

# Earth&Planetary TIMES

HARVARD UNIVERSITY DEPARTMENT OF EARTH AND PLANETARY SCIENCES

**Question:** Why were the branches ripped off this tree to a height of 8 meters?

**Answer:** The tsunami following the 2010 earthquake in Chile exceeded 10 meters in the village of Dichato. The ground Kristian is standing on is about 2 meters above sea level. The surge reached the base of the hills in the distance nearly 1 kilometer from shore.



PHOTOGRAPH BY WALTER MOONEY

## Why the Chilean Quake Didn't Take More Lives

*A survey finds preparedness pays off*

BY KRISTIAN BERGEN '06, THIRD-YEAR GRADUATE STUDENT

The fifth largest earthquake in recorded history (magnitude 8.8) struck Chile on February 27, 2010, at 3:34 am. It shook Santiago and other major cities of the Valle Central and created a tsunami that inundated the Chilean coast. An estimated 521 people were killed—remarkably few considering the magnitude of the earthquake.

I spent a year in Chile and another six months as an intern with the Earthquake Hazards Team at the US Geological Survey after college. After the earthquake hit, my former intern mentor Dr. Walter Mooney asked me to help conduct a post-earthquake survey of the region. Our goal was to

learn what happened before, during, and after the earthquake to determine what actions helped save lives.

Most deaths caused by shaking during an earthquake result from crush injuries sustained when objects or buildings collapse. To prevent this, buildings must be designed to withstand shaking, dangerous objects must be secured to walls to prevent falling, and building occupants must know how best to protect themselves once the shaking starts. After an earthquake, residents must also know how to respond to potential secondary hazards such as landslides and tsunamis.

Chile has an especially high level of seismicity, which has led to a gen-

**continued on page 3**



4

Professor Dan Schrag discusses Obama's science-friendly agenda



Undergraduate field trip on the high seas off Massachusetts



First female scientist to make the pole-to-pole journey onboard the HIAPER aircraft



Molly Markey PhD '06 puts graduate skills to work in the high school classroom

# In this ISSUE

WINTER 2011 • VOLUME 2 • ISSUE 1

## EACH ISSUE

- 9 Around the Department
- 10 Table Talk
- 13 Alumni Notes
- 20 EPS Connections
- 20 Stump the Scholar

## FEATURES

- 4 Politics, Policy, and Dan Schrag
- 5 Promotions
- 6 Chalk Talk
- 6 The Record in the Rocks
- 7 Heave, Ho!
- 8 Then and Now: Summer Field Work
- 15 All Quals, All the Time

## FROM THE CHAIR JOHN H. SHAW

EPS concentrators and SEA crew post-sailing trip. See page 7 for story.



PHOTOGRAPH BY JEFF SCHELL  
community, and we welcome your thoughts and suggestions on our programs and efforts. So please, keep writing in!

This past year has been highlighted by welcoming new faculty, staff, and students to our Department. The new faculty appointments and promotions noted in our inaugural newsletter have led to major renovations of our buildings and facilities. We have new biogeochemistry (Ann Pearson) and low-temperature isotope (David Johnston) labs in the Hoffman Building, and have significantly upgraded our rock preparation and analysis facilities (Francis Macdonald) in the Geological Museum Building. This past fall, we welcomed an incoming class of 14 graduate students, reflecting a nearly 80% yield from our offers of admission, and continue to support a diverse group of undergraduate concentrators in both Earth & Planetary Sciences (EPS) and Environmental Sciences & Public Policy (ESPP). Of note, the EPS concentration (...a major, in Harvard speak...) was given the highest rating for student satisfaction this past year. We have also joined forces with other concentrations (Organismic & Evolutionary Biology [OEB] and the School of Engineering and Applied Sciences [SEAS]) to develop a new Environmental Sciences cluster for advising students as they navigate from the Yard to a choice of concentration. Finally, additions to our staff have helped us manage better all of these programs. Newly arrived EPS preceptor Hillary Jenkins, for example, has begun working with faculty and graduate teaching fellows to strengthen the "hands-on learning" aspects of many of our courses. In a future issue of the *Times*, we look forward to sharing these enhancements to our undergraduate courses and curriculum with you.

For now, please read ahead and enjoy this current issue of the *Times*. Also, remember to be in touch and share your thoughts and stories with us. Perhaps you will be highlighted in future editions of the *Earth & Planetary Times*!

Harry C. Dudley Professor of Structural & Economic Geology | Harvard College Professor | Chair EPS

## Letters to the Editor

I have had the wonderful newsletter buried on my desk all spring, meaning to write a letter of thanks to those who produced it. I completed my PhD in 1970 and, over the past 10-15 years, if not longer, I have been amazed at the profound silence from HU EPS with respect to its graduates. Having attended another university and worked in the geodepartments at three others, I was eternally amazed that Harvard was the only one that had no regular contact with its alumni. I am glad this lacuna has at last been filled.

And, not just filled, but filled with an engaging and well-produced newsletter.

Thanks again.

Geoff Feiss PhD '70  
President, Geological Society of America Foundation

**Greetings.** I greatly enjoyed the courtesy copy of the new EPS newsletter. Thank you. The place has certainly changed, even since my days on the Departmental Visiting Committee in the '80s! One question. It was mentioned that Ann Pearson is the department's first tenured woman faculty member. Congratulations to her aside, I thought Roberta Rudnick deserves that honour. She was associate professor to 2000, and promoted to full professorship in the spring of 2000. She left later that year for the University of Maryland, where she is now—and recently was elected to the National Academy of Sciences. Surely, those exalted ranks came with tenure!

Am I wrong? Or is a correction in order?  
Thank you for your attention.

E-an Zen PhD '55

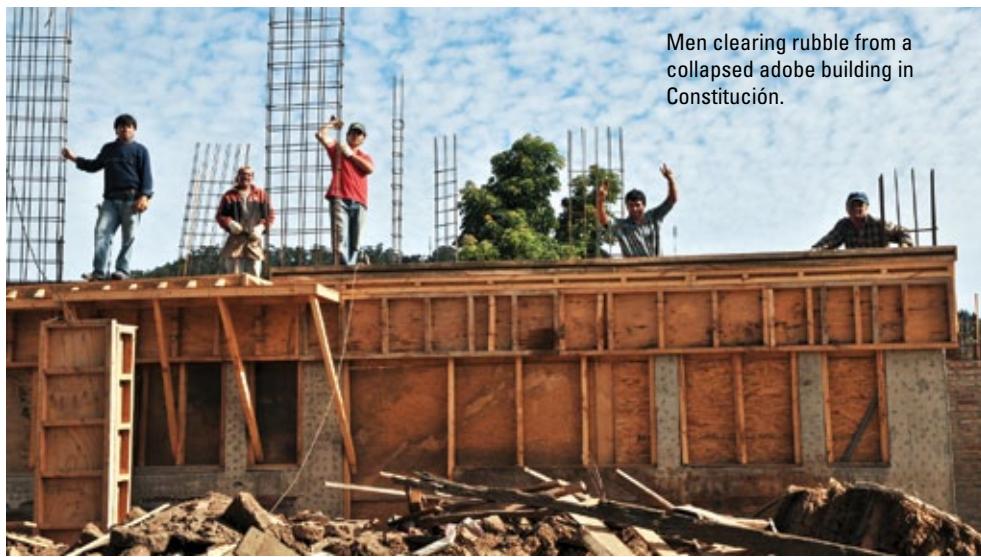
**Editor's response:** Dr. Zen is correct that Roberta Rudnick was the first woman to be offered tenure in the department, but, as he noted, she decided to go to the University of Maryland instead. Perhaps we should have said that Ann Pearson was the second woman to be offered tenure in EPS but the first to accept. We thank Dr. Zen for his close reading.

**Your thoughts?** *Earth & Planetary Times* welcomes letters on its contents. Please send your comments to [epsnewsletter@teps.harvard.edu](mailto:epsnewsletter@teps.harvard.edu). Letters may be edited to fit the available space.

### Does anyone know...

We are in search of any information about the 1912 Mason & Hamlin upright piano that resides in the Hoffman Student Lounge. If you know a bit of its history, please send it along to [epsnews-letter@teps.harvard.edu](mailto:epsnews-letter@teps.harvard.edu). We eagerly await enlightenment.





## chilean earthquakecontinuedfrompage1

eral awareness of earthquake response within the populace. The largest earthquake ever recorded, a magnitude 9.6 that devastated the city of Valdivia in 1960 and took an estimated 1,655 lives, occurred just south of the 2010 rupture. Since that earthquake, Chile has enacted and enforced some of the world's strictest building codes. The consequences were evident after the recent earthquake: modern reinforced concrete, constrained masonry, and wood-framed homes suffered at worst only superficial damage, while older adobe and masonry structures were heavily damaged.

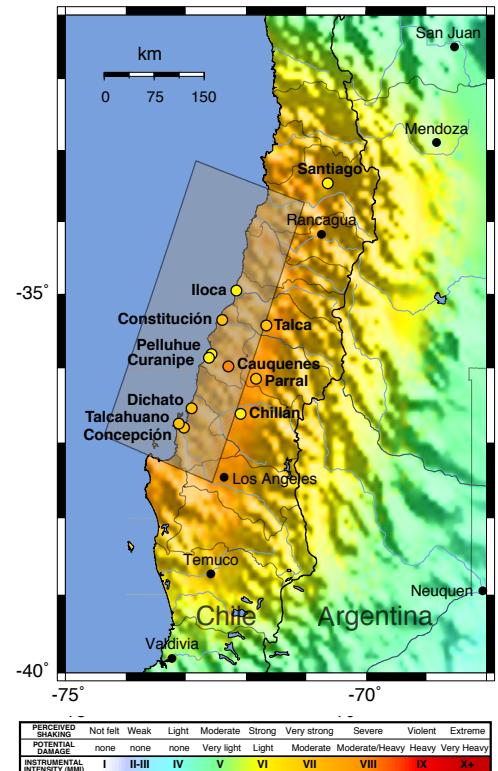
The devastated Valle Central region is the historical heartland of Chile. The cities of Constitución, Talca, Parral, and Cauquenes had many adobe structures dating back to the nation's early history. Adobe, a clay-, sand-, and straw-based building material, is ubiquitous throughout Latin America and performs very poorly in earthquakes. This was

the case with nearly every adobe structure we encountered. Thankfully, Chileans living in unreinforced buildings responded to the first signs of shaking by immediately evacuating. In the hardest hit place we visited, the more than 40,000 resident city of Cauquenes, locals reported that prompt evacuation led to only ten deaths despite severe damage to over half the city's buildings.

