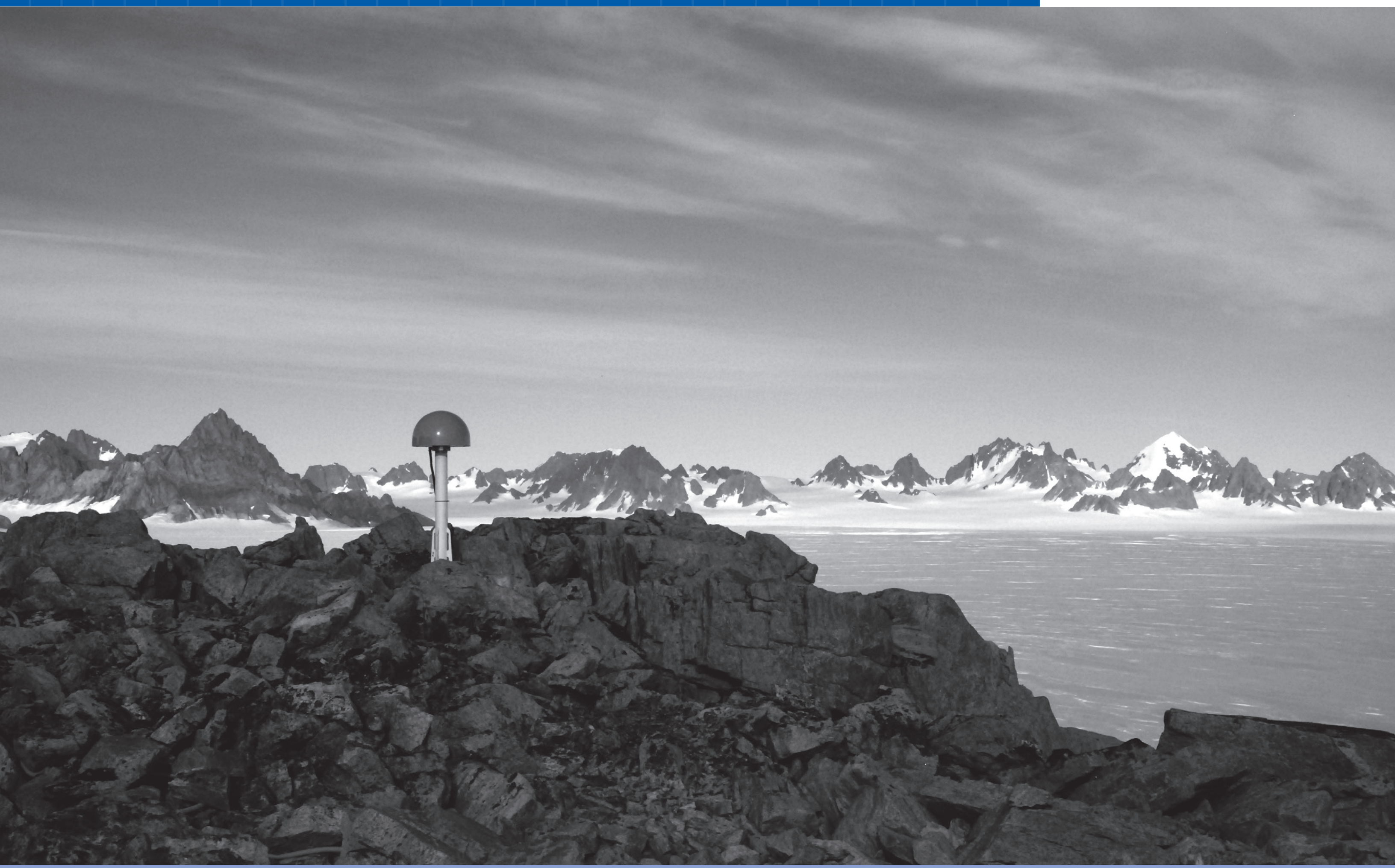
LDEO

ALUMNI AND FRIENDS NEWS

SPRING 12

Issue 19



FEATURE ARTICLE

Refining a Theory: Plate Tectonics in the 21st Century

Special Announcement: Lamont-Doherty Names New Director

Lamont-Doherty Earth Observatory

COLUMBIA UNIVERSITY | EARTH INSTITUTE

Issue 19
LDEO Alumni and Friends News is published twice a year by the Lamont-Doherty Earth Observatory of Columbia University

61 Route 9W, Palisades, NY 10964
Tel: 845-365-8599
E-mail: alumni@LDEO.columbia.edu

Interim Director of the Observatory
Arthur Lerner-Lam

Director for Development
Barbara Charbonnet

Development Officer
Stacey Vassallo

Development Associate
Erika Freimuth

Administrative Assistant and
Staff Photographer
Ronnie Anderson

Editor, Erika Freimuth

To subscribe to this newsletter, please send an e-mail to alumni@LDEO.columbia.edu

Cover image:
A millimeter-accuracy GPS antenna collects data on the shores of eastern Greenland. Jim Davis and other geodesists use these data to measure present-day ground motion called postglacial rebound, a phenomenon that yields insights into the last glaciation.
Photo credit: UNAVCO

Eileen Barroso

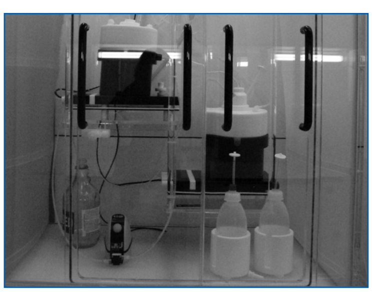
Letter from the Interim Director

Erika Freimuth

In March, Lamont's Ocean Bottom Seismology laboratory was shaded by a blossoming alley of cherry trees.

Ronnie Anderson

Gregory Mountain (right) speaks with attendees following his presentation during the Observatory's spring Public Lectures.



Erika Freimuth

A workstation in the nearly complete ultra clean laboratory for geochemistry awaits use by scientists and students.

Dear Friends,

As I write this, we are in the process of welcoming Lamont-Doherty's next director, Dr. Sean Solomon. Sean's record of distinguished leadership at the Carnegie Institution's Department of Terrestrial Magnetism, his world-class scholarship and international prominence, and his devotion to the Earth sciences and the foundational institutions such as Lamont usher in a new era for us all.

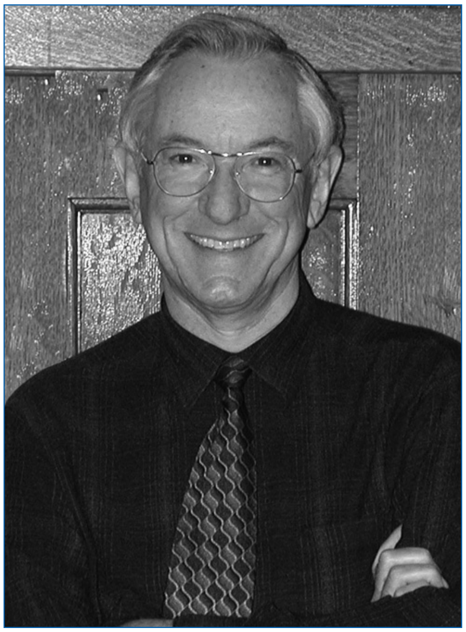
Our ability to attract such outstanding leadership is predicated on the successes achieved under Mike Purdy's directorship. Over the past decade, Lamont attained new levels of accomplishment and stability. Mike opened up new areas of scholarship with the hiring of peerless scientists. With Wally Broecker and others—and with major support from the Comer Foundation and other donors—he oversaw the construction of a world-class geochemistry laboratory, the first new lab building at Lamont in more than 30 years. He secured the purchase of the ex-M/V *Western Legend* and led its overhaul, turning it into a uniquely capable vessel. And by emerging from the shipyard as the R/V *Marcus G. Langseth,* it became the floating embodiment of one of Lamont's most prominent and well-loved scientists. Finally, after a long and at times arduous process, Mike enhanced the stability of the soft-money staff by leading the effort to establish the Lamont Research Professor track, the very first class of research professors in the history of Columbia University.

Sean's arrival will build upon these remarkable accomplishments. My colleagues and I are excited by what the future holds. In this era of environmental volatility and stress, basic research in the Earth sciences is more important than ever. The conduct of our science needs public and private support matched with an uncompromising commitment to excellence. We go where the science leads, not where the political winds blow. With your support, there will be no limit to what Lamont will be able to accomplish.

Warm regards,

Arthur Lerner-Lam

Top Planetary Scientist to Lead Observatory



Sean C. Solomon has been named the new director of Lamont-Doherty Earth Observatory.

