

# GEOLOGY *at SMU*

An occasional newsletter for alumni and friends. October, 2001

*New holder of SMU's Albritton Chair*

## Stump helped with nuclear test ban treaty

The September 11 terrorist attack on the United States emphasizes the importance of understanding and limiting the spread of weapons of mass destruction. New Albritton Chair Brian Stump was part of the technical team involved in negotiating the treaty designed to stop the testing of nuclear weapons. The Comprehensive Nuclear Test Ban Treaty (CTBT) supports the Non-Proliferation Treaty that entered into force in 1970 and was renewed in 1995. Ratification of this treaty by nuclear capable countries including the United States, Russian Federation, United Kingdom, France and China means that these countries will no longer be able to conduct nuclear tests for any purposes. This result would be significant enough on its own, but the treaty is much more than that. The U.S. Senate has not ratified the CTBT and the Bush administration does not plan to push for its ratification.

### **BRIAN STUMP**

*Appointed to Claude C. Albritton, Jr., Chair  
of Geological Sciences, August 2001  
Chair established by*

*Roy M. ('38) and Phyllis Gough ('43) Huffington  
in 1981 with a generous \$1 million gift  
in honor of Professor Albritton*

*Peter A. Scholle was the first holder of the chair  
from 1985 to 1999*

The CTBT calls for a robust verification system known as the International Monitoring System (IMS) designed to supplement systems developed by individual countries. The international monitoring system includes technology designed to detect and locate the source of signals from any nuclear explosion, conducted in the atmosphere, underwater or underground, whose size is of significance. The IMS is a system of 321 seismic, hydroacoustic, infrasound and radionuclide monitoring stations distributed around the world.

Professors Gene Herrin and Brian Stump and their coworkers within the Department of Geological Sciences have been responsible for the installation, maintenance, and operation of several of the monitoring stations. Field data from these stations is channeled directly through computers to SMU. Earth science research will benefit greatly from the IMS, with the network delivering a wealth of information on geophysical phenomena such as volcanic eruptions, atmospheric disturbances like tornadoes and hurricanes, the



**Geological Sciences Professor Brian Stump studies a summary photo of the Phelps-Dodge copper mine in eastern Arizona. SMU is currently cooperating with the mine to study the seismic and infrasound (low-frequency acoustic) signals generated by activities at mines (explosions and other mining activities.)**

rate of micrometeorite bombardment, and the warming of the ocean to name a few. Graduate students in earth sciences are taking advantage of this unique source of data for studying complex problems in the atmosphere and the earth.

Within the U.S., the CTBT has been attacked on two fronts. The first is that the monitoring system is not adequate to monitor zero yield tests. Such a system is a virtual impossibility. However, the IMS has been designed by groups of international experts, including many from the U.S., to detect and locate a source whose size could provide significant scientific and military value if it were a nuclear explosion.

*Continued on Page 3*

## Chairman's Report

# Texas' public schools continue to ignore importance of geology as a subject

By Robert Gregory

Texas still has a lion's share of the fossil fuel reserves held by the United States, yet the State of Texas declined to add geology to the list of core science courses for secondary schools. The last time Texas public school students will be exposed formally to Earth Science is during the second semester of year 8. Earth science and related topics are a mainstay of public television and radio, cable channels such as *Discovery* and the science pages of major newspapers and magazines. Texans should have more opportunities to learn the basics of geology in a classroom.

Some of the major problems facing *Homo sapiens* are geologic in origin and require geologic knowledge for a solution. These include the location and distribution of natural resources (minerals, oil and water), the protection of the environment, mitigation of natural hazards and the use of geophysical techniques to enforce international treaties regarding the development and proliferation of nuclear weapons. So why are the Earth Sciences such a hard sell? Clearly, they shouldn't be.

