Annual Report 2002

Bureau of Economic Geology

Scott W. Tinker, Director

John A. and Katherine G. Jackson School of Geosciences

The University of Texas at Austin

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Shaded relief map of Mexico on page 3 courtesy of The General Libraries, The University of Texas at Austin.

Director's Message

Perhaps we have turned a corner this year. To be sure, our challenges are great, but a sense of health, camaraderie, and pride prevail. It's nice to see. Bureau folks move around Texas and the globe with confident efficiency. Just a week ago we had a high-level visitor in town. I was frustrated to find many people out of the office—London, Calgary, Midland, Poza Rica, Houston, The Hague, Galveston, Saudi Arabia—until I realized that is exactly where they should be, out there doing science, making an impact on our state and our world.

So many good things this year. The addition of a major new core facility in Houston owing to the generous gift from BP, highlighted by a visit from Lord John Browne of Madingley, BP's chairman and chief executive officer. High-impact studies completed and continuing in Mexico, highlighted by a visit from PEMEX Director General Ing. Raúl Muñoz Leos. By all accounts, one of the best GCAGS meetings ever held—run largely by folks from the BEG. Top young talent joining our ranks from some of the premier universities. Solid foundations being laid for the Jackson School future. Broad-based funding spread across Federal, State, and private sources.

I am now beginning to understand and define my own role a bit better, and it can be summed up by one word—education. My day consists of a steady stream of electronic, spoken, written, and silent communication, all with the express intent of exchanging information to achieve some form of education. I either educate, or am educated by, people from other countries and companies, Federal and State employees, colleagues within the academic community, associates within the University, friends at the Bureau, my graduate students, or my four kids at home. Franklin Roosevelt said, "The real safeguard of democracy . . . is education." If my year is representative, democracy is stronger than ever!

One of the passions that I have developed in the 3 years that I have been at the Bureau is to educate everyone who will listen as to the necessity of the conjunctive association between the three E's: energy *and* environment *and* economy. These are not mutually exclusive choices, as represented broadly by the media. They are mutually inclusive. Balancing the sensitive relationship between energy, environment, and economy worldwide is the great challenge for the 21st century.

The time is now for the best minds—those at the Bureau and elsewhere in the world—to address the critical issues required to make the transition smoothly from a global economy that runs on coal and oil to one that runs on natural gas, and eventually hydrogen. Solutions will include energy *and* environmental *and* economic understanding at all levels, including sequestration of greenhouse gases. The Bureau will be there, and our global understanding will be brought home to impact Texas and Texans.

The year ahead promises new insights, challenges, and friendships. Let's get after it!

2002 News at the Bureau

Left to right: *The University of Texas at Austin President Larry R. Faulkner, Lord John Browne, and Bureau Director Scott W. Tinker.*

Houston Research Center

The Bureau has acquired a world-class core and sample repository in Houston, Texas. This facility was part of a major donation to The University of Texas at Austin by BP America that was announced in August during a visit to the University by Lord John Browne of Madingley, BP chairman and CEO. The gift has a value of $7 million (land, buildings, cash). The facility contains approximately 450,000 boxes of samples and cores, almost all of which were obtained as a result of exploration for oil and gas. The building includes modern core examination rooms (with roller tables and excellent lighting), office and laboratory space, and a conference room with ceiling-mounted projectors. All interior space, including the warehouse, is air-conditioned. The operational costs for the first year were covered by a grant from the U.S. Department of Energy. Efforts are under way to establish an endowment of $10 million to operate the facility in future years, and BP America has provided the first contribution of $1.5 million.

In addition to use by geologists in the oil and gas exploration business, this facility is expected to be used by those studying water resources, soil stability, and other issues associated with the Earth's subsurface. The Bureau also intends to establish a K–12 outreach program in the new facility, which will provide Houston area youths opportunities to study geology and earth science.

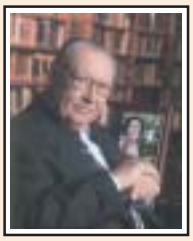
The Bureau has maintained and operated core and sample repositories for more than 70 years in the State of Texas. In addition to the new Houston facility, the Bureau operates two other facilities. The Austin Core Research Center currently houses more than 390,000 boxes of core and 311,000 boxes of cuttings in a 95,000-ft^2 building constructed in 1984. The Midland Core Research Center has more than 224,000 boxes of core and 275,000 boxes of cuttings housed in 45,500 ft^2 of warehouse space.

The Houston Research Center, located at 11611 West Little York in west Houston, is open Monday through Friday from 8 a.m. to 5 p.m. Additional information can be obtained by calling the center directly at 713-466-8346. A searchable list of all the material currently stored in the facility can be found on the Bureau's Website (http://www.beg.utexas.edu/crc/houston.htm).

New Book by Peter Flawn Chronicles Bureau "Near-History"

President Emeritus of The University of Texas at Austin and former Bureau Director Peter T. Flawn has written and published a book titled *Texas Geologist and the Bureau of Economic Geology, 1949–1970*, wherein he recalls, among many things, his early days in the field in West Texas, dealings with the Department of Geological Sciences at The University of Texas at Austin, and his decade as Bureau Director. With humor and insight, Flawn vividly recalls people and places that influenced his career in Texas and his tenure as State Geologist. Flawn's story of the practice of geology at the State Survey during the latter part of the mid-century will appeal to geologists and those interested in the history of the times. The 182-page book (2002) is sold through the Bureau's office of Publication Sales.

John A. and Katherine G. Jackson School of Geosciences



The Jackson School of Geosciences at The University of Texas at Austin was established in 2001 by The University of Texas Board of Regents and named in honor of Mr. Jackson and his late wife. A major gift by Mr. and Mrs. Jackson made possible the formation of this interdepartmental school that promises to become one of the leading geoscience education and research centers in the world. Former Bureau Director William L. Fisher is Director of the school. The Jackson School will promote excellence in teaching and research in geology; geophysics; energy, mineral, and water resources; as well as the broad areas of the earth sciences, including the Earth's environment. The new Jackson School unites the Bureau of Economic Geology with the Department of Geological Sciences and the Institute for Geophysics at The University of Texas at Austin, supporting greater collaborative research and teaching between these organizations.

Bureau Director Scott W. Tinker sits on the Executive Committee of the school, and he and Doug Ratcliff, Bureau Associate Director, sit on the Steering Committee. Eight Bureau scientists have joined the Graduate Studies Committee of the Department of Geological Sciences and can now serve as graduate-student supervisors: Alan Dutton, Bob Hardage, Martin Jackson, Charles Kerans, Stephen Laubach, Jerry Lucia, Bridget Scanlon, and Lesli Wood. With support from the Jackson School, Lesli Wood co-taught the graduate course in Basin Analysis with Bill Galloway of the Department in the 2002 spring semester. Three senior research scientists at the Bureau—Martin Jackson, Charles Kerans, and Bridget Scanlon—were named Jackson School Fellows for the 2002–2003 academic year. These annual appointments are among the first endowed fellowships ever awarded to research scientists at The University of Texas at Austin.

Awards

It is always a pleasure to make note of Bureau staff who receive awards and honors during the year. **William Fisher** received several prestigious awards, including the 2002 Don R. Boyd Medal for Excellence in Gulf Coast Geology from the Gulf Coast Association of Geological Societies (GCAGS). He is also one of three recipients of the 2002 University of Texas Presidential Citation and was honored by the Texas Independent Producers and Royalty Owners Association with the *Hats Off!* Award. **Scott Tinker** was named the Edwin Allday Chair in Subsurface Geology in the Department of Geological Sciences at The University of Texas at Austin and received a Distinguished Service Award from the West Texas Geological Society. **Doug Ratcliff** received a Distinguished Service Award from GCAGS for his many contributions over the years to the society. **Stephen Ruppel** was awarded the American Association of Petroleum Geologists Wallace E. Pratt Memorial Award for his paper titled "Contrasting Styles in Reservoir Development in Proximal and Distal Chert Facies: Devonian Thirtyone Formation, Texas." **Shinichi Sakurai** was awarded the Society of Professional Well Log Analysts (SPWLA) 2002 Best Poster Award for his presentation at the 2002 SPWLA Annual Symposium in Oiso, Japan, titled "Petrophysical Evaluation of Miocene-Pliocene Gas Reservoirs: Veracruz and Macuspana Basins, Mexico." **Bob Hardage** received Input/Output's "Multi-Component Technology Pioneer" award, which recognizes individuals who have made significant contributions to the seismic industry.

New Research Horizons

The Bureau is building on the foundation of our current strengths to develop research initiatives in topics related to energy and environmental studies. Chief among these are collaborations with researchers and professors in our sister units of the John A. and Katherine G. Jackson School of Geosciences (JSG). We are now planning innovative studies in such important issues as hydrogeology, airborne geophysics, fluid-rock seismic technology, linked mechanical and chemical processes in sedimentary basins, and other topics of significance that may be selected to become pillars of the research program of the JSG. We also hope to expand our current studies related to the geologic sequestration of greenhouse gases and basic research conducted through our Industrial Associates consortia, including salt,

carbonate reservoirs, multicomponent seismic, fractures, deep-marine margins, and environmental quality.

