

# Earth & Planetary **TIMES**

HARVARD UNIVERSITY DEPARTMENT OF EARTH AND PLANETARY SCIENCES



**Record setting.** A succession of winter storms made February 2015 Boston's snowiest (and the second-coldest) month on record, the depths of which are captured by the snowy blanket enveloping John Harvard's statue in the Yard.

STEPHANIE MITCHELL © HARVARD UNIVERSITY

## Looking Beyond the Gulf Stream

*The role of the atmosphere in controlling the seasonal cycle in temperature*

BY KAREN ALINE MCKINNON '10, FOURTH-YEAR GRADUATE STUDENT

**T**he city of *Porto*, Portugal, is located at almost the same latitude as Cambridge, MA, but winter temperatures rarely drop below freezing. Even London, nearly 10 degrees farther north, is milder than our local climate. While this difference between the East Coast and Europe is often attributed to the Gulf Stream, my graduate research at EPS suggests that a different process may be important—with potential implications for our understanding of past and future climate changes.

The mid-latitude or extratropical seasonal cycle can be well described by its *amplitude*, which can be thought of as the range of temperature from winter to summer, and its *phase lag*, or the number of days between the peak in solar insolation

(the amount of energy reaching the Earth from the sun) and the resulting peak in temperature. A seasonal climate like that of Cambridge, with a larger amplitude and smaller phase lag than Porto, is typically described as more “continental.”

The difference between the seasonal climate of the east coast of North America and that of western Europe is often attributed to the Gulf Stream, which moves warm water north and east, toward Europe. London, after all, does not share the seasonal climate of Newfoundland. But London and Porto are different from Newfoundland and Cambridge not only in their location with respect to the Gulf Stream, but also in their position on their respective continental masses. The prevailing westerly winds have passed over North America before reaching

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Four EPS graduates develop risk models at RMS



“So what is this fellow thinking 70 years later?” A tribute to Adam M. Dziewoński



Undergraduate field trip to Hawaii



Two generations of alumni notes

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## FROM THE CHAIR JOHN H. SHAW



EPS concentrators on the Papakolea green sand beach in Hawaii. See page 14 for story.

No, the EPS Department hasn’t been sucked into a black hole, destroyed by a tsunami, or devoured by a plague of locusts. Honestly, we can’t even use the nine feet of snow in Cambridge this winter as an excuse for being so long in providing this issue of *Earth & Planetary Times*. We’ve simply been busy. The past few years have been full of departures and arrivals, celebrations

of our distinguished faculty, reviews and promotions of junior colleagues, visiting committees, major research discoveries, and curricular changes. Moreover, we have spent a lot of time in the classroom, lab, and field with our spectacular graduate students and growing legion of energetic undergraduate concentrators.

Peter Huybers, Miaki Ishii, Zhiming Kuang, and Brendan Meade were promoted from within to full professor, and David Johnston and Francis Macdonald were elevated to the rank of associate professor. We also welcomed Naomi Oreskes and Robin Wordsworth as affiliated faculty in the department. Many old friends and EPS colleagues came back to campus for symposia to honor Jim Anderson, Adam Dziewoński, and Rick O’Connell. We are saddened to say that we lost Rick this past April. He along with two other of our most distinguished friends and colleagues—late emeritus faculty Jim Thompson and Dick Holland—had profound and lasting impacts on our field and the community in EPS.

The EPS concentration was again ranked by graduating seniors as highest in overall satisfaction among the 40-plus programs on campus—this makes eight years in a row that EPS has been ranked first or tied for first! These satisfied students reflect the dedication of our faculty, preceptors Hillary Jenkins and Jennifer Cole, staff, and students to enhancing our concentration through new and improved courses, expanded field trip offerings, and efforts to nurture a strong sense of community within EPS. We also undoubtedly provide the best departmental “swag” on campus (see page 27)!

I hope you enjoy reading about all of these happenings in this issue of *Earth & Planetary Times*. And while we are sure to remain busy, we promise that the next issue will be forthcoming soon!

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

## Letters to the Editor

In the last issue of *Earth & Planetary Times*, we asked if anyone could shed light on the 1912 Mason & Hamlin upright piano that resides in the Hoffman student lounge. Thankfully, former graduate student Bob Kamilli PhD ’76 shared the following:

“I was a graduate student in geology at Harvard in the early 1970s. Professor Ray Siever arranged for the piano to be placed in the Hoffman student lounge. He played piano (I believe) in an amateur music group composed largely of Harvard professors. One of the professors was in the government department and was a friend of Ray’s. I do not remember his name, but I know that he lived in Newton. He donated the piano to Harvard geology through Ray. I know, because I was one of graduate students whom Ray rounded up to help move the piano. This took place in about 1971–72.”

Kamilli also noted, “The geology department used to have talent shows in the early 1970s and the piano got a lot of use. I have photos, e.g., of Steve Gould singing with a graduate student named Andy Knoll.”

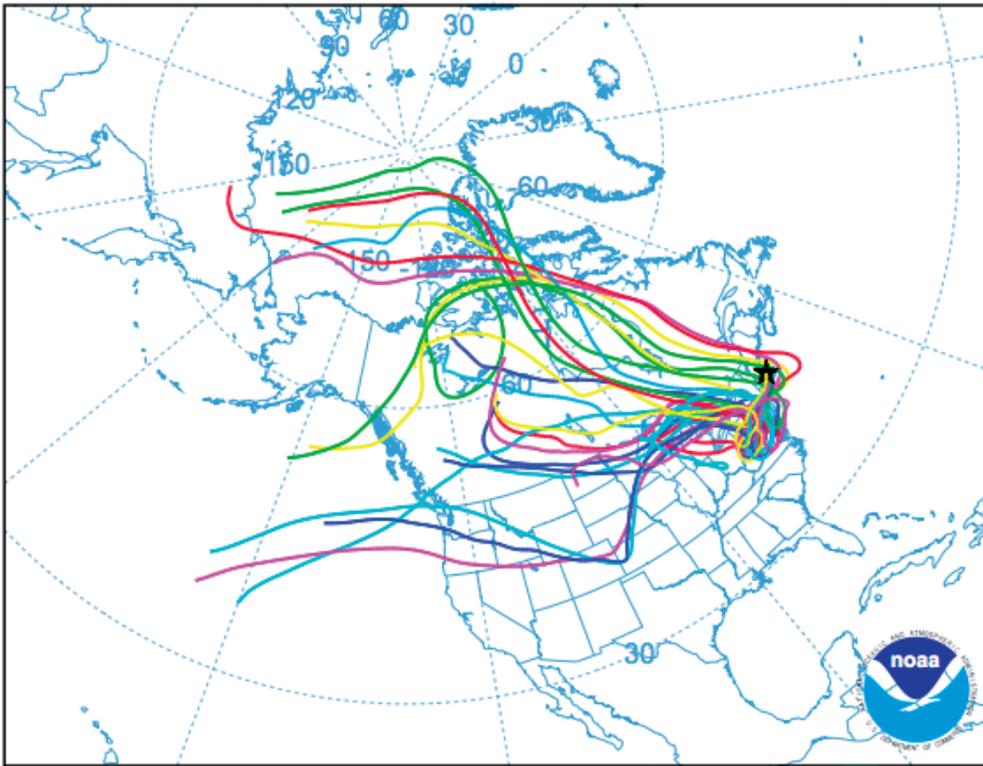


**Bawdy elegance.** Graduate students Bob Hazen PhD ’75, Andy Knoll PhD ’77, Richard Sailor PhD ’79, and Assistant Professor Steve Gould singing Henry Purcell bawdy songs at the March 22, 1974, talent show. As Hazen notes, “Sort of the perfect elegant yet crude entertainment appropriate for such a celebration.”

**Editor’s note:** The department continues its annual revelry of skits, presentations, and trivia contests during St. Barbara’s Day in December, a celebration honoring the patron saint of mining.

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





**Tracking the wind.** This image shows how, using HYSPLIT, 24 air parcel trajectories were tracked over seven days, all of them ending in Cambridge on April 22, 2014.

global grid. To summarize, this model allows us to test the extent to which the movement of heat between land and ocean, which have very different heat capacities, controls the amplitude and phase of the seasonal cycle.

By comparing the model results with observations, we found that our model could skillfully reproduce the seasonal cycle across the extratropics, including some interesting characteristics that we identified in the data analysis. For instance, some land regions have a smaller amplitude seasonal cycle than ocean regions because of the strong influence of the ocean to their west! However, if one considers both the amplitude and the phase lag, an oceanic location will almost always have a larger phase lag than land, even if the two locations have the same amplitude. So peak summer comes later in the year if you are hanging out in the ocean, even if the seasonal cycle is as big as another location on land.

These results have implications for how and why the seasonal cycle might change going into the future—or looking into the deep past. For instance, a change in mean atmospheric circulation patterns related to global warming could shift both the phase and amplitude of the seasonal cycle. Although this work has focused on the extratropics, similar mechanisms may be at play in higher latitudes. If so, the melting of sea ice may affect atmosphere-ocean heat fluxes and alter the high-latitude seasonal cycle. The different continental configurations of the deep past would have a substantial influence on seasonal temperature variability, and a model such as this one could be used to estimate what the spatial distribution of seasonal variability may have looked like.

The seasonal cycle is an important part of our everyday life, and it can be studied to gain a deeper understanding of our climate system. It appears that the mean atmospheric circulation is highly influential in controlling the seasonal cycle because of its mediation of heat fluxes between the atmosphere and Earth surface. And it's possible that this effect may be more important in explaining the mild climate of London than the notorious Gulf Stream—although further research is necessary to help

us answer this question. Stay tuned!



VALERIE LAZARI

*Karen McKinnon is a fourth-year graduate student working with Peter Huybers on understanding extratropical climate variability.*

*The seasonal cycle is an important part of our everyday life, and it can be studied to gain a deeper understanding of our climate system. ~Karen McKinnon*

**GULF STREAM**

**CONTINUED FROM PAGE 1**

Cambridge, as compared with the winds that cross the Atlantic Ocean before Porto. In the mid-latitudes, the atmosphere generally advects heat from west to east, thereby connecting the climate of a given location to its neighbors to the west. The heat capacity of land is much smaller than that of the ocean: Think about the greater energy it takes to boil a pot of water compared with the energy it takes to heat up a layer of soil. Thus, one would expect the climate of a location on the east coast of a continent to have a more continental seasonal cycle than a location on the west coast of a continent. But how large is this advective effect, compared with other climate processes?

To help answer this question, my adviser, Peter Huybers, and I first used the Hybrid Single-Particle Lagrangian Integrated Trajectory model, or HYSPLIT, to quantify atmospheric circulation. HYSPLIT is a commonly used model that allows the user to track air parcels forward or backward in time, after specifying where and when the parcel begins or ends. To visualize how the model

works, imagine using a marker to color in some air molecules outside your window. Your parcel of air molecules will start moving with the local wind and, on monthly timescales, will cross entire continents and ocean basins. HYSPLIT allows us to continuously follow air parcels that we've "colored" using historical meteorological fields, thus providing a metric of actual atmospheric circulation.

For our work, we tracked almost 1,000 parcels that eventually ended at each grid-box on a 2.5-degree global grid. The parcel trajectories were sampled across time of day and day of year, over the course of five years. While HYSPLIT can provide a large amount of information about the properties of the air parcels over time, we only retained information about when the parcel was over land or ocean.

We then incorporated this information into a simple energy balance model of an atmosphere flowing over and exchanging heat with land and ocean, where the ordering of the land and ocean came from the HYSPLIT results. The energy balance model was driven by the seasonal cycle in solar insolation, and was used to solve for the average seasonal cycle in temperature at every location on the

## EPS Revamps Its Introductory Series

### *Making Introductions*

A number of factors spurred a recent review of EPS's introductory courses: recent instructor changes, the creation of a department preceptor, and the inclusion of EPS's introductory courses into the College's General Education (formerly known as Core) curriculum. Members of the Undergraduate Curricular Committee (UCC) and other interested faculty volunteered to identify the curricular goals of the introductory series, discuss the sequencing and timing of the courses, and prioritize critical content development. The outcome? The introductory series was reduced from three courses to two.

Faculty decided that reducing the introductory series by one would provide room for an extra upper-level course within EPS's 14-course concentration requirement. (EPS concentrators, in addition to the two introductory courses, are now required to take four upper-level EPS courses, two math, two to three physics, one to two chemistry, and one to three EPS or EPS-related courses to fulfill concentration requirements.) Additional benefits to the two-course introductory series include a clearer pathway into the concentration (an appealing concept to undergraduates), the ability for students to complete the series within a year of declaring EPS as their concentration, and easier staffing and sabbatical planning from the faculty perspective.

The two introductory courses were broadly defined as "solid Earth" and "fluid Earth,"

and two faculty committees were formed with then co-head tutor Ann Pearson, professor of biogeochemistry, overseeing the fluid Earth committee and then co-head tutor Sarah Stewart-Mukhopadhyay, John L. Loeb Associate Professor of the Natural Sciences, overseeing the solid Earth committee. The two groups met throughout the 2010–11 academic year to evaluate the syllabi of the introductory course series (EPS 5 Introduction to Environmental Science: Atmosphere, Ocean, and Biosphere; EPS 7 Introduction to Geological Sciences; and EPS 8 History of the Earth), identifying redundancies, omissions, and must-haves. They next discussed content development, curricular objectives, and pedagogical approaches. The final step—perhaps the most difficult one—was to create viable syllabi.

Throughout the process faculty revisited three overarching questions: "What do we want our students to learn?" "What makes for a well-educated Earth sciences graduate?" and "How can we achieve all of this in 13 weeks?" They continually worked to find a balance between exposure to the broad array of topics and preparing students for upper-level courses.

In the end, by spring 2011, the EPS faculty at large reviewed and approved two new courses proposed by the committees: EPS 21 The Dynamic Earth: Geology and Tectonics Through Time, and EPS 22 The Fluid Earth: Oceans, Atmosphere, Climate, and Environment. The courses could be

taken in any order with an understanding that an EPS concentrator would complete them within a year of declaring EPS. For the 2011–12 academic year, Francis Macdonald, then assistant professor of Earth and planetary sciences, and the late Richard O'Connell, professor of geophysics, offered to teach EPS 21; and Peter Huybers, professor of Earth and planetary sciences, and

With this issue, *Earth & Planetary Times* introduces a new column: "Curricular Currents." Our intention is to share developments in the department's course offerings: what's new, what's changing, and what's staying the same. In this issue, we note the restructuring of the department's introductory course sequence, which occurred during the 2010–11 academic year, and the introduction of a field-based course offered for the first time in 2012.

Steven Wofsy, Abbott Lawrence Rotch Professor of Atmospheric and Environmental Science, volunteered to teach EPS 22.

During the summer, the instructors along with Hillary Jenkins, department preceptor at the time, worked to develop course content, create labs, and plan field trips. EPS 21 was first offered in fall 2011 and taught students how basic concepts in physics, chemistry, and biology explain patterns in nature. "We explore what the Earth is made of, why there are continents and oceans, and how plate tectonics unifies geological observations," explained Macdonald. In addition to a weekly three-hour lab, the course included two field trips. "Field trips provide opportunities to learn how to read rocks, to see data in the field, and to interpret observations in terms of their possible history and forces acting in and on the Earth," Macdonald said.

