LDEO

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FEATURE ARTICLE

From Dynamite to Satellite:
Lamont-Doherty's
Ocean Explorations




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Cover image:
Scientists aboard the R/V *Atlantis* recover a CTD rosette in the Atlantic Ocean, near the mouth of the Amazon River. The CTD is a device used to collect water samples and measure the physical properties—including the conductivity (or salinity), temperature, and density—of the ocean at specific depths. Lamont Research Professor Joaquim Goes uses the CTD data gathered on the expedition in his studies of phytoplankton communities in the Amazon River plume.
Photo credit: Lance Wills

Wade Mertzall

Letter from the Director

Dear Friends of Lamont,

Since my arrival at the Observatory a few months ago, I have been impressed daily with the energy, creativity, and collective breadth of expertise of Lamont personnel, from the most senior staff to the undergraduate interns who recently completed intensive research experiences this past summer.

The campus is exploding with new growth in the biogeosciences, with the arrival of Lamont Assistant Research Professor Solange Duhamel, the anticipated arrivals of Associate Professor Sonia Dyhrman and Professor Hugh Ducklow in January, and the transformation of the second floor of the New Core Laboratory to new laboratories for major research thrusts in the areas of marine biology, biological oceanography, and ecology to be led by these investigators.

This fall brought 20 new graduate students and a cadre of new postdoctoral scientists that raised the total population of Lamont scientists at the postdoctoral level to 45, the largest in history. The enthusiasm and fresh ideas of these new campus colleagues promise to transform the scientific directions that the Observatory will be pursuing over the next several years.

The R/V *Langseth* has completed more than 200 days at sea this year, carrying out an impressive range of scientific projects with support from the National Science Foundation, and our scientists continue to conduct fieldwork on every continent, on each of the world's oceans, and in both polar regions.

We have recently inaugurated a new strategic planning effort for the campus. The first step will be the identification of the most promising directions for future research at the Observatory. We will build on that plan to forge a strategic plan for the Lamont campus by reaching out to colleagues at the International Research Institute for Climate and Society, the Center for International Earth Science Information Network, and the Tropical Agriculture and Rural Environment Program, particularly to seek those areas for which scientific cooperation and collaboration across units can be of greatest mutual benefit. That campus science plan will lead to long-term plans for facilities, laboratories, information technology, and infrastructure, and will feed, in turn, into expanded programs in development, communication, and education.

As the pace of discovery quickens on this campus, I look forward to sharing our most recent findings and to working with you to ensure that the impact of research at Lamont on Earth science and on society at large continues to grow.

With best regards,

Sean C. Solomon

Payette Associates Architects, Boston, MA

An artist's rendering shows one of the new labs being constructed for the Center for Biogeochemistry.

Ronnie Anderson

The Lamont community gathered outside Lamont Hall in September for an afternoon party to welcome the new Department of Earth and Environmental Sciences graduate students.

Arnold L. Gordon

Oceanographer Arnold L. Gordon with the R/V *Nathaniel B. Palmer* during a research expedition to study ocean circulation in Antarctica's Ross Sea.

Faculty, Staff, and Student Awards


Joerg Schaefer


Bärbel Hönisch


Catherine Tozer


Daehyun Kim


Maureen Raymo


Geoff Abers


Alberto Malinverno


James Davis


Aaron Putnam


Harald Rieder


Rafael Almeida


Shannan Sweet

Geochemist and Lamont Associate Research Professor **Joerg Schaefer** received LDEO's eighth annual Excellence in Mentoring Award to honor his significant impact on student growth and success. At the May award ceremony, students and colleagues thanked Schaefer for helping them develop technical skills and networking abilities, and for encouraging them to publish their research in top journals. Assistant Professor **Bärbel Hönisch** and Geochemistry Division Administrator **Catherine Tozer** were also recognized for their commitment and contributions to mentoring at the Observatory.

Postdoctoral researcher **Daehyun Kim** was awarded the American Geophysical Union's 2012 James R. Holton Junior Scientist Award in recognition of his early career achievement in atmospheric sciences. Kim studies the Madden-Julian Oscillation, a weather pattern that typically forms in the Indian Ocean and brings heavy rains and hurricanes to many parts of the globe; he is the third Lamont scientist to win this prestigious award since it was established in 2004.

