GEOLOGY & GEOPHYSICS NEWS

Yale University | Department of Geology and Geophysics Fall 2010

New Faculty in Geology & Geophysics

Seven new assistant professors have joined the Department in the last three years. Here they are as a group in the Departmental Lounge. From the left: Kanani Lee (geophysics), Zhengrong Wang (geochemistry), Mary-Louise Timmermans (oceanography), Maureen Long (seismology), Trude Storelvmo (climate), Bill Boos (climate), Hagit Affek (geochemistry). (Elias Loomis in portrait)

Chairman's Letter

David Bercovici (david.bercovici@yale.edu)

Dear Friends and Alumni of Yale Geology & Geophysics,

I'm happy once again to report on latest developments in our department.

This academic year saw the arrival of our latest faculty addition, **William Boos**, who joins us as an Assistant Professor. Bill's PhD is from Harvard University and he recently completed a postdoctoral fellowship at MIT. His research involves the effect of global climate change on regional circulation, such as the monsoonal cycles. Soon after Bill arrived he was awarded the James Holton Award for an outstanding junior scientist by the American Geophysical Union's Atmospheric Science Division. With the addition of Bill Boos and two previous junior hires—arctic oceanographer **Mary-Louise Timmermans** and atmospheric physicist **Trude Storelvmo**—our atmosphere, ocean, and climate dynamics group has effectively doubled in size. Moreover, the hiring of geochemists **Hagit Affek** and **Zhengrong Wang**, both of whom do work in atmospheric chemistry and/or paleoclimatology, the department's footprint in the area of climate science has considerably expanded (also counting our eminent senior faculty working in this area as well). The expansion of these research areas has also prompted the building of a Geology & Geophysics supercomputer cluster dedicated to climatological and geophysical numerical modeling. In total, the Geology & Geophysics department has unequivocally become the nexus for climate science at Yale.

Along the same lines, the department's contribution to the ever-growing Yale Climate & Energy Institute (of which I've written previously; see also www.climate.yale.edu) remains substantial. In addition to providing scientific expertise and leadership roles on the Steering and Executive Committees of the Institute, a group of G&G faculty, led by **Zhengrong Wang**, parlayed a YCEI seed grant on carbon sequestration into a $2.5 million grant from the Department of Energy, making Yale a major player in this arena. The project involves sequestration in mafic rocks, like basalt and peridotite, which is considered one of the most promising methods of carbon dioxide sequestration because it stores carbon stably by creating carbonate minerals from siliceous ones. This project is considered one of the first major successes of the YCEI.

A future Yale Climate & Energy Institute activity of interest to G&G alumni is the Annual Conference, regarding energy transitions and security, being organized by G&G Professor **Mark Pagani**. This event

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follows immediately after the Yale Alumni in Energy Conference, April 8, 2011, (with an overlap keynote lecture by G&G alumnus **Dr. David Lawrence G '84** of Shell Corporation). We know many G&G alumni will attend the YAE conference and we hope you will plan to participate in the YCEI Annual Conference as well.

In addition to growth in the area of climate science, the department has continued to make major impacts and strides in other areas. For example, there have been several major paleontological discoveries regarding dinosaur coloring and eating habits from **Derek Brigg's** and **Jacques Gauthier's** groups, new experiments on the nature of minerals near the core-mantle boundary from **Kanani Lee's** group, revelations about glacial erosion of mountains by **Mark Brandon's** team, a new seismological field program in Peru to study the Nazca subduction zone by **Maureen Long**, a new theory for a crucial step in solar system formation from **John Wettlaufer**, and the discovery of enigmatic metamorphic rocks in eastern Connecticut with probable micro-diamond inclusions by **Jay Ague**. Additionally, the department is building up efforts in the field of extra-solar planetary research in collaboration with new Astronomy hire, Professor Debra Fischer, who has a joint appointment in Geology & Geophysics.

To explore future areas of geoscience, the department has been running exploratory symposia (starting last spring and going through Spring 2011), in preparation for considering where we are going in the next ten to twenty years. Last May we held our first symposium on "Frontiers in Paleontology and Geobiology", which was a great success and displayed new directions and talent in areas ranging from astrobiology to the latest discoveries in vertebrate paleontology. Earlier this Fall we held a symposia on "Frontiers in Crustal Geoscience", which was also highly successful and covered areas from the origin of continental crust to the dynamics of river networks. This May (2011) we will have our third (and probably not our last) symposium on Earth system interactions, concerning exchanges of volatiles like water and carbon between the atmosphere, ocean and solid Earth. Information about past and future symposia can be found at www.geology.yale.edu/seminars.

Finally, following the terrific G&G Alumni Reunion of Fall 2009, which many of you attended, there has been a new effort to form a G&G Alumni Liaison Committee, spearheaded by **Tom Jantzen '85**, who has kindly provided a brief summary in this newsletter. This committee is working to strengthen ties between the alumni and the department, with common activities such as recruitment of majors and future reunion events. This committee is also discussing ways in which alumni can help department educational activities, for example, field work (for both classes and undergraduate research projects), which many G&G alumni found to be their most memorable and transformative experiences at Yale.

Looking back on the last four years, the department has undergone significant expansion, with the hiring of seven new faculty (see attached photo), the tenuring of five faculty into the ranks of full professor, building several new labs, renovating all of our classrooms and lecture halls, and leading in the initiation of the new Yale Climate & Energy Institute. The recent release of the National Research Council's report on graduate programs places our department in the very top tier of programs in Earth sciences, with one of the highest rankings of Yale science departments; and this was only based on 2006 data. The recent economic downturn will doubtless slow down further expansion for a while, but we have managed to accomplish much already and we are determined to make great strides in the future.

Once again, thank you for your support and interest in the department and bearing with me in summarizing our activities. I hope this newsletter finds you well, and I wish you all the best for the coming year.

Alumni Advisory Panel

Following the successful Alumni Reunion meeting reported in the last Newsletter, it was decided that a panel of former G&G majors might help the Department with some long-standing issues.

The G&G Alumni Panel had its first meeting on August 24th in KGL. Participating in the discussion were **Dave Bercovici** (Chairman of the Department) and alumni **Julie Edwards '80**, **Joe Greenberg '83, Tom Jantzen '85, and John de Neufville '61**. The major goal of this group is to foster communications between the Department and the alumni across a variety of initiatives, including:

- increasing the awareness and appeal of the G&G major
- enhancing connections between the Department and the alumni
- exploring cross-disciplinary opportunities with other departments
- facilitating relationships with the Development Office

Comments from interested alumni are welcome and can be sent to: tjantzen@comcast.net

FACULTY RESEARCH

Using Seismological Observations to Probe the Dynamics of Subducting Slabs

By Maureen Long (maureen.long@yale.edu)
***Maureen Long** joined the Department in January 2009, following a postdoc time at the Carnegie Institution of Washington. Maureen is a seismologist.*

Fig. 2. Maureen Long and graduate student Erin Wirth discuss data from the Japan subduction zone.

The recycling of plates of oceanic lithosphere back into Earth's mantle is perhaps the most important process that takes place involving the dynamics of our planet's interior. Subducting slabs drive the movement of tectonic plates (and thus the mechanics of hazards such as earthquakes and volcanoes) and their motions stir and cool the Earth's mantle. However, our understanding of how slabs sink from the surface to (possibly) the base of the mantle is crude, and how slabs deform and interact with the surrounding mantle during their descent remains an open question. My research group at Yale uses a combination of seismic data analysis and modeling as a way to study how slabs deform and how they stir the mantle as they sink from the surface to the core-mantle boundary.

When the mantle flows and deforms as a consequence of convection, the flow leaves behind a telltale "fingerprint" in the way seismic waves behave as they pass through. Mantle flow leads to seismic anisotropy, a property which refers to the directional dependence of seismic wavespeeds. Seismologists can determine the anisotropy and use the information to analyze the patterns of flow in different parts of the mantle.