In spring 2012, EPS 22 debuted. "Students learn about Earth's weather and climate, including the forces that cause flow in the atmosphere and ocean, the cycling of carbon through the Earth system, and how and why the cryosphere changes," Huybers said. "We learn about the basic processes of the fluid Earth in the context of past, present, and future climates." EPS 22 also includes an introduction to scientific computing and a substantial writing component. "At the outset we want students to gain familiarity with how computation can be used to understand Earth processes," explained Huybers. "For example, students track the flow of energy in a simple model of the oceans and atmosphere in order to better understand how Earth's temperature is maintained and how it can change."



**The fluid Earth.** EPS concentrator Matt Luongo '17 and teaching fellow Shannon Koplitz G4 work on one of EPS 22's problem sets where the students used Matlab and real data from the Atlantic Ocean to explore the factors controlling density across different oceanic water masses.

The writing component in EPS 22 is not a typical term paper due at the end of the semester, but rather a program that builds from week to week. “Students read accessible articles from the primary literature, discuss them in class and section, and write a series of critical summaries and comparisons that they receive detailed feedback on,” said Huybers. “This year students are researching either the viability of sequestering carbon in the oceans or the slowing in global warming relative to earlier decades. Beyond learning

the basics, for these topics we want students to write a synthesis paper that actually critiques the state of the science.”

Another outcome of the introductory course review process anticipated by the EPS faculty was that a complementary need for new courses at the upper level would present itself. And indeed it did. During the 2012–13 academic year two new courses at the intermediate level were offered: EPS 52 Introduction to Global Geophysics, taught by Professor of Geophysics Jerry Mitrovica (fall term),

and EPS 56 Geobiology and the History of Life, offered by Fisher Professor of Natural History and Professor of Earth and Planetary Sciences Andrew Knoll and David Johnston, then associate professor of Earth and planetary sciences (spring term). Last spring, Stein Jacobsen, professor of geochemistry, offered another new course: EPS 51 Introduction to Planetary Materials and Earth Resources.

» *Written with the assistance of Atreyee Bhattacharya PhD '12*

## Searching for Snowball Earth Clues in Death Valley

*EPS offers field course during January*

Since the change in Harvard's academic calendar five years ago, the College has been open in January to departments providing creative learning opportunities for students prior to the start of spring term, a period informally referred to as “J-Term.” Seeing an opportunity, Francis A. Macdonald, then an assistant professor and now John L. Loeb Associate Professor of the Natural Sciences and co-head tutor, thought J-Term would be a perfect time to offer a field-based course.

Previously, field geology courses were only available by granting credit for classes taken at other colleges. To accommodate the growing interest in field geology among EPS concentrators and to promote more hands-on learning techniques in the field, Macdonald created his own field geology course in EPS 74/274 Field Geology.

“There's no alternative to observing rocks and their geometry relative to one another in their natural setting,” says Macdonald, who believes that despite advances in laboratory techniques and high-precision instruments, Earth science is still rooted in



**In the spirit of 1915.** The students participating in this year's field camp pose for a campsite photo; trip leader Francis Macdonald (back row, third from left) lends a bit of timelessness with his sepia retouch.

the field. The course trains students in the art and science of fieldwork while piecing together the tectonic and stratigraphic history of the desert Southwest. Of particular interest, some of the rocks in the map area were deposited approximately 700 million years ago during Neoproterozoic Snowball Earth events, when it is thought that the entire Earth was covered in ice.

The first year of the course, in January 2012, a group of 15 Harvard

students set up camp near the Saddle Peak Hills, a region in the southern part of Death Valley National Park rich in geological history. Macdonald divided the students into groups (with the more-seasoned seniors helping the less-experienced freshmen) and assigned them individual map areas. During the next three weeks, the students learned to identify, measure, and interpret geological features. Over dinner each evening, groups would lead discussions, summarizing their findings. “EPS 74 was a course—yet we all were co-investigators looking for clues to put together a picture of the Saddle Peak Mountains during the Snowball Earth,” says Emmy Smith G5, then a second-year graduate student.

**The great outdoors.** A student embraces the desert's expansiveness.



*“EPS 74 was a course—yet we all were co-investigators looking for clues to put together a picture of the Saddle Peak Mountains during Snowball Earth.”*

*~Emmy Smith G5*

Once back in Cambridge, the group met twice weekly during spring term to digitize their maps, stitching together an overview of the Saddle Peak Mountains, creating the first geological map of the area to be digitized at such detail. The design of EPS 74/274—combining fieldwork with classroom work—allows students to learn mineral/lithological identification, structural microfabrics, macro-structure, mapping,

## FACULTY TRANSITIONS



ELIZA GRINNELL

**Peter Huybers** was appointed Professor of Earth and Planetary Sciences, effective 2011, and in 2014 became jointly appointed with the School of Engineering and Applied Sciences (SEAS) as Professor of Earth and Planetary Sciences and of Environmental Science and Engineering. Huybers came to Harvard as a Harvard University Environmental Fellow in 2006, and joined EPS as an Assistant Professor of Earth and Planetary Sciences in 2007.

Huybers's interests lie in understanding the climate system and its implications for society. His research on the Pleistocene era's climate, combining physics, statistics, and mathematical modeling, helped explain the Earth's approximately 100,000-year glaciation cycle in terms of obliquity—i.e., the changes in the angle of the planet's tilt in relation to the sun that result in greater and lesser amounts of solar energy hitting different latitudes. Applied to the present, Huybers's model, which brings together land, ocean, and atmospheric dynamics, indicates that the Earth is “probably off its normal sequence” with regard to its glacial cycles. He notes that this shift is possibly a result of human factors such as greenhouse gas emissions, though the relatively short time scale over which anthropogenic climate change applies makes it difficult to draw long-term conclusions.

In recent years, Huybers received a MacArthur Grant, a Packard Fellowship for Science and Engineering, and the American Geophysical Union's (AGU's) Macelwane Medal.



**Miaki Ishii** was promoted to Professor of Earth and Planetary Sciences in July 2013. She earned a PhD in geophysics at Harvard in 2003, and then worked as a visiting scientist at the University of California, Los Angeles, and as a Green Scholar (postdoctoral fellow) at the Scripps Institution of Oceanography, University of California, San Diego.

She joined Harvard in 2006 as Assistant Professor of Earth and Planetary Sciences, and was promoted to Associate Professor in 2010.

Ishii's main interests include using recordings of seismic energy to image the internal structure of the Earth and to study properties of earthquakes. She explains that just as X-ray (CAT scan) and MRI provide noninvasive ways of viewing the inside of the human body, different geophysical data can be deci-

phered to obtain pictures of the Earth's interior without sending instruments deep underground. Seismological observations are particularly suitable for such study, and they allow us to see the internal structure from different angles. These data also contain clues about the source of the energy, that is, how the Earth slipped to cause earthquakes.

In recent years, Ishii was named the 2012–2013 IRIS/SSA Distinguished Lecturer and the 2012 Kavli Fellow, and in 2009 she received the AGU's James B. Macelwane Medal.



JOHN HANES

**David Johnston**, who came to Harvard as a Microbial Science Initiative Fellow in the Department of Organismic and Evolutionary Biology in 2007 before joining the EPS faculty as Assistant Professor in 2009, was promoted to Associate Professor of Earth and Planetary Sciences in July 2013; in fall 2014 the Provost's Office officially recognized his appointment as the John L. Loeb Associate Professor of Natural Sciences.

Johnston's group endeavors to better understand the relationship between microorganisms and Earth surface evolution. The work ranges from geologically rooted questions, in which the group aims to track the onset or environmental expression of different metabolic processes and follow atmospheric/oceanic oxidation, through to modern processes and environments. Johnston's lab conducts experimental work with extant organisms, purified protein, the modern ocean water column, and early diagenesis in marine sediments.

In addition to his promotion, in 2013 Johnston received the Geological Society of America's Outstanding Contribution Award in the Geobiology and Geomicrobiology Division, and that same year he was named a Sloan Research Fellow in Ocean Sciences. In 2012, he was awarded the F.W. Clarke Medal from the Geochemical Society, and in 2011, he received the National Science Foundation's Earth Sciences Career Award.



CLAUDIO CAMBON

**Zhiming Kuang** was named Gordon McKay Professor of Atmospheric and Environmental Science in July 2012. Kuang joined the faculty of the Department of Earth and Planetary Sciences and the Harvard School of Engineering and Applied Sciences in 2005 as an

regional geology, tectonics, sedimentary structures, and stratigraphy.

This past January, under Macdonald's leadership, Harvard organized the trip to the Funeral Mountains, Grapevine Mountains, and Mount Dunfee area of northern Death Valley; the fieldwork focused on mapping Ediacaran to Early Cambrian strata along a southeast-to-northwest transect across large stratigraphic and metamorphic facies

change. Several MIT students joined the field camp, and future student exchanges between Harvard and MIT field camps are being promoted.

Looking back at this January's trip, EPS–Astrophysics concentrator Cecilia Sanders '16 notes, "I'll be telling stories about field camp until well after I graduate. We saw a spectacular sunrise over the desert every morning, and a spectacular sunset over the mountains every

night, and in between the most incredible stars and the hardest, most rewarding work I've ever done. We were tackling some of the most interesting, and hotly debated problems in Earth history, in one of the most beautiful places on the planet. I can't wait to do this for the rest of my life."

*»Written with the assistance of  
Atreyee Bhattacharya PhD '12*

Assistant Professor, and was promoted in 2010 to Associate Professor of Climate Science. He has a PhD in planetary science, with a minor in applied computation, from the California Institute of Technology (2003).

Kuang's current research focuses on better understanding and simulating how tropical convection interacts with the large-scale flow. This interaction is key to the tropical circulation, particularly the rainfall distribution and its variability. His group uses novel high-resolution numerical model experiments, together with observational data analysis, to guide development of theoretical models. Besides the meteorological implications of tropical convection, Kuang is also interested in its role in global chemistry.

Kuang's recent honors include receiving in 2012 the Clarence Leroy Meisinger Award from the American Meteorological Society and presenting "Tropical Convection, Waves, and Climate" as a distinguished lecturer at the Asia Oceania Geosciences Society–American Geophysical Union Joint Assembly, in Singapore, also in 2012.



**Francis Macdonald** was promoted to Associate Professor of Earth and Planetary Sciences in July 2013; in fall 2014 the Provost's Office officially recognized his appointment as the John L. Loeb Associate Professor of Natural Sciences. He was an Assistant Professor from 2009 to 2013, soon after having earned his PhD in Earth Planetary Sciences from Harvard University.

Macdonald's research focuses on reconstructing the geological context of pivotal environmental transitions in Earth history. He specifically focuses on the interactions of tectonics, climate, and biological evolution. Macdonald's work begins with geological mapping, and uses stratigraphic analysis, isotope geochemistry, geochronology, paleomagnetism, and paleontology to reconstruct paleoenvironments and tectonic histories. Recent projects have focused on the initiation and duration of Snowball Earth events, the chemical evolution of the ocean leading up to the Cambrian explosion, and the Neoproterozoic to Paleozoic tectonic evolution of North America and Asia.

In 2012, Macdonald was awarded Harvard College's Star Family Prize for Excellence in Advising, and in fall 2014, Macdonald received the Donath Medal from the Geological Society of America (GSA) at its annual meeting in October. The Donath Medal is given to a young scientist for "outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences."



**Brendan Meade** was promoted to Professor of Earth and Planetary Sciences in July 2013. Meade joined Harvard as a Daly Postdoctoral Fellow in 2004, was named an Assistant Professor in 2005, and then Associate Professor of Earth and Planetary Sciences in 2009. He earned his PhD in Earth, atmospheric, and planetary sciences at MIT in 2004.

Meade's research bridges earthquake science and active tectonics to answer questions about the behavior of the earthquake cycle, plate and fault system interactions, and the ways in which mountains evolve. His research focuses on the geodetic imaging of earthquake cycle processes with an emphasis on the detection of interseismic elastic strain accumulation. Meade's lab is responsible for deconvolving tectonic and earthquake cycle signals across the Japanese Islands to identify the coupled subduction zone interface that ruptured during the great Tohoku-oki earthquake of 2011.

**Naomi Oreskes** is Professor of the History of Science and Affiliated Professor of Earth and Planetary Sciences. She recently arrived at Harvard after spending 15 years as Professor of History and Science Studies at the University of California, San Diego, and as Adjunct Professor of Geosciences at the Scripps Institution of Oceanography. Oreskes's research focuses on the Earth and environmental sciences, with a particular interest in understanding scientific consensus and dissent. (Please see page 15 for an update on her recent activities.)



HANNAH BELITZ



**Robin Wordsworth**, Assistant Professor in the School of Engineering and Applied Sciences and affiliated faculty member of Earth and Planetary Sciences, joined Harvard in January 2015. Prior to coming to Harvard, Wordsworth was a postdoctoral researcher with the Department of the Geophysical Sciences at the University of Chicago. His research focuses on theoretical and numerical modeling of planetary climate, paleoclimates of Earth and Mars, exoplanet atmospheric composition and habitability, radiative transfer, and geophysical fluid dynamics.

# “RickFest” Recognizes EPS Professor of Geophysics Richard J. O’Connell

*Celebrating pioneering contributions, mentoring, and more*



**Rick’s Other Family Tree.** Rick is joined by his son Brian O’Connell, wife Susan Playfair, and stepdaughter Lily Faulhaber at the Loeb House reception and dinner held in his honor last September.