Columbia University has named geophysicist Sean C. Solomon, whose research has combined studies of the deep Earth with missions to the moon and the solar system's inner planets, as the next director of Lamont-Doherty Earth Observatory. As a research scientist and director emeritus at the Carnegie Institution in Washington, D.C., Solomon led NASA's orbiting exploration of the planet Mercury. He is also a past president of the American Geophysical Union, the world's largest organization of Earth and space scientists. He will start at Lamont on July 1, replacing Interim Director Arthur Lerner-Lam.

"We are fortunate to have someone of Sean Solomon's extraordinary scientific accomplishments and executive experience become Lamont-Doherty's new director," said Columbia President Lee C. Bollinger in his April 4 announcement. "He is an admired leader, and we welcome him as our colleague in applying Columbia's great scientific expertise to the urgent questions facing our society."

Solomon has been the principal investigator for NASA's *MESSENGER* mission to Mercury, which entered orbit last year and is now mapping Mercury's surface and delving into the planet's origins, atmosphere, magnetic field, and interior. Some of his other projects are household names in space science: the *Magellan* mission to Venus and the *Mars Global Surveyor* mission. He is also a co-investigator for NASA's *GRAIL* mission, now mapping the moon's gravitational field.

Back on Earth, Solomon is a veteran of numerous oceanographic cruises aimed at studying mid-ocean ridges and the dynamics of the deep subsurface. Most recently, he has been involved in the PLUME project, which is using seismology on land and at sea to study the deep origins of the volcanic processes that have formed the Hawaiian Islands.

"I have enormous admiration for the achievements that have been made by Lamont staff in science and education," said Solomon. "The Observatory's emphasis on fundamental research and its tie to the Earth Institute, where science is applied to address social issues, is a package I found difficult to resist."

Solomon has been a member of the Earth Institute's external advisory board since 2004. "Earth is at a turning point, and the Earth sciences are in the midst of an intellectual transformation," said Lerner-Lam, who previously headed the Observatory's Division of Seismology, Geology, and Tectonophysics and is a Lamont Research Professor. "Sean's international stature and distinguished record of scientific leadership combined with Lamont's institutional strengths will undoubtedly usher in a new era."

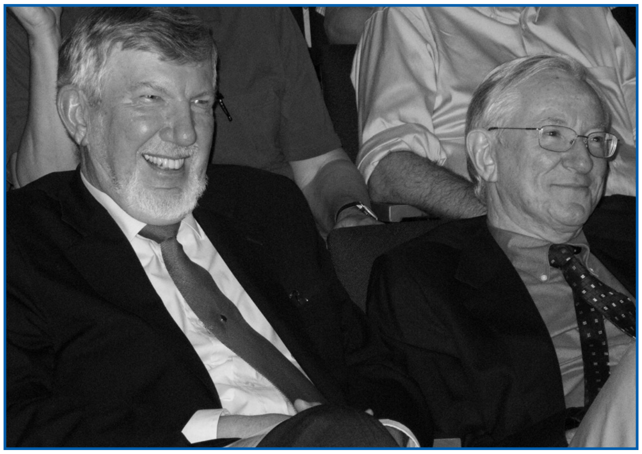
"Sean Solomon will bring remarkable scientific leadership to Lamont," said Jeffrey Sachs, director of the Earth Institute. "His renowned expertise extends from the very frontiers of basic science, across the solar system, and to the interface of science policy and human needs. We are thrilled he will join us as a colleague, as director of Lamont, and as a member of the leadership team of the Earth Institute. Sean will also continue to be a leader of global science as well, at a time of remarkable discoveries but also of remarkable urgency for the well-being of Earth and humanity."

Solomon was born in Los Angeles, the son of New Yorkers: his mother was an artist and his father a chemical engineer who worked in water treatment. He says he was fascinated early on with dinosaurs and thought of becoming a paleontologist. But his path changed in the summer of 1965 after his junior year at California Institute of Technology, when images from the *Mariner 4* mission that flew by Mars were broadcast live on TV screens on campus. "That mission whetted my appetite for planets," he said.

After finishing his PhD in geophysics at Massachusetts Institute of Technology in 1971, he stayed on to teach and conduct research there for two decades. In 1978, a paper he published in the journal *Geophysical Research Letters* provided an elegant explanation of the thermal evolution of relatively small bodies such as the moon and Mercury, which apparently do not have multiple tectonic plates like those on Earth. This "one-plate planet" concept became the paradigm for understanding the tectonics of the solar system's rocky inner planets.

At MIT, Solomon ran one of the earliest ocean-bottom seismometer labs. He investigated mid-ocean ridges by leaving those instruments at the bottom of the Atlantic, Pacific, and Indian Oceans to record earthquakes on the seafloor and measure Earth's structure below. As a result, he made important contributions to understanding how Earth's multiple plates generate new crust below the sea, where most plates intersect. He moved to Carnegie in 1992, where he headed its Department of Terrestrial Magnetism until last fall. Among other roles, he served as principal investigator for Carnegie's part of the NASA Astrobiology Institute, which seeks to understand the origin of life on Earth and its potential to exist elsewhere.

"One of the important perspectives Sean



Ronnie Anderson

G. Michael Purdy, former director of Lamont-Doherty, with Sean Solomon at an Observatory event in 2010 brings is his knowledge of the other planets," said Lamont's previous director, G. Michael Purdy, now the University's executive vice president for research. "The Earth is not unique. The mapping of other planets has helped in our understanding of this planet's evolution and vice versa."

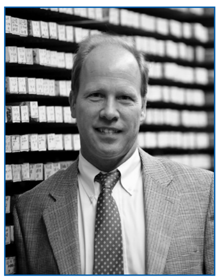
Solomon has been a member of both the National Academy of Sciences and the American Academy of Arts and Sciences, and is the recipient of numerous awards. These include the Geological Society of America's G. K. Gilbert Award for solving broad problems in planetary geology and the American Geophysical Union's Harry H. Hess Medal, given for outstanding research on the evolution of Earth and other planets. Last fall, when he stepped down as a director at Carnegie, colleagues arranged to have a previously discovered asteroid named after Solomon. Asteroid 25137 Seansolomon, about a mile and half wide, is currently orbiting the sun between Mars and Jupiter.

William Menke

View of the director's office, overlooking the Hudson

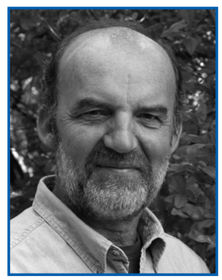
Lamont-Doherty 2012 Award Winners

Anthony D. Del Genio



Peter B. deMenocal

Andy Juhl



Dennis V. Kent

Steve Brusatte

John Templeton

Tiffany Rivera

Kaori Tsukui

Adam Formica

R/V *Marcus G. Langseth*

Anthony D. Del Genio, adjunct professor at NASA Goddard Institute for Space Studies, was named a Fellow of the American Geophysical Union for fundamental contributions in atmospheric and cloud physics to improve understanding of climate.

Peter B. deMenocal, professor and chair of the Department of Earth and Environmental Sciences (DEES), was also named an AGU Fellow, for his seminal work linking Plio-Pleistocene and Holocene African climate variability to human evolution and culture.

The Graduate Student Committee in DEES selected Lamont Associate Research Professor **Andy Juhl** for the academic year's Best Teacher Award.

Adjunct Senior Research Scientist **Dennis V. Kent** has been elected to the American Academy of Arts and Sciences. A leading expert in the history of Earth's magnetic field, Kent's most recent work dates advanced tool-making by early humans to 1.8 million years ago—at least 300,000 years earlier than previously thought.

Steve Brusatte, a PhD candidate through Columbia's collaboration with the Division of Paleontology at the American Museum of Natural History, received DEES' Best Teaching Assistant Award for his role as TA in the course Dinosaurs and the History of Life.

This year's Sara Fitzgerald Langer Book Prize was awarded to **John Templeton,** a graduate student in the Seismology, Geology and Tectonophysics Division, for enhancing academic and student life at Lamont-Doherty.

Tiffany Rivera and **Kaori Tsukui** were selected to receive AGU's Outstanding Student Paper Award. Rivera, a student at Roskilde University, works with Lamont-Doherty's Geoinformatics for Geochemistry group to maximize the application of digital scientific databases for research and education. Tsukui, a graduate student in the Observatory's Geochemistry Division, uses geochronology to explore Earth history and vertebrate paleontology. This is Tsukui's second such award from AGU.

Environmental science major **Adam Formica** is one of three Columbia College juniors to be awarded the Barry M. Goldwater Scholarship. This summer, Formica looks forward to starting his senior thesis on the physiology of tundra shrubs in Alaska with Professors Natalie Boelman and Kevin Griffin.

