and understand what they're studying. Even if it's a simple problem, I try to get them to solve it themselves."

In a popular undergraduate course, he divided students into teams of four or five to study seismic data. This was real data that petroleum companies used before deciding where to drill. The students would then compete with each other in a "lease sale." Each team had $100 million to buy leases and had to defend their choices. Representatives from petroleum companies would fly out to evaluate their projects. It became a much anticipated public event.

At the graduate level, he designed and led the GeoSystems Initiative. With the support of Shell and Chevron, he recruited students and formed them into teams each

Flemings has made several field trips on the JOIDES Resolution to study submarine landslides, oil and gas migration, and methane hydrates.

consisting of a geoscientist, petrophysicist, geophysicist, and petroleum engineer. Each team would analyze just one deepwater oil field as part of their master's thesis. They shared the same laboratory, interned with industry, and took many courses together.

"The focus is to preserve the depth of the individual fields, but lay on top of that a layer of interdisciplinary research, an understanding of the different fields, and a business understanding," said Flemings. "You take people with disciplinary depth and get them to understand all the linkages. For the good ones, it's extraordinary how well it works."

The idea for the course came from members of the oil industry who came to him in the 1990s saying they needed graduates who could work in an interdisciplinary fashion, work well in teams, and quickly make technical decisions such as where to drill for oil or how to develop an oilfield.

Flemings, who won Penn State's EMS Mitchell Award for Innovation in Teaching for his GeoSystems Initiative, hopes to start a similar program here at the university where he believes there will be more resources, more available staff, and more ties to industry than at his former institution.

He also helped build Penn State's partnership with Fort Valley State University in Georgia. Undergraduates in the Cooperative Developmental Energy Program (CDEP) spend their first three years at Fort Valley and their final two years at Penn State, The University of Texas at Austin, or several other institutions. They obtain degrees in geology, geophysics, petroleum engineering,

Peter Flemings after a month aboard the JOIDES Resolution as co-chief scientist for Expedition 308. Photo by William Crawford.

The JOIDES Resolution in port in Mobile, Alabama just before setting sail for an IODP expedition, spring 2005. Photo by William Crawford.

or natural gas engineering. (The Jackson School's first CDEP students, Stanley Stackhouse and April Duerson, graduated from the school's undergraduate program in June 2007.)

"I am extremely excited about this effort because we are training extraordinary young men and women that have the potential for deep impact," said Flemings.

Plop, Plop, Fizz, Fizz

Icy substances below the seafloor called methane hydrates have generated a lot of buzz in recent years. They form when methane gas bubbles up from great depths and encounters cold water at high pressure. Under the right conditions, the water freezes into tiny cages that trap gas bubbles. Early estimates suggested that they might store as much energy as all traditional oil and gas reserves combined. (See related article on page 50.)

Scientists have also worried about their possible dark side. As global warming intensifies, they reasoned, these deposits could begin to break up, releasing the potent greenhouse gas methane into the ocean and eventually into the atmosphere. This could set up a feedback loop that would accelerate the warming. Not only that, but as the methane belches out, it could generate dangerous underwater landslides.

Flemings and his student Xiaoli Liu developed a model that used techniques from the petroleum industry to simulate how hydrates form. It showed how methane gas migrating up through the "hydrate zone"—the region that is cold enough and under high enough pressure to form hydrates—could avoid an icy prison and pass right on through to the ocean.

"The answer is salinity," said Flemings. For the same reason that people in northern climes put salt on a road to keep snow from turning into ice, the saltier the water, the harder it is to form icy hydrates. Flemings showed that as hydrates form, the surrounding water becomes saltier. If there is enough gas bubbling up, some of it will use these saltier regions as avenues to continue their escape to the seafloor. Flemings' model was driven by observations made on an ODP leg where these vents of salty water and escaping methane really exist.

"By explaining how they occur, and how gas is expelled through the hydrate stability zone, we have suggested that there may not be nearly as much methane locked up in hydrates as was once thought," said Flemings. "For all the climate modelers, that's a big deal because there isn't as much to warm up the Earth." Flemings emphasizes that these ideas are currently under great debate in the community.

Although Flemings suggests that there is less total methane hydrate in the world, his model also describes in what locations you can have high concentrations. This could actually turn out to be good news for energy companies.

"We've explained a way that you can create very high concentrations of hydrate," said Flemings. "Instead of a few percent, you could get 50, 60, 70, or 80 percent. And that's of interest to energy companies."✷

Horton

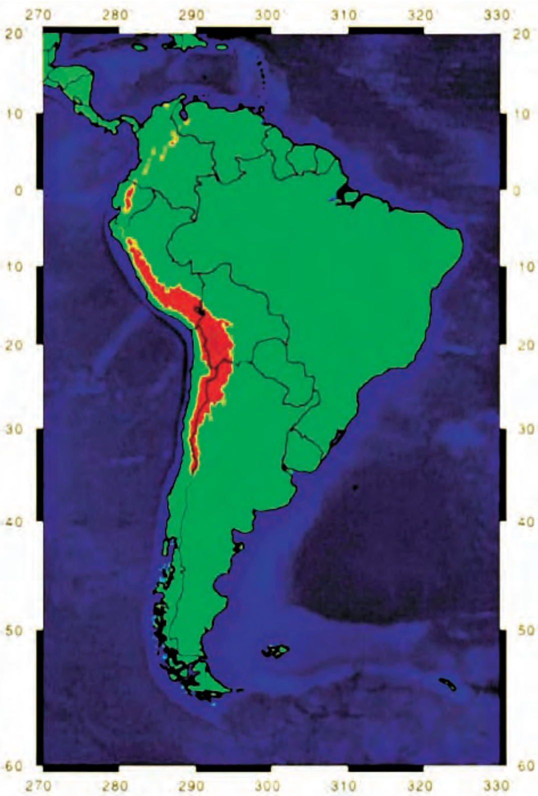
Making Mountains:

BRIAN HORTON SEES EMERGING ANALOG IN THE ANDES

BY MARC AIRHART

For most of us, it's hard to remember the moment when we first knew what we wanted to do for the rest of our lives. Sure, we may have wanted to be a fireman, a gymnast, or an astronaut. But those notions most likely evolved gradually into other pursuits.

Map of South America, based on USGS data, shows elevations over 3 km in red.



Not so for Brian Horton. When he was 15, he and his family moved from Illinois to northern New Mexico.

"That turned out to be a pivotal moment because that's when I realized how much I was fascinated with the topography and landscape of the western U.S.," he said. He rode a train solo cross country to his new home. "When I arrived in New Mexico, I was simply thrilled with the Colorado Plateau and the Rocky Mountains. And from that moment on, I knew I wanted to do something that involved working outdoors in mountainous regions."

In high school, he read a booklet about careers in the geosciences and discovered how he could make a living while pursuing his fascination with the outdoors. He went to the University of New Mexico on a full scholarship to study geology.

Later, as a Ph.D. student at the University of Arizona, he was strongly influenced by a professor, Peter Coney, who conducted research in the western U.S. and in the Andes Mountains of South America. Like Horton, he had a love of the Colorado Plateau and the Rocky Mountains.

"Peter had a very distinctive way of integrating many different data sets from different techniques into a comprehensive regional scale understanding," he said. "And so that's something that I've always strived for—a multidisciplinary approach to seek answers to large scale problems."

His doctoral dissertation focused on a series of sedimentary basins within the Andean mountain belt in southern Bolivia.

"The question was, 'When did deformation take place and how was that related to accumulation of sediment in these basins?'" said Horton. His Ph.D. work and subsequent research on sedimentology, provenance, magnetic polarity stratigraphy, and tectonics suggests that geologists might need to rethink their understanding of the formation of another famous mountain belt—the North American Cordillera, which runs from the Brooks Range in Alaska south to Mexico's Sierra Madre ranges and includes in its majestic sweep the U.S. and Canadian Rockies.

He has continued to work in Bolivia, where he may have found an answer for a long standing mystery—namely, why are the Andes Mountains narrow in the north and wide in the south? He has also worked on the Tibetan Plateau and in Iran's Zagros Mountains. Work in the latter region has been suspended indefinitely because of deteriorating U.S.-Iran relations.

Horton's work can best be summed up as a search for signatures. For over a hundred years, there has been a debate about how tectonic events and climatic events are actually recorded in the accumulation of sediments in sedimentary basins. Geologists have commonly looked at the stratigraphic layering of sedimentary deposits and made inferences about such events, but they're often little more than inferences. There is rarely a smoking gun.

"What I'm searching for are the stratigraphic signatures of tectonic and climatic processes," said Horton.

Maintaining Strength

In 2004, Horton received the Young Scientist Award from the Geological Society of America, an annual honor bestowed on a

According to Brian Horton, the Andes Mountains are a better analog for certain types of mountain formation than mountains of the American West. Photo of student mapping in Bolivia by B. Horton.

scientist 35 years or younger for "outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences." Winners receive a gold Donath Medal and a cash prize of $20,000. The first person to receive this award was Mark Cloos in 1989, now a professor and Getty Oil Centennial Chair in the Jackson School.

In the fall of 2006, Horton joined the Jackson School with a dual appointment to the Department of Geological Sciences and the Institute for Geophysics. He spent his first year on sabbatical at the University of Potsdam in Germany conducting research related to tectonics and climate in Argentina. His year abroad was supported by an Alexander von Humboldt Foundation Research Fellowship.

The Jackson School attracted Horton for several reasons. He noted that it has a reputation as a world leader in sedimentology and that researchers such as Earle McBride and Robert Folk are legends in the field.

"I'm thrilled to be involved in maintaining and energizing that strong tradition in sedimentary geology and at the same time to help move it into exciting new directions," said Horton.

He noted that by splitting his time between the Department and Institute, he will have more opportunities for research than working solely in a single unit.

"I view it as a wonderful opportunity to interact with a larger number of geoscientists working on a vast array of different projects," he said. "Already in my first year away in Germany, I've been involved in five new proposals as a principal investigator along with other faculty in the Department or Institute."

Strong ties to industry and exposure to a large pool of talented graduate students were also benefits, he added.

"It was stunning this spring to see literally hundreds of applicants for graduate school and to be choosing amongst the best and brightest," he said.

Emerging Analog

There's a debate in the geological community over when the soaring mountains of the western U.S., as well as the rest of the North American Cordillera (NAC), reached their full height, said Horton. The classical theory was that most surface uplift occurred only a few million years ago. The Andes have been considered a modern analog for past processes in the NAC.

"My research on sedimentary basins in the central Andes suggests that mountain building, and by inference surface uplift, commenced much earlier than thought, by several tens of millions of years," he said. "Our data suggests initial mountain building and foreland basin development by early Cenozoic time, roughly 60 to 40 million years ago."

The difference is not trivial.

"It would have implications for how we understand mountain building in general because the North American Cordillera is the best studied mountain belt on Earth," said Horton. "It has served as the type example for many other mountain systems. So understanding its history is critical to how we apply knowledge elsewhere."

Horton thinks the Andes are an underappreciated analog for the evolution of certain kinds of mountain belts formed along ocean-continent boundaries. Both the Andes and the NAC formed as the result of oceanic crust subducting beneath continental crust. They're comparable in size; both are about 7,000 kilometers long.

"We go to the Andes because they are actively growing, so it's a recent phenomenon and we feel we have better potential to understand what is happening there presently or in the recent geologic past," he said. "So in that way it serves as a fundamental analog for certain types of mountain belts globally."

Chicken or Egg?

Horton's work in the Andes reflects another shift in thinking about the process of mountain building. In the past, geologists gave tectonics—the effects of Earth's shifting plates—most of the credit for building mountains. Climate and erosion were seen as forces that merely sculpted their final appearance, but having little to do with the underlying process.

"There's a growing population that believes that in fact it's erosion and climatic situations that help promote mountain building," said Horton. "So it's very much a shift in the thinking behind what's cause and what's effect. It's a chicken and egg problem."

Geologists have long recognized that the tectonic uplift of mountains has an impact on climate and erosion. For example, as mountains get taller, local climate becomes colder and glaciers can develop. Glaciers in turn are extremely effective at scouring rock and carving valleys. But how might climate and erosion control tectonics?

The Andes Mountains are actively being uplifted by the subduction of the Nazca oceanic plate beneath the South American plate. They're also expanding eastward toward the interior of the South American continent as the compressive force of the two colliding plates causes new faults to grow east of the mountains.

That eastward expansion isn't uniform, though. Pull out a map of Bolivia and you quickly see that the Andes mountains are narrow in the north and wide in the south. And not by just a little: they are twice as wide in the south. This has been a long standing mystery.

Horton thinks climate and erosion play an important role. He notes that the recent climate has been humid and rainy in the north and dry in the south.

"Where it's humid, you have high erosion. You effectively remove large amounts of mass from the interior of the mountain belt and the faults become stalled," said Horton. "And that compels the mountain belt to grow vertically rather than advance forward."

"We go to the Andes because they are actively growing and we feel we have better potential to understand what is happening there presently or in the recent geologic past," said Brian Horton. Photo by B. Horton.

Out in the Field

Before his fellowship in Germany, Horton was an assistant professor at the University of California, Los Angeles (UCLA). With his new dual appointment at the Department and Institute, the balance of his work will shift towards research, but he will continue teaching.

"To me, the most rewarding aspect of teaching is instructing students in the field," he said. "What's amazing is that students are always making connections in the field from different parts of their coursework that they wouldn't make in the classroom. They put things together in a useful, meaningful way."

As a student, Horton took field courses in New Mexico and Colorado. Later, as a professor, he taught field courses at UCLA and even took students on a 3-week trip to Bolivia.

"I bet if you talked to 100 geologists like me at this level, 90 of them will tell you that field camp was the best time of their life," he said. "It's really challenging physically and mentally, but most people find it a lot of fun."

Next spring, he will co-teach a course in field methods and stratigraphy that will involve a series of field trips around Texas. Ultimately, he would like to take students on longer trips to the western U.S. and South America.✷

Born into Science:

SERGEY FOMEL ADVANCES SEISMIC DATA ANALYSIS

BY MARC AIRHART

Sergey Fomel grew up in Akademgorodok, literally "Academic Town," a scientific hub in Russia's third largest city, Novosibirsk. Surrounded by a forest of birch and pine trees, tens of thousands of scientists live and teach at Novosibirsk State University, and do research in any of 37 research institutes. The town, which was founded in the 1950s by the Soviet Academy of Sciences, is its own little universe, complete with homes, stores, hospitals, restaurants, clubs, and cinemas.

Fomel's parents were physicists. Most of their friends were scientists. His classmates were children of scientists. Most went on to study science at the university.

"There was never a question that I would go into science," said Fomel. "It was just a choice between disciplines."

Still, as a child, Fomel wasn't a junior scientist. He didn't have a rock collection or perform chemistry experiments in his bedroom. He preferred cross-country skiing. But he was good at math.

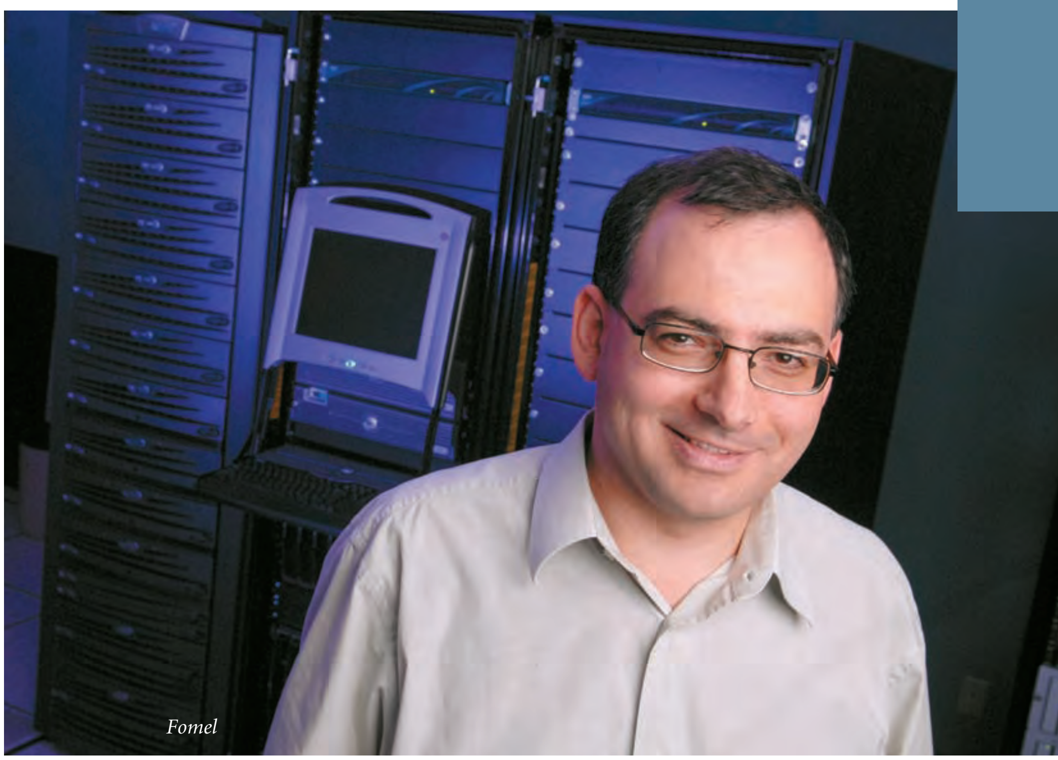
In Russia, students must choose a career path when they graduate from high school. Fomel was 16 years old when Sergey Goldin, a friend of his father and a brilliant and charismatic professor at the university, helped nudge him towards geophysics.

"He used to say that geophysics is physics of the real world," said Fomel. "If you study physics, you can focus on abstract things like elementary particles. But geophysics is about the real Earth. It's harder because you can't replicate it in the lab, so that was an attraction to me."

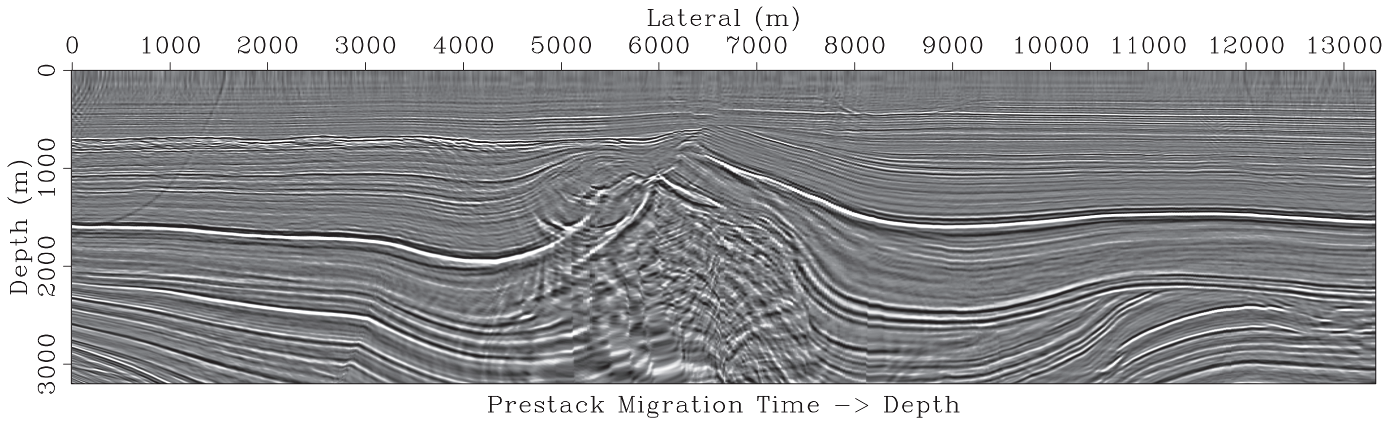
In 2002, Fomel came to work as a research associate at The University of Texas at Austin's Bureau of Economic Geology.

"My specialty is exploration geophysics, the application of geophysical methods to petroleum exploration," said Fomel. "And UT is a very good environment for that. So I came to the Bureau, which is an organization with many excellent connections to industry." He also appreciates the flexible research groups at the Bureau that allow interactions between people with different backgrounds and interests.

Sergey Fomel strives to improve the processing and analysis of seismic images. He also created the Madagascar software package.



Fomel



This seismic image from the North Sea was created using a new technique proposed by Fomel and colleagues at U.C. Berkeley for converting from time to depth.

While at the Bureau, Fomel created Madagascar, an open-source software package used primarily for processing and analyzing seismic data. The package is part of a new movement in computer-aided science, which seeks to make computational experiments more transparent and allow independent researchers to reproduce and confirm other's results.

In September 2006, the Society of Exploration Geophysicists rated three of Fomel's presentations among the top 30 given at its annual meeting. There are typically 600 or 700 presentations given each year. One of the presentations, titled "Local Seismic Attributes," demonstrated a new way to extract additional information from seismic images. In particular, it showed a way to reconcile two different kinds of images—those produced with shear waves and compression waves—for a better characterization of the Earth's interior. This paper won the best poster presentation award.

Now, in the fall of 2007, Fomel has begun a dual appointment at the Department of Geological Sciences, where he will spend a third of his time teaching courses and mentoring students as an associate professor. The other two-thirds of the time, he will continue his work at the Bureau.

From Theory to Application

Fomel acknowledges that three mentors have been especially important in his career.

He was greatly influenced by Sergey Goldin, the man who first set him on the geophysics path. After graduating from Novosibirsk State University with a geophysics degree in 1990, he went to work on theoretical problems with Goldin at the nearby Institute of Geophysics.

"His knowledge of geophysics was very broad and deep," said Fomel. "You could go to him with any question and he would know the answer. He was so far ahead of his students and that was intimidating." He developed a reputation as a top scientist in his field. Special conference sessions have been organized in his honor.

Goldin, who passed away last year, taught himself how to paint, draw, write poetry, and play a stringed instrument called a domra, as well as write and direct theatrical productions.

"The way he explained it was that he felt the need to exercise a different side of the brain," said Fomel. "He thought that one can not only do science all the time."

Fomel admired and respected his advisor, but actually grew the most as a scientist when Goldin was away at Stanford for four months and later in Brazil for a year.

"Goldin's biggest gift to me was actually going away," said Fomel. "I went through a lot of frustration but finally learned how to work independently." Fomel became interested in going beyond theoretical work.

"I wanted to break away from theory and work on practical applications and that's mostly why I went to study at Stanford and changed my specialty," said Fomel.

At Stanford, he studied under Jon Claerbout and earned a Ph.D. in geophysics in 2001.

"Jon is a legendary person in our profession and the scientific father of about 50 graduate students," said Fomel. Some went on to become professors at places such as MIT, Caltech, Stanford, and Colorado School of Mines. Most went into the petroleum industry and became industry leaders.

"Unlike Goldin, you could go to Claerbout with a question and he would not give you an answer even if he knew it," said Fomel. "That's partially why many of his students became so successful and independent."

It was at Stanford that Fomel developed an interest in reproducible computation. Claerbout and his students at the Stanford Exploration Project—an industry-funded academic consortium designed to improve the theory and practice of constructing 3-D and 4-D seismic images of the Earth—pioneered the application of reproducibility to computational geophysics. This concept is at the heart of Fomel's Madagascar software package, which was publicly released last year.

Why Madagascar?

The mind strains to find a connection between Madagascar, a large island nation off the southeast coast of Africa with many plants and animals found nowhere else on Earth, and a piece of geophysical software used to analyze seismic data. And with good reason.

The software had originally been dubbed Regularly Sampled Format, or RSF. Only no one could remember the name or the abbreviation. They would remember it as RFS or some other almost-correct abbreviation. So Fomel decided to find a more memorable name.

"I decided to look at airport codes, those three letter codes that represent airports around the world," said Fomel. "Maybe there was one with RSF."

As it turns out, there isn't. Undaunted, he noticed there was an RSE (in Australia) and an RSG (in Brazil). If there were a mathematics of the alphabet, RSF would be the average of these two places.

"So I drew a straight line between the two and the middle happens to be in Madagascar," said Fomel. And the name stuck. "At least people can remember it," he added.

Do That Again

Scientists tend to be a pretty skeptical bunch. When they read published results from an experiment, they want to be able to repeat the experiment and confirm the outcomes. Consequently, they publish their results in such a way that everything can be reproduced, describing exactly what they did and how they did it.

Computers have become an indispensable tool in science. They allow scientists to carry out entire experiments in silico, without labeling a single test tube or releasing a single sensor into the ocean. That ability is leading to amazing breakthroughs from medicine to astrophysics to geoscience. It also has scientists struggling to verify each other's work.

In this new landscape, a reviewer has to have the same software—not just the same software, but the same version—as well as the same initial data, and they must use all the same settings and methodology of the original scientists. And yet the traditional medium for publishing results—a scientific paper just a few pages long—can't possibly give a researcher everything they need to replicate this new class of experiments.

"As it is now often practiced, one can make a good case that computing is the last refuge of the scientific scoundrel," said Randy LeVeque, a prominent mathematician in a keynote presentation at an international mathematics conference in 2006. He complained that published results of computational experiments often lack detailed descriptions of the methods used. "Scientific and mathematical journals are filled with pretty pictures these days of computational experiments that the reader has no hope of repeating," he said.

Fomel designed Madagascar as an antidote.

"Reproducibility means maintenance," said Fomel. It means maintaining computational experiments together with data sets and past versions of the software. It means documenting how the software changes and repeating experiments on newer versions to see how they compare with earlier runs. Fortunately, the rise of the Internet has made sharing data and software much easier.

By using an open-source model, researchers can look under the hood and see exactly how the software works. Developers around the world collaborate to improve Madagascar. A similar approach has led to many well-known software products such as the Linux operating system and the Firefox Web browser. In addition to Fomel, contributors in this ongoing development include Jim Jennings, formerly of the Bureau, now at Shell; Paul Sava, formerly of the Bureau, now at Colorado School of Mines; Joe Dellinger at BP; Ioan Vlad at Statoil; Gilles Hennenfent, Henryk Modzelewski, and Colin Russell at the University of British Columbia; and others.

Computational reproducibility is now appearing in other fields such as statistics, bioinformatics, and econometrics.
For Fomel, though, the focus remains seismic imaging.

Late Arrivals

After graduating from Stanford, Fomel took a postdoctoral position at Lawrence Berkeley National Laboratory and worked with Jamie Sethian, the third scientist to have an influence in his early career.

"Jamie is also a legend," said Fomel. "He is a true applied mathematician who loves difficult applications such as seismic imaging."

Sethian, head of the mathematics department at Lawrence Berkeley, earned the Norbert Wiener Prize in Applied Mathematics "for his seminal work on the computer representation of the motion of curves, surfaces, interfaces, and wave fronts, and for his brilliant applications of mathematical and computational ideas to problems in science and engineering."

"My postdoc appointment at Berkeley was one of the happiest times in my professional career, because with Jamie's help, I could go outside of geophysics and from a bird's eye view try to determine the most important geophysical problems to work on," said Fomel. "Many of the ideas that I develop today came out of that experience."

When geophysicists do seismic imaging, they often encounter a problem in which the returning sound waves travel multiple paths. Consequently, different parts of the wave arrive at different times. An example of a medium in which this might happen would be a soft material surrounded by a harder material. Because sound travels more slowly in the soft material, some of the sound would bypass it and travel faster through the harder rocks.

Fomel, who grew up in Novosibirsk, Russia, earned a geophysics degree from Novosibirsk State University. Image: NSU main building.

"It would be easy if you could ignore all late arrivals, but that doesn't produce the best image," said Fomel. He and Sethian developed a technique that computes the second arrival and yields a clearer image. Their paper appeared in the Proceedings of the National Academy of Sciences. With support from the petroleum industry, this work continues now at the Bureau.

Professor Fomel

Fomel has taught courses in seismic migration theory at Novosibirsk University, numerical analysis at the University of California at Berkeley, and seismic wavefield imaging at UT Austin. So he's quite comfortable in the role of professor. This fall, in his dual appointment with the Department, he is again teaching a course on seismic imaging.

"I'm excited," said Fomel. "I really enjoy teaching. The previous times when I did teach, it wasn't really part of my job duties, but to me it was a joy. Sometimes when you try to explain something to students, you find holes in the existing research or you find that you really don't understand something. So it can actually benefit your research."

He has reorganized his seismic imaging course to be more accessible.

"I discovered that when you try to explain it to people outside of our field, you start to run into some inconsistencies and logical gaps," said Fomel. "So I've tried to determine how to tell a consistent story without too much jargon and without resorting to saying something is true because an authority says so. That's the challenge."✷

Renaissance Wonk:

MICHAEL WEBBER PUSHES BETTER ENERGY POLICY

Inventor, op-ed writer, policy wonk, and engineer—Michael Webber has done them all with success. But he's just getting started on his dream job, teaching and conducting energy policy research at The University of Texas at Austin.

Webber was the first person Director Charles Groat hired for his Center for International Energy and Environmental Policy (CIEEP), an organization the Jackson School launched in the fall of 2005 to inform energy and environmental policy-making with the best scientfic and engineering expertise.

CIEEP unites the capabilities of the University's Jackson School of Geosciences, Cockrell School of Engineering, and LBJ School of Public Affairs. As the center's associate director, Webber is in perfect sync with CIEEP's hybrid nature.

Both a policy researcher and assistant professor in the College of Engineering, Webber has bridged disciplines most of his life. As an undergraduate at The University of Texas at Austin, he completed two degrees in 1995, a B.S. in aerospace engineering and a B.A. in the College of Liberal Arts' Plan II Honors Program.

He left Austin to earn his master's and doctoral degrees at Stanford University in mechanical engineering, focusing on thermosciences. Webber learned to make sensors for emissions testing. He ended up working for a startup in the sensor business, inventing devices that monitor air quality. Webber's experience as an inventor started him down the path that led to the Jackson School.

"Making sensors, I found the company didn't have enough customers to buy them," he said, "and realized there are a lot of good engineering and science solutions held up by bad policy." Webber subsequently became an analyst at the RAND Corporation, where his projects included energy and environmental issues. Seeking the ability to focus more directly on policy while studying a wider range of issues, he was thrilled to find an opportunity with CIEEP and the Jackson School.

Though an engineer by training, Webber appreciates the chance to work on energy policy from within a geoscience institution. "It's hard to tackle energy and environmental issues without an understanding of geosciences," he said. "To cover the big picture, it's much better to be in the geosciences. You tell people you're an engineer and they ask what kind of widget you're making."

Academics with Impact

Though he only began teaching this fall, Webber, who had a partial appointment to the Jackson School as a research associate in 2006–2007, has already had a direct impact on Texas energy and environmental policy. This summer he was architect of an amendment that Rep. Mark Strama sponsored to House Bill 3732. The successfully passed amendment created a large tax incentive for oil companies to use captured, man-made carbon dioxide for enhanced oil recovery. "The incentive is $15 a ton, big enough to maybe kick start a carbon capture industry in Texas," said Webber.

HB 3732, which incentivizes advanced coal burning technologies, drew criticism from some environmentalists, but the amendment Webber helped craft drew support from both the pro-energy and pro-environment lobbies. Industry liked the amendment for its incentives. The Sierra Club liked the potential infrastructure for carbon sequestration.

Excerpts from *"Don't Blame China for High Oil Prices"*

Op-ed by Michael Webber
***Geotimes,* September 2007**

"The reason China is assigned so much blame is because Chinese oil consumption has been on an amazing rise over the last decade, with its daily demand for petroleum increasing by more than 3.6 million barrels between 1996 and 2006. In other words, China presently demands 3.6 million more barrels of oil every single day than it did in 1996.... And so it's no wonder these clever pundits neatly pin the blame for high prices on recent Chinese demand.... But the part of the story that is repeatedly left out is that over the exact same time span, U.S. oil demand rose as well, and our imports of oil from the world markets went up 3.6 million barrels every single day, which is even greater growth than witnessed in China's imports.... Somehow, these important pieces of information are universally missing from our collective consciousness. It's as if we operate from the mindset that rapidly growing demand for imported oil is acceptable in America, but not in China."

Webber

The idea for the amendment, said Webber, emerged from a report written by public affairs graduate students in a class team taught by Ian Duncan, the Bureau of Economic Geology's associate director for environment, and David Eaton, a professor in natural resource policy studies at the LBJ School of Public Affairs. The students' report, "Creating a Carbon Storage Industry in Texas," concluded that a carbon storage industry would make economic sense for Texas.

The report synthesized Eaton's research on policy and Duncan's assessment of the state's geoscience potential for a carbon storage industry.

"So the amendment was built on Bureau of Economic Geology research, UT policy research, and UT student work," said Webber. "UT research revealed something useful can be done—and then it was passed into law."

Improving Policy

All too often, said Webber, the policy-making process does not work so smoothly where energy is concerned. "We actually have a lot of solutions but don't implement them due to bad policy," he said. He cited America's "corn-alcohol fetish" as a classic example: Though neither engineering nor objective policy analysis support corn-based ethanol as a viable energy solution, politicians from the powerful corn-producing states do, and they carry the day.

"When you bring engineering and science to bear on the analysis, you can get better solutions, such as the cap-and-trade approach to emissions," he said. "It's a good policy because everyone sat down at the table together, with engineers and scientists included, to work it out."

At the Cockrell School of Engineering and the Jackson School's Earth and Energy Resources (EER) graduate program, Webber will be training some of the well-informed analysts who will hopefully get called to the table. In addition to a core engineering course on thermodynamics, he will teach three general courses on energy this year, including a policy course cross-listed with engineering, EER, and the LBJ School. Next fall he returns to his undergraduate roots, teaching a Plan II Honors course on Energy and Society.

Changing the Debate

Though he teaches through the School of Engineering, Webber was hired by the Jackson School and CIEEP. Through CIEEP, he will continue to develop research programs and classes while working with people inside and outside the university who want to do multidisciplinary studies around energy.

Webber does not confine his ideas to white papers, however—over the past year he has published five op-eds on energy and environmental topics. His work has appeared in all of Texas' major daily papers—sometimes in several at once—and in *Geotimes*.

"My mission is to raise public awareness about the tradeoffs of energy," said Webber. His November 2006 op-ed for the *Austin American-Statesman* and *Dallas Morning News* caught the spirit well, describing the opportunities for bipartisan energy policy that followed the mid-term U.S. congressional elections. Lamenting traditional U.S. energy politics, Webber wrote:

"The energy debate that has raged for decades still breaks down into two ideological camps: those who believe in low production and low consumption, and those who believe in high production and high consumption. Consequently, America has the worst of both—high consumption combined with low production. This means we suffer the national security and environmental impacts of high consumption, but reap few economic benefits from low production."

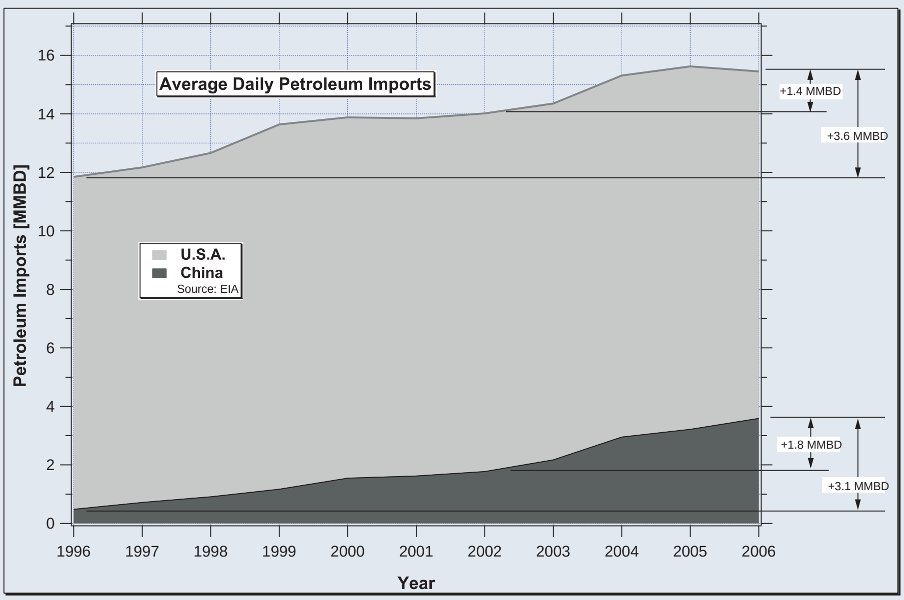
In contrast, Webber suggested pushing policies that slow demand and increase domestic production, to lower prices, support domestic industry, and improve both environmental quality and energy security.

Webber's commentaries have engaged the blogosphere, drawing widespread recirculation in the days after publication. Whether the subject is U.S. policy on climate change or the tendency of pundits to blame China for high oil prices, he is not shy about taking a stance.

University colleagues, including fellow energy experts, do not always agree with his opinions, he said. He appreciates both their perspectives and the give-and-take of information that follows his op-eds—information that has deepened his understanding of energy, in which UT Austin has depth and breadth matched by few universities.

"If I stir up a range of opinions, it means I've touched a nerve and I'm talking about the right issues," said Webber. "I like the opportunity to get these thoughts and opinions out there. I think we need more engineers and scientists out there." ✷

The average daily petroleum imports in millions of barrels per day (MMBD) for the United States and China have shown similar patterns of growth over the last decade. U.S. petroleum imports have grown 3.6 MMBD since 1996, and 1.4 MMBD since 2002. China's petroleum imports have grown 3.1 MMBD since 1996, and 1.8 MMBD since 2002. Overall, U.S. consumption and imports of petroleum are three and four times larger than China's, respectively. (Source: U.S. Energy Information Administration)



Mead Allison

Mead Allison joined the Institute for Geophysics as a senior research scientist in August 2007. Allison's research focuses on coastal geological oceanography, including both the modern and paleo environments.

"Most of my work is around the transition where large rivers impact the ocean, the river-dominated continental margin," Allison said. "These are areas where there are the largest and most rapid accumulations of continentally derived sediments. This is interesting because you have a way to look at modern systems of sedimentary strata formation that can inform us about ancient fluvio-deltaic and marine analogs."

These areas are potentially extremely valuable paleoclimate records as well. They are challenging because they are so dynamic in location and how they are shaped by marine processes, but they could provide a higher resolution record compared to locations farther offshore. Allison's recent research has focused on the Mississippi Delta region.

"You have this thick, rapidly accumulating sediment adjacent to rivers that provides a high-resolution climate record that includes both organic and inorganic materials," Allison said. "The nice thing is, compared to tree rings or ice cores, this record is specific to conditions on the adjacent continent. If you look at the Mississippi, you are studying two-thirds of the country. It's less sensitive to local climatic changes and more integrative of factors that are continental in scale."

The record from the historical period in the Mississippi has revealed surprisingly detailed information, including the effects of dam construction, institution of soil conservation, clearance for agriculture, and other human activities.

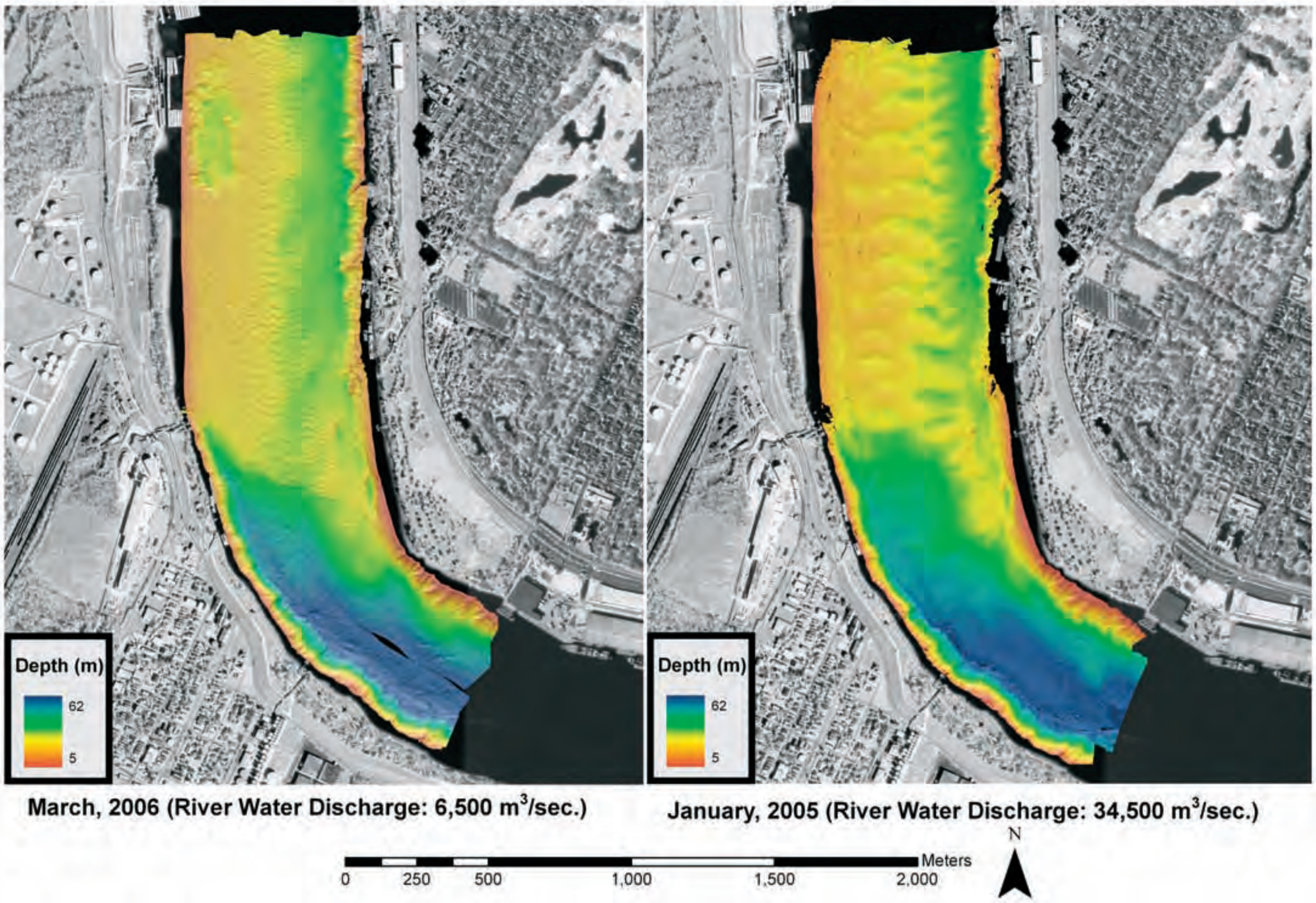
Prior to joining the Institute, Allison was a professor of Earth and Environmental Studies at Tulane University. He earned his Ph.D. from the State University of New York, Stony Brook.

Aaron Averett

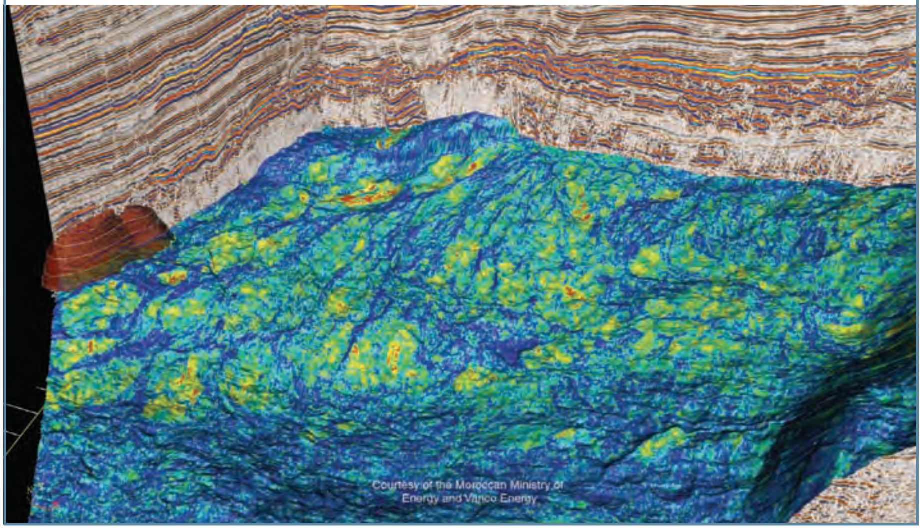
Aaron Averett joined the Bureau of Economic Geology as a research scientist associate in May 2006.

Averett develops internet applications that incorporate Geographic Information Systems (GIS) in support of several Bureau projects. He recently developed a surface casing estimator application for the Texas Commission on Environmental

Comparison of distribution of river bottom dunes under low (left) and high (right) discharge scenarios. Image based on multibeam bathymetry data from the lower Mississippi River at Audobon Park, New Orleans. Courtesy of Mead Allison and JSG doctoral student Jeffrey Nittrouer.



Example of Dallas Dunlap's work in the QCLIA visualizing the internal architecture of large debris flows. Image shows amplitude extraction draped over a structural surface representing the base of a Cretaceous-age mass transport deposit in offshore Morocco. Large blocks have been dislodged and moved downslope from right to left. These blocks (shaded) have a three-dimensional, undeformed architecture and contain imageable channels in their strata. Courtesy of the Moroccan Ministry of Energy and Vanco Energy.



Quality. This application uses data representing the depth at which groundwater contains specific levels of dissolved solids, allowing users to determine the depth at which a particular concentration occurs for a given location. This information can then be used to determine how to construct a well that complies with environmental regulations.

He is also making information on the Bureau's extensive geologic sample and log collections available to researchers around the world. This application uses GIS to generate a map showing the location where each sample originated and provides information about the sample and the site.

"This is a relatively new field, especially in terms of web applications," Averett said. "Every six months we get a new version of the server software and our capabilities increase. It dramatically improves what we can accomplish."

Averett earned his B.S. in geograph with a specialization in GIS at Texas A&M University in 2006, where he also developed Web applications for their Department of Psychology.

Dallas Dunlap

Dallas Dunlap returned to the Bureau of Economic Geology as a research scientist associate in June 2006, a position he previously held from 1996 to 2004.

Dunlap works in the Quantitative Clastics Laboratory Industrial Associates program (QCLIA) where his research focuses on the analysis and visualization of morphology in seismic data. Known as quantitative seismic geomorphology, this approach

involves imaging sedimentary forms–channels, deltas, shelf sands, debris flows, and mass landslide deposits–from seismic data to understand the evolution of continental margins. "We are looking at how sediment moves from the continental shelf to deep water," Dunlap said. "We also want to better understand how sediments are deposited and preserved in the subsurface, which can lead to improved success in hydrocarbon and water exploration in those systems."

Currently, he is examining Cretaceous-age mass transport systems off the Moroccan shelf using advanced three-dimensional software technology to image and interpret these flows. He will present the results of his research at the Moroccan Association of Petroleum Geologists meeting in Marrakech, Morocco in October.

"Some of these debris flows off the shelf have boulders that are two or three square kilometers in size," he said. His group is trying to discover what might have caused the movement of such massive objects.

In addition to working in the QCLIA, Dunlap also provides software training and technology support to other projects within the Jackson School of Geosciences.

Dunlap earned his B.S. in geology from The University of Texas at Austin in 1997.

Raymond Eastwood

Raymond Eastwood joined the Bureau of Economic Geology as a research fellow in October 2006, where he works in the State of Texas Advance Resource Recovery (STARR) program.

As a petrophysicist in the STARR program, Eastwood uses Geolog analysis software to create log interpretation models designed to improve oil and gas recovery in Texas. Eastwood's work helps determine the potential of subsurface reservoirs and provides guidance to small, independent oil and gas companies.

"In the study we are doing now, the well logs range from the 1960s to the present day," Eastwood said. "One of our challenges is to come to grips with those older logs, which may not be as reliable as logs today. The second challenge is getting reliable, usable data from the bottom of the hole to the top of the hole. Today, we might have six or eight logs to work with, whereas 40 years ago there were maybe three logs. That is sometimes a tough issue."

His research also aims at a better understanding of reservoir characteristics.

"We want to know where porous rocks are and how porosity might vary with depth," he said. "One of the ideas we have is that reservoir rocks closer to the surface are more porous than deeper rocks, so we are looking at a variety of wells and testing."

Before joining the Bureau, Eastwood worked for BP, developing log interpretation models for Prudhoe Bay and the Aurora Borealis fields on the North Slope of Alaska.

Nick Hayman

Nick Hayman joined the Institute for Geophysics as a research associate in September 2007.

Hayman's research interests include structural geology and geodynamics. He is working in the Marine Seismology group studying the ocean crust, particularly the geological structure of fault zones.

"I look at things we see in the geological record in order to quantify certain parameters," Hayman said. "For instance, I am studying fracture distribution in submarine exposures of oceanic crust to understand what controls its geophysical properties."

One of his current experiments, inspired by a series of geologic studies in California, is studying how stress is supported in fault zones using both the geologic record and experimental faults.

"Faults are a cornerstone of plate tectonics and they are at the heart of our understanding of the earth and other planets," Hayman said. "At the same time they are hazardous and pose environmental concerns, including those related to energy recovery. We want to understand their physical nature, but there are some big gaps in our knowledge."

Hayman finds that collaborating with other researchers at the Institute provides valuable insights.

"It's been an eye opener working with marine geologists, geophysicists, and even biologists to develop projects that 10 years ago were impossible," Hayman said. "The techniques and ideas we are working on are relevant for a broad range of studies."

Hayman earned his Ph.D. in geology from the University of Washington, and also holds an M.S. in geology from the University of Albany, SUNY.

Rebecca Jones

Rebecca Jones recently rejoined the Bureau of Economic Geology. She worked as a research scientist associate from 2001 to 2005 and returned to this position in May 2007.

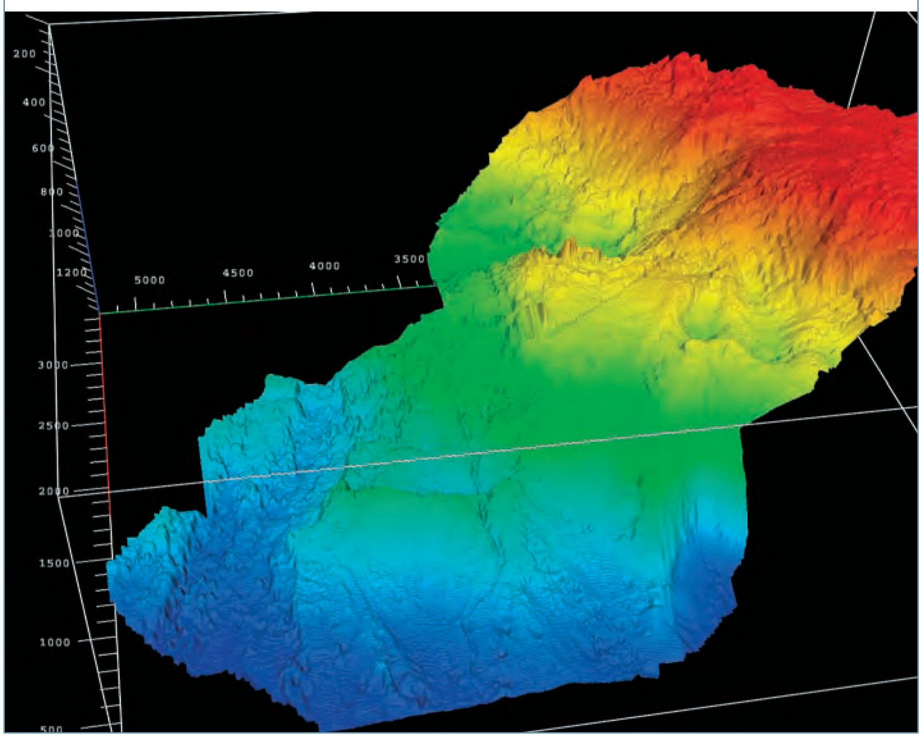
Her interests include stratigraphic and seismic interpretation and reservoir characterization. She has primarily studied the Permian Basin region of West Texas. She is currently working on regional sedimentological and stratigraphic studies using core, thin sections, and wireline logs as part of the Permian Basin Geological Synthesis Project. She also participates in regional studies for the STARR program, with a focus on the geology of West Texas reservoirs on state lands.