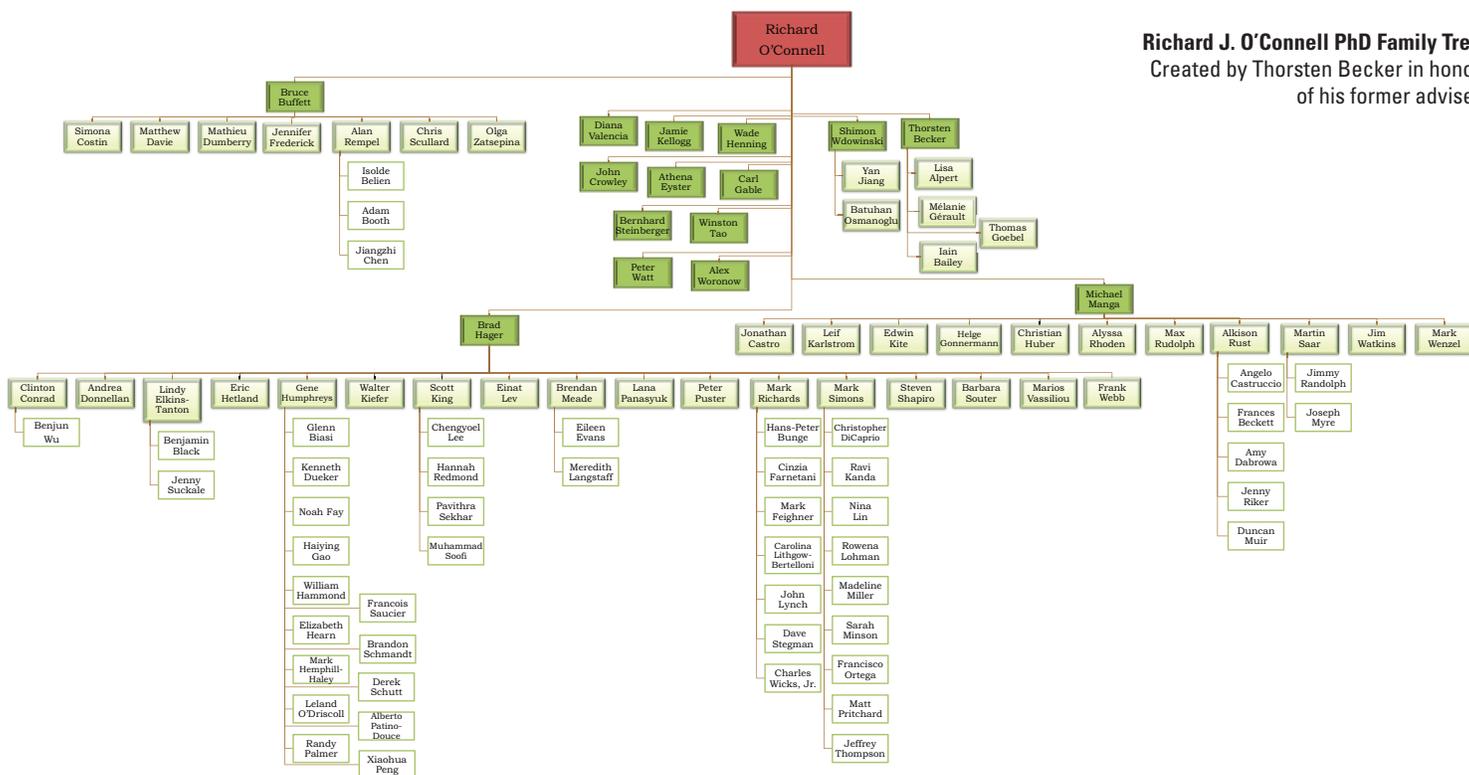
affectionately as “RickFest.” “People were arriving to the symposium with enthusiasm and excitement about Rick’s work and what his career has meant to them both professionally and personally,” noted Paul Kelley, EPS’s lab director and one of the greeters at the opening reception.

Instigated by former students Bradford Hager PhD ’78 (director of the Earth Resources Laboratory at MIT and professor of Earth sciences at MIT), Thorsten Becker PhD ’02 (professor of Earth sciences at the University of Southern California), and Michael Manga PhD ’94 (professor of Earth and planetary sciences at the University of California, Berkeley), and organized with the assistance of a range of EPS staff, RickFest launched with hors-d’oeuvres and drinks Friday, September 5, in the Earth and Planetary Sciences Gallery at the Museum of Natural History. It continued on Saturday at the Northwest Science Building with poster sessions and a dozen presentations related to O’Connell’s work, and concluded with a reception and dinner in Loeb House—“a gathering that brought friends and colleagues together in a truly collegial environment,” noted attendee Brendan Meade, professor of Earth and planetary sciences at Harvard.

“My life was changed the day that I met Richard J. O’Connell,” said Hager Saturday morning in welcoming attendees. “He has shaped me and my scientific career profoundly. ... We are here for many reasons. Most of us are here because of Rick’s

*Editor’s note: Sadly, Rick O’Connell passed away on April 2, 2015, after a three-year battle with prostate cancer. Although we will include a more in-depth piece about Rick’s life and work in the next newsletter, we are able to share in this issue the highlights of last fall’s symposium, where friends and colleagues gathered to honor and celebrate Rick.*

**S**ome 125 former students, friends, colleagues, and former classmates traveled from Canada, the United Kingdom, Europe, and across the United States to Cambridge in September 2014 to join local students and colleagues in celebrating EPS Professor of Geophysics Richard J. “Rick” O’Connell at a symposium known



**Richard J. O’Connell PhD Family Tree**  
Created by Thorsten Becker in honor of his former adviser

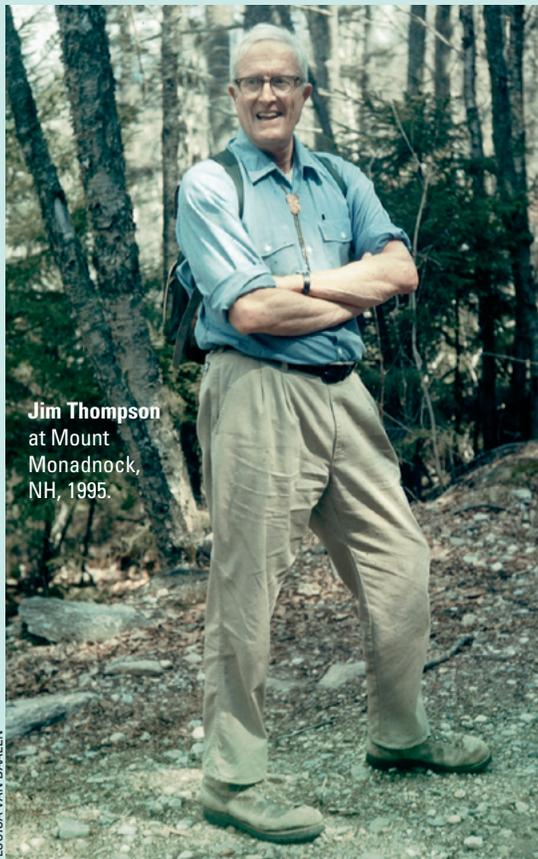
# JAMES B. THOMPSON JR. (1921–2011)

**Sturgis Hooper Professor Emeritus**  
James B. Thompson Jr., known to legions of students and colleagues as JBT, or Jim, died November 15, 2011, a few weeks after more than 50 colleagues and former students convened in Cambridge to celebrate his 90th birthday.

Born in Calais, Maine, Thompson earned a degree in geology from Dartmouth College in 1942, entered military service as a weather forecaster for the Army Air Force, and then attended MIT, where he received his PhD in geology in 1950. He came to Harvard in 1949 as an instructor in petrology, and was promoted to assistant professor in 1950 and to full professor in 1960 before being named the Sturgis Hooper professor in 1977. He retired 1989.

Throughout his career Thompson combined geological fieldwork, primarily in Vermont, with groundbreaking work laying the chemical thermodynamic foundation for understanding the origins of metamorphic rocks. His revolutionary proposal that the Northern Appalachians contained huge fold nappes, similar to the Alpine nappes of Switzerland, has become an integral part of geological understanding of northern New England.

He pointed out the importance of fluids during metamor-



Jim Thompson  
at Mount  
Monadnock,  
NH, 1995.

LOUISA VAN BAALLEN

phism, and pioneered many tools for analyzing mineral assemblages in multicomponent chemically open systems. He predicted the possible existence of several hypothetical silicate minerals that were subsequently found in nature. One of these, containing triple silicate chains, was accordingly named *jimthompsonite*.

One of Thompson's most creative contributions to geology—the notion of composition space and reaction space—came late in his professional life. The last few years of Thompson's career were mainly concerned with regional mapping issues in New England. He also remained an active participant in the New England Intercollegiate Geological Conference.

Thompson was a member of the American Academy of Arts and Sciences and the National Academy of Sciences. He was awarded the Arthur L. Day Medal of the Geological Society of America, the Mineralogical Society of America's Roebling Medal, and the V. M. Goldschmidt Award of the Geochemical Society.

*This text is adapted from a Memorial Minute submitted by Stein B. Jacobsen, Ulrich Petersen, Mark Van Baalen, and Charles W. Burnham.*

pioneering contributions to the science of geophysics, which range from new approaches to understanding the viscoelastic properties of cracked rocks, to unraveling the three-dimensional structure and dynamics of the convection that accompanies and drives motions of the tectonic plates, to anticipating the properties of extra-solar super Earths. Many of us are here because Rick has mentored us directly, or mentored our mentors, or our mentors' mentors. All of us are here because Rick O'Connell has cared about each of us, helping us to thrive."

The talks, organized into sections titled "Big Bang Theories," "United Plates of America," "Across the Scales, Gladly," and "When Hal Freezes Over," featured speakers including G. J. "Jerry" Wasserburg (John D. MacArthur Professor of Geology and Geophysics Emeritus at the California Institute of Technology), Paul Hoffman (Harvard's Sturgis Hooper Professor of Geology Emeritus), and Carolina Lithgow-Bertelloni (Professor of Earth Sciences, University College London). Current Advanced Geophysi-

cal Analyst for the Engineering Seismology Group and former O'Connell PhD student John Crowley PhD '12 honored O'Connell with his talk "Ricktonics: Understanding Mantle Convection Through the Use of Simple Models."

Additional guests included Adam Dziwowski, Harvard's Frank B. Baird Jr. Professor of Science Emeritus, similarly honored three years ago for his retirement and 75th birthday (see article on page 12); Jeremy Bloxham, Mallickrodt Professor of Geophysics and dean of science in the Faculty of Arts and Sciences at Harvard; and Robert B. Smith, emeritus professor of geophysics at the University of Utah.

In addition to former students Hager, Becker, and Manga, the RickFest committee included EPS chair John Shaw, EPS lab director Paul Kelley, EPS faculty coordinator Lisa McCaig, EPS administrative coordinators Maryorie Grande and Noreen Morrissey, and department administrator Kathleen McCloskey.

In his remarks, Winston Tao PhD '92,

captured the overarching sentiment of the occasion: "It's an honor to come celebrate Rick, as it was truly an honor and privilege to have Rick as a PhD adviser. Rick's a great scientist, yes, but more than that he's a wonderful human being: a 'gentleman' in the old sense of the word, someone who appreciates both the world and the people in it. I learned a great deal from Rick: about Earth science, of course, but also about integrity, intellectual grace, humility, and above all about how people should treat one another. That's why so many singularly amazing people have come back to EPS for this gathering: Rick's touched a lot of souls, in a great many ways, and we all want to thank him for that."

"This symposium provides an opportunity to celebrate the impact of a truly remarkable gentleman," Hager concluded. "Let's make it an occasion to remember."

»Cathy Armer

*A compilation of messages to Rick, photos, and materials related to the RickFest symposium are available at <http://scholar.harvard.edu/occonnellsymposium>.*

# Risky Business (But Not for Four EPS Grads)



Mark Piana '11 at his desk in RMS's office in Hoboken, NJ, in 2014.

*Editor's note: The following article was written for Earth & Planetary Times last year. Despite the time lag, we thought our readers would still enjoy it. The current positions of the alumni profiled are presented following the article.*

**G**eochemistry. Spectroscopy. Tectonics. Meteorology. Atmospheric chemistry. Stable isotope geobiology. Global geophysics. Thermodynamics.

With academic interests like these, many EPS concentrators often find their futures in graduate studies, teaching, nonprofits, and research labs, or in consulting for oil and gas companies.

But four EPS college graduates have landed at RMS, self-described as the “world’s leading provider of software, services, and expertise for the quantification and management of catastrophe risk.” These EPS alumni are generating risk models for more than 400 of the world’s leading property and casualty insurers and reinsurers, trading companies, and financial institutions so that these enterprises can calculate the businesses’ risks of catastrophic events.

To create those risk models, RMS—the abbreviation stands for Risk Management Solutions—melds science, business, and technology. Mark Piana '11 says that along with the rest of the EPS contingent at RMS—Renata Cummins '11, Meghan Purdy '09, and David Tune '09—we “address all those fields.”

**Purdy**, the first to join RMS (shortly after graduating), knew from her freshman year that EPS was to be her Harvard home.

“EPS was really great. I got a wide range of exposure to a lot of different things,” she says,

recalling a summer spent on a glacier, classes in meteorology and oceanography, and a thesis in atmospheric chemistry, working with Professor Daniel Jacob. She was president of the student-run organization Geosociety and considered pursuing a PhD in meteorology, but a required distribution course piqued her interest in economics, which she eventually made her secondary field.

At an RMS information session at Harvard, she saw a place for herself that combined economics with her EPS foundation. In the five years since she started at the company, she has worked in the analytical services and data solutions departments, and is now an associate manager on the business solutions team, a role that involves translating what the software and modeling teams are building for their clients to the client-facing teams. She spent two years in RMS’s New York office, and is now going on three years in the San Francisco office, her point of departure for travel to clients and conferences around the world. (From January to April 2014 Purdy had been to London four times).

“It’s helpful that I know about earthquakes and hurricanes and can talk about these types of issues with people. I don’t rely on my science background too much, but EPS taught me about thinking analytically and being part of community, and that’s really important,” she says.

**Tune** graduated with Purdy, but knew her only slightly because much of his time and energy at Harvard was focused on water polo. He was captain of the Harvard team his senior year.

At EPS, he says, “I took all sorts of classes: environmental geochemistry, history of the Earth, geology, atmospheric chemistry. My favorite class was EPS 8, which was ‘History of the Earth,’ taught by Dan Schrag. The lectures were engaging, and the grad students were really supportive during the labs and helped with understanding pretty foreign concepts that were super-interesting to me.”

After graduation, Tune worked for several months on a cattle ranch in Colorado and then took a job with a small environmental consulting company in San Francisco, where he was then contacted by an RMS recruiter. Researching online, he was surprised to see Purdy and another Harvard friend in RMS videos. “I talked to both of them a lot about RMS, and it sounded like a great opportunity,” he says.

In October 2011, Tune joined RMS’s management consulting team (part of the professional services group) as an analyst. Based in the company’s New York office, and now a consultant, he helps clients transition to RMS(one), the company’s soon-to-be launched cloud-based catastrophe risk management platform.

“I think that having a general comfort with Earth science gives credibility to the conversations that we have with our clients, whose business is to understand risk related to the Earth. Just being able to speak intelligently—or somewhat intelligently—about hurricanes and earthquakes is beneficial.”

The most recent of the EPS graduates to be hired by RMS (in September 2013), **Cummins**, now a senior analyst in the RMS model development group, uses mapping



David Tune '09 and Meghan Purdy '09 at Exceedance, the annual RMS client conference, in 2014.

platform ArcGIS and statistics to help produce the sophisticated models that RMS clients use to predict the financial effects of natural disasters.

Her job, Cummins says, is “to figure out how many buildings there are and how much it will cost to rebuild those buildings if they are damaged. It’s not science, but I’m applying a lot of the skills I learned in EPS.”

Cummins entered Harvard with an eye on a physics concentration, but after attending the EPS open house in spring of her freshman year, and learning that students were going to Hawaii in the fall, she says, “I went to Hawaii and never looked back. It was EPS all the way after that.”

At EPS, Cummins found that she “liked thinking about what the Earth was like a long time ago, before dinosaurs, or before animals even evolved.” She worked in a lab, and later worked with Professor David Johnston on her thesis. “I really enjoyed having my own project where I was responsible for seeing the project through and making sure that the quality of research was good,” she says.

She went on to earn a master’s degree in geobiology from the California Institute of Technology, and during her job search discovered that classmate Mark Piana was working for RMS. Even though her graduate work was not an exact match for the job she applied for, her EPS background was applicable—and a recommendation from Purdy, whose senior year overlapped with Cummins’s first in EPS, didn’t hurt.