Lamont Research Professor and Core Repository Director **Maureen Raymo** received the Montefeltro Medal from Italy's Urbino Summer School in Paleoclimatology. The prize is awarded annually for outstanding contributions to the advancement of knowledge in the field of paleoclimatology through integration of modeling and proxy records.

Lamont Research Professor and Associate Director of Seismology, Geology, and Tectonophysics **Geoff Abers** was named Distinguished Lecturer by the National Science Foundation's GeoPRISMS Program for his contributions to the field of earthquake seismology.

Senior Research Scientist **Alberto Malinverno** and Assistant Professor **Bärbel Hönisch** were named IODP Distinguished Lecturers by the Consortium for Ocean Leadership in recognition of their outstanding work in the field of ocean sciences.

Lamont Research Professor **James Davis** of Seismology, Geology, and Tectonophysics was named a fellow by the International Association of Geodesy for his major contributions in the areas of positional and physical geodesy.

Postdoctoral fellow **Aaron Putnam** was awarded the 2012 Outstanding PhD Student Award by his alma mater, the University of Maine's College of Natural Sciences, Forestry, and Agriculture, for his achievements as a graduate student, which include being lead or co-lead author on 12 journal articles, while also spending 90 weeks in the field.

Postdoctoral fellow **Harald Rieder** of the Division of Ocean and Climate Physics received the 2012 Dobson Award for Young Scientists by the International Ozone Commission for publishing an outstanding paper on atmospheric sciences.

Department of Earth and Environmental Sciences (DEES) graduate students were honored with the following awards in 2012: **Rafael Almeida** earned the Paul G. Richards Graduate Student Research Award; **Shannan Sweet** received the James B. Hayes Graduate Student Research Award; and **Celia Eddy** earned Departmental Honors.


Celia Eddy

Terry Plank among MacArthur "Geniuses"

In October, the John D. and Catherine T. MacArthur Foundation named geochemist and Department of Earth and Environmental Sciences Professor Terry Plank a 2012 MacArthur Fellow. The Foundation awards fellowships to high-achieving individuals based on their creativity, originality, and potential to make important contributions in the future. The prestigious "genius" award provides each recipient an unrestricted five-year grant; Plank plans to use her award to further explore existing datasets, investigate new projects, and collaborate with scientists in other disciplines. In 2012, Plank was also named a Distinguished Lecturer by EarthScope, a program of the National Science Foundation, for her work on volcanoes and volatile contents of magmas.

New Colleagues on Campus

Ronnie Anderson

Lamont's new Department of Earth and Environmental Sciences graduate students take a moment to relax during their September orientation.

In September, Lamont welcomed nine new postdoctoral scientists to campus, bringing Lamont's postdoc ranks to 45, the largest ever. The new faces include Emilie Dassie and Mieke Thierens in the Divison of Biology and Paleo Environment; Yakov Weiss and Nicolas Young in Geochemistry; Meredith Reitz in Marine Geology and Geophysics; Kevin Grise, Harald Rieder, and Isla Simpson in Ocean and Climate Physics; and Nicholas van der Elst in Seismology, Geology, and Tectonophysics.

At the same time, 20 new graduate students, extraordinarily broad in their collective interests, began their studies in the Department of Earth and Environmental Sciences (DEES) and at Lamont. They are Natalie Accardo, Celia Eddy, William Hudacek, Helen Janiszewski, and Hannah Rabinowitz in seismology; Asna Ansari in mineralogy; Annabelle Batista in geodynamics; Alexandra Bausch in biogeochemistry; Tarini Bhatnagar and James Gibson in marine geophysics; Logan Brenner in paleoceanography; Etienne Dunn-Sigouin and Nora Mascioli in ocean and climate physics; Jonathan Gale in remote sensing; Yonaton Goldsmith and William Jacobson in isotope geochemistry; Darren McKee and Nandini Ramesh in physical oceanography; Rajib Mozumder in groundwater geochemistry; and Emma Mungall in chemical oceanography.

Carol Mountain, DEES senior administrative manager, was delighted to welcome the new cohort of graduate students. "We are accustomed to extraordinary students and this new group is no different. DEES students are serious, focused scientists in the making, and they contribute greatly to this program and to Lamont as colleagues and friends. They will more than likely do the same for their profession as they journey through the rigors of graduate school and out into the world," she said.