Major carbonate reservoir research continues with ILRIS technology. Bureau researchers now have the capability of acquiring 5-cm point-spaced data from outcrop faces as much as 1 km distant using ILRIS 3-D laser scanning. ILRIS data have served as the basis for a method of constructing realistic 3-D reservoir models using a series of interpretation techniques similar to those used for interpreting horizons in a seismic data set. These horizons are then exported to a geocellular-mapping package. Researchers in the Reservoir Characterization Research Laboratory have completed initial 3-D images of deepwater debris flows at Victorio Canyon, Sierra Diablo, and a classic rudist reef complex at the Pipe Creek outcrop, Central Texas.

Web-Based Educational Modules

In 2002, the Bureau began work on the next generation of educational, Web-based reservoir characterization modules in collaboration with the American Geological Institute (AGI) and the American Association of Petroleum Geologists (AAPG). The new series, distributed by AAPG through the Interactive Online Learning program, focuses on carbonate reservoir characterization with content from Bureau researchers. The new modules are structured around real data sets and complement the first series, already online, which illustrates the principles of reservoir characterization for fluvial depositional environments. These interactive, game-theory-based modules allow students to interact with geological, geophysical, and engineering data; make data interpretations; and then test their answers against the instructor's. The modules also feature an evolved instructional model and user interface.

PEMEX Head Visits Bureau

Left to right:
Ing. Luis Ramírez Corzo, PEMEX Director General of Exploration and Production, Ing. Raúl Muñoz Leos, PEMEX Director General, and Scott W. Tinker, Bureau Director.

Delegates from Petroleos Mexicanos (PEMEX), including PEMEX Director General Ing. Raúl Muñoz Leos, visited the Bureau in November to hear presentations about joint Bureau-PEMEX research. Muñoz Leos gave a public lecture titled "PEMEX in the Decade Ahead" at the Bass Lecture Hall on The University of Texas at Austin campus as part of the Mexican Center's "Distinguished Mexicans in Texas" lecture series. He outlined the principal challenges facing PEMEX today as the need to stem the decline in known reserves through expanded exploration, especially in natural gas, to increase productivity and efficiency, and to improve the business management and competitiveness of the organization. PEMEX is the national oil and gas company of Mexico.

Keynotes Lectures

Each year, Bureau scientists disseminate research results around the globe through invited lectures and keynote addresses. Bureau Director **Scott Tinker** was invited to speak at the Plenary Session of the U.S. Department of Energy's Conference on Natural Gas Technology—Investment in a Healthy U.S. Energy Future in Houston, Texas. He also gave the all-convention luncheon address at the Rocky Mountain Section/American Association of Petroleum Geologists (AAPG) meeting in Laramie, Wyoming, and was the keynote speaker at the ChevronTexaco Geology Forum in Galveston, Texas. Farther away from home, Tinker spoke at the 17th World Petroleum Congress in Rio de Janeiro, Brazil, and delivered the keynote address to the 11th Annual Venezuelan Geophysical Congress in Caracas, Venezuela. **Martin Jackson** presented the Fourth Annual Robert E. Sheriff lecture at a dinner meeting of the University of Houston Geosciences Alumni Association and the Houston Geological Society Division of International Explorationists. He also gave a keynote paper at the First Marrakech International Oil and Gas Conference and Exhibition in Morocco. **David Jennette** was invited to participate in a deepwater turbidite reservoir workshop preceding the annual meeting of the European Association of Geoscientists & Engineers in Parma, Italy, and was an invited lecturer at the Energy and Minerals Applied Research Center at the University of Colorado Boulder and the University of Wyoming. **Charles Kerans** toured Saudi Arabia, Oman, United Arab Emirates, Turkey, and Kuwait in the spring as an AAPG International Distinguished Lecturer and was an invited speaker at Rice University's Vail Fest, a symposium honoring stratigrapher Peter R. Vail in Houston. **Robert Loucks** was one of 18 Paleozoic experts from around the world invited to present their carbonate research at a conference sponsored by TotalFinaElf in Pau, France, and was an invited speaker for the Mississippi Geological Society 2002 Spring Symposium in Jackson, Mississippi. He also delivered the keynote address at the Texas Alliance of Energy Producers conference in Wichita Falls, Texas, and presented a seminar on paleocave reservoirs at the AAPG Southwest Section annual meeting. **Bridget Scanlon** gave a keynote address on groundwater recharge at the annual National Ground Water Association meeting in Las Vegas, Nevada.

2002 GCAGS Convention

The 52nd Gulf Coast Association of Geological Societies (GCAGS) Annual Convention was held October 29–November 1 at the Austin Convention Center and the Radisson Hotel. Hosted by the Austin Geological Society, along with the Gulf Coast Section of SEPM and the Austin Chapter of the Society of Independent Professional Earth Scientists, the meeting attracted more than 1,400 people and 60 exhibitors, exceeding all expectations, to make it a successful convention by all accounts. In keeping with this year's theme—Beyond the Horizon—GCAGS welcomed the Asociación Mexicana de Geólogos Petroleros (AMGP) as a new member society. Many Bureau employees contributed to the planning, organization, and management of the convention. Bureau Associate Director Doug Ratcliff served as General Chairman and organized volunteers and resources on all fronts. A strong technical program featuring 17 technical sessions comprising more than 110 oral presentations and 32 poster sessions, as well as 6 short courses, was put together by Bureau Director Scott Tinker and Bureau researcher Julia Gale. The largest ever Transactions volume was edited by Bureau scientists Shirley Dutton, Stephen Ruppel, and Tucker Hentz and distributed to all participants on CD; print-on-demand copies of the 1,213-page volume were also available. GCAGS also organized a teachers' workshop titled "Using Natural Disasters to Teach Earth Systems." Instructors were from the Bureau, the Institute for Geophysics, and the U.S. Geological Survey. Sold-out events included the All-Convention Luncheon, which featured a speech by Assistant Secretary for Fossil Energy Carl Michael Smith, and an evening of entertainment at the Bob Bullock Texas State History Museum.

New Researchers

The Bureau added several new scientists to its research staff this year. **Xavier Janson**, a carbonate researcher who holds a Ph.D. from the University of Miami (2002), joined the Bureau in December. Xavier received his M.S. degree from the Institut Français du Pétrole (IFP school) (1997) and his B.S. degree from Joseph Fourier Université Grenoble 1. **Jean-Philippe Nicot**, a researcher in hydrogeology, received both his M.A. (1995) and Ph.D. (1998) degrees from The University of Texas at Austin. His B.S. (1981) degree in geological engineering was earned at the Institut National Polytechnique de Lorraine in Nancy, France. Geophysicist **Florence Bonnaffé** began work at the Bureau in December as well. She has an M.A. degree in applied geophysics from Pierre et Marie Curie University in Paris and a B.A. degree in geology from Joseph Fourier Université Grenoble 1. **Sergey B. Fomel** received his Ph.D. (2001) in geophysics from Stanford University and his Diploma in geophysics (1990) from Novosibirsk University in Russia. Sergey came to the Bureau from Berkeley, California, where he was a Postdoctoral Fellow at Lawrence Berkeley National Laboratory and a Visiting Assistant Professor at the University of California. Long-time Graduate Research Assistant **Luciano Correa** became a permanent employee in September. Luciano holds an M.S. degree in finance from the University of Chile and an M.A. degree from The University of Texas at Austin College of Engineering, from which he will also soon receive an M.S. in operations research and industrial engineering.

Basic and Applied Research

INDUSTRIAL ASSOCIATES PROGRAMS

Applied Geodynamics Laboratory (AGL)

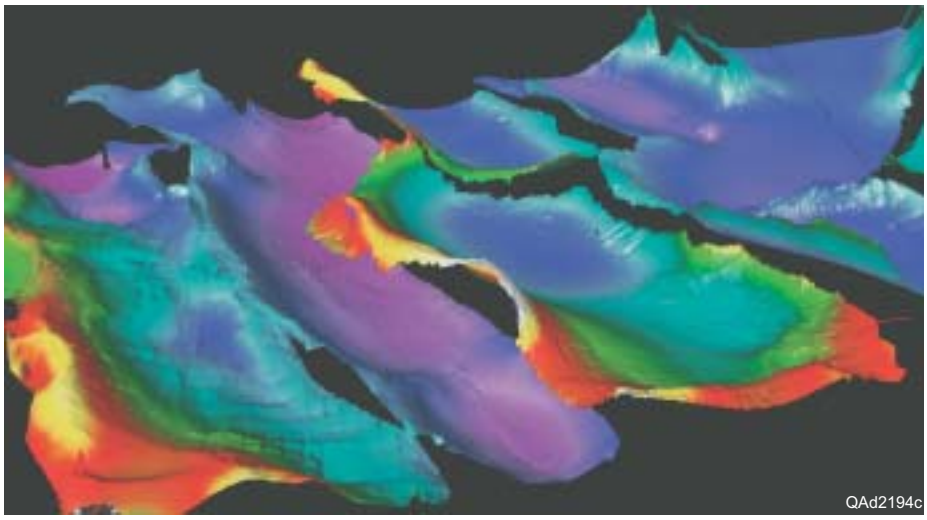
Martin P. A. Jackson, Michael R. Hudec, Bruno C. Vendeville, Daniel D. Schultz-Ela, and David C. Jennette

AGL research on salt tectonics continued to expand in scope during 2002, including new modules of a digital atlas, fundamental geologic research on a large, 3-D seismic volume, and ongoing tectonic modeling.

The Salt Mine, a browser-based, interactive atlas of salt tectonics, features a comprehensive collection of salt structure images and the best models produced during the lab's 15-year history. Four new atlas modules were produced, which completes the topic of contractional salt tectonics. The atlas is available only to AGL sponsors at present. Four animations illustrating fundamental interactions of salt tectonics and sedimentation were also produced.