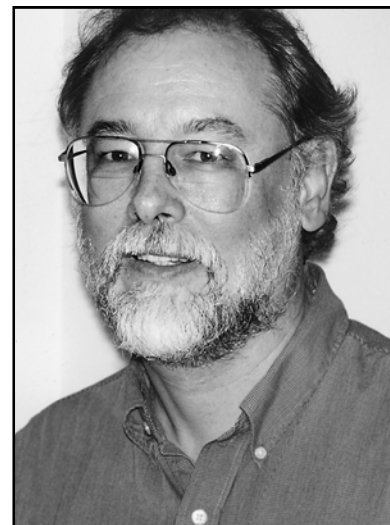
The last half of the twentieth century saw revolutions in geochemistry, geobiology, and geophysics. The first gave us the age of the Earth and the solar system as well as methods for tracing planetary and stellar evolution while the latter gave us the unifying theory of earth science, plate tectonics. The practice of geology moved off the Earth and yielded new insights into the solar system. This in turn resulted in a new view of Earth history. Geologic studies on the catastrophic consequences of giant impacts resulted in predictions about the consequences of first strike nuclear war contributing to the decline of the cold war. Seismology became the weapon of choice in the war against the proliferation of nuclear weapons. Before the last century was out, we saw for the first time a series of impacts on Jupiter comparable to the type capable of generating a mass extinction event on Earth.

Views of Mars and Venus reminded us about the importance of atmospheric evolution and the role of plate tectonics and water in providing the stability for higher life to evolve. Measurements of carbon dioxide contents in the atmosphere (almost 50 years worth) and in ice cores (back to 400,000 years) show that human activity is driving levels of greenhouse gases from geologic lows to levels not seen for many millions of years.

Geochemists and geobiologists working on hydrocarbons and

ore deposits recognized the signature of life in many chemical and isotopic reactions in the crust of the Earth. Microbial life could flourish in extreme environments several kilometers beneath the surface of the Earth. There are even claims of traces of life found in a meteorite from Mars, and microbial life will be found perhaps on some of the icy moons orbiting the giant planets.

Over the next several newsletters we would like to share some of the exciting research that is underway at SMU with an eye towards problems of general interest. The first of these articles is on the Comprehensive Test Ban Treaty, written by Brian Stump, the new Claude C. Albritton, Jr., Chair of Geological Sciences. It is fitting that this report and our first two features touch on topics that would have been of interest to the late Professor Albritton, who thought a lot about the impact of geological knowledge on our species. We will also try to highlight our alumni (send us your stories); the first in the series is from Dr. Steve Balsley (1994), now a staff member at Sandia National Laboratory working on materials characterization for the nuclear physics program including the quest for controlled fusion.



Robert Gregory

### Meet Robert Gregory, new chairman of Geological Sciences at SMU

- \* Appointed chairman, July 1, 2001
- \* Joined SMU faculty in 1989 as Stable Isotope Lab director
- \* Taught six years in Monash Univ., Melbourne, Australia
- \* Born in Chicago, Illinois; reared in the shadow of the San Gabriel Mountains, California
- \* Obtained Ph.D. from California Institute of Technology
- \* Stable isotope geochemist
- \* Has mapped in Australia, Saudi Arabia, and the Sultanate of Oman
- \* Married with three children

### A Brief Note About This Publication

*Geology at SMU* is an occasional publication of the Department of Geological Sciences, Dedman College, Southern Methodist University. It is intended for alumni, faculty, students, friends, and others. Questions and comments are welcome. Please notify us of any address corrections.

