

The Earth Scientist

Fall 2008

City of Rocks Pluton. Photo by Elizabeth Miller.

Save The Date

Join the Stanford School of Earth Sciences for the following free events!

September 23

Alumni Reception* at the Society of Petroleum Engineers Conference, Denver CO.

October 6

Alumni reception* at the Geological Society of America Conference, Houston TX.

October 10

Earth Sciences Barbeque during Reunion Weekend, Stanford CA. 4-6 pm, Mitchell Earth Sciences patio.

November 9

Alumni reception* at the Society of Exploration Geophysicists Conference, Las Vegas NV.

December 15

Alumni reception* at the American Geophysical Union Conference, San Francisco CA.

February 9

Alumni reception* at the NAPE Conference, Houston TX.

June 8

Alumni reception* at the American Association of Petroleum Geologists Conference, Denver CO.

Check our Web site for event details:
<http://pangea.stanford.edu/alumni/events/>

* Beverages and hors d'oeuvres are provided. Reception dates are approximate and will be confirmed 6 weeks prior to the event. Contact Mona Tekchandani '96 if you have any questions: 650-723-2101 or monalisa@stanford.edu.

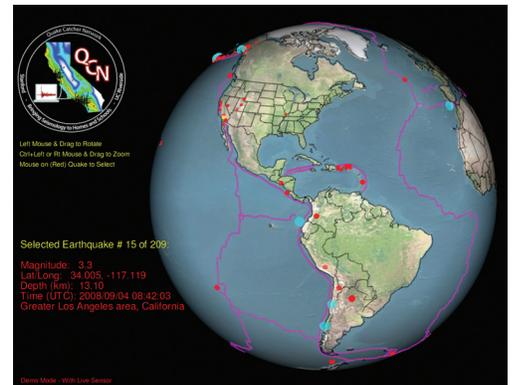
Catching Quakes with Laptops

As a colorful globe spins on his monitor, Jesse Lawrence, assistant professor of geophysics, clicks his computer mouse and a bright red dot appears in the Far East marking an earthquake that happened during the past week. One more click, and Earth is shown in "night view," with metropolitan areas defined by clusters of light, in stark contrast to the darkness of largely unpopulated countries. "This is a great way to view the Earth to teach seismology," Lawrence says. "Where populations and earthquakes overlap, you have the greatest seismic hazard."

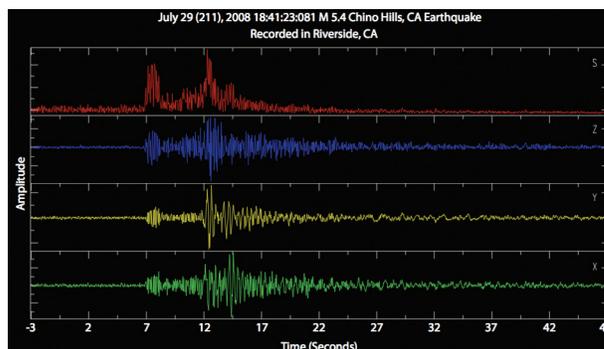
As captivating as the interactive program is, Lawrence says the earthquake detection system that he and Elizabeth Cochran, a seismologist at UC-Riverside, are developing is the genuinely cool stuff. Their Quake-Catcher Network will enlist volunteers whose laptops have sudden-motion sensors, or accelerometers, to detect earthquakes. Desktop computers also can be equipped with motion sensors that plug into a USB port, at a cost of \$30 to \$100. Ultimately, the network of laptop and desktop computers might be used to issue early warnings to the public. In addition, Lawrence and his collaborators will distribute USB shake sensors to schools so students can be part of the network and use it as an educational tool.

Lawrence and Cochran believe that earthquake detection can be done faster with lots of low-grade sensors than with fewer, more expensive research-grade sensors, which can cost up to \$50,000. Initially, Lawrence wrote "sort of a clunky version" in order to do simple tests that included leaving a laptop running in a closet for three months. Result? "We were able to detect a 3.7." Now the distributed computing system is being developed by Carl Christensen, a software architect. "We have about 500 volunteers running the software on the Macintosh beta version," Lawrence says. "And we have about 1,000 volunteers ready to sign up, using PCs, whenever we release the beta version for that." People can join the network online at <http://qcn.stanford.edu>.

Lawrence says there currently aren't enough users for it to be "an active system" that is viewed in real time. Yet the QCN has already recorded earthquakes with laptops. This past July 29 at 11:42 am, a magnitude 5.4 earthquake occurred in the Greater Los Angeles Basin, and the QCN was ready. Three sensors recorded the seismic event, providing a test of the QCN system and showing where the



Screen from the Quake-Catcher Network software.



The QCN software recorded the Los Angeles area earthquake on July 29, 2008.

A New Academic Year

It is my pleasure to introduce another issue of the Earth Scientist and to bring you news of the school at the start of another academic year. This one promises to be an exciting one.

Along with pieces about our new department, two new endowments, honors and awards, faculty and student research, and retiring and new faculty, we've added a Class Notes section with your news—alumni news—that we hope you'll read with interest. I invite you to share your milestones with us so we can share them with your fellow alumni in future issues.

Your comments and suggestions about the newsletter are always welcome and appreciated; please let us know what you would like to read about.

With best wishes and thanks for your interest in our programs,

Pamela Matson



Photo by L.A. Cicero

Pamela Matson

*Chester Naramore Dean of the School of Earth Sciences
Richard and Rhoda Goldman Professor of Environmental Studies*

Alumni Volunteer Leaders Establish New Endowment Funds

Hormoz Ameri (MS'84, Petroleum Engineering) and Hal Washburn (BS'83, Petroleum Engineering) established new named endowment funds to benefit the School of Earth Sciences.

The Hormoz and Fariba Ameri Endowment Fund for Graduate Education in the School of Earth Sciences will support graduate students and graduate education, with a preference for the Department of Energy Resources Engineering. The Washburn Family Fund in Support of Undergraduate Education at the School of Earth Sciences will support undergraduate programs and activities. Washburn's wife Peggy also graduated from Stanford, with an AB in International Relations in 1984.