My Yale group uses studies of seismic anisotropy in subduction regions to understand the pattern of mantle flow associated with downgoing slabs, and the work is turning up some surprising results. It has long been thought that as slabs descend, they tend to drag the surrounding mantle down with them, resulting in two-dimensional corner flow above the slab and entrained flow beneath the slab. But analysis of seismic anisotropy in subduction zones around the world demonstrates that this simple model almost never holds up. Rather, sinking slabs sometimes collapse back on themselves, and the motion tends to push mantle material out to the side and around the slab (Fig. 1) rather than dragging it down. The discovery that mantle flow tends to be parallel to subducting slabs has implications for understanding the generation and transport of melt above subducting slabs, and for the dynamics of the mantle as a whole. Graduate student **Erin Wirth** (erin.worth@yale.edu) (Fig. 2) is tackling the problem of anisotropy and mantle flow in the Japan subduction system by combining various seismological techniques, while graduate student **Brad Foley** (bradford.foley@yale.edu) is studying the pattern of mantle flow beneath the Tonga slab. A new effort is underway, in collaboration with Chris Kincaid at the University of Rhode Island and Laurent Montesi at the University of Maryland, to create geodynamical models (both laboratory and numerical)

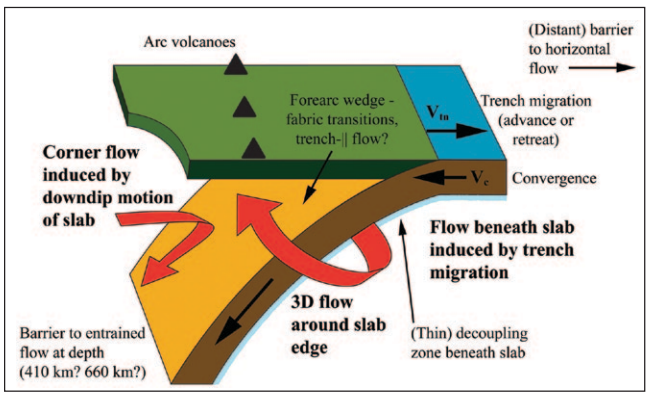

Fig. 1. A sketch of a proposed model for mantle flow in subduction systems.

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of the subduction process, and to compare their predictions to seismological observations.

Another major enigma related to subduction is the sometimes circuitous route that slabs take through the mantle as they descend. For example, beneath much of Peru the subducting Nazca slab descends to a depth of about 100 km, then flattens and travels horizontally in the mantle for ~500 km before resuming its descent. We do not understand what controls this process, but a similar regime of so-called "flat-slab" subduction may have been responsible for widespread mountain building (and subsequent unusual volcanism) during the Laramide orogeny in western North America. In order to understand the dynamics of flat-slab subduction beneath Peru, we are deploying 40 broadband seismometers across the Peruvian Andes; our collaborators are Lara Wagner at the University of North Carolina and Susan Beck at the University of Arizona. Graduate student **Jenny Hanna** (jenny.hanna@yale.edu) (Fig. 3) is spending most of the fall in Peru installing seismometers, and recent Yale College English major, **Laura Marris '10** (lauramarris@gmail.com) has written a field blog relating her experiences doing field work in Peru this September and October (http://singularsubduction.wordpress.com).

Closer to home, my group has been involved in a major seismological deployment in the High Lava Plains (HLP) region of eastern Oregon; the field work drew to a close in late 2009. The HLP has been the locus of voluminous volcanic activity over the past ~12 Myr that continues to the present day, but it is unclear whether the volcanism is related to the putative Yellowstone plume to the east, subduction of the Juan de Fuca plate to the west, or some other process. The HLP Project is a major interdisciplinary effort geared toward understanding HLP volcanism and involved deployment of over 100 broadband seismometers in eastern Oregon, Nevada, and Idaho. Graduate students **Brad Foley, Jenny Hanna, Duayne Rieger** (duayne.rieger@yale.edu), **Erin Wirth,** and **Patrick Young** (hobart.young@yale.edu) have participated in HLP field work (Fig. 2), and data from the project are now starting to yield exciting results. Analysis of the pattern of mantle flow beneath the HLP, and comparison with geodynamical models, indicates that volcanism is probably controlled by subduction-related processes, rather than by a mantle plume—an inference that is helping the project's scientific team to unravel the mysteries of the origin of the HLP.

Fig. 3. Graduate student Jenny Hanna services a seismic station in the High Lava Plains of eastern Oregon.

Subducting slabs start their journey at the surface, but global tomography models suggest that many slabs make it all the way to the core-mantle boundary (CMB). The so-called D" region at the base of the mantle represents a major enigma for seismologists, geodynamicists, and mineral physicists—the region is associated with a recently discovered mineral phase change, and aspects of seismic wave behavior in D" have been puzzling seismologists for decades. Observations of seismic anisotropy in D" can help us unravel the pattern of flow and the base of the mantle and tell us about the interaction between the remnants of subducting slabs and the CMB. Postdoctoral researcher **Xiaobo He** (xiaobo.he@yale.edu) has recently arrived at Yale from Yonsei University in South Korea to work on characterizing seismic anisotropy at the base of the mantle, trying to tease out inferences about mantle flow and the dynamics of slabs as they interact with the CMB.

There are still many unanswered questions related to slab dynamics: How do slabs interact with the mantle around them as they sink? What controls the path they take through the mantle, and why don't they sink straight down? How do the remnants of slabs interact with the lowermost mantle, and what are the consequences of this interaction? Sinking slabs represent a crucial component of the solid Earth system, but fundamental aspects of their behavior continue to challenge us. Using the tools of observational seismology and geodynamical modeling, my research group is striving to address these unanswered questions.

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Exceptionally Preserved Fossils

By Derek Briggs (derek.briggs@yale.edu)
***Derek Briggs** is the Frederick W. Beinecke Professor of Geology and Geophysics, and Director of Peabody Museum*

New fossil discoveries

The 15 million years or so after the start of the Cambrian (542 m.y. ago) witnessed the emergence of almost all the major animal groups—the so-called Cambrian explosion. This was followed, about 35 million years later, by a dramatic diversification of marine life, the Great Ordovician Biodiversification Event. These events are recorded by the presence of shelly fossils, but only about 40 percent of marine animals have shells—the remainder are soft-bodied and rarely fossilized. Clearly unusual deposits that preserve evidence of soft tissues provide essential information about the evolutionary history of the majority of animals (e.g., jellyfish, worms, many arthropods).

Fortunately rocks of Cambrian age yield an unusually high number of soft-bodied fossils compared to younger sequences. This may reflect the rarity of deep burrowers at this time—animals overcome by current-transported sediment ended up out of reach of scavengers. The early evolution of the major animal groups is recorded in deposits like the Maotianshan Shale near Chengjiang, China and the Burgess Shale of British Columbia. Many of these remarkable animals, including the giant predator *Anomalocaris*, lacked hard skeletons and are only preserved in these exceptional deposits. Until recently these Burgess Shale-type creatures were unknown in younger rocks but this has changed with discoveries of remarkable fossils (Fig. 1) near Zagora in Morocco by postdoc **Peter Van Roy** (peter.vanroy@yale.edu).

Fig. 1. The arthropod *Furca* from the Ordovician Fezouata shales, Morocco.


Fig. 2. Jakob Vinther, Peter Van Roy, and Derek Briggs in the field in Morocco.

Van Roy has found a diversity of soft-bodied animals in rocks of Early Ordovician age (Fig. 2). These Moroccan fossils, from the Fezouata shales, provide a link between the products of the Cambrian Explosion in the Burgess Shale and elsewhere, and the subsequent Great Ordovician Biodiversification Event. Finding deposits that provide the right circumstances to preserve soft-bodied animals is essential to tracing the history of life.

