GEOLOGY & GEOPHYSICS NEWS

Yale University | Department of Geology and Geophysics Fall 2011

The arrival of new young faculty, married postdocs and graduate students has brought the sounds of juvenile voices to the halls of Geology and Geophysics. Here is a gathering of the parents and their children who attended the recent Chair's annual Fall Reception.

Chairman's Letter

David Bercovici (david.bercovici@yale.edu)

David Bercovici

Dear Friends and Family of Yale Geology & Geophysics, I'm happy to once again report on recent activities in our Department.

Although no new faculty joined our department this last year, we continue to explore new frontiers, including geobiology, crustal geology, surface processes, energy science and exoplanetology, in preparation for possible hiring in the near future. Even so, the overall size of the Department has grown dramatically in numbers of students and postdoctoral scholars, to the point that we have now used up almost every available square foot of space in Kline Geology Lab.

July 1, 2011 witnessed the retirement of Karl Turekian from his Professorship. Karl taught at Yale since 1956 and was—as many of you know so well—one of the pillars on which today's Department was built. Karl has been a superstar of geochemistry for decades, and in many ways is one of the fathers of modern isotope geochemistry. He was deeply involved in the modernization of the Department in the mid 1960s that ushered in the fields of geophysics and atmosphere, ocean and climate dynamics that we see blooming today. Karl's retirement marks the end of an era. However he has started a new phase of his life as a Research Scientist and continues with his many projects including editing the monolithic *Treatise on Geochemistry.*

This last June the Department underwent the University's required quinquennial External Review, which actually last happened 15 years ago. This involved a major self-study report about the status and future of the department carried out by the Department faculty, which then provided the launching point for the External Review. The Review Committee

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A recent photo of Karl Turekian, Sterling Professor Emeritus.

was comprised of Steven Sparks (Chair) from University of Bristol, Margaret Leinen former Director of the NSF Geosciences Division and now CEO and Founder of the Climate Response Fund, Peter Olson from Johns Hopkins, George Philander from Princeton, Brian Wernicke from Cal Tech and John Flynn from the American Museum. The committee met with faculty, staff, students and postdocs for two days and reported their findings to the Provost. The report was released to the faculty and was very favorable and generous to the Department and made various recommendations about future directions and initiatives that we are already acting on.

One such initiative involved our on-going investigation of future areas of geoscience, which the department had been doing through exploratory symposia (starting Spring 2010 and going through Spring 2011), in preparation for considering where we should be going in the next ten to twenty years. May 2010 saw our first symposium on Frontiers in Paleontology and Geobiology, and in Fall 2010 there was a symposia on Frontiers in Crustal Geoscience. The final symposium, in May 2011, was on Earth Surface 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.

The Department continues its deep involvement in the Yale Climate & Energy Institute (YCEI). The YCEI worked toward the establishment of the new Energy Sciences Institute on the West Campus, which was recently given a gift of $25M by Thomas Steyer and Kathryn Taylor to help launch the new science and technology institute (see the Yale Daily Bulletin Story: http://dailybulletin.yale.edu/article.aspx?id=8865). This institute will focus on both renewable energies like solar fuels, as well as transitional technologies (like carbon sequestration and shale gas), so there is a very big role for the Department to play in this new venture. The YCEI is also spear-heading the development of a new Energy Curriculum and Certificate program, in which the Department is again playing a critical role in offering classes on resources and sustainability, fossil fuels and energy transitions, and natural renewable energies. The YCEI in general continues to fund and facilitate research in renewable energy, carbon sequestration, adaptation in developing countries, climate change science and impacts, building efficiency, shale gas research and much more. The YCEI also had a review by its External Advisory Committee, which includes several G&G alumnae, David Lawrence from Shell Corporation, Joe Greenberg from Alta Resources, and Dan Schrag from Harvard University.

Finally, I should note that this will be my last letter as Chair, since I will be stepping down at the end of the 2011–2012 year. The next Chair is not yet designated but this decision will be made next Spring. Looking back on the last nearly 6 years, I'm very happy and proud of all that the Department has accomplished, both in its growth and in the role it has played in the University at large. It was an honor and a pleasure to serve the Department during this time.

Once again, thank you for your support and interest in the Department. I hope this newsletter finds you well, and I wish you all the best for the coming year.

G&G Postdoc News

Yahya Al-Khatatabeh (yalkhatatbeh@simons-rock.edu) who was working with Kanani Lee, is now a Postdoc in the Department of Physics at Bard College at Simon's Rock in Great Barrington, Massachusetts. **Richard Krause** (richard.krause@yale.edu) who was working with Derek Briggs, is now a Research Assistant in the Department of Paleontology at the Institute of Geosciences in the University of Mainz, Germany. **Chris Brierley** (c.brierley@ucl.ac.uk) who was working with Alexey Fedorov, is now a Lecturer (faculty rank of Assistant Professor) at the University College of London. **Gabe Bever** (gsbever@gmail.com) who was working with Jacques Gauthier is now an Assistant Professor in the Department of Anatomy at the New York College of Osteopathic Medicine. **Yue Jian Wang** (ywang235@oakland.edu) who was working with Kanani Lee, is now an Assistant Professor in the Physics Departemnt at Oakland University in Rochester Michigan. **Peter Van Roy** (peter.vanroy@ugent.be) who was working with Derek Briggs, is now a Postdoctoral Fellow at the University of Ghent in Belgium. **Marc LaFlamme** (LaflammeM@si.edu) who was working with Derek Briggs is a Smithsonian Postdoctoral Fellow in the Department of Paleobiology at the Smithsonian Institution in Washington, DC.

FACULTY RESEARCH

Mineral and Rock Physics Laboratory

Shun Ichiro-Karato

Yale's Mineral and Rock Physics Laboratory was established when Shun Karato joined the faculty in August, 2001. The lab is designed to conduct studies on the properties of materials in order to understand the structure and dynamics of Earth and other planets (Figure 1).

Earth is a dynamic planet in which solid materials slowly move both horizontally and vertically. These processes occur not only at the surface but also in the deep interior. Evidence for active motion deep inside Earth and resultant chemical reactions has been obtained through geophysical and geochemical studies. In the Mineral and Rock Physics Lab, we investigate a range of physical and chemical properties of materials that control the processes in order to interpret the motions. We use both experimental and theoretical approaches.

Fig. 1: The members of the Yale Mineral and Rock Physics. First row from left: Lowell Miyagi, George Amulele, Shun Karato, Jun Yi, Zhenting Jiang, the second row from left: Robert Farla, Tolulope Olugboji, Zhengyu (Andy) Cai, far back from left: Duojun Wang, Kazuhiko Otsuka, Catherine Padhi.

Rock sometimes fractures and cause earthquakes, but sometimes it flows and causes tectonic plates to move. Hot materials move upward and partially melt near the surface—oceanic crust is the product. Hot oceanic crust is in contact with sea-water and intense chemical reactions occurs at mid-ocean ridges that modify the composition of the surface rocks (the lithosphere) and sea-water—a project on this process (chemical reactions of CO2-rich fluids with rocks) is underway in collaboration with faculty colleague **Zhengrong Wang** (zhengrong.wang@yale.edu) and undergraduate student **Catherine Padhi** '14 (catherine.padhi@yale.edu). Metamorphosed oceanic crust together with the underlying cold lithospheric mantle, returns to the mantle at subduction zones. These materials sometimes sink to the bottom of the mantle (~2900 km deep), but sometimes they stay in the middle of the mantle. During these slow motions in the Earth's interior, sinking slabs go through various regions with different physical and chemical properties, and often undergo chemical reactions, including melting. The composition of shallow-mantle melts is different from melts formed in the deep mantle. Melts formed in the shallow mantle are silica-rich (basalt or granite) but melts formed in the deep mantle are silica poor. When melting occurs in the upper mantle, magma rises upward to form a volcano. However, when melting occurs under deep Earth conditions, magma may sink rather than rise upward. This is due to the high compressibility and iron-rich compositions of the melts. We have conducted systematic experimental studies on the melt density and composition, and also developed a new theory of silicate melts. In this theory, we employ the concept that the compression of silicate melts occurs mostly through a change in the geometrical arrangement of nearly rigid "molecules". We have proposed a universal equation of state for silicate melts by which we can calculate the density of any silicate melts if the composition is given. This work is the core of a PhD study of former graduate student, **Zhicheng Jing, G '10** (zjing@uchicao.edu), now a post-doc at the University of Chicago. The studies are now being extended to the lower mantle.