Integrated structural-stratigraphic research was carried out on proprietary 3-D seismic data from the deepwater Lower Congo Basin in offshore Gabon. AGL researchers investigated synsedimentary thrusting, compressional diapiric rejuvenation, allochthonous salt extrusion, and inversion of extensional faults and turtle structures. The study included extensive seismic interpretation, tectonic synthesis, restorations, facies mapping, and development of new concepts.

Modeling research continued into salt tectonics associated with hydrocarbon traps. Researchers use computer-controlled devices to simulate various structural styles while overhead photographs, serial sections, time-lapse videos, and CT scans assist in reconstructing and analyzing structural evolution. Pilot experiments were carried out on physical models incorporating high fluid pressure and on laser scanning of evolving model topographies.

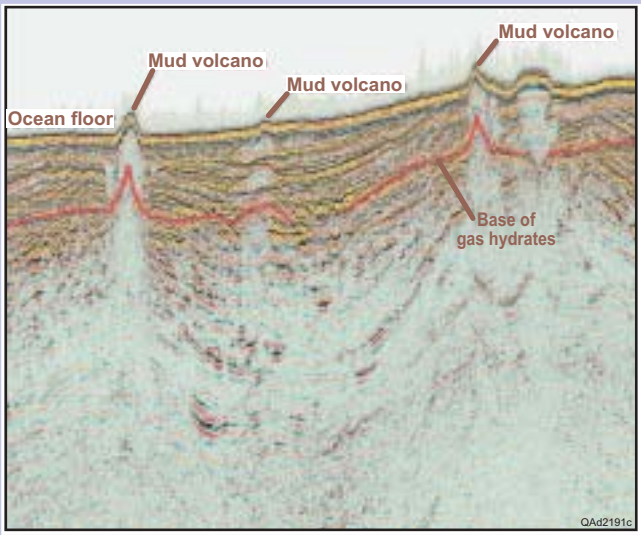


Oblique view of structural duplication of a stratigraphic horizon in a fold-and-thrust belt in deepwater Gabon, West Africa. The horizon is currently buried under 3 km of younger sediment. The landward part (right-hand side) shows gaps representing normal faults or salt diapirs. The basinward part (left-hand side) shows overlapping thrust sheets.

Deep-Marine Depositional Margins Industrial Alliance (DM^2)

Lesli J. Wood and Paul Mann (The University of Texas at Austin Institute for Geophysics [UTIG])

The offshore margins of Trinidad and Venezuela are leading sources of oil and natural gas for the U.S. market and are expected to remain so for the first part of the 21st century. Researchers have begun a 3-year study, funded by a group of companies interested in deep-marine hydrocarbon exploration and development in mobile shale basins. The marine margin off eastern Trinidad offers a unique opportunity to gain enormous insight into the structural and stratigraphic development of these margin types through an extensive database. The team is currently interpreting up to 2.5 seconds of 10,000 km^2 of



Large gas-hydrate deposits are found in offshore regions of Trinidad and eastern Venezuela. Numerous mud volcanoes are currently active on the seafloor and, as in the past, influence the distribution of deep-marine sediment transport and depositional systems. The relationship between structure and mud volcanoes/shale diapirs is being explored by the DM^2 research group.

contiguous 3-D seismic data and hundreds of shallow dropcores, as well as conventional hazards seismic, sonar, and core.

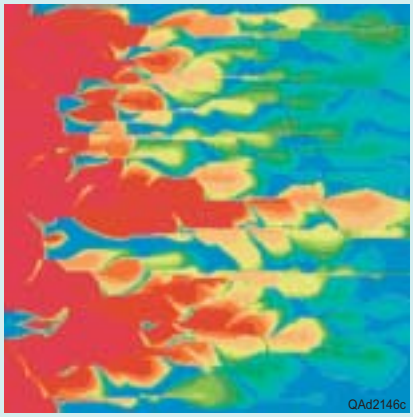
The primary goal of the project is to characterize the late Pleistocene and Holocene stratigraphy, structure, and depositional processes in this tectonically active, deep-marine mobile shale basin. Gas hydrates, mud volcanoes, seafloor and subseafloor structure, slope, and 3-D stratigraphic architecture are some of the issues being examined to explain the processes involved in margin evolution and the potential for resource development in deep-marine settings. Data will be processed, mosaiced, and interpreted by UTIG and Bureau researchers.

Fracture Research and Application Consortium (FRAC)

Stephen E. Laubach, Randall A. Marrett (Department of Geological Sciences, The University of Texas at Austin), Jon E. Olson (Department of Petroleum and Geosystems Engineering, The University of Texas at Austin), Julia F. W. Gale, Kitty L. Milliken (Department of Geological Sciences, The University of Texas at Austin), Robert K. Goldhammer (Department of Geological Sciences, The University of Texas at Austin), and Robert M. Reed

Recent results include linked geomechanical and structural-diagenetic models that make accurate predictions of fracture architecture that can be verified using limited subsurface samples. Predictions of interwell fracture patterns from these models have been used to design drilling and stimulation programs and as input in fluid-flow simulators. Another effort is under way to use new fracture characterization methods, which overcome the sampling limitations that plague conventional methods, to calibrate seismic fracture detection methods. Currently, the project is conducting studies in deep sandstone targets in Texas, the Rocky Mountain region, and Venezuela, and analysis of fractures in carbonate rocks in Texas, the eastern United States, and Mexico.

The FRAC group conducts research to better understand fractures and faults that influence the successful extraction of resources. Many fractures are difficult or impossible to adequately characterize using currently available technology. Consequently, fractured reservoirs have been difficult to describe and interpret, posing serious challenges to successful exploration or development. The methods under development by FRAC can be used for evaluating individual wells or, using data from many wells, identifying field- or regional-scale fracture patterns and drilling fairways.



Simulated sweep pattern through a realistic fracture network generated by J. Olson's geomechanical modeling software.

Environmental Quality Research (EQR)

Bridget R. Scanlon

This year investigators used data sets developed as part of the EQR program or related projects to evaluate the applicability of various codes to accurately describe water flux in the vadose zone. The results of this study, which have been described in various publications and presentations, will assist industry and regulators in assessing modeling results that predict the fate and transport of contaminants.

The EQR group provides research to support decision-making concerned with petroleum-related contaminants; evaluates the latest technology for characterizing contaminated sites (direct and remote sensing measurements); leverages existing contracts funded by the U.S. Department of Energy, the U.S. Environmental Protection Agency, and other agencies to address petroleum issues; and interfaces with regulators to ensure that regulations are based on technically reliable data. Applications for EQR research are wide ranging and include unsaturated-zone hydrologic studies, including monitoring and modeling approaches to evaluate aquifer vulnerability to contamination, guiding environmental regulation, and remediating and closing contaminated sites; airborne geophysical studies to locate contamination resulting from oil wells; and studies identifying suitable subsurface sites for carbon dioxide sequestration.

Exploration Geophysics Laboratory (EGL)

Bob A. Hardage, Milo M. Backus, Robert J. Graebner, Sergey B. Fomel, Michael V. DeAngelo, and Paul E. Murray

Joint studies with industry sponsors give EGL access to several onshore multicomponent seismic data sets and to multicomponent marine data across the Gulf of Mexico. In 2002, EGL demonstrated that four-component ocean-bottom-cable (4-C OBC) seismic data should be used to improve the understanding and characterization of gas-hydrate systems across the northern Gulf of Mexico. Advantages of the 4-C OBC data are that C waves can image the internal architecture of those portions of gas-hydrate areas that lie inside gas-charged sediment. Time-warped C data have better spatial resolution in shallow seafloor strata than do compressional-wave (P-wave) data. Consequently, EGL researchers recommend that 4-C data be incorporated into gas-hydrate studies whenever possible.

Joining the staff this year was geophysicist Sergey B. Fomel, previously with Stanford University and Lawrence Berkeley National Laboratory. The EGL develops technologies, such as seismic field-recording techniques and data-processing and data-interpretation procedures, to image reservoirs using all components of the seismic wavefield. The goal is independent (P-wave) and shear-wave (S-wave) images of stratigraphic systems. As these images are combined, researchers are gaining insight into petrophysical rock properties, pore structure, pore-fluid properties, sequence-stratigraphic relationships, and spatial distributions of lithologies, fractures, and anisotropic properties of complex reservoirs.

Reservoir Characterization Research Laboratory (RCRL)

Charles Kerans, F. Jerry Lucia, James W. Jennings, Jr., and Jerome A. Bellian

In 2002 RCRL completed the first 3-D outcrop images using the outcrop-surveying tool called ILRIS 3D, completed an in-depth outcrop and subsurface reservoir study of the South Wasson Clear Fork field (Permian), West Texas, constructed a reservoir model of the Sacroc reservoir (Pennsylvanian), conducted small-scale simulation studies using high-resolution CT scans, and prepared an initial database of rock-fabric and petrophysical information.

Two reservoir studies were also completed in 2002. A final report was submitted to the U.S. Department of Energy for an integrated subsurface and outcrop study of the Clear Fork outcrops in Apache Canyon, Sierra Diablo, and South Wasson Clear Fork field, West Texas. This report describes a method for constructing a reservoir model that has been developed by the RCRL over a number of years. The Sacroc reservoir study was completed and submitted to the operator, Kinder-Morgan. A porosity and permeability model of the northern platform was constructed using a stratigraphic framework based in core descriptions and 3-D seismic interpretation. Permeability profiles for 450 wells were calculated on the basis of rock-fabric porosity-permeability transforms specific to stratigraphic horizons.