Apart from yielding unusual animals that would look perfectly at home in the Cambrian, the Fezouata shales are remarkable in how frequently soft-bodied fossils occur. Specimens have come from more than 40 small excavations over an area of 500 km_2 in the Draa Valley north of Zagora where the productive sequence is over 700 m thick and spans some 8 m.y. Upstate New York is a less promising collecting ground than the deserts of the AntiAtlas, not least because of vegetation and overburden, but it provides a similar lesson. We have reexcavated Beecher's Trilobite Bed (Upper Ordovician), which is famous for the preservation of trilobite limbs investigated by Yale paleontologist Charles Emerson Beecher in the 1890s. Graduate student

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Una Farrell (una.farrell@yale.edu) investigated how the trilobites became mineralized in pyrite, and discovered a number of new beds with pyritized soft-tissues in the process. Several other sites with pyritized fossils (Fig. 3) have also turned up across northwestern NY showing that, where conditions are favorable, soft-bodied fossils are much more widespread than previously realized.

Fig. 3. The trilobite *Triarthrus*, preserved in pyrite, from the Ordovician of Upstate New York.

Molecular paleontology

Although the records of Cambrian soft-bodied fossils are patchy, they provide important information about the ancestors of today's marine life, how they are related, and the sequence in which they evolved. Timing the origin of many soft-bodied groups is difficult, however, as they have a very sporadic fossil record. Recent advances in sequencing the genome of living animals have provided a new and independent approach to interpreting the Cambrian explosion. The surge of interest in biodiversity prompted evolutionary biologists to use DNA sequences to determine the relationships of major groups of modern organisms and the order in which they branched from the tree of life. Calibrated with dates from the fossil record, differences in the gene sequences from organisms on the tree can be used to calculate rates of genetic change over time, and thus the timing of branching events—a kind of "molecular clock."

Small highly conserved genes called microRNAs are particularly useful for determining relationships between major animal groups and are the subject of a collaboration between members of our group and Kevin Peterson's lab at the University of Dartmouth. Graduate student **Erik Sperling** (sperling@fas.harvard.edu) (now at Harvard) used microRNAs to investigate the relationships and divergence history of sponges. He concluded that sponges originated in the Neoproterozoic more than 100 m.y. ago before the first spicules are found in the fossil record in Early Cambrian rocks. Sperling and fellow graduate student **Jakob Vinther** (jakob.vinther@yale.edu) also used microRNAs to resolve debates about the relationships and evolutionary history of different groups of marine worms based on other genes. They were able to show that the order in which bristle worms and peanut worms (polychaetes and sipunculans) appear in the fossil record corresponds to the sequence in which they evolved.

Unfortunately the molecules that carry genetic information are very prone to decay—extensive DNA sequences are essentially unknown in fossils more than 100,000 years old even in settings like the Siberian permafrost. So insights about the early evolution of animal groups based on gene sequences can only come from living organisms. Proteins within mollusk shells survive much longer. The isotopic composition of nitrogen and carbon in these proteins can yield valuable information about the ecological role (e.g., predator, grazer) of living and fossil animals. Graduate student **Michelle Casey** (michelle.casey@yale.edu) has used this approach to examine the effects of pollution on clams and snails in Long Island Sound. Her analysis of shells accumulated by native Americans hundreds of years ago provides a pristine ecological baseline against which recent changes to molluscan communities can be evaluated.

Other kinds of organic molecules are much more decay resistant—otherwise there would be no fossil fuels! The organic remains of the cuticles of shrimps and leaves, for example, are common in the fossil record. Their chemistry is altered, however, to longer-chain macromolecules similar in composition to kerogen. Little of the original chemistry is evident in fossils predating the Tertiary, although postdoc **Neal Gupta** (sngupta@iisermohali.ac) (now at the Indian Institute in Mohali) used synchrotron analyses to show that traces of chitin, a major component of arthropod cuticles, can persist even in Paleozoic fossils. More striking perhaps was our laboratory demonstration that the aliphatic components that make up kerogen begin to form in decaying shrimps in less than a year. Thus studies of fossilization can provide insights into the process involved in the formation of hydrocarbons.

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Fossil preservation

Understanding decay and preservation is essential to interpreting the significance of fossils. The living notostracan crustacean *Triops cancriformis* was thought to range back 200 m.y. to the Late Triassic—making it a classic "living fossil." Observations of decaying specimens of this "tadpole shrimp" by graduate student **Thomas Hegna** (thomas.hegna@yale.edu) showed that important differences between the fossils and the living species are real, and not just a result of degradation. No fossil examples can be identified confidently as *Triops cancriformis*—the so-called living fossil has no fossil record! Hegna has described beautifully preserved new notostracans from China (Fig. 4).

Fig. 4. The notostracan ("tadpole shrimp") *Chenops* from the Cretaceous of China.

Fig. 5. A chrysomelid beetle from the Eocene of Eckfeld, Germany. The color is structural in origin.

Postdoc **Marc Laflamme** (marc.laflamme@yale.edu), in contrast, is investigating the preservation of some of the oldest large organisms, the enigmatic frond-like fossils that abound in some late Precambrian (Ediacaran) assemblages, notably at Mistaken Point in Newfoundland. He is the first to section specimens to establish their three-dimensional form. Maps of the bulbous holdfast that anchored the fronds in the sediment show a concentration of elements representing the position of a microbial film or mat that enveloped the structure (microbial mats were common in the Ediacaran seas as grazing invertebrates had yet to evolve). Intriguingly our analyses also reveal that the sediment within the holdfasts is distinctive in composition indicating that the organism itself may have incorporated sediment to provide ballast!

In the meantime **Alex Lin** (jihpailin@gmail.com) (now at the Nanjing Institute, China) analyzed the composition of specimens of the arthropod *Naraoia*, which is found in Burgess Shale-type assemblages from Lower to Middle Cambrian age in China and British Columbia. All the fossils consist of the altered organic remains of the cuticle while the gut trace is the result of mineral precipitation. Contrasts in the appearance of specimens of *Naraoia* from different localities are the result of later diagenesis and weathering.

There is also much to learn about the fossilization of shells. Postdoc **Richard Krause** (richard.krause@yale.edu) is investigating the replacement of original calcium carbonate by silica, a type of preservation that allows spectacular specimens to be extracted from limestones by dissolving them in acid. Through laboratory experiments and investigation of thousands of fossils in the collections of the Yale Peabody Museum of Natural History, Krause is finding that silicification, like other modes of preservation, offers a somewhat biased view of ancient marine communities because some types of shells are simply not preserved.

Other research on fossil preservation led graduate student **Jakob Vinther** to observe that structures on fossilized feathers and fur, previously interpreted as preserved decay bacteria, are melanosomes, the organelles that synthesize melanin. This led to our discovery, with Rick Prum, Chair of Ecology and Evolutionary Biology, of iridescent structures in a feather from the Eocene of Messel, Germany, and, with a larger team of collaborators, to the color reconstruction of the plumage of a feathered dinosaur, *Anchiornis* from the Jurassic of China. Postdoc **Maria McNamara** (maria.mcnamara@yale.edu) is extending our research on color preservation to encompass fossil insects, including the fabulously shiny jewel beetles from Messel and other Tertiary lake deposits (Fig. 5) and much rarer examples of fossil butterflies. Through exceptional preservation, ancient animals can show their true colors!

New Analytical Facility

Zhan Peng checking standards.

Zhengrong Wang preparing samples for analysis.