We also encountered many unreinforced masonry structures built before Chile enacted modern building codes. Unreinforced masonry was commonly used in construction after Chile's deadliest earthquake, a magnitude 8.3 in 1939 that killed an estimated 30,000 and destroyed the cities of Chillán and Concepción. The wings of hospitals in Parral and Cauquenes, for instance, were both built with unreinforced masonry. In Parral, the unreinforced section collapsed entirely, while in Cauquenes the damage was so severe that the hospital wing will have to be demolished. Amid the destruction, however, was one positive: a section of the original Parral hospital

**USGS ShakeMap: OFFSHORE MAULE, CHILE**

Sat Feb 27, 2010 06:34:14 GMT M 8.8



**Above:** Estimated Modified Mercalli Intensity (MMI) shakemap from the US Geological Survey (<http://earthquake.usgs.gov/earthquakes/shakemap/global/shake/2010fan/>). The MMI scale categorizes the effects of an earthquake on buildings, humans, and other natural objects. Colored circles show MMI estimates for cities visited during the post-earthquake survey based on damage observations and personal accounts of ground motion. The grey square is an estimate of the fault area that slipped during the earthquake. For more information on shakemaps, visit <http://earthquake.usgs.gov/earthquakes/shakemap/background.php>.

that was recently retrofitted with internal reinforcements sustained only minor damage during the earthquake. Similar retrofitting efforts would greatly improve the seismic safety of historical structures like churches and cathedrals throughout Latin America.

Despite the robust building codes enacted after 1960, some modern structures suffered significant damage. Three apartment buildings partially collapsed in the rapidly growing Santiago suburb of Maipú. Inadequate concrete was implicated in one, and poor design in the two others. Structural resonance may have played a role in the collapse of two tall structures in Concepción, but similar structures nearby had no problems. The financial pressures of cost and time were likely involved in all of these structural failures. Ground-failure, such as liquefaction and lateral spreading, was not commonly observed near buildings. This suggests that the selection of building sites was adequate. Transportation infrastructure was generally unaffected, but two of three bridges in

Concepción collapsed as well as some older bridges along the Ruta 5 highway. Isolated cases of lateral spreading beneath roads and overpasses occurred throughout the region.

For the towns and cities along the coast, shaking from the earthquake was just the beginning. A tsunami struck the coast between twenty and thirty minutes after the earthquake. Most of the Chilean coast has steep topography, so a short walk up the hills is all that is required for a successful evacuation. But given how quickly a tsunami can arrive, people must know to evacuate immediately after a strong earthquake. There is not enough time to wait for an evacuation alert from authorities, which typically takes over ten minutes to be issued. It was the swift response of coastal residents that prevented a much greater loss of life.

The tsunami height barely exceeded three meters in most locations. This was the case in the port city of Talcahuano, where containers and ships were carried into buildings. The idyllic village of Dichato, set alongside a horseshoe bay, was hit by a tsunami exceeding ten meters, razing homes to their foundations and heavily damaging those still standing. Local residents evacuated to the hillsides before the surge arrived, but many tourists did not. This story was echoed in the towns of Curanipe and Pelluhue where locals

*Local residents evacuated to the hillsides before the surge arrived, but many tourists did not.*

*~Kristian Bergen*

evacuated to the hills in front of a tsunami that crested at an estimated eight meters. Many tourists staying in vacation homes or popular campsites near the shore did not evacuate. An unknown number of visitors were washed away from an island in the Maule River near Constitución where they were camped for a weekend festival. In many cases the number of people who died at those campsites and hotels remains unknown as the logbooks were washed away along with the buildings.

When asked why they immediately evacuated to higher ground, many coastal residents mentioned knowledge of the 1960 Chilean earthquake and tsunami. The majority, however, referenced news coverage of the 2004 Indian Ocean tsunami. Additional education is clearly needed for the many visitors to the coast. Unfortunately, even many local residents were unaware that tsunamis have several surges (or waves); in Curanipe and Constitución we heard stories of people returning after the first surge to seek loved ones, only to be swept away by the second

surge several minutes later. Greater awareness of the nature of tsunami hazards in the public and the media is needed to avoid this preventable loss of life.

While there are many lessons we have learned from Chile's experience, the overwhelming conclusion is that earthquake preparedness does pay off. Careful design and construction left nearly every modern structure in good condition. Education and a culture of earthquake awareness resulted in prompt, and life-preserving responses once the shaking started and the successful evacuation of most coastal inhabitants after the shaking stopped.



KARIN JOHNSON

*Kristian graduated Harvard class of 2006 with a degree in Earth and Planetary Sciences. He is currently a graduate student working with John Shaw on seismic hazards in the Los Angeles, California region.*



## Politics, Policy, and Dan Schrag

*Obama's new science-friendly agenda*



Daniel P. Schrag

In late 2006 Earth and Planetary Science (EPS) Professor Daniel P. Schrag testified before Oklahoma Republican Senator James Inhofe's Senate Committee on Environment and Public Works. The agenda was the media's coverage of global warming.

It was not an enjoyable experience for Schrag, currently director of the Harvard University Center for the Environment and Sturgis Hooper Professor of Geology. In fact, Schrag, who was invited to testify by the Committee's Democratic staff to counter the notion that global warming is some sort of con cooked up by pointy-headed scientists (Inhofe has called it "the greatest hoax ever perpetrated on the American people"), was so incensed by the misinformation and distorted science aired in the meeting (one witness, a scientist, claimed that "global warming stopped in 1998") that he was moved to write about it in the December 17, 2006 *Boston Globe*.

In his op-ed, Schrag wrote that the hearing was "a gathering of liars and charlatans, sponsored by those industries who want to protect their profits." He noted that two witnesses were scientists "associated with

CLAUDIO CAMPION

# PROMOTIONS

HARVARD PHOTO SERVICES



## Miaki Ishii

Promoted in 2010 to Associate Professor of Earth and Planetary Sciences, Miaki Ishii uses recordings of seismic energy to image the internal structure of the Earth and to study properties of earthquakes. Ishii first came to the department as a graduate student and received her PhD in 2003; after a postdoctoral appointment at the Scripps

Institution of Oceanography, UCSD she returned to Harvard in 2006 as an assistant professor in Earth and Planetary Sciences. Her current research focuses on three main projects: properties of large earthquakes, complex features that exist in subduction zones, and large-scale mantle structure using solid Earth tide.



## Zhiming Kuang

Zhiming Kuang, who joined the faculty of the Department of Earth and Planetary Sciences and the School of Engineering Sciences in 2005 as an assistant professor, was promoted in 2010 to Associate Professor of Climate Science. Kuang's research aims to improve understanding of moist convection and its many roles in climate through both

novel numerical experiments and the development and analyses of theoretical/conceptual models. His current work focuses on understanding how tropical convection interacts with the large-scale flow, with the goal of better predicting tropical rainfall distribution and its variability.

industry-funded think tanks." His visit to Washington, Schrag wrote, gave him "a glimpse at our government...which treats science as a political football, no matter what is at stake." He concluded: "I am not counting on government, or at least this government, to lead us to a solution [to global warming.]"

Fast forward to 2009 when Schrag was appointed by President Barack Obama to the President's Council of Advisors on Science and Technology (PCAST). So today Schrag is part of government, and now he sees government as part of the solution, not part of the problem.

"My perception of the Bush administration is that they wanted to keep science far away from the White House because they didn't want constraints on what they wanted to do," Schrag says.

But since his appointment to PCAST, co-chaired by John P. Holdren (EPS Professor of Environmental Science and Public Policy, Teresa and John Heinz Professor of Environmental Policy, and Director of the Program on Science, Technology, and Public Policy at the Kennedy School), Schrag sees the change in administrations as heralding a change in the relationship between government and industry, and between science and policy. As Obama said in his announcement of Holdren's appointment: "Promoting science isn't just about providing resources—it's about protecting free and open inquiry. It's about ensuring that facts and evidence are never twisted or obscured by politics or ideology."

According to Schrag, the new administration has changed the character of PCAST which, Schrag stresses, is not only charged with keeping the President informed on

science and technology issues but also can make policy recommendations, as it did when it reported that last year's swine flu pandemic (which turned out not to be as virulent as feared) would be hitting earlier than previously predicted.

"Traditionally," Schrag says, "PCAST was composed of people not actively engaged in doing science." These were men and women who had transitioned to emeritus positions, both figuratively and literally. But the new PCAST, Schrag points out, has a large number of younger, more scientifically active members, including Holdren, Chad Mirkin, Director of Northwestern's International Institute of Nanotechnology, and Christopher Chyba, Professor of Astrophysical Science at Princeton. Schrag names other serious, active scientists filling significant posts in the Obama administration, among them US Secretary of Energy Steven Chu and Jane Lubchenco, head of the National Oceanic and Atmospheric Administration. These appointments, according to Schrag, are a sign that Obama is "someone who values scientific perspective."

"It's hard not to be impressed by Obama," Schrag continues. "In person, he's smart, interested in the right things. As a scientist, I'm impressed that he wants to get it right."

For Schrag, getting it right, in part, means reversing the previous administration's attitude toward the relationship between science, regulation, and industry.

In the Bush administration, it was gospel that regulation was inimical to business growth. "Regulators were told not to make trouble for industry," says Schrag. "But encouraging industry doesn't mean relaxing regulations. High penalties for bad operators don't stop good operators from thriving.

The idea that that's a good trade-off—relaxed regulation for growth—is fundamentally flawed."

As an example, Schrag points to the BP tragedy, which he and many others see as a fruit of indifferent regulation. The ultimate consequence, Schrag believes, far from encouraging growth is likely to chill it. "Who's going to trust industry now?" he asks. "Do you want to build a nuclear plant, which doesn't involve drilling? Good luck. Do you want to do carbon capture and storage, which does involve drilling? Good luck."

PCAST has not been involved in the government's BP oil spill response ("We decided it wasn't our expertise," says Schrag) but climate change is always near the top of Schrag's agenda. And although he now plays a more active role in crafting policy than when he testified before Inhofe's committee, he's cognizant of the difficulties that lie ahead.

"You have to remember," Schrag says, "the energy sector represents the largest industry in this country. And really addressing climate change means we will have to stop doing what we're doing and that will impact the energy industry negatively because it

*"We have to remember that the energy system is private and government can't just flip a switch and make things happen."*

*~Dan Schrag*

# CHALK TALK



PHOEBE COHEN

cal eras: the Paleozoic, the Mesozoic, and the Cenozoic, as well as records of climate change through time. Because the chalk drawings are exposed to the weather, they will be renewed from time to time with future murals focusing on topics such as bacterial life. As Cohen noted, "It's transitory art, just like life itself. A lot of the things we're drawing here are extinct now."

First-year graduate student Justin Strauss lends an artistic hand to create the first panels of the chalk talk series outside Ann Pearson's lab.

will mean that we will have to give up our pickup trucks and change our lifestyles."

The enterprises that provide the energy that supports the lifestyles that would be threatened by taking action to mitigate the impact of climate change have, according to Schrag, spent "a lot of money to convince a large portion of the American public that climate change is a left wing conspiracy.

Consequently, a lot of money will have to be spent to change that belief.