In addition to these reservoir studies, efforts continued in characterizing plug-scale heterogeneity using high-resolution CT scans, developing a database, and distributing research results through workshops. Simulation studies at the plug scale demonstrated the effect of scattered anhydrite on flow properties. The results support previous conclusions that anhydrite is not as detrimental to permeability as previously thought. In 2002 RCRL distributed an initial copy of its rock-fabric/petrophysical database containing photomicrographs, rock-fabric descriptions, and petrophysical data from 156

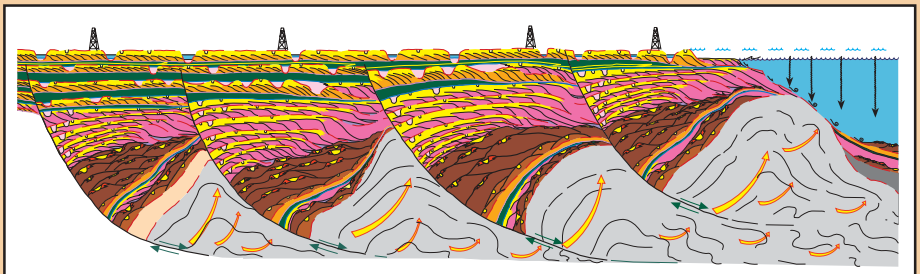
samples selected from 8 carbonate reservoirs and 1 outcrop. This database will be useful to geologists and petrophysicists conducting rock-fabric and rock-typing studies. In addition, researchers presented a workshop on reservoir modeling specifically aimed at engineers as a continuing effort to inform RCRL sponsors of our research results.

The RCRL industrial research consortium has run continuously since 1987. Its mission is to use outcrop and subsurface geologic and petrophysical data from carbonate reservoir strata as the basis for developing new and integrated methodologies to better understand and describe the 3-D reservoir environment. Membership has held steady at 13 to 18 companies per year having strong interests in Permian and Alberta Basins, as well as Middle Eastern carbonate reservoirs.

ENERGY

STARR: Technology Center for Oil and Gas Recovery Optimization on Texas State Lands

Robert G. Loucks, L. Frank Brown, Jr., Shinichi Sakurai, Randy L. Remington, Ramón H. Treviño, and Eugene M. Kim



Schematic representation of successive growth-faulted intraslope subbasins of the Oligocene Frio Formation in the Corpus Christi region, offshore South Texas. Lowstand sedimentary wedges and superposed shelves become younger in a seaward direction.

During the past 7 years, the State of Texas Advanced Resource Recovery (STARR) project researchers have been applying the latest geological concepts and geophysical techniques to mature fields on State Lands. The goal of the project is to enhance ultimate hydrocarbon recovery on State leases by working jointly with oil and gas operators who are producing from or exploring these leases. This goal is accomplished through reservoir characterization studies and extended development, including drilling new wells, recompleting old wells, developing enhanced recovery programs, and defining deeper targets.

Project STARR has been involved in 16 oil and gas fields. We are now concentrating on the Red Fish Bay field area in the lowstand, prograding-wedge section of the Oligocene Frio Formation, where we are working to delineate new compartments for gas production. Lowstand

basin-floor fans and slope fans are also being investigated as deeper production targets. Landmark Graphics Corporation software is used extensively to analyze 3-D seismic data, model seismic attributes, and correlate wireline logs.

STARR is a State of Texas program designed to increase royalty payments—a result of drilling profitable oil and gas wells—for the benefit of the Permanent School Fund. Texas State Lands operators are invited to participate in STARR, which provides free, expert technical advice on developing their fields.

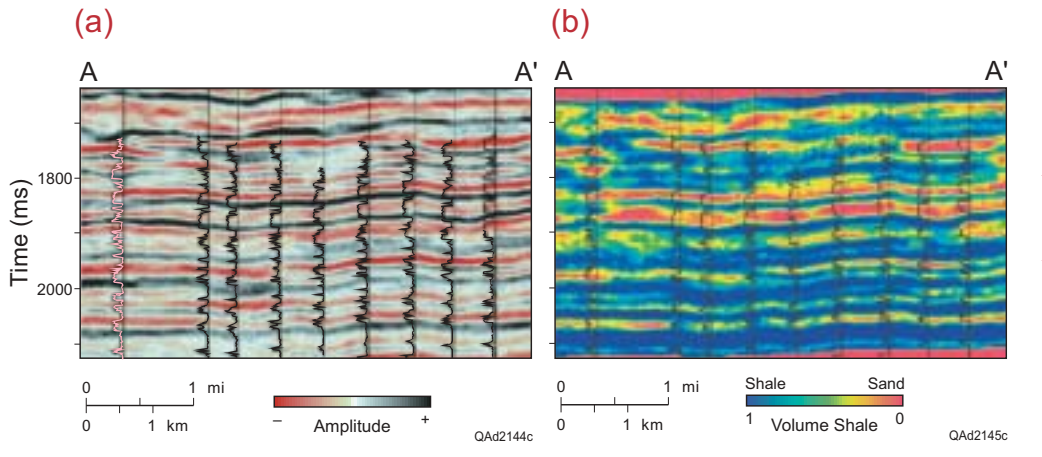
Targeting Reserve Growth Opportunities in the Northern Gulf of Mexico Basin: Transferring Secondary Gas Recovery Technology to the Offshore Environment

Lesli J. Wood, Tucker F. Hentz, Hongliu Zeng, Michael V. DeAngelo, Mark H. Holtz, Shirley P. Dutton, Ke-Sheng Chan, Eugene M. Kim, Dallas B. Dunlap, and Paul R. Knox

The Offshore Secondary Gas Recovery research program (Offshore SGR), a joint venture between the Bureau and the U.S. Department of Energy, was successfully completed in September 2002. Begun in 1998, the project was charged with identifying new technologies and processes to aid in the recovery of natural gas from mature U.S. fields. The research focused on Miocene-age reservoirs in a 352-mi^2 area of the offshore-Louisiana continental shelf (Vermilion and South Marsh Island Areas). We targeted Miocene-age strata of the northern Gulf of Mexico (GOM) because they are the most productive of all chronostratigraphic units in this region, accounting for 40 percent of both cumulative hydrocarbon production and total remaining proven recoverable reserves. Moreover, most of these Miocene resources are restricted to the present continental shelf, where the majority of active fields are considered mature. Chevron-Texaco, our industry partner, provided all geological and geophysical data, including a high-quality 3-D seismic data set.

Principal research results of the Offshore SGR project show that there is potential for significant gas resources to have been bypassed, even in the densely drilled on-shelf fields. We used a fully integrated analytic approach; a few of its components are highlighted here. Although a strong structural-trapping component exists in the study area, combined sequence-stratigraphic and advanced seismic analysis indicates that more than 90 percent of all hydrocarbons in the study area occur within third-order lowstand systems tracts. In addition to many conventional seismic applications to image these and other intervals, we used a new seismic attribute, amplitude versus frequency (AVF), that when combined with neural-network-assisted multiattribute analysis dramatically improved bright-spot identification in thin-bedded reservoirs. Neural-network analysis also enabled us to conduct automated depositional-facies recognition and to predict log properties from seismic attributes, both critical for reservoir-facies identification on seismic images outside areas of well control. Among other targets, we identified several deep (below ~12,000 ft) structural closures, and petrophysical and petrographic analyses show that favorable porosity and permeability exist in Miocene units below 14,000 ft. Both observations indicate significant potential for deep reserves throughout the area. Overall, we identified 54 risk-assessed, resource-addition opportunities, 3 of which have been drilled by our industry partner so far, and all were successful.

As the United States moves from an oil-based economy to a natural-gas economy, programs such as Offshore SGR will continue to play a vital strategic role for the United States. We anticipate that project results will ultimately add significantly to current resource assessments in the region and provide operators and interested companies with a road map to success in the GOM on-shelf Miocene.



(a) In this conventional seismic profile of amplitude-to-well-log ties from the Miocene section of offshore Louisiana, amplitude events correlate only qualitatively to lithology (shale volume) because of the tuning effect. Although red amplitudes (trough) indicate existence of sandstone bodies, the thickness definition is poor. (b) Neural-network-assisted lithology inversion of the same profile greatly reduces the tuning effect and dramatically improves the correlation between seismic data and lithology. Predicted volume of shale not only indicates existence of sandstones but also is a good measurement of sandstone thickness.

Linking the Mexico and U.S. Gulf Coast: Geologic Framework and Play Definition Research in the Laguna Madre – Tuxpan Area

William A. Ambrose, Khaled Fouad, Shinichi Sakurai, L. Frank Brown, Jr., Edgar H. Guevara, Dan D. Schultz-Ela, Timothy F. Wawrzyniec, Suhas Talukdar, Dallas B. Dunlap, Luis Sánchez-Barreda; and Alfredo Guzmán, Mario Aranda, Ulises Hernández, Ramon Cárdenas, Héctor Ruiz, Juan Alvarado, Santiago Sarmiento, and Eduardo Macias (PEMEX)

A new, 18-month evaluation of basin-scale oil and gas systems began in April in the Laguna Madre–Tuxpan area located north of the Veracruz Basin. The study area covers six 3-D surveys and intervening 2-D seismic lines and links the Veracruz and Burgos Basins.