Yale's ICP-MS (inductively-coupled plasma mass spectrometer) facility (icpmalab.geology.yale.edu) came on-line in April, 2010, in the Department of Geology and Geophysics, designed and built by the Pico-trace Company from Germany and managed by Babbidge. It is composed of two underclass-10 laminar flow clean rooms ("class-10" means that the maximum number of larger than 5-micron particles allowed in one cubic feet of air is 10), one single collector ICP-MS, one multicollector ICP-MS, and one Excimer laser (193-nm wave length). This facility is designed for analyzing both concentrations and isotope compositions of most elements on the periodic table with great precision. The single collector ICP-MS can measure multiple elements with concentrations in the range of 1 part per trillion (ppt) to 1 part per million (ppm) within a few minutes. The multicollector ICP-MS can measure isotope compositions of most stable and radiogenic isotopes, and the laser will facilitate all measurements in situ. This facility will be used to investigate problems in geology, environmental sciences, chemistry, material sciences, chemical engineering, archeology, and metallurgy, and is currently directed by Assist. Prof. **Zhengrong Wang** (zhengrong.wang@yale.edu). The key features of the facility are (1) computer-controlled air-handling system to automatically adjust temperature, humidity, air-flow rate and hot-plate temperature; (2) laminar flow lab and work stations; (3) all plastic furniture, duct-work and ceiling; and (4) "state-of-the-art" ICP-MS instruments.

Visiting Faculty From Other Institutions

Siver, visiting from Connecticut College.

Peter Siver is visiting from Connecticut College, where he is the Becker Professor of Botany and Director of the Program in Environmental Studies. Peter's research, in collaboration with **Leo Hickey**, focuses on the study of freshwater algae, with an emphasis on the use of diatoms and chrysophytes as indicators of environmental change. Currently, he is investigating the remains of siliceous microbiota in three ancient kimberlite maar lakes from the Canadian Arctic that existed during the Cenozoic hot house. While at Yale, he hopes to use remains of siliceous algae from specimens housed in the Peabody collections in order to better understand evolution of the diatom flora in North American lakes over the Cenozoic.

Zhao, visiting from the University of Fort Hare, Republic of South Africa.

Professor Baojin Zhao (bzhao@ufh.ac.za), Chair of the Department of Geology, University of Fort Hare, South Africa, is visiting the Department for the Fall Semester 2010. Professor Zhao hails originally from Chengdu, China, but earned his Ph.D. from Witwatersrand University in Johannesburg; he is now a citizen of South Africa. Baojin is working with **Ruth Blake**.

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Bill Boos

Congratulations to **William R. Boos** (William.Boos@yale.edu) for winning the 2010 James R. Holton Junior Scientist Award from the Atmospheric Sciences Section of the American Geophysical Union. The citation for the award quoted a letter of nomination, as follows: "contributed significantly to our understanding of the role of wind induced surface heat exchange on monsoon onset, both theoretically and observationally, and reflected a deep and broad understanding of monsoons and general aspects of tropical meteorology. "In addition, as documented in a paper in *Nature* this year, "Among other accomplishments, Bill showed that the conventional view that the Asian monsoon is driven primarily by heating of the Tibetan Plateau... is probably wrong; instead, it seems to be driven by surface fluxes from the Bay of Bengal, aided by the prevention of southward flow of low entropy air by the Himalayan range. This is a very fundamental contribution to our understanding of the South Asian monsoon and will impact the field for many years to come."


Bob Gordon

Robert Gordon (robert.gordon@yale.edu) is congratulated for the General Tools Award, for Distinguished Service to Industrial Archeology. The award is the highest honor bestowed by the Society for Industrial Archeology. The lengthy citation for the award stressed the importance of Bob's research and his teaching. It also pointed out that "Bob's experience as a surficial geologist, metallurgist, and historian have made him an almost unique historical geographer and have inspired his articles, books, lectures, field guides for students and professionals, and course materials on landscape changes related to industrial history. His ability to present complex, long-term patterns in readily-accessible language has instructed large numbers of students, archaeologists, and historians in the origins of the landscapes they see today, which are often deceptively bucolic."


Ronald Smith

Ronald Smith (ronald.smith@yale.edu), Damon Wells Professor of Geology and Geophysics, is congratulated for receiving the 2010 Mountain Meteorology Award, presented in "recognition of your outstanding contributions to mountain meteorology." Squaw Valley, CA 2010.


Peter Lipman

Congratulations to **Peter Lipman '58** (plipman@mojave.wr.usgs.gov) on receiving the first Distinguished Geologic Career Award of the MGPV Division of GSA. The Mineralogy-Geochemistry-Petrology-Volcanology (MGPV) Division selected Peter for the inaugural award in recognition of "his seminal papers in volcanology and igneous petrology and for their significance to tectonics, economic geology, and volcanic hazards." His citation reads, in part "Peter Lipman shaped our view of basaltic volcanism, particularly with regard to intraplate volcanism of the Rio Grande Rift and Hawaii, through his remarkable paper on the 1984 eruption of Mauna Loa volcano (Lipman and Banks, 1987). The paper stands as the most detailed and insightful investigation of an aa flow emplacement that exists for any volcano. He and Jim Moore also put together the astounding

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story of giant landslides formed by partial collapse of individual Hawaiian volcanoes (e.g., Lipman et al., 1988). This work represents part of Peter's long-term fascination with the growth of Hawaiian volcanoes, work that has led him to extensive exploration of the submarine, as well as subaerial records of volcanic history (e.g., Lipman et al., 2002).

Dana Royer

Congratulations to **Dana Royer G '02**(droyer@wesleyan.edu) for the GSA's Young Scientist's Award for 2010. Also known as the Donath Medal for the generous couple, the Donaths, who funded it, the Young Scientist Award is for a scientist who is 35 years of age, or younger, in the year of the Award. The citation for the award reads, in part: "Dana is best known for quantifying pCO_2 through time from many proxies, including his own major line of research estimating paleo-pCO_2 from fossil plant cuticles. Dana's work on pCO_2 through time connects the deep-time record to the present day in societally relevant ways. In a striking set of papers, Dana demonstrated more convincingly than anyone previously that pCO_2 and temperature are well correlated on geologic time scales, and quantified the long-term sensitivity. His high-profile articles in *Science* and *Nature* are widely cited in the modern climate-change literature, including several IPCC and NRC reports."

Skip Hobbs IV

Congratulations to **G. Warfield (Skip) Hobbs IV, '69** (skiphobbs@ammoniteresources.com), who was installed as President of the American Geological Institute on November 2, 2010. The photo of Skip was taken at the departmental alumni reunion, September 2009—he seems to be polishing his oratorical skills in anticipation of his forthcoming appointment.

Erik Sperling in the field in southern Namibia investigating Ediacaran Nama Group fossils (photo by Ian Rose).

2010 George Gaylord Simpson Prize

The Yale Peabody Museum of Natural History (YPM) awarded its George Gaylord Simpson Prize for 2010 to **Erik A. Sperling G '10** (sperling@fas.harvard.edu) and **Jakob Vinther** (jakob.vinther@yale.edu), past- and current doctoral candidates, respectively, in the Yale Department of Geology & Geophysics.

Sperling received the prize for his 2010 paper "Where's the glass? Biomarkers, molecular clocks, and microRNAs suggest a 200-Myr missing Precambrian fossil record of siliceous sponge spicules," co-authored with Jeffrey M. Robinson, Davide Pisani and Kevin J. Peterson (*Geobiology* 8[1]:24–36). Sperling's research encompassed both the earliest evidence for animal life in the fossil record and molecular analysis of modern demosponges to provide insights into the Precambrian origins of multicellular animals more than 700 million years ago.

Vinther was recognized for his 2009 paper, "The canal system in sclerites of lower Cambrian/Sinosachites (Halkieriidae: Sachitida): Significance for the molluscan affinites of the sachitids" (*Paleontology* 52[4]:689–712). Vinther was also a receipient of the 2008 Simpson Prize for a paper on machaeridians, palaeozoic armoured annelid worms, published in *Nature*.

YPM's George Gaylord Simpson Prize is awarded annually to a Yale University graduate student or

Jakob Vinther (photo by Ryan Carney)

recent doctoral candidate for a paper concerning evolution and the fossil record. The prize is named for **George Gaylord Simpson** (1902–1984; Yale PhD '26), one of the most influential paleontologist of the 20th century and a major proponent of the modern evolutionary synthesis.