"We have to remember that the energy system is private and government can't just flip a switch and make things happen," says Schrag. "In Europe, countries can agree on energy reductions and enforce them. Here, that doesn't work.

"Lots of people have been disappointed

that they already haven't gotten the kind of carbon reductions they're looking for. But the problem with energy is that nothing is cheap and everything involves a trade-off. Do you want to build windmills? They have a land-use impact; you need lots and lots of them. A lot of people don't like that. And the electricity produced by wind power is expensive. Nuclear power troubles people. And nobody wants a coal plant or gas plant built nearby.

"What people want is clean, cheap power that has no footprint and is far away from wherever they are. Essentially, that's a fantasy.

"Ultimately," Schrag concludes, "we need to make change profitable for industry. We need to put a price on carbon—either cap-and-trade or a carbon tax. As long as there's no price on carbon, industry has no incentive to reduce emissions."

PCAST meets in DC every other month but a lot of Schrag's time is spent in smaller working groups. He's not paid for his PCAST duties, but he's officially a government employee.

"PCAST is a lot of work," says Schrag. "I really don't want to think about how much of my time this is taking up." A bottom-line optimism helps him keep those thoughts at bay.

"With all these scientists having access to the White House, that's an extraordinary thing," he says. "Remember: everybody in this government is relatively new. It will take a while. But I think, soon, we'll start to see changes, visible changes for the better.

"I'm realistic. But I'm also optimistic. Especially," says Schrag in his political personae, "in public."     »David Rosenbaum

## The Record in the Rocks

*EPS 182 ventures to Italy*

**B**efore them was a sheer cliff made of whitish limestone. Tearing across the cliff was the Bonarelli, a stark black layer of rock over a meter thick, and highlighted below by flares of rusty orange. The question for these students was: How did this rock get here, and what can it tell us about Earth history?

History is written in stone. At least, it is for the geologist. One group of students enrolled in EPS 182 Stratigraphy and Sedimentology journeyed to the Umbria-Marche region of Italy over spring break 2010 to study the most important book of

their required reading. That book, of course, was the Earth itself, and the pages were layer upon layer of rock, each revealing part of the tale.

"This area is a really classic area for looking at Earth history," said Assistant Professor Francis Macdonald, a field geologist and the trip leader. The Umbria-Marche Appenines of Italy are world renowned for their geological outcrops. One of the best recorders of Earth history is marine sediment, which is preserved layer upon layer, era to era, on the ocean bottom. The Apennine Mountains are formed from these

marine sediment layers, which have been thrust upward from the depths of the sea by plate tectonic motions. Clearly exposed in Italy, like almost nowhere else on the planet, is an account of history from about 220 million years ago to 2.6 million years ago.

Close to sunset, below a meandering ancient Roman aqueduct, Steven Jaret looked through his magnifying hand lens at an unremarkable bit of red clay. "Oh, wow! This is really cool. Look at that spherule: big, green, perfectly round," exclaimed Jaret, a first-year EPS graduate student, as he spotted vapor condensates that must have rained from the heavens shortly after an Earth-shattering asteroid impact. He had identified the thin layer in the rock record that divided two great eras. Below the clay layer, other students corroborated, it was evident the



**Looking at the KT Boundary:** Students line up along the boundary rock layer, which marks the mass extinction that killed the dinosaurs.

oceans were teeming with life. They could see the micro-organisms eternally fossilized in the rock. Above the clay, only the smallest and simplest life forms persisted. The rocks suggest the ocean underwent a catastrophic extinction event—one that correlates perfectly to the extinction of the dinosaurs. Few driving along this lonely road would

suspect that it had been these rocks that spawned the asteroid impact hypothesis for the demise of the dinosaurs. About thirty years ago, this clay was discovered to have a spike in the rare earth element iridium. The iridium could only have come from an extraterrestrial source: an asteroid. Students put their fingers on the thin clay layer that

*“Oh, wow! This is really cool. Look at that spherule: big, green, perfectly round.”*

~Steven Jaret

divides the eras, sampling the evidence that sparked one of the most fruitful geological discoveries of our time. Not only did it prove the asteroid impact, but also it catalyzed a paradigm shift in geological discourse: no longer was the Earth viewed simply as a gradually evolving system.

“It is very important to have students really appreciate how geologists think,” said Macdonald, who led the trip to Italy. “You have a problem, and you have to be able to figure out a way to use this data in the field to come up with a story. ... Geology is really a question-driven science, and here there are just some really big questions exposed in the rocks.”

The presence of the Bonarelli is one of the mysteries that challenge modern geologists. EPS biogeochemistry professor Ann Pearson joined the trip to survey the rock layer. The layer is composed of organic material that must have been deposited when there

## Heave, Ho!

**Undergraduates** literally headed out for the high seas for this year's field trip. When the group of 21 departed Woods Hole, Massachusetts aboard the SSV Corwith Cramer, waves were reaching heights of eight to ten feet due to a late August storm. The sailing trip, organized by Professor Ann Pearson, was aboard a research vessel affiliated with Sea Education Association (SEA). For four days students were conducting research such as analyzing water column structure, currents, and nutrients as well as conducting deck watches and hauling the halyards. When the students returned to land they spent a couple of days on SEA's Woods Hole campus preparing presentations based on the research data they collected. In addition there was a field trip to the Little Sippewissett Salt Marsh where the group learned how to chart the marsh's major features, dissect a microbial mat, and detect remaining traces of the 1969 oil spill in Buzzard's Bay. As Pearson noted, “The pouring rain and wind on the first day was a great reminder that field work carries on, no matter the conditions. By the end of the trip, our BBQ and party were in full sunshine, a wonderful end of summer and a great beginning to the school year.”

Next year's destination: Hawaii. ☺



EPS concentrators from front to back Parker Lawrence '12, Lizzie Abbott '12, Patricia Levi '12, Daniel Villafana '12, and EPS preceptor Hillary Jenkins work together to trim a sail during the undergraduate SEA sailing trip last August.

JEFF SCHELL

was no oxygen in the oceans. But why was there no oxygen in the oceans, and could that happen again? While Pearson collected samples to study the isotope signature of the material, students measured the distance between the various rock layers below the Bonarelli to determine if natural ocean cycles predict such a massive ocean event, or if this one was something truly extraordinary and perhaps cataclysmic.

Grappling with such problems may be advanced for beginners. But all the students agreed exposure to the “real questions” was far more illustrative than “book-learning.” Emily Howell, a freshman who challenged herself to participate in this upper-level course, said, “It’s definitely been tricky, but...I think that just going right out into the field is one of the best things because

you actually get to see all these words that you keep hearing, and you get the big picture.”

The more experienced first-year graduate student, too, found the field experience indispensable. Jaret said, “You look at it in the fields and then you look at it in the textbook, and it’s like, ‘Oh, wow. That is not what it looks like in the textbook at all.’ It is really nice to actually see what geology is actually like.”

Before they left, the students did take time to experience the local culture. On the final day of the trip, after having been blessed with a week of good weather (and therefore productive fieldwork), students had an opportunity to roam the streets of the ancient city of Assisi, a fortified hilltop town famous for being the home of St. Francis.

The walls of the buildings and fortifications of the city were constructed from the very same stones that the students had been studying for a week. Well, most of the stones, at least. While savoring gelatos, a few students noticed that some of the construction materials weren’t local; these randomly placed pieces must have been carted in and integrated into the town’s architecture far more recently. The geologist observes his or her environment, and then make inferences about a place’s history. But perhaps more than just Earth history is written in stone. »Caitlin Rotman ’10

*This article first appeared in The Harvard Gazette and is reprinted with their and the author’s permission. Caitlin, class of 2010, concentrated in Earth Science and Media.*

## THEN AND NOW



Harvard Geological Summer School, Montana, 1911



EPS graduate students at Glacier Point, Yosemite National Park, CA. Half Dome (elev. 8836 ft.) can be seen in the background. August 2010.

### THEN

In 1875 Nathaniel Southgate Shaler, professor of paleontology, organized the first formal summer field course in geology. Its primary objective was to train participants in methods of observation. Initially, the field work was conducted in the mountains of New England, New York, and local coastal areas. It expanded to summer expeditions to the Rocky Mountains and other points west with “Old Baldy” in Montana as a destination for several years. Participants bore the cost of the trips, which included provisions, guides, pack animals, packers, wagons, and other transportation expenses. Unlike other summer courses offered by Harvard at the time, this course was a men’s-only venture.\*

### NOW

This summer’s graduate student field trip was to Eastern California. Chosen for its diversity of field sites, the trip exposed students to sedimentary geology, structural geology, tectonics,

volcanism, glaciology, biogeochemistry, weather and climate, and water resource management. Thirty-two students spent eight days camping in temperatures ranging from 40° to 115°. As with past trips each student developed a lecture to accompany one component of the trip. Helen Amos, G2, discussed the consequences of gold mining in Death Valley; G1 Jason Munster ’07 discussed playas and salt flats at the Badwater field stop; and Allie Gale, G5, explained past volcanic activity at the Long Valley Caldera Obsidian Dome. Hilary Close, G5, revealed the chemistry behind the surreal tufa towers at Mono Lake. G2 Sierra Peterson explained granite weathering in Yosemite National Park. The trip’s organizers, G4 Bess Sturges Corbitt ’06 and G4 ’06 Lee Murray noted that the field trip was a pleasure to lead, and that they learned more about geology than they ever thought possible. They were impressed with the enthusiasm of all participants, and were especially happy to welcome the new G1s. Plans for next year’s trip are already underway. Possible destinations? Pacific Northwest and Southern Appalachians.

# Around the DEPARTMENT

## Faculty

**Paul Hoffman**, *emeritus* Sturgis Hooper Professor of Geology, Harvard, paulhoffmanATyahoo.com: At the December 2010 meeting of the American Geophysical Union, Emeritus Professor Paul Hoffman received the Walter H. Bucher Medal, awarded every two years "for original contributions to the basic knowledge of crust and lithosphere." He will also be honored as a newly elected Fellow of AGU.

**Charles Langmuir**, '72, Higgins Professor of Geochemistry, langmuirATeps.harvard.edu, http://www.people.fas.harvard.edu/~langmuir/: Was the recipient of the 2010 Urey Medal from the European Association for Geochemistry (EAG). The medal honors those who have made outstanding contributions to geochemistry throughout their career. Charlie accepted his award during a formal ceremony held at the Goldschmidt Conference last June in Knoxville, TN.

In addition, this past spring the Langmuir Lab earned the first EPS FAS Green Lab Certification (with a special shout-out to Lab Manager **Zhongxing Chen** and Research Associate **Stéphane Escrig**). For more information on the Green Labs Certification program see <http://green.harvard.edu/node/443>.