While navigating the world's oceans on a year-round schedule of research projects, the ***R/V Marcus G. Langseth*** continuously records data pertaining to meteorology, seafloor bathymetric mapping, ocean currents, magnetics, gravity, and carbon dioxide concentrations. The National Oceanic and Atmospheric Administration (NOAA) recently honored the *Langseth* with a Voluntary Weather Observing Ship Award, for its outstanding total of 3,749 manual and automated marine observations in 2011. Reports from the Langseth are updated every 24 hours at www.sailwx.info.

Updates from the R/V *Marcus G. Langseth*

Eduardo Acorda/Sandbox Studio SF

The Research Vessel *Marcus G. Langseth,* owned by the National Science Foundation (NSF) and operated by Lamont-Doherty Earth Observatory, offers scientists unparalleled opportunities in marine geophysics, seismology, and general oceanography research. Since the ship set sail at the end of 2007, our knowledge of Earth's geological history, natural hazard potential, and climate systems has grown considerably, thanks to the *Langseth*'s technical capabilities, the dedication of the ship's crew and staff, the management of the Observatory's Office of Marine Operations (OMO), and the boundless drive of the international science community.

Chief among the *Langseth*'s strengths is its ability to image the sub-seafloor—some of the most inaccessible and seismically significant parts of our planet. The vessel spent much of this past year exercising these capabilities in the Pacific Ring of Fire, an area responsible for some of the largest earthquakes and tsunamis ever recorded. In all, it collected more than 13,000 km of 2-D seismic images in addition to its second-ever 3-D seismic survey.

The *Langseth* schedule for 2011 consisted of a total of 246 operating days in support of six cruises, all led or co-led by Lamont scientists or alumni. Last April and May, Lamont alumnus **Dr. Nathan Bangs** (University of Texas) led a 3-D seismic cruise off the Pacific coast of Costa Rica aboard the *Langseth.* An array of hydrophones attached to four 6 km cables trailed the vessel, recording sound waves reflected from structures at or below the seafloor. These data were used to construct an 11 x 55 km cube displaying the 3-D structure and material properties of colliding plates in the region.

The ship then sailed north to the Gulf of Alaska and the Bering Sea, where Lamont alumna and U.S. Geological Survey (USGS) marine geophysicist **Dr. Ginger Barth** was a chief scientist on two cruises undertaken as part of the nation's long-term plan to map its extended continental shelf boundaries in fulfillment of the United Nations Law of the Sea Treaty. This research will help define the rights and duties of the United States with respect to navigation, environmental protection, natural resources, scientific research, and international disputes in these northern waters.

Between the two USGS cruises in July and August, the *Langseth* covered 3,700 km through the Aleutian Islands. Under the direction of Lamont Assistant Research Professor **Donna Shillington,** the research team sent pulses of sound to the seabed and decoded the echoes, called seismic reflection data. Shillington and Associate Professor **Maya Tolstoy** invited five Columbia undergraduates to join the cruise. "It's an intense immersion in research, and it's basically a big adventure," said Tolstoy. The students monitored data collection around the clock. "We could immediately see the raw data," said Andrew Wessbecher, a Columbia senior who left the Navy to study Earth science. "It was a rare vision of the Earth." The students named their group Team Diebold, after Lamont's late, much-loved marine scientist John B. Diebold, a pioneer in the use of sound waves to explore the ocean floor.

Following the Bering Sea cruise in August, the *Langseth* sailed to the Chukchi Sea, less than 1,300 km from the North Pole. Led by Lamont alumnus **Dr. Bernard Coakley** (University of Alaska–Fairbanks), the international science team used seismic reflection data to image the region's dramatic deep-sea topography. In his field reports to the *New York Times' Scientist at Work* blog, Coakley noted that, "The R/V *Langseth* is the primary vessel in the United States research fleet capable of this work. The vessel is named after a man I knew. Marcus was an exceptional scientist and, as is true of the best of them, extraordinarily clear in his thinking and naturally understated about his substantial achievements."

Lamont Associate Research Professor **James Gaherty** spent the holiday season aboard the *Langseth* with a team of scientists pursuing the fundamental geophysical question: *What is a plate?* Using both 2-D seismic profiling and 61 ocean bottom seismometers (OBS), this project characterized a section of the central Pacific seafloor in unprecedented detail, advancing our understanding of the fundamental structure and evolution of oceanic plates.

The busy ship schedule continued into 2012 with a transit from Hawaii to Guam, where the *Langseth* prepared for a series of new cruises. From February through late March, the *Langseth* conducted a study over the Marianas Trench that included 2-D seismic imaging as well as collaborative profiling that made use of 85 OBS from Lamont, Scripps Institution of Oceanography, and Woods Hole Oceanographic Institution to study the deepest part of Earth's oceans.

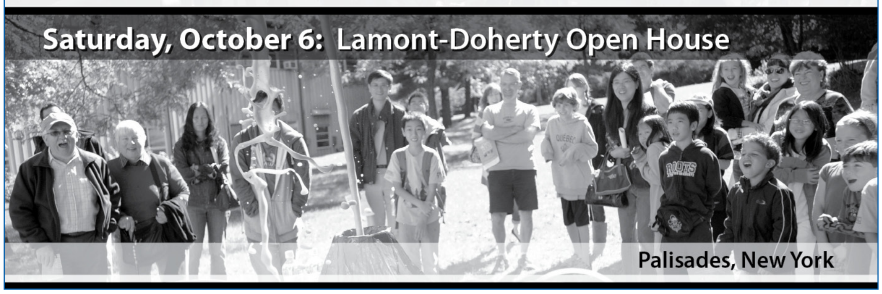
During May, the *Langseth* will conduct its first coring and high-resolution seismic cruise under the direction of Lamont Assistant Research Professor **Pratigya Polissar** and Lamont alumna **Jean Lynch-Stieglitz.** The goal is to collect sediment cores and water samples near the Line Islands in the central equatorial Pacific in order to gain new insight into alternating El Niño/La Niña weather patterns that affect much of the globe.

Jun Korenaga

Crew and scientists unload in Honolulu after a 23-day cruise in March and April to the Shatsky Rise, an oceanic plateau in the Northwest Pacific.

UPCOMING EVENTS

Save these dates to see Earth science come alive with Lamont-Doherty!



Lamont-Doherty's First Postdoctoral Symposium

Kim Martineau

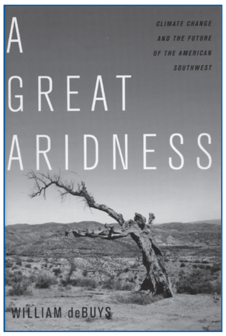
Postdoctoral research scientist Beth Stauffer presents her work on marine environmental biology.

On April 5, 2012, the Observatory held its first-ever Postdoctoral Symposium, a daylong event highlighting the work of Lamont-Doherty's exceptional postdoctoral researchers. Organized by Kuheli Dutt, assistant director of Academic Affairs and Diversity, the day began with individual oral presentations, followed by an afternoon poster session. The symposium was very well received by the Lamont community and showcased the richness and breadth of research carried out by the Observatory's postdocs, a diverse and talented group of about 35 scholars, the largest in the institution's history. Lamont-Doherty's annual postdoctoral search selects from an applicant pool of hundreds of the world's most promising early-career scientists.

Postdoctoral researchers pursue innovative projects with senior scientists in the Observatory's five research divisions while distinguishing themselves as future leaders in the field. By bringing this group together to present their research to the wider community, this symposium is part of ongoing efforts to foster further collaboration at Lamont-Doherty and strengthen this group of remarkably creative and energetic young scientists.

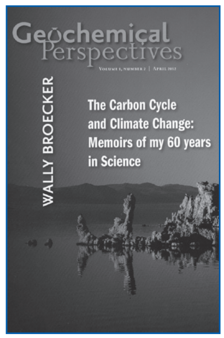
On Our Bookshelf

A Great Aridness: Climate Change and the Future of the American Southwest
By William deBuys, Oxford University Press, November 2011



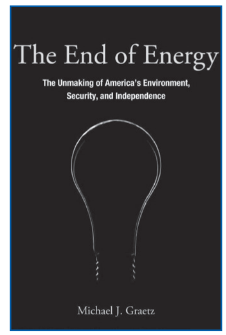
With its soaring azure sky and stark landscapes, the American Southwest is one of the most hauntingly beautiful regions on Earth. Yet staggering population growth, combined with the intensifying effects of climate change, is driving the oasis-based society close to the brink of a Dust Bowl–scale catastrophe. In *A Great Aridness,* William deBuys paints a compelling picture of what the Southwest might look like when the heat turns up and the water runs out. deBuys consulted with Lamont Research Professor **Richard Seager,** who is quoted in the book discussing climate models that describe a more arid American Southwest.