New Faculty Appointment

Mike Oristaglio in his office.

When **Mike Oristaglio** left Yale in 1974 he moved on to Oxford University as a Rhodes Scholar. He completed his Oxford D.Phil. in Geophysics in 1978. After 28 years with oilfield services company, Schlumberger, Mike is back at Yale as Senior Research Scientist and a part-time independent consultant, focusing on science, technology, and business strategies in energy and geophysical services.

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V. Rama Murthy

V. Rama Murthy G '57 (vrmurthy@umn.edu) writes, "I came to Yale in 1954 from India, with the notion of a graduate degree in economic geology. **Professor Bateman** was traveling in India the year before and I had an opportunity to meet him. But soon after my arrival, **Richard Foster Flint**, then the Director of Graduate Studies firmly explained to me the need to follow a core curriculum and the value of a broad education, etc., no matter what I wished to specialize in. I followed his advice to finish my Ph.D. dissertation in 1957 "Bedrock Geology of the East Barre Quadrangle, Vermont" —an apprentice mixture of geology, petrology, and structural geology. My advisor was **John Rodgers**, a remarkable intellect on the campus.

An event in my last year at Yale profoundly changed my career. **Karl Turekian** joined the faculty that year, and there was a lot of talk of "geochemistry" in the corridors of Kirtland Hall. At the end of that year, I had a postdoctoral fellowship at Cambridge, England. But Turekian who by this time had become a strong mentor to me persuasively recommended that I go to Cal Tech instead. He called the department chair at Cal Tech and got me a fellowship there. I have fond memories of that summer, both of us driving across the country (then largely without freeways) to Pasadena, CA, in his brand new Ford.

At Cal Tech I joined the isotope geochemistry group, working with Claire Patterson, the discoverer of the age of the Earth. In a paper in 1962, Patterson and I coined and defined the word, "Geochron," for the primary lead isochron that best defines the age of the Earth. This reference isochron is still used today. It was an exhilarating time to be at Cal Tech in the early days of isotope geochemistry and planetary sciences.

A chance meeting with Nobel laureate Harold Urey at Cal Tech resulted in an invitation to join his newly established isotope laboratories at La Jolla, CA, on the campus of Scripps Institution of Oceanography. I worked there as a Research Geochemist on meteorites and planetary science problems using isotope techniques. In 1962, I was appointed an Assistant Professor of Geochemistry in the newly formed University of California now known as University of California, San Diego. In those days there was much talk of the possibility of lunar sample analysis and my ideas of returning to India slowly vanished with the prospect of working on lunar samples.

In 1965 I became an Associate Professor in the Department of Geology and Geophysics at the University of Minnesota. Most of my professional and personal growth occurred here, where I established state of the art isotope laboratories to analyze the Apollo-returned lunar samples and do research on mantle geochemistry using various isotopic systems, taught various courses on geochemistry and planetary sciences and advised students. Promoted

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to a Professor in 1969, I served as the Head of School of Earth Sciences for thirteen years and in the following decade dabbled in various administrative positions (Dean, Vice President for Academic affairs, Vice Provost etc). After my stint in administration, I returned to my department and actively participated in undergraduate teaching, course development and advising. In recognition of these activities, I was appointed the Mr. and Mrs. George W. Taylor Distinguished Professor in 1994.

I retired from the University of Minnesota as the C.S.E Distinguished Professor of Geology and Geophysics, in 2006. Currently I hold a position as Research Professor in the Institute of Meteoritics in the Department of Earth and Planetary Sciences at the University of New Mexico. My wife Janice and I live now in the bucolic little Hispanic village, Corrales, on the banks of Rio Grande with majestic views of Sandia Mountains, about 20 miles north of Albuquerque."

George Devries Klein

George Devries Klein G '60 (gdkgeo@earthlink.net), still works as a consulting petroleum geologist in the greater Houston, TX, area. During the past 17 months, he has been under full-time contract working on international petroleum exploration projects in East Africa and Peru (all based in Houston). With economic uncertainty in the USA, the international arena is where such work is available.

George wrote and published his memoirs *"ROCKNOCKER: A Geologists Memoir"* (CCB Publishing: http://www.ccbpublishing.com/gdklein.html ; amazon.com) in which a long chapter describes his three years at Yale and what happened to him after earning his PhD in 1960.

Bruce and Karen having breakfast on Avanti.

Bruce Clark '63 (bruce-clark@cox.net) reports "On leaving Yale with my BS in Geology in hand in 1963, I headed off to Stanford where I earned a PhD under Ben Page, then to Michigan for a 9-year stint as Assistant and Associate Professor, working on the deformation behavior of the common sulfide ore minerals at high pressure and temperature in a lab I set up in Ann Arbor to squeeze rocks and minerals. As my interests moved on to the mechanics of earthquakes, I decided that a west coast base of operations would put me a lot closer to where the earthquakes were, and since I was doing field-based instrumentation (looking for small precursory stress changes in rocks near the fault zone), I moved to a senior position with Leighton and Associates, a regional geotechnical consulting firm in Irvine, California, in 1977. At Leighton, I learned about engineering geology, evaluating geological and seismic hazards, and the complexities of mapping geology at a scale of 1 inch to 40 feet. A few years later, I ended up running the place as President and CEO, and dealing with the growth of an organization that peaked at about 400 employees in the late 1980s. As if that wasn't bad enough, we had as many geotechnical engineers as we had geologists, and my toughest job was to keep them talking to each other. We had a good run though, working on some of California's biggest and most challenging construction projects. On the side, I also chaired the Advisory Committee for the new California Seismic Hazards Mapping program for the California Division of Mines and Geology (now the California Geological Survey). The resulting maps and methodology for evaluating seismic hazards became the guidelines for the current generation of geological and seismic evaluations for new construction around the State. By 2002, I had had enough of administration and retired from that side of Leighton's business, although I am still a senior consultant. But by then, the California Governor had appointed me to the state's Seismic Safety Commission, which I chaired from 2001-2003. The Commission made some good progress on improving the seismic safety of schools and other public buildings during my seven years of service, but to this

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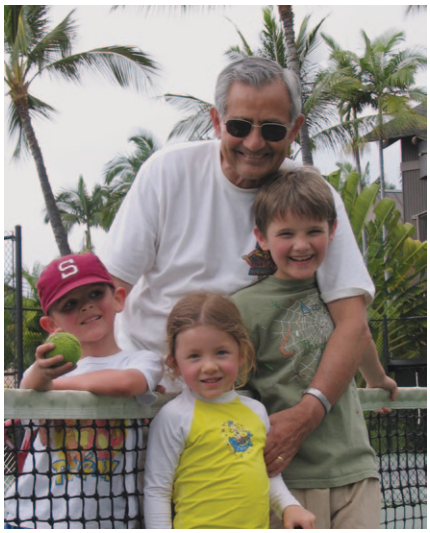
day has not been able to get the State's critical-care hospitals to upgrade their buildings to even the basic non-collapse level of earthquake safety standards. In recent years I have also become more involved in GSA leadership, chairing the Investments Committee, serving on the Audit Committee, and last spring elected to Council.

At about the time of my retirement from Leighton, my wife Karen and I decided that since the kids were grown and off on their own, it was time for us to do something different. So we bought a 40-foot boat in the Mediterranean, and spent the next eight summers visiting several hundred ports and harbors from Spain to Turkey and back. Last month we brought the boat back to Palma, Majorca, where we had begun the epic voyage in the spring of 2003. Our next plan is to do the Great Loop (Intracoastal Waterway, Atlantic, Hudson River, Great Lakes, Mississippi) in a new boat that we will be looking for this coming winter. In the next few years we'll bring it out to the west coast and make it into a vacation getaway in San Francisco Bay, close to where our first grandchild lives.