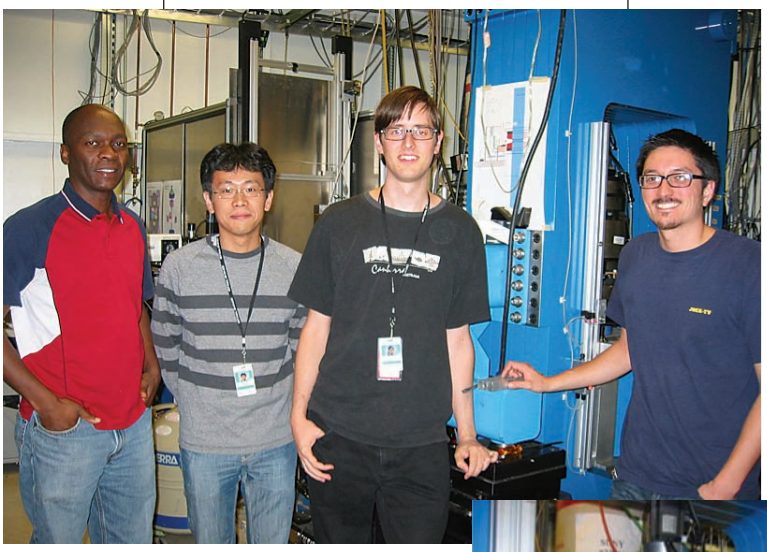
Similar to the ocean floor, where hot rocks meet sea-water, rocks meet hot molten iron at the core-mantle boundary and intense chemical reaction may occur. Graduate student **Kazuhiko Otsuka** (kazuhiko.otsuka@yale.edo), is investigating the nature of chemical reactions between rocks and molten metals (including Fe). He has discovered that the degree

FACULTY RESEARCH

of chemical reaction between the molten core and the rocks at the base of the mantle may be far more extensive than previously thought.

Properties of materials change drastically under the extreme pressure and temperature conditions of planetary interiors. For example, under the deep Earth conditions, many minerals become good hosts for water. In fact, if all the mantle materials contained water to their limits, there would be more than 10 oceans of water in the Earth's mantle. We are investigating how water is held in minerals and how water changes the properties of minerals. We have found that water enhances plastic flow of minerals by as much as 10,000 times, and also enhances the electrical conductivity of minerals. Comparing our own data with the results of geophysical remote sensing, we have found that water is distributed heterogeneously in the Earth's mantle, being enriched in the mid-mantle region (transition zone) where it promotes partial melting. Minerals under the lower mantle conditions behave rather differently than those in the shallow parts. Kazuhiko Otsuka is investigating the properties of the lower mantle mineral (Mg,Fe)O. He has developed a new model for the physical properties of (Mg,Fe)O, and is inferring the physical and chemical conditions of the lower mantle. Once we understand the properties of lower mantle minerals, then by a combination with geophysical measurements, we will be able to probe the whole mantle of the Earth to obtain key clues to its overall properties.

Deformation often changes the structure of a rock. Such changes can be detected by high-resolution seismological studies (faculty colleagues **Jeffrey Park** (jeffrey.park@yale.edu) and **Maureen Long** (maureen.long@yale.edu) carry out these sorts of studies). If the relation between the deformation pattern of a rock and the flow geometry is known, then such observations will tell us the flow pattern in the Earth's interior. Based on hundreds of experiments conducted in the lab, starting with the work of former graduate student, **Haemyeong Jung** (hjung@snu.ac.kr) (now an Associate Professor at the Seoul National University in Korea), we have discovered that such a relation is sensitive to water content as well as stress and temperature. Our studies have provided a guideline for interpreting these observations.



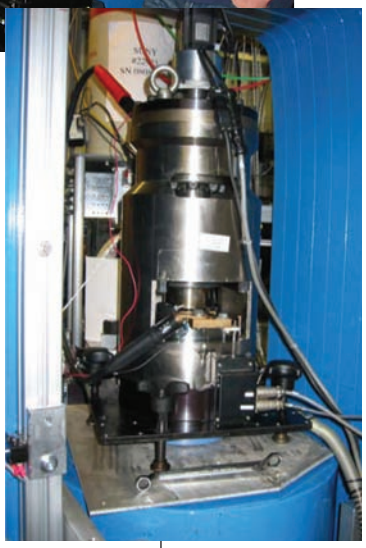


Fig. 2: The operation of RDA (rotational Drickamer apparatus) at the National Synchrotron Light Source at Brookhaven National Lab. From left: George Amulele, Kazuhiko Otsuka, Robert Farla, Lowell Miyagi.

One of the special aspects of the lab is that we conduct experimental studies using newly designed equipment, new methods of investigation, and development of new theories. One of the new devices is a so-called rotational Drickamer apparatus (RDA) (Figure 2). This apparatus, designed in the lab, allows us to study the plastic flow properties of rocks under deep Earth conditions, and extends the maximum pressure of operation by more than a factor of 10 over previous studies. To date, we have operated this apparatus to pressure of ~23 GPa and a temperature of ~2200 K under the synchrotron facility at Brookhaven National Lab (in the Long Island, NY). These are record-breaking quantitative studies of plastic deformation. The studies have been conducted with several post-docs and graduate students including Zhicheng Jing, Kazuhiko Otsuka, Zhixue Du, Liam Slivka.

FACULTY RESEARCH

Modeling and observations of aerosol-cloud-climate interactions

Trude Storelvmo

We all know that fossil fuel burning, currently supplying more than 80% of the world's energy, emits greenhouse gases (GHGs) that act to increase Earth's greenhouse effect and heat the planet. The effect of aerosols, tiny particles that are co-emitted with the GHGs is less well known. Aerosols reflect solar radiation back to space, either by direct scattering of solar radiation or by brightening clouds, and thereby cool the planet. This cooling effect is masking part of the greenhouse warming, but the magnitude of the masking is largely unconstrained. According to the last report from the Intergovernmental Panel for Climate Change (IPCC) it could amount to anything from a negligible cooling to one comparable in magnitude to the amplification of the greenhouse effect. The fact that an unknown proportion of the greenhouse warming has thus far been compensated for by aerosol cooling complicates projections of future climate. The uncertainty associated with the aerosol effect reflects how challenging it is to represent aerosol emissions (Fig. 1), their atmospheric lifetimes and their impacts on clouds and radiation in global climate models (GCMs).

Fig. 1: The complexity of atmospheric aerosols: A mixture of aerosol pollution is shown at the top: the picture to the left shows urban aerosol pollution and the picture to the right shows aerosol pollution from the India and Bangladesn. Examples of the main natural and anthropogenic aerosol sources are, from the top left corner and counterclockwise: **The volcanic eruption** of Grimsvotn, 21 May 2011, emitting primary volcanic ash and SO2 resulting in sulhate aerosols. **Sea spray**, illustrating sea salt aerosols. **Desert storm** in Iraq, 26 April 2005 showing mineral dust aerosols. **Savannah biomass burning**, illustrating both anthropogenic and natural fires as sources of aerosols. **Coal power plants**, illustrating industrial and fossil fuel aerosol sources. **Ship** in a Norwegian fjord resulting in aerosols containing carbon, sulhates, and nitrates. **Cooking**, representing a large domestic source of carbonaceous aerosols. **A truck**, representing the transport sector. The core of the figure shows examples of aerosol structures illustrated by an electron microscope image of black carbon attached to sulhate particles. Credit for microscope picture: Peter Buseck, Arizona State University.

My research to date has focused on how the representation of aerosol-cloud-climate interactions can be improved in GCMs, with the hope that by improving the parameterizations in the models we can be more confident about their projections of future climate. The aim is to refine the treatment of aerosol- and cloud-physics in GCMs, underlaid by recent findings from laboratory and theoretical studies and field measurements.

In an attempt to tackle this problem from a slightly different angle, I've recently joined forces with P.C.B. Phillips, a professor in Yale's Department of Economics, in an effort to disentangle the greenhouse and aerosol effects in observations and in the IPCC GCM output archive. Our approach is to apply methods that are well established in the econometrics community, but novel in the climate research community, to climate data sets. We recently received a Yale Climate and Energy Institute (YCEI) seed grant to pursue this research, and the preliminary results look intriguing.