Postdoctoral scientists and graduate students are an important part of the Lamont community, bringing new energy and enthusiasm to our campus. Lamont's postdocs advance the Observatory's research mission, while gaining the essential training and skills they need to become successful individual scientists. The DEES graduate program is academically rigorous, but students are supported through a strong network of faculty and peer mentors, and both postdocs and graduate students are encouraged to participate in the lighter side of campus life: pickup soccer and TGIF.

Open House: Every Continent, Every Ocean

On Saturday, October 6, almost four thousand people visited Lamont's Palisades campus during our annual Open House. Following the theme of Every Continent, Every Ocean, science enthusiasts of all ages were introduced to the excitement of the Observatory's global research through science presentations, hands-on activities, and conversations with scientists. A wide range of research and tools were on display for the public to explore, from investigations of the ways climate change is affecting the ocean, to the study of tree rings to interpret changes in the environment. Open House is a fantastic opportunity for Lamont researchers to share their work with a wide audience and for the public to learn more about the important Earth science research happening in their community. Each year the event is thoroughly enjoyed by visitors, Lamont alumni, and scientists alike.

Rebecca Fowler

Rebecca Fowler

Hakim Abdi

Pacific Time

Edie Miller

The R/V *Marcus G. Langseth* at a dock in Astoria, Oregon, during a maintenance period and visit from Lamont scientists and personnel in July

Lamont-Doherty's research vessel, the *Marcus G. Langseth*, spent the busy summer field season cruising the Pacific Northwest coast. On June 13, Lamont Research Professor Suzanne Carbotte set out on a 26-day voyage to image the Juan De Fuca plate, a part of the Cascadia subduction zone that runs along the coasts of Oregon, Washington, and British Columbia, marking the first attempt to image an entire oceanic plate. The Langseth team worked with colleagues on the R/V *Oceanus*, including Woods Hole Oceanographic Institution (WHOI) scientists and Lamont Assistant Research Professor Helene Carton, and with land-based seismologist and Lamont Research Professor Geoff Abers.

At the end of this cruise the *Langseth* docked in Astoria, Oregon, for maintenance and an inspection by National Science Foundation personnel. Lamont Director Sean Solomon, Deputy Director Art Lerner-Lam, Deputy Director for Research Management Kathy Callahan, and Assistant Director of Finance and Administration Edie Miller also visited the *Langseth* in port, touring the ship and discussing the *Langseth*'s scientific capabilities with Director of Marine Operations Sean Higgins, Captain Jim O'Laughlin, and other members of the *Langseth*'s crew.

By August, the *Langseth* had completed its 190 days of scientific work for the calendar year, when, in response to an emergency request from the National Science Foundation, the *Langseth* was used for an additional cruise. This 11-day expedition was part of an ongoing study of active Axial Seamount submarine volcanoes off the coast of Washington state and two other seafloor observatories nearby in Canada. The collaborative project involved scientists from more than eight institutions and included using WHOI's remotely operated vehicle *Jason II* to monitor the volcanoes. The cruise was a great opportunity for the *Langseth*, as it gave the ship even more days at sea and expanded her capabilities into the realm of general-purpose oceanography.

In early September, the *Langseth* underwent maintenance in Astoria before heading south for a series of late fall and winter cruises off California.

Homecoming

Pratigya Polissar

Lamont Assistant Research Professor Pratigya Polissar in the Core Repository after unloading the sediment cores collected during his May research cruise

In June, nearly 500 feet of sediment cores from the central Pacific Ocean were unloaded into refrigerators at Lamont's Core Repository. Scientists collected the sediment cores from the seafloor near Hawaii and the Line Islands during a May cruise on the R/V *Langseth,* led by Lamont Assistant Research Professor Pratigya Polissar. The cores will be analyzed and used to study past changes in climate and the El Niño weather pattern. The oldest core recovered on the expedition dates back about 350,000 years, covering the last three glacial cycles.

Celebrating Kim Kastens

The Lamont community gathered in the Monell Building in late August to honor and bid farewell to Research Scientist Kim Kastens. During her 31 years at Lamont, Kim's research interests spanned marine geology, science journalism, and science education, improving the way that Earth science is taught and inspiring countless colleagues and students. Tributes from Art Lerner-Lam, Robin Bell, and Dave Walker recognized Kim's achievements in Earth science, which include being the first female co-chief scientist on the *JOIDES Resolution*, the first woman in Columbia University's Geology Department, and founder of Lamont's science journalism program. Kim began a new job in September as distinguished scholar and principal scientist at the Education Development Center near Boston.