“I think the EPS concentration is great preparation for a job like Meghan’s, where you need to be technical enough to understand how the models work and also broad enough to explain them to clients who maybe are not

## FREE BEERS AND THREE CHEERS FOR HARVARD

On November 21, EPS alumni joined current members of the department for the second biennial Harvard-Yale Pizza Party. This event, conveniently scheduled to coincide with the weekly pizza-beer hour held on Fridays at 5 p.m., carried a celebratory feeling owing not only to the confident cheering for Fair Harvard’s win over Yale but also for the free beer, as succinctly noted on the graduate student refrigerator.



so familiar with the science,” Cummins says. “I also think that being in the EPS Department gives you a good appreciation for the effects of natural disasters and gives you a reason to care about RMS’s mission, which is to increase resilience.”

Purdy also played a role in bringing Piana to RMS: The two met at a Harvard career fair, where they “bonded a little bit over being EPS concentrators,” Piana says. “RMS sounded cool, combining natural disasters and all of the science I was interested in with business.”

He joined the RMS analytical services team following graduation and recently moved to consulting, where he is senior analyst on the same consulting team as Tune, working to “help clients develop—in our lingo—a resilient risk management strategy.”

Piana began his Harvard studies in engineering, switching to EPS to focus on the science behind climate change. “I like science, and I like being able to understand how the world works. Ultimately, I’m interested in how you apply science to solve real-world problems.”

Noting that the catastrophe modeling field and RMS are a “niche,” Piana says his EPS background has been helpful, for example, in talking about hurricanes and understanding a client’s opinions on hurricane risk.

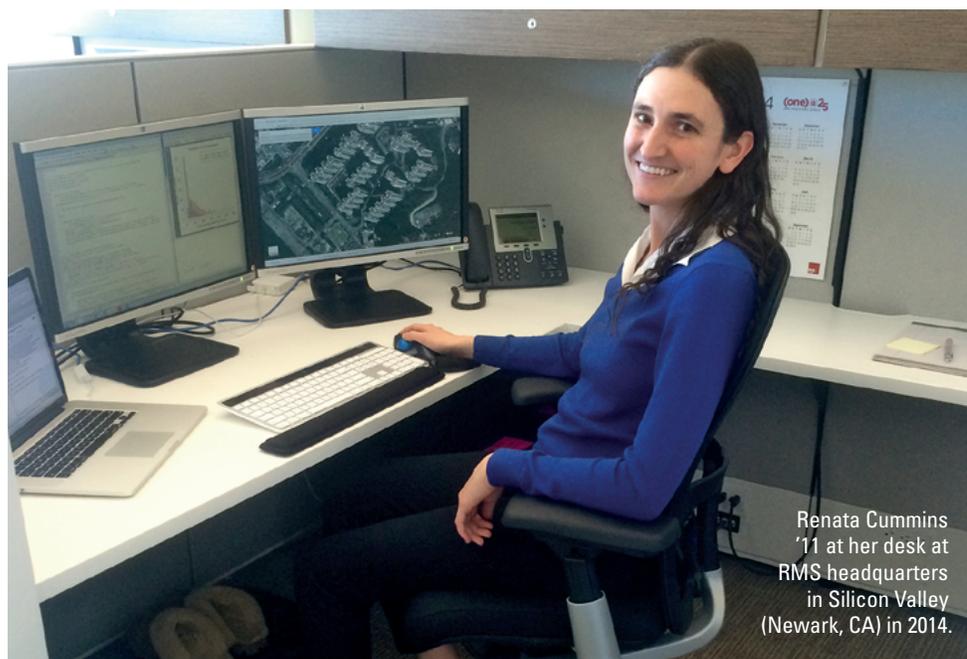
But above all, he says, “EPS and Harvard in general are great at teaching students how to think and learn. Coming out of Harvard, every student has the ability to learn a completely new field and master it.

“When I started at RMS I knew nothing about insurance. I knew nothing about the technology that we’re using except at a basic level, and I knew very little about catastrophe models. Not that I’m an expert at this point, but I feel comfortable being put in a position where if someone asks me to learn something, I can do it,” says Piana.

That ability to adapt and learn is key, as the four graduates note that RMS is always innovating. “The good news for EPS graduates: “We’re always hiring,” Purdy says.

» Cathy Armer

*In the year since this article was written, Meghan Purdy has transferred internally and is now a manager on RMS’s Platform Product Management group, where she leads a team of software developers; Renata Cummins’s position at RMS has changed from senior analyst to modeler; David Tune has entered a full-time MBA program at the University of Chicago Booth School of Business; and Mark Piana has taken a position at EnerNOC, an energy intelligence software company in Boston.*



Renata Cummins '11 at her desk at RMS headquarters in Silicon Valley (Newark, CA) in 2014.

# A Tribute to a Researcher and Mentor

*Adam M. Dziewoński Symposium*



PHOTOGRAPH COURTESY OF KC COHEN

Many of the nearly 100 faculty and researchers attending the “Advances in Seismology and Implications for Interdisciplinary Research: Adam M. Dziewoński Symposium” posed with Adam (front row, center) alongside the whale skeletons in the lobby of Harvard’s Northwest Science Building.

“Nearly always Adam was there first: surface wave dispersion with digital data, normal node inversion, travel time tomography, and moment tensor inversion ...”

**Brian Kennett**

*Professor of Seismology, Earth Physics  
Australian National University*

“Adam: I’ve known you since you were a Texan and named Earth models after office numbers ...”

**Sean Solomon**

*Professor of Geophysics, Department of  
Earth, Atmospheric, and Planetary Sciences  
Massachusetts Institute of Technology*

“As a young seismologist, I always feel amazed and grateful to the tremendous scientific treasures you have built up in modern seismology and geophysics ...”

**Huajian Yao**

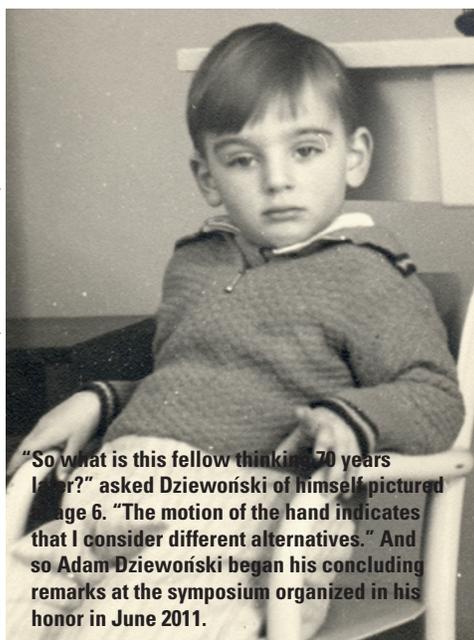
*Green Scholar,  
Scripps Institution of Oceanography*

“Adam, I am very grateful that you paid no attention whatsoever to the research interests that I expressed in my graduate-school application ...”

**Göran Ekström**

*Professor of Earth and Environmental  
Science, Columbia University*

**A**nd so read the many “Messages to Adam” collected as a part of the “Advances in Seismology and Implications for Interdisciplinary Research: Adam M. Dziewoński Symposium” held June 4 and 5, 2011. Dziewoński’s former students Miaki Ishii PhD ’03, Richard V. Sailor PhD ’79, and Göran Ekström PhD ’87 organized the symposium to commemorate Dziewoński’s retirement and 75th birthday. The event was held in Harvard’s newest science research complex, the Northwest Science Building, and drew faculty and researchers from leading universities across the world. Symposium topics ranged from seismology (“Seismology of Once-in-a-Lifetime Events,” Hiroo Kanamori, California Institute of Technology) to mineral physics (“Mineral Physics Interpretation of Mantle Seismic Structure from Top to Bottom,” Tom Duffy, Princeton University) to geodynamics (“Tomography-Based Convection Models Reveal the Importance of Deep-Seated Hot Thermal Upwellings in the Mantle,” Alessandro Forte, University of Quebec, Montreal).



“So what is this fellow thinking 70 years later?” asked Dzięwoński of himself pictured at age 6. “The motion of the hand indicates that I consider different alternatives.” And so Adam Dzięwoński began his concluding remarks at the symposium organized in his honor in June 2011.

also spanned a broad spectrum of topics. “EPS provided sponsorship and administrative support for which I am very thankful,” said Ishii. In addition to EPS, the symposium, which attracted almost 100 attendees from across the globe, was sponsored by the National Science Foundation, along with donors (Joseph M. Steim AM ’09, T. George Chou PhD ’79, and Richard V. Sailor PhD ’79) and businesses (Quanterra Inc., Chevron, and BBN Technologies). As a result of generous support, the registration fees were waived. The fund even provided some young scientists financial assistance to attend.

“This was something important about the symposium,” said Ishii, who stressed Dzięwoński’s dedication to students. “Adam was always very involved with young students, mentoring them and providing assistance. He and his wife Sybil frequently had students come over for dinner at their home,” reminisced Ishii.

The symposium showcased the impact of seismology on different fields of Earth

science, as well as recent advances. Speakers and presenters noted the challenges that remain and the importance of carrying on the work that Dzięwoński helped pioneer. In his closing remarks, Dzięwoński continued his pioneering ways by advocating for the establishment of what he called a “global array of arrays.” By installing seismometers in a relatively small area, he said, scientists can collect data useful in various ways, from understanding small-scale features in the Earth’s deep interior to creating detailed images of earthquake processes. But one array of devices can only provide limited coverage. If, however, there were arrays established around the world—global arrays—Dzięwoński maintained that Earth scientists would be able to gain a more holistic view of our world both on the surface and in the interior.

Thinking big, thinking deep, has always been the Dzięwoński way.

»Written with the assistance of  
Atreyee Bhattacharya PhD’12

Students, postdoctoral fellows, and researchers complemented the talks with posters that

## HEINRICH HOLLAND (1927–2012)

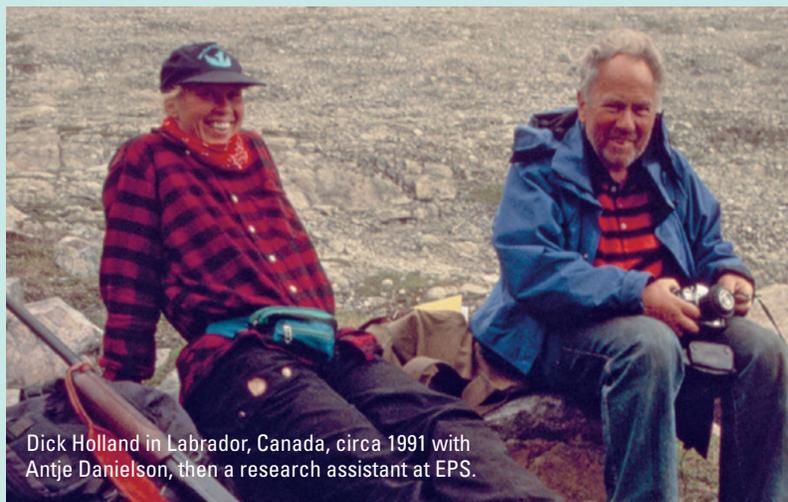
**Dick Holland**, the former Harry C. Dudley Professor of Economic Geology and faculty member at Harvard from 1972 to 2006, died May 21, 2012, in Wynnewood, PA, just short of his 85th birthday.

Born in Mannheim, Germany, Holland received his bachelor’s degree in chemistry (with high honors) from Princeton University in 1946, served in the US Army, then entered graduate school at Columbia University, where he worked with Laurence Kulp as part of a remarkable group of students who went on to become leading figures in geochemistry. He received his master’s degree in 1948 and his PhD in 1952, both in geology.

Holland served on the Princeton faculty from 1950 to 1972, when he came to Harvard. He “retired” in 2006 to become a visiting scholar at the University of Pennsylvania, where he remained active in research and writing until his death.

During the 1950s and ’60s, when geochemistry blossomed with the advent of various isotopic techniques and the application of quantitative physical chemistry to geologic problems, Holland published two major papers (1959 and 1965) on the applications of thermodynamic data to problems of hydrothermal ore deposits.

Holland’s paper “Model for the Evolution of the Earth’s Atmosphere” (1962) established the idea of a progressive change in



Dick Holland in Labrador, Canada, circa 1991 with Antje Danielson, then a research assistant at EPS.

ANDY MACFARLANE

the Earth’s atmosphere from highly reducing to highly oxidizing. Over ensuing years Holland established the paradigm that is now conventional wisdom: an early atmosphere that was reducing followed by a “great oxidation event” about 2.3 billion years ago in which oxygen levels rose to approximately their present-day values. He continued to refine his ideas on atmospheric oxygen in a series of papers, the latest of which appeared in *Earth &*

*Planetary Science Letters (EPSL)* in 2012.

Holland also wrote (with Ulrich Peterson) *Living Dangerously* (1995), which addressed resource depletion and environmental degradation, and he and Karl Turekian were responsible for conceiving the 10-volume *Treatise on Geochemistry* (2004).

Holland will be deeply missed both for his contributions and for his warmth as a human being. His life, work, and friendship were celebrated during the August 2013 Goldschmidt Conference at a Holland Symposium and lunch, attended by 30–40 former graduate and undergraduate students from both Harvard and Princeton, colleagues from universities and research groups across the globe, and family members.

*This text has been adapted from text prepared for the Geochemical Society by James Drever with input from Mark Logsdon and Hiroshi Ohmoto.*

# In *the* FIELD

**EPS@Midnight.** EPS secondary field concentrators Reid Bergsund '15 (left) and Forrest Lewis '17 at the Kilauea Caldera use a flashlight to light-paint "EPS." Bergsund and Lewis were among the record number of 43 undergraduates participating in this year's field trip to Hawaii. Led by EPS Associate Mark Van Baalen '66, PhD '95, with the help of former EPS concentrators Tom Benson '09 and Libby Felts '14, the group spent six days visiting the eastern, southern, and western coasts of the Big Island of Hawaii. The itinerary included stops at the Hawaiian Volcano Observatory at Kilauea, the Mauna Loa Observatory (home of the famous Keeling Curve), the Puna Geothermal Power Plant, and the Papakolea green sand beach, and snorkeling on the Kona Coast in Kealahou Bay. During hikes to Mauna Ulu and along the Napau and Naulu trails, EPS seniors were responsible for providing brief presentations to the group at designated stops. Topics ranged from identifying A'a versus Pahoehoe lava to discussing the creation of lava tree forests to explaining how the Mauna Ulu Lava Fountains were formed.