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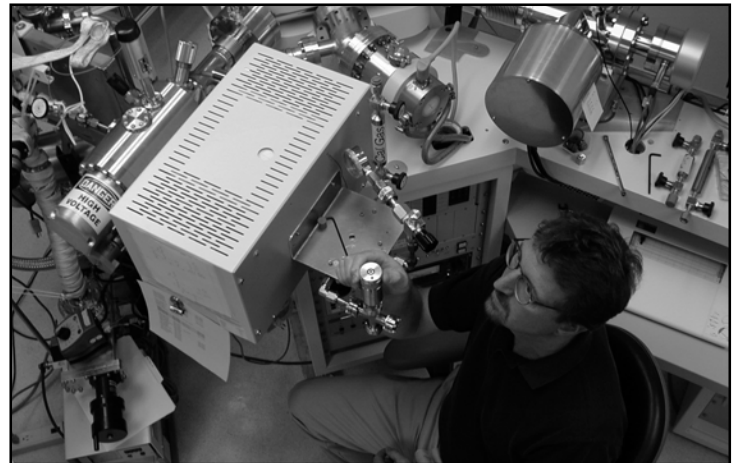
# Balsley breaking new ground in energy studies

So why is an SMU graduate with a Ph.D. in Geology specializing in the origin of silicic volcanic rocks doing mass spectrometry in a nuclear physics laboratory? The answer: Steve is the person who characterizes the starting materials. If the experiment fails to produce the desired results, then the composition of the starting materials needs to be checked. That's where mass spectrometry comes in. It is well known that if you wish to know how materials are put together, ask a geologist.

To create a high-yield nuclear fusion reactor that will ultimately produce cheap electric power from sea water, Sandia National Laboratory researchers must be able to evenly compress a BB-sized pellet filled with hydrogen gas so that its atoms are forced to fuse. Recently, Sandia's "Z" machine — the most powerful laboratory producer of X-rays in the world — spherically compressed a simulated fusion pellet during a firing, or "shot," of the giant accelerator. In addition to successfully accomplishing uniform 3-D compression of the pellets, future fusion shots at "Z" will require accurate knowledge of the starting ratio of deuterium-tritium gas mixtures within pellets prior to initiation of the experiment.

For the first time, Principal Scientist Steve Balsley (Ph.D., 1994) and co-workers at Sandia successfully measured the gas quantity in a number of test pellets using a Finnigan-MAT 271 gas mass spectrometer. The ability to quantitatively determine such small gas quantities will play an important role at "Z" as well as at the National Ignition Facility at Lawrence Livermore National Laboratory, scheduled to come on line in 2004. The MAT 271 is a specialized version of the MAT 251 instruments used in many stable isotope laboratories, including SMU. Undoubtedly, the experience gained by Balsley in the Stable Isotope Laboratory at SMU contributed to the success of making such a challenging measurement. Steve illustrates by an example:

Take a scandium deuteride thin film deposited on a molybdenum substrate, and subject it to microsecond long pulses of current to form a deuteron plasma. Here is the basis of an interesting material science problem requiring a set of tools familiar to most igneous petrologists. Balsley, a principal member of the technical staff at Sandia, is currently working on these and other materials



**Balsley "at the helm" of the 271 at Sandia National Laboratory.**

problems that regularly make use of the practical skills learned as a hard-rock geosciences graduate of SMU. In some ways, igneous petrology and many materials science problems can be approached the same way. For instance, phase diagrams play an important role in igneous petrology and materials science--the only difference is the elements of interest. With an understanding of the phase relations of say, scandium deuteride, it is possible to custom design a system to perform a task within specified physical limits. In effect the difference may be summarized as this: the material scientist worries about how to make a chemical system work best under a given set of conditions, and the igneous petrologist worries about determining the conditions under which nature produced a chemical system.

Either way, the tools are pretty much the same. Balsley relies upon a diversity of experimental experience and education gained as a geologist to solve practical problems. The foundation for these endeavors was gained through combined classroom and laboratory training, and experimental knowledge, both of which are the hallmark of the graduate experience in hard-rock geology in the Geological Sciences Department at SMU. Graduates like Balsley are well prepared to contribute within and outside the earth sciences.

## Brian Stump helped in formulating nuclear test ban treaty

*Continued from Page 1*

The second criticism is that the nuclear weapons currently in the U.S. inventory cannot be maintained in a safe and reliable condition without testing even though the National Laboratories responsible for the design of these weapons have certified that the weapons can be maintained through computer simulation and material testing of the individual components. There is a perception that the stockpile of nuclear devices cannot be maintained in perpetuity so that someday in the future, the United States may need to return to testing.