Space- and ground-based remote sensing is crucial in constraining and validating aerosol effects on climate, and I am increasingly using satellite data in my research. An example is the data set obtained by the Cloud and Aerosol Lidar (Light Detection and Ranging) with Orthogonal Polarization (CALIOP) onboard NASAs CALIPSO satellite. CALIOP is the first polarization Lidar in space, and provides valuable information on the thermodynamic phase of clouds. CALIOP has, since it was launched in April 2006, revealed an intimate relationship between certain aerosol types and the occurrence of ice in clouds. This has implications for both aerosol effects on climate and cloud-mediated climate feedbacks. I am currently leading an international GCM intercomparison project using CALIOP data to validate the GCM's

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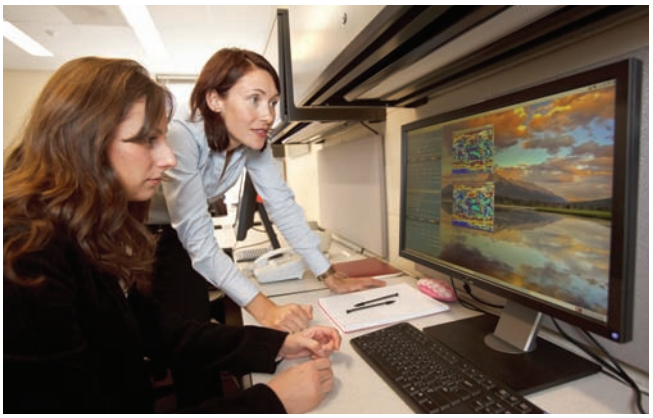
MODELING *continued from page 5*

Trude (right), postdoc Muge Komurcu, and student Rick Russotto on the roof of KGL where the new lidar instrument will be making measurements.

performance. In Spring 2011, with the purchase of a Lidar designed to measure aerosol- and cloud-properties, Yale got its own instrument with the same capabilities as CALIOP. With the Yale Aerosol and Cloud Lidar, remote sensing of aerosols and clouds over Yale Campus and New Haven are now possible. We made measurements with the new instrument from the roof of the KGL building for a few weeks this spring, and it was thereafter shipped to Martinique to complement the host of ground-based and airborne atmospheric measurements made during the DOMEX (short for *The DOMinica EXperiment: Orographic Precipitation in the Tropics*) field campaign led by my colleague **Ron Smith** (ronald.smith@yale.edu) in April and May of 2011. Unfortunately, the Lidar had problems with the torrential tropical rain showers and proved not to be completely watertight. The instrument's laser was damaged by the water, and the lidar system is currently in France, where it was manufactured, to be repaired. **Rick Russotto '12** (rick.russotto@yale.edu) had planned to use data from the Yale Aerosol and Cloud Lidar for his senior research project, so we were forced to come up with a Plan B for his work. Luckily, the DOMEX data set has provided a beautiful example of how aerosol and cloud microphysics is intimately coupled to large-scale atmospheric dynamics, and how the microphysics and dynamics act together to determine whether a given cloud will form rain or not. Rick is currently analyzing aerosol and cloud data from the DOMEX field campaign, and will follow up with numerical modeling of aerosol-cloud interactions. He will present his preliminary results at this year's AGU Fall Meeting.



Trude and Muge Komurcu, looking at GCM output.

Postdoc **Muge Komurcu** (muge.komurcu@yale.edu) recently came to Yale after completing her PhD at Penn State on modeling of Arctic mixed-phase clouds. She will continue to do similar work and specifically, she will seek to improve the representation of ice clouds in GCMs, in particular when it comes to the treatment of ice crystal shapes, which we know is currently oversimplified in GCMs.

In addition to the above activity, I am currently directing much of my Junior Faculty Leave to investigations of the viability of several so-called geoengineering schemes. Such schemes seek to artificially strengthen the current aerosol cooling effects on climate in the event that global warming accelerates and develops into a substantial threat to our environment and civilization. Geoengineering is a particularly hot topic in my field, and a recent YCEI sponsored geoengineering workshop revealed that scholars within fields as diverse as Policy, Law, History, Economy and Engineering have also started to pay attention to this topic. The question of whether to geoengineer, or even perform research on geoengineering, is a controversial one. However, I strongly believe it is our responsibility as scientist to ensure that the geoengineering schemes that have been put forth are based on solid and sound science. Only then can policymakers and society as a whole make well-informed and responsible decisions, should we ever be faced with dangerous climate change.

FIELD STUDIES AND FIELD TRIPS

Participants on the South Africa/Namibia departmental field trip visit the Witwatersrand (Afrikaans for "white water ridge") near Johannesburg.

The Von Damm Fellowships were endowed by the late **Karen Von Damm '77,** to support undergraduate field research and field trips.

Von Damm Fellowship recipients for calendar year 2011:

Alexandra Andrews '11, "Thermal evolution of the Kaapvaal craton, South Africa: The effect of diffusion on the geotherm" (advisor: Zhengrong Wang). **Chelsea Willett '11**, "Timescales of glacial limits to mountain topography in the Patagonian Andes" (advisor: Mark Brandon). **Joe O'Rourke '12** and the Yale Drop Team, "The influence of gravitational variations on solidification of fluids and the formation of mushy layers" (advisor: John Wettlaufer). **Tony Fragoso '13**, "Slumping and entrainment in gravity currents" (advisor: John Wettlaufer). **Cody McCoy '13**, "Dental microwear in mammalian woodpeckers and comparison with a fossil notoungulate" (advisor: Jacques Gauthier).

G&G Fieldtrip To South Africa, Summer 2011

Bulldogs in Southern Africa

In July and August, a group of 25 G&G students and faculty visited geological highlights of South Africa and Namibia. Led by faculty members **David Evans** and **Jay Ague**, and with extensive planning assistance from Evans's long-time colleague and **Professor Emeritus Nic Beukes** (Univ. Johannesburg), the group journeyed through 3.5 billion years of Earth history as dramatically illustrated by the rich stratigraphic record in that region. Participants with interests in planetary science and geophysics marveled at Earth's largest impact structure (Vredefort) and one of the best understood Archean cratons (Kaapvaal), including direct sampling of the mantle lithosphere by diamond-bearing kimberlite pipes (e.g., the Big Hole in Kimberley). In terms of structural geology and petrology, the group traversed ancient mountain belts (e.g., Cape Fold Belt around Capetown) and world-famous igneous intrusions (e.g., Bushveld Igneous Complex). Concerning paleoclimatology, the

FIELD STUDIES AND FIELD TRIPS

Climbing the world's highest sand dunes at Sossusvlei, Namibia.

group visited rocks containing Earth's oldest well preserved sedimentary and volcanic environments (Barberton Greenstone Belt), they saw pristine sedimentary sections spanning progressive atmospheric oxygenation through the Archean-Paleoproterozoic boundary interval (Witwatersrand and Transvaal Supergroups), and they witnessed direct evidence for "Snowball Earth" glacial deposits and cap carbonates formed in low paleolatitudes (Makganyene and Numees/Namaskluft, respectively Paleoproterozoic and Neoproterozoic in age). The trip was also a paleontological showcase of the world›s oldest alleged fossil-bearing sediments (Barberton), soft-bodied Ediacara biota from the end of the Precambrian (Aar and Swartpunt farms in Namibia), the richest terrestrial sections through the Permian-Triassic mass extinction (Rubidge farm near Graaff-Reinet), and amazing cave deposits with fossil hominids (Cradle of Humankind near Johannesburg). Geomorphology ranged from rolling savannah of the high veld, to deep canyons (e.g., Fish and Orange Rivers) incised into the 1.5-km-high plateau; from snow-tipped mountains (near the Cape of Good Hope), to some of the world's highest sand dunes in one of the driest deserts (Sossusvlei, Namibia). The group spent a day appreciating African ecology in Kruger National Park, including a memorable episode involving one of the rental vans becoming mechanically disabled just as three lions approached and circled about. Fortunately, this was one of the few moments when things didn't go quite as planned! Days spent under the African winter sunshine ended with campfires and "braai," South African-style barbecues, under the stars. In all, after 8000 km of driving and three weeks of camaraderie, participants returned with a unique and firsthand experience with some of the world›s most important rock outcrops for elucidating Earth history.