In addition to their generous gifts, Ameri and Washburn have been active volunteers for a number of years as members of the school's Petroleum Investments Committee (PIC). Composed of 25 alumni volunteers, the PIC oversees the investment of the Petroleum Investments Funds (PIF), two endowment funds initiated by Earth Sciences alumni in 1953 and 1982 to capitalize on the expertise and experience of alumni to invest in producing oil and gas royalties and other energy-related investments. Washburn has been on the PIC since 1998 and served as chairman in 2003. Ameri has been a member since 2000 and currently serves on the four-member executive committee.

The PIF distributed more than \$1 million in discretionary funds to the school for the fiscal year ending August 31, 2008. PIF income has been used as seed money to launch new activities like the Stanford Center for Computational Earth and Environmental Science (CEES), to help support major initiatives like the development of shared analytical laboratory facilities,

and to underwrite the start-up costs for new faculty members that have just arrived at the school.

In addition to these alumni donors, many other alumni provide annual support for the school through the Earth Sciences Fund. The unrestricted nature of these gifts allows a high degree of flexibility in meeting the school's most pressing needs and funding important projects. This year the Earth Sciences Fund was used to support the start-up costs of new faculty members (like Jesse Lawrence, see p. 1); to revitalize the undergraduate curriculum (already resulting in increased enrollment); to enhance field research opportunities; to create a new graduate student lounge; and to support the GeoKids Program, which brings Earth sciences education to local K-12 students.

Want To Know More?

For more information on the PIC and PIF, please visit <http://pangea.stanford.edu/support/pif/> or contact David Gordon at dsgordon@stanford.edu, 650-723-9777.

For more information about the Earth Sciences Fund, please contact Mona Tekchandani ('96), Director of Alumni Relations and the Earth Sciences Fund, monalisa@stanford.edu, 650-723-2101.

Schoolchildren Donate to the Environment Through CEES

The Stanford Center for Computational Earth and Environmental Science (CEES) has received a surprising contribution. At the end of the school year, a group of students from Franklin Elementary School in Oakland, California, sent the Center a donation of \$100 to be used in research to help the environment.

The 17 students, all part of the Gifted and Talented Education Program (GATE) at Oakland Unified School District, made cloth shopping bags from recycled curtains and sold them for \$10 each to raise the money. All the bags carried messages reinforcing the need for recycling, reusing, reducing, and decomposing trash. After reading about CEES in the newspaper, the children decided that sending their donation to the center would be a good way to help the environment.

CEES, a research partnership created by the Stanford School of Earth Sciences, with affiliates from the Stanford Computer Systems Laboratory and private industry, has the main goal of expanding the capacity for interdisciplinary Earth science research and engaging computer architects to design hardware and software that are better suited to Earth and environmental science problems.

The research projects currently going on at CEES include a partnership with the Carnegie Institution's Department of Global Ecology to address the problems of ocean acidification and climate change and issues associated with rising levels of greenhouse gases. The Stanford Ocean Biochemistry Laboratory is also using CEES resources in their research on exploring controls on the southern ocean carbon cycle via numerical ecosystem modeling. Another project being developed by the Stanford Wave Physics Laboratory is full wave seismic simulations on CO₂ geological storage monitoring.



Dennis Michaels gives a tour of the CEES facilities to students in the GATE program. Photo by Clay Hamilton.

Deana Fabbro-Johnston Wins Amy Blue Award



Deana Fabbro-Johnston, one of three winners of the 2008 Amy Blue Awards. Photo from Stanford News Service.

In recognition of her commitment, devotion to students, and administrative expertise, Deana Fabbro-Johnston was named one of the 2008 Amy J. Blue Award winners this past May. The award honors staff members who are exceptionally dedicated, supportive of colleagues, and passionate about their work.

Fabbro-Johnston is one of two associate directors of the interdisciplinary Earth Systems Program. She and colleague Julie Kennedy both work on the curriculum and advise students on a drop-in basis.

"I don't treat these kids any different than I treat my own children," Fabbro-Johnston said. "I

know how things work at Stanford, and the normal undergraduate, 18 to 22 years old, sometimes needs a little help figuring out that path and the system, and that's what I do."

Research Briefs

A New Center for Heavy Oil

Margot Gerritsen (Energy Resources Engineering), PhD '97, has specialized in the design of effective computational algorithms for the general class of fluid flow problems and applied those understandings to a wide variety of research projects, including the investigation of coastal ocean dynamics, yacht sail design, and the aerodynamics of prehistoric pterosaurs. In the field of energy, her background in computer simulation and mathematical analysis of engineering processes has led towards efficient numerical schemes for the fluid flow processes used in enhanced oil recovery.

Recently, Gerritsen and Tony Kavscek (Energy Resources Engineering) established a new research center, the Center of Excellence for Simulation of In-situ Combustion (CESIC). CESIC specializes in the experimentation and simulation of in-situ combustion processes (ISC). ISC is a very attractive recovery method for heavy oil and Gerritsen hopes ISC will lead to unlocking the world's significant heavy oil, resources in an environmentally friendly way. The more ways in which oil recovery processes can be optimized, she says, the better off we are, both in terms of available resources as well as the environment.

The Potential of Virtual Earthquakes

Earthquakes are threatening primarily through the havoc caused by the waves they generate. Predicting the intensity of those waves is critically important for understanding and mitigating the risk posed by earthquakes, but it is extremely challenging because those same waves are strongly distorted by the complex geology of the Earth's crust. Even in well-studied regions like California, we have a very incomplete knowledge of crustal geology.

Recently, seismologists demonstrated that it's possible to extract the response of the Earth to a concentrated source using the ambient seismic field. The ambient field consists of weak seismic waves, previously regarded as "noise", that are present all the time. These waves are generated by all sorts of things other than earthquakes—such as waves in the ocean coupling into the solid Earth. Greg Beroza (Geophysics) and his colleagues have shown that the ambient field can be used to construct "virtual earthquakes" that represent the response of the Earth in its true geologic complexity. These virtual earthquakes accurately predict the intensity and variability in waves from real earthquakes. Measurements of the

Research Briefs cont'd

ambient field have the potential to transform seismic hazard analysis from a passive endeavor, where we deploy instruments and wait for earthquakes to happen, to an active one, where we create virtual earthquakes and can anticipate the effects of real ones.