Lack of U.S. ratification of the CTBT is potentially a serious blow to limiting the spread of nuclear weapons because of the provision for on-site-inspections for signatories of the treaty. Recent nuclear tests by India and Pakistan attest to this need. Failure by the U.S. to support the CTBT may send the wrong message to

existing and potential threshold states and undermine the Nuclear Non-Proliferation Treaty. Rejection of the CTBT would mean that the IMS designed to monitor the treaty would not be fully developed, limiting our ability to monitor activities in countries such as the Russian Federation and China.

Cooperation among the nuclear capable countries, together with the International Monitoring System and on-site-inspection, provides assurances to each that further development of weapons of mass destruction does not occur and that the technology is not spread to others.

*On March 10, 2002, Professor Stump will speak to members of the Collegium daVinci, a society for scientific discussion. His topic will be "Seismology and Politics in the Nuclear Age." For further information about the Collegium please contact Jeanene Anderson, Dedman College, SMU, PO Box 750235, Dallas, Texas 75275-0235 or email [collegium@mail.smu.edu](mailto:collegium@mail.smu.edu).*





**SMU alumna Illeana Tibuleac helped kick-off the Fall 2001 term as the first noontime seminar speaker on August 29. Her topic was "P Wave Amplitudes in the 3D Earth." Tibuleac received her Ph.D. from SMU in 1999. She is a native of Romania.**

## SMU graduate returns to give seminar in P Wave Amplitudes

Illeana Tibuleac visited SMU for the first time since she departed for a postdoctoral fellowship in the Department of Geosciences at Princeton University that began during February of this year.

As part of her SMU Ph.D. thesis (1999) under the direction of Gene Herrin, she examined "slowness" anomalies attributed to lower mantle structures using the Lajitas Seismic array.

Seismology examines lower mantle structures from several points of view related to the properties of seismic waves. These are:

- 1) slowness (how fast a seismic disturbance moves across the surface of an array of seismometers, i.e. the horizontal velocity component of the wave arriving from deep within the Earth),
- 2) azimuth (deviations in the angle the ray makes with the surface compared with angles predicted by standard Earth models),
- 3) travel time (how long it takes the wave to travel from the earthquake source to the seismometer),
- 4) amplitude, and
- 5) wave splitting (multiple paths leading to multiple arrivals).

While at Princeton, Illeana has been extending her interest in this problem by looking at amplitude anomalies associated with seismic waves propagated through the lower mantle. These types of studies are the only way to construct high resolution images of lower mantle structure, to address the fate of subducted slabs, and possible interactions between the core of the Earth and the lowermost mantle.

## SMU faculty supports regional science fair

**By John Goodge**

**Associate Professor of Geological Sciences**

Remember that science project you had to do in school way back when? Well, school kids are still doing science projects from elementary school on up, and SMU is directly involved in supporting them as part of the Dallas Regional Science & Engineering Fair.

Since the first Dallas regional fair in 1957, the annual event has grown to be one of the largest student science fairs in the United States. Each year there are over 1000 projects entered by 7th to 12th grade students from the greater Dallas area.

Winners from the Dallas Fair go on to compete at state and international competitions. Several Dallas students have been recognized as place-winners at the recent international competitions, showcasing a strong science and engineering education tradition in the Dallas area.

Events such as the annual Science Fair give SMU an opportunity to reinforce the importance of learning, experimenting and healthy competition. SMU is one of the principal co-sponsors of the Dallas fair along with the *Dallas Morning News*, Toyota, Beal Bank and the Dallas County Medical Society Alliance.

Additional support comes from the Science Place and UT-Southwestern Medical School. Each year, projects are judged for creative ability, scientific thought, skill, thoroughness and clarity by more than 300 volunteer judges from area businesses, professional organizations and schools.