The Carbon Cycle and Climate Change: Memoirs of My 60 Years in Science
By Wally Broecker, European Association of Geochemistry, *Geochemical Perspectives,* Volume 1, Number 2, April 2012
www.eag.eu.com



In this manuscript, **Wally Broecker** presents the development of our current understanding of how the oceans operate and how past climates are reconstructed—from the application of radiocarbon dating of carbonate rocks, to the essential role of global ocean circulation and atmospheric carbon dioxide content.The manuscript concludes by describing how the collected knowledge about the carbon cycle provides insight into capture of CO_2 from the atmosphere with the aim of storing it and attenuating the potentially devastating effects of fossil fuel burning on global climate change.

The End of Energy: The Unmaking of America's Environment, Security, and Independence
By Michael Graetz, MIT Press, April 2011



The third annual Arthur D. Storke Memorial Lecture was given at the Observatory on April 20, 2012, by **Michael Graetz,** a distinguished professor of law at Columbia University, emeritus professor at Yale Law School, and a Fellow of the American Academy. Graetz's presentation, "Energy Policy: Past or Prologue?" was based on his most recent book, *The End of Energy: The Unmaking of America's Environment, Security, and Independence,* in which he describes more than forty years of energy policy and argues that we must make better decisions for our energy future.

Spring 2012 Public Lectures

Watch the lectures you missed on the Observatory's website! ***www.LDEO.columbia.edu/video***

What Do Dead Plants Tell Us about Earthquakes?
Heather Savage, *Lamont Assistant Research Professor*
Pratigya Polissar, *Lamont Assistant Research Professor*

Landscapes Beneath Our Feet
Gregory Mountain, *Professor, Rutgers University*
Adjunct Senior Research Scientist, Lamont-Doherty Earth Observatory

Mapping the Source of Great Alaskan Earthquakes
Donna Shillington, *Lamont Assistant Research Professor*

Peak Earth: Population, Climate, and Energy in the 21st Century
Peter Kelemen, *Arthur D. Storke Memorial Professor, Department of Earth and Environmental Sciences, Columbia University*

Ronnie Anderson

Donna Shillington explains plate tectonics during her lecture on the great Alaskan earthquakes.

Refining a Theory: Plate Tectonics in the 21st Century

By Whitney Barlow


UNAVCO

A GPS antenna sits atop a single mast bolted to the bedrock in eastern Greenland.

It's 10 a.m. on Monday morning, and two chunks of granite have been pressing against each other for the past half hour. Under the force of 700 pounds per square inch, they stick, then slip, causing cracks and pops to echo through the room. A transducer latched to the side of the rock sends a digital record of waves to a nearby computer, where Heather Savage starts crunching the data.

Savage is a rock mechanics specialist, a master of earthquake simulation. She's one of several new scientists in Lamont-Doherty's Seismology, Geology, and Tectonophysics Division using innovative technology to understand the behavior of tectonic plates as they move across Earth's surface. By pushing faults to their literal breaking points and creating miniature quakes in the Observatory's new rock mechanics lab, Savage and her colleagues are extending Lamont-Doherty's long legacy of describing the movements of the earth.

Erika Freimuth

In the recently renovated rock mechanics lab, Heather Savage slides two wedges of rock into a biaxial deformation apparatus, which applies pressure until the two pieces slip. Attached wires record displacement and acoustic emissions, allowing Savage to model the behavior of faults under stress.

LAMONT-DOHERTY AND THE BIRTH OF PLATE TECTONICS

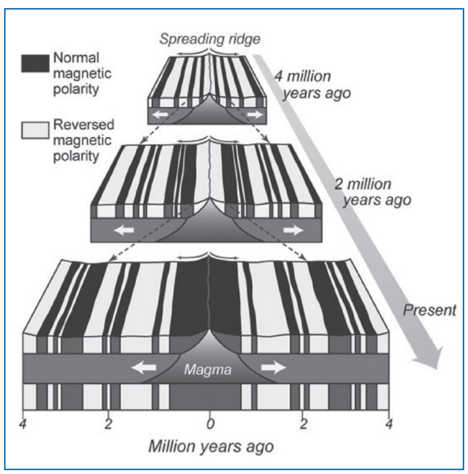
As early as the 1500s, cartographers could see that the continents, particularly South America and Africa, fit together like puzzle pieces. But it wasn't until the 1950s that scientists began to understand how continents could march across the globe.

Lamont-Doherty scientists Marie Tharp and Bruce Heezen laid the foundation for an explanation that would come to be known as seafloor spreading. Using echo soundings that measured seafloor depth below ocean research vessels, they generated a topographic map of the ocean floor. This rendering revealed a deep-sea mountain range stretching from north to south throughout the world's oceans, a distinct V-shaped valley often running along its peak.

Harry Hess of Princeton University realized this mid-ocean ridge might be the seam at which the continents drift apart, explaining their uncanny fit. He proposed that a constant supply of magma from within Earth was emerging from the ridge's peak and spreading in opposite directions—thus expanding ocean basins and nudging the continents away from the mid-ocean axis.

For this model to be true, the seafloor on either side of the ridge should show a symmetrical pattern of alternately magnetized strips of rock, as noted by British scientists Fred Vine and Drum Matthews. The magma from the mid-ocean ridge

WHOI



Magma cools as it spreads out from a mid-ocean ridge, solidifying into strips of rock with alternating polarity corresponding to the planet's magnetic field at the time of their formation. Data found on early *Eltanin* surveys revealed this magnetic profile, confirming the theory of seafloor spreading.

contains iron-rich minerals that point to Earth's magnetic poles like compass needles. As magma spreads from the ridge and cools, these minerals lock in place, thus recording the planet's magnetic field at that time. Since Earth's magnetic poles flip about every 200,000 years, the rock emerging from the underwater mountain should reflect these periodic reversals in polarity.

In the mid-1960s, the National Science Foundation research vessel *Eltanin* explored the waters of the Pacific with Lamont-Doherty scientists aboard, gathering sediment cores and towing a magnetometer behind it like an aquatic caboose. While journeying over the Pacific-Antarctic ocean ridge, the crew took measurements of the seafloor that would come to be known as "the magic profile," providing the exact mirror image of magnetized rock predicted by seafloor spreading.

"It was as perfect a symmetry as nature was going to give you," recalls Walter Pitman, a research scientist at Lamont-Doherty who was aboard one of the early *Eltanin* cruises. And so plate tectonics was born, envisioning Earth's surface as a network of rigid plates riding in concert across melted rock, propelled by a spreading ocean floor. The seabed was churning, and the continents were on the move.

FROM OCEAN TO ORBIT

A 21st-century understanding of how the plates move requires going beyond the oceans. In fact, it requires going beyond Earth. Space-based geodesy is a field of research that paints a large-scale picture of the planet by determining its shape, size, and orientation in space using signals from orbiting satellites and even distant galaxies. These advanced data collection methods offer a new era for understanding if plate tectonic theory matches present-day movements of Earth.

Jim Davis, a geodesist at Lamont-Doherty, uses a network of GPS receivers to understand fine movements of tectonic plates. "Measurements of the ocean floor in the 1960s showed that plate tectonics happened," says Davis. "Geodesy supplies the data that prove the plates are still moving today."

The GPS receivers Davis uses are super-science versions of those in cars. "When you're driving, you can be a few meters off," says Davis. "But our instruments allow us to detect if these plates move by less than the width of a human hair every year." Satellites orbiting Earth send signals to receivers placed across the globe, and Davis analyzes the collected data to monitor how the distances between points on Earth change over time.

These precise measurements have revealed that disastrous quakes are not the only events altering the planet's crust. Plates may also slip in "silent" earthquakes that change the shape of Earth in months rather than minutes. "They still look like earthquakes and deform the plate in the same way that an earthquake does," says Davis. "It's just really slow, so no one notices."

These slow-slip events occur in predictable cycles throughout the Pacific Northwest. Davis is currently researching a 1,000-kilometer stretch between the Rockies and the San Andreas Fault that may be undergoing silent earthquakes as well. The finding is startling because early plate tectonics visualized rigid plates moving at constant velocities across Earth, whereas Davis's research suggests the motions take place at varying speeds, with movement happening far beyond plate boundaries.

"We're beginning to see a real refinement of plate tectonic theory," explains Davis. "It opens the question: if you get better and better accuracy, can you really say any place is moving at a constant speed all of the time? Maybe plate tectonics shows a low-resolution view of Earth, where it looks like rigid plates move past each other at constant velocities. But once you get out the microscope and look at very fine motions, you find that's not true."