Have Seismic Data, Will Travel

Every year the Society of Exploration Geophysicists (SEG) and European Association of Geoscientists and Engineers (EAGE) choose a prominent geophysicist whose work and presentation appeals to a wide audience, ranging from students to professionals near the end of their careers. The selection is considered to be a major honor and recognition of excellence.

Biondo Biondi (Geophysics), MS '88, PhD '90, was selected as the SEG/EAGE Distinguished Instructor last year, and he traveled around the world presenting at over 29 locations. Biondi's presentation was based on work that has been carried out within the Stanford Exploration Project and addressed three crucial problems in the practical application of 3D seismic data: 1) choice of the most effective migration algorithm, 2) estimation of the velocity model, and 3) poor image quality caused by irregular and inadequate data spatial sampling and incomplete subsurface illumination. The presentation was recorded and is available for purchase by SEG/EAGE members and the public through <http://seg.org>.

Relative Permeability Explorer

When Sally Benson joined Energy Resources Engineering last year, she formed the Benson lab to study fundamental aspects of geologic carbon dioxide sequestration in saline aquifers. Lab researchers replicate reservoir salinity, temperature, and pressure conditions upon cores of rock and flow mixtures of CO₂ and brine. Their current focus is to investigate the sensitivity of relative permeability to injection flow-rate and various fluid properties such as viscosity, pressure, temperature, and interfacial tension.

This past spring, former Lab Research Associate Ljuba Miljkovic released the Relative Permeability Explorer, a collection of published and unpublished relative permeability curves for brine and CO₂. These curves are used as parameters in multiphase flow simulations and have a significant impact on brine displacement in carbon sequestration applications. The tool is available to researchers at <http://pangea.stanford.edu/research/bensonlab/relperm>.

Stories from Beneath the Ice

As an English major at the University of Nebraska, Christina Riesselman never dreamed she'd be spending austral summers in Antarctica working with a team of international scientists on an innovative drilling project. But that is precisely what happened after a geology class led her in an unexpected academic direction.

"I took a class from David Harwood, who is one of the seminal figures in this current debate about the stability of the Antarctic ice sheet," Riesselman explains, "And I was astonished to discover that ... we don't know how long that blanket of ice has existed the way that it does today, and we don't know how sensitive it is to changes in the global climate, and that was astonishing to me; that was a mystery I could really sink my teeth into."

Riesselman's interest led her to pursue a PhD in the Department of Geological and Environmental Sciences with Professor Rob Dunbar. Her graduate work has centered on finding ways to reconstruct the sea ice fringe surround-



Christina Riesselman, PhD candidate in the Department of Geological and Environmental Sciences.

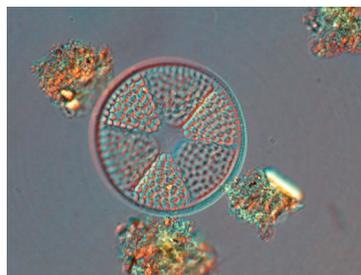
"One of the most important things we need to learn about Antarctica in the next ten to twenty years is what's going to happen to the ice sheet."

ing the Antarctic continent, and how that fringe has responded to changes in global climate. She has focused on the Ross Sea in particular.

"One of the most important things we need to learn about Antarctica in the next ten to 20 years is what's going to happen to the ice sheet there," says Professor Dunbar. "If all of the ice in the Antarctica were to melt, sea level around the globe would rise by about 60 meters; it would rise by about 200 feet. And this would be very dramatic – it would have disastrous consequences for all nations that have coastlines. So, we're very interested in understanding what's happened to Antarctica's ice."

To learn more about past changes in West Antarctica's sea ice, Riesselman has been studying sediment cores brought up from beneath the Ross Ice Shelf. The Ross Ice Shelf is the largest floating ice shelf on Earth and is about the size of Texas. It currently ranges in thicknesses from 200 meters up to 1,500 meters. It's basically a massive area of ice floating in the ocean but held in place by its attachment to West and East Antarctica as well as to several islands in the Ross Sea.

Riesselman is interested in the sediments beneath this ice shelf because they hold clues, in the form of single-celled organisms called diatoms, that point to the past behavior of Antarctica's ice cover. The diversity and abundance of organisms that live within the sea ice are different from those that live in the open ocean. As organisms die, they sink to the sea floor where they become incorporated into the sediment. Scientists have long recognized that if sediment core samples could be retrieved from beneath the Ross Ice Shelf,



Microscopic siliceous organisms called diatoms hold clues to past Antarctic environments.

it might be possible to determine when and for how long the Ross Sea was ice-covered or ice-free. The technology to retrieve sediment cores from beneath the ice, however, was prohibitively difficult. The drilling rig has to withstand harsh Antarctic conditions while drilling through hundreds of meters of ice before extending down through almost a kilometer of cold sea water to drill into the sea floor. The ice shelf can flex by as much as four-and-a-half feet due to tidal cycles, so the drilling rig has to absorb this movement while keeping the drill pipe in place. Taken together, these obstacles proved to be too much and sediment cores had never been retrieved from beneath the Ross Ice Shelf.

Until now. With the launch of the ANDRILL program (ANTarctic geological DRILLing, <http://andrill.org>), drilling to retrieve core samples became possible. ANDRILL is a multi-national collaboration comprising scientists, educators, students, technicians, drillers, and support staff whose goal is to uncover the elusive history of Antarctica by drilling and recovering sediment cores from below the seafloor that had previously been unobtainable.



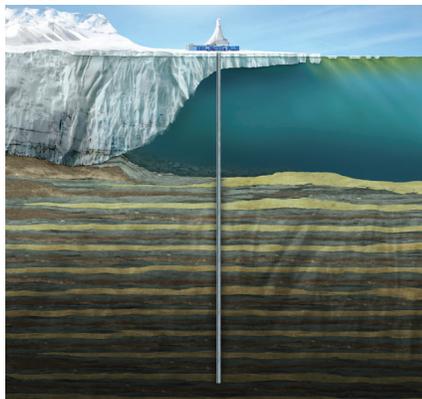
A 3-D reconstruction of Antarctica's Ross Sea coast today (left) and how it may have looked millions of years ago (right). Illustrations courtesy ANDRILL Science Management Office.