SMU contributes in many ways, including organizational leadership, scholarship prizes, and informal mentoring to students seeking help with their project. Science faculty represent SMU in the Dallas community as Director of the Fair. Professor John Goodge served as Director through 2000, with a great deal of help from Diana Vineyard, previous departmental assistant, after our Department took over the reins from Biology for the last year. The Department of Physics now oversees the Fair under the guidance of Professors Fred Olness and Randy Scalise.

Over the past few years, the Science Fair saw a number of important changes, including development of additional corporate sponsorship from Toyota and Beal Bank, getting us up-to-date with computerized data management, expansion of individual, teacher, and school Shopping Spree prizes, and consolidation of Fair finances.

A number of science and engineering faculty also volunteer as judges on a regular basis, and we host the annual awards banquet each year at SMU. The university also offers a 4-year, \$18,000 scholarship to each of the senior division grand prize winners, and one student is currently working on her degree in the Department of Chemistry.

### **News about our alumni**

Shannon Clark Thorne (2000) is in her second year at the University of Texas School of Law. Last summer she clerked in the environmental law division at Fulbright & Jaworski in Austin. She is a staff member of the *Texas Environmental Law Journal*. Shannon's course load includes oil and gas law and environment and natural resource law. In December, 2000, she married another SMU grad, Brian Thorne.

## SMU Alum

# Charles F. Dodge, 77, dies in Midland, Texas

By James Brooks  
Professor Emeritus Geological Sciences

Charlie Dodge was a person of strong loyalties and firm opinions, thoughtfully arrived at and not casually abandoned. His loyalties were to family, friends, former professors and, equally, former students. He was quick to credit a handful of faculty for the education that paved the way for his very successful career as a geologist—teacher and practitioner.

Their names arose frequently in conversations with Charlie—Claude Albritton, Arthur Richards, Kathleen Keithley (all at SMU, where Charlie earned the B.S. and M.S. degrees) and Sherman Wengerd (Charlie's Ph.D. advisor at the University of New Mexico).

## CHARLES F. DODGE

*Born May 28, 1924, in Dallas, Texas*

*Died on May 29, 2001, in Midland, Texas*

*B.S., M.S., Southern Methodist University*

*Ph.D., University of New Mexico*

On that solid educational base Charlie built a career as exploration geologist, teacher of geology (at the University of Texas at Arlington and as Adjunct Professor at SMU) and as independent exploration geologist. In these roles, he touched and influenced many lives—educating both students and professional colleagues.

Intensely enthusiastic about the projects he was interested in and working on, Charlie spared no effort to accomplish his goals. And the projects varied from what one of his students was working on, to a favorite oil or gas “play” that he believed in, to the politics of the local and national geological societies in which Charlie was always an active member.

In fact, more people than probably realize it have been honored at the local or national society level because Charlie knew about and believed in what they were doing and made the effort to aggressively support their being recognized by the society. Such was Charlie's loyalty and friendship.

Similarly, institutions that interested Charlie benefited from his interest and his creative thinking about programs that the institution might undertake that would be good for the profession and, thus, benefit the institution as well. The Institute for the Study of Earth and Man in its energy programs was frequently the beneficiary of Charlie's interest, advice and effort.

Of all the appellations and adjectives that could appropriately be used in connection with Charlie, “Independent” most typifies him—independent in thought and independent in action—and fiercely loyal to family, friends, institutions and ideas—the kind of person to be respected and cherished.

Memorials may be made to the Charles F. Dodge/DGS Scholarship Fund, Communities Foundation of Texas, 4605 Live Oak St., Dallas, Texas 75204.



Ghent to earn doctorate in December 2001.