Erika Freimuth

Art Lerner-Lam presents Kim Kastens with a "Piece of the Rock," a polished and mounted slice of the Palisades sill, in recognition of her leadership and dedication to research in geoscience education and marine geology during her 31-year career at Lamont.

Under Construction

Patrick J. O'Reilly

New structural steel is hoisted to the rooftop of the Core Laboratory to complete the Center for Biogeochemistry. The comprehensive renovations also include replacing windows, new ductwork for ventilation systems on the rooftop, and a new mechanical room on the first floor.

With the arrival of spring's warm weather came the time to tackle construction projects around campus in an effort to strengthen, improve, and update Lamont's facilities. A major renovation on the second floor of the Core Laboratory has made space for the new Center for Biogeochemistry, which will be ready for occupancy in January 2013. This space will accommodate the growing biogeosciences group, including recent hires Professor Hugh Ducklow and Associate Professor Sonia Dyhrman.

A new radiation laboratory in the marine biology wing of the Seismology and Marine Biology Building was recently completed, as was office space for new hire Lamont Assistant Research Professor Solange Duhamel. Upstairs in the building, offices and workspaces are being created to accommodate the growing number of postdocs and graduate students working in the Division of Seismology, Geology, and Tectonophysics.

Renovations also continue in the Core Repository. This project, led by Repository Director Maureen Raymo, includes the addition of sample and analytical storage space, increased room for instrumentation, and labs and offices for staff and visiting researchers. Space is also being added to house a collection of coral cores that Lamont scientists have accumulated over the last few decades. These cores will soon be cataloged and made accessible for use by investigators worldwide.

Elsewhere on campus, two new suites have been created in the Oceanography Building for the atmospheric sciences group. The Integrated Earth Data Applications (IEDA) group, a data management project, also has a new home in the seminar wing of the old Geochemistry Building. This includes offices and a conference area, providing a central point on campus for big data discussions. In addition, important renovations continue in the servers rooms, supporting the growing computational requirements of our investigators.

Guest House Six, also known as Sutton House, is being converted to a graduate student lounge and meeting area, while just outside the Guest House, the Lamont community garden recently received a makeover. In June, support from the Department of Earth and Environmental Sciences and the director's office, and volunteer labor facilitated the construction of a new garden fence. At the same time, the area for planting was expanded to accommodate the increasing number of Lamonters interested in growing produce in Palisades.

Looking ahead, efforts will be made to preserve the original pieces of the Lamont estate, beginning with historic Lamont Hall. Minor improvements continue to be made to the Lamont family's former residence while plans are made for a more extensive restoration of the building.

Rebecca Fowler

The Lamont community garden in September, with Guest House Six, home of the new graduate student lounge, behind it

Students Showcase Science's Bright Future

On July 31, the Observatory's 27 summer interns presented the results of their nine-week research projects to a large group of friends, family members, and the Lamont community. Each intern gave a short summary of their research and talked about their work further during a lively poster session in the Comer Building. The talks and poster session featured research topics ranging from an investigation of climate influences on carbon storage through analysis of Alaskan peat bog cores, to the potential for large-scale food production using New York City rooftop greenhouses. Following the presentations, scientists, interns, and their guests gathered on the Comer deck and lawn for a barbeque celebrating their accomplishments. For more than 30 years, Lamont's summer intern program has provided a hands-on research experience in Earth and ocean sciences to undergraduate students from Columbia University and other colleges and universities around the United States.

Rebecca Fowler

Summer interns present their research to family, friends, and the Lamont community at a poster session in the Comer Building atrium.

Out of the Classroom, Into the Field

By Nunny Reyes

This summer, 39 students from eight New York City high schools spent their vacation as scientists. For six weeks, the students participated in Lamont-Doherty's Secondary School Field Research Program (SSFRP). Their days were spent either in Piermont Marsh a few miles north of the Observatory, collecting samples and conducting surveys, or processing and analyzing data on the Lamont campus. The students' research will be presented at national science conferences and submitted to peer-reviewed journals. Each of the SSFRP students has gone to college; many have received merit scholarships, including four Gates Millennium Scholarships covering the full cost of their college education.