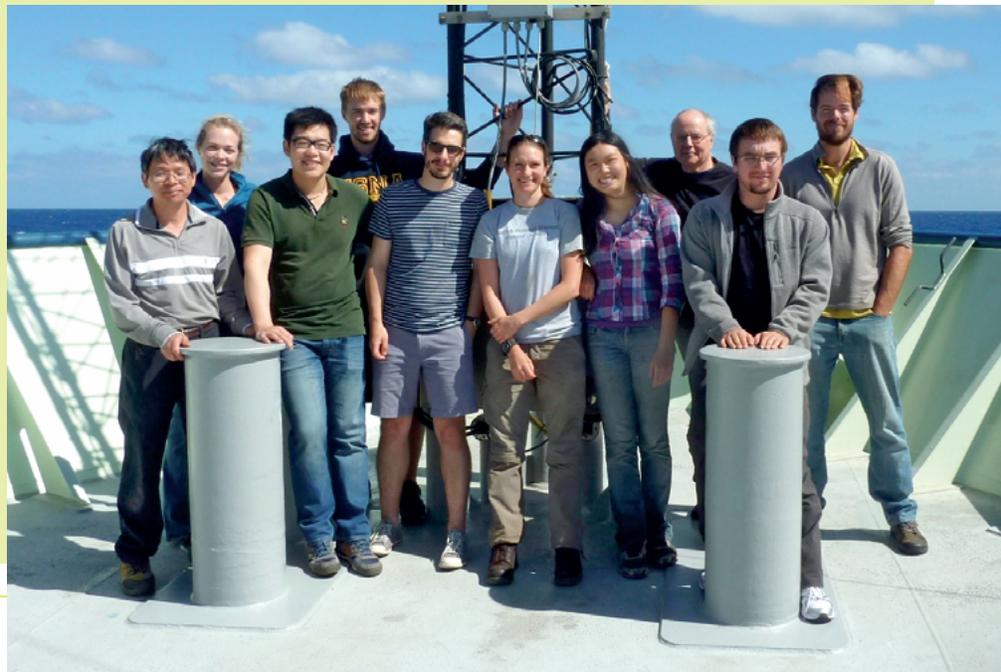
TYLER BARRINGER '16



SARAH COLGAN

**Bonding over banding.** This year, EPS graduate students organized their annual field trip to the Upper Peninsula of Michigan. Intrigued by the region's history spanning almost 4 billion years, the students wanted to see firsthand the mountains, basins, and lakes that capture the events of glaciation, rifts, and deposits, as well as two mines. Fifteen students spent nine days in the field, setting up two campsites (the first in Van Riper campground and the second in Colwell Lake Campground). This group photo was taken near Jasper Knob, Ishpeming, where the students investigated the exposed banded iron formation (an approximately 1.87 billion-year-old Negaunee iron formation).

**SeaVOICE.** The Harvard crew on board the R/V *Atlantis* for the science portion of the SeaVOICE cruise. This expedition, co-led by EPS Professors Charlie Langmuir and Peter Huybers, was undertaken in September 2014 to investigate the hypothesis that sea level change influences ocean ridge volcanism and its associated hydrothermal activity. Participants, from left to right, are Langmuir lab manager Zhongxing Chen, sponsored research administrator Samantha Schwartz, postdoctoral fellow Yinqi Li, Jacob Kremer '16, postdoctoral fellow David Ferguson, Jenny Middleton G4, Florence Chen '15, Langmuir, Cristi Proistosescu G6, and Huybers.



# Around *the* DEPARTMENT

## Faculty

**James G. Anderson**, Philip S. Weld Professor of Atmospheric Chemistry, received a 2012 Smithsonian American Ingenuity Award in Physical Sciences for his revolutionary connection between climate change and ozone loss.

In fall 2011, **Paul Hoffman**, emeritus Sturgis Hooper Professor of Geology, paulhoffman@gmail.com, received the Penrose Medal at the Geological Society of America (GSA) Annual Meeting. The Penrose Medal is the GSA's highest honor, and it is awarded "in recognition of eminent research in pure geology, for outstanding original contributions or achievements that mark a major advance in the science of geology." In 2012, Paul was invested as an Officer of the Order of Canada "for advancing the field of geology, notably through his landmark research on the Precambrian period of Earth's history." In February 2015, Paul celebrated his 51st year of marathon running with a 26-miler in eastern Washington: "Another marathon in the sample bag. First oldster, over 5 minutes faster than four years ago (my previous one). Miracles of modern medicine."

**Andrew H. Knoll**, Fisher Professor of Natural History and Professor of Earth and

Planetary Sciences, was the 2012 recipient of the Mary Clark Thompson Medal by the National Academy of Sciences. Andy was recognized for his unparalleled contributions relating Precambrian life to Earth's physical and chemical history and for innovative contributions on the paleophysiology and evolution of algae and angiosperms. In 2014 he also received the Oparin Medal from the International Society for the Study of the Origins of Life for lifetime contributions to understanding life's early evolution.

In fall 2015, **Jerry X. Mitrovica**, Professor of Geophysics, was elected by his peers to the Royal Society of Canada for his "seminal contributions to the theory of planetary deformation and patterns of sea level change that occur in response to surface loading and mantle convection, with applications to the mantle viscosity structure, orbital history, rotational stability, ice-age terminations and global warming."

Starting fall 2014, both **Sujoy Mukhopadhyay**, former Associate Professor of Geochemistry, and **Sarah T. Stewart-Mukhopadhyay**, former Professor of Earth and Planetary Sciences, accepted faculty positions at the Department of Earth and Planetary Sciences, University of California, Davis.

In 2014, **Naomi Oreskes**, Professor of the History of Science and Affiliated Professor of Earth and Planetary Sciences, received the AGU Presidential Citation for Science and Society, given to leaders whose work has advanced understanding and appreciation of the value of Earth and space science to society. Also in 2014, she was given the Herbert Feis Award for public history from the American Historical Association, in recognition of her distinguished contributions to public history. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*, a book she co-authored with Erik Conway, has been made into a film by Sony Pictures and was released in March 2015.

In May 2013, **Ann Pearson**, Murray and Martha Ross Professor of Environmental Sciences, was one of 16 scientists from 14 different institutions to be named a Gordon and Betty Moore Foundation Marine Microbial Initiative Investigator. This award is intended to "give scientists in marine microbiology the freedom and flexibility to take more risks, forge unusual collaborations and, ultimately, make noteworthy, new discoveries."

**James R. Rice**, Mallinckrodt Professor of Engineering Sciences and Geophysics,

## ERIK TAMRE '16

As part of the Juneau Icefield Research Program, **Erik Tamre '16** and collaborators investigated the vertical profiles of water isotope composition in the accumulation zone of the Juneau Icefield. The isotopic profile of the snowpack records traces of processes that precipitation has undergone after falling onto the glacier: How much melting, refreezing, and sublimation is going on in the densifying snow? Although the work is still ongoing, the group already presented preliminary results ("Isotopic Signatures of Rain and Snow in the Juneau Icefield Snowpack") at the 2014 GSA annual meeting in Vancouver. In this photo, Erik (right) performs his first downward dog yoga position on Taku A mountaintop with collaborator Danielle Beaty from the University of Colorado, Boulder.



was awarded the 2012 Louis Néel Medal from the European Geosciences Union (EGU) for his “seminal contributions to our fundamental understanding of strain localization, poromechanics and friction and [for] his elegant and systematic studies [that] have elucidated fault mechanics and the coupling with hydrologic and thermal processes during all phases of the earthquake cycle.”

In 2012 Jim also received the Walter H. Bucher Medal from the AGU “for original contributions to the basic knowledge of crust and lithosphere,” presented in December 2012, in San Francisco. He was awarded the Harry Fielding Reid Medal by the Seismological Society of America (SSA) at the 2013 SSA meeting in Salt Lake City. The Reid Medal is SSA’s highest honor and is awarded for outstanding contributions in seismology and earthquake engineering. And in spring 2014, Jim was also chosen to receive the Theodore von Karman Medal of the American Society of Civil Engineers (ASCE) for distinguished achievements in engineering mechanics.

## Academic & Administrative Staff

**Zachary Adam** recently joined EPS after he was awarded an Agouron Geobiology Postdoctoral Fellowship to explore the early fossil record of eukaryotes. After completing his PhD in geology at Montana State University, Zach joined Andy Knoll’s lab group where he is comparing and contrasting the morphological and biogeochemical signatures of Precambrian protistan-grade fossils with those of extant protistan-grade cysts and spores. He is also researching the thermodynamics of geologic settings capable of stimulating the prebiotic replication of DNA on the early Earth.

**Jennifer Cole**, EPS department preceptor for the 2013–14 academic year, accepted a position in Harvard’s Extension School teaching “Natural Disasters in a Global Environment.”

Former EPS Research Associate **Vivien Cumming** is currently a postdoctoral research fellow in the Earth and Planetary Sciences Department at McGill University. Her research involves using radiogenic isotopes and redox proxies to understand the co-evolution of life and climate during the Precambrian. As part of Galen Halverson’s group at McGill, Viv continues her postdoctoral research that began at Harvard on

## TABLE TALK

In many ways, the fourth floor of Hoffman Labs is the hub of the Earth and Planetary Sciences Department. With coffee available 24/7, cookies served daily at 3 p.m., and pizza delivered at 5 p.m. on Fridays, the student lounge with its 11-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.

“You shouldn’t disregard the entire model just because some tiny aspect doesn’t agree with it.”

“How was your weekend?”  
“I was in bed  
all weekend—alone!”

*“If we wanted to shoot half-inch sapphire glass wedges, we could do that.”*

“I always thought EPS had the best student lounge, but now I KNOW it does.” (*reaction to the new coffee machines*)

“Tectonic segmentation ... who cares about that?!”

*“All my life is the meaning of this moment.”*

“It’s symmetrical in velocity but asymmetrical in thermocline.”

“We know most models begin the season too early for CO<sub>2</sub> and methane.”

“What’s a five letter word, third letter ‘l,’ meaning river deposit?”

*“Did you hear about the scandal in Humanities?”*

*“You mean that they are still accepting graduate students?”*

Meso and Neoproterozoic rocks from Arctic Canada collected last summer.

After working as a temp in EPS in August 2014, **Sarah Dominique** is now the full-time administrative assistant for Juan Perez-Mercader’s “Top-Down Synthesis of an Ex-Novo Chemical Artificial Living System” lab. Prior to joining Harvard, Sarah worked in development for two years. **Alice Colby**, who held this position until recently, retired in 2014.

**Ken Ferrier**, ferrier@gatech.edu, former postdoctoral fellow in Jerry Mitrovica’s group, recently began his position as assistant professor of geology in the School of Earth and Atmospheric Sciences at Georgia Tech.

After receiving a PhD in isotope geochemistry from Johns Hopkins University in September 2014, **Greg Henkes** has joined Ann Pearson’s group at EPS. At Johns Hopkins, Greg was a teaching assistant and faculty research assistant, and as a graduate student was the Ernst Cloos Memorial

Fellow. At Harvard, Greg is a postdoctoral fellow currently working with the Pearson group to study the nitrogen isotope composition of petro- and geoporphyryns across various spatial and temporal scales during the Phanerozoic.

In September 2014, **Yuandu Hu** joined the Juan Perez-Mercader group. Yuandu studied at the Huazhong University of Science and Technology in Wuhan, China, and earned his PhD in June 2013, majoring in polymer chemistry and physics. He spent one year at the University of Notre Dame as a postdoctoral research associate, dealing mainly with the fabrication of Janus microgel particles and self-propelling materials to mimic microorganisms’ motion behavior. Yuandu’s main project in the Perez-Mercader group is to construct polymer vesicles-based artificial “living” systems to mimic life behavior.

**Hillary Jenkins**, EPS Department preceptor from 2010 to 2014, left the East Coast to accept an accelerated tenure-track position at the University of Redlands in California in the Environmental Studies program.



## CELEBRATING JIM ANDERSON

More than 100 friends and colleagues gathered on February 21–22, 2014, to celebrate the 70th birthday of Philip S. Weld Professor of Atmospheric Chemistry James Anderson (front row, center). Organized by Harvard's School of Engineering and Applied Sciences (SEAS) and the Harvard Center for the Environment, the festivities, affectionately titled "Jim Fest 2014," opened with a Friday cocktail reception at the Charles Hotel, continued Saturday at Harvard's Pfizer Lecture Hall with a full day of symposia—where the topics ranged from "Carboxylic Acid-Mediated Hydrolysis of Formic Acid" (Heather Rypkema, Purdue University) to "Jim Anderson: 215 Slides in 20 Minutes" (Mark Francis Witinski, Eos Photonics) to "(Some) Lessons That I Learned from My Time in Jim's Group ... and a Foray into the World of Black Carbon" (Jon Abbatt, University of Toronto)—and concluded with a dinner and a "Jim Anderson Slideshow" at the Harvard Faculty Club.

In January 2014, **Jenifer Lee** joined EPS as lab coordinator to professors Brian Farrell, Zhiming Kuang, and Eli Tziperman. Prior to coming to Harvard, Jen worked at Suffolk University in the English Department as the office manager. Jen organizes the ClimaTea lecture and Climate Seminar. This past winter, Jen and her husband welcomed their second child, daughter Annette Jung In Lee.

**Amanda Legee** joined the EPS staff in November 2014 as the coordinator for Professor Stein Jacobsen's labs, and will eventually provide support to new faculty members. Amanda comes to EPS with a background in higher education publishing. While the department faculty search is ongoing, Amanda will assist with general department administration, including organizing meetings, events, and seminars. Her predecessor, **Elizabeth Busky**, has taken a new role in the department as the lab coordinator supporting Professors Brendan Meade and John Shaw.

**Nagissa Mahmoudi** has joined EPS, as part of Ann Pearson's research group. Nagissa completed her BSc in integrative biology at

the University of Toronto and earned her PhD at McMaster University in Canada. Prior to joining EPS, Nagissa was a postdoctoral fellow at the University of Tennessee, Knoxville, where she investigated the biodegradation potential of native microbial communities in deep-sea basins. Nagissa was awarded an NSERC Postdoctoral Fellowship to work at Harvard to investigate factors that constrain microbial carbon cycling in marine sediments.

We would like to welcome **Lisa McCaig**, who joined EPS in 2014. She is the faculty coordinator for Charlie Langmuir and Ann Pearson, and was central in organizing RickFest (see page 8). Lisa comes to us after providing several years of support as a program assistant at the Kennedy School. Her predecessor, **Olga Kolas**, departed to a position with FAS Research Administration Services.

We would like to congratulate **Giuseppe Torri** on becoming a research assistant in Professor Zhiming Kuang's group. Giuseppe arrived in September 2012 as an Environmental Fellow at the Center for the

Environment, working with Zhiming on problems related to atmospheric convection and cloud dynamics. He has said his fellowship provided the opportunity to explore many directions in his field of research and credits Zhiming's tireless guidance as essential to furthering his academic career. As a research assistant, Giuseppe will continue his work, and he recently contributed to an exciting paper on the role that various mechanisms play in sustaining deep convection in environments with little wind shear, as often found over the tropical oceans.

Also adding to the Perez-Mercader group is **Weicai Wang**. Weicai received his PhD in polymer chemistry and physics from Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, in July 2014. After that, he worked as a visiting scholar in David A. Weitz's group at SEAS. His work focused on the design and synthesis of amphiphilic block copolymer by controlled radical polymerization (ATRP and RAFT), fabrication of polymer hierarchical porous spheres, and polymersomes in microfluidic devices. He joined Juan Perez-Mercader's



MICHELLE WRAY

**CAROLINE JUANG '17** spent last summer with the Center for Earth and Planetary Studies (CEPS) at the Smithsonian National Air and Space Museum. For 10 weeks, she researched layered deposits of ice and dust in the troughs of the Mars North Pole by looking at images taken by HiRISE on the Mars Reconnaissance Orbiter (MRO). By differentiating layers across several pictures, CEPS can use the information in the future to find patterns in atmospheric conditions of prehistoric Mars. This spring, Caroline co-chaired Harvard's student-run Environmental Action Committee and helped prepare for the annual Earth Day celebration on April 22.