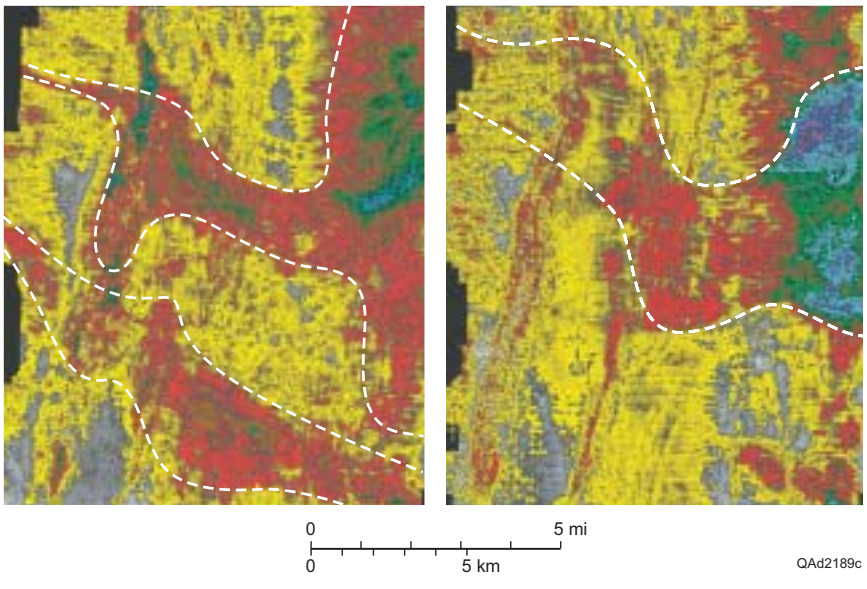
This study, conducted by Bureau and PEMEX teams in Poza Rica and Tampico, will define major Miocene and Pliocene plays in the offshore Gulf of Mexico between the Veracruz and Burgos Basins offshore to a water depth of 500 m.

Laguna Madre–Tuxpan plays are structurally and stratigraphically complex, affording a unique opportunity to examine a complete coast-to-basin succession from valley fill to basin floor over a distance of less than 25 km. A dynamic, tectonically active setting, coupled with an abundant sediment supply, resulted in a greatly telescoped system. Narrow shelf margins in the Laguna Madre–Tuxpan area represent an end member in the spectrum of shelf-margin types and promise to be of significant worldwide interest.

Plays in the Laguna Madre–Tuxpan study are defined from mappable geologic attributes. This study uses a threefold definition for plays based on (1) sequence-stratigraphic occurrence and age, (2) facies association, and (3) trap. Examples of Laguna Madre–Tuxpan plays defined in this study are the Upper Miocene Slope Channel/Levees and Upper Miocene Canyon, Stratigraphic Trap plays.

The primary conclusions from the research show that a variety of plays and exploration opportunities exist in the basin, especially in downdip areas in basin-floor and slope systems. Other areas of the basin in major fault-bounded depocenters contain numerous three-way fault-seal opportunities at many stratigraphic levels. Identification and mapping of these plays will yield a structural and stratigraphic framework for existing prospects and hold promise to identify a spectrum of additional opportunities in the basin.

Location of the Laguna Madre–Tuxpan study area. The study area encompasses six 3-D seismic surveys (shown in rectangles) and intervening 2-D lines (not shown) in an area covering more than 15,000 km² to a water depth of 500 m.



Examples of stratigraphic plays in the Laguna Madre–Tuxpan area. Upper Miocene channel and canyon trends are inferred from these root-mean-square amplitude maps.

ULARI: Integrated Geological and Engineering Characterization of the Fullerton Clear Fork Field in Andrews County, Texas

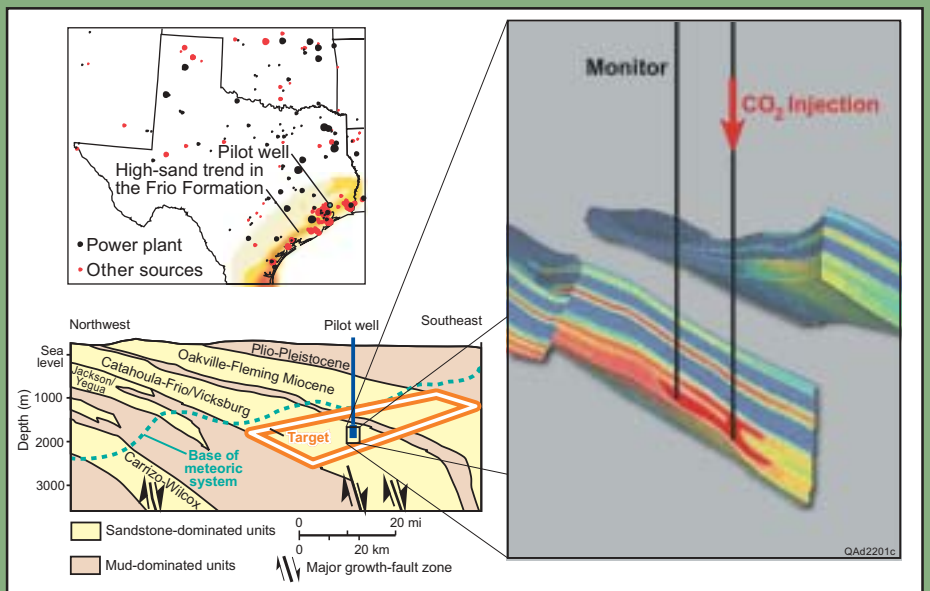
Stephen C. Ruppel, Fred P. Wang, Jeff Kane, Hongliu Zeng, F. Jerry Lucia, James W. Jennings, Jr., Rebecca H. Jones, Charles Kerans, Mark H. Holtz, Dallas B. Dunlap, and Joseph S. Yeh

Leonardian reservoirs rank last in oil recovery efficiency among Permian Basin carbonate oil reservoirs. Accordingly, they contain large volumes of remaining mobile oil. The goal of this new project under the University Lands Advanced Recovery Initiative (ULARI) program is to apply Bureau approaches to reservoir characterization to define additional opportunities for the recovery of this oil resource in the Fullerton Clear Fork field, which with original oil in place of about 1.5 billion barrels and cumulative production of more than 300 million barrels is the largest Leonardian reservoir in West Texas and the largest reservoir in University Lands.

The Fullerton study is a collaborative effort between the Bureau, ExxonMobil, and Oxy Permian and is jointly funded by The University of Texas System, ExxonMobil, and the U.S. Department of Energy. Among the key issues to be addressed in the study are (1) stratigraphic architecture and flow-unit continuity, (2) rock-fabric character and its effect on the distribution of porosity and permeability, (3) the volume and distribution of original and remaining oil, and (4) the value of 3-D seismic in defining stratigraphic architecture and porosity distribution.

In the first year of the project, which involves a multidisciplinary team of Bureau geologists, petrophysicists, geophysicists, and petroleum engineers, efforts have been focused on creating a reservoir model that can serve as a basis for simulation of reservoir performance and on defining the controls of underlying structure on reservoir architecture and rock properties using 3-D and 2-D seismic data. When completed, Bureau characterization and modeling studies at Fullerton field will serve as a critical basis for designing advanced recovery programs in Leonardian reservoirs throughout the Permian Basin—a target resource of more than 2.5 billion barrels of oil.

ENVIRONMENT



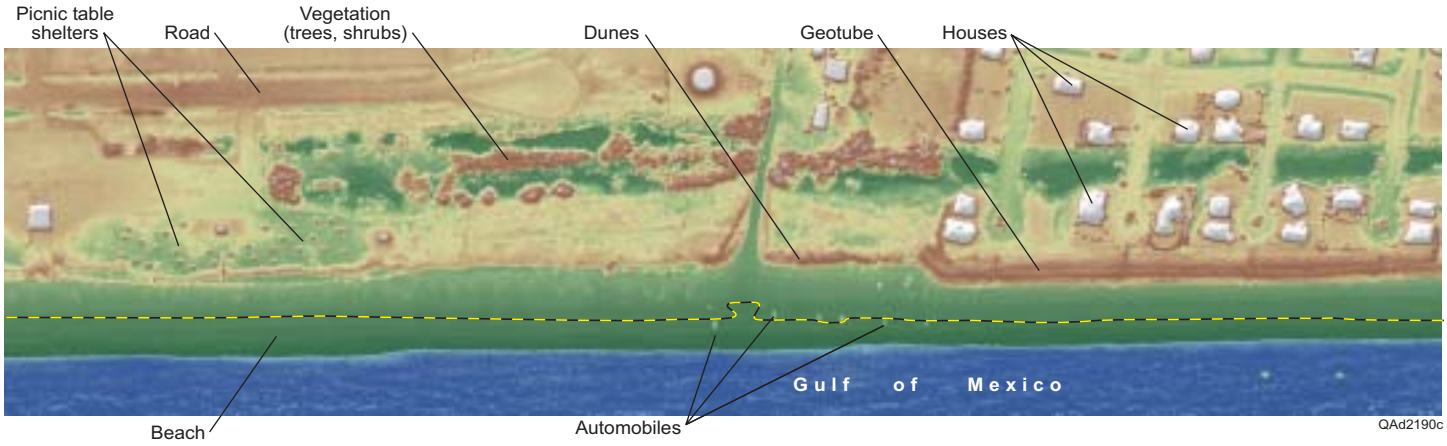
The target CO_2 injection interval includes the thick wedges of fluvial-deltaic and strandplain sandstones of the Miocene Oakville and Fleming Formations and the Oligocene Catahoula-Frio-Vicksburg Formations below meteoric water and above the strongly growth faulted and geopressured zone. The pilot CO_2 sequestration project is sited on the sand-rich fairway of the Frio Formation in the upper Texas Gulf Coast. We will inject into a thin, high-permeability sandstone of the upper Frio Formation beneath the Anahuac Shale within a fault-bounded compartment on the flanks of a salt dome. Oil field reservoir characterization has been completed to support simulation of the injection.