Robert I. Tilling G '63 (volkno@earthlink.net) writes "After obtaining my Ph.D. in geology in 1963 from Yale, I worked for the U.S. Geological Survey (USGS) for 42 years, first in the Boulder batholith, southwestern Montana, and then afterward mostly on studies of volcanic eruptions and associated hazards. I also served in several USGS management positions: Scientist-in-Charge of the USGS Hawaiian Volcano Observatory (HVO), 1975-76; Chief of the Office of Geochemistry and Geophysics,



Bob Tilling enjoying quality time with his grandchildren on the Big Island of Hawaii in 2007.

1976-1981; and Chief Scientist, Volcano Hazards Team, 1996-1999. I found it particularly satisfying that my efforts—in research as well as management positions—had both scientific and societal relevance. Career apogees included working at HVO and directing the USGS scientific response to the 1980 eruptions of Mount St. Helens Volcano. Although I retired in early 2004, I still remain active as a Scientist Emeritus with the USGS Volcano Science Center in Menlo Park, California. During 2005-2008, I was a consultant in volcano hazards for the *Multinational Andean Project*, a technical-assistance program managed by the Geological Survey of Canada, involving numerous trips to Chile, Ecuador, and Peru.

In 1962, I married Susan Greenfield (Pomona College '59), and we have two daughters and three grandchildren. Susan is still working as a realtor (Coldwell Banker office, Menlo Park); but, despite our work schedules, we squeeze in lots of pleasure travel and time with our children and grandchildren. We also greatly enjoy wine tasting, including taking occasional "field trips" to wineries in the U.S., as well as abroad. Overall, post-Yale life has been, and continues to be, a great ride.

Kathe Bertine G '68 (kbertine@geology.sdsu.edu), writes "After leaving Yale I spent a year doing a postdoc in Belgium at the Institute Royal des Sciences Naturelles de Belgique. Thoroughly enjoyed mussels, waffles and the beer—all of which one can buy on the street corners. Then off to Scripps Institution of Oceanography for another postdoc. Fell in love with San Diego weather so decided to get a job in the region and accepted a faculty position in Geology at San Diego State University. Got married to Ed Goldberg and had two

Kathe Bertine white water kayaking.

daughters. Taught geochemistry and oceanography at levels from nonmajor to Masters. Research was mainly in the field of inorganic geochemistry with an emphasis on historical records of metal pollution. Traveled as much as possible and spent sabbaticals in Canada, New Zealand, Turkey, and Croatia dragging kids along with us. Became department chair for a period of 3 years and discovered I really didn't like all the bureaucratic hassles. Retired recently (SDSU offered a really good golden handshake) and am now enjoying

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my grandchildren, taking art classes, tutoring at the local grade school, bridge, pickleball (yes it is a real game) and yoga. My husband died a couple of years ago. Still traveling extensively. Recent trips were to Morocco and Mongolia (rode camels, horses and even yaks!). Have recently developed a love for white water kayaking. Took a trip down the San Juan River in Utah and the spring weather included snow and hail. Didn't discourage me as I leave this week for another kayaking white water trip in the Great Smokies.

Steve Schamel G '74 (s.schamel@comcast.net), writes, "After departing New Haven in summer of 1969 I have had three different careers in the geosciences, each increasingly more challenging and rewarding. Although I very much enjoyed traditional classroom teaching and student advisement in the decade after Yale, I had a growing urge to focus on practical applications of our science. While still at The Florida State University this desire lead to developing a multidisciplinary program in Geology for Planning. In the mid-1970s timing was right, so our students, whether cross-trained geologists or regional planners, were in high demand for the then newly created positions of Environmental Planner/Managers in the rapidly growing coastal counties of Florida. During a few years at Lafayette College I spent the summers in NSF-funded structural studies in the Atlas Range of Tunisia and the rest of the time, while not teaching, making frequent trips to Houston to advise the petroleum industry on exploration in North Africa.

In 1980 I jumped at the opportunity to accept a fully-funded research professorship in the Earth Sciences and Research Institute at the University of South Carolina. There, as ESRI's first full-time appointment, I was charged with expanding the research scope and funding of the organization. Within less than a decade we had a professional staff of over 20, were engaged in regional resource studies on all continents, except Antarctica, had attracted a large number of international students earning masters and doctorates in petroleum geology, and had become the university's largest

Baerbel, Steve, Lisa, and John Schamel

earner of extramural funding. Our work was supported by industry sponsors, national oil companies, the NSF and the DOE. However, when oil company support was slack in the late 1980s, I brought in sub-contracts for geoscience work on superfund sites in the Southeast that soon lead to a new environmental studies division in ESRI. In 1990, ESRI was the first US research organization to have a protocol with the Soviet Academy of Sciences for cooperative studies of oil and gas resources in the Urals, the Pechora Basin, West Siberia, and the Caspian region. For more than five years this was a major driver for expanding our staff and technical capabilities, as well as increasing external funding. As a consequence, in 1994 we were invited to move our petroleum research group in its entirety to the University of Utah. I used the move as an opportunity to apply to the DOE for funding of a large multi-year project for a steam-flood EOR project in southern California, which was funded and proved to be very successful for expanding production to marginal parts of existing heavy oil fields in the southern San Joaquin Basin. Before that project ended I moved to the Department of Chemical Engineering to retool in reservoir engineering and unconventional gas and oil resources. Soon after, I took early retirement from the university to devote full time to my company, GeoX Consulting Inc.

Life as an independent consultant has been a delight. The projects are varied and very challenging. Mainly they have been a mix of shale gas and unconventional oil assessments in the Rocky Mountains, oil field renovation projects overseas, and prospect evaluations in California and the Gulf Coast. In addition, I have found time to serve on boards of the SPE Salt Lake Petroleum Section (Chairman, 2002-2003), the AAPG Rocky Mountain Section (President, 2006-2007), and the Utah Geological Association (President, 2010-2911). I have been able to finish a book project and turn out papers and open file reports on unconventional gas and oil resources in the Rockies. *Thrustbelts: Structural Architecture, Thermal Regimes, and Petroleum Systems* was released by Cambridge University Press in late 2005 and reprinted in paperback in 2009. I am also proud to say that I am affiliated with Skip Hobb's

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Ammonite Resources consultancy, and spent a very enjoyable period working with him in Bogota earlier this year.

Baerbel and I are still together, after more than 42 years of marriage. While at FSU, Baerbel earned an MSW degree from the excellent College of Social Work, which was quite an achievement for someone still having to learn to write in English. We have two wonderful children: John (Johann), born in Tallahassee and Lisa, born in Columbia, SC. Both are happily married to spouses we like very much. Johann is living in Myrtle Beach, SC and Lisa is happily in Los Angeles, making us a bi-coastal family. Although we have enjoyed every community in which we have lived, for us Salt Lake City is very special. In addition to the very lively arts scene—music, dance, opera, theater, you name it—we have easy access to spectacular scenery for hiking and cross-country sking, blue-ribbon trout streams, and wonderful places just to be alone with Nature. Wanting to be near the university and downtown Salt Lake City, we ended up purchasing a charming, nearly 100-year old Arts and Crafts bungalow on Yale Avenue. Where else?

David Yale '80 (dpyale@aol.com) and **Leslie (Berlincourt) Yale '80** (lbyale@aol.com) write "It has been 30 years since the Yales left Yale, so we thought we would let you know what we have been up to. After leaving New Haven, Leslie and David found themselves together again at Stanford's School of Earth Science. During their four years in California, they found enough time to get their degrees (metamorphic petrology and geophysics, respectively) but the temptations of the mountains and

Leslie and David Yale hiking up a frozen river in the Canadian Rockies earlier this year.

the coast made it tough. They left for the oil patch and spent 23 years in Dallas and Houston. Along the way they had two sons who strayed from the path a bit (Chris is now a physicist, Yale 2009, and Nate a computer scientist, Carleton, 2011). Despite not ending up geologists they actually admitted to enjoying all those geology lectures during our myriad of road trips and hikes throughout the West not to mention a certain pride in being the only ones in their classes to ace the rocks and minerals identification exam in elementary schools.