Last March, a two-day symposium was held to celebrate the academic contributions of **Michael B. McElroy**, Gilbert Butler Professor of Environmental Studies, mbmATio.harvard.edu, http://www.seas.harvard.edu/directory/mbm. Folks gathered in Maxwell Dworkin to discuss recent results in planetary sciences, atmospheric chemistry, climate, and energy policy. Speakers included Harvard colleagues (Jim Anderson, Bromine: The Key to Climate-Ozone Coupling), beyond-Cambridge colleagues (Wally Broecker, Columbia University, Climate and Water Availability) and former students (Yuxuan Wang, PhD '05, Recent Results in Air Quality Studies over China).

A feature of Caltech's January symposium, "Mechanics in Geophysical and Materials Sciences" was the celebration of the pioneering contributions of **James R. Rice**,



ADRIENNE DEJEANT

Juraj Farkas taking a sampling of a soil profile and atmospheric deposition at the old-growth forest site in the Wachusett Mountain State Reservation, MA.

*"I even had barite roses  
in my bouquet—at ~250  
million years old, they also  
qualified as my 'something  
old.'" ~Amanda Hughes,  
Fifth-Year Graduate Student*

Mallinckrodt Professor of Engineering Sciences and Geophysics, riceATesag.harvard.edu, http://esag.harvard.edu/rice/ on the occasion of his 70th birthday. Speakers were selected among individuals who had been students of Jim's throughout the years or close scientific co-workers and the symposium reviewed the mechanics driven advances in geophysical and materials sciences, and discussed future research directions.

**Sarah Stewart** '95 is featured in the November issue of *Popular Science* in their "Brilliant 10: Your Guide to America's Young Science Geniuses," <http://www.popsci.com/science/article/2010-10/brilliant-10-sarah-t-stewart-master-blaster>.

## Post-doctoral & Research Staff

**William Boos**, former Reginald Daly Postdoctoral Fellow, '08-'10, william.boosATyale.edu, <http://geology.yale.edu/people/moreinfo.cgi?netid=wb98>: Started as an assistant professor in the Department of Geology and Geophysics at Yale University, where he is setting up a small group and preparing for his first semester of teaching. He is continuing his research in monsoon dynamics, but has also recently been studying the climate of the last glacial maximum.

**Juraj Farkas**, Fellow '07, Postdoctoral Fellow '07-'09, Research Associate '09-'10, juraj.farkasATgeology.cz: In September 2010, I started a new position as a researcher in the environmental geochemistry group at the Czech Geological Survey in Prague. Our team just started a new isotope laboratory (MC-ICP-MS), which is a first-of-its-kind in the Central European region, and one of the projects that I am working on investigates long-distance atmospheric transport of toxic trace elements in aerosols and atmospheric liquid phases. We are using non-traditional isotope systems of heavy metals, such as Cr, Cu and Zn, as tracers of toxic metal sources and their transport in the atmosphere. This project is supported by a grant provided by the Norwegian Financial Mechanism.

I am also involved with the preparation of the upcoming Goldschmidt Conference which will be held next year in Prague, on August 14-19, 2011 ([www.goldschmidt2011.org](http://goldschmidt2011.org)). Thus, I would like to invite everyone to visit this beautiful ancient city in the heart of Europe, and hope to see many of you next year in Prague!

**Jake Gebbie**, Postdoctoral Fellow '04-'07, Research Associate '07-'10, jgebbieATwhoi.edu: I have taken a new position as an assistant scientist in the physical oceanography department at the Woods Hole Oceanographic Institution. A key part of my research agenda is to take insights on ocean circulation, developed with Peter Huybers while I was at Harvard, and to apply them to the ocean of the Last Ice Age. My role at WHOI is to spearhead a Climate Initiative that aims to bring scientists from Harvard, MIT, and WHOI closer together. I am also

**JUAN PEREZ-MERCADER** joined Harvard last April as a Senior Research Fellow in EPS and the university's Origins of Life Initiative, where he is starting a project on the "Top-down ex-novo Synthesis of Life." Juan is a practicing scientist, "interested in all scientific and technical questions at the frontier between physics, biology, chemistry, planetary science, computing and engineering." He has predicted proton decay, contributed to supersymmetric unification, explained the fractal correlation between galaxies as a critical phenomenon, tested General Relativity experimentally and developed instrumentation for life detection on arbitrary environments. His PhD is from City College, New York and after returning to Spain in 1984, joined Spain's National Research Council, where he is a Research Professor. In 1998, he founded Spain's Centro de Astrobiología (CAB) as an Associate Member of the NASA Institute of Astrobiology. He was CAB's first director from 1998 to 2008. During his tenure, CAB has become a world-class transdisciplinary research institute, employing more than 150 scientists and engineers and, contributing, for example, both instrumentation and infrastructure to NASA's Mars Science Laboratory which will fly to Mars in 2011. The recipient of many honors and distinctions he is an elected member of the International Academy of Astronautics and of the European Academy of Arts and Sciences.

*jpererezmercader@fas.harvard.edu*



organizing the Paleolunch seminar series, so consider this an open invitation to everyone at Harvard to come give a talk!

**Helge Gonnermann**, Daly Postdoctoral Fellow '05-'06: I am still an assistant professor at the Department of Earth Science at Rice University and I now have

two PhD students and am looking for a postdoc. My physical modeling lab has been evolving and I am also working on some numerical modeling projects. We have settled into life in Houston and even enjoy the climate, which is actually quite nice for most of the year. The only thing missing is some topographic relief.

## TABLE TALK

In many ways, the fourth floor of Hoffman Labs is the hub of the department. With coffee available 24/7, cookies served daily at 3:00, and pizza delivered at 5:00 on Fridays, the Student Lounge with its eleven-foot-long oak table serves as a gathering spot for faculty, students, and staff throughout the day. The friendly and collaborative nature of the department often makes for interesting conversations, snippets of which are captured below.

**“科技始終來自人性”**

(Translation: Technology always stems from humanity.)

**“Why would it be the second derivative?”**

**“I have no idea.”**

*“I would take of piece of the sun and then cool it.”*

*“I feel that if we had force fields we would be doing much more interesting stuff.”*

*“It’s that old adage, ‘Everyone wants to go to heaven but nobody wants to die.’”*

*“Rick has thought of a way to constrain the gamma of the fluids.”*

*“You’re the scourge of the Earth.”  
“No you’re the scourge of the Earth.”  
“Uh-oh—this is going to make it into Table Talk!”*

*“A lot of people are trying to find the melting curve of iron.”*

*“This year I am going as a dinosaur.”*

Welcome to Postdoctoral Fellow **Lindsay Hays**, lhays@fas.harvard.edu: I come to EPS from not too far down the road—the EAPS department at MIT. In June of this year I graduated with my PhD in geobiology using lipid biomarkers to study ocean conditions and microbial communities during the Permian-Triassic boundary extinction event in Roger Summons's lab. Currently I am working in Ann Pearson's lab, looking at biomarkers from much older rocks—mid-Cryogenian age carbonates collected from Mongolia by Francis Macdonald.

Postdoctoral Fellow **Sarah Jordaan** joined Dan Schrag's lab this past September. Her research interests fall within the topic of energy systems analysis, generally focusing on transportation fuels. She has participated in research on life cycle assessment of oil sands technologies, water and land use impacts of energy development, and the role of cogeneration in carbon management. She completed her PhD in environmental design with a specialization in energy and environmental systems at the University of Calgary in 2010. Currently Sarah is investigating environmental impacts of shale gas development, primarily surrounding water use and quality.

**Daniel Rogers**, who received his PhD in 2010 from the MIT-Woods Hole Oceanographic Institution Joint Program in Chemical Oceanography, joined Ann Pearson's lab in June. As a postdoctoral fellow he is continuing the Pearson lab's

environmental metagenomic research, focusing on examining the environmental and phylogenetic distribution of functional genes involved in terpenoid lipid biosynthesis. Daniel's goal is to design new primers that accurately target and amplify genes of interest from a wide range of environmental samples. The recovered genes from each environment are then sequenced using the 454 pyrosequencing chemistry. The data produced from this effort will both increase our knowledge of the phylogenetic diversity of these functional genes by increasing the number of sequences of these genes stored in GenBank by orders of magnitude, and provide insight as to potential correlations in the presence or absence of these genes and environmental or community parameters.

Visiting Postdoctoral Fellow **Erik Sperling**, [sperlingATfas.harvard.edu](mailto:sperlingATfas.harvard.edu), came to the department in September: Prior to coming to Harvard I completed my PhD with Dr. Derek Briggs at Yale University. My thesis worked on combining data from the fossil record and the molecular (genetic) record to determine the body plan of the last common ancestor of animals, and when animals evolved. I've received an Agouron postdoctoral fellowship to work primarily with Dr. Andrew Knoll, but also Drs. David Johnston and Francis Macdonald, on reconstructing paleo-environmental conditions during this time period (the Cryogenian) when animals likely evolved.

**Carl Tape**, former visiting postdoctoral fellow '09-'10, and his wife Elisabeth Nadin proudly announce the arrival of Leo Nadin Tape (8 lbs, 9 oz), born on March 1, 2010 in Cambridge, MA. Carl is currently an assistant professor at the Geophysical Institute and Department of Geology & Geophysics, University of Alaska Fairbanks, <http://www.giseis.alaska.edu/input/carl/>.

Before arriving as a research associate last September in Dave Johnston's lab, **Scott Wankel**, worked as a postdoc in Harvard's Department of Organismic and Evolutionary Biology, investigating deep-sea biogeochemical cycling of carbon and nitrogen, through the development of innovative *in situ* sensor technologies. Scott's background is in marine stable isotope biogeochemistry (PhD from Stanford University '07). His work with Dave will involve exploring the interactions between nitrogen cycling and both metal and sulfur cycling using innovative stable isotope measurement techniques in a variety of environments.

## Graduate Students

Thirteen graduate students began their first year in the department this fall (one of our 14 admits deferred to study in New Zealand for a year). We extend a hearty welcome to:

**Uyanga Bold**, *Mongolia University of Science and Technology and geologist with Rio Tinto*

**Athena Eyster**, *University of Michigan*

**Joseph Fitzgerald**, *University of Waterloo*

**Sarah Hurley**, *Wellesley College*

**Eugenia Hyung**, *Ohio State University*

**Kathryn McKain**, *consultant with Scitor Corporation working with the Wofsy group*

**Christopher Miller**, *University of Wollongong, Australia*

**Jason Munster** '07, *research assistant working with the Anderson group*

**Alex Robel**, *Duke University*

**Phoebe Robinson** '09 (applied math), *Hershel Smith Fellow in Experimental Sciences at Cambridge University*

**Emily Smith**, *English professor at Kunming University, China*

**Justin Strauss**, *field assistant at Harvard and lab manager at Princeton University*

**Jonathan Tucker**, *research laboratory manager at Mount Holyoke College and teaching assistant at Amherst College*

### Teachers Extraordinaire

The department recently created the Shaler Teaching Award\* to recognize EPS teaching fellows who have excelled in the role of educator, have gone above and beyond the required effort, and have demonstrated to their students a passion for teaching. Recipients receive a Certificate of Outstanding Teaching, along with a \$500 award. For superlative teaching in academic year '08-'09 the inaugural recipients were **Jessica Creveling**, G4 for EPS 8 History of the Earth and **Allison Gale**, G5 for B-35 How to Build a Habitable Planet. In '09-'10 Shaler recipients were **Judith Hubbard** G6 for SPU 12 Natural Disasters and **Rita Parai** G3, '07 for EPS 7 Introduction to Geological Sciences. Congratulations—and thank you—to all four students.