Field Work in Peru

This past May and June, a group of G&G seismologists spent several weeks in Peru installing seismometers as part of the PULSE (PerU Lithosphere and Slab Experiment) project. This experiment, led by **Maureen Long** in collaboration with scientists at the University of North Carolina and the University of Arizona, is geared towards understanding the unique dynamics of the subducting Nazca slab beneath Peru. The subduction zone in this region has an unusual geometry; the slab subducts to a depth of about 100 km and then flattens for several hundred km before resuming its descent into the mantle. Flat slab subduction is a poorly understood process, and data gathered during the PULSE experiment will provide constraints on mantle structure and dynamics beneath the Peruvian flat slab. Participants in the Spring 2011 PULSE field work included graduate students **Caroline Eakin, Colton Lynner,** and **Erin Wirth**, and recent graduate **Jenny Hanna (G '11).**

From left to right, graduate students Erin Wirth, Colton Lynner, and Caroline Eakin, with Maureen Long; construct a site at a school in El Carmen, Peru.

FIELD STUDIES AND FIELD TRIPS

Field Work in the Arctic Sea

Mary-Louise Timmermans wrote about her work in the Arctic in the Spring 2010 Newsletter. In the article she described the difficulties of getting long-term measurements from beneath the Arctic sea ice. She was back in the field for the summer season, July–August 2011. The photo shows Mary-Louise (left) kneeling on the ice as she deploys oceanographic sensors through a hole in the Arctic sea ice. The instruments return measurements of ocean properties via satellite, monitoring the ocean's impact to sea ice throughout the year.

"Fossil Fuels and Energy Transitions" GG274A Field Trip

The Fall Semester for 2011 saw the first offering of a new course G&G 274A Fossil Fuels & Energy Transitions taught by Michael Oristaglio and Brian Skinner. On October 11, 2011 the class visited a shale–gas drilling site operated by Carrizo Oil & Gas in Montrose, Pennsylvania. Far right is their host for the day, Jim Pritts, VP Business Development, for Carrizo. On the same day they also visited an active fracking operation in the Marcellus Shale on a site owned by the Williams Company.

FIELD STUDIES AND FIELD TRIPS

"Dynamic Earth" GG111A Field Trip

Autumn escapades. The G&G Department continues to gain a well deserved cross-campus reputation for student opportunities in the field, whether for research or for class instruction. October is a particularly opportune month for escaping New Haven to enjoy (usually) dry weather and glorious Fall colors of the Northeast. Among several undergraduate classes with weekend field trips (including the well established trips in Stratigraphy, and Structural Geology & Tectonics), the newly created laboratory course for introductory geology ("Dynamic Earth") now also embarks on a weekend camping trip to Delaware Water Gap. There, students first absorb a synoptic overview of the Gap's stratigraphy and structure from the overlook at Mt. Minsi, Pennsylvania (instructor David Evans at left), looking across the river to Mt. Tammany, New Jersey, which contains the Taconic unconformity between cliff-forming Silurian conglomeratic quartzites and underlying Ordovician black shales. Students then traversed a small segment of the Appalachian Trail and other blazed paths, measuring structural attitudes and producing a simple geological map of the area. Such experience-based field training will become more feasible next year and beyond, as Yale College adopts a five-day October recess to complement its week-long break at Thanksgiving.

VISITING FACULTY FROM OTHER INSTITUTIONS

Gurol Seyitoglu

Gurol Seyitoglu (gurol.seyitoglu@yale.edu) is a Professor in the Department of Geological Engineering at Ankara University in Turkey. Gurol plans to enhance his knowledge on morphotectonics. His current research is on various tectonic settings such as strike slip faulting, normal faulting in metamorphic core complexes and thrust faults creating wedge geometries. He's looking forward to the opportunity of discussing each case study from Anatolia with **Mark Brandon** (mark.brandon@yale.edu) and **David Evans** (dai.evans@yale.edu), and comparing these structures with worldwide equivalents.

Duojun Wang

Duojun Wang (duojun.wang@yale.edu) is an associate professor of Geophysics at Graduate University of Chinese Academy of Sciences (GUCAS). His research focus is on laboratory measurements of electrical conductivities of mantle minerals under the condition of high pressure and temperature and how can we use these results to understand the Earth's interior. Dr. Wang is currently working with **Shun-ichiro Karato** (shun-ichiro.karato@yale.edu).

Jun Yao

Jun Yao (jun.yao@yale.edu) is a Professor at the School of Civil & Environment Engineering, University of Science and Technology in Beijing, People's Republic of China. Professor Yao's work at Yale is in collaboration with **Ruth Blake** (ruth.blake@yale.edu) in the area of oxygen isotope analysis of oxy-anions. The study has applications in tracing pollution sources of phosphate, arsenate and selenates in water bodies, soils and sediments in China, with a broader objective of deciphering their fates and transport in soils and groundwater. Part of the overall goal will be to replicate research efforts in characterizing oxygen isotope signatures of phosphate within water columns of the South-East China Sea and to understanding the biogeochemical processes involved in phosphorus-cycling in oceanic systems. Another area of interest is the microbial and enzymatic degradation of organophosphate pesticides in soils and water systems with the aim of characterizing oxygen isotope values of the phosphate in relation to natural biodegradation processes.

RECENT AWARDS & HONORS: FACULTY


Ron Smith

Congratulations to **Ron Smith** (ronald.smith@yale.edu), on being awarded the **Jule G. Charney Award** by the American Meteorological Society. The citation for the Award reads, "For fundamental contributions to our understanding of the influence of mountains on the atmosphere, through both theoretical advances and insightful observations." The Award was presented at the Annual Meeting of the Society in January 2011.


John Wettlaufer

Congratulations to **John Wettlaufer**(john.wettlaufer@yale.edu) who has been named the **Tage Erlander visiting professor** at Stockholm's Nordic Institute for Theoretical Physics (NORDITA) for the year 2012.

The Swedish Research Council announced Wettlaufer's appointment early in October. The post provides $350,000 to support graduate students, postdoctoral associates, and visitors, and will underpin Wettlaufer's work on projects related to climate change, planetary accretion, and fluid dynamics.


William Boos

Congratulations to **William R. Boos** (william.boos@yale.edu) for winning the **Office of Naval Research Young Investigator** Award. The award is for compelling research with the potential to deliver game-changing naval science and technology.

Bill Boos' research focuses on the fluid dynamics of Earth's tropical atmosphere and concentrates in particular on monsoon circulations, which deliver water to billions of people in socially vulnerable, agricultural economies. Despite the importance of monsoon rainfall, there is no established theory that explains the observed variability of monsoons, and that variability is poorly simulated and predicted by computer models. Bill's research involves developing and testing theories for how Earth's monsoons work. The award will fund his work on monsoon depressions.


Kanani Lee

Congratulations to **Kanani Lee** (kanani.lee@Yale.edu) on receiving the National Science Foundation's most prestigious award, the **NSF Career Grant**, in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations.

Kanani studies the physical and chemical properties as well as the crystal structures of materials at high pressures and temperatures to better understand the dynamics and structure of Earth and other planetary interiors. Using the laser and resistively-heated diamond-anvil cells and ab-initio computations, she is able to simulate the extreme pressure and temperature conditions on relevant planetary materials and can measure their changing properties in situ. The knowledge of the materials at deep interior conditions is key to understanding the formation and evolution of the Earth and planets in general.


Maureen Long

Congratulations to **Maureen Long** (maureen.long@yale.edu) for being awarded an **Alfred P. Sloan Research Fellowship**. The Fellowships seek to stimulate fundamental research by early-career scientists and scholars of outstanding promise. These two-year fellowships are awarded yearly to 118 researchers in recognition of distinguished performance and a unique potential to make substantial contributions to their field.

Maureen is an observational seismologist whose primary scientific interests include the structure and dynamics of the Earth's mantle, with a focus on subduction zone dynamics and processes. Much of her research focuses on understanding seismic anisotropy in the mantle; because anisotropy is a consequence of deformation, its measurement and interpretation give us some of the most direct constraints we have on mantle flow processes. In addition to using seismological observations, she integrates constraints from geodynamical models (both numerical and analog) and mineral physics experiments into her work, and her research spans all of these disciplines. Some of her current projects include the characterization of the mantle flow field in subduction zone regions, investigations of the relationship between mantle processes and tectonomagmatic activity, the measurement and interpretation of seismic anisotropy in the D" region at the base of the mantle, and the development and application of techniques for anisotropy tomography. Maureen's research has a substantial field component, and the deployment of broadband seismometers in temporary arrays is one of the tools she uses to characterize mantle structure and processes.