David has stayed with Mobil (aka ExxonMobil now) for the last 25 years and has managed to walk that fine line between engineering and geoscience. He has specialized in geomechanics (fracture mechanics, earth stresses, stability of wellbores, compaction of reservoirs) and has managed to stay in research throughout his career. He is currently leading a large project to develop a better way to get bitumen from oil sands (yes, it involves geomechanics and frequent trips to Calgary, not to mention the side trips to the mountains).

Leslie slid over to the computational side of geology when the boys were young before going back to get her PhD in igneous petrology at the University of Texas at Dallas. She taught geology, earth science, and oceanography at community colleges for several years in Dallas and Houston before getting involved in the boards of various non-profit organizations in New Jersey.

Texas' proximity to the Rockies and David's plethora of frequent flyer miles over the years have meant the opportunity to travel extensively. Of course being geologists has had its drawbacks travel wise. Stopping at every road cut and putting every mountain scene into geologic context sometimes got old for the boys but breaking the Customs conveyer belt coming into the US from Canada with a duffle bag full of samples of the Grenville gneiss was probably the high point. Leslie's passion for photography allowed her to catalog our adventures, complete with children artistically placed for scale.

When the boys left home for college Leslie and David managed to move back East to New Jersey for a change of scenery at EM's lab in Clinton. David's giant lab in Clinton (60 ton, 2 meter ID pressure vessel) helped swing them a trip to Italy for David to present a paper on it at the Society of Petroleum Engineers Annual Conference in Florence this past September.

Lisa (Earl) Castillo '82 writes from Brazil where she lives. I don't have children but in the 15 years since starting my PhD, I have been through a lot. In 1999 I was diagnosed with breast cancer, a month after my 39th birthday.

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Lisa at a street festival in Lagos.

My degree took a detour for over a year as I went through surgery, chemotherapy, and radiation. I did manage to work on a documentary film that year, though, an ethnographic study of Carnival in Bahia called "Festive Land." I finished my PhD in 2005 and in 2008 it was published in Portuguese: "Entre a Oralidade e a Escrita: a Etnografia nos Candomblés da Bahia" [Between Orality and Writing: Ethnography in Bahian Candomblé]. Since they only printed 400 copies, after a year I was able to brag that it was sold out! I have been on postdoctoral research grants since then, tracing the life histories of Africans who were sold into the slave trade in Brazil but eventually earned their freedom and traveled back and forth between Brazil and West Africa. I am writing from Nigeria, where I have come to participate in a colloquium. I had to make a connection in South Africa and yesterday flew up the length of the continent, over the Kalahari Desert and on up over Namibia, Angola, and the Congo. I had asked for a window seat as it is my first trip to Africa and I wanted to see as much as I could. Fortunately the day was clear and as I gazed down at the earth I remembered my days as a student in **Brian Skinner's** G&G 110 class, with the fabulous slide shows that made geological processes come vividly alive. His class was singlehandedly responsible for my becoming a geology major. It didn't end up being the focus of my life, I loved everything I learned in the geology major and wouldn't do it differently if I had to do it over.

Tim Herbert '80 (timothy_herbert@brown.edu), writes, "When I left Yale, I was quite sure I would never end up in academia. Not because I didn't enjoy my time in the Geology department, but because I was sure it was too far away from the action of the real world. I'm now a Professor in Geological Sciences at Brown and chair of my department, so obviously things changed along the way.

I did take a formative time away from the ivory tower in Texas after leaving Yale. I worked first as a Uranium exploration geologist in south Texas and then with a petroleum exploration company founded by **G.W. (Skip) Hobbs '69**, through a connection facilitated by **Brian Skinner**. I arrived in Corpus Christi to start the uranium job and quickly realized that my blue button-down oxford shirts weren't really in style the same way there as in New Haven. Driving around Jim Hogg County in a company Bronco was eye-opening for a northeasterner like me. I also learned a great deal about stratigraphy in the course of my time in both the uranium and oil businesses, and I value those experiences tremendously.

Tim with current graduate students on the Woods Hole ship R.V. Knorr during a sediment coring cruise off the Galapagos Islands in 2009.

When I returned to graduate school at Princeton, I discovered through TA'ing that I really enjoyed teaching. I was able to do a thesis with Al Fischer, one of the grand old men in paleontology and paleoclimatology, in the Gubbio area of Italy. I still return to Italy today to carry on research—it's worth finding things left undone to get back there. While at Princeton, I had a really formative collaboration with **Jeff Park**, then a postdoc, now Yale faculty. Jeff brought my time series skills up considerably, and I helped show Jeff that the sedimentary record has real signals to it. We were able to convince skeptics that 100 Myr-old sediment records have strong periodicities of the same nature as the well-known Pleistocene ice age cycles. I've had a number of other fortunate path-crossings with current Yale faculty, including collaborations with **Alexy Fedorov** on Pliocene climate, a shared interest with **Mark Pagani** in the power of organic "biomarkers" preserved in sediments to tell us new things about the past, and continued discussions with **Karl Turekian**.

I hope that I have retained something of **Brian Skinner's** attitude in my own teaching. Brian's introductory class taught me that you could make students satisfied with a truly rigorous course if you were well prepared and presented the material like it mattered. In hindsight, I marvel at how far-sighted Brian was. I remember well his closing lecture on the "support square" from the Earth that we depend on for everything from energy to water to recreation. Ending a course in physical geology

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that way was far ahead of its time, and certainly captures what many of us in the environmental side of earth sciences see as the most important message of our research.

One last Yale connection that I'd like to share: I'm engaged to marry **Mara Lytle '86,** who is the niece of the late **Phil Orville**. Many of you may also remember Phil's wife Lise, who worked for many years to connect science at Yale with the New Haven schools.

The Lentz family (Eric, Rebecca, Rachel and Miranda) after a warm hike near the Devil's Postpile at Mammoth Lakes (2008).

Rachel (Friedman) Lentz '91 (rcflentz@gmail.com) writes, "Wow, has it really been almost 20 years since graduation?! And what have I accomplished? Well, let's see. After leaving the hallowed halls of Yale, I worked for a year at Scripps Institution of Oceanography to continue pursuing paleomagnetism (which had been the topic of my senior thesis) with my mentor, **Lisa Tauxe '78**. Despite her wonderful tutelage, I decided to go to graduate school in planetary geology and could not resist the opportunity presented by the Planetary Geology Division (now part of the Hawaii Institute for Geophysics and Planetology) at the University of Hawaii, Manoa. I worked with Jeff Taylor and a host of great meteoriticists and geologists, both planetary and terrestrial. My dissertation and other studies focused on applying quantitative petrographic techniques to examining emplacement and crystallization processes in lava flows on Earth, the Moon, Mars, and Vesta. This gave me the opportunity to do field work in both Canada and Hawaii, plus remote "field work" studying lunar and martian meteorites and eucrites, and using remote sensing data. Along the way, I also managed to pick up a husband (Eric Lentz) from the US Navy at Pearl Harbor.

After finishing the PhD, I took up a postdoc position in meteoritics working with Hap McSween at the University of Tennessee at Knoxville. This time was mostly spent applying the quantitative petrographic techniques of my dissertation on more meteorites, but also developing some geochemical tools, all in the pursuit of elucidating the history of water in the martian meteorites, as proxies for the martian mantle. Unfortunately, permanent employment eluded me, and despite the success of bearing two adorable and brilliant girls, it was time to move on. We decided we missed the warm breezes (and Bluer politics!) of Hawaii, and returned there for another postdoc.