Riesselman has spent the last several years working with the ANDRILL project as a field-based scientist studying sediment cores retrieved from depths of almost one and a half miles. Once the cores have been brought to the surface, she studies the single-celled diatoms that the sediment cores contain. Diatoms are particularly good recorders of the environment present at the time they were incorporated into the sediments. They record environments both geochemically and ecologically (different diatom species inhabit particular environmental niches). By examining the diatoms in the sediment cores, Riesselman is able to identify the changing environmental conditions.

“In addition,” Riesselman points out, “diatoms are a really good recorder of time.” Because diatoms are small and evolve rapidly, they have very distinct evolutionary lineages. These lineages can be compared between different drill sites to create a picture of the changing polar environment. More importantly, the lineages recovered cover a crucial interval in Antarctica's history—a period about three million years ago when there was major planetary warming.

“I think what's most exciting about the initial results coming out of the

ANDRILL Project that Christina has been working on is this sense that West Antarctica is very unstable,” says Rob Dunbar. “And we have this idea now that large parts of West Antarctica melted away and then formed anew every 100,000 years or so, or maybe even every 40,000 years – over and over and over again in the last three to four million years. And in fact, the evidence may show us that that ice sheet melted back and formed anew as many as 40 to 50 times. Now, this is a real surprise. We've all been prepared to think that West Antarctica melted back once or twice during that time period, but nobody thought that it was that dynamic.”



Cross-section illustrating the drilling environment where ANDRILL's first core was collected. Illustration courtesy ANDRILL Science Management Office.

Research Briefs cont'd

Coupling Landscape Processes to Weathering and Nutrient Supply

George Hilley (Geological and Environmental Sciences) is interested in the types of interactions involved in silicate weathering, including climatic (precipitation and temperature) and tectonic (erosion or uplift) processes. Research has shown that the chemical weathering of silicates in bedrock is a major sink for atmospheric CO₂ over geologic timescales, modulating Earth's climate through CO₂ drawdown and profoundly affecting ecosystem productivity by inputting nutrients during soil development.

Hilley has recently been working with professors across the school to calibrate a steady-state weathering model for predicting silicon fluxes and potential net CO₂ drawdown across a landscape. Once calibrated, this predictive model of landscape development can be coupled with a biogeochemical understanding of nutrient availability to better understand changes in soil fertility over time. Although the model indicates that tectonic uplift rates can profoundly influence phosphorus availability, fieldwork will be conducted to validate that result. Upcoming trips to test the model include New Zealand and Central America.

Modeling Trace Metals

Trace metals such as mercury, arsenic and selenium are released from coal combustion flue gases worldwide. Jennifer Wilcox (Energy Resources Engineering) focuses on the modeling and direct measurement of trace metal speciation and sorbent design to prevent the release of these harmful pollutants into the atmosphere. A main focus of her research is on the design of catalytic materials for environmental applications. Her work also includes catalytic designs for Fischer-Tropsch fuels, carbon dioxide sorbents, and inorganic membranes for CO₂/H₂ separation. Additionally, she is applying these fundamental catalytic principles to carbon dioxide sequestration applications including CO₂-mineral and CO₂-carbon interactions for carbon storage in unmineable coalbeds for enhanced methane recovery.

The development of a multiscale model is under way in which fundamental quantum chemistry calculations will be used to calibrate force field schemes for the interaction of CO₂ and methane with surface functional groups and other trace elements typically found in coal such as silicate- and iron-based minerals. The force field solver takes into account

Research Briefs cont'd

both short- and long-range forces to calculate adsorption, transport, and stability parameters associated with the long term storage of CO₂ in coalbeds with enhanced methane recovery. The model will be generalized for application to activated carbon and other sorbent simulation predictions as well.

Paleocalibration of Global Climate Models

Recent studies have suggested that atmospheric circulation patterns in the Northern Hemisphere are shifting in response to increasing levels of atmospheric CO₂. Migration of the westerly jet streams may have consequences for both ocean circulation and the rainfall patterns on continents. For example, a northward shift in the Northern Hemisphere jetstream (which supplies much of the winter precipitation to Northern California) could dramatically change yearly precipitation patterns and amounts, affecting ecosystems, agriculture, and municipal water supplies. In order to understand what controls the position and strength of the Northern Hemisphere jet stream, long-term continuous records from continental settings are critical. The challenge is obtaining records with the correct distribution in space and time. Slow-growing carbonate minerals and opaline silica precipitated in soils can provide long-term paleoclimate records if analyzed at the appropriate scale (ca. 10's of microns).

Kate Maher (Geological and Environmental Sciences) and her colleagues are using the Stanford's Sensitive High Resolution Ion Microprobe - Reverse Gravity (SHRIMP-RG) lab to determine the age of soil precipitates that formed during the last few glacial-interglacial cycles across a latitudinal gradient in the western United States. Together with researchers at the USGS and the University of Wisconsin, they are coupling these high resolution dated growth records with isotopic and elemental records that reflect the relative changes in rainfall. These unique records enable the researchers to track how the jet streams migrated in response to past climate variations. This information can then be used for paleocalibration of global climate models that are used to predict the response of atmospheric circulation to increased atmospheric CO₂.

Earth Sciences Adds New Department

The new Department of Environmental Earth System Science (EESS) was formally established by Stanford's Board of Trustees in December 2007. Headquartered in the Yang and Yamazaki Environment and Energy Building (Y2E2), EESS offers the master's degree and PhD, and began this academic year with a cohort of approximately 30 graduate students. Faculty are drawn from the school's other departments and programs, with the addition of several courtesy faculty members from other parts of the university: Greg Asner and Ken Caldeira of the Carnegie Institution's Department of Global Ecology, and Peter Vitousek of the Department of Biology. Searches are under way for several additional faculty members, who will hold joint appointments with the Woods Institute for the Environment.

Through the department's graduate and undergraduate programs, Stanford Earth Sciences will train a new generation of scientists who understand the multiple facets of environmental processes, and who are able to think synthetically, evaluating change in our oceans, water, air, and land systems—as part of an integrated and connected system. The graduate program will be flexible, giving students the opportunity to develop curricula optimized to their research focus area. Potential focus areas of graduate study include biogeochemical cycles, climate and global change, water systems and cycles, and land-ocean interactions.