**Kimberly Moore**, *Yale University*  
**Rachel Silvern**, *Barnard College*

### Teachers Extraordinaire

The winners of the 2013-14 Shaler Teaching Award are **Mary Moore**, who was a teaching fellow (TF) for SPU 25 Energy: Perspectives, Problems, and Prospects, and **Andy Rhines** who was a TF for EPS 22 The Fluid Earth: Oceans, Atmosphere, Climate and Environment. The Shaler Teaching Award is given annually to teaching fellows who exhibit excellence in teaching. Each recipient of this award receives an "Outstanding EPS Teaching Fellow" certificate, an engraved Estwing Rock Hammer, and a \$500 award. Congratulations—and thank you—to Mary and Andy.

### Undergraduate Students

**Jay Alver '15** took a 14-day trip to Antarctica visiting various sites on islands and the mainland, looking at wildlife, historical artifacts, ice, and rocks.

Joint Engineering Sciences–EPS concentrator **Tyler Barringer '15** spent last winter break hosting a conference for high school students in Hong Kong called Harvard Model Congress Asia. Over 500 delegates from 15 countries were in attendance to learn and debate the issues facing the world today.

**Florence Chen '15** co-authored a paper with EPS Professor Jerry Mitrovica and classmates from Mitrovica's course EPS 52 Introduction to Global Geophysics in *Journal of Climate*. Chen also recently submitted another paper as lead author that describes sulfur cycling in a natural CO<sub>2</sub> reservoir. "I conducted this research at Cambridge University in summer 2013 when Charlie (Langmuir) and Dan (Schrag) connected me with Dr. Alexandra Turchyn PhD '05 and University of Cambridge Professor Mike Bickle. After graduating, I will be returning to Cambridge on a Fulbright Scholarship to earn an MPhil by research with Dr. Turchyn. Then I'll move out to San Francisco to start a career as a business

analyst at McKinsey, where I hope to work in the energy and mining sectors."

Joint Engineering Sciences–EPS concentrator **Kalina Grabb '15** presented a part of her senior thesis at a poster session at the fall 2014 AGU meeting. The project, based on research conducted with Assistant Scientist Scott Wankel of Woods Hole Oceanographic Institution, investigates iron oxidation, nitrite reduction coupled reactions in anaerobic aquatic environments. "My research investigated the role of reduced clays in these reactions in artificial seawater," says Kalina. "The intention is to characterize the isotopic signature of the abiotic reactions in order to compare it with biotic reactions and help distinguish these processes in the natural environment."

Discussing the models she presented fall 2014's AGU conference, EPS–Astrophysics concentrator **Cecilia Sanders '16** explains, "Planet formation is a mysterious process—to tease it apart, we need to understand the physics and chemistry of accretion, as well as the small-scale trapping of volatile materials like water and the noble gases. The models I presented at AGU demonstrated this small-scale trapping for a model gas—the first step toward building comets, which may be implicated in the late-delivery of volatiles to the Earth. In turn, the delivery of water, noble gases, nitrogen species, and organics to the surface of terrestrial planets may have been critical to the origins of life." This coming summer Cecilia anticipates doing research with planetary atmosphere models that may play into her senior thesis.

**Jessica Yap '15** is currently helping postdocs at the Kennedy School's Sustainability Science Program conduct research on integrated crop and livestock systems. Raised Catholic but, as she says, "only figuring out why in undergrad," Yap will be working as a missionary for two years with FOCUS (the Fellowship of Catholic University Students) after graduation. She invites all to follow her vlog and adventures in the coming years on the YouTube channel: QuoVadis Jess.

group as a postdoctoral fellow in January 2015, and currently works on "active" polymersomes to explore the origin of life.

From November 2014 until April 2015, visiting scholar **Yangli Yu** worked with Professor John Shaw on 3-D structural restoration. Yangli is a PhD candidate from Zhejiang University, China, working on the Mesozoic transpressional structures and evolution of the northwestern Junggar basin, China. After working with John, Yangli returned to Zhejiang University to complete her research.

**Yige Zhang** is a new Harvard University Center for the Environment (HUCE) environmental fellow working with EPS Professor Ann Pearson. Yige graduated from Yale University in October 2014, having done his PhD work with Mark Pagani focusing on reconstructing Cenozoic atmospheric CO<sub>2</sub> and ocean temperature evolution using biomarkers and their stable isotopes. His current project in Pearson's lab is to refine the alkenone-pCO<sub>2</sub> approach, a method widely used to evaluate past changes in atmospheric CO<sub>2</sub> levels, and validate it over glacial-interglacial timescale.

### Graduate Students

Six graduate students began their first year in the department in fall 2014. We extend a hearty welcome to:

- Ben Boatwright**, *Amherst College*
- Raouaa El Mousadik**, *École Polytechnique*
- Blake Hodgins**, *Lab Manager and Research Assistant with Francis Macdonald's group*
- Jonathan Moch**, *ChinaFAQs Project Specialist at World Resources Institute, Washington, DC*

# Alumni NOTES

## Graduate Students

**Art Boucot** PhD '53, boucota@science.oregonstate.edu: I am still with Oregon State University, in the recently renamed Department of Integrative Biology, as an emeritus professor. Currently, I am working with colleague Dr. Kathryn Nichols (Norm Silberling's widow), who is also a Triassic specialist, on a treatment of what can be said about the "evolution" of human behavior during the past 2 million years (the overall conclusion is that nothing very basic has changed in the slightest although technology has galloped ahead at an ever-maddening pace).

**Edwin Gaucher** PhD '60 (geology), edwiningaucher@videotron.ca: I am still prospecting with Beep Mats and hoping to walk across a huge and valuable orebody. [Submitted in 2014]

**Robert Schmalz** '51 (geology), AM '55, PhD '59, rfs3@psu.edu: I retired from Penn State as professor of geology emeritus in 1991 (OMG—24 years ago!). At that time I was also chairman of the State College Water Authority—the municipal water supplier for a community of about 70,000 people. I continued with the Authority for eight years, then was asked to join the boards of the State College Sewer Authority and the University Area Joint Authority (a regional service provider), which I now chair. In odd moments I am a docent at the Palmer Museum of Art (PSU) and try to keep financial records for the Friends of the State College public library. Although in a sense I started a new career after my retirement, in fact research that began with (sometimes frustrating) efforts to apply J.B.

Thompson-style p-chemistry to low temperature aqueous systems evolved into studies of aqueous chemistry generally, then low temperature rad-waste management, and natural radon. Retirement has been challenging and rewarding—a period enriched by friendships with a distinguished group of fellow GSAS graduates, but marred by the untimely death of my wife, Barbara, in 1997.

**Donald D. Runnells** MA '60, PhD '64, drunnells2@msn.com: I was delighted to receive the winter 2011 EPS newsletter. I have often wondered why I regularly receive newsletters from my undergraduate university, but never before from the Department of Earth and Planetary Sciences.

I received my MA (1960) and PhD (1964) from Harvard, with guidance mainly from Professor Robert Garrels and Visiting Professor Chuck Meyer (Berkeley). Four of my years at Harvard were supported by a National Science Foundation Fellowship, with the Nathaniel Shaler Fellowship helping during the last year. My dissertation concerned the geochemistry and mineralogy of the Ruby Creek copper deposit in the Brooks Range, Alaska. Contemporaries at Harvard included Hal Helgeson, Harrison (Jack) Schmitt, Bruce Hanshaw, Charlie Guidotti, Lew Gustafson, Roger Eckstrand, Don Langmuir, Jim Anderson, Kurt Lynn, Gene Simmons, Peter Solomon, Sam Adams, and a host of other bright, fun, and successful graduate students. Some of us had our offices in the old Vanserg building, built during World War II, which is still standing.

My first full-time job (1963–1967) was with Shell Development Company, where Hal Helgeson and I were colleagues. My work was in carbonate geochemistry, while Hal was expanding his studies in the theoretical geochemistry of aqueous systems. My next stop was as an assistant professor at the University of California, Santa Barbara, where I taught geochemistry and ore deposits. In 1969 I moved to the University of Colorado in Boulder, beginning as an assistant professor and retiring in 1993 as full professor and chair of the Department of Geological Sciences. Along the way I managed to publish about 90 professional papers. In 1999 I was appointed to a four-year term on the Nuclear Waste Technical Review Board to review the geochemical work being done for the proposed nuclear repository at Yucca Mountain, NV.

Upon retirement from the University of Colorado, I joined a private consulting firm (Shepherd Miller Inc.) in Fort Collins, CO, where I served as president and senior geochemist. The change from academia to the world of consulting was fun and challenging. I learned what it takes to make a profit, sustain a company and its employees, and meet hard-and-fast deadlines.

All in all, it has been a good career. I still do a little consulting in geochemistry, but mostly I am retired, living in Fort Collins with my wife (Erika) of 56 years. We have two grown children and five grandchildren. Harvard remains a vivid, wonderful memory for me; it changed my life. Unfortunately, we have never returned to Cambridge for a visit, but we hope to correct that before it is too late.

**Jeff Warner** PhD '67, PatnJeff@Keyway.net, www.Keyway.net/~PatnJeff: This year I lowered my carbon footprint. My wife and I moved from a 2,900-square-foot house in the suburbs with two cars that we drove 16,000–20,000 miles per year. We moved into a luxury condo-loft in Koreatown, in Los Angeles, on the corner of Wilshire Boulevard and Western Avenue. We have a subway in the basement, a heliport on the roof, and a river running through the lobby. There are buses going east-west on Wilshire and north-south on Western; other routes go southwest to the beach cities and west-southwest to Santa Monica. We have one car and it looks like we will drive fewer than 8,000 miles per year.

Besides that, life goes on. I am now retired 16 years. I am still a peace and human rights activist, focused on bringing peace to Israel-Palestine and restraining American imperialism and militarism in the general Middle East. Now that I live in Koreatown, I can do more to save the world, although I have not yet been arrested or even indicted.

**Ursula Marvin** AM '46, PhD '69, umarvin@cfa.harvard.edu: I retired from the Smithsonian Astrophysical Observatory in Cambridge in 1998 after 37 years of studying meteorites and lunar samples, including two seasons of collecting them in Antarctica. During the '50s I traveled widely with my husband, Tom Marvin, in search of ore deposits in South America and Africa. Our discussions with geologists in different countries whetted my interest in the widely

### Tidings

EPS is always pleased to hear from our alumni and friends. Send us your comments or news to [epsnl@fas.harvard.edu](mailto:epsnl@fas.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 versions.*

# NEXT STEPS: 2013–14 PHD GRADUATES

**Fifteen EPS graduate students** received their doctorates in the academic year 2013–2014. With dissertations bound (available online <http://dash.harvard.edu/>) and PhD diplomas in hand, these alumni have dispersed around the globe.

## **Helen Amos**

*Dissertation:* “Toward an Improved Understanding of the Global Biogeochemical Cycle of Mercury”

*Current position:* Postdoctoral Fellow, T.H. Chan School of Public Health, Harvard University

## **Nathan Arnold**

*Dissertation:* “Atmospheric Superrotation in Warm Earth Climates”

*Current position:* NOAA Climate and Global Change Postdoctoral Fellow, Colorado State University, Fort Collins, CO

## **Roderick Bovee**

*Dissertation:* “Lipidomic and Genomic Investigation of Mahoney Lake, BC”

*Current position:* Chemist at Schlumberger-Doll Research Center

## **Erik Chan**

*Dissertation:* “Stability of Planetary Rotation”

*Current position:* NSERC Postdoctoral Fellow, Department of Physics, University of Toronto

## **Eileen Evans**

*Dissertation:* “Geodetic Imaging of Fault System Activity”

*Current position:* Mendenhall Postdoctoral Fellow, US Geological Survey, Menlo Park, CA

## **Natalya Gomez**

*Dissertation:* “On Sea Level—Ice Sheet Interactions”

*Current Position:* Ed Lorenz Postdoctoral Fellow with the Mathematics and Climate Research Network, Courant Institute at New York University

*This summer:* Professor in the Earth and Planetary Sciences Department, McGill University

## **Meredith Langstaff**

*Dissertation:* “Mechanical Models of Continental Plate Boundaries: Fault Slip Rates and Interseismic Stress Rotation Rates”

*Current position:* MBA Candidate, Harvard Business School

## **William Leavitt**

*Dissertation:* “On the Mechanisms of Sulfur Isotope Fractionation During Microbial Sulfate Reduction”

*Current position:* Fossett Postdoctoral Fellow, Washington University in St. Louis, MO

## **Marcos Longo**

*Dissertation:* “Amazon Forest Response to Changes in Rainfall Regime: Results from an Individual-Based Dynamic Vegetation Model”

*Current position:* Postdoctoral Fellow, Embrapa (Brazilian Agricultural Research Corp.), Satellite Monitoring Unit, Campinas, Brazil

## **Eloise Marais**

*Dissertation:* “Non-Methane Volatile Organic Compounds in Africa: A View from Space”

*Current position:* Postdoctoral Fellow, School of Engineering and Applied Sciences, Harvard University

## **Eric Morrow**

*Dissertation:* “Estimates of Land Ice Changes from Sea Level and Gravity Observations”

*Current position:* Postdoctoral Fellow, Rutgers University

## **Ji Nie**

*Dissertation:* “Probing the Dynamics of Shallow Cumulus Convection”

*Current position:* Lamont-Doherty Earth Observatory Postdoctoral Fellow, LDEO, Columbia University

## **Rita Parai**

*Dissertation:* “Volatiles in the Earth and Moon: Constraints on Planetary Formation and Evolution”

*Current position:* Carnegie Postdoctoral Fellow, Department of Terrestrial Magnetism, Carnegie Institution for Science

## **Kevin Wecht**

*Dissertation:* “Quantifying Methane Emissions Using Satellite Observations”

*Current position:* Fellow at Insight Data Science

## **Peter Zoogman**

*Dissertation:* “Geostationary Satellite Observations of Ozone Air Quality”

*Current position:* Postdoctoral Fellow, Atomic and Molecular Physics Division, Smithsonian Astrophysical Observatory

divergent ideas on the history of geology. This led to my book *Continental Drift: The Evolution of a Concept*, published in 1973 by the Smithsonian Press. By then we were settled in Harvard Square from which Tom traveled widely doing private consulting while I walked to work. On alternate years from '74 to '92, I taught a course in the EPS Department titled “Seminar on the Solution of Scientific Problems.” Meanwhile, I was

conducting extensive research on extraterrestrial samples and presenting my results at meetings in the Americas, Europe, China, and Japan. At each stop, I gathered information on local meteorite falls to add to my historical reviews. In '09, we moved from Harvard Square to a retirement community in Concord, where Tom receives the nursing care he needs. I still have a small office at the Observatory, and am continuing my research

and writings on the history of geology and meteoritics.

I received the History of Geology Award from the Geological Society of America in 1986 and the Sue Tyler Friedman Award from the Geological Society of London in 2005. Asteroid Marvin was named in 1991, and Marvin Nunatak, in Antarctica, was named in 1982. In 2012 the Meteoritical Society presented me with its Service Award

for “documenting the history of the Society and the personal histories of some of the most influential people in meteoritics and planetary science.” [Submitted in 2012]

**Robert “Bob” Alan Rich** MA ’70, PhD ’75 (geological sciences), bobrich2525@gmail.com: I am president of Rich Associates Inc. in Orleans, MA. Recent work has included consulting services provided to Paladin Energy Ltd. (Perth, West Australia), Emirates Nuclear Energy Corporation (Abu Dhabi, UAE), and Sumitomo Corporation (Tokyo). I specialize in all aspects of uranium geology and commercial transactions.