\*The Shaler Teaching Award is named after Nathaniel Southgate Shaler (1841-1906), who was the first recipient of a degree in geology at Harvard (advised by Louis Agassiz, ~1869) and the first professor of geology (1888-1906).

*He served as an artilleryman in the civil war and was a renowned war poet. Shaler also served as Harvard's dean of sciences and during his Harvard tenure was considered one of the university's most popular teachers.*

**Amanda Hughes** G5 and **Eric Kiser** G4 were married on September 18th in Butler, PA. Amanda writes: Several other graduate students attended. We included rocks in our event in many ways—we labeled the tables with rocks and minerals we had collected on our trips, decorated with them, and I even had barite roses in my bouquet (at ~250 million years old, they also qualified as my "something old.") We also went on our honeymoon to Colorado, where we did a lot of hiking and some rock collecting, too. To enjoy photos from the wedding visit: <http://ahughes1241.zenfolio.com/p111591238>.

And just a few months before, **Eric** was selected as the IRIS 25th Anniversary "Birthquake" baby. IRIS, the Incorporated Research Institutions for Seismology, bestowed this award to a workshop participant whose birth date was closest to the IRIS date of incorporation of May 8,



ELIN KALESON

Steven Jaret G2 during his visit last summer at the Gardnos Impact Structure (Norway), peeling moss off an outcrop to uncover the contact between the top of the impact-deposits and post-impact sediments.

1984. Eric received a Garmin Forerunner 305 GPS-enabled personal trainer at the 25th Anniversary Celebration Dinner on Thursday, June 10. As his advisor Miaki Ishii notes, "I think this is great considering that at the same workshop, Adam Dziewonski was recognized as one of the two founding fathers of IRIS!" You can see Eric getting his certificate from Jim Rice at <http://www.iris.edu/hq/gallery/photo/6547>.

## Academic & Administrative Staff

**Markos Hankin** '86 (physics) joined the department in June as lab manager for Sarah Stewart-Mukhopadhyay's Shock Compression Laboratory. Prior to coming here, Markos worked at MIT Physics managing their "demonstration group," supporting physics classes, labs, and research. **Lee Farina**, who had been the Shock Compression lab manager since 2006, moved to Wisconsin where her husband accepted a faculty position at the University of Wisconsin.

We bid farewell to faculty coordinator **Robert Henry** who accepted a position in pre-award research administration at Northeastern University and extend a welcome to his successor, **Sabinna Chang Cappo** who joined us last July. In her role as faculty coordinator she will be providing support to Peter Huybers and David Johnston, as well as coordinating the department's Monday Colloquia. Prior to coming to EPS Sabinna spent several years as program manager at EC Boston, part of a group of English language schools operating in Europe, South Africa, and the United States.

**Tricia Hopkins** joined the EPS staff last Au-

gust as its research administration specialist. Tricia hails from Harvard's Office of Sponsored Programs (OSP) where she worked for the past two years as a sponsored financial analyst working on post-award research administration supporting several departments, including EPS. Her successor, **Marcie Steeves** left to enroll into a graduate program in genetic counseling at Brandeis University.

Welcome to **Hillary Jenkins**, EPS's new preceptor. Hillary, who received her PhD from Duke University in 2009 in paleoclimatology and stable isotope geochemistry, arrived last July and has been working closely with faculty and teaching fellows on a wide range of curricular activities, most notably this fall on developing and teaching new lab and section content in the department's Gen Ed and introductory courses. Her predecessor, **Jeff Standish**, moved to Washington, DC with his wife, **Cara M. Santelli**, former postdoctoral scientist in Colleen Hansel's lab, who accepted a position as research geologist in mineralogy, at the Smithsonian Institution. Jeff will be developing curriculum for the American Chemical Society's Profession Education group, in an effort to reshape how professional education and training is conducted.

We are also delighted to welcome **Olga Kolas**. Olga has joined us after providing several years of administrative support and instruction at ELS Language Centers and Bunker Hill Community College. As a faculty coordinator, Olga will be providing support to Charlie Langmuir, Ann Pearson, and Rick O'Connell. Olga succeeds **Rady Rogers** who accepted a new position in Harvard's FAS Research Administration Services as an ARRA project specialist.

**Jennifer Lake** started in September as the Harvard University Center for the Environment faculty assistant working for Dan Schrag. Prior to coming to Harvard Jennifer was an executive administrative assistant in an engineering department within Microsoft Corporation. Her predecessor, **Nathaniel Gill**, left in August to become the administrative coordinator for the Center for Computational and Molecular Biology at Brown University.

In June, **Andrew Masterson** started as the laboratory manager and research technician in David Johnston's lab. Andrew joins us from the University of California, San Diego where he was a graduate student researcher in Mark H. Thiemens's lab.

We also welcome **Marisa Reilly**, faculty coordinator for Adam Dziewonski, Miaki Ishii, Francis Macdonald, and Jerry Mitrovica, who arrived last April after working for a couple of years in Harvard's Office of Governing Boards providing support to the associate secretaries and university secretary.

The Mineralogical Museum has had two recent additions. **Jess Dugan**, who started in January, comes to us from the Harvard Art Museum. In her role as curatorial assistant, she will be photographing the Museum's collections. Although **Tracy Warmington** started in April as curatorial assistant she previously worked in EPS doing sample preparation work for Francis Macdonald. In addition, Tracy has been a teaching assistant twice for the Gen Ed course Natural Disasters and last year earned a Certificate in Teaching award from the Bok Center.



## JASNA PITTMAN

Former graduate student **Jasna Pittman** PhD '05 (see Alumni Notes this issue) is currently a research associate in the Wofsy Group. One of her current endeavors is HIAPER Pole-to-Pole Observations (HIPPO), a worldwide study of greenhouse gases (<http://hippo.ucar.edu>). This multi-institution project has completed three out of five phases: two in 2009 and one in 2010. Jasna participated in HIPPO-3 and was the first female scientist to make the pole-to-pole journey onboard the HIAPER aircraft, a highly modified Gulfstream V. The ten-person flight crew consists of five scientists, two pilots, and three aircraft support personnel. Each HIPPO phase covers ~30,000 miles in ~3.5 weeks, flying numerous vertical profiles between 500 ft and 45,000 ft, from 85° north to 67° south, primarily over the Pacific Ocean. "It was a privilege and honor, and certainly great fun to be part of the crew," Jasna said. "We went from snowy winter in Alaska to hot summer in Hawaii to colorful fall in New Zealand in just ten days! The views from the plane were truly spectacular and the scientific results are very interesting and should be quite valuable!" The last two phases of the project are scheduled for the summer and fall of 2011. [pittmanATseas.harvard.edu](mailto:pittmanATseas.harvard.edu)

# Alumni NOTES

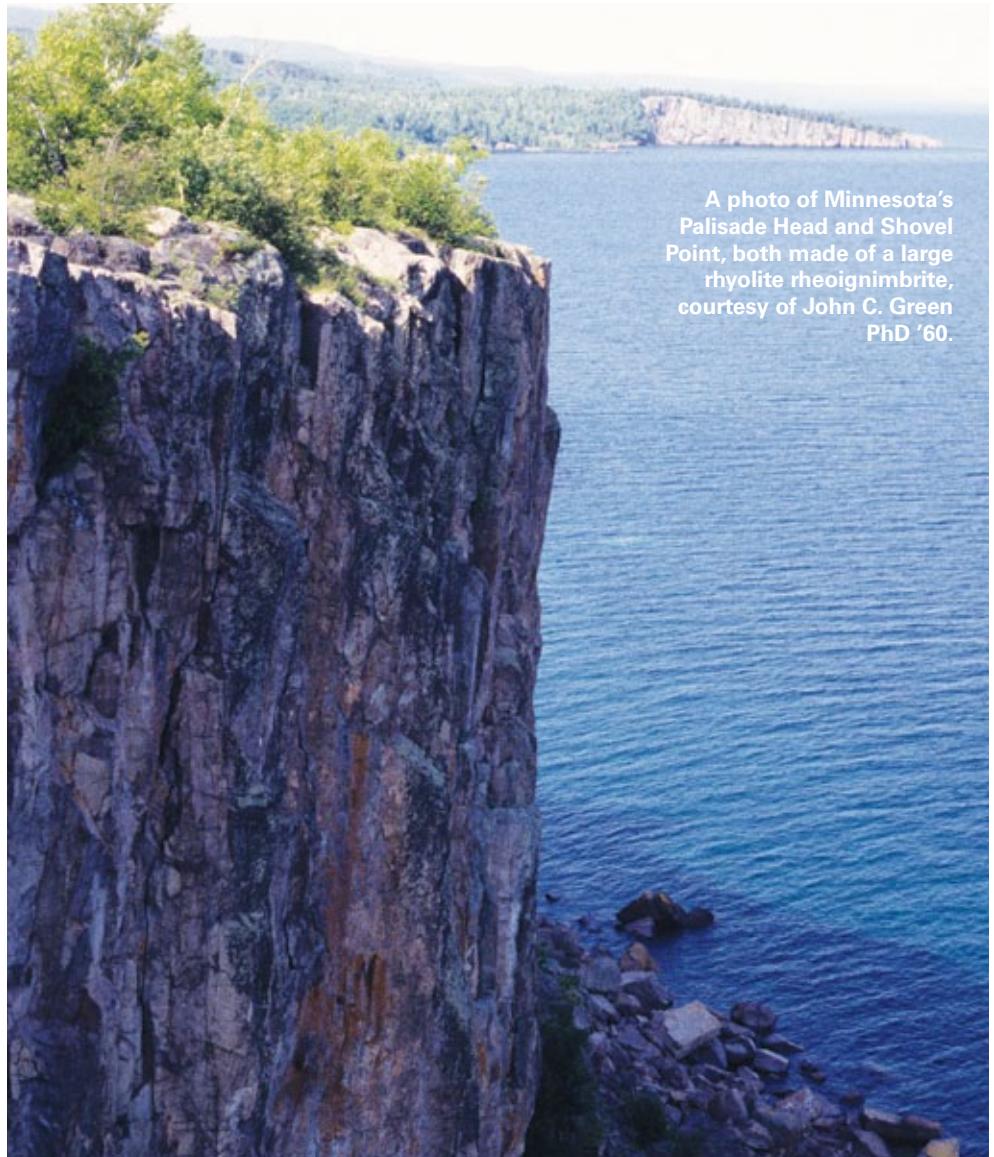
## Graduate

**John C. Green** PhD '60, jgreenATd.umn.edu: I retired in 1999 as geology professor at the University of Minnesota Duluth, where I taught mainly mineralogy, petrology, volcanology, and environmental geology. My main research has been on 2.7 and 1.1 Ga volcanic rocks in NE Minnesota, especially Keweenawan plateau lavas of Minnesota's beautiful North Shore of Lake Superior. I was part of the Lunar and Planetary Institute's Basaltic Volcanism Study Project (publ. 1981) and also have worked on the large, high-temperature rhyolites that are a significant part of the Midcontinent Rift volcanic section.