"One of the things that I've really enjoyed is working with different experts at the Bureau," Jones said. "My role as a geologist is working in a team with geophysicists, petrophysicists, and engineers to construct a comprehensive model of a stratigraphic interval. There is an incredible amount of expertise here and, as a junior scientist, the interdisciplinary mentoring I receive is very valuable."

After earning a B.A. from Dartmouth and an M.S. in geology at the University of Wyoming in 1999, Jones joined ExxonMobil where she explored for oil and gas in West Africa, conducted regional studies in the Middle East, and worked in production in West Texas.

"For me, the Bureau provides a very nice niche between academia, public service, and industry," Jones said. "We are conducting studies that not only utilize the large data sets common in industry but also contribute to the public domain literature."

Regional erosional surface in the continental margin of eastern offshore Trinidad. This surface defines the base of a slope-attached mass transport complex near its depletion zone. Colors represent depth in milliseconds, with shallower depths in red (outer shelf and shelf break) and deeper depths in dark blue. Sedimentary sources of slope-attached mass transport complexes are associated with catastrophic collapses of the upper slope region. Graphic and caption courtesy of Lorena Moscardelli, Bureau of Economic Geology.



Lorena Moscardelli

Lorena Moscardelli joined the Bureau of Economic Geology as a research associate in June 2007, after earning her Ph.D. from the Jackson School's Department of Geological Sciences in May.

Moscardelli's main interest is in mass transport complexes, research she began while working on her dissertation.

"Other universities may have access to the data, but we have the resources and the computer power to analyze it more efficiently."

She also participates in the State of Texas Advanced Resource Recovery program.

"In the past I was describing these deposits, their morphology and architecture," she said. "Now I am at the stage where those descriptions will allow me to develop a new classification system."

Currently, she is working on a classification system for submarine mass transport complexes–slope-attached systems, shelf-attached systems and detached systems–whose different characteristics affect the timing of mass transport events and their propensity to produce catastrophic results, such as tsunamis.

"We are trying to better understand these deep water deposits and the implications of these events for coastal communities, to mitigate the hazards," Moscardelli said. "They are also an important element when we are exploring for oil and gas."

Moscardelli recently acquired an advanced work station that allows her to handle very large data sets more efficiently.

"We want to describe the deep water setting with the beautiful data sets we have," Moscardelli said. "They are huge and very high quality. That is unique about this program– other universities may have access to the data, but we have the resources and the computer power to analyze it more efficiently."

Doug McCowan

Doug McCowan joined the Bureau of Economic Geology as a research associate in June 2007, working in the Marine Seismic Data Center. McCowan splits his time between the Bureau and Houston where he works as an independent seismic software developer.

His research focuses on the acquisition and analysis of multichannel seismic reflection and refraction data, multi-dimensional signal processing, and hardware and software development. McCowan is currently working to develop seismic analysis software to improve imaging and provide better measurements of subsurface attributes such as pressure, temperature, and velocity.

"Seismic data has to be processed and that's the business I'm in," McCowan said. "I am developing software that incorporates new seismic processing algorithms to get more out of the data. For decades, the focus has been on imaging, but I am also interested in processing the seismic data to improve the attributes derived from it."

McCowan focuses on the practical aspects of seismic analysis. By improving the performance of seismic models, his research supports oil and gas companies by turning their data sets into detailed information on the subsurface useful for exploration.

McCowan earned his Ph.D. in geophysics from Pennsylvania State University and holds a B.S. in physics from the Massachusetts Institute of Technology.

Michael Tobis

Michael Tobis joined the Institute for Geophysics as a research scientist associate in May 2007 working in the climate research section designing, implementing, and managing software projects.

His interests include earth system modeling, and most of his work uses the National Center for Atmospheric Research's Community Climate System Model. He is currently working with Charles Jackson, a research scientist at the Institute studying the confidence limits of climate models and seeking ways to improve their fidelity.

"The ongoing experiment is about free parameters in the way clouds are described within the model," Tobis said. "The tradition is to measure things as best you can, and then if it doesn't work there is an ad hoc tuning process to make the model work a little better. But we go back to the data to find objective ways to improve the values of the underlying parameters."

By repeatedly running the climate models, then analyzing the results and making adjustments, Tobis refines their performance–sometimes in unexpected ways.

"Climate models have not been very effective at capturing extreme rainfall events," he said. "We tuned the model to get other things right and the extreme rainfall events improved dramatically. It took us by surprise, but it gave us confidence that our work is producing something real."

Tobis earned his Ph.D. in atmospheric and oceanic sciences at the University of Wisconsin in 1996, and he also holds a master's degree in systems and computer engineering from Carleton University.

Chris Zahm

Chris Zahm joined the Bureau of Economic Geology's Reservoir Characterization Research Laboratory in January 2007, where he works on fractures and non-matrix pores in carbonate reservoirs.

Zahm looks at outcrops as an analog for subsurface reservoirs, building models based on the outcrops to be able to run tests to determine how fractures and karst-type systems might impact flow. This applied energy research is supported by oil and gas companies seeking to better understand their own reservoirs.

"The reservoir type I specifically work on is where we see high-permeability zones," Zahm said. "These are often times related to factures or other non-matrix pores, like touching vugs or karst. These zones present problems during enhanced hydrocarbon recovery. It can be very helpful to see these systems in outcrops where the full heterogeneity is present and to visualize what the sub surface might look like."

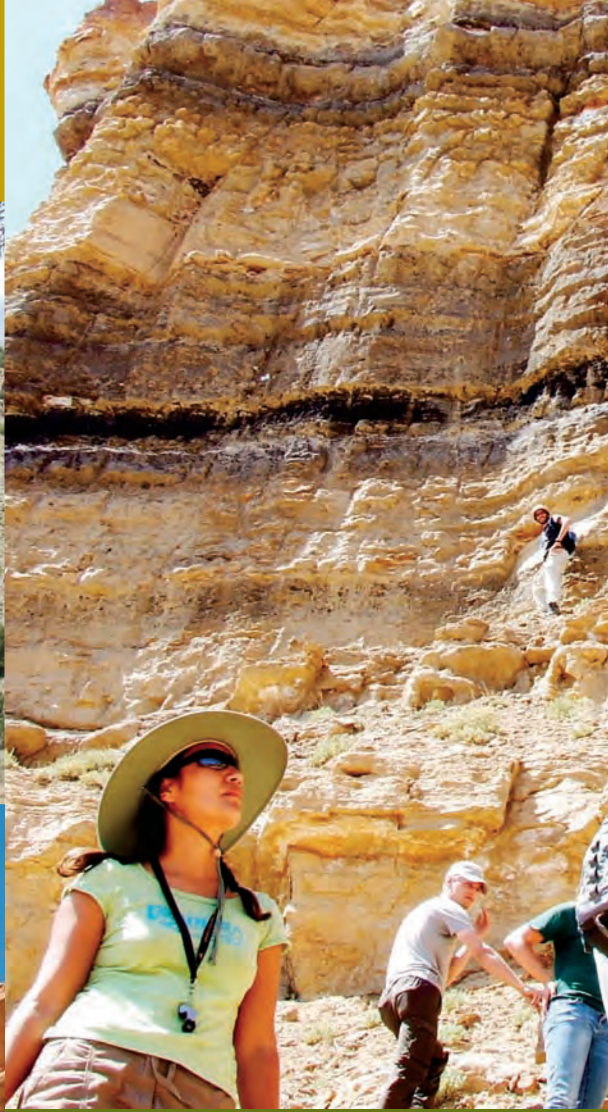
Zahm is currently doing research on outcrops in Central Texas, West Texas, Wyoming, and New Mexico's Guadalupe Mountains.

"What most interests me are the application and integration of rock mechanics, stratigraphy, and structural geology with reservoir engineering," Zahm said. "It's the way those four pieces combine. Classically those are four sub-disciplines, but it's the integrated analysis across the four disciplines that becomes very interesting."

After earning his Ph.D. from the Colorado School of Mines in 2002, Zahm joined ConocoPhillips Subsurface Technology as a structural geologist where he worked on reservoirs around the world, primarily in the North Sea and Southeast Asia. ✷

SCIENTISTS

SUMMER FIELD CAMP



GEO 660 Summer Field Camp 2007

Top left: *Lesli Wood explains facies relationships within the Sego Formation sandstones, Book Cliffs, near Moab, Utah.*

Bottom left: *Students measure section, San Arroyo Canyon, Book Cliffs, Colorado. Photo: Miriam Barquero-Molina.*

Bottom right: *Measuring trend and plunge of a hinge line, Hecla project, Pioneer Mountains, Montana. Photo: Miriam Barquero-Molina.*

Top right center: *Examining Pennsylvanian strata in the Sacramento Mountains, near Cloudcroft, New Mexico.*

Top right: *Students with Mark Helper, Sandy Hollow project, McCartney Mountains, near Dillon, Montana. Photo: Miriam Barquero-Molina.*

Center: *Examining a Cretaceous clastic section with Dr. Steel, Uinta Basin, near Price, Utah.*

Below: *Newspaper Rock, Utah, petroglyph panel etched in sandstone recording up to 2,000 years of human activity.*

Photos courtesy of Mark Helper, Christian George, and the Geo 660 2007 students.



LIBRARY REPORT

Endowments, Digital Initiatives Expand Offerings to Scholars

By Dennis Trombatore

This has been another exciting and active year for the Walter Library with lots of support from the Jackson School and our loyal alumni and friends. I'm pleased to announce that we will be among the first subscribers to the Geological Society of London's Lyell Collection in 2008, a complete digital file of the entire history of the society's publications.

On the endowment front, I am extremely pleased to report two items. First, we have reached our initial $100,000 goal for the Chernoff Family Library Fund for Geophysics, and this year we will begin to expend the earnings from that new fund. We hope to double this fund eventually to really increase the global depth and breadth of our geophysics and earth sensing information resources. Second, we have recently received a $5,000 challenge donation from Mike Wiley (M.A. '63, Ph.D. '70) to help us launch an endowment fund to support hydrology materials for the library. Our first goal for this fund is to raise the $25,000 necessary to establish the endowment, so all you hydro grads out there, this is your chance to step up—we are counting on your support. Over the past 20 years, the water sciences have been the biggest growth area of the collection. Despite this, there are many new resources—especially internationally—that we want to add to our holdings; it is time the water sciences have a fund of their own.

The Jackson School has, meanwhile, supported the acquisition of upgraded computer equipment. We have ordered three laptops for student use and two scanners for our student work stations, as well as several more comfortable chairs for users. Thanks to the Jackson School, we have also had several graduate research assistants (GRAs) from the School of Information this past year who have made dramatic improvements in two areas especially. Our suite of digitized geology publications has grown to include a large number of early Bureau of Economic Geology titles in the UT Bulletin and UT Publication series. We will continue to produce these pdf's until we complete all the out-of-print materials. To see the materials, go to: http://www.lib.utexas.edu/books/landscapes/

Another recent project that I want to draw special attention to is a new effort instigated by Professor Tim Rowe, director of the Vertebrate Paleontology Laboratory at the Texas Natural Science Center and a professor in the Jackson School. Amy Baker, one of our GRAs, worked as project supervisor to produce a full preservation digitization of Richard Owen's *Memoirs on the Extinct Wingless Birds of New Zealand*. This rare and elaborate paleontology text, with an introduction by Rowe, has set a new standard for high-level online presentation of historical scientific research materials. Under Rowe's guidance we expect to continue to produce selective rare paleontology materials. To see the work, go to: http://www.lib.utexas.edu/books/nzbirds/

For her efforts on this project and on our other digitization work, Amy is one of this year's Guion Staff Award winners.

April DeRome, our other GRA, has been continuing the project of upgrading our catalog access to USGS materials and other major serial monograph series in the collec-

Sir Richard Owen posed in 1879 for one of the most famous natural history photographs of the 19th century, holding the original fragment of a Moa femur he announced to the world in 1839 and, beside him, a fully reconstructed skeleton of the giant, ostrich-like bird. Owen's claim of the Moa's prior existence, based on a few small bones, met widespread skepticism throughout the early stages of his career before the concept of Dinosauria (a term he coined) evolved into our modern understanding of dinosaurs. The Walter Geology Library holds a rare copy of the original Memoirs on the Extinct Wingless Birds of New Zealand by Owen, which contains the photograph. A digital version with high resolution images can be found online at http://www.lib.utexas.edu/books/nzbirds/.

Walter Geology Library 2006-2007 Donors of Books and Materials

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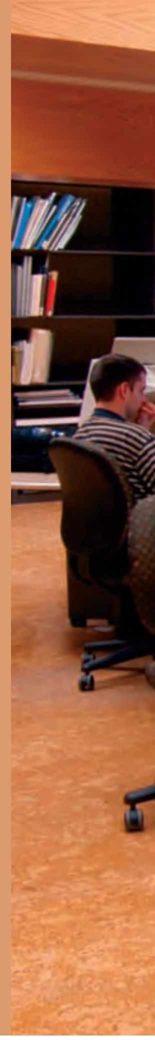


tion. Her big contribution this past year was to add records for all the USGS Bulletins, making each issue accessible by title, author, and subject in the online catalog.

Speaking of the catalog, the University of Texas Libraries had a major technology upgrade this past year with the changeover from several mainframe and other platforms to an integrated commercial library computer system. Migrating 8 million records and 70,000 user files without downtime is no small task. Our new catalog has a new look and feel, with many new features, and should add behind the scenes efficiency and cost savings as well.

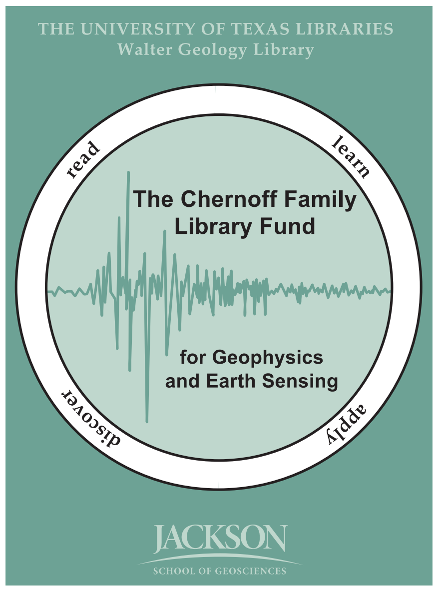

Drake

In staff news, first we were all saddened by the death of our excellent and long serving volunteer Rosemary (Brant) Barker during the Summer of 2006. We will miss her enthusiasm, her inclusiveness, and her many contributions. Vickie Drake, in addition to her significant efforts as part of the library system's migration project, has had a busy year on the UT Staff Council as chair of the Insurance Committee and as an elected member of the UT System-Wide Insurance Advisory Committee. Vickie was one of the winners of the Harold Billings Staff Honors Award for 2007. Vickie continues to improve our web site and participates in the UT Libraries "chat reference" service two hours a week, in addition to her other duties.

Because of the strengths of the collections, the Walter Library is used as a remote site for indexing of materials for the GeoRef database, along with libraries in Denver and Palo Alto. Pat Dickerson (Ph.D. '95) is our onsite indexer, and to thank her for all the assistance she gives us with reference and research questions, Pat is the second winner of this year's Guion Staff Award. Pat, who also worked for some years for NASA at Johnson Space Center in Houston, was also given NASA's Exceptional Public Service medal this summer, largely for her work in geologic field training for the astronaut corps. Congratulations, Pat!

I remain chair of the GeoRef Advisory Committee at the American Geological Institute, and also serve on the GeoScience World Advisory Committee. GeoScience World had a successful launch and, under the able leadership of Sharon Mosher, is growing steadily. I also went to California this summer as a driver with Mark Cloos and a group of U-Teach science education graduate students for a ten day field trip.✷

Bookplate designed by Jeffrey Horowitz of the Department of Geological Sciences commemorating acquisitions made through the new Chernoff Family Library Fund for Geophysics.



From Academic Leadership to Geoscience Powerhouse

In the fall of 2006, as part of the overall process of launching a new strategic plan for the Jackson School, each of the school's units completed new strategic plans. Following are excerpts and overviews. For a look at the school-wide plan that emerged from the unit plans, see related feature on page 78, "Changing the World of Geosciences, Jackson School Launches New Strategic Plan."

Founded in 1888, the Department of Geological Sciences is one of the oldest, largest, and most prestigious academic geoscience programs in the world. With the creation of the Jackson School and new dean Eric Barron's push for a new, school-wide strategic plan, this venerable institution was challenged to redefine its role in the university and the world.

Sharon Mosher, incoming chair of the Department of Geological Sciences where she holds the William Stamps Farish Chair, led the Department's effort to draft a new strategic plan.

"The strategic plan is very bold and forward-thinking, taking full advantage of the opportunities made possible by the Jackson endowment," said Mosher. "We propose to build collaborative research groups focused on answering fundamental questions, by bringing in scientists that complement existing strengths."

"One of the most exciting things about this plan is the integration of the entire School," said Clark Wilson, the Wallace E. Pratt Professor in Geophysics and Mosher's predecessor as chair of the Department, having twice served in the position (1990-1994 and 2004-2007). "We can partner with scientists at the other two units. It expands our teaching and research opportunities. We can go beyond a geological department to being a geoscience powerhouse in the nation."

He said the expanded research and teaching opportunities will give the Department a huge boost in recruiting students and faculty.

In addition to research, the Department's plan also addresses education, student services, recruiting, faculty support, workforce diversity, and building a stronger sense of community.


Mosher

"Developing the strategic plan gave us a chance to take a candid look at the status quo, to figure out what we would like to become in the next three to five years, and then decide what steps we need to take to get there," said Mosher.

Wilson recalled a quote from Dwight Eisenhower: "Plans are nothing, planning is everything."

"In other words, the process of writing the plan is more important than the plan itself," said Wilson. "It got people in the Department thinking about what we could be doing, rather than what we were doing."

EXCERPTS FROM THE DEPARTMENT OF GEOLOGICAL SCIENCES STRATEGIC PLAN

The Department of Geological Sciences has internationally renowned research programs with notable breadth and depth and strong graduate and undergraduate programs. National rankings over the past decade define our core strengths in traditional areas, such as sedimentary geology and stratigraphy, structural geology and tectonics, hydrogeology, paleontology, and geophysics, but in fact the disciplinary breadth of our current faculty ranges well beyond these to include petrology, mathematical theory, experimental and computational geosciences, geobiology, geochemistry, space science, climate science, and energy policy.

In addition to our research strengths, both graduate and undergraduate programs are strong and substantial in size. The education and accomplishments of students who complete these programs will continue to be a major asset in our development as the leading geosciences institution in the world. Few peer institutions can claim such an asset.


The Geology 660 summer field course is set for considerable growth as the number of geoscience undergraduates increases over the next four years.

Without doubt, the size and quality of our student body reflects the fact that, for a major research institution, our faculty has an unusually strong commitment to undergraduate and graduate teaching and supervision. Beyond the instruction of our own students, there is a strong sense of responsibility to teach non-scientists to produce an informed and scientifically literate citizenry. This is our mission as a public university, and we embrace it strongly.

To further the Jackson School goal to become the premier research institution, the department's strategy is to grow in new frontier areas while maintaining and strengthening our core programs. Future advances in our science will come from discoveries at the interfaces of traditional disciplines, resulting from interdisciplinary studies on coupling of physical, biological, and chemical processes and interactions among Earth's interior, hydrosphere, biosphere, and atmospheric systems.

We outline two fundamental Earth Science frontier areas as directions for new interdisciplinary studies. The first is concerned with Earth's near-surface processes, and the second with the origin and evolution of Earth, and processes underway in its interior.

New faculty and research staff hires in these two areas will be catalysts for research integration and build strong collaborations between the department and other units within the Jackson School and university. To strengthen our current research and graduate programs and those of new faculty and research scientists, we have identified critical actions that will allow us to attract and retain cutting edge scientists, increase research productivity and impact, become a premier graduate program, and develop the research infrastructure needed to be a preeminent research institution.

To bring the department to the forefront of education, student services, and student opportunities, we will develop a stronger sense of community and enhance services by creating student-oriented spaces with superior support staff and providing student-oriented experiences, educational opportunities, and a superior undergraduate and graduate curriculum. We will also enhance our already strong undergraduate teaching program, while not compromising the department's research mission, and better integrate research scientists from all units of the Jackson School into the overall teaching program.

A truly great college requires more than stellar researchers, outstanding research facilities, superior students, and premier graduate and undergraduate programs. What makes a college exceptional is the fabric and texture of the college that binds it together and creates an environment that nurtures creativity, innovation, collaboration, integration, diversity, and leadership.

The Department is committed to actively participating in developing such a college. We will provide an intellectually stimulating environment where faculty, students, and research scientists communicate freely, sharing the joys of discovery and engaging in ongoing scientific debate. Within the Department we will develop a culture that nurtures, recognizes, and rewards research accomplishments, supports excellence in teaching, and provide leadership to the larger professional community and society.

With the Institute for Geophysics (UTIG) and Bureau of Economic Geology (BEG), we will transform the Jackson School of Geosciences (JSG) into the premier geoscience institution in the world. The plan to achieve this involves three themes related broadly to developing (1) our research profile; (2) services to the student body; and (3) the Jackson School as a great college.

Institute Drafts Strategic Plan from Bottom Up

Stoffa

In the fall of 2006, the Institute for Geophysics began the process of drafting a strategic plan to help guide the unit's growth and evolution over the next few years.

"This was a bottom up procedure," said Paul Stoffa, director of the Institute. "Our youngest people, our research associates and research scientists, contributed the most to the science areas." Senior members of the institute then discussed and slightly modified their proposals.

"It was good to do the exercise and see what emerged as the important topics," said Stoffa. "I was glad to see that the senior staff mostly agreed. Everyone was pleased with the vision showed by the Institute's research scientists and associates."

Three new research themes emerged in the process. One of them—Upper Mantle and Crustal Dynamics and the Role of Fluids—paralleled a similar theme in the Department of Geological Sciences' plan.

"It was exciting to see that develop independently," said Stoffa. That particular theme was later elevated to one of four School-wide major research foci in the overall plan for the Jackson School of Geosciences.

Stoffa also emphasized how the new plan would benefit students.

"We envision all of our facilities and all of our research programs as graduate research opportunities," said Stoffa. He noted that the Institute's facilities and research opportunities are unique within the Jackson School as well as among universities nationwide. "Students doing their research at the Institute have the opportunity to go to sea, to Antarctica, and to Greenland. Our ability to mount these kinds of programs will be enhanced by the strategic plan."

EXCERPTS FROM THE INSTITUTE FOR GEOPHYSICS STRATEGIC PLAN

In the 34 years since its founding, the Institute for Geophysics of The University of Texas at Austin (UTIG) has combined a high quality scientific and technical staff with an agile and flexible approach to research opportunities to build a strong reputation in marine geology and geophysics, tectonics, terrestrial and lunar seismology, and quantitative and exploration geophysics. Over the past decade, UTIG has hired scientists involved in geophysical studies of ice sheets and climate, and its staff strongly believes that the most pressing problems in the Earth sciences now lie in the integrated study of the solid earth, the cryosphere, the hydrosphere, and the atmosphere.

Towards this effort UTIG scientists have identified three frontiers as research priorities for the immediate future. Our overall strategy will be to move forward on a broad front, taking care to maintain our current strengths while hiring new staff within each of the frontier areas. We are open to applicants at all career levels and the possibility

In addition to their airborne geophysical work in Antarctica, researchers in the Institute for Geophysics are actively studying ice stream flow and West Antarctic ice cores, among many other projects.

that some may be joint appointments with other units in the Jackson School of Geosciences (JSG).

The first frontier—Quantifying Uncertainties, Variability, and Changes of Mean State in the Climate System—requires hiring a statistical climatologist working on the detection and attribution of climate change, a paleoclimatologist/paleo-oceanographer who uses climate archives to quantify the response of the Earth system to climate forcings, a physical oceanographer, an expert in the ocean carbon cycle, and an expert on large-scale models of the ocean and the coupled ocean-atmosphere system.

The second frontier—Earth Surface Processes: Crossing the Land-Sea Divide—involves both climate and tectonics and will require hires in the area of surface processes, atmospheric and lithospheric dynamics, ice-sheet modeling, ice-ocean interactions, deep earth fluids, and sea level dynamics.

The third frontier—Upper Mantle and Crustal Dynamics and the Role of Fluids—also requires scientists in the fields of geodynamics and deep earth fluids. Our plan is to hire broadly within all three identified frontier areas during Year 1. Subsequent hires in Years 2 and 3 will be based on these results.

Several of UTIG's future research projects will require new facilities, e.g., data collected by a large number of ocean bottom seismometers (OBS) which we propose to acquire by becoming an NSF facility and using JSG funding as a match. This OBS Facility would support NSF funded scientists from the U.S. along with UTIG scientists. In addition, UTIG would have access to a small private pool of OBS's available for industry supported programs.

With sustained support, UTIG and the BEG can develop a Multi-Instrumented Aerogeophysics Program that would draw on UTIG's experience in the Antarctic and the BEG's many airborne LIDAR missions. Other needed facilities include a High Resolution Geophysical System to acquire data at higher frequencies and at critical hard-to-reach locations.

Finally, we believe that in conjunction with the BEG and DGS we can combine these and other JSG resources to make Rapid Response Teams to gather time-critical observations immediately after large-scale 'geoevents'—such as earthquakes, tsunamis, volcanic eruptions, and hurricanes.

Computational facilities that advance research goals are essential to the success of UTIG's research program and for training students. Fortunately the Texas Advanced Computing Center (TACC) has developed a high performance computing system which, in conjunction with UTIG's local computing resources, can easily satisfy UTIG computational needs. However, utilizing these resources effectively will require technical IT support in this area, specialists in GIS, databases, specific applications, and WEB Services. A Center for Stochastic Geosystems Modeling is proposed for the analysis of complex Earth systems such as climate, geodynamics, and reservoir production. This is possible to develop only because of TACC's resources.

Students have always figured prominently in UTIG's research programs, from planning through data acquisition to interpretation and publication. We plan to expand their involvement in our activities and to enhance their research experience with UTIG. This will require additional staffing, and support for ongoing and new professional development programs. We believe these will encourage undergraduates, as well as graduate students to confront a broad spectrum of ideas, to interact with professional geoscientists, to participate in field projects, and to gain experience with the facilities described above. Finally, we propose that the UTIG staff work closely with the faculty of the Department of Geological Sciences to enhance the curriculum in marine geology, geophysics, and climate science, areas in which UTIG has particular expertise.

Bureau Prepares to Go to Next Level

The Bureau of Economic Geology's annual bookings have grown from $10 million in 2000, when Scott Tinker took over as director, to nearly $20 million today.

Most of that growth has come from external funding sources. But according to Tinker, there were limits to how much the Bureau could grow.

"It is quite possible we had hit a 'capacity ceiling' given our current funding model," said Tinker, who recently led the Bureau's effort to draft a strategic plan. "The plan provides for a small School investment in each Bureau researcher—something we have never had—to support proposal development and publishing. This is exactly the kind of investment we needed to have the potential to go to the next level."

An external advisory committee had been put in place when Tinker arrived at the Bureau in 2000, which he said "has helped the Bureau plan and focus."

"However, a detailed written plan had not been done, and it came at just the right time," he said. "It was important to get everyone engaged and formalize our growth areas."

Tinker said the strategic plan will help the Bureau maintain traditional core strengths and enhance its efforts in several important areas, including carbon management, unconventional gas, subsurface micro and nano-sensors, advanced seismic imaging, paleoclimate, and sustainable water resources.


Tinker

"A strategic plan is only as good as the ability to execute," said Tinker, "and Eric Barron's willingness to invest in ideas and talent is vital to successful execution."

EXCERPTS FROM THE BUREAU OF ECONOMIC GEOLOGY STRATEGIC PLAN

The Bureau benefits the School in several ways.

In terms of the research mission, the Bureau attracts significant external research funds each year—$13.6 million in FY2006 from a diverse portfolio of federal, state, private, and foundational sources. External investment in research and education could grow significantly school-wide by expanding programs to collaborate with the Department and Institute and by creating new programs.

The Bureau has research strengths that complement those of the other units (so growth would not be duplicated), and it has a tremendous capacity, if supported, to contribute to graduate education.

As the State Geological Survey, the Bureau is politically engaged and can open doors for the School to help bring science to policy. Finally, the Bureau has a professional support staff that can benefit the entire School.

Tactical Needs

The Bureau has three pressing tactical needs: talent, stabilization, and facilities.

In the area of talent, we propose seven new programs: Talent Growth, Research Chairs and Jackson Fellows, Postdoc Matching, Moving and Startup, Integration/Collaboration Incentive, Excellence Support Fund, and Joint Appointment Insurance.

For stabilization, we propose five new programs: Base Level Researcher Support, Researcher Backstopping, Support-Staff Capacity Building, Service and Outreach, and a Development Fund.


Researchers at the Bureau of Economic Geology's Applied Geodynamics Laboratory are advancing the frontier in salt tectonics.

Finally, in terms of facilities, we propose new investments in: Satellite Operations, Database Modernization, and a Houston Research Center Renovation match.

In addition to financial investments, organizational requirements in the form of incentives, removal of barriers, portfolio balancing, and policies will strengthen the Bureau's role in the School. These include managing the external investor portfolio, GSC membership, membership in the School for all researchers and directors, facilitating hybrid research/faculty positions, and improving ways for all staff to meet and interact.

The Forefront of Research

Many of the projects and programs represented by the 175 active Bureau accounts address common research or societal themes and can be "rolled up" into focus areas. There are two broad classes of focus areas, one in which projects are coordinated around a common research theme and the other represented by major programs with an overarching purpose driven by the Bureau mission.

Research focus areas comprise advanced energy consortium, coastal change in Texas, fracture processes, salt and shale tectonics, sedimentary rock systems, seismic imaging in complex environments, unconventional fossil energy, and groundwater hydrogeology.

The major program focus areas are represented by significant, funded research or service programs in which the Bureau is heavily invested. These include the Center for Energy Economics, Gulf Coast Carbon Center, international research and education partnerships, professional and societal service, State Geological Survey, and State of Texas Advanced Resource Recovery program.

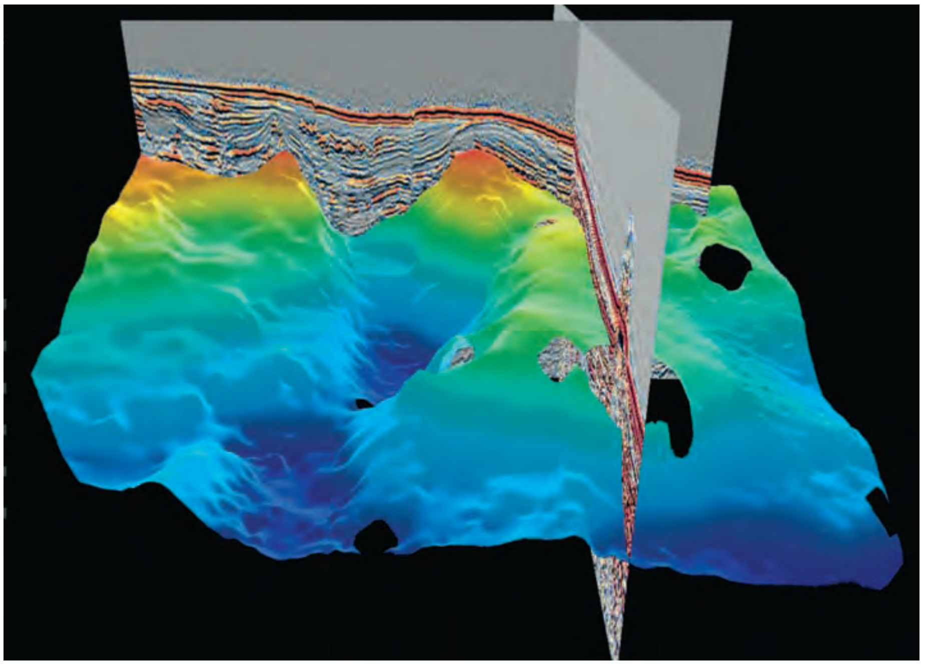
The Bureau aims to solve refractory challenges by using innovative, integrated geoscience and engineering approaches to benefit society.

Addressing research opportunities often requires multidisciplinary, collaborative research teams that cross focus areas and engage in efforts sustained over many years. We call these long-term, integrated efforts scientific movements. They include: Carbon Management, Coastal Dynamics, 4-D Quantitative Stratigraphy, Mobile Substrate Tectonics, Structural Diagenesis, Sustainable Water Resources.

The Forefront of Education

The Bureau educates at many levels: undergraduates and graduates, K-12 students and teachers, private citizens, government employees and decision makers, and private industry. Students at the Bureau have access to research teams working on important issues, excellent data sets generally unavailable in academe, leading technology, and industry contacts and careers.

There are several key areas in which the Bureau, with the proper School support, can help the School attain the forefront of education: advising and mentoring, teaching, internships, and recruitment. The team-based research program promotes student interaction with scientists and faculty and fosters a strong sense of community. The Bureau's outstanding research and core facilities, flexible staff, and administrative structure can facilitate education at all levels. Facilities could include a student/researcher area, computer workrooms with skilled IT support, and a visualization lab with TACC, a library, and classrooms.



Deep slope canyon in offshore eastern Trinidad, mapped by the Quantitative Clastics Laboratory at the Bureau of Economic Geology using 3D seismic data and Landmark software tools. These canyons are Quaternary in age and their presence is controlled by transpressive faulting patterns along the Caribbean-South American plate margin. The Quantitative Clastics Laboratory is one of nine highly active Industrial Associates programs at the Bureau of Economic Geology.

The Fabric of the School

The process of planning has brought a welcome internal examination of the Bureau and assessment of our role in the School and our impact on science and society. The Bureau today is a healthy, growing, globally recognized science and engineering organization with broad-ranging research and education strengths. Bureau researchers are engaged in programs that have the potential to influence the way others think or act in their daily lives—to contribute substantially to real issues that impact global society. For example:

- How can we transition globally from carbon-based energy to decarbonized energy?
- What, if anything, can we do about climate change?
- What new discovery is possible if we put smart, mobile microsensors into the Earth?
- How should societies adapt to coastal dynamics?
- Where will the world's freshwater come from this century?
- How can societies build sustainable economic, business, institutional, and human resource capacity to address these issues?

This potential for transformational impact is rare in any field of endeavor. In the end, it is exactly this kind of impact that drives us—that wakes us up early and keeps us up late.

UNIT OVERVIEWS

A New Kind of Energy Policy Center

In 2005, The University of Texas at Austin chartered the Center for International Energy and Environmental Policy (CIEEP) to join the scientific and engineering capabilities of the University's Jackson School of Geosciences and the College of Engineering with the policy expertise of the LBJ School of Public Affairs.

Programs at other institutions address energy and environmental policy, but they approach it from the perspective of business, economics, political science, or law.

"CIEEP is different," said Charles Groat, director of the center. "It is driven by what science and engineering tell us about energy and environmental policy. We claim to be grounded in real world applications."

Groat, with input from colleagues involved in the CIEEP program, drafted a strategic plan for CIEEP to guide its growth over the next three years. A primary goal is to "become nationally and internationally recognized by government, private sector, and education organizations as a preferred source for the analysis of international energy and environmental policy and the formulation of policy options."

"We are interested in creating a body of work that gets broad recognition in an area that we do well in and that has not been preempted by another institution," said Groat.

One of those areas involves the intersection of energy and water. Many forms of energy development, such as enhanced oil recovery, can require large amounts of water. Likewise, it takes energy to move and treat water. Desalination of sea water, for example, requires an enormous amount of energy.

"No other institution is taking on this energy/water roadmap," said Groat. "We have great expertise in this area. People won't look at us and say, 'Who are you?' UT has historically been strong in energy and in the water demands for energy development." The idea, he added, is to start with something you already have strength in so that you have credibility.

Other areas that CIEEP is uniquely positioned to address include development of unconventional hydrocarbons and alternative sources of energy, application of best practices and technologies to resource development and resource-related environmental conflicts, sustainable development of oil and natural gas resources, and landscape and land-use effects on water and renewable energy resources.

EER graduate students Banke Funsho (left) and Mary Bezara (right) gained practical experience as research assistants at the Bureau of Economic Geology.

Graduate Program Joins Jackson School Family

In 2005, the home base for the Energy and Earth Resources Graduate Program (EER) shifted from the Department of Petroleum and Geosystems Engineering (PGE) to the Jackson School of Geosciences. The shift revitalized the program, raising enrollments and, through the leadership of director Charles Groat, heightened EER's profile with energy companies seeking its graduates.

EER provides a multidisciplinary degree to prepare students for analytical and leadership positions dealing with resource issues spanning science, engineering, management, economics, business, finance, law, and policy. Established in 1981, EER was known until 2006 as the Energy and Mineral Resources program. The new name reflects a wider scope developed in response to employer needs.

Groat drafted a strategic plan to help guide the program over the next three years. One of his main goals is to integrate EER and its students into the fabric of the Jackson School as the program continues to raise its stature.

"We are the new kids here," said Groat. "It's a small program compared to the school's three main units, but it's not that small. It's different."

The program has 35 students and has enormous growth potential, he said. It also contributes a great deal to the Jackson School through its relationships with faculty and researchers in other parts of the university, such as the McCombs School of Business, the Department of Economics, the LBJ School of Public Affairs, and Petroleum and Geosystems Engineering.

"For us to be an integrated part of the Jackson School family is a major institutional goal," said Groat.

Among other things, the plan calls for student offices and access to computer labs, a dual master's degree program in Geological Sciences and Energy and Earth Resources, more funding for merit-based student support, and increased participation by Jackson School faculty in course design, instruction of students, and supervision of their research.

Groat was pleased that the needs of a growing EER program were incorporated into the Jackson School's overall strategic plan.

"To see it reflected in the new theme hires, specifically the Energy, Environment, and Policy Research theme, gave us a chance to be thought about when the school's plan was drafted," he said.

EXCERPTS FROM THE ENERGY & EARTH RESOURCES GRADUATE PROGRAM STRATEGIC PLAN

The four principal goals for the EER Graduate Program for the 2007-2010 period relate to the "forefront of education, student services and student opportunities" theme of the Jackson School strategic plan.

1. Building on the Dean's pronouncements that there should be no second-class citizens or programs in the Jackson School, further integrate the EER program and its students into the Jackson School so that it becomes equal in stature to existing programs and receives a proportionate level of academic, financial, administrative, service, and facilities support.

2. Continuously improve the quality of EER students and build the reputation of the program on an international scale.

3. Provide additional courses geared specifically to the needs of EER students and research opportunities that provide career-relevant experience.

4. Encourage more geoscience graduate students to add to their professional capabilities in ways that will equip them for the operational, managerial, and leadership dimensions of their careers.

This Cambrian Eriboll sandstone from Scotland is an example of a natural, quartz cement filled fracture from a sandstone that is an outcrop analog for producing tight gas sandstone (TGS). Outcrop analogs allow researchers to study features like fracture patterns that are exceedingly difficult or impossible to see in deeply buried, producing tight gas sandstones. The Jackson School's unique lab facilities at the Bureau of Economic Geology allow for obtaining large area, high resolution cathodoluminescence images of rock microstructures such as this to discover features that govern gas producibility. Source: Bureau of Economic Geology.

Exploration & Innovation:

Geoscientists Push the Frontiers of Unconventional Oil and Gas

By Nicole Branan

As petroleum supplies tighten, crude oil prices remain high, and energy security continues to concern U.S. politicians, the world is increasingly turning its attention to unconventional oil and gas.

Energy analysts now routinely accept that the world's unconventional hydrocarbons, such as gas hydrates, tight gas sandstones, and oil and gas shales, hold more fuel than undiscovered conventional energy sources. While the potential of unconventional oil and gas has long been acknowledged, a host of challenges have dampened expectations. Today, this seems set to change. Unconventional hydrocarbons currently account for less than 15 percent of the world's global oil production of about 70 million barrels per day, according to energy consulting firm Wood Mackenzie. But by 2025, predicts Wood Mackenzie, unconventional oil will supply more than 20 percent of global demand. Unconventional gas will be even more important, especially in the United States, where it already accounts for more than 40 percent of the natural gas supply, according to the U.S. Department of Energy.

Until recently, the general consensus was that unconventional oil and gas were too expensive and technically difficult to pursue. But skyrocketing fuel prices and major technology advances have changed that outlook dramatically.

"We now see that there is enormous potential in unconventional oil and gas," said William Ambrose, a research scientist at the Jackson School's Bureau of Economic Geology. As president of the Energy Minerals Division of the American Association of Petroleum Geologists in 2006-2007, a professional organization whose mission encompasses advancing the science of unconventional hydrocarbons, Ambrose is in a position to know. He is part of a core of researchers at the Jackson School, principally in the Bureau of Economic Geology, working to advance geoscience knowledge of unconventional resources.

Unconventional Resources, Economic and Technological Tradeoffs

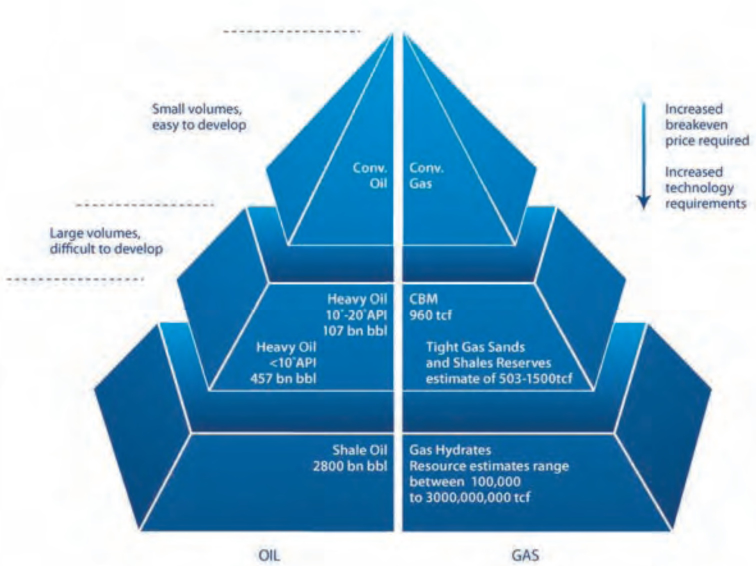


Figure courtesy of Wood Mackenzie.

Unconventionals at a Glance

Methane Hydrates:

- Estimated resources in the U.S.: Between 112,000 trillion and 676,000 trillion cubic feet (tcf)
- Environmental Aspects: Potential impacts on marine life, risk of unintentional release of methane gas into the atmosphere
- Current Status: No commercial production

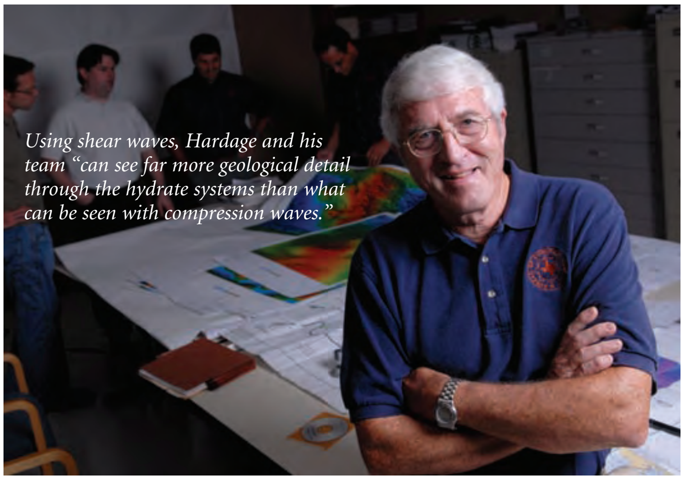
Gas Shales/Tight Gas/Coalbed Methane:

- Estimated resources in the U.S.: Shale gas 500-780 tcf, Coalbed Methane 700 tcf, Tight gas 450 tcf
- Environmental Aspects: Impacts on landscape, wildlife, communities, air quality, water supply
- Current Status: Currently contributes more than 40 percent to U.S. gas production

Oil Shales:

- Estimated resources in the U.S.: more than 2 trillion barrels
- Environmental Aspects: Impacts on landscape, wildlife, communities, air quality, water supply
- Current Status: Commercial production in U.S.: less than 1 percent

Sources: U.S. Department of Energy, USGS, Schlumberger.



Using shear waves, Hardage and his team "can see far more geological detail through the hydrate systems than what can be seen with compression waves."

Some unconventional supplies are already fueling our homes. "What were once considered these avant-garde resources that nobody dared to approach are now suddenly well sought-after commodities in the industry," said Ambrose.

Energy security concerns further heighten interest in unconventional resources. Unlike conventional hydrocarbons, unconventionals are well distributed in the United States and some of its closest allies, like Canada. Pursuing unconventional resources, the political argument goes, can reduce American dependence on oil from more volatile regions of the world.

Despite a rosier forecast for unconventionals, however, they still face many obstacles. While fuel from traditional reservoirs doesn't need much persuasion to flow to the well, coaxing oil and gas out of unconventional hideouts can be a huge headache. Not only are the fuels locked away tightly but they also accumulate in spots that are often hard to get to. In fact, the largest amount of unconventional gas may be sitting in one of the least accessible places on the planet: the ocean floor.

Gas on the Rocks

Squeezed together under megatons of water, methane litters the seafloor and the mud and rock beneath it in the form of hydrates—ice-like deposits of gas and water. Hydrates occur when water molecules form crystalline structures leaving cavities which can be occupied by a single gas molecule. The structure enclosing the gas is known as a hydrate cage.

Because of the crushing pressures and chilling temperatures at the bottom of the ocean, gas trapped in hydrate cages is highly concentrated. "The energy density of hydrates is 42 percent that of liquefied natural gas," said Bob Hardage, senior research scientist at the Bureau of Economic Geology. "LNG is the highest energy concentration of natural gases that man can make, and hydrate is not far behind LNG technology in terms of efficiency of energy concentration." If captured, these hydrate formations could be abundant reservoirs of fuel. But while researchers have had some success recovering hydrates from permafrost regions in the Arctic, marine sites remain a challenge.

"Whether or not you can actually produce gas from seafloor hydrates is still a big question," said Hardage. The technological challenges are formidable and scientists have raised safety and environmental concerns.

There are several ways to release the gas molecules from their hydrate cages that include decreasing the pressure to liberate the gas or increasing the temperature to melt the deposits. But one needs to know that the seafloor is stable before pursuing either of those options, said Hardage. "If you reduce the pressure in an unstable area, the seafloor might slump and you could lose a good chunk of shallow strata." That could release massive amounts of methane into the water column and eventually into the atmosphere. And because methane is a greenhouse gas about 20 times as potent as carbon dioxide, such an event could contribute significantly to global warming.

Even though scientists don't know exactly how much natural gas is bound in hydrates, most agree the quantities are enormous. "There is a tantalizing possibility that the amount of energy available in hydrates exceeds that of conventional gas resources by several factors," said Hardage. But the exact numbers are still contentious, partly because it's difficult to image the deepwater deposits. Determining amount and distribution of methane hydrates near the ocean floor is currently the primary research focus in the field, said Hardage.

He and his team are working with multi-component seismic data to create detailed profiles of near-seafloor strata beneath the Green Canyon area in the Gulf of Mexico where heavier thermogenic gases (ethane and propane) fill some of the hydrate cages and cause the hydrate to be stable over a wider range of pressure and temperature than is pure-methane hydrate. By sending sound waves through the ground and measuring how fast they travel, the team can gain clues about the composition of the sediments, such as potential hydrates content. Rather than the commonly used compression waves, Hardage and his team use shear waves, which provide better resolution. "We can see far more geological detail through the hydrate systems than what can be seen with compression waves," said Hardage.

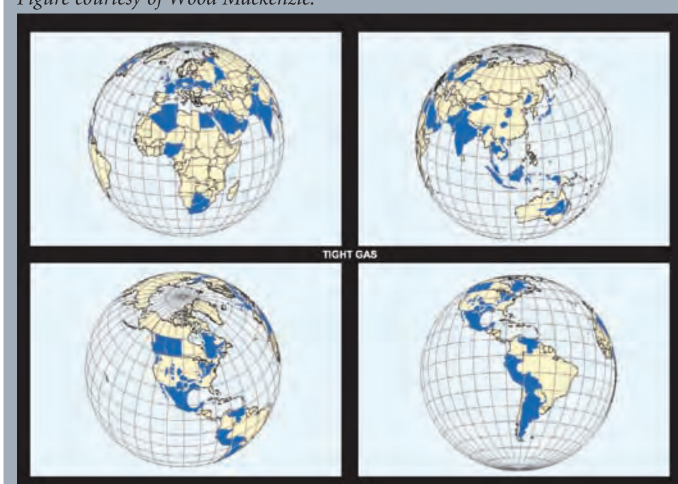
Based on their data, Hardage and his team have developed rock physics models that relate seismic wave velocities to different percentages of hydrate concentrations in various mixtures of sand, clay, and brine.

Deeper Resources

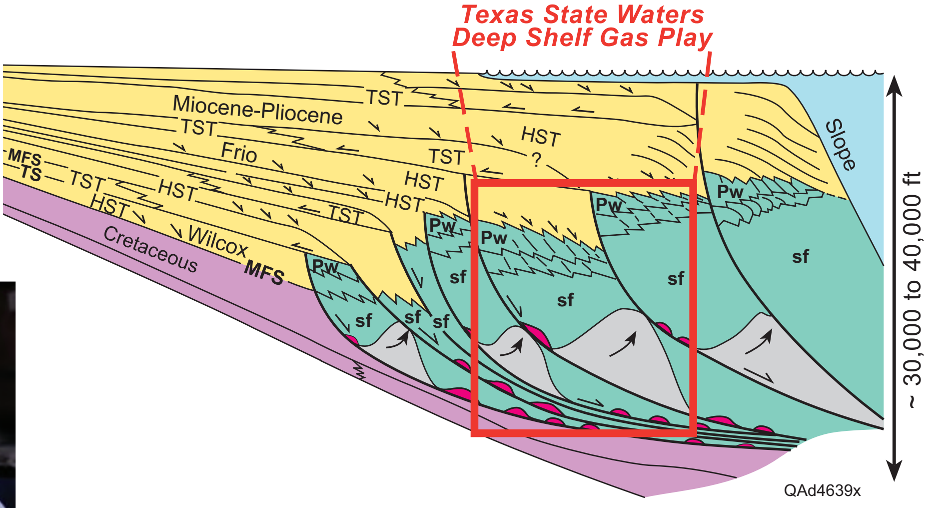
While gas are still in the experimental phase, commercial production of several other unconventional gas resources is already in full swing. According to the U.S. Department of Energy, coalbed methane, shale gas, and tight gas currently account for more than 40 percent of U.S. gas production. "We have basically gone through the resources that are easy to locate and produce and now we have turned to the next category," said Eric Potter, associate director for energy programs at the Bureau of Economic Geology. "And even though this gas is dispersed and expensive, it's still a lot more realistic to produce than alternative forms of energy like wind or solar."

A major unconventional gas resource is tight sandstone—rock with low permeability and porosity. Such formations develop when

Global distribution of tight gas resources (blue). Figure courtesy of Wood Mackenzie.