Feasibility Assessment of Carbon Dioxide Sequestration in Brine-Bearing Formations in Texas

Susan D. Hovorka, Paul R. Knox, Mark H. Holtz, Khaled Fouad, Shinichi Sakurai, Jeffrey G. Paine, and Joseph S. Yeh

Combustion of fossil fuel releases carbon dioxide to the atmosphere at a much higher rate than has occurred in the recent past. These releases contribute to the long-term global heat budget, sometimes referred to as the "greenhouse effect." Possible effects of increased retention of solar input into the atmosphere include higher temperatures, increased desertification, increased severity of storms, sea-level rise, changes to ecosystems, and broadening of the ranges of tropical diseases.

The Bureau team is testing the effectiveness of geologic sequestration, one of the widely accepted options for reducing the release of carbon dioxide to the atmosphere. Sequestration would involve capturing carbon dioxide from smokestacks and injecting it into the



Lidar topographic relief image of a Galveston, Texas, beach with a +0.6-m mean-sea-level contour line.

deep subsurface. We are participating in two projects funded by the U.S. Department of Energy/National Energy Technology Laboratory. In the first project, the Bureau is leading a team to design and implement an experiment that will inject a small volume of carbon dioxide into a high-permeability but saltwater-bearing Frio sandstone for the purpose of closely monitoring performance of the subsurface for accepting and retaining the carbon dioxide. Monitoring of the expected updip migration of injected carbon dioxide will use the injection well and one monitoring well and will include pressure and temperature, cross-well seismic and vertical seismic profiling, geochemistry using natural and introduced tracers, and surface monitoring for carbon dioxide. Monitoring results will be matched to model predictions to test the reliability of monitoring and modeling techniques and correctness of conceptual models.

The second part of this effort is part of the GEOSEQ project led by Lawrence Berkeley National Laboratory to assess the long-term fate of carbon dioxide to constrain the rate and processes of the leakage from the subsurface back to the atmosphere. These two studies are prerequisites to larger scale projects that have potential for cumulative significant reduction in emitted carbon. In the near term, results might include more widespread use of coupled enhanced oil recovery with sequestration. Eventually, carbon from fossil fuels could be extracted before combustion and sequestered, simultaneously reducing all atmospheric emissions.

Shoreline Change and Storm Hazards along the Texas Coast

James C. Gibeaut, Roberto Gutierrez, Tiffany L. Hepner, Rebecca C. Smyth, John R. Andrews, and Melba M. Crawford (Center for Space Research, The University of Texas at Austin)

Texas has a variety of shoreline types along its coastal bays and open Gulf of Mexico coast that are constantly shifting and mostly retreating landward. This retreat results in loss of private and public property and important natural habitats such as beaches, dunes, and marshes. To address this problem the Texas Legislature passed the Coastal Erosion Planning and Response Act in 1999. This Act authorized the General Land Office to conduct a coastal-erosion response program. In support of the program, Bureau coastal researchers are identifying and studying eroding areas along the Gulf of Mexico and coastal bay shorelines of Texas, quantifying data gleaned from research and creating a comprehensive, digital database of historical shoreline positions and average annual rates of shoreline change that are being made available to the public through the Internet.

The goal of the Texas Shoreline Change Project is to develop a modern shoreline-monitoring and shoreline-change analysis program that will help guide coastal-erosion and storm-hazard-mitigation projects along bay and Gulf shorelines. This goal is being accomplished through digital rectification of historical photographs to extract past shoreline positions, airborne topographic lidar surveys for acquiring new and future shoreline data, select ground topographic transects, and the establishment of Global Positioning System (GPS) reference points to support the monitoring.

Funding from the National Aeronautics and Space Administration has enabled the Bureau to develop the application of lidar and geodetic GPS surveys for tracking coastal change. The Bureau owns and operates an Optech Inc. lidar instrument and is continually developing new and improved coastal survey techniques. During 2002, we conducted lidar surveys of the upper Texas Gulf shoreline and the bay shorelines of West and East Bays in the Galveston Bay System. We have developed processing techniques for extracting shoreline positions from the lidar data as well as mapping sediment volumes alongshore. Spatial variation in the sand volume and elevation and shape of the beach/dune system are primary controls on the amount of damage to landward structures that can occur during storms. This work involves mapping these variations and developing new parameters to describe them for use in hazard mitigation efforts.

Selected shoreline-change data collected from various sources are now posted on a newly developed Website (using new Arc/Info Internet Map Server software) at www.beg.utexas.edu/coastal/intro.htm.

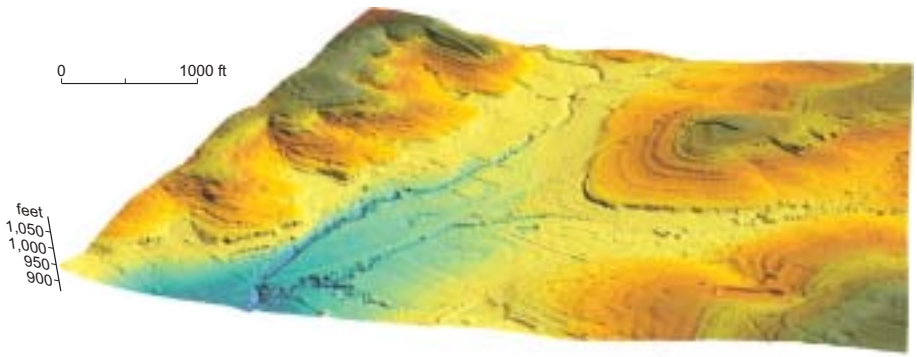
Groundwater Recharge

Bridget R. Scanlon and Robert C. Reedy

During 2002, we conducted several projects related to groundwater recharge in Texas. A detailed numerical modeling study was conducted to evaluate whether recharge occurs in interdrainage areas in arid-semiarid regions in the southwestern United States. Long-term monitoring records from four different sites in Texas and Nevada indicate that infiltration is restricted to the shallow subsurface (0.3- to 2-m depth). Upward water pressure gradients indicate that water flow is upward in these settings. Numerical simulations of liquid and nonisothermal vapor flow used to simulate measured water potential and chloride profiles at several sites indicate that flow has been upward for time periods ranging from 2,000 to 9,000 yr in the Southern High Plains to a maximum of 16,000 yr in the Chihuahuan Desert in West Texas and the Amargosa Desert in Nevada. These results indicate that there has been no recharge in interdrainage arid-semiarid regions since the Pleistocene and that thick unsaturated zones in these regions have been undergoing long-term drying during the Holocene. These results have important implications for water resources because interdrainage areas constitute substantial portions of alluvial basins in the southwestern United States. The results also indicate that these settings should be suitable for waste disposal because contaminants would be trapped in the shallow subsurface in natural systems. This work was conducted in collaboration with Jirka Simunek at University of California, Riverside, and Brian Andraski of the U.S. Geological Survey in Nevada.

The Bureau recently began a modeling and field study for the Texas Commission on Environmental Quality to evaluate groundwater recharge in the major aquifers in the state. Estimates of groundwater recharge are critical for estimating groundwater availability and for estimating aquifer vulnerability to contamination. The modeling analysis will provide a screening tool to evaluate relative recharge rates related to different climate, vegetation, and soil types in the major aquifers. The codes UNSATH and HYDRUS will be used for the simulations. Long-term (30- to 100-yr) climate records will be generated for the simulations. The modeling work will be used to identify areas where field studies should be conducted to further evaluate recharge. Field studies will include the use of soil physics monitoring and environmental tracer analysis to constrain recharge estimates. The results of this study will form the foundation for more comprehensive field studies of groundwater recharge throughout the state.

Perspective view of three superimposed digital elevation models (DEM) of the Oak Hill area of Austin, Texas: vegetation (green), buildings (red), and terrain (earth colors).



Perspective view of the terrain-only DEM of Oak Hill. The stairstep topography of the Cretaceous Glen Rose Formation is apparent in this 5 ft by 5 ft DEM.