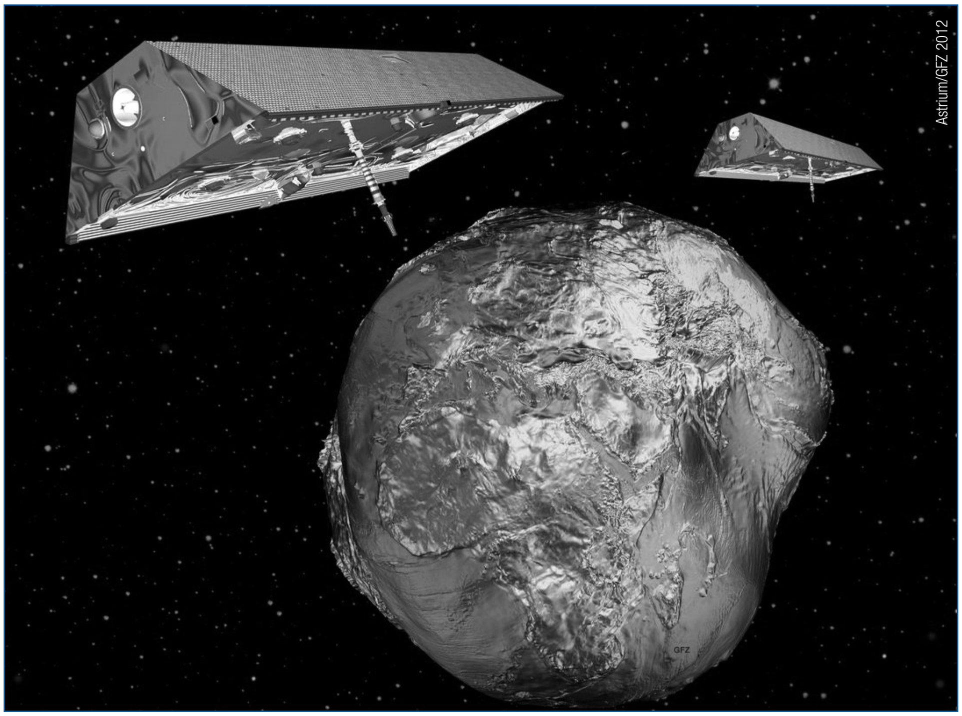
Much like Marie Tharp and her topographic map or Walter Pitman on the *Eltanin,* Davis and his colleagues are in the data-gathering stage. "The development of plate tectonic theory was led by the data, and the data at that time pointed to the rigidity of plates," he says. "It's a very important part of science to find models and theories that explain the data."

Starting this spring, Davis will head Lamont-Doherty's first geodesy lab. Its researchers will analyze plate movements and glaciology while developing the hardware for more accurate GPS receivers. In addition to monitoring silent earthquakes, Davis will study other forces on plates, including a phenomenon called postglacial rebound.

When glacier coverage of the planet peaked around 20,000 years ago, the weight of these ice masses caused depressions to form on the continents. As the glaciers melted, the dimples remained, forcing the planet into a state of readjustment that can affect everything from present-day sea levels to distributions of gravity.

Davis pioneered the use of GPS receivers to study this effect, and it's another way space-based techniques are giving Lamont-Doherty researchers a more nuanced understanding of the forces shaping Earth's surface.

"Plate tectonics assumes there are rigid plates moving around," says Davis, "but in reality, none of these plates are really rigid, ever, anywhere—and so it's because there are these other forces like postglacial rebound acting on plates that we need to study all of Earth's tectonic movements." By serving as an incubator for increasingly accurate GPS technologies, the new geodesy lab promises to bring plate tectonics into the 21st century by incorporating these subtle yet significant changes in Earth.



NASA's twin Gravity Recovery and Climate Experiment (GRACE) satellites orbit Earth, taking high-precision gravity measurements used by Jim Davis to quantify changes such as mass loss from melting glaciers in Greenland. The irregular shape of Earth is an exaggerated representation of the varying strength of the planet's gravity field due to uneven distributions of mass.

SHAKING THINGS UP

Back in the rock mechanics lab, Heather Savage uses an array of earthquake-mimicking machines to test how plates move, interact, and deform. The lab's goal is to study how and why earthquakes begin where they do, why some get large and some stay small—and what it takes to get them started.

"All faults are under stress right now, but earthquakes aren't happening on every single one," says Savage. "We're trying to understand how easy it is to trigger a fault, whether from human activity or natural forces in the Earth."

Savage simulates stress conditions on a fault by taking two pieces of rock with a saw-cut in the middle and applying pressure until they give way. Other times, she'll load a machine with an intact specimen to see how long it takes to shatter. In a separate room shielded by steel-lined walls, a triaxial apparatus applies pressure from three directions, allowing Savage to emulate the extreme temperatures and pressures up to 15 kilometers within Earth—once she leaves the room for safety, of course.

"The great thing about conducting experiments is that you can re-create the same conditions at the depth where earthquakes start and then tweak those conditions to understand how faults will respond," says Savage. "It's a really fun way to ask questions."

The lab uses either rocks widely tested in the literature with well-documented experimental records, or, when available, rocks from real fault zones. For the latter, they can sometimes keep the fault intact and place it in the apparatus for a near–in situ test of fault strength and other properties.

But Savage doesn't limit her research to the catastrophic quakes. Like Jim Davis, she also

"We're trying to understand how easy it is to trigger a fault, whether from human activity or natural forces in the Earth."

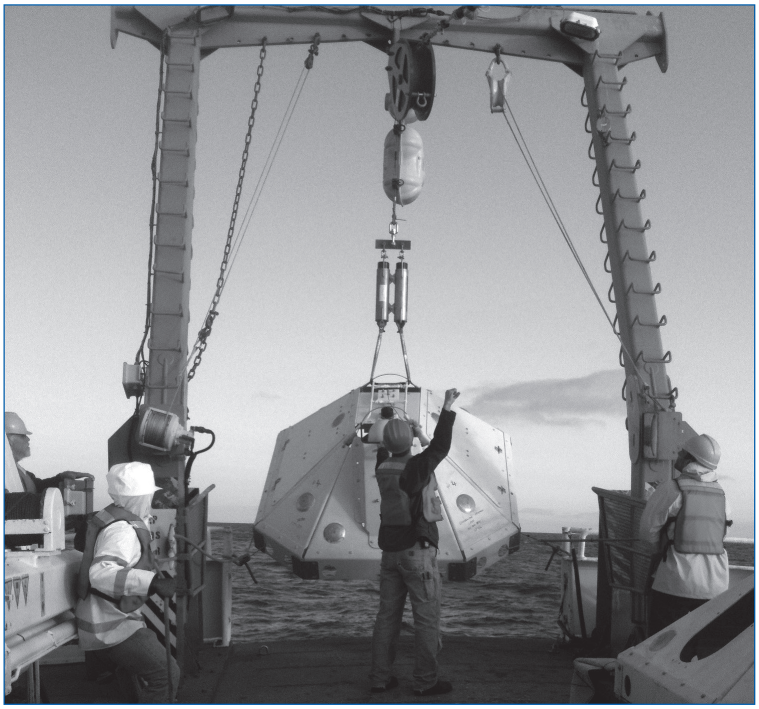
studies slow-slip events and has started experiments on these phenomena in the lab. Her team hopes to identify the special conditions that allow faults to move at this rate.

"We've known even before plate tectonics that earthquakes happen on faults," says Savage, "but to really understand the full spectrum of fault behavior, from slow-slip events to earthquakes—that's the next challenge."

Ocean Bottom Seismometers: Putting an Ear to the Seafloor

By William Weir

Maya Tolstoy



Lamont-Doherty engineers Vincent Oletu, Drew Stolzmann, David Gassier, and Ted Koczynski deploy a trawl-resistant OBS from the R/V *Wecoma* off the coast of Washington in July 2011.

Deploying an ocean-bottom seismometer—that is, using a crane and cables to lower 1,500 pounds of very expensive, very sensitive equipment to the bottom of the ocean to record seismic activity—is a daunting technical challenge. And that's only half the battle. Up to a year later, these instruments must be recovered from the depths, brimming with data used to reveal structures and processes deep beneath Earth's crust.

Lamont-Doherty's Ocean Bottom Seismology (OBS) laboratory is charged with engineering instruments that meet this challenge and provide the international science community with unprecedented information about seafloor earthquakes, hydrothermal processes, volcanic hotspots such as Hawaii and Iceland, and the generation of new oceanic crust from magma.

Since it was established in 2001, Lamont-Doherty's OBS lab has fueled a number of major breakthroughs to become a distinguished leader in the field. Off the coast of Mexico in 2006, Lamont-Doherty geophysicists became the first to use OBS to record seismic data during an underwater volcanic eruption. The same expedition yielded surprising findings about hydrothermal vents (systems where geothermally heated water gushes up from the ocean floor) that upended previous understanding of where they occur.