500 Million Years in 5 Minutes

When she first proposed the idea, no one took her seriously, but Earth Systems student Kat Hoffman, BS '07, MS '08, persevered. This past spring, more than 200 volunteers converged on Roble Field to reenact a half-billion years of plate tectonics for a film Hoffman is making.

"I saw the protein synthesis video a few years ago," said Hoffman, "and thought it would be a good idea to make a sequel." The video Hoffman is referring to is a short film produced in 1971 by Nobel laureate and Stanford biochemist Paul Berg. In the film, Berg has students act out the process of protein synthesis.

Hoffman's sequel begins 250 million years ago with the Pangea super-continent and ends 250 million years from today, when Pangea is expected to re-form. Participants wear color-coded clothing to represent different continents and people trailing blue streamers, representing ocean currents, run around the continents.

"Oceans, you need to learn which direction you are flowing," shouts Hoffman through a bullhorn high above the laughing students. To capture the event on video, she rented a 43-foot-high lift, from which she could see the whole field and give direction. "North America, you are way too north right now!" Highlights of the tectonic sequence include an axe-wielding, grey sweat-suited asteroid running across Roble Field to smash into the Gulf of Mexico, the ramming of India into Asia causing the Himalayas to uplift, and a synchronized mass extinction.

Students weren't the only ones who got into the act. Professor Rob Dunbar, wearing a penguin-like white shirt and black jacket, was happy to join the group representing one of his areas of research, Antarctica. Other faculty participants included Peter Vitousek (Biology), Robert Siegel (Microbiology and Immunology), Meg Caldwell (Law), and Deborah Sivas (Law).

"It's a pretty fun way to represent plate tectonics," Hoffman says. She is working on the final edit of her film now and hopes to have it done soon. In the meantime, there is a preview available at <http://pangea.stanford.edu/alumni/video.php>.



Participants outline continents in Kat Hoffman's re-enactment of 500 million years of plate tectonics.

New Faces



Marty Grove has joined Geological and Environmental Sciences as professor (research), director of the Stanford Geochronology Lab, and co-director of the Sensitive High Resolution Ion Microprobe - Reverse Gravity (SHRIMP-RG) Lab. He works with large-radius ion probe and noble gas isotopic technologies to date Earth materials and better understand the tectonic evolution of western North America. Previously, Grove managed the ion microprobe facility at UCLA.



Leif Thomas has joined Environmental Earth System Science as assistant professor after previously working at the Woods Hole Oceanographic Institution. Using theoretical and numerical modeling, Thomas has developed novel theories explaining the mechanisms by which winds drive vertical and horizontal motions in the upper ocean. This research has the potential to significantly impact our understanding of the global climate system.



Tapan Mukerji has joined Energy Resources Engineering as associate professor (research) and co-director of the Stanford Center for Reservoir Forecasting. Previously he was a senior research scientist in the Department of Geophysics. Mukerji is a leader in numerical simulation and has contributed significantly to broad areas of geophysical simulation using geostatistical approaches as well as innovative approaches to interpretation of geophysical signals.



Jennifer Wilcox has joined Energy Resources Engineering as assistant professor. Wilcox's interests span a broad spectrum in the area of energy conversion and environmental mitigation, including the removal of heavy metals from coal-fired power plant emissions and approaches to the separation of hydrogen (as an energy source) from gas mixtures.

Faculty News

Khalid Aziz (Energy Resources Engineering) was awarded an Honorary Doctor of Law degree from the University of Calgary. The award credits him with "providing the cornerstone for the Univ. of Calgary's Oil and Gas Engineering Program."



Jerry Harris (Geophysics) was named the 2008 Engineer of Distinction by the University of Mississippi. The title is bestowed annually on an engineer associated with the school who is truly exceptional.



Mark Zoback (Geophysics), PhD '75, was awarded the 2008 American Geophysical Union's Walter H. Bucher medal. This medal is awarded "for original contributions to the knowledge of Earth's crust."



David Pollard (Geological and Environmental Sciences), PhD '69, and co-author Ray Fletcher were awarded the 2007 Best Publication of the Year Award from the Geological Society of America for their book *Fundamentals of Structural Geology*.



George Thompson (Geophysics, emeritus) was awarded the Penrose Medal from the Geological Society of America. This medal recognizes eminent research, outstanding contributions, or achievements that mark a major advance in geology.



Retirements

Amos Nur (Geophysics) helped define the science of rock physics as an integral part of modern geophysics. Virtually all modern seismic methods for fracture characterization rest on Nur's quantitative modeling work. In addition, Nur performed fundamental work on how to interpret geophysical data to gain insights into the fluid content. Besides rock physics, Nur pursued an interest in the role of earthquakes in history.



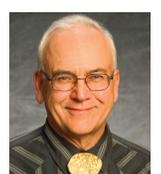
Simon Klemperer (Geophysics) was awarded Stanford's 2008 Allan Cox Medal for excellence in fostering undergraduate research. The medal was established in memory of the former Dean of the School of Earth Sciences.



Greg Beroza (Geophysics) was elected a fellow of the American Geophysical Union. Election to AGU Fellowship is very high recognition by one's peers. The number of Fellows elected may not exceed 0.1% of the membership in any given year.



Jon Claerbout (Geophysics) is a seminal figure in geophysics, having pioneered the use of computer processing for filtering, analyzing, and imaging seismic exploration data. Claerbout demonstrated how to use wave propagation theory to develop a seismic section in depth, which revolutionized the field of exploration seismology. In 1973, he started the Stanford Exploration Project, focusing on solving real-world problems and providing tools to industry.



Class Notes

We heard you! By popular demand, we've added a class notes section to the newsletter. Alumni with multiple degrees are listed under their first degree year.

1934

Fred Kalenborn, AB '34, lives at the Rosewood Retirement Community in Bakersfield, California, where he enjoys playing cards and going to meetings. Fred says that he uses a cane for walking, and wears hearing aids and glasses, but is still happy to be driving. He has two children, Lynne and Bill, and five grandchildren. His wife Janet Kempenich, AB '34, passed away in 1988.

Robert Millberry, AB '34, ENG '36, is retired from the U.S. Air Force. He has now been retired for longer than he worked. Bob lives in Lakeport, California, in the same house in which he was born in 1912.