Ellen Thomas in New Zealand

Congratulations to Senior Research Scientist and Lecturer **Ellen Thomas**, (ellen.thomas@yale.edu) for being elected a **Fellow of the AAAS**. Ellen's research is focused on benthic foraminifera, microscopic unicellular organisms which make a shell of calcium carbonate or agglutinated sediment grains. She uses information on the assemblages of these organisms and their stable isotope compositions to reconstruct oceanic productivity and the biological pump after the asteroid impact and mass extinction and the end of the Cretaceous, ocean acidification and deoxygenation during extreme warm periods in Earth history, changes in ocean productivity during the formation of the Antarctic ice sheet, rates of sea level rise during the last 10,000 years in Long Island Sound, and the effects of anthropogenic eutrophication.

RECENT AWARDS & HONORS: STUDENTS

Graduate Student **Daniel Field** (daniel.field@yale.edu) is congratulated for the **Lougheed Award of Merit** from the Alberta scholarshop committee, this award is the Canadian version of NSF graduate fellowship.


Daniel Field, Graduate Student


Woosok Moon

Congratulations to graduate student **Woosok Moon**, (woosok.moon@yale.edu) who has been awarded a **NASA Earth System Science Graduate Fellowship**, the NASA equivalent to a NSF Graduate Fellowship and the first recipient at Yale.

Graduate Student **Alison Nugent** (alison.nugent@yale.edu) was a co-winner of the award for **Best Student Presentation at the 14th Conference on Mesoscale Processes** in Los Angeles. The conference was sponsored by the American Meteorological Society. The title of her presentation was "Orographic Precipitation in the Tropics: Seeding the convection".


Alison Nugent

The Yale Peabody Museum of Natural History (YPM) awarded its **George Gaylord Simpson Prize** for 2011 jointly to **Daniel Peppe, G '10** (daniel_peppe@baylor.edu), and to **April Dinwiddie** (april.dinwiddie@yale.edu); Congratulations to dan and April.

YPM's George Gaylord Simpson Prize is awarded annually to a Yale University graduate student or recent doctoral candidate for a paper concerning evolution and the fossil record. The prize is named for **George Gaylord Simpson** (1902–1984; G '26) one of

RECENT AWARDS & HONORS: STUDENTS

the most influential paleontologists of the 20th century and a major proponent of the modern evolutionary synthesis.


Daniel Peppe

Dan received the prize for his 2010 paper "Megafloral change in the early and middle Paleocene in the Williston Basin, North Dakota, USA" (*Palaeogeography, Palaeoclimatology, and Palaeoecology* 28[3-4]: 224-234.

Dan is an assistant professor in the Department of Geology at Baylor University. His research integrates paleobotany, paleoclimatology, and paleomagnetism to reconstruct past ecosystems and to examine how terrestrial ecosystems respond to climate change through time. His current work is focused on developing proxies for paleoclimate and paleoecology using modern leaf traits, characterizing the paleoenvironment of the Neogene and Quaternary in East Africa as it related to hominoid evolution, and reconstructing Cretaceous and Paleogene plant communities and paleoclimate across the Western Interior of North America.


April Dinwiddie

April Dinwiddie (april.dinwiddie@yale.edu) for her paper: "Patterning of a compound eye on an extinct dipteran wing". Baltic amber is not the most likely place to find a new take on evo-devo, but this paleobiological study provides an opportunity to study the structure, function, and developmental constraints on an evolutionary novelty.

April is currently a graduate student in the Department of Ecology and Evolutionary Biology where she is studying the development and evolution of cuticular wing scales in butterflies.


Christopher Thissen

Congratulations to graduate student **Christopher Thissen** (christopher.thissen@yale.edu) for the inaugural **Stephen E. Laubach Research in Structural Diagenesis Award** from the Geological Society of America at it's annual meeting in the fall of 2010. This is the first named award given by the Structural Geology & Tectonics Division and is intended to promote cross-disciplinary research and teaching. A structural geologist, Chris studies the governing dynamics of orogenic belts that occur as tectonic plates collide. His research links structural geology and sedimentary petrology to better understand "pressure solution," a phenomenon that plays an important role in the formation and deformation of both mountain ranges and reservoir rocks.


Erin Wirth

Congratulations to graduate student **Erin Wirth**, (erin.wirth@yale.edu) for being the recipient of a **NSF Graduate Research Fellowship**.


Simon Darroch

Congratulations to Simon Darroch (simon.darroch@yale.edu) who has been awarded the **William V. Sliter Student Research Award** for 2011 by the Cushman Foundation for Foraminiferal Research.

STUDENT NEWS

Congratulations

To the graduate students who were awarded their PhDs within the past year.

May 2011 PhD Graduates:

Una Farrell's thesis was "Taphonomy and Paleoecology of Pyritized Trilobite Faunas from Upstate New York," her advisor was Derek Briggs. Una is working as a Collections Manager for the Invertebrate Fossil Collection at the University of Kansas Biodiversity Institute where she is working with Bruce Lieberman, a former Yale postdoc.

December 2011 PhD Graduates:

Michelle Casey's thesis was "Conservation of Paleobiology of Long Island Sound Mollusks.", her advisor was Derek Briggs. Michelle is a Visiting Assistant Professor of Paleontology at Oberlin College in Oberlin Ohio.

Tom Hegna who will be defending this fall, is an Assistant Professor in Invertebrate Paleontology at Western Illinois University. His thesis will be "Fossils and Phylogeny: The Evolution of Branchiopod Crustaceans and the Conquest of Freshwater" and his advisor is Derek Briggs.

Devin McPhillips' dissertation was "Erosion and Mountain Evolution: New Insights from Thermochronology (Sierra Nevada, California)," his advisor was Mark Brandon. Devin is currently an NSF Postdoctoral Research Fellow hosted at the University of Vermont.

Jakob Vinther's thesis was "The role of fossils and phylogeny in understanding the early evolution of annelids and mollusks (lophotrochozoans)," his advisor was Derek Briggs. Jakob is a Jackson Postdoctoral Fellow at the Jackson School of Geosciences in the University of Texas at Austin.

To the students who were awarded their Master's within the past year.

December 2011 Master's Degrees:

Jenny Hanna's thesis was "Better Constraints on the Location of Anisotrophy Subduction Zones," her advisor was Maureen Long. Jenny is currently preparing law school applications.

Aaron Judah's thesis was "Climate feedback Mechanisms Determined From Flux Towers and the MODIS Sensor in a Semi-Arid area in Southern California," his advisor was Ron Smith. Aaron is currently enrolled as a graduate student in the Earth and Space Science Department at York University in Toronto, and he is also serving as a Commissioned Officer for the Canadian Armed Forces with 32nd Brigade—Engineers.

To the seniors who graduated in the class of 2011:

Alexandra Andrew's senior thesis was: "The effect of diffusion on P-T conditions inferred by cation-exchange thermobarometry," her advisor was Zhengrong Wang. Alexandra is now a graduate student at MIT working with Tim Grove on experimental petrology.

Chelsea Willett's senior thesis was: "History of long-term glacial erosion in the Patagonian Andes," her advisor was Mark Brandon. Chelsea is now working working as an Assistant Staff Geologist at Roux Associates in Burlington, MA. Roux is an environmental consulting firm that works with larger companies in brownfield remediation, litigation and engineered natural sciences. The job involves helping to direct a lot of the company's field work and sampling, as well as working with a team of other scientists to analyze data and draw conclusions.

Ariel Revan's senior thesis was "Reconstructing an icon: Historical significance of the Peabody's mounted skeleton of *Stegosaurus* and the changes necessary to make it correct anatomically," her advisor was Jacques Gauthier. Ariel is taking some time off to pursue other interests before deciding on graduate school.

Natasha Vitek's "The giant fossil soft-shelled turtles of North America," her advisor was Jacques Gauthier. Natasha received an NSF doctoral fellowship and she will be working at the University of Texas.

Matthew Ramlow's senior thesis was "Sources of error within stable isotope and carbonate dissolution measurements of early Paleocene hyperthermals" and his advisor was Mark Pagani. Matt has completed a summer internship with the

STUDENT NEWS

Verified Carbon Standard (VCS) in Washington DC. The VCS is a internationally recognized carbon standard which provides quality assurance within the market for carbon credits. For his internship he helped provide research for developing new policy, creating tools to quantify indirect emission that may result outside of the project boundary and assessing the feasibility of such projects such a carbon capture and storage as a carbon credit. He says it was an amazing internship and he would be interested in speaking with any other alums working in this field.

Roxanne Carini (Applied Mathematics), "Pattern formation in drying suspensions, or Cracks in Mud," her advisor was John Wettlaufer. Roxanne is heading to the University of Washington for graduate school.