**J. Barry Maynard** PhD ’72, maynarjb@gmail.com; I have in the past few years focused mostly on corrosion scales in water distribution systems. The geochemistry is similar to low-temperature ore deposits, so there is a good transfer of theory and techniques, but it’s a different audience. Have a look at [http://www.sedimentaryores.net/Pipe%20Scales/Index\\_corrosion.html](http://www.sedimentaryores.net/Pipe%20Scales/Index_corrosion.html). My consulting company, Maynard, Agnello & Associates, is currently testing carbon-based filtration systems as monitoring tools for distribution systems to use in complying with lead and copper regulations. We’re also working on the occurrence of manganese in scales on brass and iron pipes. I retired from teaching January 1, 2015, and my wife, Em-maly, and I will be moving to Portland, OR, where both our children (James and Elise) live and where I will enter into full-time consulting on water chemistry.

**Che-Bao Ma** PhD ’73, chebao.ma@gmail.com: This is a rapidly changing year for me and my family. I have a lot to report, but I need a few months for all issues to get settled. In the meantime, I’d like to share that since last October, I have been involved in compiling a directory of Harvard Chinese alumni (1962–1976). The endeavor has been met with surprisingly great enthusiasm, and a total of 101 alums are included. In connection with the GSAS Annual Alumni Day on April 11, 2015, many of these alumni met for a dinner reunion that evening.

My directory entry includes that my wife, Ming-Shia (we married in Appleton Chapel in 1970), and I both retired in 2007 after combined service of 31 years from the Institute of Nuclear Energy Research (INER) in Long-Tan, Taiwan. We have one daughter and two sons, who all grew up in Taiwan, graduated from National Taiwan University, and then pursued advanced studies in the United States. We have one grandchild, born January 2015.

**Yoshi Ohashi** PhD ’73, lobo\_tarojp@yahoo.co.jp: I was Charles Burnham’s student at EPS. My PhD was in the field of mineralogy and crystallography. Ben Austria, Che-Bao Ma, David Walker, and I left Harvard about the same time around 1972.

I enjoyed a 100 percent research position at Carnegie Institution of Washington’s Geophysical Lab as a postdoctoral fellow first and as a temporary staff member later. Then I took a teaching position in the Department of Geology, University of Pennsylvania. After eight years there, I moved to Dallas to work at a Central Research Center of ARCO Oil and Gas Company. My major contribution there was designing and constructing the borehole televiewer system. I really enjoyed graphic computer programming of image analysis of downhole ultrasound data.

After another eight years (eight seems a magic number in my career changes), I came back to Boston again to join a small venture company called Cognex. The company was started by a teacher and two grad students of MIT. It is one of the leading machine vision companies in the world.

In 2003 I happily retired from Cognex and came back to my mother country, Japan. After serving in outside director and technical consulting positions for several companies, I completely retired around 2010 expecting a more relaxed life with my wife. To my surprise, colon cancer was found and I had surgery. I have been feeling fine since then but a real change was hair. Even my longtime friends hardly recognize me at first.

**Ben Austria** PhD ’75, bsaustria@gmail.com: In May 2011, I retired from the University of the Philippines (UP) after more than 45 years of service. That July, the UP Geology Alumni Association organized a dinner for me titled “Pagpupugay sa Isang Natatanging Guro,” meaning “Saluting a Special/Unique Teacher.”



**Before and After.** Yoshi Ohashi PhD ’73 submits this dual portrait for your comparison.

Before the dinner, a former student gave a lecture on the history of gold and copper mining and exploration in the Philippines. I delivered my Henry Brimo Professorial Chair Lecture on “Some Lessons on the Sustainable Development of Earth Resources.” The dinner, held in the building of the National Institute of Geological Sciences (UPNIGS) where I was director when this building was completed and inaugurated in 1989, also featured a surprise music number in which I played the electric bass joined by my wife, Cris, and friends, as well as the last batch of my geology students singing “To Sir, with Love.”

Since 2011, I have served as independent director of Philex Petroleum Corporation and senior adviser of Trans-Asia Oil & Energy Development Corporation, transferring in 2013 to Trans-Asia Petroleum Corporation (a subsidiary of Trans-Asia Oil). In the past two years, I was chair of the Energy Committee of the Philippine Chamber of Commerce and Industry, the largest private

**Surprise number.** Ben Austria PhD ’75, third from left, playing electric bass at his retirement dinner hosted by the University of the Philippines Geology Association. Ben’s wife, Cris (far right), and friends joined in.





**A year of distinction.** After graduating with highest distinction in June 2014 with an MBA from the Tuck School of Business at Dartmouth, Andrew Miller AB '04, AM '04 ([amiller@pioneeringprojects.org](mailto:amiller@pioneeringprojects.org)), joined McKinsey & Company's Philadelphia office in September. In May of that same year, the Boy Scouts of America presented him with the Silver Antelope Award for distinguished service at the regional level. Andrew is pictured here with his family at the award ceremony.

sciences," and in 2014 he won the Senckenberg Research Award (Germany) for his lifetime research on mountains and nature.

**Göran Ekström** PhD '87, [ekstrom@ideo.columbia.edu](mailto:ekstrom@ideo.columbia.edu): I am a professor in the Earth and Environmental Sciences Department at Columbia, enjoying the company of three other EPS PhDs: Dave Walker (PhD '72), Meredith Nettles ('95, PhD '05), and Arlene Fiore ('97, PhD '03), and two Harvard applied physics alumni, Hugh Ducklow ('72, PhD '77) and Peter Eisenberger (PhD '67). A recent highlight was the 65th birthday symposium for John Woodhouse, a Harvard EPS professor (1978–1990), in Oxford in

sector business organization in the Philippines. I am also currently executive director of the Philippine Petroleum Association of the Upstream Industry (oil and gas) and vice president (Earth Sciences and Geography) of the Philippine Association for the Advancement of Science and Technology.

**C. Page Chamberlain** PhD '85, [chamb@stanford.edu](mailto:chamb@stanford.edu): Page is a professor in the Environmental Earth System Science Department at Stanford. He was recently elected as a fellow of the American Geophysical Union (AGU) in 2013 for his "pioneering application of stable isotopes across the geophysical

## NEXT STEPS: 2013–14 SENIORS

**When we checked in** with the 13 concentrators who graduated last year to see what their next-step plans were, we were not surprised to hear the wide range of answers:

**Dan Bradley:** "I'm working for CS 50, Harvard's Introduction to Computer Science course building demos and tools for students."

**Julianna Brunini:** "I got a Knox Fellowship to pursue a master's (MPhil) in technology policy at Cambridge University."

**Tyler Cusick:** "I am working for Boston Consulting Group (BCG) in their Minneapolis office."

**Libby Felts:** "I am currently working as a technical data analyst for Western Power Distribution in the UK, and will be moving on to graduate school in October. I will be undertaking an MSc in petroleum geoscience at Imperial College London, with support from Shell. Hopefully, by fall 2016 I will be embarking on the first step of a long career in the geosciences."

**Jimmy Looney:** "I will be teaching computer science and physical science at my alma mater, Westwood High School."

**Emily Lowe:** "I'm working as an analyst at a SAAS company in San Francisco called Zenefits. Fun fact: It was named by *Forbes* as 2014's hottest startup. I have also been marathon training and ran my first one in March."

**Ben Lynton:** "I am working as a junior geologist for Shale Petroleum Ltd. Shale is a small Calgary-based oil company that

used to be solely in exploration but has recently started drilling wells around Alberta. The week I got here was at the same time as the Calgary Stampede. Needless to say, I bought a cowboy hat straight away and watched some bulls do some damage on the small farmers who tried to ride them!"

**Elizabeth Matamoros:** "I'm working in Planning and Hazmat at AKRF in New York! It's been great so far and I feel very prepared from my coursework."

**Alex Morgan:** "I was awarded the Herchel Smith Fellowship from Harvard, so I will be obtaining a master's by research in Earth Sciences at Cambridge University."

**Ariana Saxby:** "After five years at Harvard, I am sad to be saying goodbye to Boston but excited to start my next chapter in California. I will be working as a technical writer at Qualcomm and am particularly looking forward to fresh guacamole and a paycheck."

**Rob Sauermann:** A man of mystery...

**Valerie Shen:** "Next year I will be working at McKinsey & Company as a business analyst in the San Francisco office. Then, starting in fall 2017, I will be attending the Stanford Graduate School of Business, pursuing a joint MBA and MS in environment and resources."

**Michael Traver:** "I'll be working at Google starting this fall, doing software engineering at the headquarters in Mountain View, CA."

### Two generations of EPS graduates.

Daniel Stolper '08 receiving his PhD in geobiology at Caltech's June 2014 commencement from his father, Edward Stolper '74, PhD '79, Caltech's provost and William E. Leonhard Professor of Geology, who was Caltech's interim president in 2013–2014.



March 2014. In attendance were Adam Dziewoński, myself (Harvard EPS professor from 1990 to 2006), Phil England (Harvard EPS professor from 1980 to circa 1989), Yun Wong (PhD '89), Xiaodong Li (EPS PhD '89), Domenico Giardini (EPS scientific staff 1982–1986), Andrea Morelli (EPS research associate, circa 1983–1986), Andy Jackson (EPS postdoc, 1989–1990), and Annie Souriau (EPS visiting scientist circa 1983).

### Marguerite “Mimi” Gerstell AM '91

(geophysics), mimigerstell@yahoo.com: I earned a PhD in planetary science from the California Institute of Technology in 1995. Fun facts from my professional life follow.

Most-cited first-author paper: Gerstell, Aharonson, and Schorghofer, “A Distinct Class of Avalanche Scars on Mars,” *Icarus* (2003). Most-cited nth-author paper: Cheng et al., “Photo-Induced Fractionation of Water Isotopomers in the Martian Atmosphere,” *Geophysical Research Letters* (1999). Most-disputed speculation: Yung, Nair, and Gerstell, “CO<sub>2</sub> Greenhouse in the Early Martian Atmosphere: SO<sub>2</sub> Inhibits Condensation,” *Icarus* (1997).

I commend to your attention Hu, Seager, and Yung, “Helium Atmosphere on Exoplanet GJ 436b Formed by Irradiation-Driven Escape,” set to appear soon. I was only a proofreader, but I found the speculation interesting and plausible. [Submitted in 2014]

**Daniel Holm** PhD '92, dholm@kent.edu: I graduated in 1992 with a PhD in geology (advised by Brian Wernicke). I'm finishing my seventh year as chair of the Department of Geology at Kent State University (northeast Ohio) where I have been a faculty member since 1992. My wife, Sara, is a substitute teacher at the local high school, and our three children are all still in school. Jeremy (22) is a senior at Kent State, Kirstin (20) is a sophomore at the College of Wooster, and Chloe (16) is a sophomore in high school. We travel to northern Minnesota twice a year, which is enough for our children to consider themselves Minnesotans.

**Craig B. Wood** PhD '92 (geology, vertebrate paleontology), CBWOOD@providence.edu: After obtaining an AB in geology (University of North Carolina, Chapel Hill, '64), I earned an MS ('67) from the University of Wyoming, having entered Harvard's Museum of Comparative Zoology (MCZ) in the fall of '66. I came and went several times over the ensuing years (including spending the academic year '70–71 at Princeton University, spending '88–89 as an exchange scholar at the University of California, Berkeley, and accepting, in 1974, a faculty position at Providence College, in Rhode Island), and was finally awarded a PhD from EPS in '92. After 38 years of service at Providence College, I retired in 2012, and I have now returned to the woods of Tidewater, VA.

**Dennis J. McGillicuddy Jr.** PhD '93, dmcgillicuddy@whoi.edu: I'm a senior scientist in the Department of Applied Ocean Physics and Engineering at the Woods Hole Oceanographic Institution. My primary research interest is the interface between the fluid dynamics and the biology of the sea. In particular, I study the physical-biological interactions that control plankton populations and their role in biogeochemical cycling in the ocean.

**Bernhard Steinberger**, PhD '96, bstein@gfz-potsdam.de: Since 2009, I have been a senior researcher at GeoForschungsZentrum Potsdam (the German Research Centre for Geosciences, in Potsdam, Germany) and a professor II at the University of Oslo, Norway. I am currently pursuing several lines of research—all related to the numerical

modeling of the dynamics of large-scale convection in the Earth's mantle—as I try to understand how and where slabs subducted at convergent plate margins trigger plumes at the core-mantle boundary, in particular at the margins of large low shear-wave velocity provinces, and how the pattern of slabs and plumes thus modeled compares to seismic tomography images.

In the years between my PhD and current positions, I first worked as a postdoctoral researcher at Academia Sinica, in Taipei, Taiwan (1996–1997),

and at Frankfurt University, Germany (1997–2001). I then was a visiting researcher at the University of Colorado, Boulder (2001–2002), and at Bayerisches Geoinstitut, in Bayreuth, Germany (2002 and 2004). I also worked as a researcher at IFREE, JAMSTEC, in Yokosuka, Japan (2004), and at the Geological Survey of Norway, in Trondheim, Norway (2004–2009).

**Linda C. Ivany** PhD '97, lcivany@syr.edu: I am a professor of geology in the Department of Earth Sciences at Syracuse University in New York. My research is in the fields of paleoecology and paleoclimatology, and generally focuses on the influence of changing climate on ancient marine ecosystems and their component taxa. Much of my work involves high-resolution stable isotope analysis of accretionary skeletal carbonates and the reconstruction of seasonal temperature variation, growth rate, and lifespan therefrom. I am particularly interested in climatic and biotic evolution during the Paleogene, and I have worked extensively in Paleogene sections in the US Gulf Coastal Plain and the Antarctic Peninsula. I live on a farm in central NY with my longtime partner and geologist Bruce Wilkinson and an assortment of horses, goats, and chickens.

**James Wang** PhD '03, james.wang@alumni.stanford.edu: I've been working as a scientist at NASA Goddard Space Flight Center in Greenbelt, MD, for the past three years. I use atmospheric models and satellite and ground-based observations to study the global carbon cycle. Before that, I worked for a year as an NRC Research Associate at the NOAA Air Resources Laboratory in Silver Spring, MD, where I analyzed data

on atmospheric climate trends. And prior to that, after I graduated from Harvard, I worked as a scientist for the Environmental Defense Fund in New York City for seven years, doing a mix of science and policy work.

**Ian Eisenman** PhD '08, [eisenman@ucsd.edu](mailto:eisenman@ucsd.edu): We have two children, Maya (5) and Leo (3), and I'm an assistant professor of climate dynamics at Scripps Institution of Oceanography.

**Victor Tsai** PhD '09, [vtsai@post.harvard.edu](mailto:vtsai@post.harvard.edu): In July 2011, I moved to Caltech, where I am an assistant professor of geophysics in the Seismological Laboratory. I've been busy working on a variety of problems, mostly related to either nontraditional sources of ground motion (like ocean waves and rivers) or the mechanics of glaciers.