1947

Robert Nesbit, BS '47, has been retired for more than 20 years. Bob recalls his Field Geology course in the Arroyo Seco near Greenfield, California, and doing a hard rock study east of Reno under Ben Page and Bob Carpenter. After Stanford, he performed fieldwork in Colombia and Venezuela. He obtained an MS from Oregon State University and spent most of his career working throughout California and West Texas for various companies.

1948

Edward Wasson, MS '48, manages Wasson Royalties and Edward B. Wasson & Company – two family partnerships of oil and gas properties in Wyoming, Oklahoma and Texas – from his home office in Denver, Colorado.

1950

Samuel Pratt, BS '50, MS '51, remains active full time in oil and gas exploration,

development and production. He is president and owner of Waverly Projection LP and its general partner, Force Petroleum LLC, which concentrate on southeast Texas – specifically San Jacinto County, which is about 60 miles north of Houston. Sam says that he is “looking for clues to the cure for the decline curve blues.”

Charles Dodds, BS '50, retired in 1989 and has been living in Tehachapi, California, since then. He obtained his MBA from Columbia University in 1952, after which he joined the U.S. Army and served for six years, attaining the rank of first lieutenant. He subsequently worked for the City of Los Angeles as an accountant and fiscal system specialist.

1951

From 1998 to 2002, while in Bahrain, **Louis Christian**, BS '51, MS '52, published 23 regional subsurface geologic maps of the Middle East. In Dallas in 2005, he self-published a 346-page subsurface geologic atlas of the Middle East with explanatory notes, analyses, spreadsheets and bibliography.

1952

John Rye, BS '52, lives in San Jose, California.

1954

Robert Long, BS '54, says, “The most valuable tool in my bag is the Stanford degree.”

1957

Peter Hahn, BS '57, MS '59, came out of retirement a few years ago to work for Galway Resources US Inc. on W-Mo-Cu-Zu properties in the western United States. He lives in St. George, Utah.

1958

After Stanford, **Michael Barnard**, BS '58, pursued an MA in geology from UCLA. He

mapped the Lake Casitas Watershed Area and the Matilija Quadrangle in Ventura County, for which he completed brown line surface columnar and cross sections. In 1960, he started building apartments and rest homes in Ojai. In 1969, both of his parents died and he took over the family ranches while staying involved with oil patches in Ventura Avenue and Crocket County, Texas. Michael married in December 1963; he and his wife have two children and six grandchildren. His map of Lake Casitas (the area is now under water) was published by the Pacific Coast Geology Society.

1959

James Classen, MS '59, is still getting into Gulf Coast drilling deals.

Kenneth Pierce, BS '59, is retired from the U.S. Geological Survey. He continues to work and report on the geology of the track of the Yellowstone hotspot, glaciation of the Jackson Hole area, and quaternary geology of the Yellowstone area.

1962

F.A. Schilling, PhD '62, is still practicing as an engineering geologist in the Los Angeles area. He says “earthquakes and landslides – not as exciting as oil and precious metals—but it will do.”

1963

Paul Eimon, MS '63, is listed in Who's Who Worldwide (starting in 1990), and the Platinum Edition of Who's Who Registry (1992); and his wife, Pan Eimon, is listed in the 25th Silver Edition of Who's Who of American Women (2006-2007).

1965

Glen Korpi, PhD '65, retired in 1999 and lives in Laguna Beach, California.

1971

Monte Marshall, PhD '71, retired as a geology professor from San Diego State University two years ago. He has been traveling, attending geology and geophysics meetings, leading field trips, writing guidebook articles, and enjoying life.

1973

Jose De Vasconcelos, MS '73, has worked as a geologist in the iron ore industry since 1962. He retired from CVRD, a world leading export company, in 1991, and since then has worked as a consultant. He and his wife, Aparecida, who studied and taught geography, have two children: Gustavo, who is a business administrator for FGV, Sao Paulo, and runs Gustavo-Tecnologia em Gestao, a consulting firm; and Juliana, who is the director of marketing for DHL Express in Brazil. Jose says that he is "always proud of being a Stanford alumnus."

1974

After 25 years in business, in 2007 **Gary Holzhausen**, MS '74, PhD '78, sold Applied Geomechanics Inc. to Pinnacle Technologies. The sale provided capital to fund future growth and "removed many of the daily headaches that can drive small business owners nuts," he says. "It has been a great run so far under our new management."

Peter Shanahan, MA '74, teaches environmental engineering at MIT. He previously worked as a consulting engineer in private practice for many years.

1975

Roger Newell, PhD '75, director of Capital Gold Corp., says that he attended the dedication of the El Chanate gold mine in Sonora, Mexico, in October 2007 along with other Stanford alumni, including Francisco Querol-Sune, PhD '74, John Postle, MS '68, and Guillermo Salas, PhD '71.

David Hoexter, MS '75, has been working as an independent engineering and environmental geologic consultant for the past fifteen years.

Janet Bauder Thornburg, BS '74, MS '76, says that she has good news to share: "After seven years of widowhood, I will joyfully begin a new phase of my life on January 19, 2008, when I marry Dr. Roy Hoppe. Roy, my 13-year-old daughter, Laurel, and I will continue to live in Houston. My surname will change from Thornburg to Hoppe."

1976

Sergio De Eston, MS '76, says that the University of Sao Paulo, where he is a professor, has expanded the Mining Department to a Mining and Petroleum Engineering Department, located at the Polytechnic School of Engineering. He is pleased to report that the first class of petroleum engineering students graduated in Dec. 2007.

Kern Guppy, MS '76, MS '78, PhD '80, says that he no longer works in engineering but would still like to hear from fellow Earth Sciences alumni.

1977

Darrell Nordstrom, PhD '77, has attained an international reputation for his expertise on arsenic in the environment, the geochemistry of acid mine waters, and geochemical modeling. He says that he has been invited to give four keynote lectures this year: one at the University of Wyoming on the effects of climate change on acid mine drainage, and three at international meetings in China, Sardinia and Germany. He has also been invited to give lectures in South Korea and New Zealand, and to speak at the U.S. Environmental Protection Agency at a select workshop on modeling trace elements in surface waters.