**Robin Brett** PhD '63, adelaide1935ATyahoo.com: I have just retired as a part-time administrative judge for the Nuclear Regulatory Commission.

**S. Lawrence Dingman** PhD '70, ldingmanATmsn.com: I was pleased to get the inaugural issue of *E&P Times*, and to read news of the department and of two contemporaries, Olav Slaymaker AM '63 and Jeff Warner PhD '67. We were a pretty close-knit group of graduate students during my tenure there (1960-1963), and I am still in contact with Olav, as well as Fred Shaw PhD '65 and Jonathan Swinchatt PhD '63. My brief contact with Prof. John Miller, Harvard's young geomorphologist/geochemist, in the year before his untimely death changed the course of my career. After leaving Cambridge, I did research in Alaskan hydrology for the Army's Cold Regions Research and Engineering Lab in Hanover, NH (1963-69), and got my degree in 1970. After leaving CRREL, I worked on flood issues on the Connecticut River for the New England River Basins Commission. In 1975 I joined UNH's unique Hydrology Program, and taught there until retirement in 2005. In addition to mentoring over 40 grad students, I did research on New England hydrology and fluvial hydraulics, I wrote 3 texts, *Fluvial Hydrology* (1984), *Physical Hydrology* (1994, 2002), and *Fluvial Hydraulics* (2009). I am now retired on Cape Cod, involved in several musical groups, working with some coastal geologists on the evolution of the outer Cape, and embarking on a 3rd edition of *Physical Hydrology*.

**Geoff Feiss** PhD '70, pgfeissATgmail.com:



A photo of Minnesota's Palisade Head and Shovel Point, both made of a large rhyolite rheognimbrite, courtesy of John C. Green PhD '60.

Retired in 2009 from the College of William & Mary where he was Dean of the Faculty from 1997-2003 and Provost from 2003-2009. Previously, he spent over 20 years on the faculty at the University of North Carolina at Chapel Hill. He now lives in Fort Collins, CO and is currently the president of the Geological Society of America Foundation in Boulder.

**Andy Eaton** PhD '75, ade1014ATgmail.com: I am into my 31st year at MWH Laboratories, a Division of MWH Americas Inc. as technical director. MWH Labs performs testing around the world for potable water and beverages. I seem to spend most of my time these days giving presentations at conferences (or mentoring others to give them). Occasionally all that

geochemistry background actually becomes useful in advising clients. Have been having Thanksgiving with Bob Kamilli PhD '76 and family for about the last 20 years or so,

### Tidings

EPS is always pleased to hear from our alumni and friends. Send us your comments or news to: [epsnewsletterATeps.harvard.edu](mailto:epsnewsletterATeps.harvard.edu). So that we may print your notes and photographs, please include with your submission:

- 1) your affiliation and year; and
- 2) the following statement:  
*I give consent for display of the note, my email address and/or web-link and any associated photo which may or may not appear in print and electronic version.*

and often see Steve Bushnell PhD '83 at the same gathering. Jutta Hager PhD '78 has also been an occasional visitor so I'm not completely out of touch with old colleagues. On the family front our son and daughter-in-law are based in Mountain View with our grandkids (3½ and 10 months) and our daughter has gone back to school at USC for a master's in social work. Barb retired from Kaiser a few years back after 25 years as a surgeon. Would love to have old classmates visit.

**Jeremy Boak** PhD '83, [jboak@mines.edu](mailto:jboak@mines.edu): I have recently chaired the fifth in a series of annual Oil Shale Symposia at the Colorado School of Mines, where I am the Director of the Center for Oil Shale Technology and Research (COSTAR): <http://www.costarmines.org/>. Oil shale has received a great deal of attention lately because of development in areas where shale contains already generated oil, what I call shale-hosted oil or natural shale oil (for example the Bakken Formation of North Dakota and Montana). My research has focused largely on the other kind of oil shale, which must

be heated to generate oil from the solid hydrocarbon precursor material (shale oil or synthetic shale oil). We are just beginning to highlight the common ground between the two resources, as well as links to gas shale, an already hot natural gas play.

**Alan S. Kornacki** PhD '84, [alan\\_kornacki@earthlink.net](mailto:alan_kornacki@earthlink.net), [Alan.Kornacki@weatherfordlabs.com](mailto:Alan.Kornacki@weatherfordlabs.com): I retired from Royal Dutch Shell in June. During my 26-year career, I developed and implemented petroleum geochemistry and fluid property technology for a wide variety of E&P applications. I recently focused on supporting gas shale, oil shale, tar sand, and CO<sub>2</sub> sequestration projects. Soon after I retired from Shell, I accepted a position as a part-time geochemistry consultant for Weatherford Labs in Houston, which values my expertise at evaluating unconventional gas resources. I also accepted an invitation to join the Scientific Advisory Committee for a new Department of Energy research center on Nanoscale Control of Geologic CO<sub>2</sub> at Lawrence Berkeley National Laboratory. Karen and I plan to remain in Houston

until mid 2011, and then relocate to the North Shore of Massachusetts.

**Kurt P. Wise** PhD '89, [kwise@truet.edu](mailto:kwise@truet.edu): Is in his second year as Professor of Natural Science and Director of Creation Research at Truett-McConnell College in Cleveland, GA. At his hiring he was charged with creating science majors at the College, the first one (biology) projected for the fall of 2011. In July 2010 he was appointed Chairman of the Division of Science and Mathematics at the College.

**Mimi Gerstell** AB '66, AM '91, G '92, Gp '90, [mimigerstell@yahoo.com](mailto:mimigerstell@yahoo.com): I entered the GSAS as a special student in the fall of 1988, taking courses from Stein Jacobsen, Richard Goody, and Paul Horowitz. Goody found money for me to matriculate (I was in my 40s, so not a conventional applicant), and after some more courses I began a project in modeling atmospheric radiative transfer. When Goody retired in the middle of my program, I took the "terminal" master's degree from Harvard, moved to Caltech, and defended my dissertation in 1994.

By that time, I also had a successful mortgage business, so did not engage in science full time, but hung around Caltech doing a few planetary projects that came my way. Of a dozen scientific papers bearing my name, my favorite was the least "scientific," reporting a pure discovery: "A distinct class of avalanche scars on Mars," *Icarus* 2004. I still collect an occasional pittance from Caltech for editing atmospheric papers in English written by Chinese authors. I play bad golf, and I argue against useless interventions in our climate problem, feeling that a drastic reduction in the human population is the only solution, and that it will come, but it won't be pretty.

**Cassandra Volpe Horii** PhD '02, [cvhori-i@post.harvard.edu](mailto:cvhori-i@post.harvard.edu): Since June 2009, I have been serving as dean of the faculty at Curry College, a private liberal arts institution offering bachelor's and master's degrees, just outside of Boston in Milton, MA. Besides building programs and services to enhance faculty professional development and support—including teaching, assessment, research, grants, and instructional technology—this semester I am also teaching a Freshman Seminar on sustainability. My husband, Masaki, my daughter, Maya (now in first grade), and I live in Cambridge.

**James Wang** PhD '03, [james.wang@stanfordalumni.org](mailto:james.wang@stanfordalumni.org): The timing of this call for



Che-Bao Ma PhD '73 with his wife and 3 children in front of Han-Bi-Lo, the renowned tourist hotel located in Sun-Moon-Lake in central Taiwan.

## CHE-BAO MA PhD'73

After getting my PhD I spent a year at the Department of Geochemistry, Pennsylvania State University, as a research associate, and then spent a couple of years as an Alexander-von-Humboldt Research Fellow at the Institute for Mineralogy at Ruhr University Bochum, West Germany. The majority of my career (1976-2007), however, was with the Institute of Nuclear Energy Research (INER), Long-Tan, Taiwan. After retirement in 2007, I passed the qualifying examination for certificate administered by the Ministry of Education in Taiwan for proficiency in teaching Chinese/Mandarin as a second/foreign language. My wife also retired in 2007 and since then we have been enjoying the "time bonus" of our simple and pleasant life with occasional trips to go to see our three children in the US as it is said, "To carry out inspection on North American Affairs."

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# ALL QUALS, ALL THE TIME

*Former graduate student puts  
PhD to work in high school*

BY MOLLY MARKEY, PHD '06

The Department of Earth and Planetary Sciences at Harvard gave me wonderful research opportunities and field experiences, and allowed me to pursue my interests to my heart's content. In fact, I enjoyed graduate school so much that I wanted to stay in academia and after graduation sought a tenure-track position. But today's extremely tight academic job market led me to consider other career paths and, much to my initial surprise, I have shaped a career in teaching and in educational publishing with my PhD as a valuable asset.

Upon completing my studies at Harvard I accepted a job teaching at Newton Country Day School, a private school for girls in Newton, Massachusetts.

At first, I think my new employers probably found me insufferably cocky because I had the not-very-well-hidden idea that teaching high school kids would not be particularly difficult for me, a Harvard-trained PhD. "They're teenagers!" I told myself as I walked into the classroom for the first time. "How hard can this be?"

It took about ten minutes for me to realize that I would need every ounce of the mental stamina I had developed in graduate school, along with a good deal of technical content I had learned as well. A deep and broad understanding of one's field is invaluable in the classroom. Graduate-level coursework and research help me address student questions by giving me the background knowledge necessary to "translate" scientific content into everyday language, which is an essential skill for teachers at the high school level (and, indeed, at any level). In addition, middle-school and high-school students expect their teachers to be able to answer any question they may have about the topic at hand. In fact, it is not inaccurate to say that teaching secondary school is a bit like "all quals, all the time."

Just as I had not appreciated the challenges of secondary school teaching before I was actually leading a class, I hadn't anticipated its rewards. Every day, I feel a sense of accomplishment when my students learn something new, an emotion second only to the pride I experience seeing their hard work and dedication. A particularly vivid picture of why I love my job comes to mind when I think of one of my recent freshmen biology classes. After discussing enzymes and how they catalyze chemical reactions, I showed the class a video simulation of an enzyme in action. I stayed silent to allow the class to form its own observations. Halfway through the movie, a student rocketed up out of her chair and exclaimed at the top of her lungs, "Oh my God, it's breaking bonds! The enzyme is changing the other thing, but the enzyme is staying the same!" This flash of enlightenment seemed to light up the room. Moments like these make me feel that I have the best job in the world.

Molly at Joggins,  
Nova Scotia, a  
locality noted for its  
fossils.