General sequence stratigraphic architecture for the Texas Gulf Coast area. Red box outlines the deep shelf gas play of lowstand deposits.



Dutton and colleagues are investigating whether there is a reservoir basement for TGS, "so we could say, 'If you get beyond a certain temperature or depth, an economic rate of production becomes unlikely.'"

geological processes such as compaction and cementation close the large pores of the rocks that house conventional deposits. Gas can easily flow through the large pore throats that permeate regular sandstones but in tight sandstones it is trapped. Producers have to employ special treatments to extract it. One option is hydraulic fracturing—a technique in which mixtures of water and sand or ceramic beads are pumped into the rock formation. The pressure eventually cracks the rocks, allowing the gas to flow to the well.

But all tight sandstones are not alike, said Shirley Dutton, senior research scientist at the Bureau of Economic Geology. "Some areas produce better than others (sweet spots), and it's still poorly understood what controls the production," said Dutton. Geoscientists around the world are trying to find answers to that question. One factor is how the sand was originally deposited. Depositional history determines the regional distribution, geometry, and texture of the reservoir sandstones. However, Dutton noted, production characteristics of tight gas sandstones are in large part controlled by the diagenesis, or chemical and physical changes, that the sediment has undergone after deposition. Extensive cementation is commonly the reason for low permeability. Finally, natural fractures can be locally abundant in tight gas sandstones and may play a key role in production. Open natural fractures provide pathways for fluid movement and affect the way that hydraulic fractures grow.

Dutton and her colleagues are using seismic data and rock samples to study deeply buried sandstones (>15,000 ft) below the shallow water of the Texas Gulf coast. A lot of the conventional oil and gas fields in this area are declining, and there is now a move to evaluate the kinds of reservoirs that lie beneath these depleted fields. High temperatures and pressures make drilling 20,000 or 30,000 feet deep an especially risky proposition, making it all the more important to devise methods to gauge the economic viability of resource plays at these depths. "For example, we are investigating whether there is a reservoir basement, so we could say, 'If you get beyond a certain temperature or depth, an economic rate of production becomes unlikely,'" said Dutton.

Going to the Source

Fossil fuels don't always manage to escape from the source rock. That's why shales—the ancient oil and gas factories that generated the fuels over millions of years—are another popular unconventional resource of natural gas. According to Ambrose the U.S. gas resource from shale beds ranges from 500 to 780 trillion cubic feet, though with current technologies only about one tenth of that can be recovered, he added.

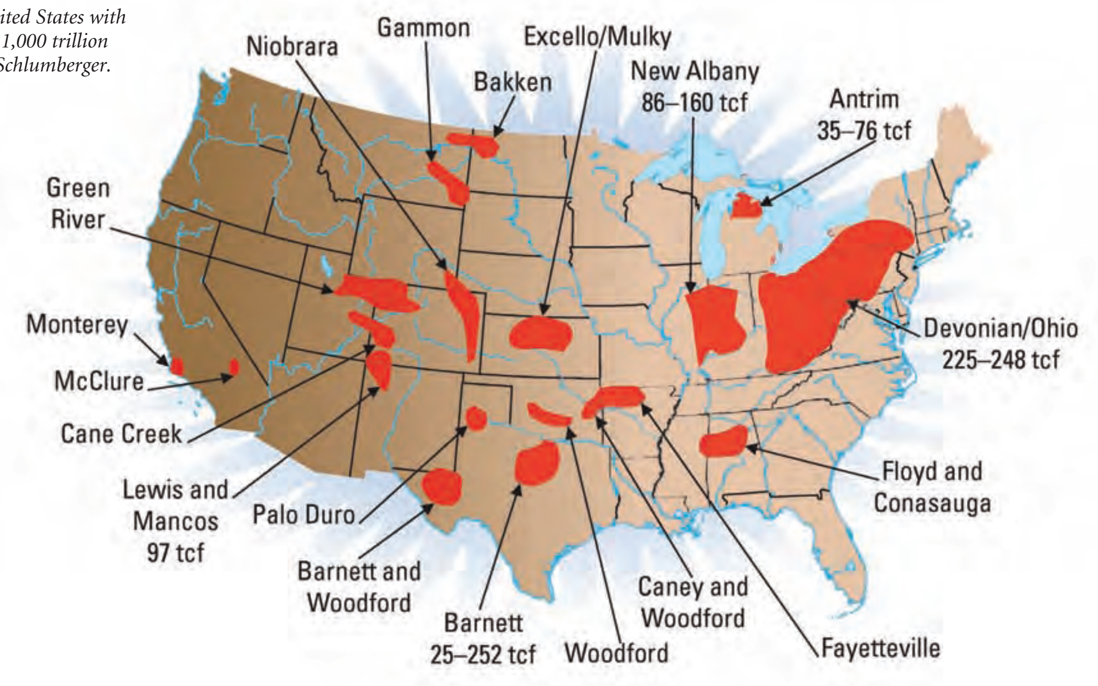
As producers in the famous Barnett Shale have taught the world, fractures are essential for gas production from shales. "The key to the Barnett Shale formation is being able to fracture the formation and to maintain the flow," said Ambrose. The shale's susceptibility to artificial fractures varies greatly and geoscientists are currently trying to find out what makes some shales break easier than others.

Variations in the mineral content of a rock and the particle types it contains all contribute to its mechanic strength, said Steve Ruppel, senior research scientist at the Bureau of Economic Geology. "The word shale encompasses a really broad range of mineralogic and sedimentary properties," said Ruppel. He and his team try to determine how their composition varies across different areas, such as the Fort Worth Basin and the Permian Basin.

The recent economic success of shale gas production has sparked a lot of research interest in shale successions, said Ruppel. "In the past there was relatively little economic value in shales so interest in studying them was limited. Now these rocks are receiving a lot of attention because we need to know their mineral composition and strength as well as the distribution of these properties," he said.

Even though shale gas production is booming, several problems have yet to be addressed. "Water is a huge issue," said Ruppel. Not only are producers competing for surface water resources required for the drilling process but water contaminated with hazardous chemicals and elements generated in the production process needs to be disposed of. Companies currently drilling in the Barnett Shale, for example, re-inject these waters deep into the geologic column. But water treatment procedures will eventually have to be developed, Ruppel said: "Otherwise you will have to truck the water off to a disposal facility. That would drive up production costs."

Major shale gas basins in the United States with total resource potential of 500 to 1,000 trillion cubic feet (tcf). Map courtesy of Schlumberger.



Ambrose: "The technology keeps improving, so you never know what might happen in the future."

Still other environmental considerations play a role as well. Production of unconventional oil and gas resources has an intensive impact on the landscape compared to old-style exploration and production, said Potter. Unconventional resources require closely-spaced wells covering large areas—often multiple counties in a given play. "It's essential to minimize the impact on wildlife and on residents."

While commercial shale gas production has taken off, oil shales are an entirely different story. Attempts to develop a shale oil industry in the U.S. go back almost a century but the process is still too costly to be economical. "With shale gas all you have to do is open up a pathway and the buoyancy of the gas will bring it to the surface," said Ambrose. But that's not enough to coax oil out of shale. "Instead, you have to heat the rocks to about 450 degrees C (842 degrees F) to liquefy the oil." That in itself is currently not economical. And water consumption plays a big role in oil shale production as well, adding substantially to the cost, Ambrose said. "But the fascinating element of all of this is that the technology keeps improving, so you never know what might happen in the future."✷

Coal Gasification Regains Spotlight

The product of coal gasification—a process that turns coal into a gas rather than burning it directly—is another type of unconventional gas that has recently moved into the spotlight. Coal gasification has been around for almost a century but climbing energy prices and growing climate change concerns are now giving the technology a push. "Gasification can allow us to utilize coal in an environmentally friendly way," said Ian Duncan, associate director for environmental programs at the Bureau of Economic Geology.

The technology could play an important part in the U.S. energy future because the country has a huge supply of raw material. "We have about 50 percent more energy resources tied up in coal than the Middle East has in oil," Duncan said. In the gasification process pulverized coal is introduced into a reaction chamber with small amounts of oxygen and steam. At temperatures of about 2,500 degrees C (4532 degrees F) and pressures 1,000 to 2,000 times higher than atmospheric pressure the coal breaks down into its chemical building blocks and produces a synthetic gas, which consists mainly of hydrogen and carbon dioxide. The hydrogen gas is then fired in gas turbines to generate electricity. Even though the technology drastically reduces emissions of nitrous and sulfur oxides, heavy metals, and particulate matter, it still spews out carbon dioxide. "To make it a near zero-emissions energy technology, the carbon dioxide needs to be sequestered," Duncan said.

Whether or not coal gasification could become economically feasible depends on a host of parameters, including what the future regulatory framework with respect to carbon emissions will look like, said Michelle Foss, chief energy economist and head of the Bureau of Economic Geology's Center for Energy Economics. "Capturing emissions would add a pretty substantial cost to the process."

The FutureGen initiative—a 1.5 billion dollar public-private venture—is planning to build the first coal gasification plant that integrates carbon sequestration next year. Researchers at the Bureau of Economic Geology have been leading Texas' bid for the project and the winning state—either Texas or Illinois—was on the verge of being announced as this edition of the *Newsletter* was heading to press.

Institute Pioneers Research on Hydrates

Researchers at the Jackson School's Institute for Geophysics have a distinguished track record of basic research on gas hydrates, from pioneering the earliest efforts at detecting them to advancing our understanding of their vertical orientation in venting systems and addressing critical questions on their potential release due to warming oceans.

Tom Shipley, a senior research scientist at the Institute, was one of the first to clarify the properties of the geophysical diagnostic of the presence of hydrates, the Bottom Simulating Reflector, or BSR. People were collecting seismic data for a long time and did not know what the BSRs were, said Nathan Bangs, Shipley's colleague at the Institute. "Tom is the one who figured out what they were," said Bangs. "Some people on the geochemistry side were working on the same issue—they came together and showed the BSR was related to a phase change between methane in the hydrate form and the free gas form."

The prolific Shipley has authored or co-authored more than 80 papers, but one of his most cited remains his 1979 report on hydrates for the *AAPG Bulletin*, "Evidence for widespread possible gas hydrate horizons on continental slopes and rises."

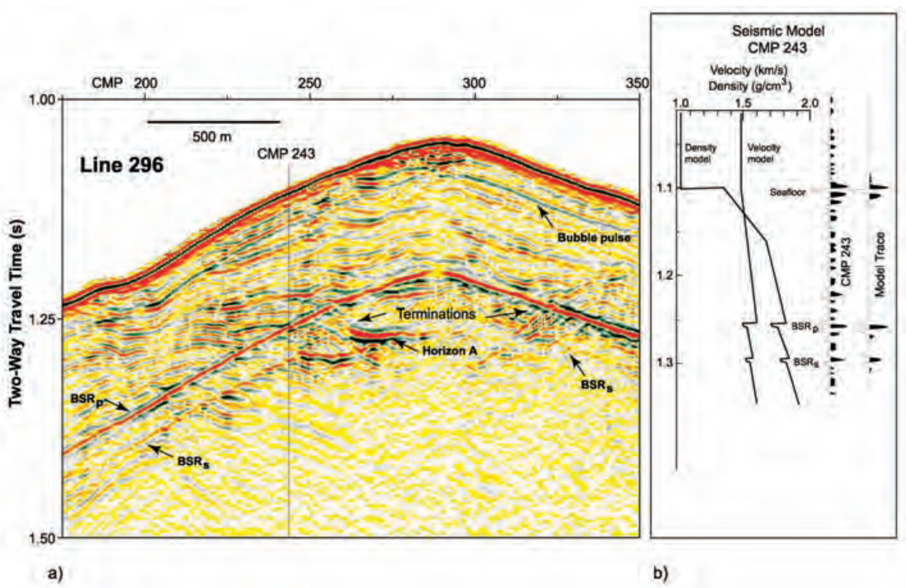
Early estimates of vast quantities of hydrates, based in part on the discovery of the BSR, proved to be way too high. "It was assumed that all the pore space from the seafloor down to the BSR was filled with hydrate," said Bangs. "We've since learned there are a lot of places where you get good strong BSRs and not much hydrate associated with them."

Interest in hydrate concentrations has renewed over the past several years, however, after researchers at the Institute and colleagues working through the Ocean Drilling Program discovered that hydrates typically form in fractures. "Places that have gas venting systems seem to be where hydrates have the highest concentrations," said Bangs, "and gas venting systems tend to fill vertical fractures."

Discovery of hydrates' vertical orientation "gives new life to the possibility there are more hydrates than we might have expected, more highly concentrated and placed in a way we did not appreciate before," said Bangs. "It also shows us where to look for them." Bangs' Institute colleague Matthew Hornbach was able to document the vertical orientation of hydrates off Blake Ridge in North Carolina.

Some of Bangs' own recent work on hydrates addressed a major environmental concern: that warming seas could melt gas hydrates leading to the release of massive quantities of methane into the oceans and possibly the atmosphere. In research at Hydrate Ridge off the coast of Oregon, Bangs found evidence of what he concluded was an earlier warming and release of methane from hydrate. The indicator was a double BSR—an upper BSR marking the current hydrate boundary and a lower one marking an earlier boundary. In a paper published in 2005 in the *Journal of Geophysical Research*, Bang showed that temperatures propagated upwards and causing the BSR to shift up. Hydrate melted and left behind a BSR signal that persisted for 5,000 years. Bangs believes it was related to the last glacial maximum and warming since then. The lingering BSR is slowly dissipating.

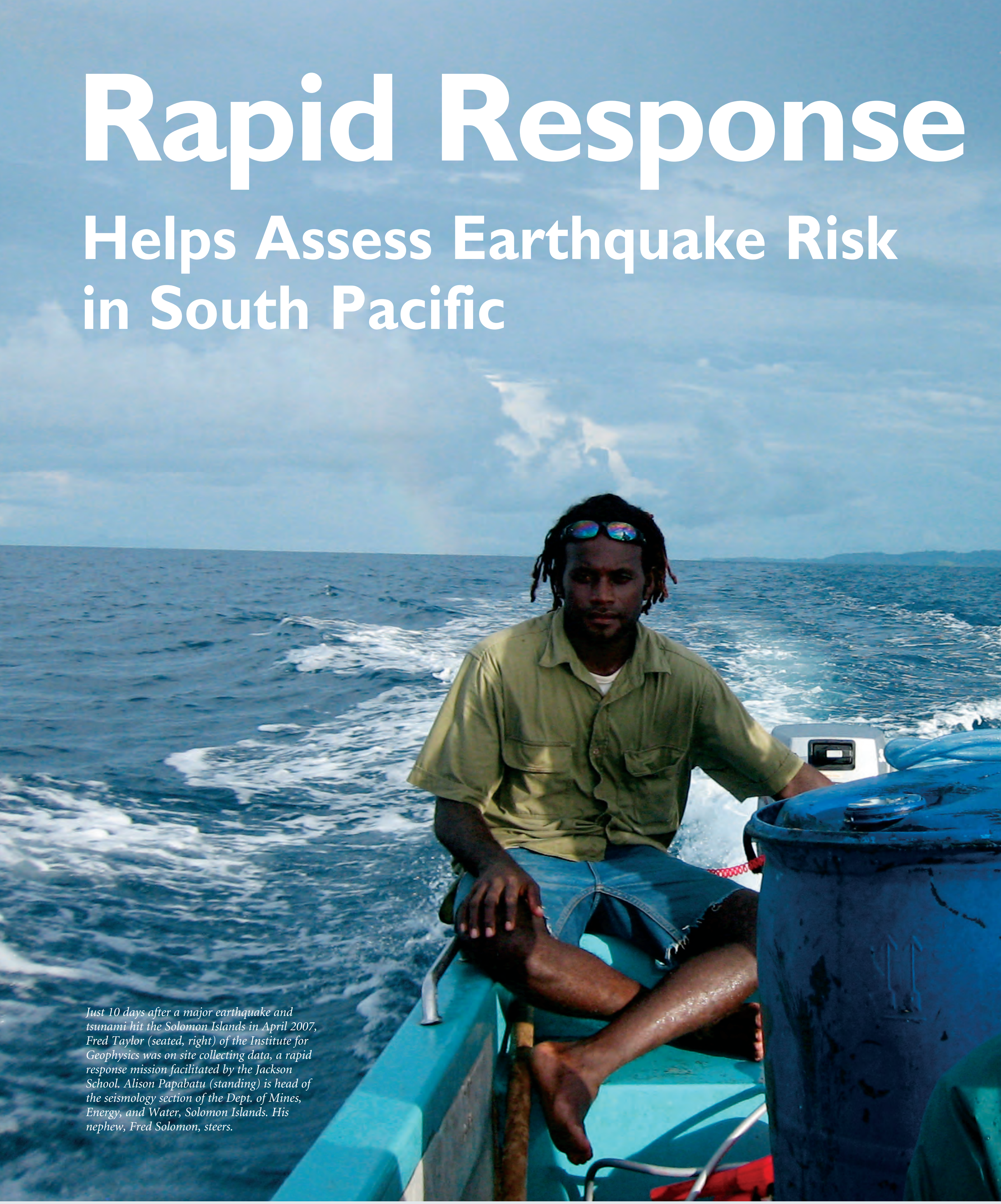
"That's a good indicator hydrate does not move very fast through the sediments in this setting," said Bangs. The incident is just one example, but in that example, at least, hydrate appears to have reconstituted higher up on the ocean floor rather than release massive quantities of methane.—*J.B. Bird*



The double BSR at Hydrate Ridge, figure originally published in the Journal of Geophysical Research, *"Upward shifts in the southern Hydrate Ridge gas hydrate stability zone following postglacial warming, offshore Oregon," by Nathan L. B. Bangs, Robert J. Musgrave, and Anne M. Tréhu. Bangs' findings suggest that following warming after the Last Glacial Maximum, hydrate reconstituted along the sea bottom at a higher level rather than vent through the oceans to the atmosphere. The paper attracted attention because of widely voiced concerns that warming oceans could belch quantities of methane gas, accelerating climate change.*

Rapid Response

Helps Assess Earthquake Risk in South Pacific



Just 10 days after a major earthquake and tsunami hit the Solomon Islands in April 2007, Fred Taylor (seated, right) of the Institute for Geophysics was on site collecting data, a rapid response mission facilitated by the Jackson School. Alison Papabatu (standing) is head of the seismology section of the Dept. of Mines, Energy, and Water, Solomon Islands. His nephew, Fred Solomon, steers.

Mission

by Marc Airhart

On Monday morning, April 2, 2007, residents of Gizo, a small fishing town in the Solomon Islands, were shaken by a massive earthquake originating 40 kilometers (25 miles) away beneath the seafloor.

"It started out slowly with slight shaking for maybe 10 or 15 seconds, then it kicked into full gear," said Danny Kennedy, a dive shop owner in Gizo and member of the local government. Kennedy's home overlooks the Coral Sea in the South Pacific Ocean.

"I was on the veranda with a cup of coffee in my hand, taking in the sea views, when our daughter Judith came running out of her room," he recalled. "I told her to stay in the doorway. It was hard to stand up. I held myself between two door jambs—Judith did the same. It never seemed to end."

When they finally looked around, everything was on the floor.

"We had a microwave that got pitched off the kitchen counter—it ripped the wires in two and left the plug in the wall," said Kennedy. "The microwave ended up four meters away. It was a violent event."

The U.S. Geological Survey later estimated it was a magnitude 8.1 quake, powerful enough to be classified as a "great earthquake," a phenomenon that only occurs somewhere in the world about once a year. This was the first large quake in the region of the Solomon Islands in recorded history, although there is geologic evidence of uplift suggesting a large earthquake might have struck about 300 years ago.

"I describe it as walking into a friend's house when he's just got a new surround sound system and puts on some music and he turns it to full volume," Kennedy said. "You feel it in your chest and your hair gets blown back. There's nothing you can do besides stand there and hope nothing crashes down on your head."

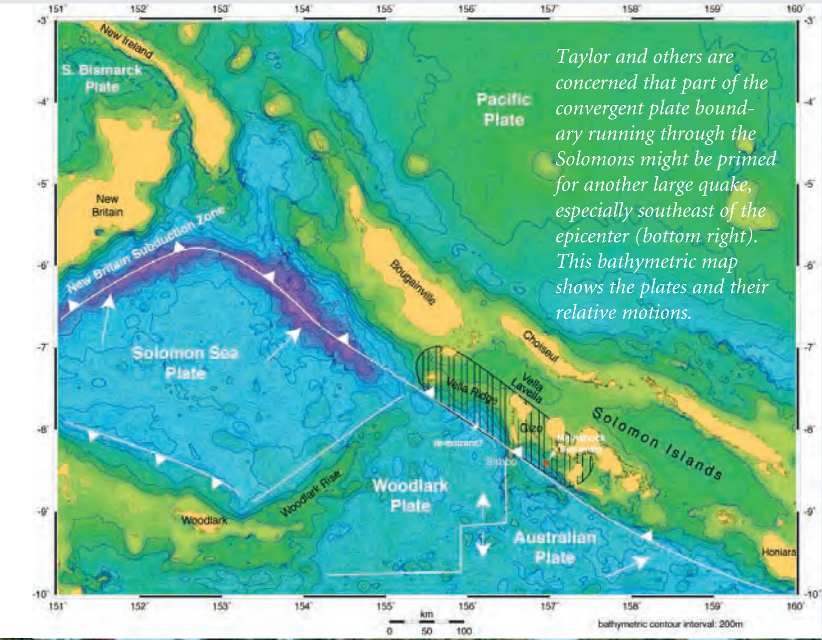
Then came the tsunami waves, in some places swelling four meters (13 feet) or higher. Tsunamis are caused by the rapid uplift or slumping of seafloor and the displacement of a proportionate amount of water. As the waves came crashing down on the coasts of these Pacific islands, traditional homes made of bamboo and palm were smashed.

According to official government reports, at least 52 people were killed and more than 6,000 displaced from their homes. Kennedy's dive shop was heavily damaged and much of the town of Gizo was destroyed. As they rebuild, many in the Solomon Islands now wonder if another great quake is imminent.

Rapid Response

Fred Taylor, a researcher at the Jackson School's Institute for Geophysics who has done geophysical field work in the Solomon Islands since 1986, recognized that amid the tragedy, there was an opportunity to conduct fundamental research that could help assess the threat of future quakes in the area. But he had to act fast.

Following a major earthquake, land that convulsed violently continues to move, albeit more subtly, for months. It was crucial that someone document how the land had moved right after the quake and then continue to track movement over time. Computer models could then help determine whether stresses underground in certain places were continuing to build or were slowly releasing. If the former was the case, it would show that the clock on the next seismic bomb had not been stopped but merely reset.



Taylor and others are concerned that part of the convergent plate boundary running through the Solomons might be primed for another large quake, especially southeast of the epicenter (bottom right). This bathymetric map shows the plates and their relative motions.

Following the earthquake, a tsunami flooded the small fishing village of Gizo, destroying homes and businesses. Photo by Danny Kennedy.

Scientists typically spend weeks or months preparing applications for research grants from government agencies or foundations. Then they wait several more months for the applications to be reviewed. Few, if any, organizations are prepared to decide on a few day's notice to fund a rapid response project.

"The National Science Foundation can not hand you thousands of dollars in a couple of days," said Taylor. "They just aren't geared to do it."

Thanks to the leadership of the Jackson School, Taylor's request was approved within a week. He left for the Solomons just 10 days after the earthquake.

"The trip wouldn't have happened without the Jackson School's support," said Taylor. "We are extremely grateful for that."

As part of its new strategic plan released in the spring of 2007, the Jackson School lays out the vision for building a rapid response capability (see sidebar). Taylor says three things are still needed to make it a reality: a stockpile of dedicated equipment such as GPS instruments, new staff members who have expertise in GPS data collection and analysis, and a streamlined system for receiving the necessary funds.

Taylor borrowed GPS instruments from UNAVCO, a consortium of research institutions including The University of Texas at Austin that supports earth science research involving the measurement of deformation. Abel Brown, a graduate student from Ohio State University helped set up the instruments and collect data. Mike Bevis, another colleague from Ohio State, helped with the GPS processing and analysis. A postdoctoral researcher from the California Institute of Technology, Rich Briggs, also came along for two weeks to help take measurements.

"We were lucky to get instruments from UNAVCO," said Taylor. "For rapid response, we need a few of our own instruments."

While funds were approved for Taylor's trip, handling the actual cash flow between approval and disbursement was a challenge. Taylor highlighted this as an area where improvement is necessary if a large public institution like The University of Texas at Austin seeks to enable rapid response teams.

Fortunately, Taylor already had GPS readings of the elevation and horizontal position of different spots around the Solomons before the earthquake. He and a graduate student, David Phillips (now with UNAVCO), had even left behind seven benchmarks, metal posts driven into solid rock, which he could go back to. At the time of this interview, he and his team were still evaluating the new GPS data and comparing it to earlier measurements.

So far, corals growing adjacent to the islands have provided the best picture of what happened during the earthquake. Each species of coral has a specific level with respect to sea level above which it can not live, which is known as the highest level of survival (HLS). When they are displaced vertically, coral either die back to a certain lower level or start growing higher to compensate. By measuring the change in the shallowest HLS of coral of a given species, Taylor determines

JSG Strategic Plan Calls for Building Up Rapid Response Research Capability

Taylor's trip to the Solomon Islands exemplified an area of research targeted by the Jackson School's new strategic plan, the development of a strong rapid response research capability.

As the plan notes, Earth's natural history is punctuated by important events such as major earthquakes, volcanic eruptions, hurricanes, and floods, which have tremendous environmental and societal impact and often leave a profound mark on the geological record. Such events may be more important to the evolution of Earth's systems than the slow and steady background processes. As a community, however, geoscientists are hamstrung in their ability to make critical, time-sensitive observations regarding such major transient events. The research is expensive, and generally geoscientists must write proposals to obtain funding for field work after an event has taken place. As a result, notes the plan, "a new paradigm is required to enable rapid collection of data when the urgency is greatest."

The JSG can develop the capability to respond rapidly to important transient events to document their effects, install instrumentation, and conduct geophysical surveys to examine their causes and development over time. The school is focusing on building rapid-response teams for the following three types of events:

1. Earthquakes/tsunamis/volcanoes, landslides and mudflows
2. Glacial surges/retreats/ice-shelf collapses
3. Hurricanes/flooding/ground water events.

For more information see the plan online at www.jsg.utexas.edu/strategicplan or contact the school to request a copy, 512-472-6048, communications@jsg.utexas.edu.

The earthquake uplifted this coral head 0.5m. Green algae is now growing on the surface as coral polyps above the water die. Alison Papabatu, head of the seismology section of the Department of Mines, Energy, and Water, Solomon Islands, stands atop the coral.

how far the seafloor has uplifted or subsided. This is known as coral geodesy.

The corals showed that in some places the earthquake had lifted the land as much as three meters. Other places had subsided. Where and how much the land shifted has provided some clues about what happened underground and what might happen in the future.

On the Other Hand

Based on the GPS and coral observations, Taylor and colleagues concluded that the rupture zone ran about 275 kilometers along the boundary of the Pacific Plate where it meets the Australian Plate and the Woodlark Plate. The land northeast of the rupture (on the Pacific Plate) was uplifted from Rendova Island up through Gizo and Ranongga toward Bougainville. The rupture zone did not extend southeastward beneath Rendova and Tetepare Islands. The land along this part of the plate boundary actually subsided.

Holding his two hands out next to each other, palms down with fingers straight, Taylor demonstrated what this part of Earth's crust experienced before and during the quakes. His fingers slowly curled down demonstrating how the front edge of the Pacific Plate had been dragged down as other plates were diving, or subducting, beneath it. What his rapid response work showed is that during the massive April quake, one hand sprang back up, releasing its stress, while the other remained curled downward.

So what is that other hand doing?

"This could denote increased stress on this part of the convergent plate boundary which potentially increases the likelihood of a future earthquake on the interplate thrust fault underlying Rendova and Tetepare," the team wrote in an unpublished preliminary report. "It also is possible that a seismic slip occurred beneath Rendova and Tetepare Islands and may have relieved stress and delayed the time of a future earthquake. Our GPS measurements on Rendova may reveal whether stress was relieved or if it increased following the 2 April 2007 event. We will report on this as soon as possible."

Now back from his initial six week rapid response trip, Taylor hopes to return in the next few months to continue observing how the land shifts over time. In addition to GPS receivers, he'd like to bring with him instruments he didn't have last time: seismometers.

"The seismometers would have cost a lot more than GPS receivers and been harder to get on short notice," said Taylor.

In 2005, he and several colleagues applied to the National Science Foundation (NSF) to install eight seismometers in the Solomons and record seismic activity for a year, but that proposal was rejected. Had it been approved, the instruments would have been operating at the time of the April earthquake.

"Most proposals are not funded on the first try and so it was with this one," said Taylor. "It is bad luck for us, but I would say that if we were not funded, then our proposal did not make as compelling a case as needed and it is up to us to do better. However, the Jackson School and Dean Eric Barron gave us an opportunity to get in there quickly and gather some critical data that will strongly underpin a new proposal to the NSF."

Matt Hornbach, a research associate at the Institute for Geophysics, has created a computer model that shows how tsunami waves propagate. Using the topography of the sea floor around the Solomons, the magnitude and location of the April earthquake, and the amount of sea floor uplift and subsidence, the model successfully reproduced the general characteristics of the tsunami that struck Gizo and other locations. It might help Taylor and others predict which coastal areas are most vulnerable to future large quakes along this plate boundary.

Taylor said a better understanding of the paleo-earthquake history of the region could improve predictions of future earthquake risks.

"We know from previous work that Rendova and Tetepare have undergone episodic uplifts of one to three meters each that may have been accompanied by tsunamis," the team reported, citing evidence in the form of emerged coral reefs and blocks of coral that appeared to have been thrown onto Tetepare by large waves. Ranongga also experienced large and rapid uplifts in the past.

"Such events are certain to happen in the future," the report continued. "However, the question is whether such future events are in the distant or the near future. At this point we simply do not know."✷

Ringside Seat

For 20 years, Taylor has done fundamental research in the Solomons, an island arc in the famous Pacific Ring of Fire. The islands trace the underwater boundary where the Pacific Plate, slowly advancing to the southwest, forces three smaller, generally northeast-moving plates down below it, in a process known as subduction. Until recently, Taylor was drawn more by the unique geology and geophysics of the location than the current earthquake risk.

He has tried to better understand how topographic features on the subducting plates, such as ridges and sea mounts, cause the sea floor and island arc to deform. To picture it, imagine you're lying in bed, watching your feet slide around under the sheets. Why do the sheets look the way they do? What can you tell about the feet by just seeing their effect on the sheets?

Taylor has attempted to understand how and why the interactions of topographic features with the Pacific Plate generate earthquakes. Using fossil coral and other geologic evidence, he showed that there have been a series of uplift events in the area over the past two thousand years that were most likely caused by earthquakes, at least one of which was apparently accompanied by tsunamis.

For Taylor, one of the big selling points for this location is its accessibility.

"There's something very unusual about this place that you'd have land next to the trench," he said, referring to the convergent boundary where tectonic plates meet. "Normally this would be underwater. Instead, it's shallow and uplifted," he said, because the sea floor being subducted is young, hot, and buoyant.

"You can get out there in places that are normally underwater and make measurements and observations," he added.

The area is also unique because the plates that converge here are "tightly coupled," in other words, they are locked together right up to the seabed. According to Taylor, it's much more common for convergent plates to be stuck together 10 kilometers below the sea floor and deeper.

Now that a great earthquake has struck the Solomons and questions remain about the possibility of another big one, Taylor's choice of research sites seems even more pertinent.

PHOTO: ©IAN AUSTIN/AURORA/GETTY IMAGES

Tomography Helps Decipher Great North American Jigsaw Puzzle

BY JOSHUA ZAFFOS

The American West is something of a seismic puzzle, and researchers are trying to figure out how the pieces got their shapes and what the picture on the box looks like.

"The western U.S. is interesting because it's divided into distinct provinces each with different topography and tectonic behavior," says Stephen Grand, Carleton Professor of Geophysics at the Jackson School of Geosciences, "yet one-hundred million years ago, all of these provinces were near sea level."

The five provinces—the Great Plains, the Rocky Mountains, the Colorado Plateau, the Rio Grande Rift, and the Basin and Range—now offer great contrast with plenty of seismic activity, volcanoes, and faulting. But such chaos has occurred away from tectonic-plate boundaries, where most seismic activity happens, adding to the questions about this geological jigsaw puzzle.

Using seismic imaging, or tomography, Grand has studied the deep structural differences between the provinces. The process is

Dawn strikes Fiftymile Mountain in Utah on the western edge of the Colorado Plateau. Here on the edge, the plateau is "sort of under attack from the west," says Rick Aster. Stephen Grand's research with Aster and colleagues suggests a close relationship between the subsurface stirrings of the planet's mantle and the warping and resulting erosion of plateau regions over time.

VISION

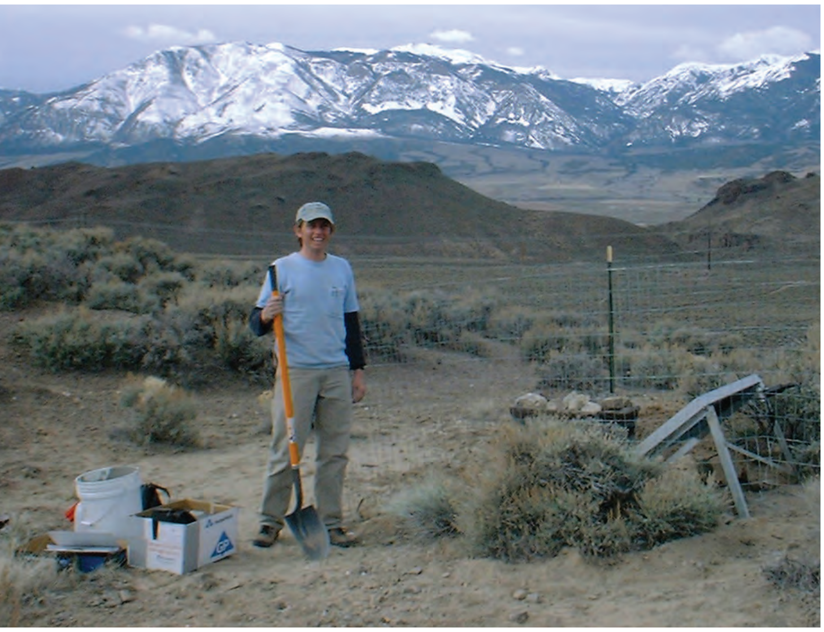
analogous to taking X-rays of the Earth's crust and mantle, and has enabled Grand to learn much about mantle structure and behavior. With a focus on the confluence of the West's tectonic provinces, Grand and other researchers have been able to answer long-standing questions—and raise a few new ones—about relations between subsurface activity and surface geology, regionally and globally.

"Every time someone goes and does imaging below the western U.S., it seems like we're finding surprises," says Gene Humphreys, University of Oregon professor of geophysics. "Until Steve came along, people didn't think the western U.S. was different from anywhere else."

A Western Profile

The western puzzle pieces began taking their current shapes and dimensions about 100 million years ago with the shallow subduction of the Farallon Plate beneath the North American Plate. The collision produced volcanoes, which formed the Sierra Nevada of California at the plate boundary. Beneath the North American Plate, the shallow interaction uplifted the Rocky Mountains, beginning around 75 million years ago.

But an abrupt change occurred beginning about 30 million years ago—"a flip-flop of plate tectonics," says Rick Aster, professor of geophysics at the New Mexico Institute of Mining and Technology, who teamed with Grand and others on the tomography project. The region stopped compressing, as the formation of the San Andreas fault system cut off the Farallon plate's trailing edge, and began extending. Hot mantle upwelling behind the foundering Farallon plate spurred an enormous outbreak of volcanism across much of what is now the southwestern United States. The extension process formed the Rio Grande Rift beneath Colorado and New Mexico, the broad Basin and Range of southern Arizona and westernmost Texas, and the Great Basin of Utah and Nevada, and it continues today. The effects of the flip-flop became a key focus of the seismic imaging project of Grand, Aster, and other colleagues.



Christopher Sine, M.S. '07, at station LARISTRA 64 in Utah. Sine worked with Grand on the project while earning his degree at the Jackson School.

To generate a panoramic tomography of the American West, the group set up a transect of seismometers, known as LA RISTRA, stretching from Texas to Utah through the Four Corners area. A shorter second line later extended the profile into Nevada, giving an unprecedented view of the seismic structure and activity across 1,400 kilometers of the West. This tomographic model is inspiring similar and even larger projects on continents around the globe.

Beginning in July 1999, Grand and the other researchers placed 70 passive broadband seismometers across the Southwest. (The National Science Foundation provided support and its collection of instruments.) The team left the seismometers, spaced 18 kilometers apart, for nearly two years until May 2001. During that period, the instruments measured and recorded all the P-waves and S-waves above a magnitude-5 tremor that traveled through the mantle and lithosphere.

Seismic imaging is conceptually similar to medical X-rays in the way it creates a detailed, cross-sectional picture. Grand and other scientists compare the work to taking a CAT scan of the Earth. Geologists even use mathematical algorithms similar to those used by medical researchers to make images.

"It's like X-ray vision," Aster says. "It's really revolutionizing the way we understand how the lithosphere, mantle, and crust interact."

The advance in tomography has followed a significant increase in the capabilities of seismometers in the last decade, Grand says. Just as CAT scans have allowed doctors to assess the inner workings of our brains and bodies, seismologists can now consider the deep mantle and its stirrings—which is among Grand's professional passions—when studying surface geology. The instrumentation of LA RISTRA makes the resulting seismic profile "the best in the region" says Grand, because of its detail and resolution.

At the eastern end of the profile, the scientists confirmed that the lithosphere has remained thick under the Great Plains and then thins out along the Rio Grande Rift. That was no revelation, since rifts usually stretch the lithosphere, but the group did find one of its major surprises along this section of the line: a "blob" of fast-sinking, cool material that is seen as deep as 600 kilometers beneath the surface. Centered under the town of Artesia, New Mexico, near the edge of the plains and the rift zone, the discrete feature could partly explain the high elevation at the western edge of the Rio Grande Rift and some of its volcanic activity.

Grand believes the mass may be the result of edge-driven convection, where a current is created as cold material sinks off the bottom of the edge of cold lithosphere and hot material wells up from the mantle to replace it. The team left the seismometers, spaced 18 kilometers apart, for nearly two years. During that period, the instruments measured and recorded all P-waves and S-waves above a magnitude 5 tremor that traveled through the mantle and lithosphere.

Other seismologists have questioned whether the blob is "an artifact of the imaging," says Humphreys of the University of Oregon. But the feature—he calls it a "drip," or, technically, "convective instability"—does help explain the ongoing seismic and volcanic activity, and Humphreys is inclined to agree with Grand's conclusions.

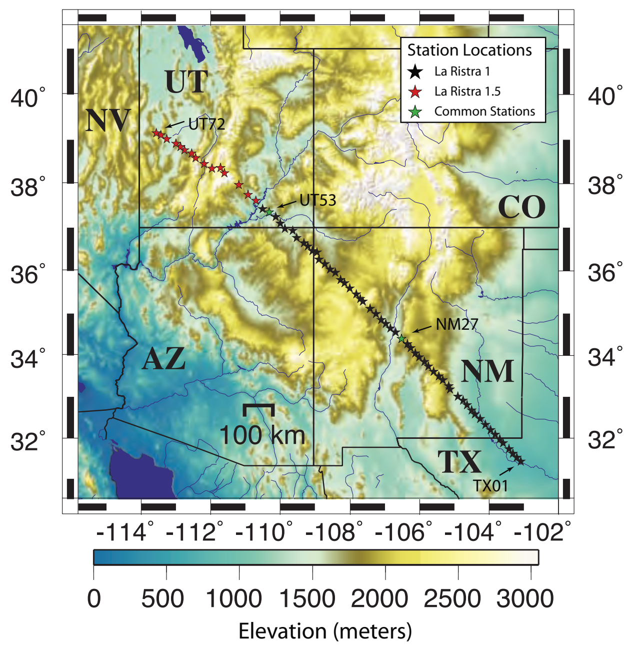
While the Rio Grande zone has split open, the neighboring Colorado Plateau has remained intact. Research has shown that other high plateaus around the world, specifically Tibet and the Andean Altiplano of South America, have gained elevation due to a thick crust. But the tomography from LA RISTRA shows that the Colorado Plateau's height is not due to a very thick crust, but a consequence of a heated and less dense mantle and the very slow-moving velocity of the mantle.

"People had speculated on this, but I think our results were definitive," Grand says of the findings.

"Steve was probably the first guy who actually defined what the seismic velocity structure is beneath the western U.S., and to recognize there was something unusual happening there," says Humphreys.

More unusual happenings were discovered along the edges of the Colorado Plateau and the Basin and Range provinces, which led Grand and his colleagues to create LA RISTRA 1.5, the follow-up profile extending further west. The group used 18 seismometers to collect data for two years, from June 2004 to May 2006, to add to the original results.

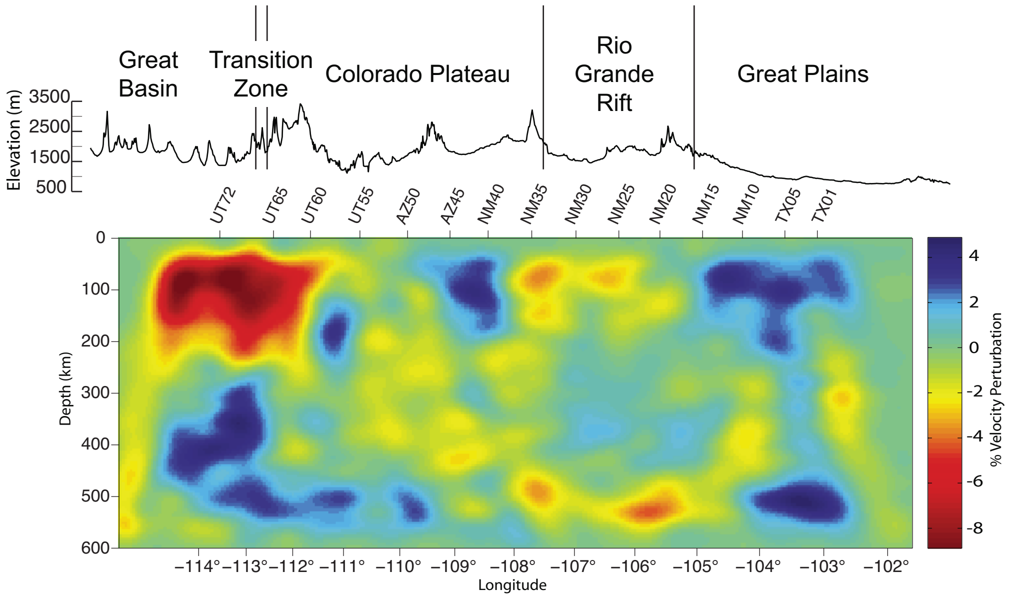
In the original profile, the researchers recognized a sharp contrast between the provinces' crusts. The extended transect allowed them to gain insight about the structure of the lithosphere and deep mantle beneath the Basin and Range region.



Map showing array of seismometers for LARISTRA 1.0 and 1.5.

The plateau is "sort of under attack from the west," says Aster of New Mexico Tech. Convection at the seam of the provinces is warping the edges of the Colorado Plateau. The seismic profile and record of volcanism suggest the mantle beneath the Great Basin, powered by upwelling, is eating away at its neighboring province, and the tomography from the study suggests a close relationship between the subsurface stirrings of the planet's mantle and the warping and resulting erosion of plateau regions over time.

"One of the key things we are discovering," Aster says, "[is that] the deep parts of the Earth, down to at least several hundred kilometers, are coupled with the shallow parts of the Earth in fascinating ways."



Lateral variations in mantle velocity down to 600 km beneath the Colorado Plateau and adjacent regions along a 2D approximately SE/NW line. The sharp velocity contrasts at the edges of the plateau are coincident with the change in stability from the plateau to its surroundings.

"It's just that we don't know much about the deep mantle," adds Grand. "We're creating new questions, but I also think we answered other questions. What excites me most are the unexpected observations."

The Tomography of Tomorrow

Grand hasn't solved all the mysteries of the western seismic puzzle yet, but his work in tomography has made him a pioneer in a pioneering science.

"He's one of the most widely known, widely respected people in seismology," Humphreys says of Grand, adding that his legacy is tied to global research as well as the findings derived from his tomography of the American West. Grand has spent years addressing fundamental issues about mantle structure, composition, and convection, which has made him a leader in the field and led him to his ongoing pursuits.

Projects like LA RISTRA have contributed to the creation of EarthScope, the major national initiative to create the first-ever, three-dimensional tomographic profile of the entire country (see sidebar).

"[Earthscope] is going to make a data set available that is unprecedented," Grand says.

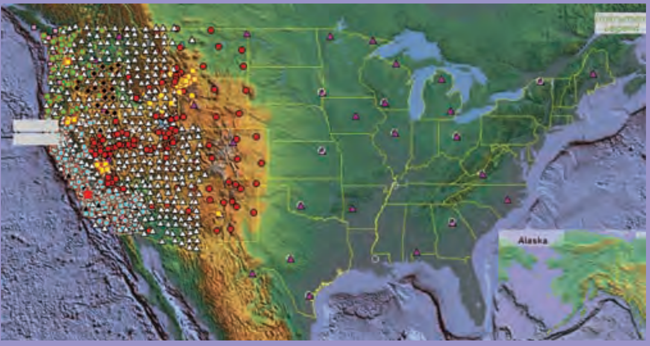
Teaming with Jay Pulliam, a research scientist jointly appointed to the Jackson School's Department of Geological Sciences and Institute for Geophysics, Grand plans to study whether edge-driven convection is responsible for the cool blob at the edge of the Rio Grande Rift. That study could contribute more insight about the causes of tectonic activity separate from plate tectonics. He is also working on a tomographic study of subduction in Mexico and a massive study, three or four times larger in area than LA RISTRA, in China.

Within the next ten or so years, through advances in tomography and instrumentation, Grand predicts he will be able to gain even more detail in his research of the deep mantle. He hopes imaging will allow scientists to get a better understanding of the mantle's physical properties and how mantle processes further impact surface geology.

"I believe in the next decade or two," says Grand, "we'll understand the operating forces in many of these regions." ✷

EarthScope Heading for Texas

LA RISTRA and other wide-scale deployments of seismic arrays paved the way for EarthScope, the national plan to make the first 3D tomographic profile of the entire country. The USArray component of EarthScope is a continental-scale seismic observatory designed to provide a foundation for studies of lithosphere and deep Earth structure over a range of scales. Scientists are placing a combination of permanent and portable seismographs across the continental U.S. A transportable array of broadband seismometers is being deployed in a uniform, rolling, 70-km grid. Within this low resolution survey, scientists are deploying a flexible array of broadband stations, short period stations, and active-source stations for focused, high resolution studies. Deployment began in California. Widespread deployment will reach Texas by 2009. Educators can get a jump on how to use EarthScope data at the annual Conference for the Advancement of Science Teachers in Austin, Nov. 15-17, 2007.



Edge of the Desert

Water Research Aims for Global Sustainability

PHOTO: JACK DYKINGA, USDA

By Lisa M. Pinsker

Ian Duncan grew up on the edge of the desert. As a child in New South Wales, Australia, years would pass without rain, Duncan recalls. His family had to rely on artesian water—hot and salty groundwater—until rain would fall and collect in a tank on the roof of his family's house. Growing up in this environment, Duncan gained an appreciation for water that would inspire his future career as an environmental scientist.

Now associate director for earth and environmental systems at the Jackson School of Geosciences' Bureau of Economic Geology, Duncan maintains a global view of water resources from his office in Austin, Texas. He sums up future water challenges in one word: sustainability.

Duncan is part of a growing cadre of researchers at The University of Texas at Austin who focus on the science, technology, and policy that will ensure future water supplies. Water and water resource sustainability is a particular focus of the Jackson School, where most of the researchers work.

Bridget Scanlon, a senior scientist at the Jackson School's Bureau of Economic Geology, works on agricultural water use and its relation to land use. With global population expected to grow from 6 billion to 9 billion by 2050, water demand is going to continue to grow, placing more strain on an already-stressed resource, Scanlon says.

Population growth is already leaving its water mark on Texas, points out David Maidment, director of the university's Center for Research in Water Resources. When he moved to Texas in 1980, the population there was 14 million; it is now 24 million. "We added 10 million people on a fixed water resource, and inevitably we are slowly evolving to a greater degree of vulnerability to shortages in water supply," Maidment says.

Fortunately for the university's water researchers, Texas is at the forefront of studying the types of water challenges that plague communities worldwide, says J.P. Nicot, a research associate at the Bureau. A combination of factors makes it an ideal place to study water resources. Texas is a semi-arid region like much of the world's population centers, and it has long-term hydrologic, agricultural, and other data to inform current studies of the water system. "There is no other state I know of that has so many models of their aquifers and such a good database for samples that would help you calibrate the models," Nicot says.

"Any type of irrigated agriculture is basically not sustainable." —*Bridget Scanlon*

Water is a resource so interconnected not only with earth systems but also with society that its management needs to be interdisciplinary, says Jay Banner, director of the university's Environmental Science Institute and a professor at the Jackson School. Maidment, Scanlon, Duncan, Nicot, and Banner (see sidebar), along with Jackson School colleagues like Jack Sharp, current president of the Geological Society of America, all bring different areas of expertise to the table to address water sustainability in the coming decades. Their work forms an interdisciplinary framework for thinking about the growing water demand.

Water for Models

What Maidment fears most, he says, is a drought—not just any drought, but a "drought of record," like the decade-long drought Central Texas experienced from the late 1940s through the late 1950s. It is the drought by which scientists now measure all droughts in Texas, Duncan says. River levels dropped dramatically; streams dried up. "If ever that happened again here, the degree of concern and disruption to the life of Texas would be quite profound," Maidment says.

Maidment has seen the effects of such a drought firsthand, not in 1950s Texas but halfway around the world in present-day Australia during a visit in November 2006. An extensive drought in Australia is causing nationwide despair, he says, with entire towns running out of water. Duncan's mother lives in East Australia, where her town is down to just having a few percent of water in the reservoir.