The OBS lab must customize instruments to meet the specific parameters of each new project and research site. Engineers developed protective shields for OBS deployed in shallow water as part of the Cascadia Initiative—a four-year multi-institutional study of the Cascadia subduction zone in the Pacific Northwest. The eight-sided encasements, known as trawl-resistant mounts, address the problem of interference from bottom trawling, a fishing method common in the area that combs the ocean floor with large weighted nets. Lamont-Doherty's trawl-resistant mounts are allowing the Cascadia subduction zone to be explored more closely than ever before.

Research scientist Andrew Barclay, who runs the OBS lab, said the device is the result of several years of trial and error, three prototypes, and the counsel of commercial fishermen. It's an innovation exclusive to Lamont-Doherty's OBS lab and one of many technologies the team has developed to negotiate extreme pressure and rugged terrain on the seafloor.

The Cascadia Initiative began last July, when 60 OBS were deployed off the coast of Washington and Oregon. Here, the Juan de Fuca oceanic plate is converging and slowly moving beneath (or subducting) the North American continental plate. It's the type of formation that results in "megathrust" earthquakes—the kind that caused the 2011 tsunami in Japan—that can exceed a magnitude of 9.0. It's been more than 300 years since the Cascadia zone has experienced a megathrust earthquake, and seismologists believe it's due for another within the next century.

Maya Tolstoy, associate professor of Earth and environmental sciences and one of the chief scientists of the project, said the diversity of formations there make it a spot ripe for study. "What you have there is every type of tectonic boundary," she said.

A more specific estimate of when Cascadia's next big quake could happen may depend on learning more about a phenomenon known as "episodic tremor and slip," or simply "slow slip." Tolstoy describes it as a very slow earthquake—one that takes a couple weeks rather than a few seconds. These tremors occur in only a handful of regions. In the Cascadia subduction zone, they happen about every 14 months. Some have hypothesized that slow slips can increase the risk of megathrust earthquakes by adding stress to the fault. So far nothing conclusive has been proven, but Tolstoy hopes the data collected during the Cascadia Initiative will yield new insights.

Lamont-Doherty scientists and engineers will go back to the Pacific Northwest this July to retrieve the OBS deployed last summer. Led by Tolstoy as chief scientist, the team will include Barclay, four OBS engineers, and up to eight Columbia graduate and undergraduate students.

"We're hoping to learn more, so we can answer those questions more precisely," she said.

Not that there's any concern about running out of questions. Tolstoy estimates that only about one percent of the seafloor has been surveyed with seismometers, and she is interested in using OBS to expand studies of submarine subduction zones around the world. The future promises continued revelations as the Observatory's scientists and engineers continue to transform our modes of exploring the vast expanses of the ocean floor.

Letter from Steven Cande Alumni Board President

Dear Alumni and Friends of Lamont,

I was thrilled, as I'm sure many of you were, to hear the long-awaited announcement that Sean Solomon will become Lamont-Doherty's next director on July 1. Since the Observatory was established in 1949 under the visionary leadership of Maurice Ewing, we've had a succession of outstanding directors. Over the last decade, Mike Purdy brought the Observatory to new heights—from acquiring the R/V *Marcus G. Langseth* and constructing the LEED-certified Gary C. Comer building to establishing the Lamont Research Professor title. The momentum will surely continue under Sean's leadership, and I wish him all the best for his years to come as a "Lamonter." Welcome, Sean.

Art Lerner-Lam provided extraordinary leadership throughout this interim period, including the extensive search process and the coming transition. My deepest admiration to you, Art.

It was great to see so many alumni this past December in San Francisco for the American Geophysical Union (AGU) conference and Lamont's annual reception. It was a pleasure to have Mia Leo join us as we saluted her upon her well-deserved retirement. Thank you, Mia, for more than 34 years guiding countless students through graduate studies in the Department of Earth and Environmental Sciences.

Congratulations to two such students, Ana Christina Ravelo of the University of California and Paul Wessel of the University of Hawaii, who were elected AGU Fellows this year. It's wonderful to see so many Lamont alumni go on to achieve such great successes around the country and the world.

Save the date for Lamont's alumni reception at AGU on December 4, when I look forward to seeing more of the generations of scientists trained at the Observatory.

After six years as an integral part of the Alumni Association Board of Directors, Joyce O'Dowd Wallace is stepping down. Joyce is always prepared with a smile and a story from her many years in the Purchasing Department. Lucky alumni will find her at future events on campus, where she'll readily share some of her great wealth of institutional knowledge. Thank you, Joyce, for your service to the Observatory!

Joyce O'Dowd Wallace

Finally, at the close of the two-year campaign to match the federal challenge grant for the ultra clean laboratory, I salute the 133 alumni who helped the Observatory come so far in reaching this important goal. I'm especially proud to know what a critical role we as alumni played in building this transformative facility.

Warm regards,

Steven C. Cande, PhD '77

AGU FALL MEETING

San Francisco | 3–7 December 2012

Save the date for our annual Alumni Reception!

Tuesday, December 4, 2012 | Marriott Union Square, 480 Sutter Street, San Francisco, CA

General Alumni Meeting, 5:30-6:30 pm *The director gives updates from the Observatory*

Annual Alumni Reception, 6:30-8:30 pm *Join the Observatory's largest alumni event of the year*

A Fond Farewell to Mia Leo

On November 28, 2011, the Lamont community gathered to bid adieu to Mia Leo upon her retirement after more than 34 years as the academic department administrator for the Department of Earth and Environmental Sciences (DEES). The celebration included a lively musical tribute by faculty and students who expressed their fondness and gratitude through hymn, carol, jug band, and doo-wop numbers before the finale, "Mama Mia," all with creatively adapted lyrics.

Leo was presented with a plaque with the following inscription: "Your wisdom, and love for education, students and indeed life have guided generations of young scientists at Lamont-Doherty Earth Observatory."

During AGU's Fall Meeting in San Francisco the following week, Leo joined some of the hundreds of students who graduated under her watch at the Observatory's annual alumni reception. Both events were fitting acknowledgments of Leo's legendary dedication, and for the depth and meaning she brought to life at Lamont over the years.

Ronnie Anderson

Mia Leo with Steve Goldstein, Peter deMenocal, and Art Lerner-Lam at her retirement party

AGU Alumni Reception 2011

Stacey Vassallo

Sarah Fowell (PhD '94) with Mia Leo, Steve Cande (PhD '77), and Sarah Tebbens (PhD '94)

Stacey Vassallo

Lamont summer 2011 interns Kyle Monahan, Scott Tarlow, and Nate O'Flaherty attended AGU to present their results and visit with Dallas Abbott, the intern program coordinator.

Stacey Vassallo

Advisory Board member Florentin Maurrasse (PhD '73) and Alumni Board member Christa Farmer (PhD '05)

Alumni Gather to Honor Ken Hunkins, One of Lamont's Early Arctic Explorers

Erika Freimuth

The gathering in honor of Ken Hunkins included, from left to right, Chuck and Nel Hubbard, Jay Ardai, Ana Maria Alvarez, Suzanne O'Hara, Margie Turrin, Art Lerner-Lam, Ken Hunkins, Arnold Finck, Mei Hunkins, Robin Bell, Kim Kastens, Dale Chayes, Tom Manley, Ray Sambrotto, and Peter Schlosser.

Early in March, just days after his 84th birthday, Ken Hunkins joined Art Lerner-Lam and a handful of colleagues and former students to have lunch and share reflections on his remarkable, ongoing career in polar geophysics. Those in attendance recognized Hunkins as a wonderful mentor, ever passionate about his work and supportive of students and younger colleagues.

Tom Manley (PhD '81), who studied Arctic oceanography under Hunkins and came from Vermont for the lunch, said "Ken had tremendous patience, provided the needed dose of compassion when things didn't go according to plan, and most importantly, provided a true and everlasting passion for research."

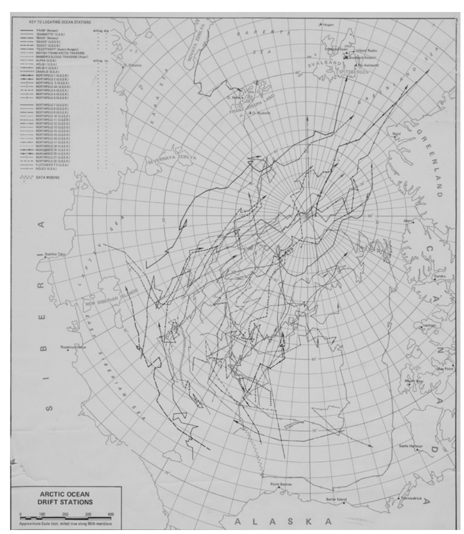
The event was inspired by the recent restoration of Hunkins' copy of the historic Arctic Ocean Drift Stations Map, which includes the track of Ice Station Alpha. This was the first U.S. scientific base on an ice floe (a sizable section of ice floating on the ocean surface), and the place where Hunkins got his start in Arctic research after returning from the Korean War to study geophysics.