In addition to classroom teaching, I have put my PhD to work in educational publishing. Over the past few years, I have been involved in projects as diverse as editing grants for cancer researchers, writing content for the teachers' edition of a popular ninth grade biology textbook, acting as a consultant for publishers developing a high school environmental science textbook, and devising puzzles and writing "fun facts" for a children's dinosaur book. But, my involvement in science writing took a similar trajectory as my teaching experience. I definitely started out thinking, "How hard can this be? I'm writing for high school students and little kids!" But it quickly became evident to me that a deep understanding of science is just as essential for writing for younger students as it is for classroom teaching. Science writers have to speak to a variety of audiences, conveying technical information using colloquial language. Doing this successfully requires a thorough knowledge of the subject matter to ensure that the finished product is scientifically accurate.

The knowledge and skills I gained as a graduate student at Harvard are just as valuable for me now, as I write children's dinosaur books and teach high school students, as they were when I was completing my dissertation. In fact, my relatively unconventional career path has made me more appreciative of the opportunities I had at Harvard to explore my interests and develop as a learner by trying new things, such as when I took the helm of a three-masted brigantine on the SEA departmental field trip. I would urge upcoming graduates to take full advantage of what EPS has to offer, and emphasize that their knowledge and experiences may take them in unanticipated but richly fulfilling career directions. ☺

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*Molly is currently a teacher at the Winsor School, a private school for girls in Boston. She lives in Woburn, MA with her husband, two children, and a leopard gecko. She can be reached at markeyATpost.harvard.edu.*

updates is perfect, as I'm about to make a career transition. I recently won a National Research Council award that will allow me to work for a year as a senior research associate

at the NOAA Air Resources Lab in Silver Spring, MD in collaboration with Dr. Dian Seidel. I plan to accept the offer and conduct research on climate trends in the tropopause

region of the atmosphere, using radiosonde and satellite observations.

I've been working as a climate scientist at the New York headquarters of the environmental organization Environmental Defense Fund for the past seven years. I've become interested in doing more fundamental science and think that the NRC position will be a great entree to that kind of a career.

## NEXT STEPS: '09-'10 PHD GRADUATES

**Nine EPS graduate students** received their doctorate in academic year 2009-2010. With dissertations bound and PhD diplomas in hand our most recent alumni have dispersed around the globe.

### Nathan Benesh

*Dissertation:* "The Mechanics of Fault-Bend Folding and Tear-Fault Systems in the Niger Delta"

*Next step:* Geoscientist with ExxonMobil Exploration Company

### Phoebe Cohen

*Dissertation:* "Investigations of Enigmatic Neoproterozoic Eukaryotes"

*Next step:* Postdoctoral Associate with the Education and Public Outreach group at the NASA MIT Astrobiology Advent of Complex Life team, Department of Earth, Atmospheric and Planetary Sciences, MIT

### Duncan Fairlie

*Dissertation:* "Transpacific Transport of Mineral Dust: its Impact in the United States and on Sulfate, Nitrate, and Ozone in Asian Pollution Plumes"

*Next step:* Federal government researcher at NASA Langley Research Center

### Itay Halevy

*Dissertation:* "Aspects of the Early Sulfur Cycle and its Effects on the Climate and Geochemistry of Earth and Mars"

*Next step:* Postdoctoral Fellow, Division of Geological and Planetary Sciences, California Institute of Technology

### Meytal Higgins

*Dissertation:* "Reconstructing Marine Productivity Using Compound-specific Nitrogen Isotopes"

*Next step:* Post-Doctoral Associate at Princeton University

### Chris Holmes

*Dissertation:* "Multiscale Models of Atmospheric Mercury: Bromine Chemistry, Air-Sea Exchange, and Global Transport"

*Next step:* Postdoctoral Fellow, Department of Earth System Sciences, UC Irvine

### David Jones

*Dissertation:* "Stable Isotopes in Neoproterozoic and Early Paleozoic Earth History: Correlation and Climate"

*Next step:* Postdoctoral Associate in the Earth & Planetary Sciences Department at Washington University in St. Louis.

*And then:* In January 2011, Associate Professor of Geology at Amherst College

### Roiy Sayag

*Dissertation:* "Dynamics and Spatiotemporal Variability of Ice Streams"

*Next step:* Postdoctoral Research Fellow at the Institute of Theoretical Geophysics, Department of Applied Mathematica and Theoretical Physics, University of Cambridge

### Lin Zhang

*Dissertation:* "Application of Satellite Observations and Adjoint Inverse Modeling to Intercontinental Transport of Ozone Pollution"

*Next step:* Postdoctoral Fellow at EPS, Harvard University

**Jasna Vellovic Pittman** PhD '05, pittmanATseas.harvard.edu: After I finished my PhD under Jim Anderson, I received the NASA Postdoctoral Fellowship. I worked with Dr. Pete Robertson at NASA Marshall Space Flight Center focusing on aircraft and space-borne measurements of upper tropospheric humidity. After NASA, I held visiting scientist and project scientist I positions at NCAR in Boulder, CO where I worked with Dr. Laura Pan on chemistry and dynamic processes in the tropopause region. After NCAR, I returned to Harvard and I now work on aircraft field measurements and data analysis of greenhouse gases in the Wofsy group.

**Jonathan Gero** PhD '07, geroATpost.harvard.edu: I'm currently a research scientist at the Space Science and Engineering Center at the University of Wisconsin-Madison. My main involvement is with the CLARREO satellite mission to study climate change, working in collaboration NASA. In my spare time I sail and teach sailing at our campus sailing club.

**Lucy R. Hutyra** PhD '07, lrhutyra@bu.edu, <http://people.bu.edu/lrhutyra/>: In January 2010 I started as an assistant professor at Boston University in the Department of Geography and Environment. My current research is focused on the terrestrial carbon cycle with an emphasis on understanding urban carbon dynamics from coupled human-natural systems perspective. I currently co-lead an NSF grant to characterize the metabolism of carbon within the Boston metro region.

**Suni Shah** PhD '08, suni.shah@post.harvard.edu: I am starting the NOSAMS postdoc at WHOI in November.

**Joe Bernstein** PhD '09, jinmoon@tgmail.com: Towards the end of my degree I took a renewable energy consulting job in Los Angeles. However, a few months after I arrived in California I was offered a job in Chicago as a programmer for a high frequency proprietary trading firm which I accepted. I currently design and code pro-

grams which make markets and facilitate trading across a variety of exchanges and products. Although I have to be at work early, there is no dress code at the company so I have transitioned to the corporate lifestyle fairly easily.

**Victor Tsai** PhD '09, vtsai@post.harvard.edu: I am still enjoying my time as a Mendenhall Postdoctoral Fellow at the USGS in Golden, CO, where I have been since leaving Harvard. In the summer of 2011, though, I am excited to say that I will be moving to Pasadena, CA where I will start as an assistant professor in geophysics in the Caltech Seismology Lab.

**Phoebe Cohen** PhD '10, pcohen@mit.edu: After graduating in the spring, I started a job as education and public outreach coordinator for a large NASA Astrobiology grant run through MIT (<http://astrobiology.nasa.gov/>). The grant's goal is to learn more about the advent of complex life (<http://www.complex-life.org/>). I communicate the underlying science of our work to the public at a variety of levels, from elementary school to college students and the general public. This includes creating middle school web-based curricula, creating teaching resources for use at the college level, doing outreach at local schools and museums around Boston, and helping scientists learn how to better communicate to K-12 audiences.

## Undergraduate

**Martin M. Cassidy** '55, jo1955mar@taol.com: Having retired from Amoco Production Company after 32 years of international oil and gas exploration I am now enjoying being an academic as a research scientist in the Department of Earth and Atmospheric Sciences. My emphasis is upon CO<sub>2</sub> naturally in the subsurface. In addition, our nonprofit American Association of Professional Geologists (AAPG) Publication Pipeline Committee has shipped many pallets of used Geoscience publications to universities around the world. For example, we just shipped 2 pallets each to 10 different universities in Nigeria. Each pallet contained about 1,200 pounds (36 boxes) of publications. Chevron paid for the shipping. Collecting donated publications, sorting, loading pallets, and arranging shipping is a major effort, but very satisfying.

**Joellen Russell** '93, jrussell@Temail.arizona.edu: After graduating from Harvard, I earned a PhD in oceanography from Scripps



## ERNEST JONES PhD '89

I'm still in the oil exploration business since graduating Harvard. Currently I'm Deep-water Exploration Manager at PETRONAS in Kuala Lumpur but I've done my time in Houston, New Orleans, London and Stavanger. The exploration business has taken me all over the world: Nigeria, Borneo, Vietnam, China, Russia, Indonesia, Eritrea, Saudi Arabia, Egypt. Drilling wildcats is the name of the game and success is still down to the geoscience fundamentals that I learned at EPS.

Ernest Jones "paying respect to Uncle Ho in Hanoi."

[ejones324@gmail.com](mailto:ejones324@gmail.com)

COURTESY OF ERNEST JONES

Institution of Oceanography and then spent 3 years as a JISAO postdoc at the University of Washington's Atmospheric Sciences Department. After another postdoc at Princeton University in NOAA's Geophysical Fluid Dynamics Laboratory, I've been an assistant professor in the Geosciences Department at the University of Arizona since 2006. We were ranked number 1 in geology by *US News and World Report* this year. I'm married and have a 3-year-old son and a 1-month-old daughter.

**Arthur White** '94, arthur\_white32@yahoo.com: I am doing well, living and working in New York City with my wife and 2 young girls. I work at McKinsey's investment office, MIO Partners, where I oversee a portfolio of commodity, energy and natural resource oriented investments. I welcome reconnecting with lost classmates and meeting new EPS alumni—especially any living in the NYC area or with mutual interests.

**Jen Smith** '96, jensmith@wustl.edu: I'm an associate professor in the Earth and Planetary Sciences Department at Washington University in St. Louis. My research involves Pleistocene and Holocene landscape and climate reconstruction using sedimentology, sedimentary geochemistry, and geomorphol-

*"My current field work is in Iraq, Syria, Sudan, Egypt, and Bolivia... and unbelievably I'm still allowed through airport security."*

*~Jen Smith '96*

ogy in the vicinity of archaeological sites. I'm principally interested in understanding how variations in water resource availability affected prehistoric occupants of arid to semi-arid environments. My current field work is in Iraq, Syria, Sudan, Egypt, and Bolivia... and unbelievably I'm still allowed through airport security.

**Kalon Morris** '98-'99, kmorris@post.harvard.edu: Saddleback College Marine Science Professor Kalon Morris recently completed publication of the 3rd edition of his *Introduction to Oceanography Lab Manual* through Kendall Hunt: [www.kendallhunt.com/store-product.aspx?id=8022](http://www.kendallhunt.com/store-product.aspx?id=8022)

# TIM WONG '05



(L) Tim Wong '05 stands beside a landscape presentation he designed while enrolled in Harvard's Graduate School of Design. (R) "Because many EPS photos seem to have hammers in them," Wong submitted this one taken of him making last-minute touch-ups to his landscape model.