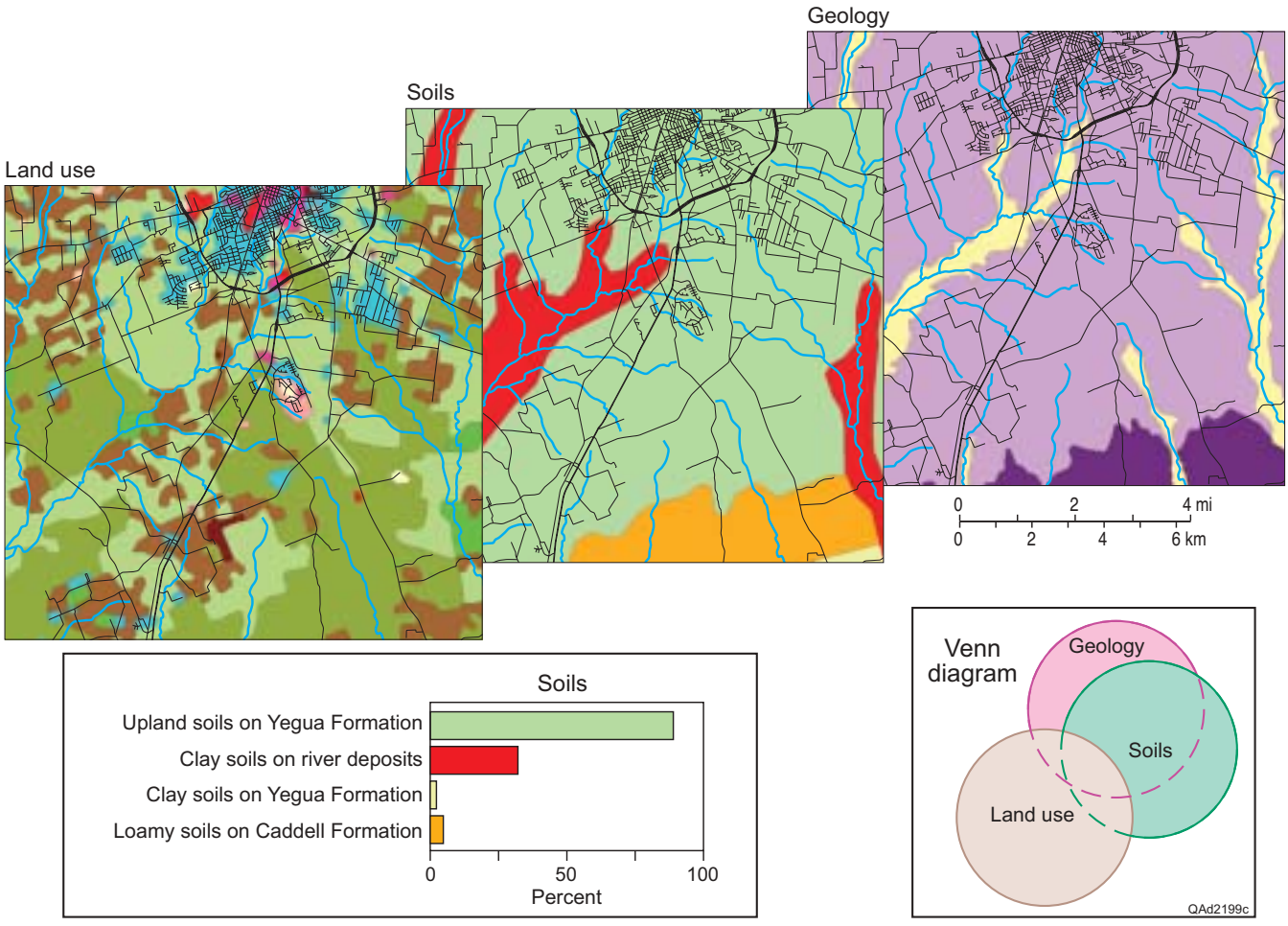
Austin Lidar Project

Roberto Gutierrez, Rebecca C. Smyth, Tiffany L. Hepner, and Christopher Weed (Center for Space Research, The University of Texas at Austin)

Because of recurring flooding, Austin, Texas, needs new flood hazard rate maps for the southern part of the municipality. The City of Austin asked the Bureau to collect elevation data over the Williamson and Onion Creek watersheds using the Bureau's airborne lidar mapping system. Airborne lidar mapping uses a powerful laser scanning system and the Global Positioning System (GPS) to measure the Earth's topography with great precision from a fixed- or rotary-winged aircraft.

In May 2002, researchers, working with the Texas State Aircraft Pooling Board, collected approximately 260 million lidar measurements over 92 mi^2 of the city. Flood hazard analysis requires an accurate representation of the ground surface and the stream network free of trees and buildings and necessitates the classification of the lidar topographic points. Using computer algorithms developed by Chris Weed at the Center for Space Research, the Austin lidar data were identified as reflections from the ground, buildings, or vegetation. Thus classified lidar data provide detailed information for hydrologic, geologic, and environmental investigations.

Public Outreach and Education



Geographic information system layers can be used to compare and contrast map patterns, and associated data can be analyzed to quantify trends.

Using GIS Technology to Explore Earth Systems

Susan D. Hovorka and John R. Andrews

During this year we continued compilation of geographic information system (GIS) data sets for student use. The Bureau participated in a partnership led by ActiveInk Corporation and Fabens Independent School District to supply participating public school districts with Web-based interactive projects funded by a Technology Integrated into Education grant. We added six new areas to the GIS data sets completed last year: Big Bend, Dallas, Houston, Kerrville, San Antonio, and Northeast Texas near the Arkansas-Oklahoma border. Each area includes a digital geologic map, satellite images, shaded relief maps, soil characteristics, land use/land cover, vegetation, and cultural features to encourage the students to explore relationships between data sets.










Earth Science Week

Sigrid J. Clift

Earth Science Week (ESW) was observed nationwide October 13–19, and the Bureau celebrated by sponsoring a Book Drive that collected $1,700 for the Austin Public Library and by hosting the third Career Day Fair. The Austin ESW Career Day Fair, organized by Bureau researcher and Austin ESW Chairperson Sigrid J. Clift and members of the Austin area ESW Consortium, treated 300 Austin-area middle school students to a day of learning about earth science careers from earth science professionals. Mary Ann Rankin, Dean of The University of Texas at Austin College of Natural Sciences, gave the opening ceremony presentation and read Governor Perry's proclamation declaring Texas Earth Science Week 2002. Presenters included Bureau researchers Dallas B. Dunlap and John R. Andrews, who staged a 3-D view of the Earth using the Bureau's virtual reality theater. To find out more about ESW in Austin and other cities throughout Texas, visit the Texas ESW Website at www.beg.utexas.edu/esw.

Petroleum Technology Transfer Council (PTTC)

Scott W. Tinker, Sigrid J. Clift, Sylvia J. Jennette, and Eric C. Potter

The PTTC Texas Region, for which the Bureau serves as Regional Lead Organization, sponsored a variety of workshops for Texas independent producers during 2002: Well-Bore Management, Field-Oriented Projects for Independents, Coalbed Methane Potential in the Gulf of Mexico, Revitalizing Gas Exploration and Production in the Gulf of Mexico Province, Interpreting 3-D Carbonate Stratigraphy Using 1-D Data, and software training workshops. In addition to workshops, the Texas Region PTTC co-sponsors the annual Permian Basin CO_2 conference in Midland, Texas. Members receive updates and technology transfer news through the PTTC quarterly newsletter, *ProducerNews,* which is distributed by mail to more than 1,000 independent oil and gas producers.

Public Information Resources

In addition to being a research unit of The University of Texas at Austin, the Bureau serves the State of Texas as the Texas Geological Survey. In this role, the Bureau maintains the following public resources and facilities: Core Research Centers, Data Center (composed of the Geophysical Log Facility and the Reading Room), and Publication Sales. These facilities are open to the public Monday through Friday from 8:00 a.m. to 5:00 p.m. Comprehensive information about these resources can be found on the Bureau's Website at www.beg.utexas.edu under the menu Public Resources.

Core Research Centers

The Core Research Centers (CRC's) are the Bureau's research and storage facilities in Austin, Houston, and Midland that house core and rock material donated to the University. The central core repository is the Austin CRC, located adjacent to Bureau headquarters on the University's J. J. Pickle Research Campus. Public facilities include core examination rooms, processing rooms for slabbing core, and office space. For-a-fee services are available, such as core photography and CRC inventories on CD's. For information, please call the Austin CRC manager, George Bush, at 512-471-0402, or read about the facilities on the Bureau's Website at www.beg.utexas.edu/mainweb/geolinks01.htm.

The Data Center

The Data Center, comprising a Reading Room and Geophysical Log Facility managed by Sigrid J. Clift, is located on the first floor of the Bureau's headquarters in Austin. The Reading Room maintains a collection of geological reference materials, including periodicals, maps, well logs, publications, and reports from various governmental and nongovernmental earth science entities. For information, please call the Public Information Geologist at 512-471-0320.

The Geophysical Log Facility (GLF) stores downhole log data received from private donations, Bureau research projects, and the Railroad Commission of Texas, which by law receives a copy of geophysical logs from every new, deepened, or plugged well drilled in Texas. Data available for public research include wireline electric logs, well records, and scout tickets from hundreds of thousands of Texas wells. Sample logs from the 1930's through the 1950's are also stored and made available for public research. Copies of logs can be requested either in person or by mail, telephone, fax, or e-mail. For information, please call the GLF manager at 512-471-7139.

Publication Sales

The Bureau publishes and sells maps and reports of research conducted by Bureau staff from 1915 to the present. In 2001 we also began handling the sales of select Gulf Coast Association of Geological Societies (GCAGS) publications. Bureau publications include reports of investigations, guidebooks, handbooks, cross sections, maps, oil and gas atlases, interactive CD's, seismic data sets, geologic folios, geologic atlas sheets, page-sized maps of Texas, classroom teaching aids, out-of-print publications, and most Bureau contract reports. The Publication Sales office is located on the first floor of Bureau headquarters in Austin. Orders for publications can be made either in person or by mail, telephone, fax, or e-mail, or through our Website at www.beg.utexas.edu. For information, please call the Publication Sales manager at 512-475-9513. Free copies of the current year's *List of Publications, Annual Report,* and *Midyear Report* are available upon request.