## Rebecca Ghent accepts Smithsonian fellowship

Rebecca Ghent, a Ph.D. candidate who is scheduled to complete her thesis in December, has been awarded a two-year postdoctoral fellowship at the Smithsonian Institution in Washington, D.C. It starts in January 2002. Ghent is specializing in planetary geology and geophysics under the direction of Professor Vicki Hansen. Her dissertation focuses on the structure and tectonics of crustal plateaus on Venus.

In Washington, Ghent will be working with Dr. Bruce Campbell of the National Air and Space Museum, Center for Earth and Planetary Studies on developing radar techniques for planetary exploration.

Ghent is a native of Randolph, New York. She earned her bachelor's degree in physics from Randolph-Macon Woman's College in Lynchburg, Virginia in 1993. She went on to get an M.S. in physics at Georgia Tech in 1994, and then taught physics at Gordon College in Barnesville, Georgia, from 1995 to 1996.

During that time, Ghent decided to fulfill a long-held interest in geology, and enrolled at SMU in 1996. Following her first telephone conversation with Dr. Hansen, she decided to work on Venusian tectonics for her Ph.D. She feels that this has been exciting and rewarding and hopes to remain involved in planetary exploration for many years. Ghent is looking forward to returning to the East Coast, and being part of the planetary research effort at the Smithsonian.

Ghent and her fiancée, Jason Head, another Ph.D. candidate in geological sciences at SMU, will be married in New Orleans in October 2001. Head, who holds a B.S. from the University of Michigan and an M.S. from SMU, also plans to graduate in December. His specialty is vertebrate paleontology.

## Hedberg Award will go to Robert J. Weimer

Robert J. Weimer, Professor Emeritus of Geological Engineering, Colorado School of Mines, will receive the 2001 Hollis D. Hedberg Award in Energy, presented annually by the Institute for the Study of Earth and Man. (Call 214-768-2424 for ticket information.)

The award will be presented on November 8 at the Dallas Country Club. Keynote speaker will be Tim Severin, noted author and explorer whose most recent book is *In Search of Moby Dick*.

# New microscopic sampler used in study of barnacles from Costa Rica sea turtles

*\$35,000 gift from New Wave Research enables work in migration patterns*

Graduate student Dana Biasanti is using a new micro-sampler to study barnacles collected from the back of a sea turtle from the eastern coast of Costa Rica. She studies the isotopic ratios in the barnacles to try to understand the migration patterns of sea turtles. Dana works with Louis Jacobs on this interesting project.

This work is due to a generous gift by New Wave Research of a Merchantek Products computer-controlled microscopic sampler valued at \$35,000. It was given to the Stable Isotope Laboratory in recognition of the laboratory's collaboration with Charles Douthitt of ThermoFinnigan Corporation in bringing a major share of the geological laser market to the company.

The micro-sampler has a milling device mounted to a microscope with a movable stage controlled by a computer. The milling bit generates powders from precisely located points on the sample allowing for microsampling of individual growth bands in biogenically-precipitated materials, e.g. bone, snail or ostracod shells. Digital pictures taken by the camera on the microscope (and interfaced to the computer) provide a permanent record of the spatial distribution of samples.

Stable isotopic analysis of the powders provides information that is used for reconstructing the changes in the environment over the lifetime of the organism. The micro-sampler enhances the mineral separation capabilities of the Stable Isotope Laboratory.

In search of a better way to ablate mineral surfaces for elemental and isotopic analysis, Chuck Douthitt and Bob Gregory, as part of a State of Texas Advanced Technology Project, recognized that ultraviolet (uv) lasers were capable of generating smaller diameter craters and cleaner ablation surfaces.

They were impressed with the precision cuts made by uv lasers in nanotechnology applied to the semiconductor industry. In geochemistry circles, infrared lasers (the long wavelength side of the visible electromagnetic spectrum) were in common use. When compared against shorter wavelength uv lasers, infrared lasers destroy mineral surfaces by heating them resulting in thermal haloes with partial melt zones around the zap pits. Chemical and isotopic fractionation can occur at these boundaries and affect the quality of the analytical results.