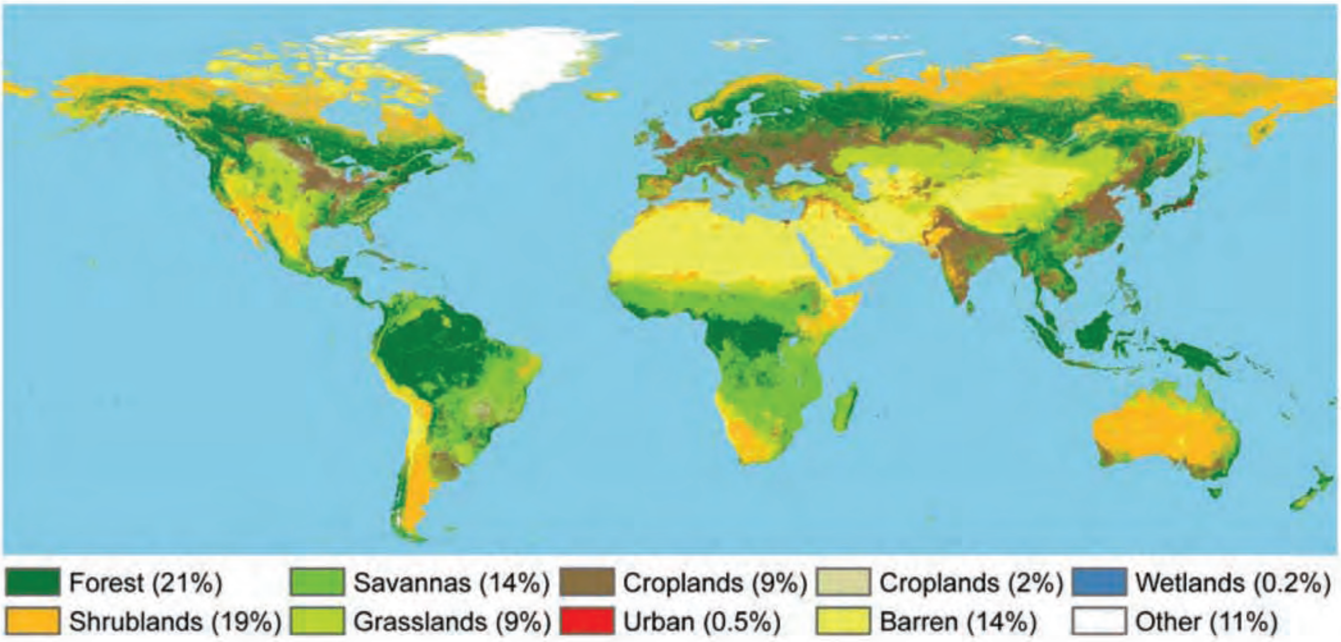
Maidment also saw similar despair in Corpus Christi in 1984, when a major drought resulted in the city having only 300 days left of water supply. "So they faced the prospect that in 1985, the city of Corpus Christi would have no water and that caused a large panic which led to a loss of confidence in the leadership of the city and to a lack of confidence in the level of technical advice they were receiving," Maidment says.

Scanlon

The city would recover, but seeing the effects of the drought on Corpus Christi gave Maidment a mission: to help make sure that a community's citizenry is as informed as possible about its own water supply. For the past 20 years, he has been working toward that by building digital maps of Texas' surface and groundwater resources. Surface water comes from streams, rivers, and lakes, while groundwater comes from underground natural reservoirs of water called aquifers.

In the late 1990s, the state's leadership, including then Governor George W. Bush, started asking questions about the state's water supply, basic questions, Maidment says, such as: How much water does Texas have? How much does the state need? Scientists and policymakers were not able to address these questions adequately, leading to the state senate passing legislation in 1997 that required that Texas digitize all its water maps and get a handle on water management.

How will the world handle increased croplands? Global cropland for food production is projected to expand this decade, primarily in sub-Saharan Africa and South America. Scanlon's research shows that if the new cropland is primarily irrigated, it will stress water supplies and water quality, whereas rain-fed croplands could enhance recharge. Map prepared by Boston University (Earth Observing System Data Gateway) based on MODIS satellite data. "Cropland (2%)" refers to cropland/natural vegetation mosaic.



SALTWATER GOES FRESH IN EL PASO

On Aug. 8, 2007, the largest inland desalination plant in the world opened in El Paso, Texas. Expected to provide 27.5 million gallons of freshwater to the growing population of El Paso, the Kay Bailey Hutchison Desalination Plant represents a burgeoning trend in the water community: desalinating salty, previously unusable, groundwater in response to a dwindling supply of freshwater. Although desalination will bring some relief to the water supply, it does pose a host of scientific challenges that geoscientists must examine more closely.

Generally, desalination takes place in coastal regions, where a plentiful supply of seawater is the source. In land-locked El Paso, however, the source is slightly salty, or "brackish," groundwater from the Hueco Bolson aquifer. The aquifer is virtually tapped out of freshwater due to excessive groundwater pumping, but the brackish water remains, says J.P. Nicot, a research associate at the Jackson School's Bureau of Economic Geology.

"When you picture an aquifer, especially in the Gulf Coast area, it's kind of slanted on a plane," Nicot says. "When you are close to the surface, recharge occurs with freshwater and then further down it starts getting brackish and gets more and more brackish until you reach the point of saline seawater."

In the last 20 years of pumping of freshwater at the Hueco Bolson, brackish water had begun creeping up, causing several wells to shut down. Now, El Paso is trying to capitalize on that previously undesired brackish water in its desalination efforts. And other cities are following suit — San Antonio and Lubbock are also developing similar desalination schemes.

Nicot is pushing the cities and the state, however, to tread carefully. Because the freshwater and brackish water are collocated in the aquifer, efforts to pump brackish water need to avoid impacting the freshwater section of the aquifer where surface water over time will slowly replenish the source.

In general, scientists need to try to better understand what happens "in the long term when you start pumping brackish water," Nicot says. "It's not like freshwater, which is easily recharged through precipitation all the time." As desalination plants pump for deeper and deeper brackish water, they will also have to deal with increasing salinity — which eventually can cause the price of desalination to skyrocket; the cost of desalination is proportionate to the level of salinity in the brackish water.

Another consideration, Nicot says, is disposal of the waste from desalination plants. "You take the brackish water out and you end up with freshwater on one side, but on the other side you also have what we call the concentrate, and you have to get rid of it," he says. For coastal desalination facilities, that brine concentrate can go back into the ocean, but for a larger inland plant, such as the one in El Paso, the only option is deep well injection. The El Paso plant will be reinjecting the salty brine deep into the ground, several thousand feet. Geoscientists will need to study the long-term effects of such deep well injection, Nicot says.

Currently, Texas has 35 public water supply desalination plants, but the El Paso and San Antonio plants alone will double the desalination capacity of the state. Desalination will continue to be an attractive option in Texas, as it is becoming more cost-effective and giving policymakers more control over their resource, Nicot says, than, for example, a water transfer from another region. As desalination expands in Texas and worldwide, Nicot just hopes that science will have a strong voice in policy-making. —*LMP*

PHOTO: ©PETER ESSICK/GETTY IMAGES

Construction of a desalination plant in Tampa Bay, Fla. The pre stage filters are being installed which use sand to filter out particulates before the salt is removed.

That was when Maidment was able to step in with his geographic information systems (GIS) and hydrology expertise. He and Ralph Wurbs at Texas A&M University had been leading research for years on surface and groundwater mapping and modeling. Now, 10 years after the legislation passed, the GIS products are finally coming out—helping to tell policy-makers and citizens alike where their water resources are located and how much they have. "We now have water availability models, and a letter has been sent to every water permit holder in the state explaining how secure their water availability is in the event of a drought," Maidment says.

But Maidment's work is not stopping there. He is working with CUASHI (Consortium of Universities for the Advancement of Hydrologic Science), an NSF-funded organization of university researchers, to make water maps and models even more accessible to the public. He wants to expand on methods used elsewhere in the country to help Texas further manage its water resources, hoping to eventually have a water availability map as easy to use as Travelocity, for example, he says.

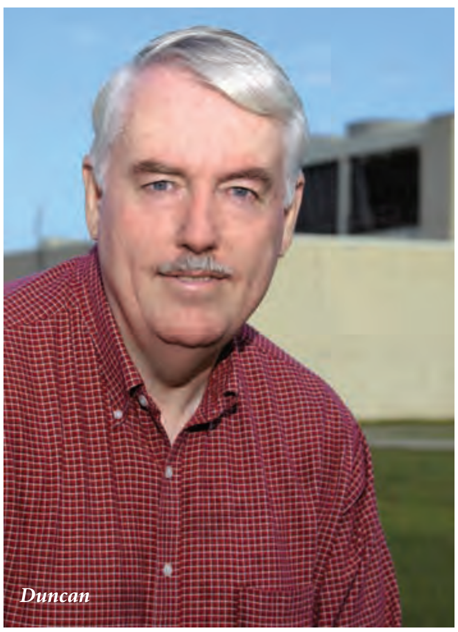
All of this work, Maidment says, will hopefully, at a minimum, mitigate the political and social ramifications of a drought. "What we owe to our citizens is that they should feel their universities and their state are on top of the problem and are conveying the magnitude of the issues."

Water for Food

When Bridget Scanlon thinks of water, she thinks of food and how vital water is to the production of agricultural crops. She initially became interested in water because of her interest in helping to feed the poor of Africa. She has not made it to Africa yet, but she is making great strides in understanding the processes at work there through her research in Texas.

For Scanlon, agriculture is the elephant in the room when it comes to discussions of water demand: Globally, agriculture consumes 90 percent of freshwater resources. "We need to get a handle on the water used in food production in order to manage water resources effectively," Scanlon says.

And Scanlon's work has been aiming to do just that. She and her colleagues have been looking at the impacts of land use on water in the Texas High Plains, which is one of the largest agricultural areas in the United States. Her work covers a lot of ground, from looking at various agricultural practices to examining flow patterns in the High Plains aquifer, which covers parts of South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas.


Duncan

Most recently, Scanlon published a paper in the journal Water Resources Research about the effects of converting natural rangeland to cropland. Some of what her research group found was surprising, for example that converting from grasslands to cropland actually increases how quickly groundwater can be replenished in the aquifer. Converting to agriculture in many parts of the world, including Australia and Africa, as well as Texas, has thus caused groundwater levels to rise. Scientists previously had not recognized such a positive benefit of agriculture, Scanlon says.

> "In order to be able to solve these water problems, we can't just do one type of water science. We need to have as broad a perspective as possible."—*Jay Banner*

Perhaps the biggest consideration for agricultural practices, however, is irrigation. "Any type of irrigated agriculture is basically not sustainable," she says. For example, even in the High Plains, where irrigated agriculture occupies only 11 percent of the land surface, it greatly depletes groundwater resources. From 1950 to 2003, the average groundwater level declined throughout the High Plains about 4 meters, and the average decline was as high as 12 meters in the Texas section of the High Plains. Irrigation is basically mining the resource, using it faster than it can be replenished.

Solving the problem of irrigation is complex, however, as deficit irrigation results in salinization of soil. When crops use water, they leave salts behind. With enough watering through irrigation, the salts get flushed out, but relying only on rainfall, the soils became inundated with salt.

The solution, Scanlon suggests, is rotating between rain-fed and irrigated agriculture, where "you let the water levels rise to a certain extent, then you have a period of irrigation, and then you move back to nonirrigated rain-fed agriculture." Other options people are considering include rainwater harvesting and planting crops more in season with natural climate variability.

Despite these challenges, however, Scanlon remains optimistic. "For agricultural water management, there's a lot we can do," she says. "Even changing tillage, you can really change the water cycles in that system." Scanlon continues to work toward understanding the various impacts people can have on agricultural water management, and hopes to eventually transfer what she has learned in Texas all the way to Africa.

Water for Energy

Agriculture accounts for more freshwater consumption than any other human activity—90 percent of all freshwater humans consume globally and 80 percent in the United States. Energy consumes less, because water used for energy is often returned to the water system, and yet energy is the largest withdrawer of freshwater in the United States, accounting for nearly half of all freshwater withdrawals.

"Every time we leave a light on in the room, we're using electricity and that electricity uses water," Duncan says. This less-publicized use of water is a major challenge to sustainability. The same population pressures that could push the water demand to extremes in the next 25 to 50 years will also create greater energy demands.

To better understand this important issue, Duncan has just received a grant from the Texas Water Development Board. He wants to find some more sustainable, viable options for electricity generation that use less water.

The majority of electricity in the United States comes from thermoelectric power. Power plants either burn coal or use uranium fission to boil water and make steam that turns a turbine and creates electricity. "We end up having to use water not just in the steam but also to condense the steam, and cool the steam down," Duncan says. The lakes of water right next to power plants are the sources of water being tied up to cool the steam. Although much water is returned to the lakes after its use in the plants—hence not contributing to higher consumption numbers—that water is not being used for drinking or growing crops, Duncan says.

One alternative to this water-heavy process is to use air, not water, to cool the water being used as steam in the power plants, Duncan says. Using technology similar to what is found in a typical air conditioner, such a system could save large amounts of water—using 5 to 7 percent less water than traditional thermoelectric plants.

One problem with air-cooling is that it works better in cold, dry areas than warm, moist areas. Duncan thus is going to be calculating which parts of Texas would benefit from dry cooling and whether that could be implemented to free up water resources for other demands.

Another solution involves desalination, says J.P. Nicot. San Antonio, El Paso and Lubbock are all moving toward desalinating slightly salty groundwater to address their rising water demands and dwindling freshwater supply (see sidebar). Ironically, Duncan says, desalination uses quite a lot of electric power, which of course uses more water. Such a route, he says, is likely not sustainable in the long term.

J.P. Nicot, however, says that one solution would be to collocate desalination plants with energy plants. That way, the water being used to cool the steam for thermoelectric power generation could then be desalinated and used for other purposes, such as drinking water and agriculture. Regions of the Middle East already employ such a technique—building power plants close to desalination plants so that the water can serve dual-use.

TOURING ANCIENT AQUIFERS

Although the water supply is a decidedly modern topic, the study of water, like all environmental issues, can benefit from a geological perspective. Deep in the caves of Texas lies a valuable repository of water data—the history of water pathways through ancient aquifers. These data are important to studying past climate changes, as well as to understanding modern-day water resources.

Speleothems, better known as stalactites and stalagmites, provide a record of how the composition of water infiltrating a cave has changed over time. "Basically, these are deposits of the mineral calcite that form from waters dripping into the cave," says Jay Banner, director of the Environmental Science Institute at the University of Texas at Austin and a professor at the Jackson School of Geosciences.

Banner and his colleagues have been precisely dating the layers of growth on these formations, and then inferring from their composition how water flow patterns have changed over time. They can then use independent climate records from the same period of time to examine how aquifers have been responding to local, regional and global climatic shifts.

This information can inform both water and climate models. "If we're going to be able to predict the future, we need to have this baseline established of what things were like in the past and in particular before humans perturbed the landscape and our environment," Banner says.

In Texas, Banner is specifically looking at 10,000 to 80,000 year old speleothem formations in the Edwards aquifer, an intricate network of underground caves and passages in Central Texas. The goal is to understand how global ice age events were affecting local climate and the water flow into the caves. He is also looking at formations from the past 10,000 years, to home in on how humans may have impacted the ancient water systems. *—LMP*

Water for Living

In addition to the many water demand challenges, including agricultural and energy consumption, society will continue to face challenges related to finding enough clean water. Particularly in developing countries, water quality is a bigger issue than water quantity, but the issues are intimately connected, says Jay Banner.

Society needs to be prepared to deal with water issues in an integrated way. "We're going to need more crops to feed more people; we're going to need more places for people to live; the cities will grow outward and continue to sprawl and change the way landscapes look and the way we use landscapes," Banner says.

As scientists strive to understand the various impacts of the way people use water, they will continue to inform policy decisions from the local level on up. Banner is thus focusing on training the next generation of environmental scientists at the Jackson School—hoping to instill in them the interdisciplinary nature of the studies that Scanlon, Duncan, Nicot, Maidment, and others undertake. "In order to be able to solve these water problems, we can't just do one type of water science," he says. "We need to have as broad a perspective as possible."

But it is not only scientists and policymakers who can make a difference when it comes to changing the global water picture. Changes in diet and personal practices can have dramatic impacts on water resources. Changing from a nonvegetarian diet to a vegetarian diet could save up to thousands of liters of water consumption per day per person, points out Scanlon, because of the quantities of water required for livestock. After changing agricultural practices, "the way that we could probably save the most water is through changing our individual habits," says Duncan, such as turning off the faucet while brushing teeth, using low-flush toilets, and planting trees that use less water.

In Duncan's mother's drought-devastated Australia, people conserve water out of habit in small and large ways that may surprise Texans and others. "My mother does things like if she turns the hot water on and it's cold initially, she puts a bucket under there and she collects all the water and she uses that for other purposes," Duncan says. "There are a lot of things we can do as individuals to conserve water." ✷

Deep Science:

Depths of Zacatón Offer Window on Life in Space

In late May 2007, a NASA-funded robot successfully navigated what is believed to be the world's deepest sinkhole, el Cenote Zacatón (the Zacatón sinkhole), part of the Sistema Zacatón, a network of underwater caves in north-eastern Mexico. The dive attracted widespread international media attention, partly for the raw achievement of probing Zacatón's depths, but also because the expedition could be a prelude to exploring Jupiter's moon Europa, believed to contain a liquid water ocean.

One of the driving forces behind the intensely collaborative mission—in many ways its instigator—was Marcus Gary, a doctoral candidate in hydrogeology at the Jackson School. Gary and advisor John M. (Jack) Sharp, Carlton Professor of Geology at the Jackson School, have led the hydrogeological mapping of Zacatón. Gary also coordinated the complex logistics for the Mexican field trips. But his connection to the project goes deeper than these key roles.

A vertical cave about 100 meters (328 feet) wide and more than 300 meters (1,000 feet) deep, Zacatón has been called an "upside down Mount Everest." It could easily swallow New York's Chrysler Building. No one has ever reached the bottom, so until recently, it's true depth was unknown.

Two scuba divers attempted to reach the bottom in April 1994. In the process, Jim Bowden set the record for the world's deepest scuba dive by descending to 925 feet (282 meters). His good friend and deep diving mentor Sheck Exley died making the same attempt. The tragic outcome caused Bowden and others, including Gary, a former diving guide at Zacatón, to rethink the way they explore the cave system. Curiosity about Zacatón also inspired Gary to become a hydrogeologist.

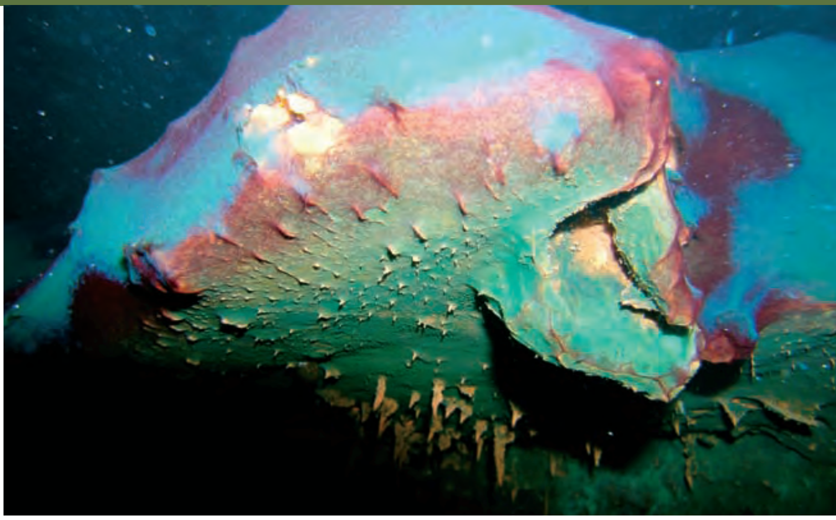
At a barbecue in Austin a few years ago, Gary asked Bill Stone, a world famous cave diver and engineer, if it would be possible to build a robot to explore the Mexican cave system. The data a robot could collect about the internal structures of the sinkholes and environmental parameters in the water, Gary reasoned, would help hydrogeologists understand how the sinkholes form and evolve over time.

For Stone, the project sounded like a great way to develop robotic technologies that might one day be useful in the search for life in space. NASA thought so too and funded the three-year, $5 million DEPTHX (Deep Phreatic Thermal Explorer) mission.

For NASA, the long-term target is Jupiter's ice-covered moon Europa, which

Dispatches from Zacatón

by Marc Airhart



Bacterial mats in La Pilita, one of the sinkholes in the Zacatón complex. The complex holds a diversity of microbial life. In photic zones of the deepest sinkholes, where water is anoxic and sulfurous, a purple biofilm coats the walls.

appears to harbor a vast salt water ocean with the potential to support life. As a stepping stone toward such a mission, NASA is funding an expedition to Antarctica's Lake Bonney in late 2008 using the technology from the DEPTHX robot.

DEPTHX was built during 2006 at Stone Aerospace. Preliminary dives took place at the Applied Research Laboratory at The University of Texas at Austin, and under outdoor conditions at the Quarries, a swimming hole owned by Austin's Hyde Park Baptist Church.

One of the distinctive qualities of the 3,300-pound, computerized, underwater vehicle is that it makes its own decisions. With more than 100 sensors, 36 onboard computers, and 16 thrusters and actuators, DEPTHX decides where to swim, which samples to collect, and how to get home, based on maps that the probe draws during each dive.

By February 2007, team members from The University of Texas at Austin, Carnegie Mellon University, Southwest Research Institute, Colorado School of Mines, and Stone Aerospace were ready to head to Mexico to continue testing DEPTHX, the world's only semi-autonomous cave diving robot.

Jackson School science writer Marc Airhart joined the scientists in March and May 2007 and reported on his experiences live from the field for the Houston Chronicle's SciGuy blog and Geology.com. Excerpts from his May dispatches follow. His complete "Dispatches from Zacatón" can be found on the Jackson School Web site.

It's May now and I'm heading back to Mexico for the finale of the DEPTHX mission. The scientists returned to Zacatón a few days ahead of me and are already hard at work.

This time around, DEPTHX will dive three times deeper than it has ever gone before to explore the depths of Zacatón, where no human has ventured. What might it find? New forms of life? Hydrothermal vents like those in Yellowstone or deep on the sea floor? Side caves that connect Zacatón to other caves and sinkholes? Lost Aztec gold?

Okay, that last one isn't considered likely. But you never know!

Marcus Gary first came to Zacatón in the early 1990s as a scuba diver. He assisted Jim Bowden in his attempt at breaking the world's deepest scuba dive record in 1994. The unique environment enchanted the young diver and inspired him to pursue a career in geology. For over 10 years, he has studied the system and is now on the verge of completing his doctorate in geology. The DEPTHX project will help cap off his dissertation on Zacatón.

The Bottom of Zacatón

When I arrived at Rancho La Azufrosa (the private ranch that encompasses Sistema

DEPTHX's engineers adapted a simple Logitech video game controller for remote steering of the probe.

Antonio Fregoso (left) from the Universidad del Noreste and Marcus Gary (right) with DEPTHX at Rancho La Azufrosa, adjacent to Cenote Zacatón.

Zacatón) last night, the DEPTHX team was wrapping up a very successful day. The robot had just made the first ever map of the bottom of Zacatón using its sonar sensors. Finally, a picture of the mysterious depths that eluded two divers 13 years ago was coming into focus.

As it turns out, the bottom of Zacatón is sloped, starting at about 290 meters at its shallowest, sloping down to well over 300 meters. The exact depth is a little uncertain because where the floor should meet the vertical wall, there is a 15 meter high indentation which the sonar sensors didn't penetrate.

Is it just a little bowl shaped alcove? Is it the entrance to a hidden passage? If so, where does it lead? Could the sinkhole actually be connected to much deeper chambers? The researchers are now interested in sending the robot back to explore this anomalous area.

Ironically, Jim Bowden, when he dove to 282 meters in 1994, was achingly close to the bottom. Had he dove just a few meters deeper, he would have stood on a muddy, sloping floor. His dive lights would surely have allowed him to see the ground around his feet.

Because of the carefully choreographed dance that was required to make the world's deepest scuba dive, there wouldn't have been time to linger and conduct any scientific investigations. After dropping nearly 1,000 feet in just 11 minutes, he had to immediately begin a several hour return to the surface. Tanks were strategically positioned along a safety line to provide him with the appropriate mixture of oxygen, nitrogen and helium to avoid the painful and potentially deadly bends.

The Hits Keep on Coming

In the last couple of days, the robot did more than just reveal the bottom of Zacatón. This morning, it used its "sample arm" to take samples of the rock wall from three points—at 115, 195, and 270 meters depth. John Spear will take these back to his lab in Colorado and use DNA analysis to identify the microbes in them. This kind of work has already revealed nine new classes of microbe (to add to the hundred or so known classes) and expect the total to rise to about 20 when the final analyses are completed in a few months. It was possible to collect those samples because of the hard work of engineers at Southwest Research Institute who designed the robot's sample arm and other scientific instruments.

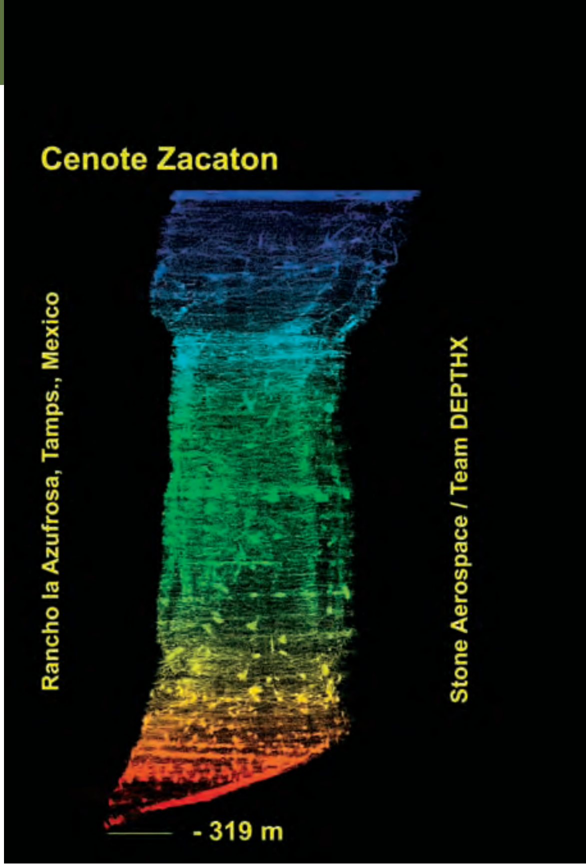
The robot also successfully demonstrated so-called SLAM (Simultaneous Localization and Mapping) technology in three dimensions. In other words, it's the first robot with the ability to simultaneously create maps of unexplored places and use the maps to determine where it is in the world, not just in two dimensions, but in every direction. The robotics and software experts at Carnegie Mellon University have truly pushed the envelope in robotic mapping and navigation.

The team ran into some technical difficulties around the middle of the day today and had to postpone further investigations. They hope to be back at it tomorrow.

Not All Caves are Created Equal

While the technical difficulties were being resolved, we took a field trip to Caverna Cuarteles, a large dry cave a short walk from the ranch.

Bats flitted above our heads and spider-like insects hid from the beams of our headlamps as we moved from room to room admiring the rocky daggers, veins, and curtains decorating the ceiling. Here and there, massive tree roots thrust down through the rock seeking water.



The May 2007 expedition determined el Cenote Zacatón's ultimate depth at 319 meters, confirming it as the deepest known sinkhole on Earth.

It was once thought that all caves formed when slightly acidic water on the surface seeped down and dissolved rock, carving out majestic halls, underwater rivers, and shafts. You can think of this as the top down theory.

There are also other ways to make caves, as scientists have been learning over the past 30 years. There is also a bottom up process.

According to Marcus Gary, these caves (such as Cuarteles) and sinkholes (such as Zacatón) began to form during the Pleistocene as a result of volcanic activity from below. This view differs from the classical theory of cave formation and also hypotheses about the formation of other large caves in this part of Mexico.

Volcanism turned deep water slightly acidic by adding dissolved carbon dioxide and hydrogen sulfide. This water slowly nibbled away at the limestone above, creating porous karst. This is referred to as "hypogenic karstification." From time to time, overlying rock collapsed into hollow chambers below, creating deep shafts.

If his interpretation is correct, Sistema Zacatón has more in common with Mammoth Hot Springs in Yellowstone than with other deep sinkholes in this same region of Mexico.

Photo by Erich Schlegel

Put a Lid On It

There's a sequel to the geologic story of Sistema Zacatón's formation. Some of the sinkholes appear to be in the process of closing up at the top as crusts of travertine (a form of calcium carbonate) form at their surfaces. It's a bit like the skin on a can of paint that has been left open in the sun. For the paint, it might take a day or two. In this case, the process probably takes thousands of years. It is basically the sinkhole's way of taking a bunch of dissolved rock floating in the water and recycling it to form new rock at the surface.

At least one sinkhole (Poza Seca) appears to have closed up entirely, sealing off an underwater lake, possibly with unusual life forms.

If such life forms exist, they're likely to be bacteria that can live without oxygen and sunlight. And assuming the lake has been sealed off from the outside world for thousands and thousands of years, they might have evolved to be different from anything scientists have ever discovered and characterized before.

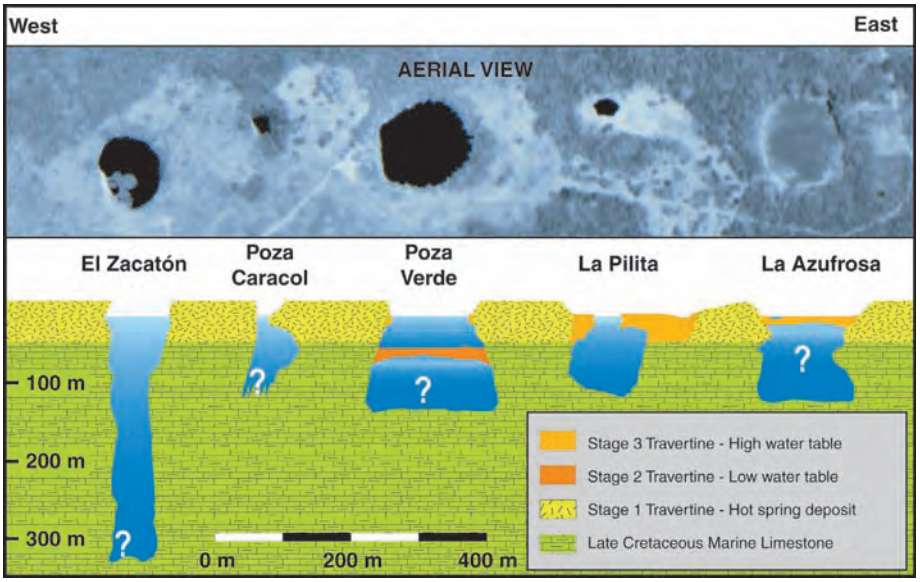
In the summer of 2006, Marcus Gary conducted experiments at Poza Seca to try to determine the size and shape of the underwater lake. Walking across the flat, dry surface of travertine "felt like walking on the head of a drum," recalled Gary.

The researchers took electrical resistivity measurements to create an image of the subsurface. The research revealed a thin travertine cap two to four meters (six to twelve feet) thick. Beneath that lies a watery lake at least 25 meters (80 feet) deep.

Today, Marcus took a group of us out to stand on Poza Seca to explain the travertine story. He said he would like to study the water below its lid, but is concerned that such research might contaminate it with microbes from above. He envisioned someday drilling a small hole through the travertine to send instruments or perhaps even a small robot to study the environment and bring back samples. But he said a lot of thought and care should go into any such investigation.

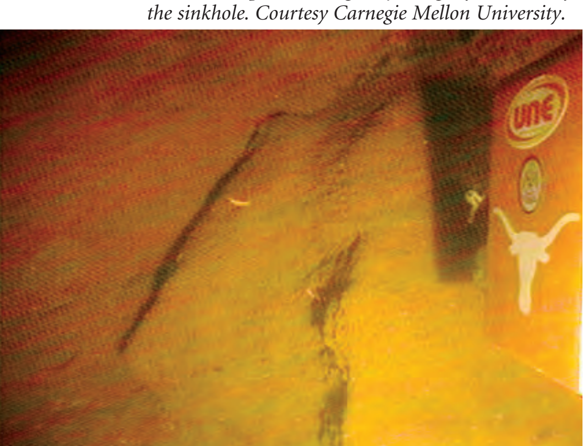
On the way to Poza Seca, Marcus pointed out a set of fossil mammoth teeth protruding from the trail. The teeth were so well preserved that you could run your hand along them and feel the serrations. Some of the smaller rows even resembled human teeth. You could imagine an upside down skull buried in the ground with the upper teeth exposed and the lower jaw missing. Scattered all about were fossil tusks and hip bones and who knows what else. Marcus hopes to entice a paleontologist to explore this apparent fossil bone bed.

Clearly, even after the DEPTHX team packs up and heads home in a few days, there will remain enough mysteries to keep Gary and others busy for a long time.



Cross section of the five cenotes in Sistema Zacatón showing their relative formations and depths, before the final depth of Zacatón was ascertained. Courtesy of Marcus Gary.

DEPTHX captured this grainy image of the walls of the sinkhole. Courtesy Carnegie Mellon University.



The Last Hoorah

Ask any scientist who does international field research and you'll find that delays and unforeseen technical issues are the norm. DEPTHX was no different. The good news is that after a few days out of the water, the team was finally able to send the robot back into Zacatón.

In the last three frenzied days of the mission, the robot returned to the bottom of Zacatón to investigate a mysterious feature in the deepest corner. It turned out to be only an alcove, not the entrance to some exotic new tunnel. I asked Marcus Gary if he was disappointed.

"No," he replied zen-like. "That's science. It just is what it is."

In a way, Marcus seems relieved the project is over. There was a deluge of media interest while the scientists were working. Reporters and photographers from Reuters, Discovery Channel, Astrobiology, and Mexican newspapers and television news stations all visited the ranch. There were high school and university students, local officials, and townspeople also vying for a glimpse of the robot in action. Marcus acknowledged the importance of getting the word out about his research, but in the future hopes to have the media visit the site at the end of the project, when most of the science is done.

The mere fact that the robot mostly did what it was intended to do is something of an engineering miracle. As Bill Stone, owner of Stone Aerospace (the company that designed and fabricated the robot) and principal investigator for DEPTHX, pointed out, all of this was achieved for only $5 million. That might sound like a lot, but he said a large firm such as Lockheed Martin would have a hard time pulling off such a project for under $50 million. He credited the team's success to being small, multidisciplinary, independent, and flexible.

The DEPTHX project has ended, but in some ways, this is just the beginning. Next year, a revamped version of the robot will go to Antarctica to explore Lake Bonney, an even closer analog to the ice-covered ocean of Europa.

Eventually, we may have the technology we need as a species to send a robot out into space to help answer one of the biggest questions scientists have ever tackled: Are we alone in the universe?✷

Crystal Ball

SCIENTISTS RACE TO FORETELL WEST ANTARCTICA'S UNCLEAR FUTURE

BY MARC AIRHART Polar ice experts once thought Antarctica's ice sheets were mostly immune to climate change. Research findings of the past decade have started to melt away their confidence.

Satellites have revealed that the ice sheets are thinning and their glacial slide into the sea is speeding up. Ice cores show that at times in the geologic past, Antarctica was ice free. Complicating matters, the West Antarctic Ice Sheet (WAIS), a mass of ice the size of Texas storing enough water to raise global sea level by 5 meters (about 17 feet), is resting on rock below sea level.

"Not just a bit below sea level, it's 2,000 meters below sea level," said David Vaughan, a principal investigator with the British Antarctic Survey. "If there was no ice sheet there, this would be deep ocean, deep like the middle of the Atlantic."

Some scientists have theorized that this makes the WAIS inherently unstable. If the ice sheet retreats beyond a certain point, a positive feedback mechanism should, they say, lead to runaway retreat that would not stop until most of the ice sheet disappears.

The recent series of reports from the Intergovernmental Panel on Climate Change (IPCC) did not include such bold predictions for the possible loss of Antarctic ice. The IPCC's estimate was that Antarctic ice flow would continue at the same rate it did from 1993 to 2003, despite an observed acceleration since then.

The IPCC's restrained estimate about the ice flow, and its possible contribution to sea level rise, was not, however, a heartening sign. Rather, it reflected the consensus view that changes in the Antarctic have been so rapid, science can not yet account for them.

"Models used to date do not include . . . the full effects of changes in ice sheet flow, because a basis in published literature is lacking," stated the reports. "[U]nderstanding of these effects is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise."

The IPCC's mid-range projection is that seas will rise 44 centimeters (17 inches) by the year 2050. That would put 100 million people each year at risk from being displaced from their homes by coastal flooding. If the WAIS were to entirely melt—which most experts doubt will happen in our lifetimes—seas would rise ten times higher.

Will the WAIS sit on the global warming sidelines? Will it gradually drip away, speeding up the slow motion flooding of our coasts? Or will it collapse in front of our eyes? And when will scientists know for sure?

These questions inspired an international conference held at The University of Texas at Austin last March, co-sponsored by the U.K. Department of Food and Rural Affairs and the Jackson School of Geosciences. While not arriving at definitive answers, the participants in the West Antarctic Links to Sea-level Estimation (WALSE) Workshop developed a new hypothesis to explain recent observations of ice sheet thinning and charted a course for future research that might be incorporated into a new National Science Foundation polar research initiative.

PULLING THE PLUG?

Don Blankenship and Jack Holt, polar researchers at the Jackson School's Institute for Geophysics, are especially concerned about the Amundsen Sea Embayment, a vast block of ice that makes up one-third of the WAIS. Recent satellite observations show the embayment is the most rapidly changing portion of the WAIS. It's also thought to contribute as much to sea level rise as the entire Greenland Ice Sheet.

Blankenship and Holt led the American half of a joint project between the Institute for Geophysics and the British Antarctic Survey in 2004 to reveal what lies below the Amundsen Sea Embayment. Using airplanes with radar antennas strapped under the wings and logging tens of thousands of air miles in a couple of months, the two teams were able to create detailed topographic maps of the rocks and sediment that form the bed on which miles of ice sits. The researchers even identified lakes of liquid water which remain unfrozen due to the enormous pressures of the ice above.

One alarming result of that work was the discovery that part of the embayment known as Thwaites Glacier is not only experiencing accelerated thinning, but it also acts as a sort of plug in the bath tub.

Polar ice experts from the U.S. and U.K. met at UT Austin in March 2007 to draft a consensus statement about the future of the West Antarctic Ice Sheet (l to r): David Bromwich (BAS), David Vaughan (BAS) and Don Blankenship (UTIG).

"Thwaites Glacier has access to the rest of the ice sheet," said Blankenship. "So changes there can propagate to the interior and indeed we have an avenue for draining all of the ice from West Antarctica into the ocean via Thwaites Glacier."

The topography of the bed underneath doesn't provide any additional protection to hold the ice back.

"The bedrock goes very deep a long way inland and even provides a mechanism for ice to connect through from the other side of the ice divide," said Holt. "There's no big impediment there. This was somewhat of a surprise."

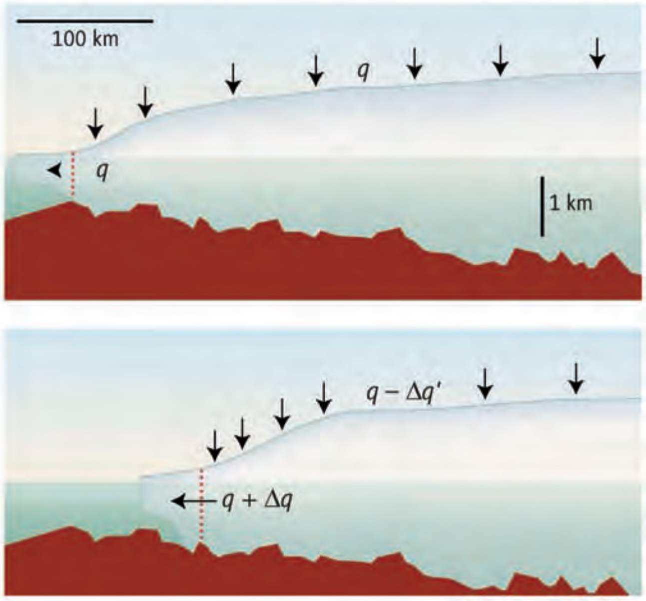
Scientists from the Institute for Geophysics and the British Antarctic Survey flew over the Amundsen Sea Embayment in 2004 with radar equipment to map the bed below the ice sheet.

IT CAME FROM THE DEEP

A lay person hearing that the melting of the West Antarctic Ice Sheet is speeding up might not be all that surprised given the routine nature over the past few years of news reports describing how the greenhouse effect is warming our atmosphere, speeding the arrival of spring, melting glaciers, and altering plant and animal ranges.

For Antarctica, the emerging picture is far more complex than the headlines. If the hypotheses of polar experts like Blankenship and Holt are correct, Antarctica might resemble less a block of ice liquefying in a sunny greenhouse than a cog in an intricate Rube Goldberg machine.

The surface of Antarctica is so cold and the ice so thick that raising the region's air temperature a few degrees is not enough to cause significant melting. Instead, scientists have long suspected that warm water in the Amundsen Sea is flowing up under ice shelves—platforms of floating ice attached to the grounded ice sheet—and melting them from below. This increased melting speeds the flow of grounded ice sheet into the water.



Concerns about stability. The ice sheet covering West Antarctica is the last great marine ice sheet. Its bed lies below sea level and slopes down inland from the coast. The profile shown is based on Thwaites Glacier, West Antarctica (11). In the top panel, the ice sheet is in equilibrium; influx from snowfall (q) is balanced by outflow. A small retreat (lower panel) will provoke changes in both the influx and the outflow. If these changes act to promote further retreat, the ice margin is unstable.

But it's unlikely these warmer waters result directly from recent climate change. By measuring oxygen content, oceanographers have discovered that the warm water welling up below the glaciers has not been near the sea surface in the past few centuries. In oceanographer's terms, the water is "old." It is part of a mass known as Circumpolar Deep Water connected to the North Atlantic through the globetrotting ocean conveyor belt. This water has been at depth for too long, scientists believe, for its temperature to reflect recent global warming.

Polar scientists meeting at the three-day WALSE Workshop knew that explaining this upwelling could go a long way towards predicting the future of the WAIS. Fortunately, the workshop brought together experts in atmosphere, oceans, and ice—all critical players in this story.

A NEW HYPOTHESIS

Adrian Jenkins, a polar researcher from the British Antarctic Survey and WALSE participant, developed a computer model that showed a possible solution.

Antarctica is encircled by atmospheric currents that largely insulate it from the rest of Earth's climate and keep it colder than it otherwise would be. Jenkins' model showed that these circumpolar currents, sometimes called "Westerlies," "the Screaming 50s," or "the Roaring 40s," actually push surface waters out away from the continent. This results from the Coriolis Force, the byproduct of Earth's rotation that causes cyclonic systems to turn counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. As surface water is pushed away, warm deep water rises to replace it.

If the atmospheric currents speed up, more water is pulled up. Indeed, observations indicate these atmospheric currents have sped up in recent decades in response to global warming. So increased upwelling seems likely.

There isn't enough observational data to validate this hypothesis yet. For one thing, sea ice makes it difficult to get there to do the work. Polar experts say repeated missions over several years are necessary to correlate wind speeds with the temperature structure of the water.

Blankenship said when the workshop began, fewer than five attendees suspected this link between atmosphere, ocean, and ice; by the end, all 25 agreed it was the most plausible explanation. He said each person was an expert in one, maybe two areas.

"But to say that atmospheric changes are causing the ocean changes that are causing ice sheet changes, that requires more self confidence than most of the people had," he said. "That could only happen by bringing together so many people with overlapping skill sets. The result was a surprise and a significant moment. We all agreed that was the most likely answer."

WHERE TO NOW?

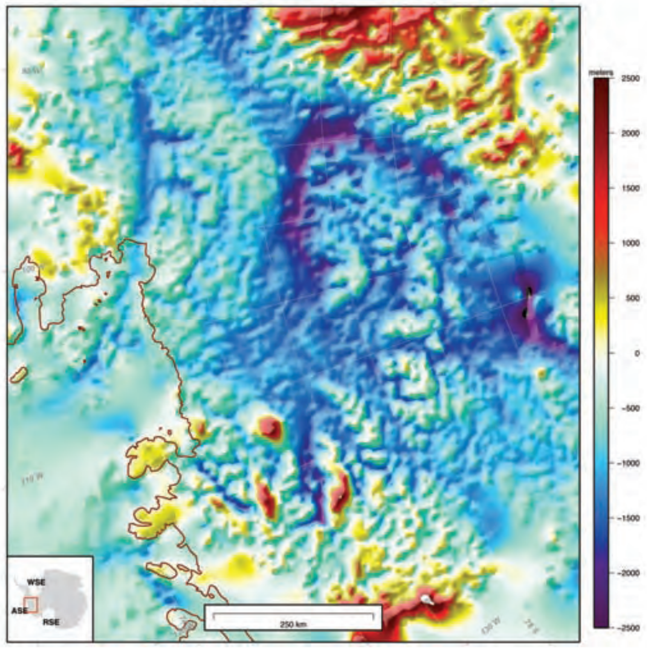
On the final day of the WALSE workshop, the attendees locked themselves in a conference room and hashed out a consensus statement including the state of knowledge in their field, the new hypothesis on the cause of upwelling, and a list of challenges that lie ahead in answering the outstanding questions.

In a draft article for EOS magazine, the participants wrote an ambitious to-do list for their community: collect baseline oceanographic data from the Amundsen Sea to begin charting changes that might relate to ice sheet melting; create a better history of deglaciation by dating marine sediment cores and rock exposure ages; create more realistic ice sheet models; couple climate models with ice sheet models; develop better tools for measuring ice sheet mass balance with satellites; and restore satellite capability that was lost in 2000 for measuring grounding-line retreat rates. (The grounding line is where an ice sheet goes afloat. Behind the line is grounded ice sheet, beyond that is floating ice shelf.)

The new IPCC reports on climate change had essentially sidestepped the issue of Antarctica's potential contribution to sea level rise. The authors pointed out, rightly, that there was just too much uncertainty to make predictions. The workshop participants were able to say, Okay, now what are we going to do about it?

Blankenship said the timing of the workshop was perfect.

Researchers were surprised to discover the depth and shape of the bed beneath the Amundsen Sea Embayment offers little protection for the ice. Like a plug in a bathtub, part of the embayment could act as an avenue for the entire West Antarctic Ice Sheet to drain to the sea. Topographic map produced in 2006 from data collected by a joint UT/UK airborne geophysical survey two years earlier.



"Two months later, we were sitting on the 12th floor of NSF presenting the WALSE conclusions to 30 polar scientists on what to do for the next decade in polar science," he said.

The National Science Foundation (NSF) had organized the meeting to start charting the course of a new interdisciplinary program called Antarctic Integrated and Systems Science. The program is part of the International Polar Year (2007-2008), a global campaign of polar research.

"There was no forum to work on problems that were that complex and interdisciplinary," said Blankenship. "And chances are, that will show up in next year's NSF budget. That's what WALSE did. That's what it was intended to do."

VULNERABILITY

Right now, 10 million people are displaced from their homes each year due to coastal flooding. If seas rise 44 centimeters by 2050 (a mid-range estimate of the IPCC), the ranks of the displaced would swell to 100 million people each year.

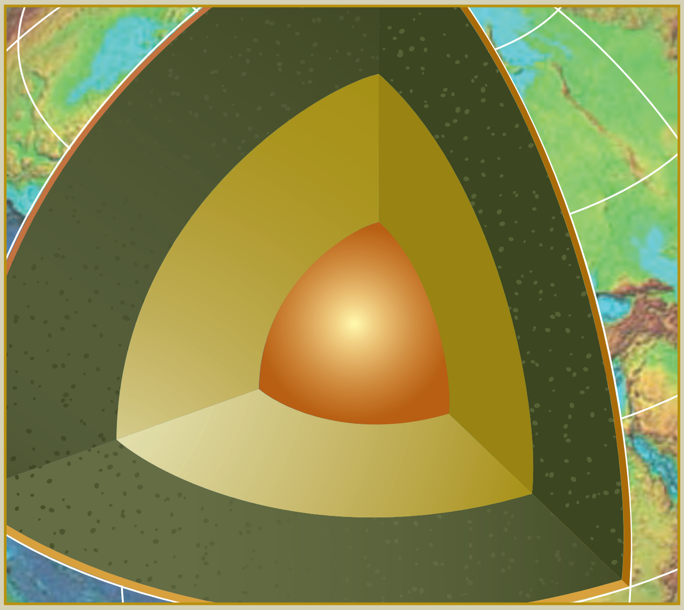
David Vaughan said there is reason to worry that Antarctic melting might boost sea level rise much higher than the IPCC's estimate. He pointed out that the West Antarctic Ice Sheet (WAIS) is resting on rock that's 2,000 meters below sea level. Some scientists have theorized that this makes the WAIS inherently unstable.

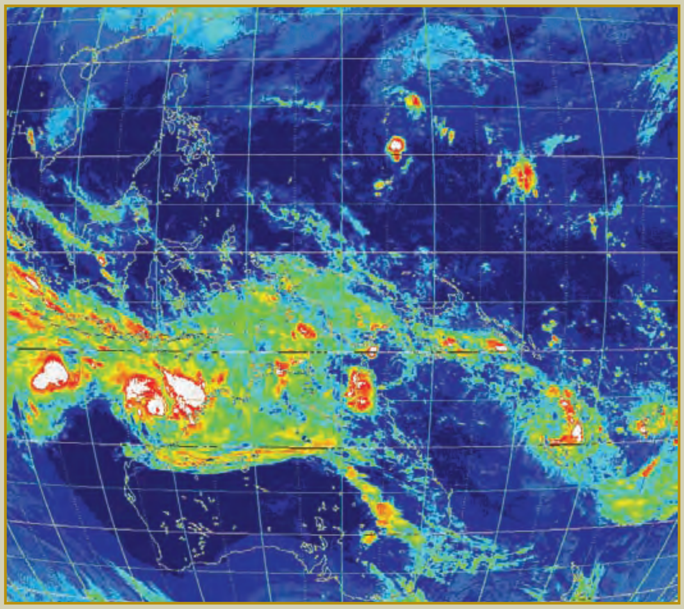
"We have this really very plausible theory that if you kick this part of the ice sheet hard enough—cause that instability to start feeding back on itself and a retreat to begin—then you could lose that whole area quickly," said Vaughan. "Now 'quickly' probably means centuries, but if you lose all of the West Antarctic Ice Sheet, you're talking about five meters of rising sea level and Cambridge, England, where I live, would be underwater."

"Five meters is an enormous amount of sea level rise and would do us untold damage," said Vaughan. "It's probably going to take thousands of years, but long before we get to that, coastal areas will start to see more frequent flooding and the big storms that happen every few years will just become that much more frequent."

For developed countries, sea level rise will be expensive, perhaps on the order of responding to several Hurricane Katrinas. The city of London is considering a costly redesign of the Thames Barrier, an enormous flood gate that closes a few times a year to protect citizens along the Thames River from storm surges. Vaughan said another meter of sea level rise would force officials to close the barrier 300 times a year.

Developing countries are the most vulnerable to sea level rise. "If you live in the developing world, everything about the developing world makes this worse," said Vaughan. "Imagine if you had to evacuate New Orleans not with cars and helicopters, but with rickshaws."



Changing the World of Geosciences

JACKSON SCHOOL LAUNCHES NEW STRATEGIC PLAN

When Eric Barron assumed the deanship of the Jackson School at a ceremony on August 31, 2007, he told the students, faculty, staff, and friends assembled in Boyd Auditorium that the first step toward "creating the single greatest geoscience program ever" would be to craft a new strategic plan, "one that is visionary (as opposed to stating mundane goals centered on statistics and percentages), one that engages and excites."

Six months later—short order for many organizations, especially a university—the Jackson School completed "Changing the World of Geosciences," the school's strategic plan for 2007-2010. The plan outlines four core themes for Jackson School leadership and seven areas where the school's units can pursue research that will expand the frontiers of the geosciences.

The plan strikes a balance between new and emerging areas and core aspects of the geosciences in which the Jackson School has always been strong.

"My philosophy on new directions is they have to come naturally from what you're doing and yet they must also reach for emerging ideas that are really important," said Barron. "You don't want to go too far," he explained, overextending into areas where research support may not yet exist, "but at the same time, you want to be cutting edge."

To achieve this balance, Barron started by asking the school's major units to complete new strategic plans. These plans, at a minimum, had to focus on the frontiers of research, the frontiers of education and student services, and measures to help achieve a cohesive college. The units presented the plans to a school-wide assembly and delivered them to a school-wide Strategic Planning Council chaired by Jim Farnsworth, president of Cobalt International Energy and at the time chairman-elect (now chairman) of the Jackson School's Advisory Council.