Yale Drop Team, a Tragic Death, and an Asteroid

The Yale Drop Team is an official undergraduate organization that carries out reduced gravity research under the auspices of a competitive NASA educational program. The organization has 22 members, and one of the faculty supervisors is Geology and Geophysics professor, **John Wettlaufer**. The 22 students involved, who have participated in 8 parabolic flights in NASA planes, include G&G major **Joseph O'Rourke '12**. Their research has been focused on the physics of plasmas and the solidification of fluids and formation of mushy layers in various gravities.

Two Yale Drop Team members getting ready to carry out an experiment in zero gravity. Michele Dufault '12 is on the left, Roxane Carini, '12, a physics major who did her senior research in G&G on mud cracks, on the right.

One of the Team members, **Michele Dufault '11**, died in a tragic accident on campus April 12, 2011, in the Sterling Chemistry workshops. Michele was a physics and astronomy major, who took many courses in Geology and Geophysics, where she had studied with both **John Wettlaufer** and **Mary-Louise Timmermans**. Hailing from Scituate Massachusetts she was fond of the ocean and began to take her interests in that direction as a senior. She spent last summer at Woods Hole working with underwater vehicles and had planned to work in ocean science at the University of Washington this coming academic year.

On July 26, 2011, word reached **Meg Urry**, Chair of Yale's Department of Physics, that an asteroid has been named in honor of Michele. The asteroid, which was discovered in 1994 by Spacewatch at Kitt Peak, is a 5 to 10 kilometer diameter object in orbit about 2.92AU from the Sun. The full name is now Asteroid (15338) Dufault. The citation reads "Named in honor of Michele Dufault (1988-2011), an outstanding astronomy and physics student at Yale College who died in a tragic accident just weeks before graduation. Michele was passionate about science and about encouraging others, especially young women, to pursue science careers"

RECENT AWARDS AND HONORS: ALUMNI

Grenville Holland G'62

Congratulations to **Grenville Holland G '62** (j.g.holland@durham.ac.uk) who in 2008 was named **The Right Worshipful the Mayor of Durham**. Grenville arrived at Yale in the Fall of 1960 and returned to Oxford in 1962 with an MS. At Oxford he completed his D.Phil and moved to Durham in 1965, initially on a 2 year post-doc government contract but the advent of the Apollo Space Programme in 1967 kept him in Durham working as a geochemist on lunar samples from 1969 to 1977. He retired from the Department in 2004 but is still active, although he has spent some time away to become the Right Worshipful the Mayor of Durham in 2008 (having begun his political career in 1981) becoming Alderman of the City in 2009.He is currently a Unitary (Regional) Councillor.

The Mayor of Durham is the 5th most senior in England and is only 1 of 2 Mayors with a ceremonial Bodyguard (normally ex-soldiers (Durham Light Infantry) and police). London is the only other city with a Mayoral Bodyguard. It is partly a matter of antiquity—the Mayor of Durham dates back to 1602. The reason he is not the Lord Mayor as befits a city of this significance is because in 1602 when the post was created by the then Bishop of Durham the Bishop did not want that post to have higher rank than himself so he created "The Right Worshipful the Mayor of Durham"—which is kind of more distinctive than merely being a Lord Mayor!

Congratulations to **Mike Dowling '74 G '82** (mpdowling@aol.com), on being awarded the **George E. Cranmer Award** from Colorado Open Lands. Award recipients are individuals who have gone above and beyond what others have done and often get things completed through determination and force of personality. They leave behind a legacy that will be valued and enjoyed for generations to come.

Michael has spent his professional life at the intersection of natural resource business, policy, conservation, and finance with a passion for the natural and built environments that has produced a diverse, values-driven career with experience in land conservation and limited development, conventional and alternative energy resources, corporate and project finance, and organizational strategy.

Mike Dowling with his family.

Michael is vice chairman of the Colorado Oil & Gas Conservation Commission, co-founder, long-time chairman, and trustee of the Colorado Conservation Trust; president of The Dowling Foundation; board member and strategy chair of the national Land Trust Alliance.

According to Mike, *I have been privileged to live in one of the most beautiful places on earth and to work with devoted colleagues whose passion is its conservation. This award is shared with all of them.*

Congratulations to **Henry Dick**, **G '76**, (hdick@whoi.edu) for being the **Harry H. Hess Medalist** of the AGU for 2011. The award is "for outstanding achievements in research of the constitution and evolution of Earth and other planets". The award brings two Yale alums together as Harry Hess was a class of 1931 geology major.

Spencer, Henry, Lydia and Winifred on the city walls in Xi'an China.

Henry writes: At Yale I worked with Dick Armstrong, mapping the Josephine Peridotite, and badgering Horace Winchell to teach me how to use the brand new electron microprobe purchased by Brian Skinner. By some combination of endurance, learned from Dick, and a healthy disrespect for convention, learned from Phillip Orville, I managed to write a PhD that had something in it to offend

RECENT AWARDS AND HONORS: ALUMNI

virtually every living igneous petrologist at the time.

By some remarkable providential fluke the only job offer I had when I finished my PhD at Yale was at the only place I wanted to go: The Woods Hole Oceanographic Institution. I've never looked back, and have had a better career here than I had any right to expect: going from post-doc to senior scientist over 36 years, discovering wonderful things about the ocean crust and mantle. I've been diving to the bottom of the Indian Ocean in a yellow submarine, and got to break open the Arctic Ice Cap on the first science cruise of the Icebreaker *Healey* with colleagues Peter Michael and Charlie Langmuir. We made the first geologic survey and high-resolution bathymetric map of the slowest spreading ocean ridge in the world—a feat that no one really thought possible.

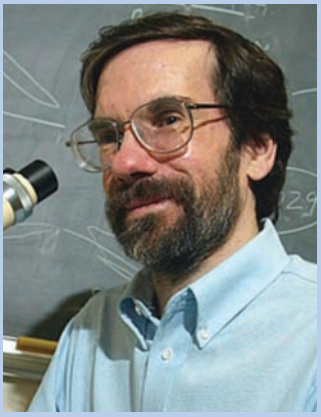
My favorite professional achievement (in the RL Armstrong tradition of why only get two or three points, when you can have a couple of thousand?) was to point count a half a million points on thin sections of highly altered mantle peridotites from the Atlantic and Indian Oceans: showing that mantle hot spots are likely hot. One of my more sophisticated colleagues at MIT at the time remarked that I wasn't allowed to show things like that with such a mundane approach: it was supposed to be the sole provenance of isotope geochemists. Another colleague simply suggested that I enjoyed the pain.

In 1990 I met my wife Winifred at a small pig roast I was having for a hundred or so of my nearest and dearest friends, and after a long 5-week courtship, got engaged to be married. That was twenty years ago and every one has been better than the last. Though she has a Harvard MBA, she gave up a career at IBM to teach English at a local high school, and seems to love every one of her students. We have three children, Helene—a sophomore at Rice, Spencer our artist, and Lydia, our ballerina, now a senior and sophomore in high school respectively. On the side we run a cut-your-own Christmas tree farm, and would be happy to provide any nearby Yalies with a tree at the family discount (retail + 25%).

Several other things I enjoyed were to lead numerous expeditions to the southern oceans where the average sea state is 30 feet. This had the advantage that for some reason no one else had worked there. There was only one time when the ship almost rolled over. After 25 years, it finally dawned on me that this and other ultraslow ridges had tectonic and crustal accretion like no other, and that they constituted an ocean ridge system as different from the slow spreading Atlantic, as the Atlantic was from the fast spreading Pacific. Moreover, for a large portion of it, the Earth was simply splitting apart, with the mantle pulled directly to the seafloor with little or no volcanic activity. In other words, it seems that for part of the oceans Harry Hess's suggestion that the ocean crust could be serpentinized mantle proved correct.

At present I am working on identifying the depleted remains of mantle plumes where they are crossed by slow and ultraslow spreading ocean ridges, and doing cooperative research with Chinese geologists on the SW Indian Ridge—which is why the photo of myself and two of our children is in X'ian. Cooperation does have its benefits. I am also trying to figure out how to avoid retiring in the near future, and like one of the Hogwarts professors, will probably be found still working at my desk long after I am dead.

Congratulations to **David Jablonski G '79**, (djablons@uchicago.edu) William Kenan Jr. Professor of Geophysical Sciences at the University of Chicago, who was elected to the **National Academy of Sciences** in recognition of his distinguished and continuing achievements in original research.