COURTESY OF TIM WONG

After studying geology as an undergrad with the EPS department, I worked for a couple years in the environmental industry, cleaning oil spills throughout New England. While driving around in the company pickup truck, I became interested in New England landscapes. I graduated this spring from the Harvard Graduate School of Design, studying landscape architecture. Now I'm doing freelance landscape design/build in the Boston area—let me know if you need some landscape work!

*thwongATpost.harvard.edu*

**Kate Tomford '99**, ktomfordATgmail.com: I'm currently living in Chicago and working for the State of Illinois in the Energy Office, which is part of the Illinois Department of Commerce and Economic Opportunity. Working for state government has been a fascinating and fun experience. After completing an MS in Environmental Science and Policy at the University of Chicago in 2007, I started working for then-Lt. Governor Pat Quinn. He became Governor Quinn in early 2009 (when Rob Blagojevich was impeached), and I continued to work on energy and environmental policy in his new office. This past May, I moved to the Illinois Energy Office, where I'm working on policies and programs related to energy efficiency, renewable energy, alternative fuels and transportation, smart grid, and other environmental priorities of the Quinn administration. Governor Quinn was just reelected on November 2, so fortunately we have at least four more years ahead. On the personal side, David Grossman (also AB '99) and I have been married over three years now, and we are expecting our first child early next spring, so life is about to get even busier!

**Hugh Daigle '04**, hugh.daigleATgmail.com: I am in the second-to-last semester of my PhD at Rice University. I have been

working on projects related to permeability and fluid flow in clays and mudstones, and numerical modeling of methane hydrate deposits and associated geomechanical aspects. I will be graduating in May 2011 and I am not sure what I will be doing after that. Maybe working in industry, maybe something academic.

In the meantime, I will be sailing on

*"I moved to the Illinois Energy Office, where I'm working on policies and programs related to energy efficiency, renewable energy, alternative fuels and transportation, smart grid, and other environmental priorities of Governor Quinn's administration."*

*~Kate Tomford '99*

IODP Expedition 333 to the Nankai Trough in December 2010. We will be taking core samples of the sedimentary inputs to the accretionary complex and some associated mass transport complexes, as well as making downhole heat flow measurements. I will be on board as a physical properties specialist and I will assist with downhole logging and measurements made on core samples. After the cruise I will measure permeability of selected samples with an eye toward determining how permeability anisotropy develops in marine muds as they are subducted. Aside from all that I have been enjoying the mild Houston weather.

**Frances Moore '06**, fcmooreATstanford.edu: I am writing with an update as I have just started a PhD at Stanford in the Interdisciplinary Program in Environment and Resources and will be working on modeling agricultural adaptation to climate change.

**Robert Koenig '06-'07**, robert.m.koenigATgmail.com: For three and a half years after graduating I worked at the Clinton Climate Initiative, a program of the Clinton Foundation that helps governments at all levels implement infrastructure and conservation projects that reduce greenhouse gas emissions in the near term. At CCI I focused principally on lighting system effi-

# NEXT STEPS: 09-10 SENIORS

**When we checked in** with the fifteen concentrators who graduated last year (with one graduating this fall) to see what their next-step plans were, we were not surprised to hear the wide range of answers:

**Kristina Bergquist:** "I will be working for Bain in San Francisco, trying my hand at consulting/business."

**Andrew Corcoran:** Remains a man of mystery.

**Su Gao:** "I am working in Beijing, China as a research assistant at Peking University in the Department of Earth and Space Sciences and volunteering at environmental NGOs."

**Talya Havice:** "I'm in Virginia, living in the woods, running around shooting at things while carrying a ridiculously heavy pack... summer camp for marines I suppose. I'll be here until mid January, then off to, well, somewhere I'm sure!"

**Peter Hedman:** "Peter Hedman will be continuing to live in Cambridge for a year or two, while working as a geobiology lab technician at MIT and sometimes being a course assistant. In January, he will be the field camp manager for MIT's 12.115 field camp course in the Mojave desert where his main task will be keeping geologists alive. In preparation, he is in the midst of research on how to make really good pancakes in his Inman Square-based apartment/griddlecake development facility."

**Antonio Iglesias:** "I'll be spending this next year writing a novel while traveling through the boroughs of NYC, and the following year, I'll be getting my masters in library and information science in NYC."

**Danny Kim:** "I'll be assisting with clinical research at the University of California-San Francisco Breast Care Center. I'll also be participating in an urban seminary internship in Oakland."

**Karen McKinnon:** "After a brief summer, I will be heading to Wellington, New Zealand to pursue a research-based master's in glaciology at the University of Victoria. Following a year of

ciency in cities worldwide. Then, in October of 2010, I said a temporary farewell to earth and climate science; I took a new position at the Clinton Health Access Initiative (CHAI), where I now work with country governments to enhance the efficiency and efficacy of HIV treatment, care and prevention programs.

**Jon Husson** '07, [jon.husson@Gmail.com](mailto:jon.husson@Gmail.com): I am currently a second-year graduate student at Princeton University, studying Earth history and geochronology with Adam Maloof (PhD '04) and Blair Schoene. My main field area is South Australia, and I am using field geology, geochronology and low-tem-

perature geochemistry to tell stories about Earth's changing climate and environment that set the stage for the rise of animals.

**Alexa Weingarden** '08, [alexa.weingarden@post.harvard.edu](mailto:alexa.weingarden@post.harvard.edu): I'm in the second year of the MD/PhD program at the University of Minnesota, and will be starting a microbiology PhD next fall. I was married this summer to Matt Granoff (AB '07). We live in St. Paul with our golden retriever Frey.

**Tom Benson** '09, [thomasrbenson@gmail.com](mailto:thomasrbenson@gmail.com): I graduated in 2009, worked at MIT until November 2010 on geother-

adventures in glacier climbing (and modeling), I will return to Harvard to begin my PhD work with Peter Huybers and Eli Tziperman."

**Jenny Middleton:** "I suppose you can tell people that I'm taking a year off before applying to graduate programs in geochemistry. I'll spend the next year traveling around and I'll be starting in Iceland before heading off to Sweden. What I do after that is undecided."

**Ben Miller:** "This summer and fall, I will be helping to prepare and teach the new Science of the Physical Universe course, Science and Cooking."

**Trevor Petach:** "I'm packing in as much fun as possible before graduate school. Right now, I'm teaching outdoor education in California—high ropes, rock climbing, sea kayaking, and backpacking. After that, I'm going to New Zealand and Alaska to work and travel."

**Yelun Qin:** "I am working at Harvard with the Harvard-Radcliffe Asian American Christian Fellowship. I am around campus, working with students, and I'll encourage all of them to try out EPS!"

**Eshwan Ramudu:** "I now work for an engineering company in Boston developing ocean wave energy converters. I am completing a project I started when I was a research student in Dr. Zhiming Kuang's group. My work investigates how the strength of convection in the Pacific Ocean near the tropics is affected by the amount of relative humidity and water vapor present in the atmosphere, and I hope to publish my results by the end of this year."

**Caitlin Rotman:** "I am a teaching assistant for the Gen Ed course SPU 12 Natural Disasters, and I've also just started working for the PBS documentary television program Frontline."

**Isaac Shivvers:** "I'm a member of the earth & planetary sciences department and the astronomy department. I'm in the process of applying to PhD programs for astronomy, and hope to enroll in a program in fall of 2011!"

mal energy. I will be a Fulbright Scholar to Iceland from December 2010-August 2011, researching geothermal systems. I am starting PhD at Stanford (Geological and Environmental Sciences) in September 2011 in volcanology.

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## EPS Connections

### Networking

Crimson Compass is an online career networking service available to students and alumni interested in learning about career and/or internship opportunities. There are currently over 15,000 alumni volunteering to share their professional experiences and expertise with students and other alumni. We would like to encourage all EPS graduates to become a part of the Crimson Compass network. To learn more about how to find an advisor or become an advisor visit <http://post.harvard.edu>.

### Financial

EPS undergraduate and graduate programs have grown substantially in recent years, in part due to society's growing interest in energy and climate but also reinforced by our efforts to maintain strong foundational programs in geology, geophysics, geochemistry, and atmospheric and oceanographic sciences. Our goal is to continue to enhance these educational programs and expand our research in ways that will lead to exciting discoveries that benefit society.

If you are able and interested in making a financial contribution to EPS please send a check made payable to Harvard University, with a note indicating that is for the Department of Earth and Planetary Sciences to:

*Department of Earth and Planetary Sciences  
Hoffman Labs, Attention Krista Lester  
20 Oxford Street  
Cambridge, MA 02138*

## STUMP THE SCHOLAR WHAT'S UP WITH SEA LEVEL?

*Submitted by the Sea-level and Solid Earth Dynamics Group*

**The puzzle:** Consider the following hypothetical situation in the year 2025: Melting of grounded ice is responsible for 3 mm/yr of globally averaged sea-level rise, but measurements at UC Santa Barbara indicate a local sea level rise of just 1.5 mm/yr from this melting.

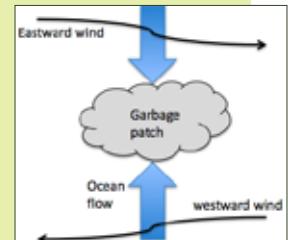
**Your challenge:** To provide an explanation for this discrepancy.

**Submit your answer to [epsnewsletter@eps.harvard.edu](mailto:epsnewsletter@eps.harvard.edu).** The winner will be selected by the time-tested method of placing all correct answers in a hat and with closed eyes the editor will draw one name. The winner will receive an EPS mug and the honor of having his or her name listed in the next issue of *Earth & Planetary Times* along with the correct answer, of course.

### LAST ISSUE'S ANSWER

## GARBAGE PATCH PUZZLE

**The puzzle:** As you may recall in our last issue the EPS Climate Dynamics Group presented the challenge of explaining why over 300,000 floating pieces of plastic per squared km existed in the Pacific, a.k.a. the "Great Pacific garbage patch."



**The answer:** The concentration of trash can be rationalized in terms of convergence of surface ocean currents driven by surface winds over the north Pacific. The winds push the upper ocean in some direction, but because of the coriolis force due to the Earth's rotation, the upper ocean moves to the right of the wind forcing. Westward surface winds in the tropics thus lead to northward surface currents, toward the center of the great garbage patch. Similarly, eastward winds at higher latitudes lead to southward ocean current, again toward the center of the great garbage patch. Hence the convergence of garbage in this area. The ocean's response to surface wind is analogous to the tea's response to frictional stress at the bottom of your tea cup.

**The outcome?** The scholar has been stumped but kudos to EPS concentrator Kevin Fan '13 for submitting an explanation closest to the correct answer. To mark this achievement, Kevin received a genuine EPS coffee mug.