Under the direction of the late Jack E. Oliver, the research team on Ice Station Alpha spent their days measuring ocean depth, collecting sediment cores, and tracking their course through the Arctic Ocean, drifting about three miles a day. This marked the beginning of both a new era in polar research and Hunkins' long and productive career.

Since joining Lamont's team in the Arctic in 1957 during the International Geophysical Year (IGY), Hunkins has remained at the Observatory, where he continues to contribute regularly to our understanding of Earth and share his enthusiasm with others.

A few years ago, he brought his map of the IGY Arctic Ocean Drift Stations to show to the public during a Lamont-sponsored Polar Weekend at the American Museum of Natural History. The map was weathered and torn around the edges, mounted on plywood, and covered with Plexiglas.

At the March event, Hunkins was presented with the original copy of the floating Arctic stations map, which Lamont's Education Coordinator Margie Turrin arranged to have restored by a professional conservator and digitally archived in the Columbia Libraries, so that this momentous piece of history would be saved to honor this important work and inspire future generations.



The Arctic Ocean Drift Stations Map, now archived in the Columbia Libraries, includes the tracks of ice floe research stations that drifted in the Arctic Ocean during the first International Geophysical Year, 1957–58.

Q & A with Ana Christina Ravelo, PhD ’91

Carlos Alvarez Zarikian, IODP/TAMU

Christina Ravelo enjoys a sunset on the Bering Sea during the expedition she co-led in 2009.

Ana Christina Ravelo is a professor of ocean sciences at the University of California in Santa Cruz (UCSC), where she uses stable isotope geochemistry to learn about conditions of the oceans and climate millions of years ago. She received her PhD from Columbia in 1991, studying the chemical composition of planktonic foraminifera to determine past ocean temperatures. After graduating, Ravelo came to UCSC, where she has continued to pursue related research questions, publishing extensively while teaching and mentoring dozens of graduate students. In January of 2012, the American Geophysical Union (AGU) named Ravelo among its 2012 class of Fellows, an honor given to members who have made exceptional scientific contributions and attained acknowledged eminence in the Earth and space sciences.

From 2005 to 2011, you were director of the Santa Cruz branch of the University of California’s Institute of Geophysics and Planetary Physics (IGPP), a research initiative designed to foster collaboration among eleven academic departments. What are some of the successes that have come from working outside of the traditional boundaries of science, mathematics, and engineering?
The most rewarding thing about being director was promoting and supporting the interdisciplinary work at UCSC. The IGPP-UCSC branch was instrumental in fostering interactions between departments in physical, biological, and social sciences and engineering. Much of my more far-reaching service has been working across the geoscience subdisciplines within the Integrated Ocean Drilling Program (IODP). There is a large community of scientists who rely on ocean drilling to explore some of the most prominent research questions in the geosciences.

What is Foraminifera geochemistry, and why does it matter to an ocean scientist?
Planktonic foraminifers are marine microorganisms whose shells are preserved in deep-sea sediments. Because most Earth system processes select for one isotope of an element over another, the chemical composition of foraminifer shells can be analyzed to diagnose past environmental conditions. Using such geochemical analysis, my research has found that the tropical Pacific was in a permanent El Niño-like state during the Pliocene warm period, 3 to 5 million years ago.

During the summer of 2009, you were co-chief scientist on an expedition to the Bering Sea aboard the R/V *JOIDES Resolution* to retrieve sediments as old as 4.5 million years. What insights has this record of ancient climate yielded?
We found that, during the early Pliocene warm period 3.5 to 4.5 million years ago, prior to the onset of large Northern Hemisphere ice ages, temperatures in the Bering Sea were about 5 degrees Celsius warmer than today, and free of sea-ice. There was also enhanced biological productivity during this period and possibly better-ventilated deep water compared to today. Once the ice ages began, there were dramatic fluctuations in sea-ice coverage, sea surface conditions, and deep and intermediate water oxygen concentrations. The alternating massive and laminated sediment textures we found in the Bering Sea are indicative of such changes in oceanic conditions. At this point, we are trying to understand how regional changes in the Bering Sea are related to basin-wide changes in the North Pacific, and to global climate change. The Bering Sea data is providing unique insight into how the North Pacific is affected by and plays a role in global climate change.

NASA marked 2011 as the ninth-warmest year on record. What does this, and projections of rapid warming over coming years, mean for the Bering Sea in particular?
At this point, it is clear that sea-ice distribution and concentration is decreasing in and around the Arctic, including the Bering Sea, and that there have been (and will be) ecosystem changes as global climate, and Bering Sea climate, warms. But, detailed projections are not possible without more research.

Considering the abundance of climate skeptics and misinformation, effective communication of your research is arguably very important. What can scientists do to help a broader audience better understand their work?
I think scientists are obligated to share their findings with the public and decision makers, and I feel I can do my part through teaching and mentoring students, giving public talks, and serving on panels and committees that promote scientific communication and education. The Internet also provides informal yet effective tools for real-time communication and outreach. I kept a Twitter feed from the Bering Sea in 2009, which was a really fun way for my friends and family to follow me, but lots of other people started getting involved, too.

What is your fondest memory of your time as a graduate student at Lamont-Doherty?
My fondest memories are of the time I spent with fellow graduate students and friends. I also have great memories of being inspired by the world-class scientists that taught classes, advised me, and came through to give seminars. I feel so well-connected to the oceanographic community because of my time at LDEO and all the people I met and worked with when I was there.

Alumni Profile: John O. Wheeler, PhD '56

Rex Gibson

Sixteen-year-old John Wheeler on the summit of Mount Hungabee, 1941. Like his father and grandfather, John was a passionate explorer of the natural world.

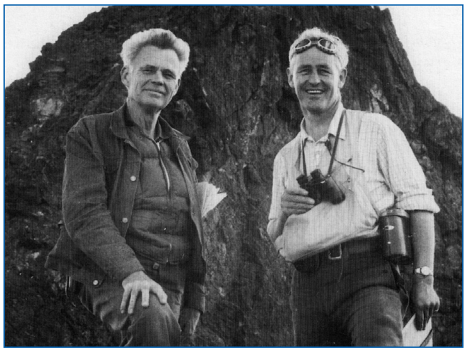


Photo courtesy of the Wheeler family

John Wheeler, president-elect of the Geological Association of Canada, with John Rodgers, president of the Geological Society of America, at Mount Revelstoke National Park, 1970

Photo courtesy of the Wheeler family

Nora, John, and their dog Mike on one of their many trips in the mountains

John Oliver Wheeler was born in 1924 in Mussoorie, India, among the foothills of the Himalayas. The world's great, uncharted mountains were not only in his line of view from the beginning—they were also in his blood.

John would grow up climbing mountains in the footsteps of his father and grandfather, both eminent mountaineers and geographic surveyors. John quickly gained a fascination with mountains that would propel him into a career marked by outstanding contributions to geoscience in Canada.

John's father, Edward Oliver Wheeler (known as Oliver), completed the first detailed map of Mount Everest as a surveyor on the British Mount Everest Reconnaissance Expedition of 1921. Oliver later became Surveyor General of India and was knighted in 1943 in recognition of his work.

John grew up in Canada, attending boarding school on Vancouver Island near the home of his grandfather, Arthur Oliver Wheeler, a world-renowned mountaineer. Over the course of his career, Arthur surveyed extensive sections of British Columbia and Alberta, and cofounded the Alpine Club of Canada.

It was summers spent climbing and camping in the Canadian Rockies with Arthur, and the influence of his father Oliver in India, that inspired John to carry on their work in what would become a legendary family tradition.

By the time John finished boarding school, he was already an accomplished mountaineer with a refined appreciation not only for the beauty and danger of mountains, but also for their nature, structure, and development. In 1947, John graduated from a geological engineering program at the University of British Columbia, with awards recognizing his academic achievements and leadership on the rugby field—both of which would prepare him for the decades of challenging fieldwork that lay ahead.

John began working with the Geological Survey of Canada (GSC) in 1945 as a student assistant in Yukon and British Columbia. Three years later, the GSC asked him to complete geological mapping of the Whitehorse area in Yukon—an offer that provided sponsorship toward a PhD.

In 1949, John began graduate work at Columbia University. Upon taking Marshall Kay's course on the stratigraphy of North America, John decided to study the stratigraphic history of Mesozoic rocks in the Whitehorse area under Kay's supervision.