Frank Shanley, BS '76, MS '77 has been in the investment management business for 28 years. He is based in downtown Red Bank, New Jersey. "I actually do quite a bit of investing in public and private mining and

energy ventures," he says, "so I like to think I am putting my degrees to good use!"

1978

Joel Bergquist, PhD '78, reports that his son Jeff Bergquist graduated from Stanford as a member of the class of 2008.

Alan Levander, MS '78, PhD '84, received a 2006-2007 Research Prize from the Alexander von Humboldt Foundation. The prize funded his research for eight months at GeoForschungsZentrum in Potsdam, Germany. He also received the George P. Woollard Award from the Geological Society of America in 2007.

F. Russell Mechem, BS '78, MS '83, lives in the Oakland hills in California with his wife Kristine, his twin daughters, Ariana and Rhea, and stepson Sean. He is a senior project manager for the U.S. Environmental Protection Agency Superfund Program in San Francisco, where he manages the remediation of some very large contaminated hazardous waste facilities. Russell has also spent more than 12 years living and working throughout the Asia/Pacific Region, directing a variety of environmental and sustainable development programs. In addition to his work on Superfund sites, he is currently managing a sustainable development project in Pago Pago, American Samoa.

1979

Michael Hatfield, MS '79, is a volunteer for the Alumni Stanford Career Network.

Mark McMenamin, BS '79, is a professor of geology at Mt. Holyoke College. "I have had the great good fortune to continue working in this field," he says. "I recently appeared on the History Channel to discuss Rodinia, Pangea, and Alfred Wegener. Working with undergraduate students of the Keck Geology Consortium, Jack Beuthin and I have made some very interesting advances in our understanding of the geology of the Boston Basin right under the noses of Harvard and MIT. Go Stanford!"

Class Notes

1980

Grant Lichtman, BS '80, MS '80, says that he enjoyed spending time on campus last fall watching his daughter Cassidy play on Stanford's women's volleyball team, which made it to the national championship. "It was really exciting to visit and see a lot of the matches at Maples," he says. Grant says that he plans to stop by Geocorner to visit with faculty during the upcoming volleyball season.

Kathanne Lynch, BS '80, retired from her position as president of Johnson Oil Corp. in 2007. She lives in the foothills near Denver. "I still play amateur golf," she says, "but my new passion is bird watching."

Following his 20-year class reunion, **Clark Callander**, BS '80, launched a successful investment banking firm called Savvian and sold it to GCA. GCA Savvian is now listed on the Tokyo Stock Exchange.

1981

Joan Harris, BS '81, has been living in Albuquerque and working at Sandia National Laboratories for 15 years. Her husband, John Aidun, also works at Sandia. Joan and John have two children, Ruby, 8, and Ivan, 11.

1982

Caroline Wehling, BS '82, has been working as an attorney at the Environmental Protection Agency for 22 years, working part time since her children were born in 1997 and 1998. Caroline says that she is still using her Earth science background to help understand water issues – such as arsenic in the drinking water – that she works with every day. She writes: "Am very grateful for my years at Stanford, very fond memories of Geology 101, Rocks and Minerals, Applied Earth Science, and summer field geology, among others!"

1983

Rona Donahoe, PhD '84, is a professor in the Department of Geological Sciences at the University of Alabama. She received the Outstanding Educator Award from the Gulf Coast Association of Geological Society at the 2007 GCAGS Meeting in Corpus Christi, Texas. She and her husband Jim have been at the University of Alabama for 23 years.

After staying home to raise her three children, **Laura Charlton Cole**, BS '83, is teaching science to elementary school students. Her oldest son completed his freshman year at Stanford and has an interest in physics and chemistry. "Possibly, another generation will pass through the School of Earth Sciences," she says. "Who knows?"

1984

Lawson Hill, PhD '84, has worked for Clean Air Task Force, a Boston-based nonprofit, for eight years. He works on climate-related projects, such as black carbon climate forcing and underground coal gasification. "While I miss the hard rocks I came to know and love at Stanford," he says, "at least I live on top of sillimanite schist in New Hampshire."

1985

Jean Bahr, MS '85, PhD '87, is department chair in the Department of Geology at the University of Wisconsin, Madison. She says that she has had the pleasure of hosting several Stanford alumni as visiting speakers, including Jun Butler and Naomi Oreskes.

Coleen Shannon, MS '85, works for Chevron in Alaska.

Michael Wheatall, MS '85, is manager of drilling and production technology for ConocoPhillips.

1986

Chris Friedemann, BS '86, MBA '92, is a petroleum engineer running corporate marketing for ION, a leading geophysical company. He says of his work: "Talk about cross-disciplinary studies!"

1993

Christina Massell Symons, BS '93, works from home part time for Scripps Institution of Oceanography while "raising two young kids and moving where the Navy sends us," she says. "All is well! Our life is full."

1995

Andrew Malk, BS '94, MS '95, MBA '01, lives in San Diego, where he grew up. He is managing director of the Midtown Group, a real estate investment company, where he heads acquisitions. Andrew says that since he joined the company, it has become a funding driver of green buildings, particularly retail buildings, helping tenants achieve LEED certification. As a volunteer, Andrew serves on the Environmental Working Group of the San Diego Foundation and advises local land trusts.

1997

Rachel Beane, PhD '97, is chair of the Geology Department at Bowdoin College. She has two children, 4-year-old Zander and 2-month-old Kira.

Stephanie Page, BS '97, MS '97, is the renewable energy specialist at the Oregon Department of Agriculture. She lives in Salem, Oregon, with her significant other, Jeff. Stephanie says, "It was great to see several ESys folks at the reunion. I always love to hear what everyone is doing!"

1998

Jeffrey Heys, BS '98, says that he is happily married to Penny Bauder, a fellow Earth scientist and outdoor enthusiast. He works for the National Park Service and defends Alaska from invasive species.

Edwin Lin, BS '98, is a senior geologist/hydrogeologist at Todd Engineers in Alameda, California. He obtained his MS in groundwater hydrology at Flinders University in Adelaide, Australia in 2006.

1999

Cecile Coulon, BS '98, MS '99, is in veterinary school at the University of California at Davis.

2001

Todd Greene, PhD '01, is an assistant professor in the Department of Geological and Environmental Sciences at California State University at Chico.