**Atreyee Bhattacharya** PhD '12, [atreyee\\_b@yahoo.com](mailto:atreyee_b@yahoo.com). After one year as lecturer in the Environmental Sciences Program and



research scholar at the Marine Earth and Atmospheric Sciences at North Carolina State University, I joined the Earth, Planetary, and Space Sciences Department at the University of California, Los

Angeles, for my postdoctoral work in 2014. I was also a research affiliate in the EPS Department between 2010 and 2014. My research focuses on using geochemical and numerical tools to address questions in the domain of paleoclimate and paleoceanography. I am also a science writer and blogger.

**Hilary Close** PhD '12, [hclose@hawaii.edu](mailto:hclose@hawaii.edu); [www2.hawaii.edu/~hclose](http://www2.hawaii.edu/~hclose): Hilary, currently an assistant researcher in the Department of Geology and Geophysics at the University of Hawaii at Manoa, received the 2015 Raymond L. Lindeman Award, which honors a scientist of 35 years of age or younger for an outstanding peer-reviewed, English-language paper in the aquatic sciences. Hilary received the award at the February ASLO Aquatic Sciences meeting for her paper "Export of Submicron Particulate Organic Matter to Mesopelagic Depth in an Oligotrophic Gyre," published in *Proceedings of the National Academy of Sciences* in 2013. The paper draws on a chapter from her Harvard dissertation, advised by Ann Pearson.

**Natalya Gomez** PhD '14, [ngomez@cims.nyu.edu](mailto:ngomez@cims.nyu.edu): Currently, I am a postdoctoral fellow working with David Holland at the Courant Institute of Mathematical Science at New York University, and I will begin as a professor in the Earth and Planetary Sciences Department at McGill University this coming summer.

## Undergraduate

**Warren D. Huff** '59, [warren.huff@uc.edu](mailto:warren.huff@uc.edu); <http://homepages.uc.edu/~huffwd/HuffPage/huff.html>: Greetings to all my classmates from the '50s. I have many fond memories of those times. Not knowing what to major in when I arrived in the fall of 1955 I decided to fulfill part of my science requirement with a physical geology class taught by Don Leet. That was a terrific class and it got me started down the road to a geology career. Don had played football in college and when he discovered that both I and Gene Anderson were on the Harvard team he used to wait around after class on Mondays to talk to us about the weekend game. He encouraged me to continue with geology and pointed me toward Bernie Kummel's historical geology class, which I also took. Eventually, I landed in Marland Billings' office where he became my academic adviser and instructor in structural geology. I took mineralogy from Connie Hurlbut, petrology from Jim Thompson, and paleontology from Harry Whittington. Again, following Marland's advice I applied and was accepted for graduate study at the University of Cincinnati. A Harvard alum, Bill Jenks, was head here at the time, and Marland thought I would enjoy the department. He was right. In fact, as I was finishing my PhD in 1963 Bill stopped me in the hall one day and asked if I would be interested in a faculty appointment in the department (those were the old days!). I said yes, and have been here ever since. What a great trip!

**Michelle Lafreniere Rich** '69 (geological sciences, Radcliffe), [mrich@comcast.net](mailto:mrich@comcast.net): In recent years I have kept a hand in Earth sciences through teaching a high school course and through my husband's (Bob Rich, see entry above) work. Most of my time is spent on volunteer work.

**David F. Greeley** '75, [david.greeley@bp.com](mailto:david.greeley@bp.com): I am a senior exploration geologist presently doing pore pressure prediction for BP's deepwater Gulf of Mexico wells.

During the past 36 years with BP (and Amoco), I've done oil and gas exploration in the Wyoming-Utah Thrust Belt, western Washington and Oregon sub-basalt play, offshore California, offshore Trinidad, Mexico, Norway, Bolivia, Colombia, South China Sea, and Colorado-New Mexico coal degas. I specialize in 3-D basin modeling in support of pore pressure prediction, and I help teach and organize BP's in-house pore pressure principles course.

After getting my MBA in 1984 from the University of Denver, I worked as an economist for Amoco Denver's exploration and production departments. Before hiring on with Amoco I worked for Power Resources Corp. as a uranium explorationist in the Williston Basin and in eastern Colorado. Finally, way back in 1975, just out of college, I taught Earth science, geology, oceanography, and astronomy at Fountain Valley School, a college preparatory school in Colorado Springs, CO.

A couple of years ago I had an opportunity to go back to the Cardwell, MT, field camp—the one run by Indiana University (IU) that EPS students attended during my years at Harvard—and hike the old field sites with Professor Lee Suttner (IU's emeritus professor, department chair, and field station director). He can still out-hike me! Fantastic geology! Parts of the field station haven't changed much in 40 years, but there are a few wonderful new buildings there. If you ever get a chance to go back, I highly recommend it.

**Dave Dobson** '91, [ddobson@guilford.edu](mailto:ddobson@guilford.edu): I've been teaching in the geology department at Guilford College since 1997 after completing an MS and PhD at the University of Michigan. It's good to hear from the department—I have many happy memories of my geology classes.

**Rhonda Gordon** '92: I have very fond memories of the department (daily teas, field trips with Professor Siever) and the wonderful undergraduates, grad students, and professors! It had to be the nicest, friendliest department on campus. As a general pediatrician, I sadly don't apply my field of concentration (environmental geoscience) daily, but it does come in handy with my inquisitive 5-year-old son. I now live in Camarillo, CA, with my husband, Matthew Gordon AB '92, and two boys (the 5-year-old and an 8-month-old). [Submitted in 2011]

**Paul Dufays** '93, [dufays@amnipetroleum.com](mailto:dufays@amnipetroleum.com): I was an EPS concentrator at Harvard College and graduated in 1993. I have been

living in London since 2000, and, after several wayward years as an M&A lawyer, I have now in a very indirect way returned to my EPS roots as I now work in project finance structuring loans to finance upstream oil and gas developments. So there's a little bit of geology in my day job now. [Submitted in 2011]

**Matt Heid '96** (solid Earth geophysics): Matt recently published his fourth hiking guidebook, *One Night Wilderness: San Francisco Bay Area* (Wilderness Press), which details every overnight backpacking adventure within a two-hour drive from San Francisco. His previous titles include *101 Hikes in Northern California* and AMC's *Best Backpacking in New England*. Matt currently works as a content manager for the Union of Concerned Scientists in Cambridge, MA, does a variety of freelance outdoor writing for the Appalachian Mountain Club and other Northeast-based environmental organizations, and leads trips for the REI New England Outdoor School. He maintains a regular blog about outdoor equipment at [www.equipped.blogger.com](http://www.equipped.blogger.com). He lives in Framingham, MA. [Submitted in 2011]

**Leslie Hsu '00**, [hsu.leslie@gmail.com](mailto:hsu.leslie@gmail.com): Since January 2011, I'm at Lamont-Doherty Earth Observatory in the geoinformatics group. For more information, see <http://www.ldeo.columbia.edu/~lhsu>.

**Duncan French '03**, [dafrench@gmail.com](mailto:dafrench@gmail.com): My current job has zero affiliation with the great education that I received in the EPS Department: I'm a pilot in the US Marine Corps—I've been flying since 2004 (I was commissioned a Marine Corps officer following graduation and am currently a Major). I was in San Diego for five years in an operational F-18 squadron, and deployed twice overseas on aircraft carriers, the second of which was to Iraq and Afghanistan in 2011. I'm now stationed in Australia as a Marine Corps exchange officer in the Royal Australian Air Force, but will be returning to the US (South Carolina) as I was selected for transition to the F-35 (Joint Strike Fighter). I'm married with a one-year-old daughter. [Submitted in 2014]

**Alvin Ellsworth Hough Jr. '06**, [alvin-houghjr@gmail.com](mailto:alvin-houghjr@gmail.com), [www.alvinhoughjr.com](http://www.alvinhoughjr.com): After graduating from Harvard, I earned a master's in meteorology at the Georgia Institute of Technology, but earth and sky have taken a backseat to music at the moment. Currently, I am the musical director and conductor of *First Wives Club*, a new show that is doing a pre-Broadway run in

Chicago before transitioning to New York in the fall. And yes, it is based on the 1996 movie starring Bette, Diane, and Goldie. I recently completed a two-year run as a keyboard player and the assistant conductor for Broadway's *Motown: The Musical* (2013–15) and was the associate conductor and keyboard 1 player of *Scandalous* (2012), Kathie Lee Gifford's Broadway show. Prior to that, I was on the road as the musical director/conductor of the first national tour of the Tony Award-winning sensation *Memphis* (2011–12) and as the associate conductor and interim musical director of the *Dreamgirls* national tour (2010).

**David Olesh '06**, [david.olesh@gmail.com](mailto:david.olesh@gmail.com): I am in my eighth year at Automotive High School in Brooklyn, NY. This year I am teaching AP Environmental Science as part of a larger initiative in the New York City public schools to offer AP classes to the most underserved schools in the city. I am teaching the course, and the students seem to enjoy it. It has the highest enrollment of any AP course at Automotive. Take that, AP Psychology! If any Harvard EPS people are in NYC and want to stop by, you are welcome to my classroom to share your Earth science experiences with my class. In other news, I will be married, in August, to Tricia Stanley. She teaches high school math in New York City. We look forward to many happy summer vacations together.

**Daniel Stolper '08**, [dstolper@gmail.com](mailto:dstolper@gmail.com): I have recently finished my PhD in geobiology at Caltech and have just begun my postdoc in Princeton's geosciences department.

**Su Gao '10**, [jsgao88@gmail.com](mailto:jsgao88@gmail.com): From Boston to Beijing to DC, I have now ended



Dartmouth PhD candidate Alexandra Giese '08 researches the dynamics of debris-covered glaciers in the Himalayas to quantify their melt. Ali is currently doing modeling work at the Centre d'Etudes de la Neige (Snow Studies Center) in France and is pictured here before Mount Nuptise during 2014 fieldwork.

up in the last place I would have imagined myself when I graduated—NYC. Turns out it's a great place to run into fellow EPS alums and reminisce about that time we tiarad you-know-who in Hawaii. I have enjoyed the last few years at Bloomberg LP working in both the New Energy Finance and Environmental, Social and Governance divisions. My favorite moment so far was when *Bloomberg Businessweek* ran a front cover that said, "IT'S GLOBAL WARMING, STUPID."

**Antonio Iglesias III '10**, [antonio.iglesias.3@gmail.com](mailto:antonio.iglesias.3@gmail.com): In 2012, I completed my MA in teaching (with a certification in Earth science) at Montclair State University through a teaching residency program partnered with Newark (NJ) Public Schools. Currently, I am in my third year at East Side High School as the lead Earth science teacher. In the near future I will be applying to doctoral programs in science education, urban education, and curriculum and teaching. On a personal note, I will be marrying my boyfriend Marc this August.

**Danny Kim '10**, [dankim15@gmail.com](mailto:dankim15@gmail.com): After graduating, I coached high school soccer for recently arrived immigrants and refugees in Oakland, CA, through an or-

ganization called Soccer Without Borders. I am currently in my third year of medical school at the University of California, San Francisco.

**Yelun Qin '10**, yelunqin@gmail.com: I work as a spiritual adviser at both Harvard and Northeastern. At Harvard, I work with the undergrad group called Harvard-Radcliffe Asian American Christian Fellowship. It's

amazing just how bright the new students are each year! I mentor students, do leadership development, and help organize events and retreats. Although it's quite different from EPS, I still think fondly of my time in the department, especially the trip to Italy with my sedimentology class!

## STUMP THE SCHOLAR

# GLOBAL DISPOSAL: NIMBY TO THE N<sup>TH</sup> DEGREE

*Submitted by Jonathan Tucker, fifth-year graduate student*

**The puzzle:** In the year 2114, humanity has accumulated so much radioactive waste that there's nowhere left to store it on Earth—it must go into space! As the rocket engineer in charge of global waste disposal, your only options are to launch a rocket directly into the sun or directly out of the solar system, otherwise it would eventually come back and hit the Earth. You also cannot use gravity assists because of the risk of contaminating the human colonies on other planets.

**Your challenge:** To select which plan takes less rocket power: launching directly into the sun or launching directly out of the solar system?

**Submit your answer to [epsnl@fas.harvard.edu](mailto:epsnl@fas.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

# WHAT'S UP WITH SEA LEVEL?

**The puzzle:** For those of you with long memories, you may recall in our last issue, the Solid Earth Dynamics Group presented the challenge of explaining the discrepancy between the hypothetical globally averaged 3 mm/year sea level rise from melting grounded ice and the 1.5 mm/year sea level rise in UC Santa Barbara from this melting.

**The answer:** Melting of an ice sheet or glacier introduces gravitational and deformational effects that lead to a very non-uniform change in sea level. In fact, within about 2,000 km of a melting ice sheet or glacier, sea level will fall in response to the melting! At greater distance, sea level will rise with progressively higher amplitude. It turns out that melting of Alaskan glaciers—which is happening as you read this—at a rate equivalent to a global average sea level rise of 1.0 mm/year will lead to about 0.5 mm/year of sea level rise in Santa Barbara. (Sea level will fall in this case in Vancouver!) So, this is consistent with our hypothetical example of a total of 3 mm/year sea level rise globally and 1.5 mm/year at Santa Barbara.

Greenland is farther from Santa Barbara, and so melting of the ice sheet equivalent to a global average sea level rise of 1.0 mm/year will lead to about 0.8–0.9 mm/year of sea level rise in Santa Barbara—a value too high to explain the hypothetical Santa Barbara observations.

**The outcome?** The scholar, Richard Holme PhD '95, had the right idea but the wrong ice melt region. Despite waiving the prize because he felt his answer was a “bit of a cheat” given that he had attended a talk by Glenn Milne, judges agreed that Holme earned an EPS coffee mug, which was sent to his home.

**Lizzie Abbott '12**, erabbott3@gmail.com: I recently moved to Wellington, New Zealand, to work as a seismic hazard specialist with GNS (which is essentially the NZ equivalent of the USGS). I will work closely with engineering and construction in NZ and will likely help with earthquake database/code updates as well. I have mixed feelings about Endless Winter 2015 but am excited for this new adventure.

## EPS Connections

### Financial

EPS undergraduate and graduate programs have grown substantially in recent years, in part reflecting 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 it is for the Department of Earth and Planetary Sciences, to:

*Department of Earth and Planetary Sciences  
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# The Call of the Flannel

Once a year, EPS concentrators select a bit of swag to demonstrate their allegiance to the department. In the past, they've chosen T-shirts, union suits, and baseball caps, but last year's flannel shirts (see photo) have been the most popular by far. So we would like to make these now-classic shirts available at cost to our alumni. If you would like to proudly proclaim your connection to EPS by acquiring an EPS flannel (plaids may vary), please complete and mail the order form below, including a check for \$25 (per shirt) made payable to Harvard University.



**Flaunting the flannel.** Seven 2014 seniors sporting EPS flannel shirts, from left to right, are Elizabeth Matamoros, Jimmy Looney, Alex Morgan, Libby Felts, Emily Lowe, Tyler Cusick (sans flannel), and Valerie Shen.

*Questions?* Please send an email to [epsnl@fas.harvard.edu](mailto:epsnl@fas.harvard.edu).

## EPS Flannel Shirt Order Form

Small    Medium    Large    X-Large

Please make checks payable to Harvard University, with a note indicating that it is for EPS flannel shirts. *Each shirt costs \$25.*

I am enclosing a check for \$ \_\_\_\_\_ to pay for \_\_\_\_\_ (number) of shirts and cost of shipping.

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