Before the Merchantek laser, most commercially-available uv lasers were large devices using noble gas halogen compounds. Merchantek, under the direction of John Roy, developed a computer-controlled, solid-state benchtop laser that generates ultraviolet radiation at 266 nanometers. The energy density of the beam generated by this laser breaks bonds at the unit cell level of the crystal and the failure surface of the mineral is controlled by crystallographic properties with very little thermal shock.

Chuck Douthitt, in his capacity as mass spectrometry specialist for ThermoFinnigan, put his clients in contact with Merchantek who provided the lasers as part of packages associated with sales of isotope ratio mass spectrometers and inductively coupled plasma mass spectrometers for elemental analysis.



**Dana Biasanti examines a barnacle through new micro-sampler provided by New Wave Research.**

## ***News about our alumni***

Brian Banks, a 1999 graduate, is a consulting engineer geologist with Law Companies Group, Inc., in Raleigh, North Carolina. He serves as a project manager for large geotechnical engineering projects, including investigations for bridges, roads, and dams. He is responsible for \$1 million annually in net fees and supervises a team of geologist, engineers, drillers, and technicians. Brian writes: "My wife and I had a healthy baby girl, Maya Nicole, on March 5, 2001. We're having a great time watching her grow up. The daily changes are astounding! At six months she is just beginning to crawl and shows two front teeth. Her best friend is our black lab, Luna. I think I'll wait until next month to start the geology lessons."



# 4 new grad students come from across the North American plate—and world



**Annat Haber, Israel**

Of the four new graduate students in Geological Sciences this fall, Annat Haber comes the farthest distance. She is from Israel. Annat, who was born in Jerusalem, received her B.S. (Faculty of Life Sciences) and M.S. (Archaeozoology) from Tel-Aviv University. Her area of interest is vertebrate paleontology. She will be working with Professor Louis Jacobs. After her graduate studies are completed, Annat hopes to work on the Cretaceous sediments of Israel. In Israel she worked with deaf and learning disabled children as a volunteer. Although not having much free time away from her studies Annat enjoys karate.



**Nick Lang, California**

Nick Lang hails from the West Coast, having been born in Fontana, California. On his way to SMU, Nick has seen a lot of geology--first at Walla Walla, Washington, earning a B.A. from Whitman College in May, 1999, then at Tennessee, where he received an M.S. in geology from Vanderbilt University. Now seeking a Ph.D. in geology with a strong interest in tectonics, he will work with Professor Vicki Hansen. While in Nashville, Nick taught general science lessons to elementary school children as a volunteer. Nick enjoys running and baseball, and he's a Los Angeles Dodgers fan.



**Paten Morrow, Texas**

Native Texan Paten Morrow is on a return mission to SMU. This time he is seeking an M.S. degree in geology with a special interest in petroleum geology. Paten, born north of Dallas in Sherman, earned an undergraduate degree in geology from SMU in May 1998. For the past three years he has been working in Fort Worth as an associate geologist for XTO Energy (formerly Cross Timbers Oil Co.). Paten believes that an advanced degree in geology will be useful in pursuing his career objectives. In his nonacademic world he enjoys scuba diving, hiking, and reading. Paten is engaged to a local Dallas attorney and plans to marry in January.



**Peter Rose, Michigan**

A native of Michigan, Peter Rose comes to SMU with a strong interest in both mammals and dinosaurs of the Cretaceous and early Tertiary. Peter met Professor Louis Jacobs at the fall 2000 meeting of the Society of Vertebrate Paleontology in Mexico City. After learning about research opportunities at SMU from Professor Jacobs he applied and was accepted to the Ph.D. program in vertebrate paleontology. Peter holds a B.S. in geology from the University of Michigan at Ann Arbor (May, 2001). Besides his academic pursuits, Peter enjoys travel, hiking, camping, rock climbing, and amateur astronomy.