John's studies were interrupted in 1952 when the GSC wrote asking if he would lead an expedition to map the Selwyn Mountains—an especially remote and uncharted region in Yukon, which the Canadian government was competing with prospectors to survey for natural resources. At the time, no maps of the area existed and knowledge was limited to a mosaic of aerial photographs.

Despite the delay it would cause in the completion of his thesis, John's thirst for challenge and adventure made him unable to resist this opportunity. Like his father's experience producing the first map of Mount Everest more than 30 years prior, the Selwyn Mountains Expedition of 1952 was a defining debut for John's career.

John embarked on the expedition in June with a party that included a geological assistant, a packer, a cook, and eight horses. In four months, this motley crew covered 800 kilometers of the most rugged terrain. Under John's leadership, they persevered through extended solitude, extreme weather, streams of rushing meltwater, and encounters with bears, returning with a precedent-setting map of the distribution and composition of rock formations in the region.

As mineral exploration expanded, the GSC called on John again in 1953 to lend his expertise to mapping the Saint Elias Mountains. These storied early expeditions remain a testament to John's tenacity in the field and his scientific wit.

Returning to Columbia, John defended his thesis in 1956 before moving back to Canada to spend the next 20 years mapping about 80,000 square kilometers in the mountainous regions of the southern Yukon and southeastern British Columbia.

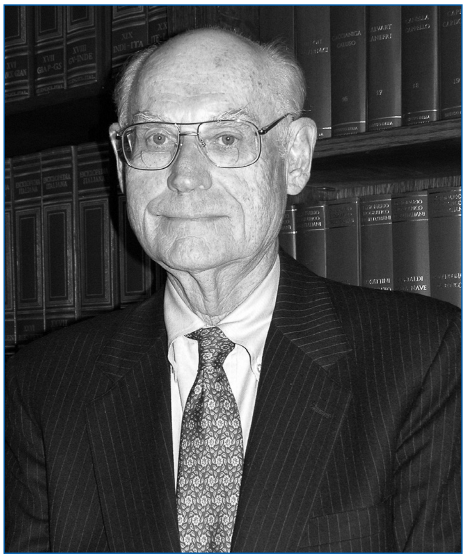
While mountaineering and fieldwork initially attracted John to geology, it was the synthesis of scientific insights that became the most satisfying of his accomplishments. He would grow to solve some of the great tectonic mysteries of the western Canadian mountains, reconciling the region's evolution with the developing model of plate tectonics. During this time, John rose through the ranks of the GSC to become deputy director general and the Survey's chief geologist, responsible for all research programming.

In the 1980s, John was coordinator and general editor of the eight-volume *Geology of Canada.* He also prepared large-scale geological maps of the Canadian Cordillera and contributed geological maps of Canada, Greenland, and Iceland for the wall-sized Map of North America.

It has been more than 130 years since Arthur Wheeler's imagination was first fired by the great unknown mountains of the western territories. In the 1960s, John mapped the Selkirk Range nearly 60 years after his grandfather Arthur had been the first to survey the area. This summer, John's grandson, Jeffrey Crompton, will be studying the Kaskawulsh Glacier in southwest Yukon, 57 years after John was the first to map its bedrock geology.

This extraordinary family passion has spanned five generations of pioneering work that endures through the continued appreciation and protection of the great mountains of western Canada.

Quentin Kennedy Retires as Chair of the Advisory Board



This plaque, unveiled in December 2011, named the conference room in the Gary C. Comer building in Quentin's honor.

When Mike Purdy asked Quentin Kennedy to take up chairmanship of the Lamont-Doherty Advisory Board in March 2006, the group was experiencing a renaissance, with a new charter and new members. Almost six years later, in December 2011, Quentin retired as chair of a transformed group.

How were you introduced to Lamont-Doherty?
I first heard about the Observatory when my oldest son, Quentin Jr., was engaged to marry Wally Broecker's daughter, Cindy, more than 26 years ago. Their wedding took place on the Lamont campus, and I was struck by the beauty and historical nature of the place, as well as the work that was being done there.

After many conversations with Wally, I became even more interested. It was so different from what I had done during my working career, which had been as a legal and financial manager with a company in the pulp and paper industry.

Do you remember the first meeting you had with former director Mike Purdy?
Though I don't recall our exact first meeting—perhaps it was a luncheon before one of the spring public lectures—I was very flattered when Mike Purdy asked me to join the Advisory Board. I was retired at the time, and becoming more involved at Lamont-Doherty provided a whole new experience and learning opportunity for me; and I felt I could help.

What have been some of your accomplishments as chair?
During my term as chairman, I am most proud of the progress we all made as Advisory Board members in expanding the Board with new and very supportive members. One of our first projects was to help produce the *Science to Sustain the Planet* DVD about the science and the history of Lamont-Doherty. This premiered in 2008 and became the centerpiece of our outreach to new audiences and prospective Board members.

Over the last two years, the Advisory Board has helped build the Director's Circle, a new group of supporters of the Observatory. We have greatly enjoyed the increased exposure to the remarkable research staff and the opportunity to bring our friends, family, and colleagues to tour the laboratories and join us in "science master classes." I hope this group will continue to grow and nurture the Observatory. Introducing new people to Lamont-Doherty has always been one of our principal goals as Board members.

I am also proud of the Advisory Board Innovation Fund, which we established in 2007. As a group, we were eager to feel that we were enabling innovative research or educational initiatives with potential for long-term and broad impact across the Observatory. The Innovation Fund has been awarded three times now, and we have been proud supporters of research related to phytoplankton and the carbon cycle led by former Lamonter Veronica Lance, and of novel studies in lava flow currently being conducted by postdoc Einat Lev. We're looking forward to hearing what Christine McCarthy is up to in understanding ice mechanics later this year, and the fourth award will be announced soon. There's always more to learn around here!

Any advice for your successor?
Frank Gumper is the ideal person to take up the position as chair. He was a student at Lamont in the '70s and has a great interest in its work. He's been a great support to me in his role as vice-chair of the Advisory Board for the last several years. Because of his background, Frank closely identifies with the Observatory's work, and as we go forward, he will help us attract new members to the Advisory Board, and more particularly to the Director's Circle. I look forward to staying on as a member of the group and to supporting Frank's chairmanship as best I can.

The Ultra Clean Laboratory: THANK YOU!

Erika Freimuth

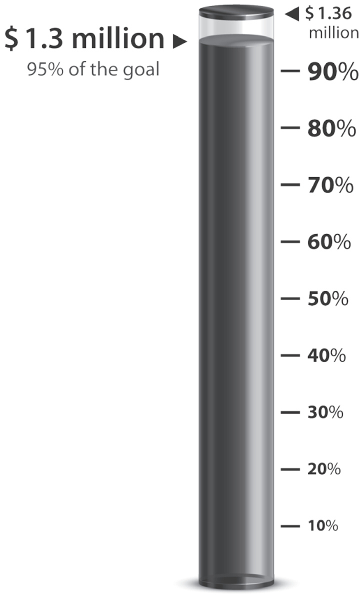
Today—thanks to the American Recovery and Reinvestment Act of 2009, and many dedicated friends, alumni, and staff—dozens of Lamont-Doherty scientists and graduate students are poised to revolutionize their research using academia's largest, cleanest, safest, and most energy-efficient ultra clean laboratory for geochemistry.

More than 235 of you stepped up over the past two years—sometimes with two, three, or even four gifts—contributing $1.3 million to bring the Observatory 95 percent of the way to matching the $1.36 million challenge grant from the National Institute of Science and Technology.

This final laboratory in the Gary C. Comer building greatly expands research opportunities at the Observatory. Early tests indicate that it will be the cleanest of clean labs in all of academia. Free of environmental contamination and outfitted with the most precise analytical equipment, this remarkable facility will open new frontiers for Lamont scientists, graduate and undergraduate students, and visiting researchers.

We look forward to telling you in future issues of this newsletter about some of the new discoveries that your critical support is making possible.

Thanks to *you*, we raised



What an accomplishment! The Observatory couldn't have done it without the more than 235 alumni, friends, and staff who made this facility a reality.

Lamont-Doherty Earth Observatory
Columbia University | Earth Institute

P.O. Box 1000, 61 Route 9W
Palisades, NY 10964-8000

NON-PROFIT ORG.
U.S. POSTAGE PAID
NEW YORK, NY
PERMIT NO. 3593

www.LDEO.columbia.edu

FROM THE ARCHIVE

Lamont Archives

This photo, taken in Lamont's old machine shop and titled *Young Men of Distinction,* includes Ray McElroy (middle) and Angelo Ludas (right).

INSIDE