David Jablonski

David focuses his research on macroevolution, which encompasses the study of large-scale patterns of evolution above the species level, mass-extinctions and their long-term consequences, diversification in time and space, and the origin of evolutionary breakthroughs.

RECENT AWARDS AND HONORS: ALUMNI

Charles W. (Chip) Goodyear '80

Congratulations to **Charles W. (Chip) Goodyear '80**, who was named a **Successor Trustee of the Yale Corporation in 2011**. Chip's career has been notable in the mining industry, initially at Freeport-McMoRan, where he was Chief Financial Officer, then at BHP Billiton, the world's largest diversified resources company, where he started as the Chief Financial Officer, became the Chief Development Officer, and in 2003, was a appointed the Chief Executive Officer, which post he held until he retired from the job in 2009. Chip is currently President of Goodyear Capital Corporation.

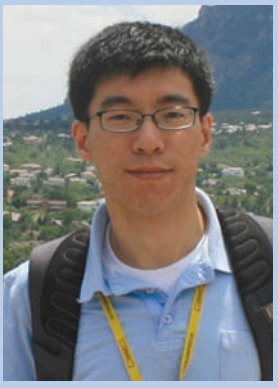
Susan Kidwell, April 2011, Baja

Congratulations to **Susan Kidwell G '82** (skidwell@uchicago.edu) on being elected to **Fellowship in AAAS**. Susan, who is the William Rainey Harper Professor in the Department of Geophysical Sciences, and member of the Committee on Evolutionary Biology, University of Chicago writes:

"I'm presently working on field experiments and modeling in modern environments to understand the formation of fossil records, with the aim of bringing very young paleontologic data to bear on issues of environmental management and conservation. It's become clear from my meta-analytic work that the very young skeletal debris encountered in modern seafloors does a remarkably good job of capturing basic biological information—so well, in fact, that when the taxonomic composition of these death assemblages does not match that of the local living community, we can infer that the community itself has changed recently, usually from human activities, rather than the mismatch arising from postmortem bias. I'm thus now testing how fully this proxy biological information is conserved as skeletal material undergoes permanent burial, with two newly funded projects that will core continental shelves with known histories of urbanization. Here at the University of Chicago, where I've been on the faculty since 1985, I still teach and advise graduate students in stratigraphy and geologic fieldwork, but most advisees are pursuing this new field of conservation paleobiology."

Karen Fischer with AGU Past President Tim Killeen.

Congratulations to **Karen Fischer '83** (karen_fischer@brown.edu) for **Fellowship in AGU**, for her contributions to our understanding of mantle flow, seismic anisotropy and the continental lithosphere.



Zhicheng Jing

Congratulations to **Zhicheng Jing, G '10**, (zjing@uchicago.edu) who will receive the **AGU Mineral and Rock Physics Graduate Research Award**.

Zhicheng is a Postdoctoral Scholar at the Argonne National Laboratory, University of Chicago where he conducts high-pressure experiments to study the properties of liquids using synchrotron X-ray facility.

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George Devries Klein, G '60, (gdkgeo@earthlink.net) has published a co-authored book on the "hydrocarbon Potential of Peru" The complete citation is: *Zúñiga y Rivero, F. J., Klein, G. D., Hay-Roe, H., and Álvarez-Calderon,* E, 2010, The hydrocarbon potential of Peru: *Lima, Peru, BPZ Exploración & Producción S.R.L.342 p.*

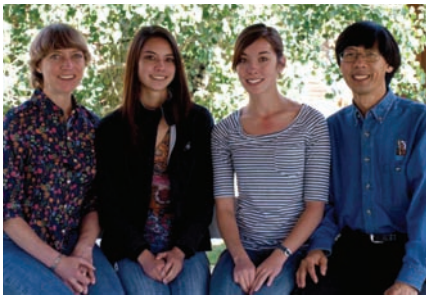
George has also been elected to serve a three-year term to the House of Delegates of the American Association of Petroleum Geologists.

Kim Nettleton '79 (kim_touy@yahoo.com) writes that she and **Yen Touysinhthiphonexay '78** (yen_touy@yahoo.com) met as undergraduates in the Yale Geology department. After a summer together in New Haven, Yen headed off to Penn State to pursue a Master's degree in geochemistry and then convinced Kim to apply to Penn State as well for a Master's in geology. They married in the summer of 1979.

Ultimately, Yen received an MS in Geochemistry from Penn State, working on the quartz-magnetite oxygen isotope geothermometer. He did additional graduate work on the origin of graphite in Montana's Stillwater Complex and worked as a research associate to experimentally refine metallurgical phase diagrams. Kim focused on geomorphology and statistics, earning an MS studying stream erosion in the strip mines of Pennsylvania, a Ph.D. studying arroyo development in northwest New Mexico and completed all the course work for an M.A. in Statistics. We both enjoyed interacting with the Penn State community through teaching, research assistantships, and extracurricular activities like ice hockey and Tang Soo Do (a Korean martial art). A graduate school highlight was spending a summer as each others' field assistants and visiting all the national parks between New Mexico and Montana (we had to camp somewhere on the route!).

In 1987, Kim joined ARCO's research lab in Plano TX and Yen joined ARCO soon after. Kim started off doing basin-scale resource assessment and ended up developing statistical software tools to enable geologists to do Monte Carlo simulation for source rock evaluation and prospect appraisal. She especially enjoyed training geologists in company offices in southern England, Alaska and Jakarta. Yen specialized in geochemical and engineering laboratory work -- analyses of brines from core flood experiments and corrosion inhibitor testing and screening for Alaskan oil fields. While working at ARCO, they had two beautiful daughters, Katy and Laura, and also ran a karate school (Yen) and did competitive and precision figure skating (Kim). Both girls participated in karate and skating, and also loved to visit the ARCO office and lab.

Life changed when BP bought ARCO in 2000. Yen's research labs were decommissioned, so he studied for and got an MCSE and started working in IT at Brinker International. Kim was developing an Immersive Drilling Planner with a Virtual Reality research group that ultimately was outsourced to University of Colorado at Boulder. Although it was hard to leave long-time friends in Texas, Kim and Yen jumped at the chance to move to Colorado and enjoy hiking, biking and skiing in the mountains. Kim enjoyed demonstrating the Immersive Drilling Planner to oil industry groups in Houston and



Kim, Katy, Laura and Yen, Creede, Colorado.

Europe while brainstorming other visualization applications with professors and grad students on the CU campus. Unfortunately 9/11 and the ensuing recession put an end to Kim's job at CU. Yen took a job with Eltron R&D as a research chemist while Kim got a certificate in Direct Marketing and rediscovered her analytical roots and love of statistical data analysis.

Currently Yen works at Eltron doing government contract research on technologies that will help clean up water and air. Kim works for Acxiom, a large marketing service and data provider, as a statistical consultant, data modeler, and developer of tools that automate and improve data analysis. Katy recently graduated from Colorado College with majors in Drama and French, is currently working as Assistant Stage Manager at Creede Repertory Theatre (Creede, CO) and is planning a career in stage management. Laura will be a junior at Colorado College, majoring in psychology, and is currently enjoying working at the La Puente Family Shelter in Alamosa CO. She recently took a college geology class, which has led to some fabulous family discussions, especially when we visit Katy and hike around the Creede caldera and silver mines!

Congratulations to **Craig Schiffries '80** (schiffries@yahoo.com) on his appointment as Director of

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the Deep Carbon Observatory, headquartered at the Carnegie Institution of Washington's Geophysical Laboratory. The Deep Carbon Observatory is an international, multidisciplinary

Craig with son Ethan (age three) at Arenal Volcano (Costa Rica) during a minor ash eruption.

effort designed to transform our understanding of carbon's chemical and biological roles in Earth's interior. Supported by the Sloan Foundation and other organizations, the Observatory will address implications of the deep carbon cycle for life, energy, and the environment by addressing questions such as the nature and extent of deep microbial life, the fluxes of carbon dioxide from the world's volcanoes, and the distribution and characteristics of deep carbon reservoirs.

Mike Fracasso G '83 (mfracasso@fs.fed.us) writes: "After reading news of former G & G student contemporaries in recent issues of the Department's newsletter and becoming re-acquainted with the Skinners and others at last Fall's GSA in Denver, I decided it's time to buck-up and help fill up some white space in the newsletter.