Members of the planning council, drawn equally from the Bureau of Economic Geology, Department of Geological Sciences, and Institute for Geophysics, worked first to identify research frontiers that involved interests of all of the units, where the school could build new and expanded areas of excellence.

The result was the selection of four research areas on which the school would focus the development of excellence: 1) Crust/Mantle/Core Dynamics, 2) Surface and Hydrologic Processes, 3) Energy, Environment, and Policy Research, and 4) Climate Systems Science. The council further identified three emerging research areas that cross-cut all of these disciplines and all of the school's units: Water and Water Resource Sustainability, Computational Geosciences, and Rapid Response Research.

With a series of personnel ads in major geoscience publications and the leading online job boards for science, the Jackson School began in April to focus on hiring top faculty and scientists in these areas and cross-cutting themes. The goal is to keep open ads for each major research area, recruiting outstanding scientists without focusing on narrowly defined research concentrations. As the strategic plan states: "Narrowly defined searches are less likely to capture truly emerging disciplines or individuals that are at the vanguard of new frontiers simply because the search seeks a defined area of expertise …. The Jackson School should always be positioned to seek the best and the brightest, regardless of specific discipline."

Next, the planning council focused on the frontiers of education and student services. The key element on this frontier is a commitment to the services that promote student success. The strategic plan calls for building a student center that includes:

Tutoring: "We want our students to take challenging classes, but we need to make sure they learn the material."

Math skills and writing skills: "These are critical for success. We can facilitate these skills through innovations like having a mathematician-in-residence and a writer-in-residence."

Advising: "We need to help students complete their degrees in a timely fashion."

Career placement: "We want to help our students launch meaningful careers."

At its heart, "Changing the World of Geosciences," like any good strategic plan, lays out a roadmap for seeking and allocating resources to ensure success. To this end, said Barron, "It's important to see the Jackson fund as an investment in the long-term success of the school and apply it to areas where we can't expect to get resources from other sources. A substantial portion of the funds outlined in the plan are to allow us to grow while maintaining our core areas."

Complete copies of the plan are available on the Jackson School Web site at www.jsg.utexas.edu/stratplan. To receive a free printed copy in the mail, call the Dean's Office at 512-471-6048 or e-mail communications@jsg.utexas.edu.

JACKSON SCHOOL STRATEGIC PLANNING COUNCIL

Chair: **Jim Farnsworth**, President, Cobalt International Energy

Vice Chair: **Martin Jackson**, Structural Geologist, Bureau of Economic Geology

Jay Banner, Professor, Department of Geological Sciences; Director, Environmental Science Institute

Don Blankenship, Research Scientist, Institute for Geophysics

Omar Ghattas, Professor, Department of Geological Sciences; Director, Center for Computational Geosciences

John Goff, Senior Research Scientist, Institute for Geophysics

Charles Jackson, Research Scientist, Institute for Geophysics

Steve Laubach, Structural Geologist, Bureau of Economic Geology

Sharon Mosher, Professor and Chair, Department of Geological Sciences

Lesli Wood, Clastic Sedimentologist, Bureau of Economic Geology

An Interview with Dean Eric Barron: The JSG Strategic Plan

Was it hard to settle on the four core research foci?

EB: It was easy actually. The only thing that was hard was how big to make each theme, defining them so they were sufficiently rich to be engaging but not so diffuse that they would lack coherency. The themes "bubbled up" readily from examining the unit plans.

Crust / Mantle / Core Dynamics: The top five schools in geosciences are also the top five in geophysics. To be in the top five, we know we need to strengthen geophysics, and in a comprehensive way. We need to be able to address the most important questions in the solid earth. This research frontier emerged from all three of the major unit plans.

Surface and Hydrologic Processes: This is emerging as a compelling societal issue. In a lot of ways it describes the interface between humans and the Earth. There was a lot of discussion about water: Should it be its own research focus? But, the planning group realized that water cuts across all of the other research frontiers, so water became one of our three cross-cutting areas.

Energy, Environment, and Policy. Obviously, this is one of our great strengths and always has been; it's a very smart thing for us to maintain and develop our strengths, and to think about the future of energy. Interestingly, everyone is looking just at the renewables, but we're going to be a fossil-fuel based economy for a long time. To ignore that just doesn't make any sense. The great universities will take a comprehensive approach to energy, including intelligent energy policy.

Climate Systems Science: To me, this was a surprise, but not to the school—all three units wanted an increased emphasis on climate. This focus allows us to work in broader areas of the earth sciences and in areas that no one else is working in at UT. We get to provide more opportunities for students. And we get to think about climate a little differently here than at other institutions—looking at past climates, for example, and important issues such as carbon sequestration.

Something interesting is that the four frontiers fit exactly with John Jackson's view of where his investment in the school should be dedicated. When he made his bequest, he wrote former UT President Larry Faulkner that the funds should go to "the subjects of geology; geophysics; energy, mineral and water resources; as well as the broad areas of the earth sciences, including the Earth's environment." With this plan, it's as if the school adopted his sentence in real terms.

How did the four major themes emerge?

EB: The themes recognize that we have a dual role, to be at the forefront of research and the forefront of education. Those two things should be the dominant elements of any academic institution's strategic plan. But, we have two more specific challenges. Never having been a college together before, we don't have this long history of having the three major units work together. So, being deliberate about creating the fabric of a college has to be a part of our plan. And our fourth theme—increasing competitiveness for top talent—stems from the fact that the geosciences are highly competitive. Yet, we have not done all the things we need to do in order to attract the best new talent and retain our existing talent.

What is the competition for talent like?

EB: There are a lot of job opportunities out there creating significant demand for personnel. If you compare us with institutions in the peer group we aspire to—one of the top five schools, like Michigan or Stanford—we do not match up very well. And in our research units, we have a substantial number of people on soft money. They are easy targets for institutions that are willing to offer them hard money, especially if our salaries are not competitive.

In order to stay competitive, we need to work on increasing a number of factors such as salary, the degree to which we support people on soft money, our sensitivity to dual career couples, and how we reward people who consistently bring in external support and publish papers that add to our reputation.

The commitment to student services and education is a very significant focus for the school, unlike many of our competitors. What inspired this approach?

Many large institutions have trouble being student-centered, just because of the large number of students. We are a small college embedded in a powerful research university. That allows us to think differently, and to approach the student environment and student services in a way that makes us competitive with any institution in the country, large or small. The student center will create a home for our majors and graduate students, adjacent to a modern classroom environment. It will be the anchor point for creating the most student-centered geosciences program in the country and the most student-centered program on the UT campus. It will contain the support personnel from advising to tutoring to career placement who will ensure the success of our students. We want to create the rigorous but supportive atmosphere of a small liberal arts college within the vibrant setting of a major research university.

It is also time to promote the idea that, as a great geosciences school, we should be exporting our geosciences curriculum to the world and that our reputation is not just research, but educational excellence.

Have you seen signs of the school creating the fabric of a great college?

EB: Absolutely. Signs were evident during the strategic planning processes itself. We were working on common goals, common capabilities. As people saw the research frontiers emerge, they had a greater view, across units, of how exciting the other units are.

We've just begun to create an alumni society, another important part of this theme. We want a life-time connection to all who cross our door, whether it is undergraduate and graduate students or former staff and alumni from the Bureau and Institute. You can just sense the potential if you attend one of our alumni and friends gatherings at the major society meetings.

And this spring, you could see the fabric of the school come to life as we began to recruit new hires based on the plan's research foci. As a first step in that process, scientists from all of our units met to try and agree on the major questions facing their disciplines. Not only did they accomplish this, they did it amazingly well. We are using these ads to pursue top scientists, many of whom will be shared hires working at two or more of the units. The response to the ads has so far been outstanding. And the cooperation shown in creating the ads bodes very well for the fabric of our college and the future of the Jackson School.✷

Dean Eric Barron

Executive Summary of the Jackson School Strategic Plan

The Jackson School strategic plan focuses on four major themes for the school to become a top five geosciences program by 2010. The plan is designed as a four-year blueprint, describing specific goals, investments, and commitments for the Jackson School to realize its vision. The complete plan can be found on the Jackson School Web site at www.jsg.utexas.edu/stratplan.

Theme 1: Placing the Jackson School at the forefront of research

At the heart of this theme—and central to the plan as a whole—the school will pursue talent by creating new and expanded areas of excellence in four major research areas:

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

In addition to these thematic hiring areas, the school will seek talented researchers in three emerging themes that cut across all of school's units and research areas:

- Water and Water Resource Sustainability
- Computational Geosciences
- Rapid Response Research

Additional goals include broadly recruiting scientists and faculty at the vanguard of the school's four research areas rather than pursuing candidates for narrowly defined areas of expertise, maintaining strength in the core areas of the geosciences, and ensuring that the school's facilities and capabilities support research productivity.

Theme 2: Placing the Jackson School at the forefront of education, student services and student opportunities

The overall goals for this theme are to create the finest geosciences curriculum and the most student-centered geosciences program in the world. To achieve these goals, the school will create student-centered facilities, including a new student center that houses student services and creates a home for our majors and graduate students, adjacent to a modern classroom environment. We will actively recruit the best and brightest students. And we will provide student services that promote learning, accomplishment, and timely completion of degree requirements while creating an environment that promotes scholarship and student success.

Theme 3: Creating the fabric of a great college

Goals for this theme are to create a collaborative, collegial, and interactive work environment across the Jackson School units, increase our commitment to the future of the geosciences, promote a strong sense of service to societal needs, and create a life-long relationship with our graduates and friends, in part through development of a worldwide alumni-constituent society.

Theme 4: Increasing our Competitiveness for top talent

Goals here focus on making the Jackson School competitive with its desired peer group of top five institutions in the geosciences. To achieve this, the school must benchmark and improve salary, support for people on soft money, support for dual career couples, and rewards for people who consistently bring in external support.

BUILDING THE PIPELINE:

GeoFORCE Texas Expands to Houston

After attending a two-day field course to the Texas Gulf Coast this summer, a ninth-grader sent Doug Ratcliff an e-mail thanking him for the trip and saying he wanted to be the first person in his family to attend college.

Messages like this are almost regular occurrences for Ratcliff, the Jackson School's director of outreach and international programs, who helped organize the field trip as part of GeoFORCE Texas, the college preparatory program he manages for the school. Since the Jackson School started GeoFORCE in 2005, the program has expanded to become the largest geoscience pipeline initiative in the country. More than 240 students from three grade levels attended GeoFORCE's spectacular programs in 2007, learning science in geologically significant locations from Texas, New Mexico, and Arizona to Oregon and Washington, D.C.

The program was set to reach its intended capacity of four grade levels and about 300 students in 2008. Instead, it's now about to double in size.

Initially open only to students from southwest Texas, GeoFORCE will expand to Houston starting in the summer of 2008. Through a partnership with the Houston Independent School District, and with major backing from industry, GeoFORCE will enroll 140 Houston public school honor students next summer in two grade levels and an additional 140 the following year.

While the original program began by admitting just one class of rising ninth graders each year, the Houston program will jump start this schedule, admitting ninth and 11th graders in each of its first two years when it will reach full capacity.

"Our sponsors want us to get Houston kids in the pipeline quickly," said Ratcliff. "They see an opportunity to turn kids on to the opportunities of science, especially the geosciences, and they want the Jackson School to help them accomplish that. We're excited to be involved with the Houston students. Inspiring young scientists is a critical part of our mission, and it's what a great school should do."

WANT TO LEARN MORE?

You can learn more about GeoFORCE—its funding model, outreach activities, and plans for expansion—by contacting Doug Ratcliff in the Dean's Office at the Jackson School, dratcliff@jsg.utexas.edu, 512-471-6048.

LONG-TERM INVESTMENT

GeoFORCE was started to address two issues facing the United States: the low percentage of minorities working in the sciences, and in the geosciences in particular, and the dwindling number of young professionals entering the geoscience workforce. Exacerbating the second problem, the geoscience sector anticipates a major wave of retirements over the next decade, even as the U.S. is experiencing a nationwide decline in academic performance and student interest in math and science.

Ratcliff frames the last issue with a personal request: "I don't want to be in a nursing home when the lights go off."

“There is a substantial consensus that we need to train more students in math and science,” he says. “And there is no doubt that young students are naturally interested in the earth sciences. Providing learning experiences that involve dinosaurs, earthquakes, and volcanoes is a slam dunk for getting their attention.”

Once you have their interest, the trick is keeping them on track for their four-year high school career. GeoFORCE accomplishes this by investing in students for the long term and keeping in near-constant touch with them throughout high school.

Students enter into one of two programs: week-long academies that involve nationwide travel or two-day field trips around the state. Professional geologists join Jackson School faculty and staff conducting the trips. All students attend at no expense, through generous support from industry sponsors and the underwriting of administrative expenses by the Jackson School.

While the field trips are the centerpiece of GeoFORCE, the program takes a comprehensive approach to encouraging academic success. GeoFORCE stays in touch during the year with students’ counselors, teachers, and parents to do everything possible to motivate them to take challenging courses, expend the effort necessary to remain high academic achievers, and begin thinking about life after high school. Academic success is a requirement to stay in the program—students must maintain a B average overall, and in math and science, to come back each year.

The program admits students as they are preparing to enter ninth grade, “when they are starting to decide what their interests are, to decide themselves what they like and don’t like,” says Ratcliff. (While the Houston program will start with both ninth and 11th grade classes in its first two years, once the program is in full swing, all new students will enter as ninth graders.)

Just as importantly, by attending dynamic programs and traveling in cohesive groups each summer, GeoFORCE students build strong relationships with each other. The program gives them the chance, unique for many of them, to make friends through shared interests in academics and science.

GEOFORCE SPONSORS

Shell
ExxonMobil
BP
Chevron
Marathon

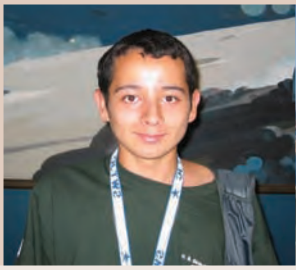
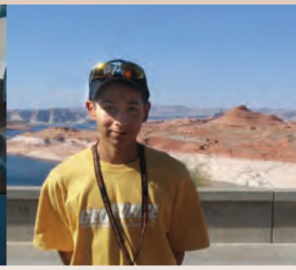
ConocoPhillips
Minerals Management Service

Alcoa Foundation
AT&T Foundation
Dominion Exploration
Halliburton
Schlumberger
Swift Energy
Vulcan Materials Foundation

In addition to week-long academies that take place around the country, GeoFORCE admits 40 students per grade-level to two-day Young Geoscientist field courses in Texas. Here students learn about the geology of Hamilton Pool west of Austin.

In Their Own Words

"It's a wonderful breathtaking experience that leaves the student wanting more! It helps us in that we study something that's right there in front of us and not in a classroom through a textbook. It makes learning fun and interesting. To tell you the truth, I never knew what geology was really about. That soon changed with GeoFORCE. I now like what geology is, how it works, and how it impacts our world." ***— Joseph Arrevalos, 11th grade (pictured all three years with GeoFORCE)***


"Honestly, all the group tutoring boosted my self esteem so much, and after that I didn't feel inadequate asking questions. What is the point of going through the whole day if you don't learn anything, right?" ***— Jayme Grander, 10th grade***

"They didn't teach us what kind of rock it was, but how to find out what kind of rock it was." ***— Elias Alvarez, 10th grade***

"I would love to pursue a geoscience career at UT and hope I do." ***— Rosalie Rodriguez, 11th grade (pictured all three years with GeoFORCE)***



"GeoFORCE has taught me to never limit my mind and to think outside the box. I now have a voracious hunger to learn more, and I feel my brain is like a sponge grasping knowledge at any time I can. Now when I travel with my parents out of town I look at the geography around me and ponder how things became the way they are. Amazingly, I find searching for answers about the land around me more entertaining than listening to my iPOD. The exhilaration of finding an answer or coming to a discovery is like nothing else." ***— Ruben Recio, 10th grade***

"[The counselors] encouraged me to ask more questions. I never asked 'Why?' so many times in my life. It was proved to me that you should always ask 'Why?' because I can guarantee you that you will learn something new every time." ***— Brooklyn Gose, 10th grade***

"A lot of people in my school are very laid back—they don't care about learning," says Andy San Miguel, an eleventh grader at Hondo High School in Hondo, Texas. He cites his friendships from GeoFORCE as one of the outstanding qualities of the program, along with the "awe-inspiring" geological sites and the chance to learn about the Earth.

The GeoFORCE approach appears to be working well. In three years, only three students out of the 120 enrolled in the academies have chosen to leave the program, an extraordinary record for any summer program, let alone one centered on academic performance.

Members of the 2007 GeoFORCE 11th Grade Academy, pictured here, visited geological sites in Oregon and Washington state, including Mount St. Helens, Mount Hood, Columbia River Gorge, Kah Nee Ta Hot Springs, and the Oregon coast.

For students who end up majoring in geosciences, the program's long-term investment in them can make the difference. "During my third year, it just clicked," said Stanley Stackhouse, a former student in Fort Valley State University's Math, Science, and Engineering Academy (MSEA), which served as a model for GeoFORCE. After attending MSEA, Stackhouse excelled at math and science at Fort Valley State, and as a result he earned the chance to complete his undergraduate studies at one of Fort Valley's partner universities in the Community Development Energy Program. Stackhouse chose The University of Texas at Austin and the Jackson School. He graduated with a B.S. in 2007 and is currently pursuing his M.S. working on carbonate geology.

Seeing a student pursue an advanced degree at the Jackson School is at the top of the "success pyramid" Ratcliff envisions for GeoFORCE.

"We think it will be a success if all the kids in GeoFORCE graduate from high school," says Ratcliff, noting that only 47 percent of students overall graduate from high school in GeoFORCE's initial service region of southwest Texas. "It will be a phenomenal success if they go to college, even better if they major in math and science, and of course the ultimate if they major in geology."

HOUSTON, WE HAVE A SOLUTION

GeoFORCE's original program in southwest Texas is starting to near the initial finish line–sending kids to college. "Our initial group, who as eighth graders cried when they left their parents for the first time and screamed when the wheels went up on their first airplane ride, are now in the eleventh grade taking the SAT exam and preparing to make college applications," says Ratcliff.

Now the Jackson School will take on the challenge of adding the seventh largest school district in the nation. Houston students will participate in the same field program as the proven southwest Texas kids.

The Houston demographics are not the same as the southwest region. The public school population of southwest Texas is rural and 85 percent Hispanic, with very few African Americans. The Houston public school population is urban, 53 percent Hispanic, 28 percent African American, and 8 percent white, with a sizeable Asian population, and some Native Americans.

While the demographics differ, "We believe the GeoFORCE approach will have very similar results," says Ratcliff.

The program's sponsors agree. They have voiced enormous faith in the program, funding its first three years, committing professionals to teach and serve with GeoFORCE in the field, and now instigating the expansion to Houston. ExxonMobil, known for backing programs with proven results, initiated the Houston program by approaching Ratcliff to ask if the Jackson School could take on the challenge. The school said it could, with support. ExxonMobil found strong support among Houston industries, particularly oil and gas companies. Mike Loudin of ExxonMobil has worked with Ratcliff enlisting support, with fundraising currently in a quiet but very promising phase.

Recruiting students for the program starts with teachers. Two teachers from the Houston Independent School District went on this summer's GeoFORCE ninth grade academy. The Jackson School will host 25 more Houston teachers for a workshop in November. The workshop will offer professional development training for Texas' new capstone course on Earth & Space Science, while introducing Houston teachers to colleagues from southwest Texas and keeping them informed about GeoFORCE. Teachers in turn will help identify promising students and encourage them to apply.

Applications for the Houston program will be due in January and selections made in February. In June, the new program will launch, exposing a new generation of Houston students to the potential for exciting careers in the geosciences.✷

Core Preservation

CHEVRON & CONOCOPHILLIPS SECURE STOREHOUSES OF GEOLOGICAL KNOWLEDGE FOR GENERATIONS TO COME

For a community devoted to understanding the deep past, geoscientists have struggled a surprising amount, in the United States at least, to preserve their own archives of geologic history—the cores and cuttings that document the subsurface.

According to a 2006 USGS report, some facilities for preserving geologic materials, such as the U.S. National Ice Core Laboratory in Denver, are model archives. "Other facilities," note the authors, "are barely a shelter for their holdings."

USGS cites the Jackson School's Bureau of Economic Geology as one of the models. It came as no surprise, therefore, that both Chevron Corporation and ConocoPhillips chose the Bureau as the recipient of major gifts of materials in 2007—1,500 tons of geological cores and cuttings collected over 60 years, along with $1.5 million to preserve and maintain the materials, from Chevron, and about 750 tons of materials with $775,000 to endow their preservation from ConocoPhillips.

With the gifts, both firms dramatically enhanced the largest publicly available collection of geologic cores and cuttings in the world. The cash donations also bolster the Bureau of Economic Geology's ability to manage its collection, helping to secure a geoscience treasure for generations to come.

"The willingness and the generosity of companies like Chevron and ConocoPhillops to make these materials and their associated data public, along with cash contributions to preserve them, is a huge, huge gift to future generations," said Scott Tinker, director of the Bureau. "It's making something permanent that would otherwise be lost and in this country would never be collected again."

The cores in the collections, like others in the Bureau collections, range from a few inches to up to 60 feet in length. The cuttings are ground up bits of rock mainly collected during oil and gas exploration and in many cases have been recovered from miles below Earth's surface.

"In a mature area like the United States, which has this huge historic backlog of information, there's the risk that many of these samples will eventually be lost," said Don Paul, vice president and chief technology officer of Chevron, and a member of the Jackson School's Advisory Council. "In some cases, in places like the Los Angeles Basin, the city now sits on top of the old wells. Cores from these areas will never be collected again. Yet the geologic information will be useful for all time," said Paul.

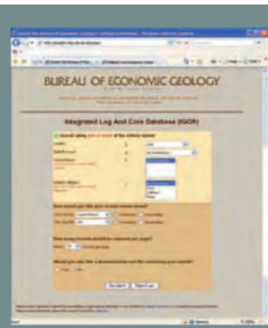
Once collected, the cores need to be cataloged and stored properly in order to preserve samples to later extract data. Most of them will be stored at the Houston Research Center (HRC), one of three core research facilities operated by the Bureau of Economic Geology. Beverly Blakeney DeJarnett, research associate at the HRC, estimates that the delivery that began in March 2007 will take another 12 to 14 months to come in, ultimately filling 20,000 square feet of the repository.

The size of the Bureau, its preservation efforts, and its reputation for staff excellence attracted Chevron, but several other factors also made it the natural choice to house both companies' donations. Samples are cataloged in a searchable online database and stored in climate controlled warehouses. In addition, the Bureau houses state-of-the-art viewing facilities that are readily available to the public, and unlike other institutions, there is room to grow.

"The BEG has been curating this type of material for over 70 years, so we're well

Core Online

Information on BEG's core holdings is accessible to the public via the Integrated Core and Log Database (IGOR), a searchable database for all core and well cutting holdings. IGOR includes the entire BEG holdings or more than 1.7 million boxes of rock material: **http://begdb1.beg.utexas.edu/Igor/**



Don Paul (right), VP and chief technology officer of Chevron and a member of the JSG's Advisory Council, was the driving force behind the Chevron gift. Also pictured: Juan Sanchez (left), VP of research for UT Austin, and Charles Groat (center), director of the Energy & Earth Resources graduate program.

experienced in how to do it," said DeJarnett. "Also, the bulk of the oil companies are based in Houston. So it's going to be easy and convenient for them, as well as scientists and students, to use. As a result, the cores will be utilized much more frequently."

The Bureau's connection to the Jackson School was still another selling point, ensuring the materials will be curated within an academic setting that places premiums on access, scholarship, and socially beneficial research.

Over the decades, petroleum geologists from the world's major oil companies have amassed cores and other geologic materials as they collect archives to determine the porosity and permeability of rock in various locations. The archives help company geologists determine how easily oil and gas can be removed and at what quantities. Cores also help geologists understand how rock was originally deposited, which further aids petroleum exploration.

The usefulness of the two donations could endure for decades, even centuries. In the immediate future, research conducted by independent oil and gas consultants and other geoscientists has the potential to boost domestic energy production and increase U.S. energy security.

Geoscientists are also likely to use the material to better understand the causes and possible warning signs of geohazards such as earthquakes or to study the effects of groundwater pollution.

Perhaps most importantly, the materials will be there for some future student, scientist, or exploration geologist who will use them to answer questions that have not yet even been imagined.

"Time after time, we've seen the situation where we don't realize what's going to be a critical issue in the future—problems we wouldn't have predicted—and scientists have come back to the rocks to find the answers," said DeJarnett.

She added that in the oil industry, "things go in and out of vogue." For example, maybe a company was drilling for one kind of reservoir in the 1960s, and subsequently the technology and economics of oil and gas changed. Additionally, when the economics prove advantageous and advances in technology and analysis are made, current holdings can be re-evaluated for new information not previously interpreted by earlier research.

"People are constantly going back into areas that were drilled before and taking a fresh look," said DeJarnett. "That happens daily. People are taking a new look at older, more developed areas."

Texas Railroad Commissioner Elizabeth Ames Jones, B.J. '78, surveys donated cores at the announcement of the Chevron gift.

The donations will provide real-world geological data and samples from around the U.S. and will allow educational and training opportunities for students, researchers, and industry professionals to promote scientific and technological innovation.

"It's a sample that to many folks might seem like just a piece of rock," said Tinker, "but a lot of times it directs us to where oil and gas is or, more important nowadays, where it might be. So the fact that these cores can be used to train the next generation of geoscientists for future study may lead to additional resource discovery in the U.S. that they might not have been able to do in the past." ✷

1937
Texas Legislature appropriated funding for Well Sample Library, administered by the Bureau of Economic Geology on main campus.

1945
Well Sample Library moved to present-day site of Balcones Research Center.

1994
Midland Core Research Center established with donation from Shell of warehouse, 500,000 boxes of cores and cuttings, and $1.3 million endowment.

2002
Houston Research Center established with donation from BP of warehouse and research building, 560,000 boxes of cores and cuttings, and $3 million endowment.

2002
Unocal donates technical library appraised at $5 million.

2002-2007
Organizations continue donations of core and financial support to BEG, including Occidental, ConocoPhillips, the Department of Energy, and the National Science Foundation.

2007
Chevron donates 1,500 tons of geological cores and cuttings and $1.5 million to preserve them; ConocoPhillips donates 750 tons and $775,000.

A Place to Call Home:

INSTITUTE FOR GEOPHYSICS GETS NEW BUILDING ON RESEARCH CAMPUS

Marine geophysicists are famous for travelling the world. One of the nation's larger geophysical communities ended an odyssey of a different sort in January 2007, when researchers from the Jackson School's Institute for Geophysics moved into their first-ever home on The University of Texas at Austin campus. The decades-long journey took them from the shores of Galveston to the office complexes of Northwest Austin, with a pit stop along the way beside the country's busiest freeway. The end of the odyssey also marked a beginning, since the Institute's new building on the university's J.J. Pickle Research Campus opens up avenues for collaboration between Institute scientists, Jackson School colleagues, computational specialists, and a wide array of visiting researchers.

The new building may have a generic name—the Research Office Complex—but its abbreviation, the ROC, is well suited to a geoscience facility, points out John Goff, the senior research scientist who was the Institute's liaison on the construction project.

By design, the ROC physically adjoins the Jackson School's other main research unit, the Bureau of Economic Geology. Walkways

between the buildings facilitate formal and informal collaboration between scientists who share research interests related to the environment, geophysics, tectonics, and the exploration for natural resources.

The proximity also speeds one of the Jackson School's overall goals of creating the fabric of a great college, uniting two of the primary research locations of greatest interest for Jackson School students and researchers with joint appointments. With the Institute and Bureau side by side, Dean Eric Barron has maintained an office at the north campus, opening up avenues of communication.

Just as importantly for Institute scientists, they now share a home with one of the country's leading supercomputing organizations, the Texas Advanced Computing Center (TACC). TACC leases the first floor of the new 94,000-square-foot building, with the Institute occupying the top two floors. TACC and the Institute already work closely together on computation problems related to the geosciences and Earth's environment, a relationship that will grow as the Jackson School builds its capacity in computational geosciences.

NOMADS NO MORE

The ROC marks the first time the entire staff of the Institute resides on The University of Texas at Austin campus. Since moving to Austin from its dockside facilities at The University of Texas Medical Branch in Galveston in 1982, the Institute for Geophysics has been housed in rental space.

The organization now known as the Institute for Geophysics was founded in Galveston in 1972. Within a few years UTIG became affiliated with The University of Texas at Austin and in 1982 moved to Austin and occupied a leased building on IH-35 beneath the flight path of Austin's old Mueller Airport. This was the first of three leased properties UTIG occupied between 1982 and 2006.

"I think it is hard to overstate how important the new building is for us," said Goff, who came to the Institute from the Woods Hole Oceanographic Institution in 1993. "During the years as leased-space nomads, I don't think we really felt like we were truly a part of

DEDICATION COLLOQUIUM HIGHLIGHTS CONFLUENCE OF GEOSCIENCES & SUPERCOMPUTING

Following the formal dedication of the Research Office Complex, five speakers gave scientific colloquia on how they use supercomputers in their work.

Gary Glatzmaier, professor at the University of California Santa Cruz, described his work trying to understand the origin of Earth's magnetic field, magnetic pole reversals, and other mysteries of the Earth's interior. In one dramatic and colorful animation, he treated the audience to a simulated reversal of Earth's magnetic pole, representing thousands of years compressed into a couple of minutes. He said the reversals happen every few hundred thousand years. The fact that his computer model spontaneously generates pole reversals without outside prompting makes him confident that he has much of the underlying physics right. Despite much speculation that Earth may be currently going through a pole reversal, he said Earth's magnetic field is actually at about average strength and that even if a change has started, it will be thousands of years from now before it is complete, "plenty of time for people to figure out how to deal with it."

Thomas Zacharia, associate lab director at Oak Ridge National Laboratory, spoke of research conducted at ORNL using supercomputers, work that relates to fusion power, combustion, biofuels, climate change, and magnetic recording media. "We are on the threshold of a new era of scientific computing," said Zacharia. "The work here at TACC is exciting. We look forward to working with you."

Charlie Catlett, director of TeraGrid, spoke of the importance of large, distributed "cyberinfrastructure" such as the NSF funded TeraGrid, which is used to address a whole host of problems from pandemics to climate change to earthquakes. The Texas Advanced Computing Center is a member of TeraGrid.

Eric Chassignet, professor at Florida State University, said he is refining global ocean models to make it possible to accurately predict conditions a few weeks to a season ahead. He talked about different ways to "slice the ocean" in computer models to obtain more realistic simulations. He said one of the biggest challenges facing him is handling all the data. He described a series of so-called "nested models" he has developed that are made up of large, coarse resolution models with smaller, more detailed models nested inside. These models offer the ability to study processes on the local scale, while still accurately modeling the linkages to global systems.

John Etgen, senior advisor for seismic imaging at BP, said that for the past 15 years, oil and gas explorers have focused too much on seismic data analysis and not enough on how the data is acquired. That is especially true when trying to image an area below a salt formation in deep water such as the Gulf of Mexico. He said BP has pioneered two new acquisition techniques—WATS (wide azimuth towed streamer) and the use of nodes (seismic sensors) attached the seafloor—which have greatly enhanced the quality of subsalt seismic imagery.

the university—just kind of hanging around the fringes and doing research on our own. But with the new building on the Pickle Campus and, just as importantly, full partnership in the Jackson School, that feeling of separateness is finally going away."

The move also makes economic sense.

"This is easily the nicest office space we have had in my 29 years at the Institute," said Cliff Frohlich, associate director of the Institute for Geophysics. "And, I do feel more secure knowing that our monthly costs are no longer controlled by the roller coaster that is Austin's commercial real estate market."

COMPUTATIONAL EDGE

The co-habitation with the computing center especially aids Institute scientists in their research of processes shaping the Earth, including sea-level fluctuations, climate change, and geologic hazards such as earthquakes and tsunamis. Much of their work relies on high-end computation. In projects like development of a new seismic volume viewer or refining our understanding of cloud modeling, TACC and UTIG researchers already work collaboratively. While geoscientists come from around the world to use TACC facilities, Jackson School researchers gain an inside edge on the computing resources.

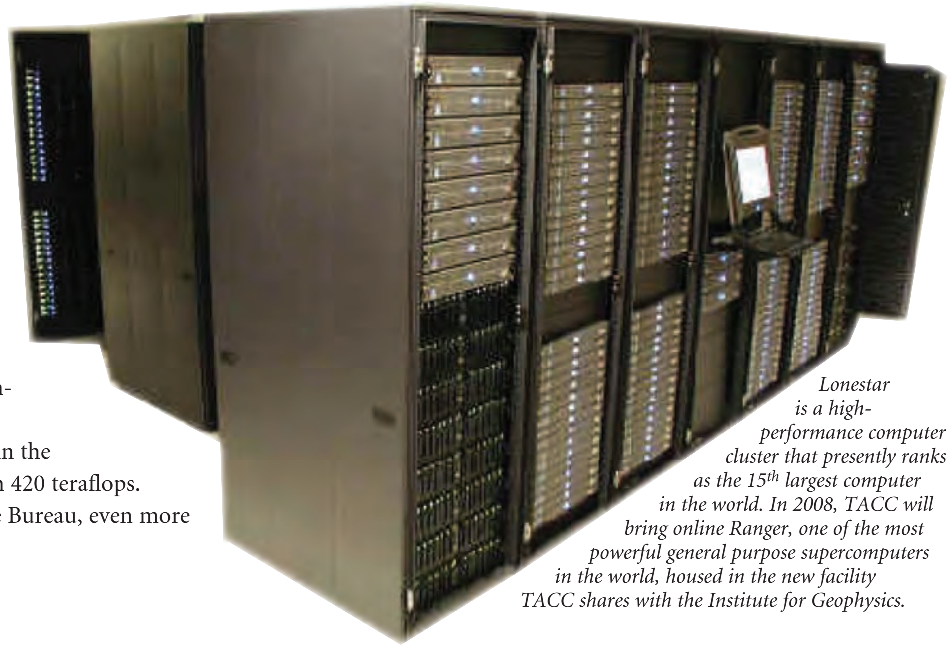
And what resources they are. Already home to Lonestar, one of the country's largest academic supercomputers, TACC will soon host Ranger, a new National Science Foundation-funded system that will be one of the most powerful general purpose supercomputers in the world, with peak performance of more than 420 teraflops.

Because the new ROC is adjacent to the Bureau, even more synergies are emerging.

"Collocating the Institute and Bureau has helped to develop collaborative research programs among the research staff of the two units," said Mrinal Sen, research professor at the Institute and professor and Jackson Chair in Applied Seismology in the Department of Geological Sciences. "We are running joint internal seminars for students and researchers with common research interests. In addition to this, I have noticed significant interaction among students and the postdocs from the two units. Researchers from the two units are always available to advise them."

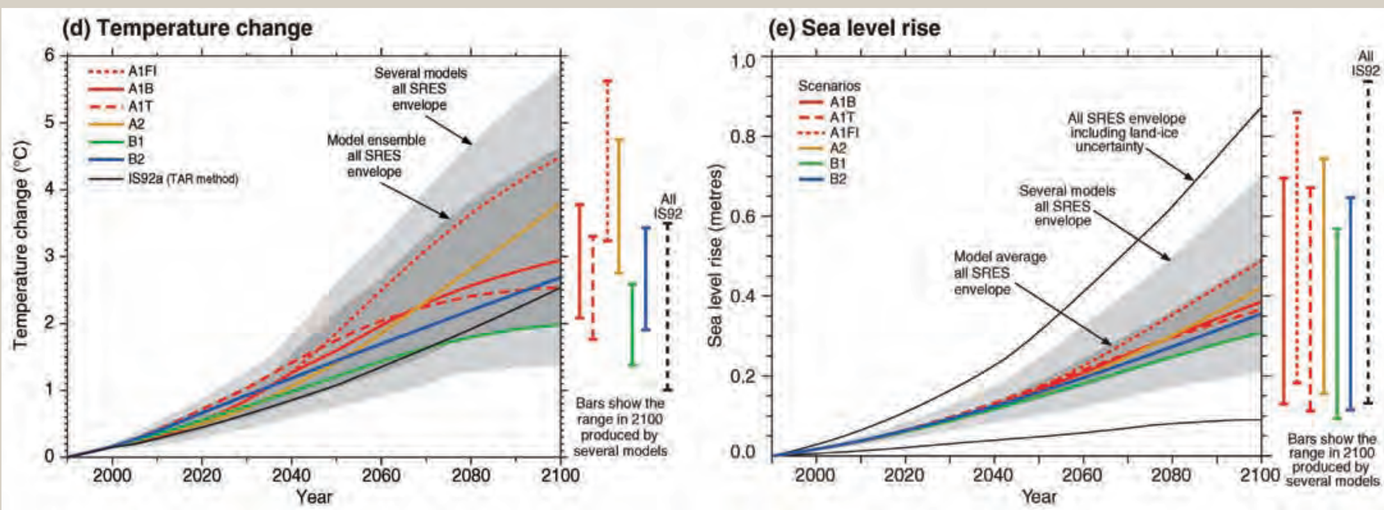
PBS&J designed the building. Flintco began construction in November 2005 and completed the $21 million project ahead of schedule and on budget. The building meets standards of the Leadership in Energy and Environmental Design Green Building Rating System, the first on the UT Austin campus.

"When the lab moved from Galveston to Austin in 1982, UT's president promised us that we would have a place on campus as soon as possible," said Cliff Frohlich. "I guess our new building at the Pickle Research Campus proves that Longhorns always tell the truth."✷



Lonestar is a high-performance computer cluster that presently ranks as the 15th largest computer in the world. In 2008, TACC will bring online Ranger, one of the most powerful general purpose supercomputers in the world, housed in the new facility TACC shares with the Institute for Geophysics.

Institute scientists Charles Jackson and Mrinal Sen, in collaboration with TACC, are helping improve the way clouds are represented in climate models. These figures from the IPCC report "Climate Change 2001: The Scientific Basis" show that projections of global temperature and sea level over the next century vary widely between different climate models. Although optimized to reproduce observational means, each model contains slightly different choices of model parameter values as well as different parameterizations of under-resolved physics.



THE ODYSSEY OF UTIG: AN INSTITUTE AND ITS MANY HOMES

1) Maurice Ewing Hall, UTIG's home during its formative years in Galveston (1972-1982) on the campus of The University of Texas Medical Branch.
2) Another view of Maurice Ewing Hall, UTIG's home in Galveston, with research ships R/V Fred H. Moore *and* R/V Ida Green *dockside.*
3) Freeway Blues: UTIG's first rental facility in Austin (1982-1986) was located on IH 35 at the end of the new runway of the former Austin Mueller Airport.
4) UTIG's rental facility near the former Austin Mueller Airport. Many staff remember having trouble carrying on a conversation at times of low approach.
5) From 1986-1997, UTIG was able to take advantage of low rental prices, moving from the runway to a more upscale corporate environment.
6) Easily mistaken for an apartment complex, the headquarters of a realty firm, or the offices of a group of pyschotherapists, this building in Northwest Austin was home to UTIG from 1997 to December 2006 until ROC was completed.

Photos supplied by Patty Ganey-Currey from the UTIG Archives.

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HISTORY OF UTIG The Institute for Geophysics was established in 1972 when Maurice Ewing, one of the most highly acclaimed Earth scientists of the 20th century, returned to his home state of Texas. Ewing, founder of the present-day Lamont-Doherty Earth Observatory of Columbia University, established and served as first director of the Earth and Planetary Sciences Division of the Marine Biomedical Institute, part of the University of Texas Medical Branch in Galveston. By Ewing's death in 1974, the division had become an established center of lunar and seismology research, and had initiated the first academic program in marine multichannel seismic research. Building on this foundation, The University of Texas Board of Regents transferred the division to the Marine Science Institute of The University of Texas at Austin in 1974, renaming it the Galveston Geophysics Laboratory.

J. Lamar Worzel became director in 1974, expanding staff in marine sciences. With the acquisition of a research vessel, the R/V Ida Green, in 1974, through a gift from Texas Instruments co-founder Cecil Green, and then a second research vessel, the R/V Fred Moore, from Mobil Oil Corporation in 1979, the lab was able to create a global program in geophysical research. In 1982, to promote closer interaction with the Department of Geological Sciences, the laboratory was renamed The University of Texas Institute for Geophysics and moved to Austin. Arthur E. Maxwell, the new director, made his mark as co-chief scientist of Leg 3 of the Deep Sea Drilling Project (DSDP) in 1968, which confirmed the concept of seafloor spreading—an accomplishment called the most significant discovery in the history of scientific ocean drilling. Under Maxwell, UTIG expanded its role in marine geophysics and seismology, and developed major research programs in polar regions.

In 1994, Maxwell retired as director and was succeeded by Paul Stoffa, who holds the Shell Distinguished Chair in Geophysics in the Department of Geological Sciences. Stoffa is a marine seismologist with expertise in multichannel seismic acquisition, the use of parallel computers in seismic processing, and the modeling and inversion of geophysical data. Under Stoffa, UTIG's scope has grown still further to embrace a wider range of geophysical projects, a program in numerical climate modeling, and a coordinated K-12 education and outreach effort. For more on UTIG's present direction, see the Unit Overviews section of this *Newsletter*.

Text adapted from "A History of The University of Texas at Austin Institute for Geophysics," by Kathy Ellins and Cliff Frohlich.

Company Profile: Dawson Geophysical

By Mella McEwen

To the extent that seismic data underpins successful oil and gas exploration, Dawson Geophysical Company of Midland, Texas, may be one of the firms with the greatest cumulative impacts, relative to its size, of any oil-services firm in the United States.

"Land 3D probably wouldn't be where it was today if it weren't for this company," says Robert Tatham, Shell Company Centennial Chair in Geophysics at the Jackson School.

Founded in 1952 by L. Decker Dawson, the company of about 1,200 employees is legendary for expanding the use of onshore three-dimensional (3D) seismic, inspiring trust in customers, and fostering an employee-centered culture that has helped the firm weather business cycles that have withered competitors.


Decker Dawson

Dawson Geophysical has also proven adept at responding to change: In 2007, Fortune Small Business ranked them No. 7 on their list of America's fastest-growing small public companies.

It's no surprise that a seismic firm would crack the top 100 list of fast-growing companies, given the robustness of the oil and gas exploration market over the past several years. That Dawson Geophysical emerges as such a leader pays testament both to the company's founding vision and ongoing management principles. It's a story—rooted in Texas history and the pioneer spirit of the American oil industry—of a son expanding on his father's legacy to create the nation's leading onshore seismic contractor.

Onshore Leaders

Today, crews from Dawson Geophysical can be found throughout the producing basins of the Lower 48 states, from West Texas and South Texas to New Mexico, Oklahoma, Arkansas, the Appalachian Basin, the Fort Worth Basin, and throughout the Rocky Mountains. Recently, Dawson trucks were even found winding their way among the big jets at Dallas Fort Worth International Airport (DFW), conducting seismic surveys for Chesapeake Energy Corp, which won approval from the Dallas and Forth Worth city councils to explore for natural gas in the Barnett Shale underneath the airport's 18,000 acres.

Larry Lunardi, Chesapeake's vice president of geophysics, agrees that the DFW job went very smoothly and notes that his Oklahoma City-based firm has a close relationship with Dawson.

"Chesapeake right now is the single most active gatherer of 3D seismic in the U.S. today and Dawson accounts for over three-quarters of our total proprietary acquisition," he says. "We have almost half their total working capacity in the field as we speak, spread across four states."

Working at DFW, says Dawson, who now serves as chairman of the board, stands out as a once-in-a-lifetime job.

"It was a huge job and involved more than technology," he says. "We were dealing with so many different government entities, it took longer to get all the clearances than to do the job. We were lucky—so much could have gone wrong but nothing did."

The DFW survey is the latest in a string of successes for the Tulsa native, whose father worked for a wireline company. Dawson recalls his father's fascination with the oil industry and its worldwide reach and says he inherited that feeling. His first job after graduating from Oklahoma State University with a degree in civil engineering was with Magnolia Petroleum.

"The first crew I worked on when I started with Magnolia—that crew had six channels, so I have seen some changes," he says. The first crew fielded by Dawson Geophysical had 24-channel equipment. Today the company's crews—soon to number a record 15—utilize 10,000 channels to record seismic data.

When he founded Dawson Geophysical, Dawson started as owner and party chief with one crew in the Permian Basin. Even as a downturn in exploration in the early 1950s reduced the ranks of other seismic crews, Dawson was able to grow. Thanks to several early finds, his company expanded to five crews by 1955. An ability to manage the up and down cycles of the industry has marked Dawson Geophysical ever since.

In the 55 years since Dawson Geophysical opened its doors, the company and its founder have become well respected, many would say revered.

"We all admire Mr. Dawson, he's well respected," says Martha George with the Midland office of WesternGeco, a unit of Schlumberger. "I've been a competitor with them for 30 years and always had a good working relationship with the company. Dawson has provided a continuous, reliable quality product and the company has a lot of experienced employees who have been there for years."

"The outstanding reputation of Dawson Geophysical is clearly attributable to the uniformly high esteem in which Decker is held by all who have known him," wrote Ken Larner when Dawson won the Enterprise award from the Society of Exploration Geophysicists in 1997.

No one, adds Hoxie Smith, who worked for Dawson Geophysical from 1992 to 1996, "certainly in the Permian Basin, has added more to geophysics and oil and gas exploration. His consistency and surviving the ups and downs of the industry are testament to his ability to manage those ups and downs. I heard stories while I was there from people who worked at the firm during the bad times that the executives would cut their own salaries to avoid layoffs."

Well Grounded

Although the company has grown from its original 10 employees in 1952 to about 1,200 today, Steve Jumper, Dawson's president and chief executive officer, says the company's operating style is "from the bottom up. It's flat."

"We have a fantastic team of great people all through the organization," he adds. "The people on the ground are where the action is. Our whole structure here is set up to support them, whether it's management, accounting, health, safety and environment, or permitting. We are set up to facilitate geophysics. They are the eyes and ears of what we do and they are the people we listen to intently on what they need and how they perform their jobs. Things go up the ladder better than they go down."

Though the crew count is not expanding fast, the company is, Dawson says. "It seems each job takes more and more equipment.

Lunardi says the company is without a doubt the premier onshore acquisition company in the United States, first because it has been around 55 years and second because of the high quality of its equipment and personnel.

"That's difficult to achieve," he said. "[Dawson employees] are extremely loyal and aren't quick to jump ship, which is rare these days. Having experienced, conscientious people in the field is very important."

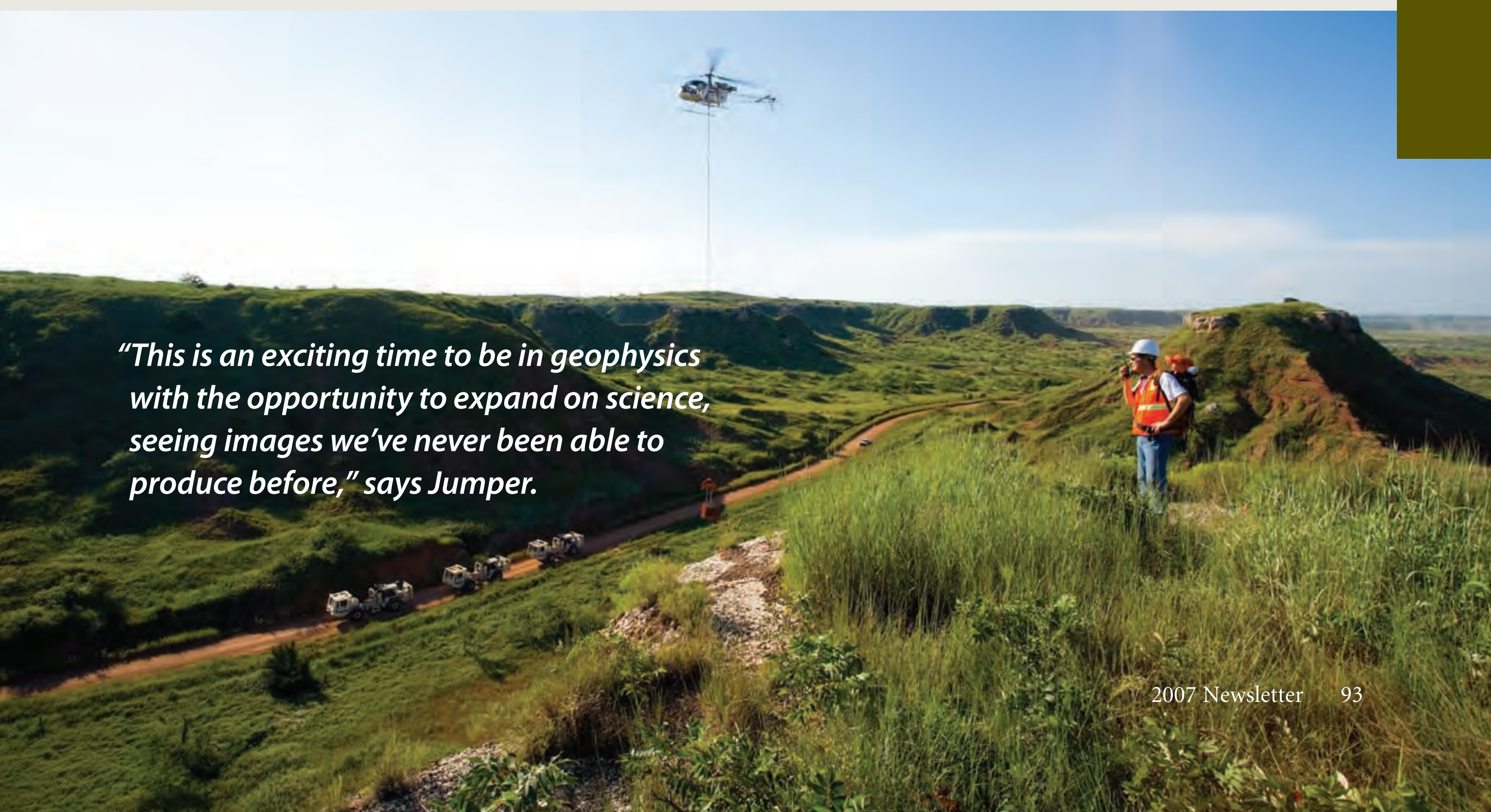
Dawson is quick to credit his employees with any success the company is enjoying and expresses gratitude for the opportunities offered by his customers.

In fact, he says, "Our customers are not customers, they're clients. Our relationship with them, while we're working for them, is to essentially become part of their company, there's such a relationship between our employees and their employees. This is not a product you can buy somewhere and deliver. It's a professional service and the exciting thing about it is the exchange between their geophysicists and our geophysicists."

Historical Perspective

In his more than 60 years in the business, Dawson has seen onshore seismic evolve from a full-service data gathering and processing service that offers prospect recommendations to the more segmented sector of today's industry.

"As things have evolved, it's gotten more complicated, it's become more compartmentalized," he explains. "There is data gathering, there is data processing, and there is interpretation. They're all intertwined, but we are now primarily a data gathering and processing company. The oil companies have taken on the interpretation. But it takes all three of those functions to get the job done."



Want to Suggest a Company Profile?

As a new feature, future issues of the *Newsletter* will profile companies closely affiliated with the Jackson School, with an emphasis on firms founded or led by our graduates. If you would like to suggest a company for us to profile, contact the editors at 512-232-9623, communications@jsg.utexas.edu.