Bob Newton, a geochemist at Lamont-Doherty and the director of the SSFRP, and Susan Vincent, a science teacher at the Young Women's Leadership School in East Harlem, started the program in 2005 to involve high school students in the creative and collaborative process of scientific research and to demonstrate that a career in science is an exciting and attainable prospect. Today, participation in the SSFRP is at its highest, with growing interest among urban schools, teachers, and students. In addition to this year's 39 participants, eight undergraduates, eight high school teachers, and several volunteers participated in the program.

Nunny Reyes first participated in the SSFRP in 2007 as a high school student. Now a junior at Hunter College studying environmental science, Reyes returned to Lamont-Doherty this summer as a SSFRP team leader.

Working at Lamont-Doherty for the past five years with the SSFRP has been a unique and fulfilling experience. Starting the program as a sophomore in high school, I had no previous experience with science outside of my course work at the Young Women's Leadership School in East Harlem. In the SSFRP, my peers and I had the opportunity to work with teachers, graduate students, and researchers at Lamont-Doherty to develop and answer scientific questions about our study site, Piermont Marsh. We were able to present our work at conferences in Washington, D.C., New York, Colorado, Minneapolis, and soon in Charlotte. By the time I graduated high school, my interest in science had grown tremendously. I did not want to continue my education without being part of this program. Since then I've continued to return to the SSFRP as a team leader, guiding groups of ambitious high school students in fieldwork, laboratory work, and data analysis.

This summer a total of six teams worked in Piermont Marsh, measuring carbon sequestration, phytoplankton abundance, fish distribution, water quality, plant succession, and sediment accretion. The first day out in the field is always something to look forward to: when students begin to realize what it's truly like to work in a tidal wetland. That first day is filled with canoes heading in the wrong direction, students giving me questioning looks, and lots of mud. Anyone can easily become immersed in sulfuric mud from one misstep in the marsh. It's happened to me countless times.

By the end of the first week of long days in the heat, covered in sweat and scratches from the invasive *Phragmites australis* that grows in the marsh, the questioning looks are no longer there. Instead, the students are motivated to collect data because they are doing real science with their classmates and mentors. By the end of the second week, students are eagerly jumping in the Hudson to cool off after a long day trekking through the marsh. The students in SSFRP bond doing this type of fieldwork and the research starts to become fun for them.

I love returning to Lamont-Doherty with SSFRP because every day I am interacting with people who are very passionate about the work of learning something new. As a team leader for the last three years, I've realized how crucial it is to positively impact high school students at an early age. These students are stressed about SATs, getting the right grades, and the difficult situations they encounter in their lives. They're still trying to grasp what inspires them and how it can translate to a better future. After spending a summer or a school year working closely with Bob Newton, Susan Vincent, and myself or another team leader, they often express an interest in studying science as they continue their education.

Building relationships with students and being able to guide them in their research is very rewarding because it makes a priceless impact. I'm inspired every day by what these students accomplish, and I cannot imagine where I would be today if I had never been involved in the SSFRP. When I needed guidance, I could rely on the relationships that I built with my peers in the SSFRP, and I understood that this research was just the beginning of where I could go or what I could study. It opened my eyes to the fact that there is no limit as long as you continue to work hard doing what you love.

Omari Matthew

Nunny Reyes (left) and Cristal Lopez, a senior at the Young Women's Leadership School, hold a sediment core in Piermont Marsh.

Students, Scientists, and Policy

By Alyssa Dubov

On June 25, graduate students in Columbia's Master of Public Administration in Environmental Science and Policy (MPA-ESP) spent a day at Lamont-Doherty learning about current Observatory research and meeting with Lamont scientists. The trip was organized and led by Lamont Associate Research Professors Jason Smerdon and Juerg Matter, who teach Climatology and Environmental Chemistry, respectively, during the program's summer semester. Professor Matter wants the students to understand the science that informs policy, explaining, "The goal of the day-long excursion to Lamont was to give the students a taste of scientific information about environmental issues that are relevant for future policy makers."

During their time on campus, students gained insight into the important role of Lamont-Doherty as a scientific research and educational institution. The day involved visits with faculty and postdoctoral researchers including Assistant Research Professor Michael Previdi, Associate Professor Maya Tolstoy, Assistant Research Professor Timothy Crone, and Postdoctoral Research Scientist Beth Stauffer. The scientists gave presentations on a wide range of Lamont research topics, from ocean acidification to the impact of anthropogenic sounds on marine mammals.