It's been a circuitous route from being awarded a Ph.D. in Vertebrate Paleontology (1983) to actually gaining full-time employment as a Paleontologist, but if nothing else, we paleos learn adaptation... I began my professional career after graduation as a stratigraphic geologist with the Bureau of Economic Geology (BEG) at the University of Texas, Austin, where I met my future wife Anne. Major projects at the BEG included subsurface characterization of bedded evaporates as potential host strata for a proposed national high level nuclear waste repository in the Texas Panhandle (site ultimately rejected in favor of the Yucca Mountain/Nevada test site—a result everyone pretty much predicted at the time (further note: funding for proposed Yucca Mtn repository dropped from 2011 federal budget)), and reservoir characterization of Cretaceous delta-platform low-permeability natural gas sandstones of East Texas. This was followed by several years of geological consulting for a small firm in the Hudson Valley of New York, focusing on environmental permitting of hard rock quarry and soft rock mining operations.

I eventually circled back to Connecticut to spend nearly a decade with the CT Department of Environmental Protection (DEP) as a hydrogeologist in the Resource Conservation & Recovery Act (RCRA) Corrective Action program chasing chlorinated solvent and heavy metal contaminant plumes around industrial sites (where I quickly learned that power politics and campaign $$ trump science), with a short stint as an interpretative paleontologist at Dinosaur State Park in Rocky Hill. While at the DEP I held a part-time adjunct faculty appointment for several years in the former Department of Geology & Geophysics at the University of Connecticut, Storrs, where I taught the courses *Invertebrate Paleontology* and *The Age of the Dinosaurs.*

Finally tiring of dealing with contaminated strata and ground water, and likewise contaminated politics, I turned to the US Forest Service (FS) for a job as a District Geologist administering development of solid mineral

Mike Fracasso on location in the Cretaceous Pierre Shale, Wallace Ranch paleontological site, Buffalo Gap National Grassland, South Dakota, 2010.

resources. I settled in Douglas, Wyoming, to manage FS projects requiring environmental permitting of 5 of the largest surface coal mines in North America, all located on the Thunder Basin National Grassland (coal from those 5 mines generates @ 10% of US electricity). I also served as the District's paleontology coordinator and administered other solid mineral operations on district (this may come as a surprise to all you academic geologists, but federal minerals are not silicates, carbonates, sulfides, etc.; rather,

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they are solid or liquid, and locatable, leasable, or salable). Administering federal geologic resources over an area roughly 190 mi N-S and 90 mi E-W, nearly 3 times the area of Connecticut, was a logistical challenge, but proved to be both a figurative and literal breath of fresh air (Converse County in WY is consistently ranked as having the best air quality in the nation...not in proximity to the coal mines) compared to hazardous waste contaminant characterization studies.

Passage of the national Paleontological Resources Preservation Act in 2009 led the FS Minerals & Geology Management (M&GM) program to create a Washington Office (WO) position in paleontological resource administration, and I was positioned through FS regulatory experience and academic/professional background to take a successful run at the job. M&GM WO program functions have since been reorganized and renamed as the Centralized National Operations (CNO) office—located "centrally" in the geologic activity hub of Denver, not DC!

At present I'm located in a "detached" CNO office in the FS Region 4 HQ in Ogden, UT, where my focus is on paleontological resource administration in the Intermountain Region, encompassing Utah, Nevada, southern Idaho & southwestern Wyoming.

Along the way I've managed to gain a family including my wife Anne and daughters Lauren and Dana (in college and high school, respectively), who've all managed to put up with boxes of fossils in storage and extended outcrop stops while traveling ("come on, I'll only be a few minutes"...yeah, right...). And I've also gained some experience with newsletter editing; in my current position I was "volunteered" to serve as editor for the FS M&GM internal newsletter "Diggin' Deep."

Lessons learned?...As in paleontology & evolution, adaptation is the key to professional survival. For all you paleos with degrees-yet-to-be-awarded and facing dismal job prospects, there's always hope in landing that paleo position...although it may take a couple of decades..."

On October 23, 2011, as this Newsletter was going to press, Mike informed us that he has been appointed National Paleontology Program Coordinator for the Forest Service's M&GM CNO office, and will be relocating from Ogden, Utah, to Denver, Colorado in January 2012. His email address and other contact information will remain the same.

Melody Brown Burkins '90, (melody.burkins@uvm.edu) writes**:** After graduating from Yale, I spent an incredible summer with the Juneau Icefield Research Program in southeast Alaska before heading to Dartmouth for both an MS and PhD in earth sciences. My first round of research was in Irish ore deposits, mentored by geoscientist and science historian, Naomi Oreskes, and her husband, hydrogeologist Ken Belitz. The lure of field work in icy Antarctica—and the opportunity to work with ecosystems expert, Ross Virginia, and isotope geochemist, Page Chamberlain —led me to four years of soil ecosystem research in the Antarctic Dry Valleys. Three amazing field seasons, several hundred isotope measurements, and a doctorate later, I headed to the Swiss Alps for a term to teach

Porter, Derek, Riley and Melody Burkins.

geology and field methods with my wonderful husband, Derek, before finishing a post-doc at Dartmouth.

In 1999, careers took us to Washington DC, where I had the honor of working for US Senator Patrick Leahy of Vermont for a first year as the GSA-USGS Congressional Science and Technology Fellow, then for another two years as his legislative aide for energy, environment, and natural resources. Returning to Vermont to start our family, I joined the University of Vermont (UVM) in roles ranging from Director of Federal Relations to Associate Dean in the College of Engineering and Mathematical Sciences while Derek dedicated himself to our family and community as full-time father to our two amazing boys. In 2009, I became the Senior Director for Research and Strategic Initiatives at UVM, advancing research priorities and managing partnerships with academia, government, and industry. I also serve as Interim Director of the Vermont Advanced Computing Center.

I remain active in science and policy issues as Vice Chair of the U.S. National Committee for the International Union of Geological Sciences (USNC/IUGS), service on coalitions for Vermont's energy future and agricultural economy, and involvement with UVM's new Institute for Environmental

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Diplomacy and Security (IEDS). On the home front, I am rapidly learning the art of music promotion as my husband's singer-songwriter career takes off (http://www.myspace.com/derekburkins) and am making time to run, ski, and mountain bike so I can try (try!) to keep up with my sons, now 6 and 8, who already rail around Vermont single-track like pros. Finally, I enjoy keeping my Yale connections by interviewing prospective students each winter and making plans to attend Yale Alumni Club in Vermont events this fall—who knew there were so many Yalies up north? I feel truly lucky for all that I have, all that I am able to do, and all that the future holds.

Alena with Bedouin kids, Petra, Jordan.

Alena Bartoli '01 (admin@enter-east.com) currently splits her time between the US and Jordan, where she runs her own business, Eastern Experience, a consulting company that facilitates learning experiences in Jordan and the region. Her projects vary, including everything from running trips for high school students to assisting foreign scholars in the organization of local research projects to location scouting for film and photo shoots. "Living among the towering sandstone cliffs of Lawrence of Arabia's Wadi Rum, at the north end of the Red Sea Rift, I am happy to be surrounded by fascinating geology even if my ability to study it is, at this point, quite limited! I have a spare room and would gladly welcome those of you who are able and interested."

Walton Green G '07 (wagreen@bricol.net) writes: After leaving Yale in 2007, I took a post-doc at the Smithsonian Institution, first with Carlos Jaramillo in Panama City, Panama, then with Scott Wing in Washington, DC. In 2008, I married Katy Black, and moved to Baltimore, commuting from there to DC and Panama, working on leaf venation patterns, graphical analysis of pollen data, and the relative influence of phylogeny and ecology on extinction. I also revisited an idea from Leo Hickey's paleobotany course at Yale: the lycopsids, an important Paleozoic plant group, apparently had a peculiar physiology involving concentration and transport of CO2 from roots to leaves in internal gas spaces. A highlight of this time was dinner with **Benjamin Zaitchik (G '06**), **Albert Colman (G '02**) and our wives; we were all Harvard undergraduates and Yale Geology PhDs who married Hopkins physicians and moved to Baltimore.

Winifred, Katy and Walton.

Last autumn, Katy and I moved to Boston. Here I've been working with Andy Knoll and Missy Holbrook at Harvard, looking at ancient lycopsid physiology and its effects on biosphere-atmosphere feedbacks in the late Paleozoic, while writing up data from my time at the Smithsonian, looking for a permanent job, and (as of July 18th) taking care of our daughter Winifred.

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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