Dawson Geophysical's maintenance shop in Midland, Texas.

Dawson has also seen the technology evolve from the exclusive use of dynamite as the energy source to generate the seismic data to the development of 3D seismic technology about 20 years ago.

"Before that all we did was 2D with simple lines. Now we lay parallel lines to get a 3D response. That requires much more equipment and the desire for improvement. Data quality is paramount—we need more channels to improve the quality of the data. The more seismic points, the more data received," he says.

As it works to offer the latest technology, Dawson has formed a joint working arrangement with its longtime competitor, WesternGeco, for the Q System, which utilizes 30,000 data-receiving channels. WesternGeco provides the technology and personnel, Dawson supplies the seismic data.

"That gives you some idea where we're headed," Dawson says. "We're excited about the relationship with that company and have high hopes that technology will help exploration efforts. When we only had six channels, that didn't sound like much but what we were looking for was easy to find, it was simple structures. Now we're looking deeper and in remote areas, mountainous and otherwise. We really do need to find the oil and gas. There's no question there's a finite amount in the world and today we're burning it like crazy with no ready-made substitute. If we want to maintain our standard of living, we need to find more oil and gas until we find substitutes. My feeling is exploration and development will be around for a long time."

It is an exciting time not only for the industry but for geosciences as well, says Jumper.

"As prospects become more and more difficult to find and define, there is a tremendous burden placed on our tools to create better images and see things we've never seen before," he explains. While Dawson is doing that level of work now, long-term, Jumper sees them getting closer and closer to reservoir characterization.

"We'll continue to develop tools like multi-component or other different ways of acquiring seismic data. We have to give our clients in exploration and production not just more information about the location but the characteristics—the permeability, the architecture inside that location. That's exciting," says Jumper, "and it's a huge challenge because it's not economically driven, it's scientifically driven. We have to solve that scientific problem."

Geophysics will become more integrated in the engineering world and geoscientists will be moving up the corporate ladder and becoming involved in everyday operations at their company, predicts Jumper, who began his college career at The University of Texas at Austin, studying to become a pharmacist. He surrendered, he says, to organic chemistry and shifted his interest to geoscience. Jumper currently serves on the Advisory Council of the Jackson School of Geosciences, alongside Dawson, who is an honorary life member and inductee in the school's Hall of Distinction.

Even as the industry strives to evolve, Jumper says he doesn't see any emerging technology that will by itself be a game-changer the way 3D seismic was when it was introduced.

"That was a different implementation of geophysics that was driven by electronics and computer power," he says. "Now the question is how do we create better images? Through more channel counts, more pixels and higher density coverage—that alone is bringing a challenge in how to handle very large channel count crews."

Technological advances, he says, may involve other sensors, other seismic waves like shear waves, which are less understood: "It's not just the burden of economics but understanding the tools and the geoscience. It won't be one technology that is a game changer, it will be computers, it will be electronics, possibly wireless seismic measurement, and interpretation technology."

Jumper sees room for geoscientists not only picking the locations for exploration and production but also understanding the process and how it relates to engineering. "It will be a gradual process; one day we may be doing it and not realize we got there," he says.

"That's how we're approaching it. We're not investing in one particular research and development project but in consortiums and industry partnerships, looking at technologies that could be useful. This is not just an exciting time from a business standpoint. People focus on the number of crews we have and our backlog and how well the company is doing. That's all wonderful and we're very fortunate, but this is an exciting time to be in geophysics. This is the opportunity to expand on science, seeing images we've never been able to produce before," says Jumper.✷

Alumni Profile:

Robert Burger, Ph.D., 2002

Assistant Provost for Science and Technology
Yale University

How has your degree helped you in your career?

Both my former and present positions have required a broad understanding of science across many disciplines, and my geological background has been ideal in this regard, having been interdisciplinary in nature. The Jackson School, with its many resources and opportunities, was an ideal place for me to gain this experience.

What do you enjoy about your current job?

I never know quite what I'll be dealing with from day-to-day; pretty much anything that has anything to do with academic or financial issues in the sciences comes through this office. The variety of challenges, and the close interaction with world-class faculty and students, makes this a fun, challenging, and rewarding job.

What have you learned out in the real world that you wished they'd taught you in school?

To appreciate the unstructured time and opportunity to focus on a single project for several years that being a graduate student offers. One of my advisors, Jamie Austin, often told us to enjoy it while it lasted, and he was right!

What has been the biggest change in your field since you graduated?

The increasingly difficult environment for federal research funding is the biggest change that I'm most acutely aware of, as I deal with its implications on a daily basis.

What advice do you have for soon to be graduates?

Be honest with yourself about your interests, goals, and priorities in making your career decisions. There are a lot of interesting and rewarding career paths out there, that are sometimes hard to envision while you're working on your degree.

What's your favorite memory of UT? What do you miss most about Austin?

The Jackson School is a unique place in that it attracts so many students with so many different interests and backgrounds, and for me, the most enjoyable part of being at UT was the daily interaction with fellow students with such a broad range of perspectives, both intellectually and culturally.

As for what I miss about Austin, where do I start? The Greenbelt, 6th street, good mountain biking, great Tex-Mex and margaritas, Walnut Creek and Emma Long Parks, Butler Pitch n' Putt, and, of course, the Salt Lick! I love New England, but I'll always enjoy visiting Austin.

What do you do in your free time?

Spend as much time as possible with my wife and daughter, work on our recently purchased home, and explore the Connecticut shoreline on my road bike.

Robert Burger earned a B.S. in Geology and Geophysics at Yale and an M.S. in Earth Sciences at Dartmouth College before earning his Ph.D. at the Jackson School. He wrote his dissertation on "Intermediate and Deep Seismicity and Lateral Structure of Subducted Lithosphere in the Circum-Pacific Region," with dissertation committee members Jamie Austin, Ian Dalziel, Bill Fisher, Craig Fulthorpe, and Bill Galloway. He was the recipient of a Ewing-Worzel Fellowship while attending the Jackson School.

Q&A with Ann Flemings

JSG DIRECTOR OF DEVELOPMENT AND ALUMNI RELATIONS

This fall Ann Flemings moved from Pennsylvania State University to the Jackson School to become the school's first director of development and alumni relations. Flemings' husband, Peter Flemings, joined the faculty as a triple appointment to the Department, Bureau, and Institute (see page 24). We talked with Ann Flemings about her new position and the development function at the Jackson School.

What attracted you to working at the Jackson School?

The attraction to me was the extraordinary potential of the school. From a fundraising perspective, it is unusual to be working from a position of resource strength. Usually, you are continually expressing a need that requires finances in order to even begin getting off the ground. The JSG is beyond that and working to leverage the impact of the Jackson's bequest to move above and beyond, with the goal of actually transforming the discipline of the geosciences. Partner that with the vision and drive of a leader like Eric Barron and you know that potential will become a reality.

What will you be working on in your first year?

I will be working on engaging and educating our alumni on what the Jackson School is all about and what an exciting time it is to become more deeply engaged with the school. I'll be helping alumni to feel that they are an important part of the school. And quite frankly, I'll be raising enough money to keep up with my dean's ambitious budget.

Where can support make a difference for the school?

This can happen in different ways. The Jackson funds can provide resources for things that are typically hard to raise funds for, such as buildings, overhead, and infrastructure costs associated with running a school. Secondly, they can provide seed funds to jump start initiatives, provide a proof of concept, and allow new investors to take part. Thirdly, with a structured matching program, we can make donor dollars go further by compounding their impact and broadening their reach.

Now take that and think about what is truly needed to transform the geosciences. Well, we are already doing that through the significant hiring goals we have set (35 faculty over the next five years) and the amazing influx of freshman for 2007-2008 (106). The key to success is to secure excellence. From faculty, to researchers, student leaders, and support staff , it is all about excellence. How do you secure that? Compensation packages, labs, infrastructure that encourages rather than hinders, scholarship dollars– the list goes on, all to help bring the best and the brightest to the Jackson School. You also work to provide an exceptional education and experience for the students that pass through the school.

Jackson School Development Team (left to right): Nancy Ewert, Ann Flemings, Julie Paul, and Debra Sue Trinque.

What are the school's main development goals?

Development includes growing funds and gaining friends, not necessarily in that order. First and foremost we want to engage our alumni. One significant event is the establishment of the Jackson School Friends and Alumni Network (JSG FANs). For the very first time, JSG alumni have an organization they can call their own, that can provide value to their experience as a graduate and hopefully, provide opportunities for them to reconnect and reenergize their relationship with us. Secondly, it is my job to raise private support and from my conversations with alumni, I see they are an enthusiastic group. That is crucial as well as heart warming. They really care about this school and what happens within the walls here. I could lay out some of the specifics like raising support for undergraduate scholarships, bringing in support for the proposed Student Center, and upping the commitments from our corporate sponsors, but the real intent behind all of that is to bring people to the table who are interested in truly making the vision a reality, who really want to help us show that "what starts here changes the world of geosciences." It is a spectacularly exciting time and I am proud to be able to play a part in it. *Hook 'em!*

CORRECTION

"Rumors of my demise have been greatly exaggerated," said Charlie Chernoff, quoting Mark Twain. In the 2006 edition of the Jackson School Newsletter, a photo caption on page 71 incorrectly stated: "The late Charlie N. Chernoff." We are heartened by the fact that Mr. Chernoff is not only alive and well, but that he still has a great sense of humor. In fact, he was just spotted at an alumni reception in Houston in September. We regret any confusion our caption may have caused.

Chernoff

Alumni Launch New Network

Alumni of the Jackson School have created a new organization called The Jackson School of Geosciences Friends and Alumni Network (JSG FANs). This marks the first time the geoscience alumni have had their own official alumni network. The purpose of the network is to:

- Create lifelong partnerships between you, our alumni, and the Jackson School of Geosciences
- Develop programs, events and relationships that enrich the careers and lives of JSG alumni
- Recognize the achievements of JSG alumni, students, and faculty
- Promote the continued development and progress of the Jackson School.

Dan Smith

About 100 alumni and friends met in Houston on September 12 for the first of several alumni events this fall slated to celebrate the new network. Dean Barron gave an update on the Jackson School and presented architectural renderings of the planned addition of a student enrichment center to the geology building. Dan Smith, executive vice president for exploration at Sandalwood Oil & Gas in Houston and inaugural president of JSG FANs, spoke about the power of the new network.

"I don't think any academic geoscience institution anywhere can match our network and the value that could be obtained by the alumni as a result of the network," he said. He noted many graduates have gone on to be presidents and CEOs of companies worldwide. "Having a network of geologists that have a similar background is important and will provide another career networking opportunity that hasn't existed until now."

Smith graduated from UT Austin in 1958 with a bachelor of science degree in geology. He said as a student, the Department of Geology (as it was then known) was like a family.

"I spent a lot of time in the building," he said. "It was a home away from home. We were a close knit group of people with

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New Society Honors Major Donors

The Jackson School has established The Hill Society to honor individuals who have made a cumulative contribution of at least $10,000 to the school since September 1975. So far, approximately 100 inaugural members have been identified.

"I can't think of a better way to honor these friends of the school than by inviting them into a society named after one of our founding luminaries," said Dean Eric Barron.

The society is named after Robert T. Hill, the first professor and chair of UT's School of Geology, which would later become the Department of Geological Sciences and ultimately the main academic unit within the Jackson School. He also helped found the University of Texas Mineral Survey, which later became the Bureau of Economic Geology, also a unit within the Jackson School and one of the largest research units at UT Austin. A biographer referred to Hill as the "Father of Texas Geology."

Born in Nashville, Tennessee two years before the start of the Civil War, Hill led a colorful life. He dropped out of school in the sixth grade and went to work for his brother at a newspaper in Comanche, Texas, a wild frontier town. He spent some time as a cowboy on the Dodge City Trail. In his spare time, he collected rocks and fossils and went on to receive a B.S. in geology from Cornell University in 1887. Through some 200 papers, books, and maps, he made significant contributions to the understanding of Texas geology.

In 1921, Hill was an expert witness for Texas in a boundary suit between Texas and Oklahoma. His testimony, along with those of other specialists, permanently won for Texas some 450,000 acres of river-valley lands and over 90 percent of the oil wells along the Red River. He received international attention as one of the first scientists to study the volcano Pelée on the island of Martinique during its catastrophic eruptive cycle of 1902, being the first to describe its classic "glowing cloud." Hill was an original fellow of the Geological Society of America.

R.T. Hill

The last ten years of his life, he wrote about science and Texas history for the *Dallas Morning News*. Hill died in 1941.

We will be honoring the inaugural Hill Society members this spring. If you are interested in becoming part of the society, please contact Ann Flemings at 512-471-1282, aflemings@jsg.utexas.edu

like interests. I just enjoyed all the associations, some of which have been life long. Dean Barron is bringing that back by trying to get connected with students and ensuring that they see it as a home away from home."

Smith said in addition to enhancing networking, he and his board will develop programs, events, and relationships that enrich the careers and lives of JSG alumni, such as field trips and continuing education opportunities to connect with faculty to learn about the latest developments in the field. Smith said he is interested in connecting alumni to students through mentoring programs. The board will begin creating local chapters in Houston, San Antonio, Austin, Dallas, Fort Worth, and Midland.

For more information about FANs and upcoming events, please contact Julie Paul at jpaul@jsg.utexas.edu.

Corporate Partners Boost Research Capacity

Dozens of corporations contribute to the Jackson School's research through the Industrial Associates Program (IA). The program supports researchers and graduate student research assistants, as well as laboratory and computational infrastructure. As part of their membership, donors receive research results, training and networking opportunities.

As they approach their 20th anniversaries, two IA programs at the Bureau of Economic Geology stand out as the longest-running: the Applied Geodynamics Laboratory (AGL) and the Reservoir Characterization Research Laboratory for Carbonate Reservoirs (RCRL), both of which began in 1988. Other IA programs at the Bureau include: Center for Energy Economics, Exploration Geophysics Laboratory, Fracture Research and Application Consortium, Gulf Coast Carbon Center and Quantitative Clastics Laboratory.

The AGL, considered the world's premier institute for salt tectonic research, is funded by a consortium of oil companies and supported by numerous software and seismic vendors. Concepts and terminology pioneered by AGL, such as "salt canopy," "salt weld," and "reactive diapir," have had a profound influence and are widely disseminated throughout the oil industry.

The AGL is now at an all time high in terms of numbers of associates (25) and annual contributions (over $1 million in 2007). Martin Jackson, a senior research scientist at the Bureau of Economic Geology, founded the AGL with help from Marcus Milling, former associate director of the Bureau, and Bill Fisher, its former director. Jackson noted that the AGL has brought in a total of $10 million, which constitutes the vast majority of the funding for salt tectonics at the Bureau in the last 20 years.

"Without corporate sponsorship, the program could not exist on this scale, which allows full-time research by professional scientists," said Jackson. "It also allows a full bag of tools to be applied to salt tectonics: physical modeling, numerical modeling, seismic analysis, field mapping, and remote sensing." The seismic data supplied to AGL by oil companies and seismic companies is difficult and expensive to obtain.

"One reason we've been so successful in attracting the seismic data is because of our track record," said Jackson. "We've churned out a lot of research results in that 20 years, including about 70 peer-reviewed external papers. The program wouldn't have the same influence if it were run on a shoestring."

Martin Jackson

The RCRL has been

equally successful. It has developed a rock-based method for building three dimensional reservoir models in layered carbonate reservoirs. Current research is focused on developing methods of characterizing more complex carbonate reservoirs.

Jerry Lucia, co-founder of the RCRL and senior research scientist at the Bureau, said their models are based on three fundamental advances also made at the RCRL: "First, we developed carbonate sequence stratigraphy, which is the basic framework for constructing all carbonate reservoir models," he said. "Second, we developed a way of quantifying the sequence stratigraphic framework in terms of petrophysical properties, which are porosity, permeability and water saturation. Third, we developed geostatistical methods for distributing petrophysical properties within the geologic framework in three-dimensional space."


Jerry Lucia

Reservoir Characterization Research Laboratory

The RCRL program has produced more than 45 external publications, as well as BEG publications, on carbonate reservoir characterization, sequence stratigraphy, petrophysics, geostatistics, and petroleum engineering.

The RCRL is enjoying all time high numbers of corporate associates (20), each of whom pays $45,000 for membership.

The Department of Geological Sciences has several IA programs, including: Forum for Exploration and Development Geophysics Education and Research (EDGER), River-Mouth Analysis Research, and Bars in Tidal Environments.

While not technically referred to as Industrial Associates Programs, the Institute for Geophysics has several projects which receive considerable corporate funding, including: the Caribbean Basins, Tectonics, and Hydrocarbons Project, the Gulf Basin Depositional Systems Project, the Gulf of Mexico Intraslope Basins Project, the PLATES Project and the Coupled Seismic and Reservoir Simulation and Inversion Program.

Dawson Gift Highlights Planned Giving Options

There are many ways to contribute to the Jackson School's mission of creating the nation's preeminent geoscience program. One option that has numerous benefits for individuals is a charitable remainder trust (CRT).

Decker Dawson, chairman of the board at Dawson Geophysical and longtime member of the Geology Foundation Advisory Council, has included the Jackson School in his will by forming a type of CRT called a unitrust.

"By forming a charitable remainder trust, I was able to give more," said Dawson. While the value of a CRT is difficult to assess at the outset because it will likely change over the years, his gift is currently estimated at over $2 million. Dawson, a member of the Jackson School's Hall of Distinction, said he hoped his gift would help address the current shortage of geoscientists.

"I just hope and pray that we can encourage more young people to become interested in geophysics and to take it up as a profession," he said. "We'd be doing any young person a favor because it's the most exciting thing anyone can get into."

He praised the strong faculty and educational opportunities available in the Department of Geological Sciences, as well as Dean Barron's vision for the entire school.

"I feel like supporting that effort because geophysics has been my life and a passion of mine," said Dawson. "So what little help I can make I'm just very happy to do."

The Jackson School community thanks Mr. Dawson for his dedication, leadership and foresight in joining his legacy to that of the school. For more information about giving options, please contact Ann Flemings at: aflemings@jsg.utexas.edu

Scholarships Help Students Achieve Academic Excellence

When Eric Barron took over the helm of the Jackson School as the new dean in August 2006, he set an ambitious goal for the school: to become one of the world's top five geoscience programs. A key to achieving that goal is attracting and supporting top students.

"The first title that I would like to claim is to be the most student-centered college that this university has ever seen, and to far exceed any other earth sciences program anywhere," said Barron.

As the Jackson School takes its crucial next steps to national prominence, private support—your support—will make the difference. To help the school attract the best and brightest students, the 2007-2008 annual giving campaign focuses on student scholarships.

For graduate students who have their choice of prestigious institutions, the availability of merit scholarship support is often the deciding factor. For undergraduates, scholarships can attract students interested in the geosciences, but who may feel other disciplines hold more opportunities. The gift of a scholarship provides hope for students who have earned access to—but may have difficulty affording—higher education. Financial resources provide encouragement for students skilled and motivated enough to make their dreams reality. And scholarships are vital to the school's vision of academic excellence and improved access for all students.

Now, thanks to a matching program instituted by Dean Barron that leverages the Jackson endowment, your gift will have a much broader impact. Any individual's contribution to a new endowed scholarship fund will be matched up to $100,000. If your company matches your contribution, the Jackson School will match the match, further multiplying your gift.

As a separate initiative, the school wants to use scholarship support to create incentives for success. To this end, Dean Barron has put forth an innovative plan to offer merit-based scholarships to full-time undergraduates who maintain a total UT grade point average of 3.0 or higher. For every quarter point above 3.0, the level of scholarship increases. This will provide another incentive for students to reach their full academic potential. It is yet another way that the Jackson gift is being used to raise the bar in the geosciences.

Julie Mitchell, a Jackson School undergraduate geoscience student, said her McCammon Scholarship freed her up to follow her passion.


Mitchell

"At the time I received the scholarship, I was still very new to the Jackson School and was still unsure as to whether

(continued on page 104)

JACKSON SCHOOL ENDOWED ACCOUNTS

Values as of August 31, 2007	Book Value	Market Value
Edwin Allday Centennial Chair in Subsurface Geology	$933,888	$2,410,924
Edwin Allday Lectureship in Geological Sciences	$251,021	$517,405
Mary and Ben Anderson Endowment for Graduate Studies in Geology	$48,111	$105,094
Millard B. Arick Memorial Fund in Petroleum Geology	$16,064	$24,811
Milo M. Backus Endowed Fund in Exploration Geophysics	$313,373	$403,793
Virgil E. and Mildred L. Barnes Distinguished Lecture Series in Geology	$49,693	$74,330
Col. E. M. Barron Trust Account	$264,898	$548,392
Barrow Periodical Fund	$268,490	$479,624
Leonidas T. Barrow Centennial Chair in Mineral Resources	$1,220,103	$3,617,762
Laura Thomson Barrow Graduate Fellowship	$340,884	$754,086
Bloomer Fund for Motivated and Late Bloomer Students	$242,939	$479,665
Leslie Bowling Professorship	$311,784	$628,561
Wayne Franklin Bowman Endowed Presidential Scholarship	$148,830	$416,749
Don R. Boyd Endowed Fund	$50,487	$71,363
Don R. and Patricia Kidd Boyd Lectureship in Petroleum Exploration	$82,752	$194,236

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Brahman Energy Company Scholarship Fund	$26,367	$74,144
Charl A. M. Broquet Memorial Endowed Scholarship Fund	$16,595	$23,582
Jesse L. Brundrett Memorial Endowed Presidential Scholarship	$62,427	$139,546
Fred M. Bullard Professorship in Geological Sciences	$443,929	$738,473
Fred M. Bullard Student Research Fund	$55,649	$73,572
Bureau of Economic Geology Research Endowment Fund	$11,055,256	$11,872,823
Thomas and Ray Burke Student Job Program	$326,643	$471,243
Hal H. Bybee Memorial Fund	$180,360	$337,809
Hal P. Bybee Memorial Fund	$742,506	$2,032,381
Robert Bybee Endowment for Student Field Studies	$55,704	$58,256
L. W. Callender Memorial Fund	$79,101	$223,593
Dave P. Carlton Centennial Professorship in Geology	$841,274	$2,316,810
Dave P. Carlton Centennial Professorship in Geophysics	$611,083	$1,865,143
Dorothy Ogden Carsey Memorial Scholarship Fund	$273,399	$572,034
J. Ben Carsey, Sr. Special Maintenance Fund	$253,039	$481,724

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Values as of August 31, 2007	Book Value	Market Value
Chernoff Family Library Fund for Geophysics and Earth Systems Sensing	$94,468	$103,961
Chevron Centennial Professorship in Geology	$323,357	$889,695
S. E. Clabaugh Fund in Hard-Rock Geology	$73,322	$159,277
W. Kenley Clark Memorial Endowed Presidential Scholarship	$64,298	$174,570
Hubert Collins Endowment for the Bureau of Economic Geology	$2,167,977	$4,306,029
Joseph S. Cullinan Memorial Scholarship in Geological Sciences	$58,539	$171,054
Robert H. Cuyler Endowed Presidential Scholarship	$89,230	$235,709
Morgan J. Davis Centennial Chair in Petroleum Geology	$1,024,064	$2,861,283
L. Decker Dawson Fund in Exploration Geophysics	$1,103,972	$1,511,182
Ronald K. DeFord Field Scholarship Fund	$264,793	$713,458
Alexander Deussen Professorship in Energy Resources	$352,064	$761,623
Michael Bruce Duchin Centennial Memorial Endowed Presidential Scholarship	$78,974	$179,718
Ralph and Sally Duchin Field Experiences Endowment	$100,000	$100,000
John E. "Brick" Elliott Centennial Endowed Professorship in Geological Sciences	$393,947	$1,187,260
Samuel P. Ellison, Jr. Fund	$147,144	$348,706
Energy and Mineral Resources Fund	$40,622	$116,910
Ewing and Worzel Graduate Fellowship	$607,483	$1,578,489
William Stamps Farish Chair in Geology	$518,652	$1,506,661
Peter T. Flawn Centennial Chair in Geology	$888,646	$2,519,738
R. L. Folk / E. F. McBride Petrography Fund	$68,596	$88,747
Robert L. Folk Excellence Fund in Geological Sciences	$103,438	$157,307
Fort Worth Wildcatters Association Undergraduate Scholarship	$31,505	$39,222
Friends of the Student Field Experiences Endowment	$39,763	$41,511
Geology Foundation Advisory Council Centennial Teaching Fellowship	$135,850	$325,065
Geology Foundation Excellence Fund	$141,096	$287,178
Getty Oil Company Centennial Chair in Geological Sciences	$1,054,907	$1,130,905
James A. Gibbs Hydrogeology and Engineering Geology Research Fund	$113,687	$128,240
Robert K. Goldhammer Chair in Carbonate Geology	$1,036,666	$1,307,675
Graduate Fellowship in Exploration Geophysics	$558,200	$775,606
Miss Effie Graves Scholarship Fund	$38,259	$117,121
Guy E. Green Endowed Presidential Scholarship	$49,101	$130,034
J. Nalle Gregory Chair in Sedimentary Geology	$810,149	$2,144,711
J. Nalle Gregory Regents Professorship in Geological Sciences	$352,664	$848,120
Thelma Lynn Guion Geology Library Staff Award	$20,925	$34,680
Karl Frederick Hagemeier, Jr. Memorial Endowed Presidential Scholarship	$54,918	$127,558
George S. Heyer Memorial Fund	$132,921	$393,995
Bill D. Holland Endowed Presidential Scholarship in Geological Sciences	$51,366	$78,255
Houston Oil and Minerals Corporation Faculty Excellence Awards	$79,429	$209,511
F. Earl Ingerson Graduate Research Assistance Fund in Geochemistry	$71,412	$155,751
John A. and Katherine G. Jackson Centennial Teaching Fellowship in Geological Sciences	$200,470	$501,671
John A. and Katherine G. Jackson Chair in Applied Seismology	$1,000,000	$1,000,000
John A. and Katherine G Jackson Chair in Computational Geosciences	$2,067,730	$2,522,307
John A. and Katherine G. Jackson Chair in Energy and Mineral Resources	$1,002,342	$1,237,606
John A. and Katherine G. Jackson Chair in Earth System Science	$1,002,137	$1,129,258
John A. and Katherine G. Jackson Chair in Geosystems	$1,000,000	$993,206
John A. and Katherine G. Jackson Decanal Chair in the Geosciences	$1,503,206	$1,693,888
John A. and Katherine G. Jackson Endowed Fund in Geosciences	$249,427,249	$347,686,339
John A. and Katherine G. Jackson Exploration Geophysics Fund	$27,901	$38,717
John A. and Katherine G. Jackson Fellowship in Geohydrology	$312,168	$576,017
John A. and Katherine G. Jackson Fund for Energy and Mineral Resources Student Support	$1,002,154	$1,138,187
G. Moses and Carolyn G. Knebel Teaching Fund	$152,560	$373,819
Martin B. Lagoe Student Research Fund for Micropaleontology	$46,974	$73,488
Clara Jones Langston Centennial Lectureship in Vertebrate Paleontology	$38,820	$93,254
J. Donald Langston Special Operations Fund	$395,525	$803,567
J.D. and V.L. Langston Endowed Scholarship Fund in Geology and Geophysics	$439,136	$439,918
Wann and Marietta Langston Research Fund in Vertebrate Paleontology	$148,251	$405,680
Jack K. Larsen-Mesa Petroleum Company Fund in Sedimentary Geology	$224,541	$578,848
Nancy and Allen Locklin Endowed Scholarship in Petroleum Geology	$25,047	$28,218
Howard R. Lowe Vertebrate Paleontology Endowment	$48,511	$129,197
J. Hoover Mackin Memorial Scholarship Fund	$35,572	$95,924

JACKSON SCHOOL ENDOWED ACCOUNTS

Values as of August 31, 2007	Book Value	Market Value
George W. Marshall, Jr. Memorial Endowed Presidential Scholarship	$47,806	$100,711
Arthur E. Maxwell Graduate Fellowship in Geophysics	$112,557	$172,890
John C. and Marian B. Maxwell Undergraduate Scholarship in Geological Sciences	$145,993	$203,229
Jack H. Mayfield, Jr., Fund for Excellence in the Geological Sciences	$577,604	$1,249,694
John H. and Lujza McCammon Endowed Scholarship	$16,872	$48,086
Mr. and Mrs. L. F. McCollum Scholarship in Geology	$31,647	$87,178
Michaux Scholarship Fund	$15,255	$43,814
Joan A. Middleton Endowed Scholarship in Geology	$12,526	$20,905
Carroll C. Miller Endowed Presidential Scholarship	$45,099	$127,240
James R. Moffett Scholarship Fund	$27,736	$34,083
William R. Muehlberger Field Geology Scholarship Fund	$158,715	$278,819
Wes Ogden Memorial Scholarship in Geophysics	$16,912	$37,670
Fred L. and Frances J. Oliver Lectureship in Texas Hydrology and Water Resources	$125,580	$256,311
Judd H. and Cynthia Oualline Centennial Lectureship in Geological Sciences	$140,585	$290,278
Judd H. and Cynthia Oualline Centennial Lectureship in Petroleum Geology	$157,129	$300,262
Judd H. Oualline Endowment Fund	$41,560	$87,490
Ed Owen-George Coates Fund	$182,262	$463,352
Palisades Geophysical Institute Postdoctoral Fellowship	$666,653	$1,433,432
James C. Patterson Fund for Excellence in the Geophysical Sciences	$172,644	$230,296
Bill R. Payne Centennial Teaching Fellowship	$138,470	$336,892
Joyce Bowman Payne Centennial Teaching Fellowship	$134,798	$317,060
Pennzoil and Pogo Producing Companies-William E. Gipson Scholarships	$251,359	$567,426
O. Scott Petty Geophysical Fund	$267,006	$710,513
Wallace E. Pratt Professorship in Geophysics	$257,411	$708,009
Louis and Elizabeth Scherck Geology Scholarship	$136,176	$334,498
Wilton E. Scott Centennial Professorship	$329,815	$986,991
Walter Benona Sharp Memorial Scholarship in Geological Sciences	$57,526	$169,916
Shell Companies Foundation Centennial Chair in Geophysics	$1,325,009	$3,544,443
Shell Companies Foundation Distinguished Chair in Geophysics	$1,129,156	$3,111,184
F. W. Simonds Endowed Presidential Scholarship	$40,215	$122,055
Judy and Russ Slayback Fund for Hydrogeologic Field Experiences	$25,500	$25,330
William T. Stokes Centennial Teaching Fellowship in Geological Sciences	$212,042	$549,836
Structural Geology and Tectonics Fund	$171,465	$368,409
Harlan Tod Sutherland Memorial Scholarship Fund	$66,863	$146,008
John and Elizabeth M. Teagle Scholarship in Petroleum Geology	$816,657	$1,946,438
David S. Thayer Memorial Scholarship Fund	$40,021	$113,948
Tobin International Geological Map Collection Fund	$104,732	$324,026
Total E&P USA Petroleum Faculty Fellowship in Geological Sciences	$254,945	$574,774
Udden Memorial Scholarship Fund	$29,383	$62,756
Glenn and Martha Vargas Endowed Presidential Scholarship	$48,716	$100,570
Glenn and Martha Vargas Endowment for Gems and Gem Minerals Instruction	$97,725	$209,773
Glenn and Martha Vargas Fund for Gem and Mineral Curation	$70,380	$100,765
Glenn and Martha Vargas Gemological Scholarship in Geological Sciences	$23,049	$55,493
Wagner Field Geology Fund	$50,000	$50,000
Joseph C., Jr. and Elizabeth C. Walter Geology Library Fund	$816,057	$1,643,740
Albert W. and Alice M. Weeks Centennial Professorship in Geological Sciences	$278,721	$675,642
Albert W. and Alice M. Weeks Fund in Geology	$674,893	$1,495,109
Katherine Hubby Weiner and Stephen P. Weiner Endowed Scholarship	$27,381	$27,195
E. A. Wendlandt Fund	$11,435	$31,698
Arno P. (Dutch) Wendler Professional Development Fund	$143,803	$407,819
Gale White Endowed Fellowship in Geophysics	$597,603	$993,207
Francis L. Whitney Endowed Presidential Scholarship	$66,498	$184,123
Francis L. Whitney Memorial Book Fund	$62,793	$132,366
Addison A. and Mary E. Wilkinson Endowed Presidential Scholarship in Geological Society	$82,920	$127,163
John A. Wilson Professorship in Vertebrate Paleontology	$246,828	$602,959
Charles E. Yager Undergraduate Field Scholarship Fund	$74,984	$206,846
The First Mr. and Mrs. Charles E. Yager Professorships	$176,866	$545,239
The Second Mr. and Mrs. Charles E. Yager Professorships	$164,406	$528,844
The Third Mr. and Mrs. Charles E. Yager Professorships	$222,891	$666,670
Keith and Ann Young Endowment for the Non-Vertebrate Paleontology Collection	$52,008	$73,408

I wanted to complete a full degree in geological sciences," she said. "This scholarship removed my need to work, and allowed me to spend more time on my studies. I had an excellent year, taking from two to four geology courses each semester last year and doing well in all of them."

Travel funding is another critical means of support for top students.

"In order for students to obtain post graduate employment where they can impact the earth sciences they must be taken seriously and have made helpful contacts during their education," said Jeri Rodgers, a Jackson School doctoral student. A travel grant from the Carsey Fund enabled her to attend the annual Society for Vertebrate Paleontology meeting in Ottowa in 2006. "Funding of travel to these meetings provides students from the Jackson School the experiences and opportunities they need outside of classes to be successful," she said.

Graduate student Beatriz Garcia-Fresca used professional development funds to visit with members of ExxonMobil's Upstream Research Center. As a result of the meeting, she was offered an internship. She said scholarships can also help students get valuable field experience.

"The JSG will be producing some of the best field geologists of the next few decades, in fact it already is," she said. "Field oriented research requires extra money to cover field expenses. The availability of Foundation scholarships contributes greatly to this purpose. They also allow students certain financial independence from their main sources of funding to pursue specific ideas and goals. It is a great way for alumni to feel a part of the JSG educational project and contribute to making it possible."

Alumni and Friends Jump Start New Endowments for Student Field Experiences

Alumni and friends have responded generously to the new Friends of Student Field Experiences Endowment campaign that Dean Eric Barron announced in December 2006. Annual giving and new endowments, combined with previous donations for field experiences plus several affiliated endowments, now total $1.2 million, almost halfway toward the goal of $2.5 million. Many students struggle with the added expense of field trips, from the extremely popular 660 Summer Field Camp for undergraduates and its parallel track in hydrogeology to the range of field experiences pursued by graduate students. Geology programs across the country are cutting back on—or cutting out entirely—their annual field courses.

"The costs are escalating and the pressure on student tuition and fees is already too great," said Barron. "Yet, in my mind, nothing cemented my enduring interest in geology more than when the blackboard was replaced by the real thing."

Adding to the challenge of funding the field experiences, the Jackson School is undergoing a rapid rise in student enrollment, particularly at the undergraduate level. Traditionally, geoscience majors have entered the discipline after their freshmen year or coming to the university as transfers. The fall of 2006, however, saw a major influx of freshmen applying for admission to the Jackson School. The new freshmen increased undergraduate enrollment overall by 25 percent in one semester. The trend is continuing in 2007-08, with fall enrollment rising to 275 undergraduates.

While this level along with the sustained high enrollment of graduate students is great for the school and the discipline, it will add significantly to the financial pressures on field experiences, making the new field experience endowments even more critical.

Students on Field Experiences and the Value of Support

"Much, if not all, of what I learned about geology over my past three years as a student at UT was integrated into the fantastic variety of formations, outcrops, folds, faults, and geologic features that Dr. Cloos showed us. It's experiences like this one that remind me how fortunate I am to be a part of an institution like UT and a community like the Jackson School.... I am amazed at the generosity of the Jackson School in financing this entire expedition."
—James Pape, undergraduate in geology who took part in a JSG-funded field trip to California led by Prof. Mark Cloos

"I think it's absolutely essential that every geologist get out and see the rocks. Ours is not a laboratory science.... I don't know how any geology student could consider themselves well rounded in their studies if they didn't have any field training. If I had not received the scholarship for 660, finding the money for the following semester would have been really tough. It took such a load off. I know many students like myself who are paying for college out of pocket and every little bit you save is worth it, but to save a big chunk like this is a serious boon."*—Wesley Schumacher, undergraduate in geology who participated in 660 Summer Field Camp in 2006*

"At the time, I considered trying to switch majors within the department to avoid field camp and get a job - not something I wanted to do by any means, but felt was my only option. The scholarship I was awarded covered my tuition, leaving me with only the smaller bill of supplies."
—Taylor Bartholomew, graduate student in geology who participated in 660 Summer Field Camp in 2006

Pape

FACULTY UPDATES

Daniel S. Barker

In 2006-2007, Dan kept busy with research projects (papers published in *Geology* and in *Canadian Mineralogist*, and another in press). Manuscripts on the Llano granites and some dikes in Big Bend are almost finished. He vacated his office in the Geology Building and works comfortably at home but misses the interruptions. He visited daughters in the northeast and in South Austin, and enjoyed a Smithsonian tour of the Galapagos Islands, for which the study leader was his last Ph.D. student, Kirt Kempter.

Christopher J. Bell

Chris initiated a new research project in Western Australia in the summer of 2005. The project goals are centered on understanding the evolutionary morphology and fossil record of lizards in Western Australia, and include investigation of materials from many of the localities excavated previously by Ernie Lundelius. Chris was in Australia for two months in 2005, and two months in 2006, working in collaboration with Jim Mead and Marci Hollenshead from Northern Arizona University, and with scientists from the Western Australian Museum in Perth. A necessary prerequisite to interpreting the fossil record is development of a detailed understanding of skeletal morphology in extant Australian lizards. Since 2005, Chris has prepared nearly 500 skeletal specimens in support of this research. The first papers describing detailed anatomy of the skulls of agamid lizards are now in review.The research team also recently submitted a manuscript describing the first known fossil record of the limbless gecko Delma.

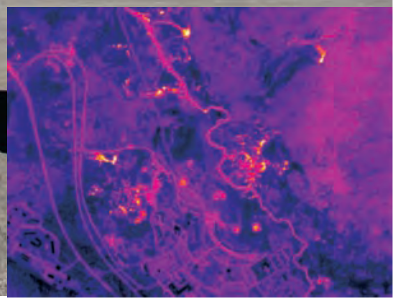
Chris also continued his collaboration with former Jackson School postdoctoral fellow Ascanio Rincón. Ascanio returned to Venezuela in October 2006 and immediately began work on an exciting new fossil discovery at the El Breal de Orocual locality near the city of Maturín in northeastern Venezuela. The Orocual discovery promises to be one of the great discoveries in vertebrate paleontology in the last quarter century. The locality was brought to light when PDVSA geologists exposed a buried bone bed in a pipeline trench. The bones were exposed for a length of 15m along the wall of the trench, and extend to a minimum depth of 2m below the ground surface. Subsequent investigation by Ascanio revealed that the fossiliferous sediments in the area may cover as much as 18,000 m2. Preliminary analysis of recovered fossils reveals a diverse assemblage of fossil vertebrate, insect, and plant material that includes remains of an extinct homotheriine saber-toothed cat. Prior to the Orocual discovery, the southernmost definitive record of this group of cats was in Texas! We anticipate a continuing series of exciting discoveries from Orocual, and will provide updates through this newsletter.

Bayani Cardenas

Bayani had a wonderful first year as a new faculty member. He continues to conduct studies on groundwater-surface water interactions, but he now has projects on ground-based and airborne thermal remote-sensing, which took him to the Virgin River just outside Zion National Park, the Texas Gulf Coast, and Yellowstone National Park. He has also conducted 2D millimeter-scale modeling studies of flow through fractures in collaboration with JSG colleagues, and has ventured towards 3D modeling of flow and

Chris Bell taking GPS data on a new lizard locality in the Shark Bay region, Western Australia. The decorative head gear reduces the annoyance of flies and provides continuous air circulation around his head; both major benefits in Western Australia. Photo by Sandra Swift.

Skull of a homotheriine cat recovered by former JSG postdoc Ascanio Rincón from El Breal de Orocual, Venezuela, in April 2007. This is the southernmost definitive record of this group of cats. Photo by Ascanio Rincón.



Thermal IR field image taken by Bayani Cardenas above Old Faithful in Yellowstone National Park. Old Faithful itself is in the middle of the circular feature. The photo was taken, around 2 a.m., from the plane shown in the adjoining photo.

transport at the individual pore scale. He also worked with students using electrical resistivity tomography to map changes in soil moisture. Bayani is now advising a first-year Ph.D. student, Audrey Hucks, and is mentoring two new M.S. students, Blair Stanley and Jeff Olyphant. He supervised Laura Merner, an undergrad from Clark University, who visited UT as part of the Environmental Science Institute's NSF/DOD-supported Research Experience for Undergraduates program. He enjoyed teaching his first-ever course at UT, GEO 346C (Intro Hydrogeology), last spring and had a blast co-teaching GEO 376L (Hydro Field Methods) with Jack Sharp this summer. But the most important highlight of the past year for Bayani happened on the first day of spring, March 21, when his family welcomed a baby girl – Mayumi Olivia! His growing family is enjoying Austin.

William Carlson

Highlights of the past year for Bill Carlson have centered on the blossoming of the Undergraduate Honors Research Program (which Carlson co-directs with Chris Bell) and on the achievements of students in his research group. The honors research program completed its first full year of operation, engaging 17 of the Department's top undergraduates in independent research projects overseen by a variety of faculty. Seven students completed senior theses this year, and the remainder still have projects underway. "A six-day field trip to California led by Mark Cloos was an extraordinary experience for these honors students, one they'll likely never forget," writes Carlson. Two of the graduating honors students, Elizabeth Hatley and Abby Temeng, did their honors thesis research in Carlson's group. Elizabeth is continuing with the group as a master's student, and Abby has enrolled in the graduate program at Stanford. Ph.D. student Christopher Berg completed his degree and has started a tenure-track faculty position at the University of Western Georgia. Martin Robyr from the University of Lausanne began a two-year postdoctoral stint last October, adding an international flavor to the group with weekly updates on his spectacular snowball garnets from the central Swiss Alps. The inclusion in the group of new master's student Emily McDowell and new Ph.D. student Stephanie Moore, along with Elizabeth's change to graduate status, has re-vitalized the group with new perspectives and additional enthusiasm. "Continued NSF funding for diffusion studies and for support of the CT facility—and NSF money for a second CT scanner and a new laser-ablation unit," writes Carlson, "ensures that we'll all remain busy and productive!"

Some of the "Carlson Group" in March 2007, from left to right: Wes Crawford, Elizabeth Hatley, Martin Robyr, Abby Temeng, Ed Lane, Chris Berg, Bill Carlson. Not shown: Eric Kelly, Josh Garber.

Mark Cloos

For the past few years, Mark has taught undergraduate structural geology (GEO 428) and graduate level tectonics classes. He continues to run a class field trip to the Arbuckle and Ouachita mountains in southern Oklahoma. He has also led some other field trips. Last spring, he took the senior-level B.S. Honors students on a five-day whirlwind tour of central California, a trip which focused on the Franciscan subduction zone and San Andreas transform tectonics. Prior to the trip, each student researched a geologic process and prepared a brief lecture, which they presented at a California outcrop corresponding to their topic. This field excursion, an outgrowth of the new DGS Honors Program spearheaded by Bill Carlson and Chris Bell, was funded by Dean Barron and the Jackson School. In May, Mark taught the Introduction to Field Geology course (GEO 320L) for non-geology majors. For two decades, this course was taught by Leon Long and has become a sought-after elective for the UTeach program. The course includes projects in the Cretaceous geology around the Austin area and the Paleozoic strata and basement terranes exposed in the Llano Uplift. This year, the flooding of the Llano River hindered completion of one of the exercises, but provided students with firsthand experience in the power of running water.

In July, Mark returned to California to lead 11 UTeach Geological Sciences M.S. students on a comprehensive 10-day field course. The journey began near Morro Bay and San Simeon, and continued northward along Highway 1 to Big Sur and Monterey. The group traveled across the Great Valley and up into Yosemite, across the Sierras into the Mono Lake-Owens Valley region, up to Lassen volcano and back down to San Jose via the San Francisco Bay and the Marin Headlands. The group of 5th through 12th grade teachers had experience ranging from four to 22 years in the classroom. They were in the second summer of a three-summer M.S. degree program spearheaded by Clark Wilson. The teachers saw much of the enormous diversity of rock types and structures that California has to offer. The trip had particular focus on coastal processes, mountain uplift and erosion, active faulting, and volcanism. This field course, unique to the entire UTeach M.S. program, would not have occurred without the generous support of the Jackson School. This trip was a plea-

Members of the UTeach M.S. Geological Sciences California Field Course are still smiling at the end of a ten day, 2100 mile, 80 stop field trip to see geology in action. The final stop was a close look at the Golden Gate Bridge, located a few miles from the San Andreas fault and the nucleation site of the 1906 earthquake. Back row from left: Dennis Trombatore (driver), Kathleen Negrito, Todd White, Jonathan Maxwell. Middle row: Jeff Horowitz (driver), Gail Dickinson (UTeach Master Teacher), Elizabeth Abernathy, Mark Cloos, Elaine Graham-Bohls, Kathy Andrews, Leon Long, Christopher Aparicio, Ashleigh Barber-Bomar. Front row: Adrian Carrales and Rebecca Frammolino.

sure to lead as every one of these "students" quickly proved themselves to be exceptionally motivated learners—they had chosen geology to enrich their classes. These 11 M.S. candidates will teach science to many thousands of students over the coming years. Mark suspects the seeds of a geoscience career will be planted in more than a few of their students.

Mark's field projects in west New Guinea near the Ertsberg Cu-Au Mining District continue with the support of PT Freeport Indonesia/Freeport McMoRan Copper and Gold, as well as a pair of M.S. students and a crew of undergraduate research assistants. Steady work continues in publishing the results of student work completed over the years. Recent major papers concern the tectonics of the New Guinea region, the megatectonic process of collisional delamination, and regional metamorphism in the highlands of west New Guinea. Field projects in the Coast Ranges of California, an area that Mark has worked in for more than three decades, have attracted a cluster of graduate students since 2000. The work continues to center on understanding subduction zone processes and the superimposed effects of transform faulting. With the collaboration of Todd Housh and two recent M.S. students—Alka Tripathy and Anna Morisani—some new geochronological constraints have come from U-Pb dating of detrital zircons that put remarkable constraints on the timing of subduction underplating and mélange formation. The work was only possible because of the Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry lab – a world-class research facility housed in the Department.

Rich Kyle

Rich reports a challenging year, following a major auto accident last September that required considerable time and energy to get his life back. Nevertheless, in the fall semester, he taught the Supervised Instruction in Geological Sciences course required of all new Teaching Assistants, as well as developing a new core course with Chip Groat on the Geology of Earth Resources for the Energy and Earth Resources graduate program. The spring semester courses were the upper division electives on the Geology of Texas and on Mineral Resources, Society, and the Environment. Rich supervised the completion of two master's theses on the world-class Cu-Au deposits of the Ertsberg district in New Guinea by Laurel Gandler and Lorraine Baline, both of whom made research presentations at the Geological Society of America annual meeting and have started their careers in the energy resource industry. He taught the introductory Physical Geology course during the first summer session, attracting some new students to switch to Geological Sciences majors. Rich enjoyed an opportunity to attend the Geological Association of Canada meeting in Yellowknife, at least getting near his Ph.D. fieldwork location, to make a well-received presentation with Rich Ketcham and former student Alison Mote of their high resolution computed tomography studies of gold in ores (see www.ctlab.geo.utexas.edu/geo/index.php#ore/). Tours of the new Barren Lands diamond mines at Diavik and Ekati were the highlight of the northern visit—still frozen in late May! A mid-summer trip to the meeting on European Current Research on Fluid Inclusions in Bern, Switzerland, provided an opportunity to make a presentation on computed tomography applications to fluid inclusion research, as well as seeing a bit of the geology of the Western Alps.

Lynton S. Land

Lynton and Judy continue to enjoy the "Land of Pleasant Living" and not a day goes by that they don't eat something they grew or caught. Last night it was fresh blueberries, tonight it's steamed crabs, and it's about time to make apple cider. The freezer is full of fish and vegetables and there are now more than 50,000 oysters off the pier as part of a VCU/VaTech project to determine quantitatively how much they improve water

Lynton Land and Colby Drechsel, B.S. '94.

clarity. Judy served her term as president of the local chapter of the Virginia Native Plant Society, but remains active and dedicated to waging war on invasive plants. Lynton also completed his term as president of the Northumberland Association for Progressive Stewardship (NAPS at www.napsva.org) but remains active planting marsh grass in spring for people who want "living shorelines" and waging war on invasive Phragmites in fall. Water quality in Chesapeake Bay continues to decline because nobody will rein in agricultural fertilization, and Lynton continues to serve on various Technical Advisory Committees and keeps trying to educate the public and the politicians—see www.VaBayBlues.org. Aaron is in LA trying to make it in the film industry—www.happypixelstudios.com. Come see us in Ophelia, Va.—JandL@rivnet.net—maybe you too can catch a big rockfish like Colby Drechsel did!

Ernest L. Lundelius

For the past year Ernie has been working on several projects. One long-term project with Bill Turnbull of the Field Museum is a study of the mammalian fauna from Madura Cave on the Nullarbor Plain of Western Australia. This project is almost done. Another, with Russell Graham of Penn State, is the compilation of FAUNMAP II, a database of North American mammals for the last 5 million years. The compilation is done, and they are now planning to use it to explore some questions about the faunal changes and their relation to environmental changes in the mammal fauna of North America over that period of time. Several of the paleontologists at UT are looking into the possibility of using enamel hypoplasia in Pleistocene horses to determine if the degree of stress increased near the time of their extinction.

Rich Kyle and Chip Groat with the Geology of Earth Resources class at ALCOA's Three Oaks lignite mine.

Earle F. McBride

The mysteries of the origin of quartz cement in sandstones continue to attract Earle's research efforts. He also is studying annual variations in the composition of Mississippi River sand at Rock Island, Illinois, his hometown. The past year saw the completion of a study (with John Warme, Colorado School of Mines) of the composition of sand in the Colorado River of Arizona, from Lee's Ferry to a point 120 miles downstream. This project was done to help the National Park Service determine why sand in river bars (called beaches by river rafters) is disappearing. Earle's collaboration with Duke Picard, from the University of Utah, led to the publication of a study of sand in a river draining the Dolomites in northern Italy. A version of Joe Mehring's thesis (M.S. 2005) on the reason the beach sand of the Florida panhandle is 99+ percent quartz also saw publication. Pure quartz sand is common in tropical settings, but is anomalous in the temperate setting of Florida. Florida beach sand is reworked from nearly quartz-pure Tertiary sand formations of the coastal plain. Earle was pleased to see his ideas on the origin of the Haymond Boulder Beds in the Marathon Uplift in West Texas were endorsed by several Creationists. After an excellent review of the literature, the Creationists accepted Earle's explanation, first expressed by Phil King in 1937, that boulders in those marine deposits were those of catastrophic submarine slides and not glacial erratics, fault blocks, etc. However, the Creationists reported that these Pennsylvanian-age deposits were "Noachian," the results of Noah's Flood, and were not ancient as previously thought. Earle was a bit stunned from this study, because he had not considered a Noachian origin for the Boulder Beds.