Sandy Chang, BS '01, MS '03, PhD '07, obtained a PhD in civil and environmental engineering at Stanford in September 2007.

2002

Amber Kerr, BS '02, MS '02, is enrolled in the PhD program in the Energy and Resources Group at the University of California at Berkeley. She passed her qualifying exam and has started her fieldwork on the effects of climate change on agro-forestry in Southern Africa.

Ziad Sami Labban, SEP Cert '02, is the president and chief executive of Saudi Refining Inc., which is based in Houston, Texas. The company is a joint venture partner with Shell in three refineries and about 8,000 Shell-branded service stations in the eastern and southern United States.

2003

Ellen McCullough, BS '03, MS '03, has moved to Seattle to help launch a new initiative on agricultural policy and statistics in the Bill and Melinda Gates Foundation's Global Development Program. She was previously at the Food and Agriculture Organization of the United Nations in Rome. Ellen recently completed editing a book titled *The Transformation of Agri-food Systems: Globalization, Supply Chains, and Smallholder Farmers*, which will be published this year.

2004

Soizic Guen, MS '04, is a reservoir engineer at StatoilHydro in the North Sea Troll field.

Thomas Burrow, BS '04, MS '04, is an environmental educator at Walden West Outdoor School, in Saratoga, California. He plans to marry Danielle Bird Robinson in October 2008.

2006

Congratulations to **Adam Kreek**, BS '06, who won a gold medal at the 2008 Beijing Olympics rowing with Canada's Men's Eight team. Way to go, Adam!

FAREWELLS

Ahmad Amin Hassan, MS, '59, died in July 2007. He earned his PhD from the New Mexico Institute of Mining & Technology in 1963. He worked for the California Department of Water Resources for 30 years before retiring in 1996. He is survived by his wife Gloria (Lowry) Hassan, BA '60, two sons and two grandchildren.

Carl K. Seyfert, PhD '65, died in October, 2006 after suffering from Parkinson's Disease for 12 years. He was born in 1938. He obtained his PhD in geology from Stanford in 1965. While at Stanford, he lived in Escondido Village. He wrote *Earth History & Plate Tectonics: An Introduction to Historical Geology*, published by Harper & Row in 1973. He was editor of *The Encyclopedia of Structural Geology and Plate Tectonics*, published by Van Nostrand Reinhold in 1987. He was professor of geology at Buffalo State University College from 1967 to 1998. He is survived by Karen Seyfert, his wife of 47 years, and two daughters. His family says that he was always grateful for his Stanford education.

Marianne E. (Blenk) Lynnworth, BS '59, died in December 2007 from complications of brain cancer at her home in Massachusetts. Born in Berlin, she earned the equivalent of a doctorate in natural sciences from the Technical University Carolo-Wilhelmina in Braunschweig in 1957. A Fulbright travel

grant brought her to study at Stanford University's School of Earth Sciences in the late 1950s. She later worked as a research assistant in the geography department at the University of Maryland in College Park, as well as at American University and Frederick Community College in Maryland. In addition to her husband, Lawrence, Mrs. Lynnworth is survived by her three children, her sister, and three grandchildren.

William R. Normark, BS '65, died in January at his home in Sunnyvale, after fighting cancer for nearly eight years. Bill attended Stanford for his undergraduate studies and Scripps Institution of Oceanography in La Jolla for his PhD. While at Scripps, he started his pioneering studies on submarine fans using the newly developed remotely operated vehicle (ROV) Deep Tow under Fred Spiess's guidance. There, he also met his bride-to-be, Dorothy Jean "D.J." Detrich. After Bill received his PhD, he and D.J. spent four years at the University of Minnesota in Minneapolis before heading west again in 1974 where Bill began a distinguished career at the U.S. Geological Survey (USGS) in Menlo Park. Bill was a recipient of the U.S. Department of Interior's Meritorious Service Award (1986) and Distinguished Service Award (2002). He was elected a Fellow of the American Geophysical Union in 2006.

Stay In Touch!

Let us know what you're doing now! Send updates and news items to Mona Tekchandani ('96), Director of Alumni Relations and the Earth Sciences Fund, monalisa@stanford.edu, 650-723-2101.

Smart Energy

At first glance, the unfiltered world of blogging may seem like the polar opposite of the polished approach that a university has toward image and messaging. As a variety of voices across Stanford are demonstrating, however, this kind of communication medium can quickly and easily share innovative thinking and research in an easily accessible manner.

Take Margot Gerritsen (Energy Resources Engineering), PhD '97. She became frustrated realizing how much good information in informal chats between colleagues never makes it out to the general public. Instead, she saw often biased reports on energy issues being brought up again and again in traditional news media. So she started her own podcast called the *Smart Energy Show*. Her purpose is to share information in a more informed and no-nonsense way while also providing broader contexts for understanding our current energy portfolio and how it may look in the future. To do this, she records 15-minute conversations with academics, venture capitalists, and industry leaders.

"I have a fantastic excuse to go and interview people and talk to them. This is something that otherwise I wouldn't do," said Gerritsen. She initially started the blog with Stanford-based or visiting researchers, but is now going farther afield. Recent trips

have included helicoptering out to an offshore oil-drilling platform in the Gulf of Mexico; visiting with energy planners, ranchers, and facility operators about the special energy needs of Hawaii; and even a tour of the wind and tidal resources of the Orkney Islands,

north of the Scottish mainland. "I've noticed in the last half year that I now have a much wider, more complete view. I have a much better idea of what's going on," she says.

Gerritsen said her extensive traveling and being on the tenure track make it difficult for her to continue producing a steady stream of episodes. But she remains excited about her blog and would like to reach a stage where she can distribute podcasts to colleagues who are teaching energy courses.

Visit the Smart Energy Web site to view Gerritsen's podcasts—<http://smartenergyshow.com>.



Margot Gerritsen uploads a podcast onto her Smart Energy Show website. Photo by Stanford News Service.

Stay Connected

We'd love to hear from you! Please contact Mona Tekchandani ('96), Director of Alumni Relations and the Earth Sciences Fund, monalisa@stanford.edu, 650-723-2101 and let her know what you think of the newsletter and what you'd like to read about in future issues. Stay up-to-date in the alumni section of the School of Earth Sciences Web site by visiting <http://earthsci.stanford.edu/alumni>.



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