In an effort to follow available money, I found myself working further from the topics I was truly interested in. I was also feeling a greater desire to contribute more directly to the community around me. So finally in 2008, I plunged from the ivory tower and took up the daunting task of teaching math to teenage girls at a local private girls' school (St. Andrew's Priory School). As I begin my third year here, I am truly in the thick of helping mold these girls' futures, as teacher, math department chair, and 9th grade class advisor. I am astonished and gratified to see the difference that I can make in the lives of these future leaders. And with incredibly beautiful volcanoes all around, I'm pushing to introduce more geology at all levels of the school to bring this important field to the next generation. Wish me luck!

Bryan Woods

Bryan Woods G 2010 (bryan.woods@aya.yale.edu; bwoods@aer.com), reports that he started on September 13 as a Staff Scientist at Atmospheric and Environmental Research (AER), Inc. in Lexington, MA. His first assignment is in the Numerical Weather Prediction (NWP) group working on a subcontract from the National Center for Atmospheric Research (NCAR) to develop a method to implement feature calibration and alignment in the Air Force Weather Agency (AFWA) Couple Assimilation and Prediction Scheme (ACAPS). Other projects include investigating the purchase of new high-performance computing resources and the development of an event definition and index for the issue of a new severe weather catastrophe bond to offset insurance risk.

STUDENT NEWS

Congratulations!

To the seven graduate students who were awarded their Ph.Ds within the past year.

May 2010 Ph.D. graduates:

Zhicheng Jing's thesis was "Equation of State of Silicate Liquids;" his advisor was **Shun-ichiro Karato.** Zhicheng is a postdoc at Argonne National Laboratory of University of Chicago where he conducts high-pressure experiments to study the properties of liquids using synchrotron X-ray facility.

Tatiana Lyubetskaya's thesis was "New Models of Thermal Evolution and Fluid Flow in Collisional Orogens;" her advisor was **Jay Ague**. Tatiana is presently doing more post-graduate study in New York City and is deciding what her future career will be.

December 2010 Ph.D. graduates:

Brian Andres' thesis was "Systematics of the Pterosauria;" his advisor was **Jacques Gauthier.** Brian is looking for postdocs and university/ museum jobs.

Melissa Spannuth's thesis was "Structure and Dynamics in Freezing and Frozen Colloidal Suspensions from Direct Observation and X-ray Scattering;" her advisor was **John Wettlaufer.** Melissa is beginning a postdoc in the Chemical Engineering Department at the University if Houston where she lives with her husband Garret Leahy, also a graduate of the Department, who works at Exxon.

Erik Sperling's thesis was "Molecular Paleobiology and Early Animal Evolution;" his advisor was **Derek Briggs**. Erik is currently a postdoc at Harvard.

Erik Thomson's thesis was "Through a Wetting-Film: An Optic and Thermodynamic Study of Grain Boundaries in Polycrystalline Ice;" his advisor was **John Wettlaufer.** Erik is now in Sweden in the Department of Chemistry at University of Gothenburg where he has begun a postdoc with Jan Pettersson studying atmospheric ice.

Bryan Woods' thesis was "Inferring Stratospheric Mountain Wave Breaking through Observations at the Tropopause;" his advisor was **Ronald Smith**. Bryan is a Staff Scientist at Atmospheric and Environmental Research (AER) in Lexington, MA.

To the two seniors who graduated the class of 2010 this year:

Lee Christoffersons's senior thesis was "Strategic Metal for Green Technology: The Geologic Occurrence and Global Life Cycle of Lithium;" her advisor was **Jay Ague**. Lee is now employed by the ARCADIS Group, in Denver, Colorado. She is working with environmental engineers, geologists, hydrologists, and geochemists on abandoned mine sites.

Sarah Dewey's senior thesis was "Observations of Shear-Driven Mixing in Arctic Winter High-Wind Events Using Ice-Tethered Profilers;" her adviser was **Mary-Louise Timmermans**. Sarah is working for a microbrewery in Oregon. We are doubtful that her senior research will help improve the quality of the beer.

To the three students who were majors in physics and completed their senior research projects in geophysics with G&G advisors.

Sophie Merrifield's thesis was "El Niño Hindcast with a Simple Dynamical Model;" her advisor was **Alexey Fedorov**. Sophie is in the Ph.D. program at MIT-WHOI.

Michele Trickey's thesis was "Atmospheric Physics in Coastal Ecuador: Establishing a Daily Rainfall Cycle in a Climatic Transition Zone;" her advisor was **Ron Smith**. Michele is currently serving as the President of the U.S. Branch of AIESEC (Association Internationale des Étudiants en Sciences Economiques et Commerciales), a global youth organization that develops leadership capabilities and engages students and graduates in international student exchanges and internship programs.

Rebecca Jackson's thesis was "Entrainment in Turbulent Gravity Currents;" her advisor was **John Wettlaufer**. Rebecca has started a Ph.D. program at MIT-WHOI.

New Undergraduate Research Support

In a previous issue of the G&G Alumni Newsletter we published the unfortunate news of the passing of **Karen L. Von Damm '77**. Thanks to her generosity and to the executors of her estate, we now honor her memory with a new fellowship program for undergraduate research in the G&G department.

In addition to Karen's research accomplishments on the geochemistry of submarine hydrothermal vents, which earned her recognition as a Fellow of the American Geophysical Union, European Association of Geochemistry, and the Geochemical Society, she was also deeply committed to undergraduate education at the University of New Hampshire, where she taught and inspired students for more than 15 years. In accordance with her wishes, women are particularly encouraged to apply for the fellowships, which we anticipate will fund several students' research projects annually, commencing in calendar year 2011.

Gerry Olack Leaves for the University of Chicago

Gerry Olack

Resarch Scientist, **Gerry Olack**, who has run the mass spectrometer lab for several years, is leaving for a similar position at the University of Chicago, where he will be associated with **Albert Coleman G '02**.

Gerry's background for his position is unusual, and by way of explanation he writes, "My undergraduate work was done at the University of Scranton where I majored in Chemistry and Biochemistry and graduated in 1984. My Ph.D. work was done at Purdue University with Dr. Harry Morrison where I looked at the photochemistry of tetracycline and I graduated in 1990. I then came to Yale Medical School where I post-doc'd in Dermatology studying the photochemistry of psoralens with Dr. Frank Gasparro. I moved to Science Hill in 1993 and post-doc'd with Dr. Harold Wyckoff where I studied enzyme kinetics and helped with small angle X-ray work. In 1996 I started working with Dr. Frederic M. Richards looking at protein folding with a photoactivatable stable isotope label. From there, I moved to Geology and Geophysics to run the stable isotope mass spectrometer with Dr. Danny Rye, which then grew into the current large facility.

IN MEMORIAM

Larry Ashmead (1932–2010) '60 Grad. Died on September 3, 2010. Larry spent two years as a graduate student at Yale before moving to an editing career where he became famous. At various times he worked for Doubleday, Simon and Schuster, and Harper Collins, from which he retired in 2003.

Jean H. Winchell died on June 3, 2010. Jean was the wife of the late **Horace Winchell**. Jean was a very generous supporter of PCI-Media Impact, which broadcasts storytelling programs to encourage people in underserved communities to improve their health, to battle the root causes of poverty and educate people on how to protect their environment in a sustainable way.

GEOLOGY & GEOPHYSICS NEWS

Alumni Please Note:

We would especially like to hear from you. Please send your news to rebecca.pocock@yale.edu.

GEOLOGY & GEOPHYSICS NEWS

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Recent Field Trips

Fieldwork at Sea, August 2010

Graduate students Duayne Rieger (far left) and Tolulope Olugboji (far right) helping the deployment of a 6-km-long multichannel streamer aboard *R/V Marcus G. Langseth* during a seismic reflection and refraction survey over a big oceanic plateau called the Shatsky Rise in the Northwest Pacific.

Department Field Trip, October 2010

Graduate students in granite quarry, Rhode Island.