Terrence M. Quinn

Terry continues to work on further development of a marine-based program in paleoclimatology in the Department of Geological Sciences and in the Institute for Geophysics. Activities in this regard include designing a new stable isotope laboratory, working with graduate students and colleagues on paleoclimate research projects, teaching at the undergraduate and graduate level, and participating in outreach activities. Renovation of the stable isotope laboratory continues with the remediation phase completed and the construction phase just beginning. The renovated lab will likely open early in 2008 and will house new state-of-the-science isotope ratio mass spectrometers. This new facility will be available for use by all members of the JSG. Terry published six peer-reviewed journal articles in the 2006-2007 fiscal year; four of these have graduate students as first authors and one was published in *Nature*. Terry also was the lead author of a book chapter ("Corals, Sclerosponges, and Mollusks") in the *Encyclopedia of Quaternary Science*. Terry taught the carbonate section of GEO 416M (Fall 2006 and Spring 2007) and is teaching Geoclimatology (371C/380T) in Fall 2007. Terry gave eight presentations at other universities across the country last year as part of the Distinguished Lecturer Series of the Joint Oceanographic Institutes. Terry also gave a keynote lecture at the "Climate Change: Past and Future Workshop" held in Sendai, Japan. KXAN-TV interviewed Terry, along with several other JSG scientists, in early 2007 regarding the science implications of the IPCC report. Terry was also interviewed by the *LA Times*, *National Geographic News*, and KLBJ-Radio on the use of coral records to constrain the history of hurricane activity over the past 270 years.

Douglas Smith

Doug is enjoying retirement by splitting his time between Austin and Durango, Colorado. Still, or perhaps especially, now there is time for research. His years of studying xenoliths to understand mantle evolution have furnished as many questions as answers for one of his favorite regions, the Colorado Plateau. As a result, he is returning to an investigation of the unusual potassic igneous rocks that were emplaced there about 25 million years ago. He hopes results will lead to further insights into how the mantle evolves and how that evolution influences crustal tectonics. He enjoys the research base provided by the geochemical labs and colleagues in the Department, a fast internet connection in Durango, and abundant free time. Of course, detrimental to research are the opportunities to enjoy the high desert, mountains, mushrooms, and granddaughters.

Jim Sprinkle (left) and Tom Guensburg from Rock Valley College point to a fossil echinoderm found in 1997 on a ridge in the western Utah desert. It was brought to the Jackson School for study and chosen as the holotype of a new Early Ordovician parablastoid genus and species. Photo by Sergei Rozhnov, Paleontological Institute, Moscow.

Jim Sprinkle

Jim is an invertebrate paleontologist who works on fossil echinoderms (such as crinoids, blastoids, starfish, and sea urchins) that lived mostly during the Early Paleozoic. He has had a long-term project to find, collect, and describe echinoderms from the Early Ordovician, a poorly known time interval at the beginning of a major radiation of marine invertebrates, including echinoderms, during the Ordovician Period. Most of the field work for this research project has been in Utah, Nevada, and more recently in southeastern Idaho, where a major discovery of Early Ordovician echinoderms was made in 2004. Jim went out on several short field trips, and spent six days this summer visiting new and old localities in Idaho and Utah to collect additional echinoderms. But most of his travel last year was to visit co-workers to try and finish papers describing these new echinoderms and their importance. These included visits to work with Tom Guensburg at Rock Valley College, Rockford, Ill., visits with former UT Ph.D. student Colin Sumrall, now at the University of Tennessee, Knoxville, Tenn., and single visits to Peter Whaley, Murray State University, Murray, Ky., Ron Parsley, Tulane University, New Orleans, La., and Forest Gahn, Brigham Young University-Idaho in Rexburg, Idaho.

Jim also spent the month of June as Co-Principle Investigator on a new NSF Grant awarded to the Nonvertebrate Paleontology Laboratory of the Texas Memorial Museum to put images of fossil echinoderms in their type collections (many collected and described by Jim in the 1970s and 1980s) on the Internet for use by other researchers. Jim taught Paleobiology (a writing-component course with two field trips) to 33 geology juniors and seniors in the fall, along with giving a lecture and running a field trip for Leon Long's graduate course Modern Geological Sciences, and taught his introductory Plate Tectonics and Earth History course to 91 freshman geology majors and non-majors in the spring. Increased enrollment in the paleobiology course has put it right at the limit for teaching it as a writing-component course. During the year, Jim had a GSA abstract and two new chapters in the McGraw-Hill *Encyclopedia of Science and Technology* (10th ed.) published, and has two joint papers now in press in paleontological journals that should be published before the end of 2007.

1930s

John D. Tuohy (B.S., 1939) writes, "Still living in Canyon Lake, Texas. Enjoy following the ever changing developments in oil exploration. Kids and grand kids all doing well. Son Thomas, UT '78, is with BP Amoco and has followed in my footsteps in that his professional career has all been overseas. He keeps me well up to date on the international doings of the industry."

1940s

Walter E. Belt, Jr. (B.S., 1943) writes, "[I've] been retired for 25 years. Virginia and I continue to happily live, for our fifth year, in Del Webb's SUN CITY Retirement Community of 5,000 homes and growing, a part of Georgetown." He can be reached at webjr@suddenlink.net.

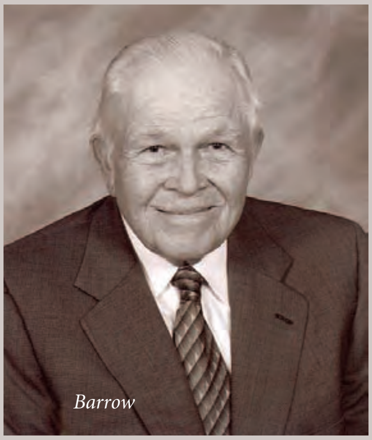
J. E. "Woody" Bryant (B.S., 1943; M.A., 1948) resides in Fredericksburg, Texas.

T. J. Burnett Jr., (B.S., 1949) writes "I am now a great granddad five and a half times over." He is retired and lives in Houston, Texas. He can be reached at tomjbjr@sbcglobal.net.

Thurman Geddie (B.S., 1945) writes, "Still investing in Oil and Gas drilling deals. Don't know when to quit." Thurman is general partner of Geddie Oil Co., GP in Austin, Texas.

Barrow Receives Distinguished Service Award from AGI

In March 2007, the American Geological Institute (AGI) announced Thomas D. Barrow (B.S., 1945, M.A. 1948) as the 2007 recipient of the William B. Heroy Jr. Award for Distinguished Service to AGI.



Barrow

The Distinguished Service Award is presented in honor of William B. Heroy, Jr., who advanced the use of geophysics in petroleum exploration and in geologic research worldwide. Recipients of this award are measured against his exemplary career and in recognition of outstanding service to the Institute and to the geoscience profession.

Barrow's hard work and influence led to an initial large contribution from John A. Jackson to initiate the William L. Fisher Congressional Geoscience Fellowship Endowment in 2003. In 2006, Barrow challenged the AGI Foundation with an additional large gift to raise an additional $200,000 while he personally met the needs to fulfill the endowment in January of 2007.

The Fisher Fellowship will now be able to support one geoscience Congressional Fellow annually in perpetuity. This represents the first congressional fellowship in the physical sciences to be fully endowed.

Barrow received both a B.S. in petroleum engineering and an M.A. in geology from the University of Texas and a Ph.D. in geology from Stanford. In 1951 he started his career with Humble Oil where he later became president and director. Barrow served as senior vice president & director of Exxon Corporation and also served as chairman and CEO of Kennecott Corporation, and vice chairman of Standard Oil Company (Ohio). He has served in management positions for several organizations and is currently president of Thomson-Barrow Corporation. He is a member of the National Academy of Engineering and is one of only three geologists from Texas currently a member of the National Academy.

Barrow's commitment to AGI through the Foundation and his work to ensure the full endowment of the Fisher Fellowship makes him extremely deserving of this award, which was presented April 1, 2007 at the AGI Past President's Dinner as part of the AAPG Annual Convention in Long Beach, California.

Rosamond Allen Haertlein (B.A., 1947) is retired, living in Fredericksburg, Texas. He can be reached at ros@tbg.net.

Elvin M. Hurlbut, Jr. (B.S., 1943) writes, "I was laid off from Shell Oil Company in September 1964 in Corpus Christi, Texas in general oil-company downsizing of the 1960's. From fall of 1964 to fall of 1965 was unemployed. Then in late 1965 became an independent and consulting geologist till May 1969. Had moved to Houston in November 1968 and went to work for an aerospace contractor at the Manned Spacecraft Center (later Lyndon B. Johnson Space Center) in May 1969. Worked for various aerospace contractors till end of December 1985. Moved to Tyler in January 1986 where I had worked for Shell from January 1949 to June 1962 when I moved to Corpus Christi and was laid off in 1964. Details of my aerospace career are listed in the 12th, 20th, and 21st editions of 'Who's who in the South and Southwest' and the 9th and 10th editions of 'Who's who in the World.'" Elvin is retired and lives in Tyler, Texas.

Edward R. Kennedy (B.S. 1948, M.A. 1949) writes: "Still live in Midland, Texas and continue to explore the Delaware Basin. See some of the surviving 1940's UT grads @ SIPES meetings – Harry Miller, Clem George, and Nolan Hirsch. We are still working to some degree." Edward lives in Midland, Texas.

Charles J. De Lancey (B.S., 1940; M.A., 1942) writes, "My class, 1940, [graduated] 67 years ago. I know of no one now living but I'm sure there is bound to be more than just me. I am only 88, living in an assisted living home. My wife and only daughter (no sons) died two and four years ago. But I feel very good, just slow, with a cane and a walker – both are very common here." Charles retired in 1985 from Exxon and lives in Houston, Texas.

Stay in Touch!

Use the enclosed envelope or our online form to let us know what you've been up to and to update your contact information. www.jsg.utexas.edu/alumni/submit.html.

Jackson School graduates, Spring 2007 Commencement.

Howard R. Lowe (B.S., 1948) writes, "I remain active in Kazakhstan but my old bones are trying to travel and work days. He is president of CAMEO Production Co. in Houston, Texas. He can be reached at howalo7@aol.com.

Jule Jacobson Moon (B.A., 1940; M.A., 1941) is retired, residing in Fairhope, Alabama.

Isaac W. Norman (B.S., 1948) is retired and resides in Taylor, Texas.

Jess Proach (B.A, in 1941) writes, "Just an old (90 years) retired geologist that spent many years hunting for oil and gas – both foreign and domestic. I enjoyed every minute of it. What an exciting life it has been." Jess is retired and lives in Austin, Texas.

James L. Salyer (B.S., 1948) writes, "I worked for two years with Petty Geophysical Company and left geological work in 1950 to go into public education. I retired in 1987 and am presently enjoying life living here in the hill country looking for fossils in the Edwards 2nd Glen Rose formations." He lives in Kerrville, Texas.

Milton R. Scholl (B.S., 1947; M.A., 1948) is retired and living in Chula Vista, California. He can be reached at mrscv@aol.com.

John E. Seale Jr., (B.S., 1941) is retired and lives in Houston, Texas.

1950s

Jim W. Adams (B.S., 1951) is retired after 43 years with Humble Oil & Refining Company (Exxon). Jim Serves as Chairman of the Youth Education and Activities Committee of the West Texas Geological Society, which involves teaching Geology in Schools year-round and for Earth Science Week as well as the Geology Merit Badge to Boy Scouts. He also helps as a member of the Confederate Air Force at their International Headquarters in Midland. He writes: "Still camping with grandson Chad in BSA; he is finishing Eagle Rank Requirements. I enjoyed taking five grandchildren on a cruise to Alaska. I recommend that for anybody. I flew over the Juneau Ice Field, which was really spectacular." He says he would love to hear from friends at slatsjacobs@grandecom.net.

Edgar P. Armstrong (B.S., 1951) is retired and lives in Houston, Texas**.** He can be reached at eja28@sbcglobal.net.

Roy Beckelhymer (B.S., 1952) lives in Lakeway, Texas.

Don G. Bilbrey (B.S., 1953) writes, "Still dodging hurricanes in New Orleans and playing golf. Being 78 new makes it a lot easier to shoot my age regularly. And being in good health also helps." Don lives in New Orleans, Louisiana and can be reached at donbilbrey@webtv.net.

Walt V. Boyle (B.S., 1954, M.A., 1955) writes, "Vada Marie and I enjoy traveling the world and gardening. Vada Marie is serving as vice president of education in the Houston Symphony League. "Walt is retired and lives in Houston, Texas.

Philip Braithwaite (M.A., 1958) writes, "Barbara and I are still enjoying retirement in Dallas, Texas. We have taken several cruises in the last four years to avoid the Texas heat. I sail at a local lake when the weather cooperates and have done some

NASA Awards Dickerson Exceptional Public Service Medal

Meet Patricia Dickerson (B.A., 1970; Ph.D., 1995) for the first time at her workspace in the Walter Geology Library at the Jackson School and you might never suspect that this affable and unassuming geologist has taught and inspired world famous test pilots and astronauts, including John Glenn.

The National Aeronautics and Space Administration (NASA) has awarded her its Exceptional Public Service Medal, granted to non-government employees for contributions to the mission of NASA. Dickerson, a research fellow working in the Walter Geology Library at Jackson School, was honored for her "outstanding contributions to astronaut training in geology and geophysical sciences disciplines."

Dickerson has trained more than 20 field teams of astronaut candidates, or ASCANs as they are known at NASA, since 1996. The groups travel to northern New Mexico to study geological features and processes similar to those on Earth's moon and Mars. Dickerson teaches them to use magnetometers, gravimeters and other geophysical instruments to image buried features such as faults. The most recent crews collected data to help assess groundwater resources for the Taos Indian Pueblo.

In addition to field instruction, Dickerson has briefed shuttle and space station astronauts (STS missions 89-117 and ISS Expeditions 1-5) on rifting and mountain-building, including earthquake and volcanic hazards. Understanding Earth processes results in informed photographs from space of scientifically significant features on Earth. A bonus for Dickerson is the opportunity to look through all the images captured during a mission.

"When reviewing all the film and electronic images, there is always the element of surprise. You may have passed over the middle of Australia 77 times, but then you see something you've never seen, because of some quirk of the light or a break in the clouds," said Dickerson. "It's just delicious!"

She has also helped select images and provide commentary for astronauts to use as they tour the world following a mission, visiting classrooms and giving public lectures

"One of my goals is to seize upon their enthusiasm and their access, particularly to kids and teachers, to excite people about the earth sciences," said Dickerson.

She began training astronauts in 1996 soon after completing her Ph.D. in geology at The University of Texas at Austin. Bill Muehlberger, a professor emeritus still active at the university, had trained astronauts in geology since the Apollo moon missions. Believing that NASA needed someone to brief shuttle and space station crews on tectonic processes and aid in interpreting Earth images taken from orbit, he recommended Dickerson. She was soon training astronauts with Muehlberger and in 1999 initiated geophysical field exercises in collaboration with colleagues at the New Mexico Bureau of Geology & Mineral Resources.

"A comment that we often get from astronaut candidates at the end of a field session is that we've forever changed their way of looking at the Earth," said Dickerson. "That's immensely gratifying!"

In a ceremony at Johnson Space Center in Houston on June 5, 2007, Dickerson and four others were awarded NASA's Exceptional Public Service Medal.

"For me, one of the joys of instructing these folks is the gusto with which they seize ideas that are new to them," said Dickerson. "Most astronaut candidates have little to no earth science background. Yet they're already well versed in using instruments of all kinds, so there's nothing intimidating about the technology. When someone pitches them something entirely out of their experience, they reach for it and they swiftly master it."

In addition to training astronauts, and serving as study leader for Smithsonian natural history tours, Dickerson conducts her own field research on the tectonic evolution of Texas and adjacent Mexico from the Precambrian to the present. She also works for the American Geological Institute contributing references to GeoRef, the most comprehensive database of geoscience literature in the world.

consulting this year for the first time since I retired."

Leonard C. Bryant (B.A., 1957) is a "self-employed and retired" petroleum geologist in Hattiesburg, Mississippi.

Susan Cage (B.A., 1950) writes, "My husband, Jack ('50), passed away November 13, '06 after a lengthy bout with Parkinson's Disease. I plan to remain in Sun City, Georgetown, pursuing my nature oriented interests while taking an occasional trip. I enjoy the newsletter!" Susan can be reached at circlesujak@aol.com.

Donald M Campbell (B.A., 1955) writes, "Absolutely no changes since 2006 except I'm another year older." Donald lives in Abingdon, Maryland and can be reached at dctexaslh@aol.com.

Marvin Carlsen (B.S., 1952). Wife Mildred M. Carlsen writes, "Marvin suffered a massive heart attack in March 2006, followed four days later by a stroke. Although he now has aphasia and apraxia, he still enjoys rock shops and attending mineral and gem shows." Marvin and Mildred live in Midland, Texas.

Jack C. Cartwright (B.S., 1951; M.A., 1955) lives in Midland, Texas and can be reached at jccaxtw@sbcglobal.net.

Louise G. Chapman (B.A., 1956) is retired and lives in Corpus Christi, Texas

C. A. Chimene (B.S., 1950) is president of The Laahnz Corp. and lives in Houston, Texas.

Weyman W. Crawford (B.S., 1950) lives in Houston, Texas and can be reached at crawfordw.c@sbcglobal.net.

Carlos Deere (B.S., 1950) writes, "The hills are alive with the sound of me falling down and yelling for help. And the days may dwindle down to a precious few as we remember the good old days at University of Texas. I don't know what was so good about them when I think about the snake they put in my bed at summer camp. It must have been as scared as I was. I think it fainted before they threw it outside. Besides, it was either 'it' or me. I never did find out (yet) who did the dirty deed. But that leaves me with a lifetime project." Carlos is a petroleum geologist at Houston Oil Co. and lives in Bellville, Texas.

Gene C. Doty (B.S., 1954) is a retired geologist and hydrologist who worked for the US Geological Survey. Gene lives in Las Vegas, Nev.

Legends Immortalized in Bronze

Visitors to the Geology Building are now greeted by life-size bronze statues of two department legends: Ronald DeFord and Ed Owen. Conceived and paid for by the late Richard Bloomer, the statues represent surveying methods that were critical tools for locating oil and gas in the early 20th century. The statues were dedicated at a ceremony attended by members of the Bloomer/Nelson, DeFord and Owen families, and members of the Jackson School community, on March 23, 2007.

"The commissioning of these two bronzes for the Jackson School was my Dad's last and most inspired project," said Carol Bloomer Nelson, daughter of Richard Bloomer. "The gift epitomizes Dad's life-long passion for his career in geology and the oil business. Through this historical view, Dad was able to recognize the adventurous souls who worked to discover Texas' natural resources, and to build the most successful industry in the world."

Marion DeFord (left) with Carol Bloomer Nelson

Ralph C. Duchin (M.A., 1955) writes, "[I am] still involved, to a limited degree, in oil and gas activity in coastal Louisiana and Texas." Ralph lives in Tucson, Arizona.

Joe A. Durham (B.A., 1957) is retired and lives in Fairview, Texas.

Curtis C. Franks (B.S., 1950) writes, "Mostly retired, but still get involved in a 'deal' occasionally." Curtis resides in Fair Oaks Ranch, Texas. He can be reached at ccfrtx@hotmail.com.

James B. Furrh, Jr. (B.A., 1947; B.S., 1950) writes, "[I am] still active primarily in Mississippi, South Louisiana, and East Texas. I have three sons and seven grandchildren. My wife and I recently celebrated our 53rd wedding anniversary with a family cruise to the Caribbean." He is the owner of James B. Furrh, Jr. Oil & Gas and resides in Jackson, Mississippi.

Ronald L. Graner (B.A., 1958) is retired and lives in Brentwood, Tenn. He can be reached at ron@graner.us

Will Green (M.A., 1955) is president of AAPG and owner of Green Energy Resources in Midland, Texas.

Arch H. Heim (B.S., 1950) retired as senior research engineer at Schlumberger Well Services. Arch resides in Nelson, Missouri.

Eleanor M. "Ellie" Hoover (B.S., 1956) writes, "I still do some consulting work and continue on the board of the local Emergency Services District (fire and rescue). The 2006 Newsletter was great, thanks." Ellie lives in Conroe, Texas and can be reached at elliehoover@aol.com.

Ed Hughston (M.A., 1950) writes: "Still 'self unemployed' in Taos, New Mexico (for last 30 years). Enjoying life; the high oil prices on the dregs of production accumulated over the past 57 years or so." Ed is on the board of SMU in Taos.

Gerhard C.J. Jansen (M.A., 1957) is retired and resides in San Clemente, California.

Erwin K. Krause (B.S., 1949; M.A., 1954) writes, "Believe it or not, I am still here. I will celebrate by 84th birthday in October 2007 by going on my 30th cruise. In early 2007 I went up in a 65-year-old B-17G that looked brand new. I sat in the cockpit. I have now been to 108 countries. I do not anticipate adding many more to that total. My two favorite places are Southeast Alaska and Bora Bora, French Polynesia." Erwin has retired from Arco, lives in Houston, Texas, and can be reached at erwinkkrause@sbcglobal.net.

H. Louis Lee (B.A., 1954; M.A., 1958) writes, "I continue to do consulting in Texas and Louisiana onshore and offshore. This year I have taken a bit of time off for travel to Russia and the U.K. I am really looking forward to the Horns' football season." Louis is a consulting geologist and lives in Austin, Texas.

Larry D. Littlefield (B.S., 1957) writes, "I can't believe it's been 50 years since I graduated from UT. I recently moved back to Texas from California and am now in the Woodlands. [I am] still consulting on Angola Exploration." He can be reached at larry-littlefield@comcast.net.

Allen C. Locklin (B.S., 1954) is a self-described "good old boy" for Locklin Oil, living in Tyler, Texas. He writes, "As I have aged, now nearing 78, I still have the desire to what I'm best doing, exploration geology for oil and gas. I am very blessed in being right in the niche. I see so many who work all their lives and dislike what they do. UT helped me find my niche. Nancy and I logged 53 years in August and we are blessed to have a great family. We love U.S. and the

Alcalde." Allen can be reached at nlocklin@suddenlink.net.

Ronald J. Marr (B.S., 1952; M.A. Liberal Arts, 1956) is retired from Conoco, lives in Johnson City, Tennessee, and can be reached at rlmmid@aol.com.

Sabin W. Marshall (B.S., 1952) is the retired manager of geology of Texas Gas Transmission. Sabin resides in Houston, Texas.

Clifford R. McTee (B.S., 1954) writes, "[I am] retired and now operating cow operation in McMuller County, Texas." He owns the L7 Ranch and lives in San Antonio, Texas.

Charles M. Merrill (B.S., 1956) writes "I continue to enjoy the good retirement life in far south Austin. Enjoy reminiscing about the 'good ol' days' in the oil patch with old classmate Ken Owens and brother-in-law Hank Ford whenever we pop a cold one together." Charles lives in Austin, Texas.

R. McKay Moore (B.A., 1952) is the owner of R. McKay Moore and resides in Winnshore, Texas.

George E. Nowotny (B.S., 1955) is retired and lives in Tulsa, Oklahoma.

Fred L. Oliver (B.S., 1951; M.S., 1951) writes, "Just retired as chairman of the advisory council to the Jackson School of Geosciences. But you are not rid of me. I am still an AC member, since 1977, and I will help as long as physically and fiscally able. The JSG will need more help from everyone, as it progresses toward the best in the nation for the geosciences for students, faculty, and research. All can help with this goal." He is the president of Petroleum Ventures of Texas, Inc. Fred lives in Dallas, Texas and can be reached at pvt@dallas.net.

Kenneth I. Owens (B.S., 1954) writes: "Promoters have staked a location for a Barnett Shale well six blocks from my childhood home in Fort Worth; and we always 'knew' there were no hydrocarbons in the Fort Worth Basin! The newsletter format if very classy, thanks. Agnes and I have lived in Austin since 1969; we are in the book for old acquaintances to call." Kenneth lives in Austin, Texas.

Gerald S. Pitts (B.S., 1954) is retired and lives in Midland, Texas. He can be reached at jerry@pittsenergy.com.

August Leo Pugh (B.S., 1952) is retired and lives in Galena Park, Texas.

Wade C. Ridley (B.S., 1953; M.A., 1955) writes, "After a little time as a widower, I have remarried and we're enjoying the flying longhorns and going to the games in Austin…and still do a little business." He is president of Ridley Oil Corporation and lives in Tyler, Texas.

Edwin C. Robinson (B.S., 1950) writes: "Have had a very interesting life thanks to Petroleum Geology. Upon graduation I worked for Sun Oil Company in Markham, Conroe, and Beaumont, Texas and Lafayette, Louisiana. In 1957 I was transferred overseas and lived in Bogota, Colombia, Caracas, Venezuela and Buenos Aires, Argentina. Subsequently, I lived in Maracaibo, Venezuela working for Martoca S.A. In 1961 I worked for Tenneco and lived in Lagos, Nigeria for a year. Returning to the states I worked for Pure Oil Company and lived in Lafayette, Louisiana and Houston, Texas. When Union Oil Company of California purchased Pure Oil I was transferred to Los Angeles, California and subsequently lived and worked for them in Lima, Peru and La Paz, Bolivia. Upon returning to Los Angeles in 1975, I traveled extensively in Asia, Latin America, Africa, Far East and Middle East looking for oil exploration prospects. Since retiring in 1986 to Carlsbad, California we have enjoyed seeing and visiting with my six married children, fourteen grandchildren and two great grandchildren. I owe all of the above experiences to Geology. Life has been good!" Edwin lives in Carlsbad, California.

Jimmie N. Russell (B.A., 1952; M.A., 1954) writes, "I am Continuing my post-retirement 'hobby' of teaching in the public schools; 13 years of this with 10 years in current postion assisting in the education of special needs junior-high and high-school students. Am actually teaching geology as part of an earth science course to seniors. I have thoroughly enjoyed visiting with old friends at

Barton Creek Association Recognizes UT Contributions

Suzanne Pierce (Ph. D., 2007), Jack Sharp, Marcel Dulay (Ph.D. candidate in the LBJ School of Public Affairs), and Will Cain (UT Digital Media Collaboratory) won the Scientists for Groundwater Award (2006) from the Save Barton Creek Association for their "commendable efforts to develop the groundwater decision support system."

Will Cain of the UT Digital Media Colalboratory and Suzanne Pierce, Ph.D. 2007 in hydrogeology, accepting the Scientists for Groundwater Award (2006) from the Save Barton Creek Association.

alumni events. Best regards to all!" Jimmie lives in Austin, Texas.

Floyd F. Sabins (B.S., 1952) is president of Remote Sensibg Enterprises, Inc. He lives in Fullerton, Calif. and can be reached at ffsabins@adelphia.net.

Ted Schulenberg (M.A., 1958) writes, "We are both still healthy enough to enjoy travel. This year an extended trip to Turkey plus two trips to the northwest. Next year will include one month in Italy plus? Janet and I both bowl (poorly once a week). Janet is deeply involved in genealogical research and volunteer work and the History Center. I golf, am active with the Hill Country Geoscientists, and give a geology course at the Adult Education Center." Ted lives in Kerrville, Texas and can be reached as schulen@ktc.com.

Eugene P. Scott (B.S., 1957) writes, "I am still a consulting petroleum geologist in Corpus Christi."

Victor M. Shainock (B.S., 1956) is vice president of Index Geo and Associates, Inc. in Houston, Texas.

Don B. Sheffield (B.S., 1958) is the owner of Hahn and Clay in Houston, Texas.

Wm. T. Sherman (B.S., 1951) is self-employed and lives in Austin, Texas.

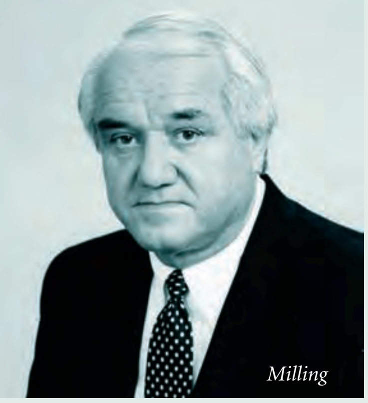
Samuel J. Sims (M.A., 1957) writes, "Not much has changed since my last submittal to this publication. I still work as a consulting geologist to the local chemical and industrial stone industry - and keep busy at it. One of these days I wll actually retire, but in the mean time I enjoy working. I enjoyed seeing the website for the 1950s reunion and seeing some familiar faces."

Marriott Wieckhoff Smart (B.S., 1957) writes, "In the past year John and I have been privileged to be in good health and to travel to some fun places. Last year in addition to visiting our daughter, Denise, in Tulsa, OK and our other daughter, Holly, and her family in Whitefish MT, we traveled to Copper Canyon, Rome and Arizona. Colorado is a beautiful place to live. We hike in the Rocky Mountains whenever we have a chance. We are enjoying retirement!

Best wishes to all." She is retired and resides in Centennial, Colo. and can be reached at marriott@ix.net.com.com.

Marcus Milling Wins Alumni Award

The late Marcus Milling, former associate director of the Bureau of Economic Geology and former director of the American Geological Institute, posthumously received the Jackson School Alumni Award for 2007. A memorial to Milling ran in the 2006 edition of the *Newsletter.*



Milling

Tommy T. Smiley (B.S., 1951) writes, "Still living in San Antonio. Have been retired 21 years but still do taxes during tax season. Built a new home last year and keep busy with yard work. Have been married 57 years and both of us are in good health." Tom can be reached at tomsmiley@sbcglobal.net.

Dan L. Smith (B.S., 1958) is executive vice president of exploration at Sandalwood Oil and Gas in Houston, Texas.

Edwin L. Smith (B.S., 1951) writes, "[I am] still active in drilling and exploration in North Central Texas." Edwin lives in Wichita Falls, Texas.

Glenn C. Smith (B.S., 1953) lives in Georgetown, Texas.

Phil Pitzer (B.S., 1954) writes, "Remain in Breckenridge, Texas. Still have active office with my son Greg, who is a graduate of Trinity University in Geology also. Still applying basic geology and geophysics to the Strawn and Pennsylvanian oil sections in North Central Texas. Through the use of modern day computer programs, Greg has had an unbelievable success ratio in reworking the old fields in this area. My primary contribution has been to look over his shoulder and make him 'nervous'! I have moved to the Caddo Creek Ranch for the last 14—found enough between it and the office to keep me busier than I really wanted to be; but it also has probably kept me in good health both mentally and physically! I have five grandchildren. Two grandsons who at present are pursuing their work in the oil business (both graduates of UT). One grandson is in the marines and stationed in North Carolina at this time. Two beautiful granddaughters, one of whom is a student at UT at this time. Best regards to any 'old' classmates I went to school with."

Robert K. Steer (B.A., 1953) is retired and lives in Austin, Texas. He can be reached at steers@austin.rr.com.

Everette Travis (M.A., 1951) is retired, residing in Tow, Texas.

Arthur J. Tschoepe (B.S., 1951) is the retired owner of Geologist-Oil Opt. He lives in Corpus Christi, Texas.

Charles Vertrees Jr. (B.S., 1951) writes, "More golf than geology now days!" He is retired and lives in Dallas, Texas.

Bernie Ward (B.A., 1955) writes, "Seems the scintillators and Geiger counters are getting active again. As with the oil biz. This time around it's 'just a little deeper.' We took a 12 day trip to China and had an American guide who lives in Shanghi and is fluent in Shanghinese. We finished the trip in Xian, home of the terra cotto army. We 'hooked-em up' with another UT alumnus, Bill Taber and his wife Gail. It was truly a wonderful trip – but began to yearn for a good hamburger!" Bernie is an independent geologist in Tyler, Texas.

Daniel L. Ward (B.A., 1949; M.A., 1950) lives in Grand Junction, Colorado.

Bill D. Watson (B.S., 1958) writes, "We welcomed our first great-grand daughter, Morgan, on June 20." He is retired, living in Missouri City, Texas. Bill can be reached at bdjewatson@verizon.net.

Leslie P. White (B.S., 1956) writes, "Thank you so much for getting the Newsletter back out. It has been a thread that has kept us all together for many years. Clabaugh's class convened again this year. We had lunch at 'the Mexican restaurant' and then retired to scenic Krause Springs for the afternoon. As usual it was a great time. If you are a former student of Clabaugh's (or not) and would like to join us, please call me at 512 301-3700." Leslie lives in Austin, Texas and can be reached at lesndianne@yahoo.com.

Phil Wyche (B.S., 1951) is retired and lives in Lakeway, Texas.

Ready to serve: Wanda LaPlante, Philip Guerrero, and Patty Ganey-Curry greeted alumni and friends at the 2006 AAPG International meeting in Perth.

1960s

Lynn S. Beeler (B.S., 1962) writes, "After graduating from UT in 1962, I spent 20 years in the army and 20 years working for a private company doing programming. Since retiring in 2002, I have kept busy with computers, the internet, and reading." Lynn lives in The Colony, Texas and can be reached at Lynn_Beeler@hotmail.com.

Julius Dasch (M.A., 1960) writes, "Pat and I recently co-taught a new, distance-learning (with Midland College) honors course, "Rocket Science." One of our students is currently at NASA/JSC/LPI doing an internship on Hi T/P experiments with Mo in silicate melts, with applications to early Earth." Julius is an adjunct professor of geology at Sul Ross State University, residing in Alpine, Texas and can be reached at edasch@sulross.edu.

Tom Freeman (M.A., 1962) writes, "Peggy [and I] greatly enjoyed the reunion of grad students of late 50's and early 60's. Especially the 'hollers' with Don, Pete, and others. 'Let's do it again!'" Tom is curator's teaching professor emeritus at the University M.D. at Columbia. He can be reached at freemanT@missouri.edu.

Thomas T. Goforth (M.A., 1962) writes, "[I was] the W.M. Keck Foundation professor of geophysics and the department of geology chair for nine years, [and] retired from Baylor University on Sept. 1, 2007." He now lives on the Georgetown Limestone in Crawford, Texas.

J. Phil Jones (B.S., 1964) is a land advisor at Devon Energy Corporation. He lives in Edmond, Oklahoma and can be reached at phil.jones@dvn.com.

Don Kerr, Jr., (B.S., 1960) resides in Houston, Texas, and can be reached at dankerrjr.2@hotmail.com.

Jereld E. McQueen (B.S., 1961; M.A., 1963) is president of Medallion Oil Company living in Kingwood, Texas. He can be reached at jeme@kingwoodcable.com.

Jerry Namy (Ph.D., 1969) writes, "I'm enjoying returning to Austin and the Jackson School for the '60's reunion. I greatly admire the enthusiasm and dedication of the retired faculty who attended the reunion. Very much like they were in the '60's." He is the CEO of Texland Petroleum, LP in Ft. Worth, Texas. Jerry can be reached at jnamy@texpetro.com.

T. I. Poe (B.S., 1962) lives in Luling, Texas and can be reached at pogopoet1@juno.com.

Rubin A. Schultz Jr. (B.S., 1961) is district maintenance administrator of the Texas Department of Transportation. He lives in Corpus Christi, Texas: "Still working for TxDOT – haven't received the 'retirement bug' yet. Last fall Nancy and I enjoyed a week in Rome and Southern Italy and in May we went back to Maui, Hawaii. Grandkids are in high school—time flies! We enjoyed the 60's Jackson School reunion in June."

Robert Samson Singer (B.S., 1961) writes, "Working contract for Large Well Known Petroleum Consulting firm as reserves engineer." Robert lives in Houston, Texas.

Charles A. Taylor (B.S., 1960) is retired and living in Boerne, Texas. He can be reached at charlestaylor@gnc.com.

Herbert "Sam" Travis (B.S., 1960) writes, "After Graduation, August 1960, first 5 years were tough, jobs were hard to come by. Work experience (5 yrs) included running electric logs in Oklahoma and working as a Seismologist in Dallas, Texas. Migrated into Digital Computing in 1965 and retired in 2003 after 33 years." Sam lives in Desoto, Texas and can be reached at herbert_travis@msn.com.

Gerald E. Weber (M.A., 1968) writes, "Semi-retired. No longer teaching at UCSC - Emeritus in the Earth and Planetary Science Department. Still consulting - working as an expert witness in engineering geology. Sue and I are traveling a great deal - still running rivers and doing some SCUBA diving. I had the opportunity to row the Grand Canyon twicce in the last 14 months - so I did it. My 9th and 10th trips. Still great fun, 42 days on the river." Gerald lives in Santa Cruz, California and can be reached at jweber@pmc.ucsc.edu.

W. M. Feathergail Wilson (B.S., 1960; M.A., 1962) is mapping, drilling, and consulting in the Texas Hill Country and Gulf Coast. He is working on the groundwater isotopic age dates and provenance. He writes, "Geology remains my passion." He is president consultant at Strata Geological Services in Bandera, Texas. Feather can be reached at featherg@hete.net.

William Feathergail Wilson (B.S., 1960; M.A., 1962) writes, "Working the surface and subsurface in the Texas Hill Country, focusing on groundwater and the details of the complex aquifers. Building a GAM for Kerr County. The two sons, Douglas and Clay, both UT Geology graduates, working in Houston and Melbourne (Anandarko and Exxon). Still living in the sticks near Tarpley, Texas." He is president and consultant at Strata Geological Services and lives in Bandera, Texas. Feather can be reached at featherg@hctc.net.

John C. Yeager (M.A., 1960) works as an independent geologist and resides in Lafayette, Louisiana.

1970s

Donna Balin (B.S., 1978) writes, "Andrew and I have our own company here in San Antonio doing geological research (DOE) and international consulting. For the past year, we've been busy on the Planning Committee for the 2008 AAPG convention, and I've also been serving as Chairman of the San Antonio SIPES Chapter and in the Environmental position on the South Central Texas Regional Water Planning Group (Region L). We traveled to Perth, Australia, for the International AAPG conference last November, which was fantastic! It would be great to see old friends if you visit SA." Donna can be reached at balin@alumni.utexas.net.

Charmaine Bentley (B.S., 1977) writes, "Finally finished MS, Computer Science from UT, Dallas – still teaching high school computer science in Dallas. Currently, [I am] running for re-election for position on the (ACM) CSTA Board of Directors (http://csta.acm.org)." Charmaine teaches at Roosevelt High School in Dallas, Texas, and resides in Plano, Texas.

Silverio "Sil" Bosch (B.S., 1974; M.A., 1975) writes, "I am still enjoying South Texas oil & gas exploration and re-discovering old prospects with the aid of 3D seismic data. The subsurface geology remains the same, but the perception and "packaging" is different thanks to the "bells-and-whistles" of the workstation. Lisa, the boys and I once again went scuba diving in Cozumel this past summer. Even after 7 trips there over the past 27 years, it is still a lot of fun and always educational. The reefs really looked stressed this time as a result of so much suntan lotion from cruise-ship tourists, and the double-punch of hurricanes Emily and Wilma in 2005. Matthew (19)is a sophomore biomedical engineering student at UT and loves Austin and the 'Horns. Our trips to visit Matthew have allowed me to go down "memory lane" and to walk all around campus and enjoy the beautiful grounds and all the new buildings-the changes after 32 years are unbelievable. Eric (17) is a senior in high school trying to decide on his future plans and career. He's also enjoyed "senioritis" from Day One of the new school year. He too loves the 'Horns and burnt orange is one of his primary colors. It's always great to run into all the UT geology grads at different business functions and to realize how great an education we all received from the University. It's a large and special fraternity and I'm so lucky to be a part of it. I doubt I will ever retire from this business as there is so much yet to find, and treasure hunts are always a lot of fun. Hook 'em !!" Sil lives in Corpus Christi and can be reached at sboschatcc@aol.com.

Donna Balin (B.S., 1978) with modern stromatolites at Lake Thetis in western Australia, November 2006. She adds, "Howdy to the Algal Mats. You know who you are!"

Royce P. Carr (B.S., 1976) writes, "My wife and all three boys have either graduated or are currently at UT. I am busy supporting two boys that are attending UT. Greetings to everyone from Northeast Texas and I hope to see many of you at upcoming events."

Chuck Caughey (B.S., 1969; M.A., 1973) writes, "I changed job assignments within Conoco Phillips and now work the Middle East. I'm based in Houston but working with people from that area and doing a fair amount of travelling. AAPG has me con-ducting campus visits by professional geo-scientists, let me know if you would like to visit the students and give them your perspective in careers in geology and geophysics." Chuck is the logistics coordinator of Iraq Studies at Conoco Phillips. He can be reached at chuck.caughey@conocophillips.com.

J. B. Chimene (B.S., 1979) lives in The Woodlands, Texas and can be reached at secure@chimene.com.

Kelton W. Cloud (B.S., 1973) writes, "I have enjoyed working for XTO Energy the past two years. I still find subsurface work in the Arkoma Basin interesting and challenging. Jo Beth (BA-Education, 1973) still teaches 8th grade science in Aledo. My son, Joel, and I hunted caribou last year in Northern Quebec and had a blast (we each got two caribou). Jo Beth and I have really enjoyed our three year old grandson, Preston, this past year. Our daughter Kristin is going to give us another grandchild next year! If anyone ever gets to Granbury, please give us a call." Kelton can be reached at kcloud@itexas.net.

John T. Dasch (B.S., 1975) lives in Dallas, Texas.

Jack Droddy (Ph.D., 1978) writes, "It's hard to believe I've reached the 20 year mark at Baker Hughes. This year has been busy with design and debugging of new rock and fluid testing equipment as well as routine projects. Pam and I are still in the Spring area north of Houston, and Daniel (10) and Leesa (8) keep us going always. I was pleased to hear of my advisor Dr. Clabaugh's induction in the Hall of Distinction, he certainly belongs there."

Heather W. (Sharrai) Echols (B.S., 1979) lives in Midland, Texas and can be reached at heather.echols@gmail.com.

John C. Griffiths (B.S., 1975) is president of Calvin Resources, Inc. in Houston, Texas. He can be reached at jgriff@calvinresources.com.

Russell & Karen Harmon (B.A., 1969; B.A., 1970) live in Raleigh, N.C. Russell is a geologist and senior program manager at the US Army Research Office and Karen is a hydrologist for the North Carolina State Dept. of Environment & Natural Resources.

Keith Haun (B.S., 1974) is a senior geologist at Duncan Oil, Inc. He lives in Houston, Texas and can be reached at khaun@duncanoil.com.

Jim Henry (B.S., 1970) is co-honcho for the Republic Of Texas Biker Rally. He lives in Frisco, Texas and can be reached at henry@rotrally.com.

Dean "Cap" A. Horning (B.S., 1977) writes, "I am retired from the oil biz. Presently safari operator and booking agent for hunting and and photographic safaris in Tanzania, Mozambique and South African." Cap lives in Wimberley, Texas and can be reached at chorning@earthlink.net.

Russell W. Jackson (B.S., 1976) is a geologist and partner at Tyler Oil & Gas. He can be reached at rwjtogi@suddenlinkmail.com.

Bob Kent (B.S., 1972) just returned back from the International Water History Association meeting in Finland where he gave a paper on the history of the water supply for the City of Boise, Idaho and the controversy concerning private ownership of water supplies. The paper was a result of research for his recently-completed masters degree. Bob semi-retired several years ago and moved to Idaho to fish more, "but wife Suzie got tired of me around the house and made me go back to school."

Ralph S. Kerr (M.A., 1976) writes, "I am living in Houston and providing organizational effectiveness consulting to Shell's Unconventional Oil business unit, which is headquarted in Houston and Calgary. Work takes me to Canada frequently, which is a pleasure, even with the cold winters." Ralph lives in Houston, Texas and can be reached at ralph.kerr@shell.com.

Charles Kreitler (M.A., 1972; Ph.D., 1974) writes, "I've been in the consulting business primarily for ground water resource evaluation. I've managed the Austin office of LBG-Guyton Associates since 1993. We deal primarily with water supply issues in Texas, and have been heavily involved in the water wars of Texas. Berf, my wife, is doing well, Jason, our son, is working on a Ph.D. in 'landscape ecology' at UC Santa Barbara, and Abby, our daughter, has one year to go at Vassar College. Sorry I missed the recent reunion, but was out of town for that June weekend." Charlie lives in Austin, Texas.

Jeff Kremer (B.S., 1979) is co-owner of Brazos Gas Company. He resides in Dallas, Texas and can be reached at kremer@sansabaroyalty.com.

Robert A. Levich (M.A., 1973) writes, "I retired from the US Department of Energy, Yucca Mountain Project at the end of 2004. Stella and I now spend half our time in Las Vegas and the remainder in West Africa, where we recently built a house above a beach cliff overlooking the Gulf of Guinea, 30 miles west of Accra, Ghana. I have worked for several years to publish some of the results from 30 years of geoscientific studies at Yucca Mountain, and finally succeeded in completing the first volume. In May 2007, The Geological Society of America published Memoir 199, "The Geology and Climatology of Yucca Mountain and Vicinity, Southern Nevada and California", edited by John S. Stuckless and Robert A. Levich, 205 pages. A second GSA Memoir that describes the hydrology of the saturated and unsaturated zones, geochemistry and radionuclide transport, and coupled thermal-mechanical-chemical-hydrologic processes relevant to constructing a deep geologic repository for high-level nuclear waste at the Yucca Mountain site is in!" Robert can be reached at cpgeologist@yahoo.com.

David Levin (B.A., 1978) writes, "Continue to work South Texas from San Antonio as I have for 30 years. Kids are out of the house and glad to have more time to hunt and fish. Warm hello to all Casita Alta Alums." He is the owner of Power Petroleum and can be reached at powerpet@juno.com.

Michael R. Looney (B.S., 1971; M.A., 1977) is president and CEO of Black Pearl Exploration. He lives in Houston, Texas, and can be reached at mslooney@att.net.

Poker crew during Geo 660, date unknown. From the collection of Earle McBride.

Sharon Pickett Maxwell (B.S., 1978) "would love to hear from friends – 1978!" She is the registrar at Criswell College in Dallas, Texas and can be reached at smaxwell1@hotmail.com.

James McCalpin (B.A., 1972) writes, "Now in 17th year of full-time consulting in geologic hazards. Field work in Colorado ski areas and above timberline keeps me in shape. Sortof. In 2008 the 2nd edition of my book Paleoseismology should hopefully be published by Elsevier." James lives in Crestone, Colorado and can be reached at mccalpin@geohaz.com.

Peter K. M. Megaw (B.A., 1976; M.A., 1979) is president of IMDEX Inc. He resides in Tucson, Ariz. and can be reached at pmegaw@imdex.com.

Roy L. Onstott (B.S., 1978) lives in Houston, Texas and can be reached at onstott182@earthlink.net.

David A. Pustka (B.S., 1976) lives in Houston, Texas.

Donald F. Reaser (Ph.D., 1974) writes, "I'm currently teaching a graduate geology course for science teachers at UT Arlington. The students are in our Master of Arts Interdisciplinary Science (M.A.I.S) program. During the summer I taught a course entitled 'Geology of the Dallas/ Fort Worth Metroplex' for M.A.I.S students. Later this fall, Bette and I are taking another cruise to the Mediterranean (Italy, Greece, and Turkey) aboard the Carnival Freedom – the newest ship of Carnival's fleet." He is retired and professor emeritus at the University of Texas at Arlington and resides in Waxahachie, Texas.

Carolyn Rutland (M.A., 1979) is a senior civil engineer for the City of Kalamazoo, Department of Public Services. Carolyn resides in Kalamazoo, Mich. and can be reached at rutlandc@kalamazoocity.org.

Charles E. Sandidge (B.S., 1978) writes, "I am a geological consultant for the oil and gas industry. The education I received from the Geology Department at UT has opened many doors. Doors opened when I graduated in '78 and continue to open to this day. I love geology and I love my profession. Thank you." Charles lives in Tyler, Texas and can be reached at charlessandidge@sbcglobal.net.

Michael W. Strickler (B.S., 1978) is geological advisor at Deep Gulf Energy LP and lives in Katy, Texas.

Cynthia G. Talbot (B.S., 1976) works at Hogan and Hartson and lives in Annadale, Va. She can be reached at cindy@commbiz.com.

Greg Tipple (M.A., 1975) works with environmental quality for the Texas Commission and lives in Austin, Texas.

Douglas N. Toepperwein (B.S., 1974) is a geologist at Sage Energy Company. Doug resides in Fair Oaks, Texas and can be reached at dougt@gvtc.com.

C. Brian Trask (M.A., 1972) is a geologist for the Illinois State Geological Survey. He lives in Champaign, Illinois and can be reached at trask@isgs.uiuc.edu.

David W. Vernon (B.S., 1979) is chief appellate at the Johnson County D.A.'s Office and lives in Dallas, Texas. He can be reached at dv5664@sbcglobal.net.

David E. Wahl, Jr. (M.A., 1973) is a consulting geologist for Mesa. He can be reached at davewahl@cox.net.

Richard Waitt (B.S., 1966; M.A. 1970), writes, "Broad-based softrock, hardrock, and geomorphology program at UT (Austin) served well during [my] PhD (University of Washington 1972) and then into gainful employment- teaching at Franklin & Marshall College ('72-'75) and in field geology with the USGS since then. Writing skills encouraged by Ronald DeFord, Charlie Bell, and Hoover Mackin at UT and have kept life more interesting ever since. I've been at USGS's Cascades Volcano Observatory at Vancouver, Washington since Mount St. Helen's eruption in 1980, now near the end of writing a scholarly-&-popular book about the eruption told not as science exposition, but as narrative through witnesses. My wife Cynthia and I live in Vancouver on acreage. Our daughter Kristin and her husband live in Seattle. Their daughter Emma Rae, our first grandchild, [was] born May 18, 2006, Mount St. Helen's anniversary." Richard is a research geologist for the U.S Geological Survey. He can be reached at waitt@usgs.gov

Richard L. Watson (M.A., 1968; Ph.D., 1975) writes, "Living in Port Aransas, 3/4 retired. Spent about 23 years traveling on boats and living in Honduras interspersed with coastal geology, consulting and captaining commercial vessels. In the 90s, I switched from boats to planes for adventure. I have built a website about Texas coastal geology with a many aerial photos and other interesting stuff. Check it out at www.TexasCoastGeology.com. My other half of 30 years, Betsy Churgai, is now running for city council which is 'interesting.'" Richard is a consulting geologist and lives in Port Aransas, Texas. He can be reached at richard@texascoastgeology.com.

"On a field trip with Shell Egypt geologists to the Western Desert of Egypt. Adel Moustafa is second one from the left."

Bonnie R. Weise (B.S., 1974; M.A., 1979) is a geological consultant in San Antonio, Texas. She can be reached at bweise1@sbcglobal.net.

Michael A. Wiley (B.S., 1957; M.A., 1963; Ph.D., 1970) is a consultant living in Canyon Lake, Texas. He can be reached at mawiley@gvtc.com.

Bruce Wilkinson (Ph.D., 1973) is a research professor at Syracuse University. He lives in Erieville, New York.

Chuck Williamson (Ph.D., 1978) writes, "Enjoying life in wine country, staying busy with multiple boards and advisory work, our dog and growing a few grapes. It doesn't feel like retirement, but enjoying the change of pace and new challenges." Chuck lives in Sonoma, California and can be reached at chuck@cwmson.com.

Steve White (B.S., 1978) writes, "I'm still enjoying the oil business in Tyler. The big news in my life the last year was the birth of our first child, a boy born in October. Proscrastination strikes again!" Steve lives in Flint, Texas and can be reached at swhiteinc@suddenlinkmail.com.

1980s

Scott Adamek (M.A., 1986) is project manager at CDM in Seattle, Washington.

Abhaya "Ajay" R. Badachhape (M.A., 1988) is a staff geophysicist at ConocoPhillips. Ajay lives in Sugar Land, Texas and can be reached at ajay.r.badachhape@conocophillips.com.