Support Staff

Administrative

Wanda LaPlante, who recently celebrated 25 years of service at the Bureau, is the Assistant to the Director. Glynis Morse supervises the administrative staff who are responsible for general administration of the Bureau. Glynis and her employees handle payroll, personnel, accounts payable and receivable, purchasing, travel and reimbursement, and countless other tasks for the Bureau's 140+ employees.

Contract Management

Contract Manager Lynda Miller and her staff help researchers prepare budgets and proposals and serve as liaisons for funding agencies. Contract management includes financial reporting, database and records management, and the documentation of progress and submission of deliverables.

Facilities Management

The day-to-day management of the building is the responsibility of Facilities Manager James A. Doss, Jr. His team provides behind-the-scene support for inhouse meetings, conventions, daily mail service, maintenance of Bureau vehicles, office moves, and inventories of basic equipment.

Editing

Chief Editor Susie Doenges supervises the Bureau's editing staff, who are responsible for editing, word processing, desktop publishing, and proofreading all varieties of Bureau publications, including contract reports, abstracts, peer-reviewed articles, and annual reports.

Graphics

Graphics Manager Joel Lardon heads up the Bureau's team of computer illustrators, a designer, and a photographer, who are responsible for producing the design, artwork, and illustrations for Bureau research and publications. Their award-winning graphics include text illustrations and presentation materials, manual and digital photography, design and layout, map design and finishing, as well as Website content and posters for the Bureau booths displayed at conventions.

Information Technology Services

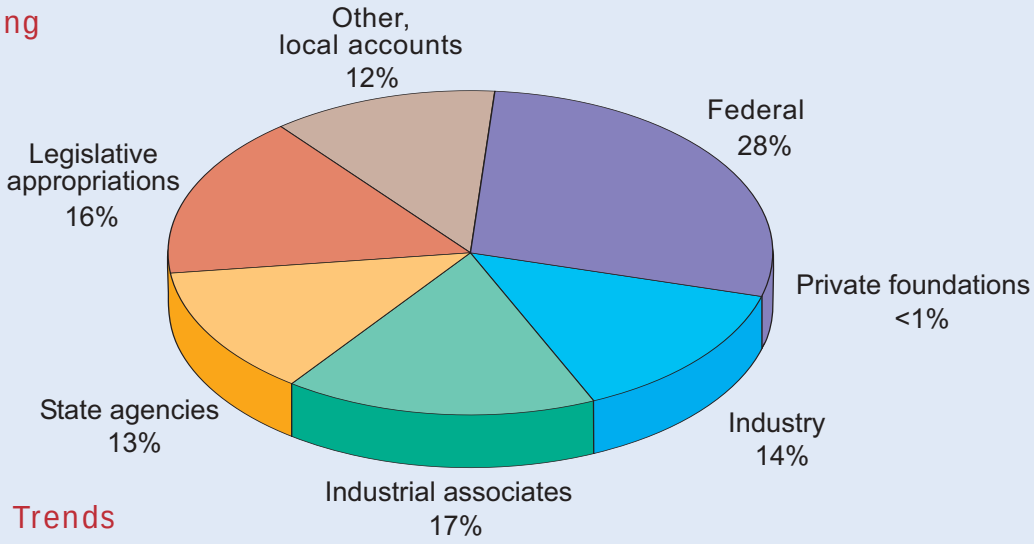
Information Technology Services (ITS) is managed by Ron Russell, who, with his team of IT experts, provides vital computer technology assistance to Bureau researchers and staff, including systems support, 3-D modeling, visualization, characterization, computer mapping, programming, database applications, statistical and graphical analysis of data, and PC and workstation platforms.

Media Technology Services

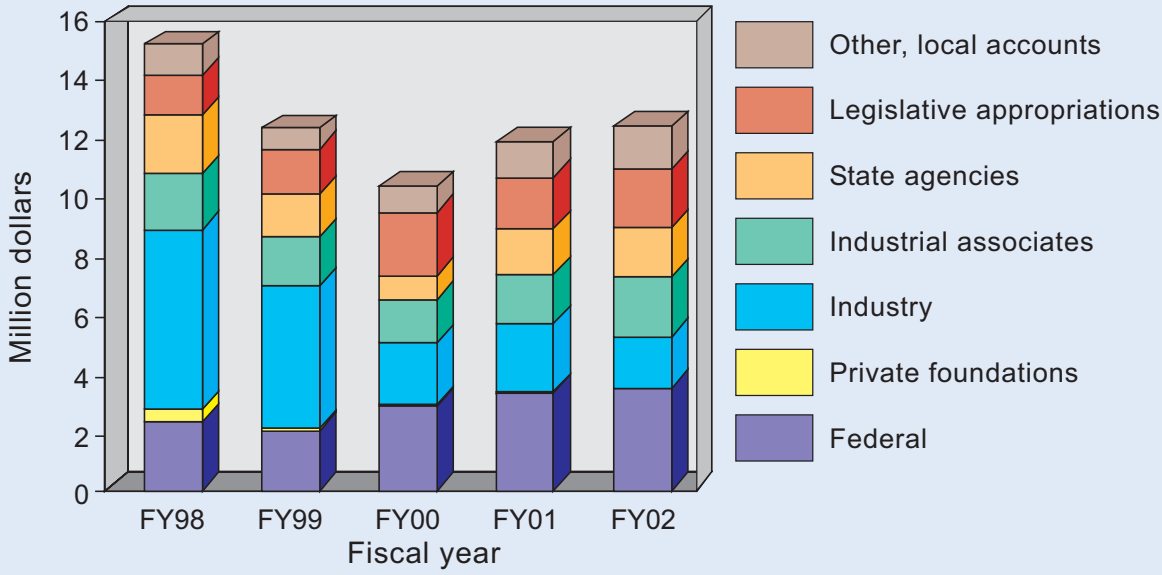
Scott Rodgers is Manager of the Bureau's Media Technologies program and is responsible for the Virtual Imaging and Visualization Environment (VIVE), a laboratory for the application of virtual visualization technologies for the earth sciences. In addition, the program develops plans for integration of digital information systems and interactive educational technologies, including digital publishing and Internet development, within the Bureau.

Bureau Finances and Staff

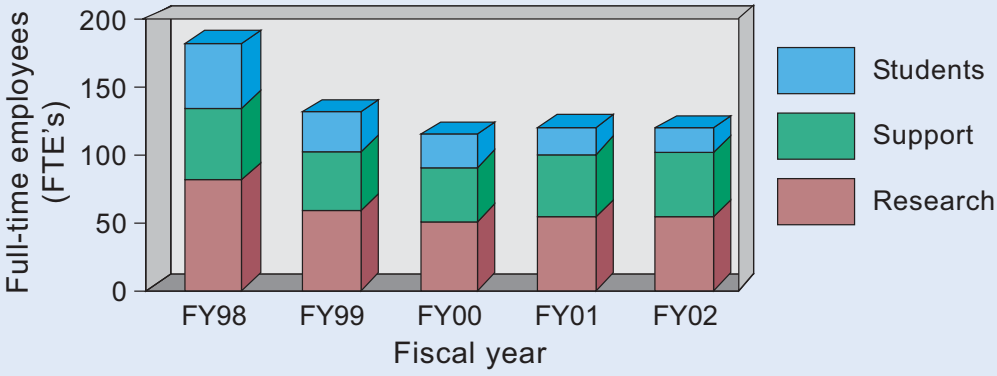
Sources of Funding



Five-year Budget Trends



Staff Trends



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BEG Research Excellence Fund

The Bureau has a remarkable history, and its alumni base is broad and strong. Many friends of the Bureau have asked, "How can I help the Bureau?" Surprisingly, there are many ways to help, including telling others about the Bureau, attending our receptions at conventions, writing letters to us with ideas and suggestions or to Congress in support of our research.

Assistance can also be financial. Bureau research is funded from a variety of sources, including Federal, State, and local government agencies, private corporations, and foundations. These entities typically fund contracts that are directed toward solving specific problems in the earth sciences. Most of these funding sources do not allow flexibility for program development, conference attendance, publication, equipment purchase, and the like.

The Bureau of Economic Geology Research Excellence Fund has been established to support innovative research projects and disseminate research results. Gifts to the Research Excellence Fund will allow us to continue our pursuit of excellence in research. We welcome the participation, ideas, and continued support of our friends and colleagues. And we appreciate your contributions, which will strengthen our ability to serve Texas and our nation as we educate the world in the earth sciences. A postage-paid reply envelope is provided for your convenience in the center of this Annual Report. Information on the Research Excellence Fund may be obtained from Glynis Morse at 512-471-1254.

On the Web at www.beg.utexas.edu

The Website continues to be a high-profile part of Bureau life. Features on the home page cover current events and news of the Bureau, research staff and their work, visitors to the Bureau, public outreach, and new Bureau publications, to name but a few.

The Website also provides basic information about the Bureau, including its mission, areas of research and public outreach, public services, a staff directory, and a catalog of publications. The site also has links to State, Federal, and industrial organizations, as well as links to geologic and earth science resources such as Texas Earth Science Week (ESW) and Texas Environmental Awareness Network (TEAN).

A new page on Bureau alumni (www.beg.utexas.edu/mainweb/alumni01.htm) contains updates and contact information on former Bureau staff. We welcome additions to this section and invite you to visit the site to read about friends and colleagues. A postage-paid reply form inserted in the center of this Annual Report has space for sending the Bureau information to be posted on our alumni page. Information on Bureau alumni may be obtained from Deborah Thomas at 512-471-0305.

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