## ALUMNI UPDATE FOR SMU GEOLOGICAL SCIENCES GRADUATES

*How about sharing some career news (also personal) about yourself for possible use in our next newsletter?*

*A photo, too. And please update your address, telephone numbers, and e-mail address.*

*We want to hear from you.*

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## GEOLOGICAL SCIENCES FACULTY, SOUTHERN METHODIST UNIVERSITY

**David D. Blackwell**, Hamilton Professor, Ph.D., Harvard. Geothermal studies and their application to plate tectonics, especially of the western United States; energy resource estimates and geothermal exploration.

**John W. Goodge**, Associate Professor, Ph.D., UCLA. Continental tectonics, as approached by petrology, structural geology and thermo-chronology. Petrologic and tectonic evolution of North American Cordillera and Ross Orogen region of Antarctica.

**Robert T. Gregory**, Professor and Chair, Ph.D., California Institute of Technology. Stable isotope geology and geochemistry, evolution of earth's fluid envelope and lithosphere.

**Vicki L. Hansen**, Professor, Ph.D., UCLA. Structure, tectonics, geomorphology, earth systems, and terrestrial planet evolution.

**Eugene T. Herrin**, Shuler-Foscue Professor, Ph.D., Harvard. Theoretical and applied seismology, solid earth properties, computer analysis of geophysical data.

**Louis L. Jacobs**, Professor, Ph.D., University of Arizona. Director of Shuler Museum of Paleontology, and President of the Institute for the Study of Earth and Man. Vertebrate paleontology, evolution.

**A. Lee McAlester**, Professor, Ph.D. Yale University. Marine ecology-paleoecology, evolutionary theory, Paleozoic geology, petroleum geology.

**Brian W. Stump**, Albritton Professor, Ph.D., University of California, Berkeley. Seismology, earthquake and explosion source theory, regional wave propagation, seismic and infrasonic instrumentation and data acquisition, and mine related seismicity.

**John V. Walther**, Matthews Professor, Ph.D., University of California, Berkeley. Experimental and theoretical aqueous geochemistry, fluid-mineral surface interactions, kinetics of dissolution, and mineral solubilities as a function of temperature, pressure and solution composition.

**Crayton J. Yapp**, Professor, Ph.D. California Institute of Technology. Stable isotope geochemistry applied to the study of paleoclimates, paleoatmospheres, and the hydrologic cycle.

### ADJUNCT FACULTY

**Steve Bergman**, Adjunct Assistant Professor, Ph.D. Princeton University. Tectonics of sedimentary basins, surface processes, volcanology, geochronology and hard rock petrology.

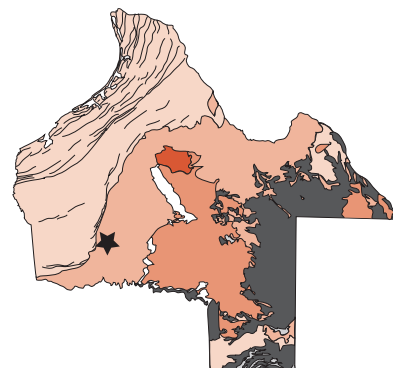
**Bonnie F. Jacobs**, Adjunct Associate Professor, Ph.D., University of Arizona. Paleobotany of Tertiary deposits of Africa, application of pollen analysis to Cenozoic geological and environmental problems. Assistant Professor, Environmental Science Program.

**Anthony Fiorillo**, Adjunct Associate Professor, Ph.D., Pennsylvania. Curator of Paleontology, Dallas Museum of Natural History.

**Douglas H. Oliver**, Research Assistant Professor, Ph.D., Southern Methodist University. Structural geology, tectonics, and economic geology.

**Alisa J. Winkler**, Adjunct Associate Professor, Ph.D., Southern Methodist University. Mammalian paleontology, anatomy.

**Dale A. Winkler**, Adjunct Associate Professor and Associate Director, Shuler Museum of Paleontology, Ph.D., University of Texas at Austin. Paleontology. paleoecology.



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