Carol Swenumson Baker (B.S., 1984) writes, "My older son, Grant, is a senior in high school this year. I'm pushing for UT! Andrew has already made up his mind that he wants to be a Longhorn. I started the brainwashing early on him." Carol can be reached at rod_carol@comcast.net.

Linda Balcom (B.S., 1987) writes, "Mark and I are still here in Colorado and between work and kids our lives are perfect. Perfectly wild. Our oldest Helen is 11, William 9 and Isabelle is 7. Work is keeping me busy, but interesting and challenging. Hope all you 87 geo grads are doing well." Linda lives in Colorado Springs and can be reached at lrbalcom@hotmail.com.

Charles "Sandy" Beach (B.S., 1987) works at Beach Exploration, Inc. and lives in Midland, Texas. He can be reached at sbeach@beach-exp.com.

Mike Bentley (M.A., 1980) is with Geomatrix in Austin.

Mark Berlinger (B.A., 1982) is area manager, HSSE, at BP Amoco. Mark lives in Mount Pleasant, S.C. and can be reached at marcladom@comcast.net.

Rhonda Rasco Rohe, B.S., 1980

Keith Bjork, M.D., (B.S., 1984) writes, "I am in my 14th year of private practice in orthopedic surgery in Amarillo Texas. If any of the old friends from the Switzerland '660' course are still around – keep in touch." Keith can be reached at kbjork-md@aol.com.

Pat Bobeck (M.S., 1985) is making a presentation about Darcy at the History of Hydrogeology meeting at the IAH meeting in Lisbon in September 2007. She then goes on to Paris where she will give a presentation about Darcy and her translation to the Ecole Nationale des Ponts et Chaussées, Darcy's alma mater.

Cynthia A. Bradford (M.A., 1982) lives in Metairie, Louisiana.

Robert Cobb (B.S., 1977; M.A., 1980) writes, "I have been working as a contract geologist for EurEnergy Resources and am looking at both the Fayetteville Shale and Barnett Shale unconventional resources."

David Cunningham (B.S., 1981) is a property tax advisor at Anadarko Petroleum. He resides in The Woodlands, Texas.

Pamela Tiezzi Darwin (M.A., 1984) is vice president for Exxon Mobil Americas and lives in Houston, Texas.

Donald Dean (B.S., 1983) is a senior geophysicist at Sanchez Oil and Gas. He resides in Katy, Texas and can be reached at dean.don@gmail.com.

Ernie Easley (B.S., 1980) works for Hunt Oil Company in Dallas, Texas as the Senior Vice President of U.S. Exploration

John L. Ebach (B.S., 1982) writes, "Hi all you Geo Dogs from the Class of 82. Just started back to work after a 2 month recovery time from a quadruple by-pass. Life is Good. Just finished my 5th trip to our offices in Tripoli, Libya. A beautiful place, and the Roman ruins in Leptis and Sabratha are out of this world. Look forward to going back again for sure when we drill our first offshore well. Write us (John and Janet) or drop us an email." John lives in Kingwood, Texas and can be reached at jebach@kingwood-cable.com.

H. C."Kip" Ferguson, III (B.A., 1988) is president of Sharon Resources, Inc. and lives in Houston, Texas.

D'nese Fly (B.S., 1980) is a geologist at William Cobb & Associates, Inc. D'nese lives in Plano, Texas and can be reached at dfly@wmcobb.com.

Cindy Fong (B.S., 1988) writes, "I'm busy here in Hawaii and having lots-o-fun teaching Earth & Space Science and running a robotics club after school for middle school students. I also am lead coordinator for the MATE - Big Island Regional ROV Competition for middle and high school students and eventually college students... learning lots about engineering designs and oceanography - great fun! I received a great honor this year by being selected as the AstroDay 2007 Excellence in Teaching Award for K-16 Teachers. Other than the above, enjoying living in Hawaii with my husband and 2 girls, and loving the fact that gardening here means throw the seed outside, ignore it and it grows. Gotta cut stuff down... after all, average rainfall at my elevations is around 180-inches/year." Cindy lives in Hilo, Hawaii and can be reached at clfong@aol.com.

William Gathright (B.S., 1988) works for El Paso Oil and Gas and lives in League City, Texas.

Ray Gedaly (B.S., 1981) is a geophysical advisor at RepsolYPF / Maxus Energy. Ray lives in The Woodlands, Texas.

Gretchen Gillis (M.A., 1989) writes, "I was elected AAPG Editor for a three-year term. I continue to enjoy working at Schlumberger." She lives in Houston, Texas.

Charles Goebel (B.S., 1980) is a senior geologist at J-W Operating Co. and lives in Plano, Texas.

Brian S. Goodman (B.S., 1980) is a hydrologist and environmental scientist at the Montana Department of Transportation in Helena. He can be reached at goodmab@hotmail.com.

Cindy (Fong) Greenblatt (B.S., 1988) teaches 8th Grade Earth and Space Science at Hilo Intermediate School in Hawaii and advises a Robotics Club at the school.

Jeremy T. Greene (M.A., 1984) writes, "Lynn and I are moving on as empty nesters. Michelle has joined Lauren at UT this year. Lauren will be graduating in December with her BS in Geology. I recently earned my Instrument Pilot rating, so I can legally keep my head in the clouds." Jeremy lives in Houston, Texas and can be reached at jgreene@huntpetroleum.com.

Brad Henderson (B.S., 1986) is a technical staff member at Los Alamos National Laboratory.

Rev. Reid Hensarling (M.A., 1981) writes, "Living in central Florida for four plus years has been a great joy for me and my family. Thank God for the many wonderful things happening in the John A. and Katherine G. Jackson School of Geo-sciences. Congratulations and keep up the great work!" Rev. Hensarling resides in Lakeland, Florida.

Suzanne Mechler Hewitt (B.S., 1989) lives in Colleyville, Texas and can be reached at suzmeister@juno.com.

G. B. Howard IV (B.S., 1982) is president of Flare Resources, Inc. in Houston, Texas. He can be reached at bhoward@flareresources.com.

L. Chris Johnson (B.A., 1974; M.A., 1980) is owner and manager of Johnson Energy Resources, LLC and resides in Shreveport, Louisiana.

Tom Kirkpatrick (B.S., 1984) writes, "After 9 years working in petroleum and 12 in environmental remediation, I have ventured into mining. The recent tripling of the price of zinc has invigorated this industry in East Tennessee. We have hired several geologists this year and likely will add several more entry level folks in the coming months. Enjoying small-town life with my wife and three kids, but wanting to get back to visit Memorial Stadium, Antone's, Lake Travis, etc., etc., etc." Tom lives in Jefferson City, Tennessee and can be reached at tom.kirkpatrick@yahoo.com.

Ralph L. Kugler (Ph.D., 1987) is geology lead at Schlumberger DCS and can be reached at rlkugler@arenisca.com.

George Laguros (M.A., 1987) is a senior geophysicist at Marathon Oil Company. He lives in Katy, Texas.

Bill Layton (B.S., 1981) writes, "[I am an] Independent Consulting Geologist, Gulf Coast Texas. K.C and I are still doing well… 'Work hard and play hard.' Jessica (23) is teaching in CC Texas and lives on Mustang Island. Jordan (19) is taking 16 hours at SAC here in town. 'I saw David Farmer at Nape 07' we had a laugh about the 'Rock hammer-wrist' story at 660-1981." Bill is a Consulting Geologist in San Antonio, Texas. He can be reached at Bill_N_KC@yahoo.com.

Kathryn Mear (B.S., 1985) lives in Austin, Texas.

Michael Maler (B.S., 1986; M.A., 1989) is a geologist at Conoco Phillips in Houston, Texas.

Dave Martens (B.S., 1984) writes, "I'm going on my second year at Marathon oil Company as the Alaska Asset Subsurface Manager after more than 21 years with Unocal. I'm enjoying both the work and the frequent trips to Anchorage and the Kerai Peninsula. My family and I are to be back in the states after a 12-year assignment in Bangkok. We're catching up on our missed opportunities for hunting, water sports, and UT football games." Dave now resides in Katy, Texas.

Ben A. McCarthy (B.S., 1980) is president of 5McC Company, LLC and lives in Houston, Texas.

Jude McMurry (M.A., 1982) is a principal scientist at the Southwest Research Institute in San Antonio, Texas. Jude can be reached at jmcmurry@satx.rr.com.

James G. Muncey (B.S., 1981) is an economist at Shell E&P, business planning & support. He lives in Houston, Texas.

Congratulations to Jose I. Guzman

Jose I. Guzman, Ph.D., 1999, and co-authors Rod Sloan, Shengyu Wu, and Shaoqing Sun, all of C&C Reservoirs in Houston, won the Jules Braunstein Memorial Award for best poster presentation at the 2007 AAPG meeting in Long Beach. Their winning poster was titled, "A Comprehensive Classification of Seals Based on Worldwide Subsurface Analogs."

David Noe (M.A., 1984) is a senior engineering advisor for the Colorado Geological Survey. He resides in Boulder, Colo. and can be reached at dave.noe@state.co.us.

Robert Timothy & Leah Kelley Parks (B.S., 1988) / (B.S., 1987) live in Houston, Texas.

Elliott Pew (M.A., 1982) is executive vice president of exploration at Newfield Exploration Co. and resides in Boerne, Texas.

Gene Pisasale (M.A., 1980) writes, "To the U.T Team- Hello from the Frigid Northeast!! I have been working in the investment industry for the last 20 years and enjoy my present position as the senior energy/natural resources analyst at Mercantile Trust in Baltimore, Maryland. Hello to the grad school class who finished with me in 1980." Gene lives in West Grove, Pennsylvania.

Victoria J. Pursell (M.A., 1985) resides in Salt Lake City, Utah and can be reached at pursell.victoria@comcast.net.

Diana Rader (B.S., 1985) is Senior Geologist and Austin Office Manager with Tetra Tech in Austin.

Rhonda Rasco Rohe (B.S., 1980) writes, "Hello! I just received the 2006 newsletter and had such a great time going down memory lane that I just had to write in for the 2007 version! For the last 18 years I have been living in Idaho and working for the Idaho National Laboratory (INL). Most of my career has been in the hazardous and radioactive waste disposal arena. For the last couple of years I have been working as a project manager for the Advanced Test Reactor at the INL. The serpentine arrangement of fuel elements in this reactor allows it to perform simulations in a matter of

Kimberly Kumar, M.S. '06, and Dhanajay Kumar, Ph.D. '05, take a break from delegate duties at the 2006 SEG meeting in New Orleans.

weeks versus several years for other test reactors. Pretty exciting stuff! Even though I miss Austin like crazy, I have enjoyed living in the Rocky Mountain west…certainly the geology is WAY more exciting (sorry all you soft-rockers). To any and all, please drop me a line anytime." Rhonda can be reached at Rhonda.Rohe@inl.gov.

R. Barrett Riess (B.S., 1986) writes "[I am] a reservoir geologist consultant, still living on cattle ranch in East Texas, and working in Houston." He resides in Grapeland, Texas.

Michael R Rosen (Ph.D., 1989) is Research Hydrologist with the USGS at the Nevada Water Science Center in Carson City.

Traugott Scheytt (Fulbright exchange student, 1987-1988) is in Berlin at the Technical University. He is head of the Geochmistry Lab, conducting his own research projects with some teaching duties. His lab measures everything inorganic—anions, cations, solid materials (XRD, XRF, TOC…), with three full-time technicians.

Scott Simmons (B.S., 1987) writes, "We are enjoying our endless backyard in the Front Range of Colorado. I now have two kids (Emma, 4; Tommy, 1.7), plus Crawdad is still around. Ronda and I take everyone into the trails whenever possible and I try not to hook one of the kids while fly fishing. Work is great, although more time is spent on defense work than geology these days." Scott lives in Fort Collins, Colorado and can be reached at ssimmons@tgstech.com.

Matt Sjoberg (B.S., 1986) is a partner at Jackson, Sjoberg, McCarthy & Wilson, L.L.P. He resides in Austin, Texas.

Traci Trauba Smith (B.S., 1985) is an office manager at Birdsung Real Estate in Lake Jackson, Texas. Traci can be reached at trackeye@swbell.net.

Stephen W. Speer (M.A., 1983) writes, "Life is good....and continues to be interesting on all fronts. No major upheaveals and I am staying semi-healthy playing tennis, but the bod seems to not be able to take it like it used to.... 'The mind is willing, the body sometimes sometimes breaks' or something like that. Oh well. Best news lately? Fellow alum Dave Noe FINALLY getting his PhD from CSM! Attaboy!!! Now if he'll just come out here to see me, I'll throw a celebration.... Wez (Dave Carr) can come too. Hope all is well with the rest of the Dirty Dozen and our erstwhile mentor, AJ. Hardly seems like 24 years have gone by....but they certainly have." Stephen lives in Mount Pleasant, South Carolina and can be reached at speerex@comcast.net.

Burgess Stengl (B.S., 1985) writes, "It's been one year, and we are still surviving in Houston. So far no hurricanes have hit, so that is good news. Living here has also brought me and my family back together with Walt and Vada Marie Boyle, and that has been a blessing. We all attend St. Dunstans Episcopal Church where I was confirmed 30 years ago after my father was transferred to Houston with Shell. My family is also still doing very well. Angela is teaching second grade in a brand new school in the Klein ISD. It's the first time she's opened a new school and is enjoying being one of the new teachers at Frank Elementary. Kyle is with Angela and is now in the fourth grade. He is enjoying soccer, Cub Scouts and the St. Dunstan's choir. I am his assistant Webelo den leader, so we are having loads of fun together. Susan is still up in Tyler and is a junior at UT Tyler. She continues to cheerlead and is also enjoying the Alpha Chi Omega sorority. She plans to graduate in December 2008. Shara is still teaching fourth grade at Matthews Elementary in Austin. Our grandson Kale is now in the 'terrible twos,' but is a loveable little boy, especially when we can give him back to Shara after a weekend visit! I continue to work at Allied Waste as an environmental manager. We have recently finished our 2008 Region budget reviews, and look forward to the fourth quarter 2007! I'd like to give my annual salute to the graduates of 1985 and to Jimmie Russell and Will Green." Burgess lives in Houston, Texas and can be reached at burgess.stengl@awin.com.

Bruce Robert Swartz (B.S., 1982) lives in San Angelo, Texas and can be reached at swartzoil@seddenlinkmail.com.

Peter R. Tauvers (Ph.D., 1988) writes, "I now live in Kyiv, Ukraine, exploring for deep gas onshore in the Dniepr-Donets Basin for Shell. I worked the GOM for 18 years in Houston and New Orleans before moving here in 2006. I recently purchased land in Latvia and plan to build a summer home on the lakefront there." Peter can be reached at peter.tauvers@shell.com.

David N. Tolces (B.S., 1985) writes, "I am alive and well in Boca Raton, Florida and keep busy as an attorney specializing in representing governmental entities and real estate matters. I am the Town Attorney for the Town of Loxahatchee Groves, the newest municipality in the state, and am busy keeping government officials on the right side of the law. My wife, Lauren, and I keep busy with Rachel (9) and Ryan (6). I still miss the tex-mex in Austin and a cool dip in Barton Springs. Hook 'em!" David can be reached at dtolces@cityatty.com.

James B. Vanderhill (Ph.D., 1986) is a program execution geologist for ExxonMobil. He lives in Bellaire, Texas and can be reached at jim.b.vanderhill@exxonmobil.com.

Mark C. Walker (B.A., 1981) is a partner at Brown McCarroll and lives in El Paso, Texas. He can be reached at mwalker@mailbmc.com.

Jefferson Williams (B.A., 1988) writes, "I'm still pursuing research on dead sea earthquakes. I made a second trip to GF2 in Potsdam, Germany to pursue this in September 2006. I'm also still running Supersonic GeoPhysical LLC. My daughter Gladys was born on December 26, 2006 in Pasadena, California, six days before UT visited the town." He is the owner of Supersonic GeoPhysical, LLC in Los Angeles, Calif. and can be reached at Jefferson.Williams@gmail.com.

John B. Willrodt (B.S., 1982) lives in San Antonio, Texas and can be reached at john.willrodt@valero.com.

Arnold Woods (M.A., 1981) writes, "What started out as a quiet year ended up fairly busy. I got involved with starting a new extractive resources program at the local community college, and taught one course, along with a couple of regular geology labs. I was going to apply for the chair of the new division, but it was only part-time, and wellsite geologists are making $750/day up here, so I'll be out in the field instead! I'm almost through updating the little book I wrote about Wyoming's dinosaurs (we're up to 63 genera for the state). I also got talked into co-editing the 2007 guidebook for the Wyoming Geological Society, as well as writing an article for the volume. That, along with a couple other apers I'm finally putting together, is taking up most of the free time I thought I would have. Those of you from the 1999-2001 period can drop me a line and let me know what you're up to." He is a consulting geologist living in Casper, Wyoming and can be reached at arnold@alluretech.net.

David L. Work (B.S., 1984) writes, "Close to almost 20 years at Anadarko, currently working Austin Chalk after stint with Middle East project. [I am] still in Houston, married to Lesley, and chasing 10-month-old Evan around!" David lives in The Woodlands, Texas and can be reached at david.work@anadarko.com.

1990s

George Alcorn, Jr. (B.A., 1996) is a senior geologist at Terralliance. He resides in Houston, Texas and can be reached at galcorn@terralliance.com.

Karen Bergeron Thompson (B.S., 1992) lives in Helena, Montana and can be reached at mtntrio@earthlink.net.

Patrick Bruines (exchange student from The Netherlands, 1992) works for Obayashi in Tokyo. Last month Patrick and **Rainer Senger (M.A., 1983; Ph.D., 1989)** met in Japan at a meeting on the Gas Migration Test (GMT) with RWMC, NAGRA, and Obayashi. Rainer is with INTERA in Austin.

Eleanor Camann (B.S., 1999) is an assistant professor at Georgia Southern University. She lives in Statesboro, Georgia. and can be reached at ecamann@georgiasouthern.edu..

Jianli Chen (Ph.D., 1998) is a research scientist at the Center for Space Research at University of Texas at Austin. Jianli resides in Austin, Texas and can be reached at chen@csr.utexas.edu.

Carlotta B. Chernoff (B.S., 1992; M.A., 1995) writes, "I am still enjoying working for ConocoPhillips and recently moved back to Houston after a year in our Perth, Australia office." Carlotta lives in Houston, Texas.

Eric Clegg (B.S., 1997) is project manager and professional geologist at Talon/LPE and resides in Leander, Texas.

Timothy E. Crump (B.S., 1991) is a project manager at TGE Resources, Inc. He lives in Houston, Texas and can be reached at bumptywoof@msn.com.

Joanna (Crowe) Curran (M.A., 1994) is moving to Charlottesville, VA. Starting in the fall, Joanna will be an assistant professor at UVA in the Department of Civil Engineering where she will be part of the environmental engineering group in the department. While looking forward to the new position, Joanna finds it hard to leave the Austin area. She had been teaching at Texas State in San Marcos.

Bruce Kelley Darling (Ph.D, 1997) writes, "Recently transferred back to Austin after a five-year exile in Banana Republicana (Louisiana). Great to be back!" He is an associate at LBg-Guyton Associates and lives in Austin, Texas. Bruce can be reached at the.limestone.cowboy@gmail.com.

Patricia Wood Dickerson (B.A., 1970; Ph.D., 1995) writes, "Another stimulating, fulfilling year! Field work in West Texas, library and lab research, NASA science advisory responsibilities, presentations in Midland (SEPM, SIPES) and at GSA-Denver (poster). I've accepted an invitation to lecture at the Laboratorio Tectonica Andina at the Universidad de Buenos Aires (a few hours of lecturing, MANY hours of tango!). Noteworthy progress in our (Bill Muehlberger, Eddie Collins) mapping in Big Bend National Park—our Glenn Spring quadrangle will be published in the BEG Miscellaneous Map Series. Great fun documenting L-M Ordovician volcanism in the Marathon Basin and Solitario! Some of that work, which has involved colleagues at JSG (Housh, Milliken, Helper, Muehlberger), as well as at California State University at Bakersfield and Australian National University, will appear in an AAPG special publication before long. NASA Science Advisory Subcommittee (Planetary Sciences) service with fellow JSG Ph.D. Lars Borg has been thoroughly enlightening. Entirely un expectedly, this year I received a NASA Exceptional Service Medal for initiating a field geophysical training exercise for astronauts. It's been a full year, made fuller by fine times with many of you!" Pat lives in Austin, Texas and can be reached at patdickerson@earthlink.net.

Frederic G. Dupuy (B.S., 1999) is a representative of Primerica Financial Services and resides in Austin, Texas. He can be reached at dupuyenterprises@hotmail.com.

Annette Summers Engel (Ph.D., 2004) is with the Department of Geology & Geophysics, Louisiana State University. She presented a talk entitled "Microbial Diversity of the Edwards Aquifer Saline-Water: Implications for Microbially Enhanced Carbonate Dissolution" at the Edwards Aquifer Authority in San Antonio, January 11.

Laura Faulkenberry (M.S. GSC, 1999) is a geologist at ConocoPhillips. She resides in Calgary, Canada and can be reached at Laura.L.Faulkenberry@conocophillips.com.

Jianhua Feng (Ph.D., 1995) is a geological associate at ExxonMobil Development Company, residing in Houston, Texas. Jianhua can be reached at feng8216@sbcglobal.net.

Douglas Gale (B.S., 1997) is assistant vice president of Citibank Texas, NA and lives in Dallas, Texas.

Mark Graebner (Ph.D., 1991) is a computer programmer at Raytheon and lives in Dallas, Texas.

Christi Gell (B.S., 1996) lives in Houston, Texas and can be reached at christigell@hotmail.com.

Jose I. Guzman (Ph.D., 1999) is a senior research geoscientist at C&C Reservoirs, Inc. Jose resides in Katy, Texas and can be reached at jose.guzman@ccreservoirs.com.

Barry Hibbs (Ph.D., 1993) of Cal State University-Los Angeles was recently promoted from Associate Professor to Professor.

Fred Holzmer (M.A., 1992) is with Devine, Tarbell & Associates in Oregon where he serves as the Manager of Regulatory Services.

John Huelsenbeck (M.A., 1992), writes, "Edna (M.A., 1992) and I recently moved from San Diego to the San Francisco bay area. I now work in the Department of Integrative Biology at UC Berkeley, doing research that is far removed from paleontology." John is a professor at the University of California, Berkeley and resides in Orinda, California.

Karen Jarocki (B.S., 1992; M.A., 1994) lives in Albuquerque, New Mexico and can be reached at kejarocki@yahoo.com.

Who Are These People?

This photo is from the 1988 Geology 660 Summer Field Course, and we'll send free prints to anyone who can identify the people in it. E-mail your answers to communications@jsg.utexas.edu. And while you're at it, send photos you'd like identified—or just want to share with *Newsletter* readers—to the communications office at the Jackson School:

***Newsletter* Editor**
Jackson School of Geosciences
The University of Texas at Austin
PO Box B, University Station
Austin, TX 78713-8902

E-mail:
communications@jsg.utexas.edu

ALUMNI NOTES

Glenn Klimchuk (M.A., 1993) is the principal of Booz Allen Hamilton in Houston, Texas and can be reached at klimchuck_glenn@bah.com.

Kristie Laughlin (B.S., 1999) has accepted a position with LBG-Guyton in Austin, Texas.

Robert Mace (Ph.D., 1997) presented at talk at this academic year's Austin Geological Society kick off meeting. Rob's talk was entitled "Policy and Science: An (Ethical) Match Made in Heaven?" It had a great attendance.

David Mackintosh (B.S., 1993) is an attorney at the Dept. of Health and Human Services in Miami Beach, Florida.

Tim McMahon (Ph.D., 1994) is a senior staff geologist at ConocoPhillips in Houston, Texas. He can be reached at tmcmahon@br-inc.com.

Laura (Brock) Marbury (B.S., 1991) is a Water Analyst with the Environmental Defense Fund in Austin. Laura is also a registered professional geologist in Texas.

Kevin Pasternak (B.S, 1995) is with URS corporation in Austin.

Christina Massell Symons (M.S., 1997) writes, "Life is good! I'm working part-time for Scripps and full-time at home (we have an incredible 2-year-old and a second on the way). I've enjoyed delving into the world of education and outreach over the last few years but still love 'real' science and am a marine geophysicist at Scripps Institution of Oceanography." She lives in Newport, Rhode Islan and can be reached at csymons@ucsd.edu.

Sarah Lindsay Tsoflias (Ph.D., 1999) is a graduate teaching assistant at the University of Kansas. She lives in Lawrence, Kansas and can be reached at sarahlt@ku.edu.

Warren James Wiemann (B.S., 1998) is vice president of Engineered Semiconductor Products, Inc. He resides in Austin, Texas and can be reached at jwiemann@espspares.com.

2000+

Randi Ashburn (B.A., 2005) is a geoscientist at Schlumberger in Houston, Texas, and can be reached at rashburn@slb.com.

Chris Ashinhurst (B.S., 2004) announces the birth of Zaira Keelin Ashinhurst, born 4:07PM 07/07/07 (east coast time that's 7:07PM). How lucky is that!

Shanna Evans Baner (M.S., 2005) is a hydrogeologist at ERM in Round Rock, Texas.

Leigh Taylor Bartholomew (B.S., 2006) writes, "I already miss being in the depart ment but always talk about the great times spent there! Glad to see how well it is growing!" Leigh lives in Ft. Worth, Texas and can be reached at L.T.Bartholomew@tcu.edu.

Carrie Beveridge (B.S., 2001; M.S. GSC 2004) is a hydrogeologist at LBG-Guyton Associates. Carrie lives in Austin, Texas and can be reached at carriebev@yahoo.com.

Reed Boeger (B.S., GEH, 2007) is interning with BP in Anchorage, Alaska.

Clay Brollier (B.A., 2005) is a geologist at Pedernales Energy, LLC and lives in Houston, Texas.

Johnathan Bumgarner (B.S., 2002; M.S., 2005) is a scientist at QEA, LLC. He lives in Austin, Texas and can be reached at jbumgarner@qeallc.com.

Robert Burger (Ph.D., 2002) is assistant provost for science and technology at Yale University. He lives in New Haven, Conn. and can be reached at robert.l.burger@gmail.com.

Terence Campbell (M.S., 2007) lives in Tunapuna, Trinidad and Tobago and can be reached at tmister99@hotmail.com.

Robert Cannon (exchange student from Flinders, 2004) is still delving into the Great Artesian Basin pressures and correcting the data in the state database.

Norma Chaires (B.S., 2005) is a project scientist at Conestoga-Rovers & Associates. Norma lives in Houston, Texas and can be reached at nchaires@alumni.utexas.net.

Melody Cornelius (B.S., 2007) has accepted a position with CH2M-Hill in Albuquerque, where she is working with Karen Jarocki (B.S, 1992; M.A., 1994).

Patrick Fortson (GEH, 2004) has relocated to Austin and is an environmental scientist with W&M Environmental Group.

Luke Francis (B.S., 2007) has taken a position with Wet Rock Groundwater Services in Austin. Kaveh Khorzad (B.S., 1997; M.S., 2000) heads the firm.

Laurel Gandler (M.S., 2006) is a geologist at Hess Corporation, residing in Houston, Texas.

Bea García-Fresca (M.S., 2004, and Ph.D. candidate) presented a poster entitled "Coastal Evaporative Environments, Hydrology, and Dolomitization" at the SEPM Carbonate Research Meeting in Long Beach. The poster was co-authored by Jerry Lucia, Jack Sharp, and Joel Stevens (M.S., 2007).

García-Fresca

Terence Garner (Ph.D., 2007) and wife, Susan, are the proud parents of Savannah Amy Garner, born 31 August 2007.

Lloyd Hemphill (M.S., 2005) lives in Lecompton, Kansas and can be reached at 1hhemphill@yahoo.com.

Jad Hixon (M.S., 2006) is a senior geologist at Exxon Mobil. He lives in Houston, Texas and can be reached at jaded@yahoo.com.

Lindsey Huang (B.S., 2004) is a hydrogeologist at Pastor, Behling & Wheeler, LLC. and lives in Port Lavaca, Texas.

Junru Jiao (Ph.D., 2001) is a senior research geophysicist at the DGS. Junru lives in Katy, Texas.

Jamey Jones (Ph.D., 2005) is an assistant professor of geology at the University of Minnesota, Morris. Jamey resides in Morris, Minnesota and can be reached at jonesjv@morris.umn.edu.

Katie (Kier) Kaighin (M.S., 2004) is joining her dad (Bob Kier, Ph.D., 1972) in his geological consulting practice in Austin.

Jesse B. Kimball (M.A., 2004) is the owner of Windswept Energy, LLC. Jesse lives in Austin, Texas and can be reached at kimballj@windsweptenergy.com.

Paul B. Kirby (B.A., 2002) is a staff scientist at Daniel B. Stephens & Assoc., Inc. He lives in Austin, Texas and can be reached at paulkirby@austin.rr.com.

Kaveh Khorzad (B.S., 1998, M.S., 2000) is President/Senior Hydrogeologist of Wet Rock Groundwater Services, LLC, in Austin. His firm is expanding and Kaveh is interviewing potential students in the Department this month.

John Kolvoord (B.S., 2005) is a geologist at Hunt Petroleum. John resides in Houston, Texas and can be reached at jkolvoord@gmail.com.

Jeff Landrum (M.S., 2007) has accepted an offer with Aspect Consulting in Seattle/Bainbridge Island, Washington. Steve Germiat (M.S., 1988) is one of the principals of the firm.

Jim Levy (B.S., 2001) is president of Horizon Exploration Services. He resides in El Paso, Texas and can be reached at jim@geotexas.com.

Ana A. Manzolillo (B.S., 2006) is a development geologist at Repsol YPF. She lives in Houston, Texas and can be reached at amanzolillo@alumni.utexas.net.

James McCallum (Aussie exchange student from Flinders University, 2004) is an Environmental Scientist with CSIRO's Resource & Environmental Management Unit in South Australia.

A. Dax McDavid (B.A., 2003; M.A., 2006) is a geologist at Stalker Energy L.P. He resides in Austin, Texas and can be reached at dmcdavid@stalkerenergy.com.

Erin McGuire (B.S., 2006) is an assistant geologist at Geosouthern Energy Corp. Erin lives in The Woodlands, Texas.

Kristine Mize (M.S. GSC, 2004) is a geologist at EnCana Oil & Gas (USA) Inc. and resides in Centennial, Colorado.

Ian Moede (B.S, 2006) is working at Rosengarten, Smith and Associates, which is an Austin-based environmental consulting firm.

Karen I. Mohr (Ph.D., 2000) is an associate professor at the Department of Earth & Atmospheric Sciences and lives in Albany, New York. She can be reached at mohr@atmos.albany.edu.

Lorena G. Moscardelli (Ph.D, 2007) is a research associate at the Bureau of Economic Geology at the University of Texas at Austin. Lorena can be reached at lorena.moscardelli@beg.utexas.edu.

Sassan Mouri (B.S., 2004) is a Hydrogeologist with Malcolm Pirnie, Inc., in Houston.

Petro K. Papazis (B.S., 2003; M.S. GSC 2005) is a development geologist at Chevron in Houston, Texas. He can be reached at p.papazis@chevron.com.

Ethan Perry (M.S. GSC, 2005) lives in Ashland, Maine.

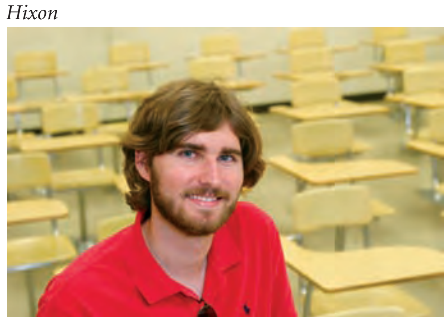
Susan Palachek (B.S., 2001) is a project manager with W&M Environmental group, Inc., in Austin.

Julie Pecarina (B.S, 2003) is a hydrogeologist CH2M Hill in Portland, OR.

Suzanne A. Pierce (Ph.D., 2006) is a senior member of the technical staff of Geohydrology at Sandia National Laboratories. Suzanne lives in Austin, Texas.

Stephanie Wise Reed (B.S., 2000) is the Engineering Coordinator for the Railroad Commission of Texas in Austin, where she studies basin impacts from mining activities and implements rules and limitations to ensure minimal affects to the regional hydrologic regime with increased mining of lignite, cannel coal and sub-bituminous coal resources. Since 2003, Stephanie has been coordinating the work efforts of the Division's engineering team (8 hydrologists and engineers). She notes that the RRC is

Hixon



Jack Sharp

still looking for two hydrologists to join their team!! In her free time, Stephanie is mapping, playing on vertical ropes, studying karst recharge in local caves, and hosting crayfish boils.

Robert Rogers (Ph.D., 2003) writes, "Started new tenure-track position at California State University, Stanislaus in fall 2006." He is an assistant professor at the department of geology and lives in Turlock, California. Robert can be reached at rrogers@geology.csustan.edu.

William Kurt Rucker (B.S., 2006) is a M.S. student at UCLA and resides in Los Angeles, California.

Rosario V. Scheerhorn (Ph.D., 2005) is a senior geologist at Conoco Phillips. Rosario resides in Spring, Texas and can be reached at j.r.scheerhorn@sbcglobal.net.

Chris Schneider (Ph.D., 2003) is adjunct assistant professor at California State University, Bakersfield and lives in Bakersfield, California.

Nazim Ozgur Sipahioglu (M.S., 2000) is a geoscientist at TPAO and can be reached at osipahi@petrol.tpao.gov.tr

Nicholas Sommer (B.S., 2003) is a graduate student at Colorado University at Boulder, where he resides. Nicholas can be reached at nsommer@gmail.com.

M. David Soto (M.S., 2007) is a geologist at Marathon Oil in Bellaire, Texas. He can be reached at mdsoto@marathonoil.com.

Desi Sweet (GEH, 2007) has taken a position with Malcolm Pirnie in Houston. She married in June (see photo with her bridesmaids). Erin Prante (GEH, 2007) is on the right. Notice the burnt orange dresses even though there are two Aggies in evidence! Hook'em!

Joy Thomas (M.S., 2001) writes, "I am still enjoying my part-time job with Marathon. I am now working in International Exploration-West Africa. My (almost) 3 year old son keeps me busy the other part of the day." Joy lives in Houston, Texas.

Michelle Tiemeier (B.S., 2006) accepted a position as Associate Geoscientist/Hydrologist with INTERA in Austin.

Sarah Lindsey Tsoflias (M.S, 2000) is Vice President of the International Association of Geophysical Contractors. Sarah is chiefly involved in assessing marine environmental issues for the Association.

Courtney Turich (M.S., 2000) writes, "I received my Ph.D. from Penn State Dept. of Geosciences in December 2006, and am currently enjoying a terrific post-doc job at the Skidaway Inst of Oceanography in beautiful Savannah, Georgia. In the coming year, I am looking very forward to marrying my fiancé and fellow geologist (Indiana Univ) Dariusz Strapoc." Courtney lives in Savannah, Georgia.

Abigail L. Watkins (B.A., 2005) is a junior geologist at Ecology and Environment, Inc. Abigail resides in Dallas, Texas and can be reached at abigail@paperclipped.net.

Adrienne Ruppelt West (B.S., 2001) is an advanced geophysicist at Marathon Oil Company and lives in Houston, Texas.

Mark Wiley (B.S., 2006) is a graduate s tudent at Colorado School of Mines. He resides in Austin, Texas and can be reached at marklwiley@gmail.com.

Andrew Yen (B.S., 2007) lives in Houston, Texas.

Cengizhan Yenerim (M.A., 2007) lives in Houston, Texas and can be reached at cyenerim@gmail.com.

Desi Sweet and bridesmaids.

Kathryn Young (M.S., 2006) is a geophysicist at EOG Resources. She can be reached at kyoungtt@gmail.com.

Susan Young (B.S., 2005) is senior field engineer at Schlumberger Wireline & Testing and resides in Tyler, Texas. She can be reached at youngsa@gmail.com.

Sarah Zanoff (B.S., 2006) works at Schlumberger and lives in Houston, Texas. She can be reached at szanoff@houston.oilfield.slb.com.

Friends, Faculty, Former Faculty, and Staff:

John L. Snyder is retired from the National Science Foundation and resides in Arlington, Texas.

Julia L. Hall lives in Austin, Texas and can be reached at juliah@sbcglobal.net.

Bill Woods writes, "After retiring I took a year off to work around the house and just do nothing. I got a lot accomplished on both tasks. The next year I worked as a UTEMP for 5 months and then used the earnings to spend a month in Scandinavia. My travels can be seen at my website: www.osote.net. In 2007-08 I am working as a UTEMP again and planning another vacation trip, destination yet undecided. I occasionally have lunch with some of my former co-workers and it's always a pleasure to catch up." Bill lives in Austin, Texas and can be reached at billw@mail.utexas.edu.

Meghan Ward Playton writes, "I was a Master's student in structural diagenesis from Aug 03-Dec 06, working with Steve Laubach at the Bureau of Economic Geology." Meghan lives in Austin, Texas.

MEMORIALS

Alumni

Payton Victor Anderson, B.S., 1945, of Midland, died January 9, 2007. He was born November 25, 1924 in Rapid City, South Dakota. Payton worked for Humble Oil Company until 1949 when he returned to Midland to form the firm of W. D. Anderson & Sons with his father and brother, Paul D. Anderson. In his career he was instrumental in the discovery and extension of numerous oil and gas fields in the Permian Basin and also North Dakota, Wyoming, Colorado and the Black Warrior Basin of Alabama and Mississippi. Payton is survived by his wife, Evelyn Brewster Anderson of Midland, Texas, three daughters, six grandchildren, and three great-grandchildren.

Robert Jerry Brod, B.S., 1957, died December 31, 2006, at Balfour Retirement Community in Louisville, Colorado. He was 76. Jerry was born in Houston, Texas. After receiving his B. S. in geology from The University of Texas in Austin and serving in the Army, he joined Geophysical Exploration Corporation in Houston, Texas. In 1963, he became a partner and vice-president in the firm and moved with his family to Calgary, Alberta, Canada, where he opened an office for Geophysical Associates International, working primarily in supervising airborne surveys. In 1980 he started his own company, RJB Exploration, and continued conducting surveys and doing consultation until his retirement in 2000. He was a long-time member of the Society of Exploration Geophysicists, the American Society of Petroleum Geologists, and the Canadian Society of Exploration Geophysicists. Jerry is survived by his wife Shirley, three sons, and two granddaughters.

John Doyne Cooper, M.A., 1964, Ph.D., 1970, died September 8, 2007, of a heart attack during a morning walk near his Chino Hills, Calif. home. He was 68 years old. John was born June 12, 1939, in Wichita, Kan. He worked as an exploration geologist for Shell Oil before he began teaching at Cal State Fullerton, where he remained until his retirement in 2002. John was recognized as an international expert in sequence stratigraphy and was widely known for his research on the evolution of eastern California. John is survived by his wife Nancy, daughter Chaska, son Zachary, stepson Randy Thompson, a sister, and a grandson.

William P. Craddock, Jr., M.A., 1947, 89, died October 26, 2006. Bill was a member of the greatest generation that believed in God, family and country. He served in WWII as a Naval pilot in Europe and North Africa. He was a member of The Navy Patrol Squadron VP-63, The Mad Cats, and was awarded the Air Medal and Distinguished Flying Cross. Bill was a member of St. Mark's Episcopal Church for over 50 years. Retired from Exxon after 35 years of service, he was current president of the Exxon Annuitant Club. Bill is survived by his two daughters, three grandchildren, and one great grandson.

Leslie Alfred Dedeke Jr., B.S., 1955, died March 8, 2007. Leslie was born 31, 1932, in New Braunfels, Texas." He was in the Navy ROTC, and joined the Navy soon after graduating from college. During his Navy career he attained the title of Commander. He worked as a geophysicist for Unocal and retired in 1992. Leslie is survived by a daughter; a son, two granddaughters, grandson, and a great granddaughter.

William Davis "Dick" Frazell, M.A. 1935, 94, and a longtime resident of Lafayette, died March 25, 2007, at Lafayette General Hospital. He began his career with Union Producing Co. in Shreveport. In 1955, he successfully organized W.W.F. Oil Corp. and worked in Abilene, Texas, and Lafayette, Louisiana since 1954. He was a member of the American Association of Petroleum Geologists, Lafayette Geological Association, Society of Independent Petroleum Earth Scientists, and the Petroleum Club of Lafayette. The Lafayette Geological Society recognized him in its first class of LGS Legends in 1999. He is survived by his wife, Jean G. Frazell, three sons, a stepson, stepdaughter, and two granddaughters.

Charles Frederick Haas, B.S., 1941, died January 21, 2007. He was born on February 2, 1917 in Edinburg, Texas. In 1936 he enrolled in the University of Texas at Austin on an athletic scholarship playing football and baseball. He was drafted by the Boston Red Sox. He returned to the university where he graduated with a geology degree. He was employed by the Chicago Corporation as a consulting geologist working near Bishop, Texas. In 1950 he became an independent oil and gas operator, creating Haas Drilling. Later his brother Richard E. Haas joined him in forming Haas Brothers Drilling Company. He served as president of the UT Longhorn Club in Austin, The "T" Letterman Association of UT, and the Statewide Longhorn Club. He also was a founding member of the UT "One Hundred Club"; the Haas Family Endowed Presidential Scholarship for the Handicapped; and endowed Presidential Scholarship honoring his parents, Fred and Nora Haas. He is survived by his wife of 67 years, Eunice C. Haas.

H. W. "Bill" Hollingshead, Jr., of Midland, passed away June 4, 2007. He was born June 12, 1929 in Seminole, Oklahoma. A 1st Lieutenant at Connally Air Force Base, he was an instructor from 1950 until 1955. Bill had worked with Marathon Oil Company, Pennzoil as Division Manager, Tipperary, and retired from Pennzoil as Research Advisor. His memberships included AAPG in Midland, Shreveport, and Houston, and the West Texas Geological Society. He is survived by his wife, Patricia A. "Pat" Hollingshead, a daughter, son, nine grandchildren, and two brothers, Ronald and Corkey Hollingshead.

Harold E. Jones, B.S. 1941, 87, died, February 25, 2007 after a courageous battle with complications of diabetes. From hardscrabble roots as the son of a Knippa rock quarry foreman, Harold put himself through college at The University of Texas at Austin and spent a lifetime pursuing a passion for geology in Midland. His geology career took root in Houston after the war, with a stint at Brazos Oil & Gas and his first big discovery—Anna Mae Brown. They wed and moved to Midland soon afterward. Harold worked for Stanolind Oil & Gas and Bankline Oil & Gas before launching a successful career as an independent geologist in 1957. Harold was active in Toastmasters International for over 25 years. He was also a member of SIPES, AAPG and WTGS. He served First Christian Church as Deacon, Elder and Elder Emeritus. He is survived by his wife and best friend, Anna Mae Jones.

Virginia Lee "Ginny" Langston, wife of **J. Donald Langston (B.S., '41),** died in Kailua-Kona, Hawaii on November 16, 2006. She was a member of the Littlefield Society at the University of Texas at Austin. She and her husband were generous contributors to the Jackson School, in which the J.D. & V.L. Langston Foundation was named after them.

William Bohning Newberry, M.A., 1952, of Austin, Texas, was born in Ft. Worth, Texas in 1928 to Beth Bohning and Oliver Perry Newberry. He died December 10, 2006, in Austin. Newberry worked in the oil and gas exploration and production industry for over 50 years. Surviving him are his wife, Suzanne and their children, Susan, Bill and Marianne, and John and Diane, and six grandchildren, Bill, Christie, Michelle, Tammy, John and Robert.

Curtis V. Pennington. B.S. 1980, 51, died on Thursday August 16, 2007 after a courageous battle with cancer. Curtis was born in Midland, TX on September 20, 1955. Curtis is survived by his loving family, his wife of 23 years, Phyllis Elolf Pennington; son, Nathan 21; daughter Molly 18; brothers William F. (Bill) Pennington and wife Sandy, Thomas B. Pennington and his wife Doris; many nieces, nephews and cousins. Curtis graduated from the University of Texas in 1980 with a B.S. in Geology. He began his career with Core Lab in Dallas, but soon moved to Houston to work for Getty Oil Company in the Offshore Division. At Getty he made lifelong friends including Phyllis who became his wife in 1984. Curtis worked for several companies in his career as a geologist/geophysicist including Texaco, Fina and The Houston Exploration Company.

Wilburn H. Seals, BBA 1947, M.A. 1939, died away Tuesday, Aug. 28, 2007 at home from cancer. Will was born July 22, 1916 in Archer City, TX. After attaining a BBA and then a Masters in Geology at The University of Texas at Austin, he went to work for what would later be Standard Oil. After serving in WWII he returned to work for Standard Oil and spent a few years in Venezuela locating and developing oil reserves. Later, he returned to Texas and settled in Dallas where he continued his oil explorations throughout the state and in New Mexico. Forming a partnership with the Hollywood T.V. producer Jack Rather (owner of Lassie and The Lone Ranger), he spent his entire career in the Oil Patch with significant success. He is survived by his loving children, Alan E. Seals; Marilyn Addison and her husband Steve and their children Lauren Self (and Jake) and Scott Addison; and Beverly Storey Balch (and Billy).

Katherine Archer Tyson, B.A., 1935; M.A., 1936, died peacefully in Salado, Texas on August 5, 2007 surrounded by friends and family. Her first job in 1936 was with Continental Oil Company in Houston. While at Conoco she met her future husband, A. Knox Tyson (B.A., 1921; M.A., 1922), a Division Geologist with Conoco. They were married in 1939 and had a life long love affair. On Mr. Tyson's retirement as an independent oil man in Houston, they traveled the world studying geological formations and collecting fossils.

Preston M. Walters, B.S., 1973, died May 21, 2007 in Austin at the age of 56. He was a skilled geologist respected by those he worked with. He was born on October 18, 1950. He graduated from the University of Texas at Austin with a degree in geology and worked in the oil industry until his death. He served as an ordained elder in the Presbyterian Church, Sunday School teacher, Cub Scout den leader and cubmaster, and softball referee. He loved hunting trips with his dad, chatting with the "gold bugs" online, and was always fascinated and excited by geology. He is survived by his wife Dawn, daughter Alissa Odom and husband Paul, son Josh Walters, granddaughter Mikaela Walters, father M.S. Walters, sisters and brother-in-laws Mayme and Bill Trumble, and Ruth and Mike Rios, nephew Jonathan Trumble, and niece Alison Rios.

Charles J. Worrel, B.S., 1951, was born October 11, 1919 and died on September 4, 2006. He spent his early years in Houston. He entered The University of Texas in Austin in 1938 where he was a member of Kappa Sigma Fraternity. At San Jacinto High, he met Eva May Kinzbach who would become his wife on March 25, 1942. He left the University in January 1940 to join the U.S. Navy. In September 1945, he returned to Austin to complete a degree in geology. In 1951 he went to work for Deep Rock Oil Company and began his association with Maurice E. (Bud) Forney. In September 1954, they created Forney and Worrel, Consulting Geologists, a partnership that lasted 28 years. He served as President of the Texas Section of the American Institute of Professional Geologists and served as President, Treasurer and Executive Committee Member of the South Texas Geological Society. He is survived by his wife.

William Blake Dub Yarborough, Sr., B.S., 1940, passed away on September 28, at the age of 92. He was born in Fredericksburg, Texas on August 26, 1914. Dub chose geology for a career and in June of 1940 graduated from the University of Texas with a B.S. in geology. In August of 1940 Humble Oil

& Refining Co. hired him to work in their Houston Office. On December 6, 1941 he married the love of his life and college sweetheart Katherine Kay Searcy Kleberg. In WWII he saw active duty in the Photographic Intelligence Division assigned to the Asiatic Pacific Theatre. In December 1951, he resigned from Humble and struck out on his own to be an Independent Geologist in the oil and gas business. In 1978 he became a Director of King Ranch, Inc. and was elected Vice President of their oil and gas activities. In 1980 King Ranch, Inc. formed its subsidiary King Ranch Oil and Gas, Inc. and Dub became the President, CEO and Chairman of the Board of this new company. He managed the business from Midland until his retirement in 1988. In 2001 Dub received the Pioneer Award from the West Texas Geological Society honoring his 60 years in geology. Dub is survived by his two sons, his daughter, and his seven grandchildren.

Faculty

Horace Edward White, B.S., 1957, a 76 year old independent petroleum geologist, died April 15, 2007 in Austin, Texas. H.E. White was a resident of Austin. He was born in Denton and grew up in May and Brownwood. His lifelong passion for flying began in childhood. As a little boy, his bedroom ceiling was covered with model airplanes that he had built. After school he worked at the Brownwood Municipal Airport, fueling planes until he was old enough to earn his wings. He began flying planes as a teen and enjoyed the countryside as an acrobatic flyer. On his 17th birthday, he received his pilot license. White graduated from Brownwood High School in 1946. After graduation, he attended North Texas State University for a couple of years and then joined the Navy. He served as a jet pilot during the Korean War. After his military discharge, the dashing young pilot hung up his white uniform and returned to Texas, where he attended the University of Texas at Austin, graduating in 1957 with a bachelors degree in geology.

Following university, he moved to Abilene and joined his father and younger brother in the family oil business. In Abilene, he married Dale Byram, mother of three of his five children, John Byram, Holly and Kaylea. In the mid-1960s, he left the family business and moved to Austin, where he taught geology at the university, studied for a master's degree and did some of the first geologic computer mappings.

His first marriage ended in 1968. From 1970-1979 he worked in the General Land Office of the State of Texas, as a manager and pilot. His happiest moments were spent driving along open roads with his convertible top down, pondering the stars or admiring the sunrise over the land and trees at the family farm in Comanche County. In 1979, he began working for himself in the oil business. He had an idea of following up on his father's oil exploration at the family farm and in the surrounding counties of Texas. In 1980, he was blessed by his marriage to the widow Nelda Morehead. White's family expanded to include Karen and James. In the 80s and 90s he could most often be found driving his vintage Cadillac convertible on the streets of Austin, or taking his family to one of the area lakes around Austin or to Lake Brownwood. In recent years, he divided his time between his home in Austin and the family farm. He was especially proud to be a part of a family that pioneered the Amity area in Comanche County. In 2002, he and his brothers, Robert Wayne White and William Allen White, represented the Robertson family descendants at the State of Texas Family Land Heritage Ceremony at the state capitol, honoring Texas farms that had been owned by the same family for over 100 years. He is survived by his wife Nelda.

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The staff and members of the Jackson School of Geosciences would like to convey our respect to the families of the following alumni:

Melvin L. Augustus, B.A. 1932

Dale Dodson, B.A. 1953

John D. Gould, B.A. & M.A. 1949

Charles J. Greene, B.S. 1975

Charles Henry Hightower, Jr., B.S. 1956

James Starke (Jimmy) Isom, B.A. 1959

Kenneth Lee Jarratt, B.S. 1957

Jon T. Jorgenson, B.A., 1949

Asa Duncan McRae, B.S. 1942

William I. Mounger, B.S. 1940

Joseph Lucian Pritchett

Ann Joyce Ruby, B.A. 1948

Frates Slick Seeligson, B.A. 1945, J.D. 1949

Edgar John Stulken

James "Jeff" Tucker, B.S. 1948

Curtis Whited, B.S. 1975

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The following members of the Jackson School of Geosciences community were previously honored in the 2006 Newsletter:

William "Bill" Moore Beecherl, B.S. 1941

Warren J. "Jack" Cage, Jr., B.S. 1950

Marcus E. Milling

Ronit Nativ

Arthur Branch "Bo" Williams