Students especially enjoyed hearing the underwater audio recordings of whales and earthquakes that were included in Dr. Tolstoy's presentation and the policy implications of Dr. Crone's involvement in measuring the oil flow out of the well head after the Deepwater Horizon oil leak in April of 2010. "It was exciting to see the real world implications of what our professors have been teaching us in class over the last few weeks," ESP student Monica Pham said.

While on campus the students also toured the Borehole group's test well site, used by researchers to conduct in situ experiments, and historic Lamont Hall, where they were introduced to the early days of scientific research at Lamont and the many breakthroughs in understanding Earth systems that have occurred on the Lamont campus. Their visit ended with a tour of the Observatory's Core Repository, home to the largest collection of deep-sea cores in the world, a collection which helps Lamont scientists analyze and understand Earth's paleoclimate.

ESP student Alana Miller gained a new appreciation for how the research that informs policy is conducted, saying, "Lamont has a long history of scientific exploration. I'm really glad we are able to spend a day learning more about the work being done here."

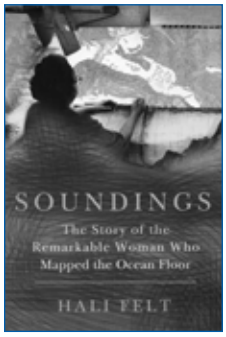
Alyssa Dubov

MPA-ESP students examine a few of the sediment cores in Lamont's Core Repository.

On Our Bookshelf

Soundings: The Remarkable Woman Who Mapped the Ocean Floor
By Hali Felt, Henry Holt and Company

Felt's rich biography provides a wealth of insight into the work and life of **Marie Tharp**, the groundbreaking Lamont geologist and cartographer who created the first comprehensive map of the seafloor.



Global Weirdness: Severe Storms, Deadly Heat Waves, Relentless Drought, Rising Seas, and the Weather of the Future
By Climate Central, Pantheon

From the scientists behind Climate Central, including contributor **Heidi Cullen** PhD '00, this approachable volume of essays explains current climate science, why it matters, and what we can—and can't —do about climate change.

The Continental Drift Controversy
By Henry R. Frankel, Cambridge University Press

This four-volume set, featuring forewords from **Steve Cande** PhD '77 and Senior Research Scientist **Dennis Kent**, is the first complete history of the origin, debate, and gradual acceptance of the revolutionary continental drift theory.

From Dynamite to Satellite: Lamont-Doherty's Ocean Explorations

By Scott Witmer

Greg Horning

Above left: During a streamer cable deployment on Suzanne Carbotte's July cruise aboard the R/V *Langseth*, researchers attach "birds" with remotely operated wings to the streamer cable. The streamer cable contains hydrophone listening devices; the "birds" are used to keep the streamer submerged 10 meters beneath the sea surface as it's towed behind the ship.

Above right: Researchers on Joaquim Goes' Amazon Continuum cruise recover the MOCNESS (Multiple Opening and Closing Net, with an Environmental Sensing System), a special plankton net that is towed alongside the ship. The MOCNESS allows scientists to capture samples of plankton from different depths, which are used to study plankton community structures in the Amazon River plume.

In the 1930s, before pioneering geophysicist Maurice "Doc" Ewing founded the institution that would become Lamont-Doherty Earth Observatory, he gathered seismic data about the geology of the Lehigh Valley by setting off explosives throughout the countryside and measuring the effects at a distance. It wasn't until he sought to understand the 70 percent of Earth covered in water that Ewing turned his attention to the ocean, which he once considered "a murky mist that keeps me from seeing the bottom."

Joaquim Goes

Today, Lamont-Doherty scientists study all aspects of the ocean, from the seafloor up through the depths and currents, and on into the atmosphere. Traveling to remote and exotic parts of the world, researchers investigate ocean processes by gathering physical, chemical, and biological data. Thanks to the myriad technological advances since Ewing's time, Lamont scientists are able to look back at the geological record, monitor ongoing changes in the ocean, and predict the environmental impact of natural and anthropogenic stresses.

TRACKING SEISMIC ACTIVITY AT SEA

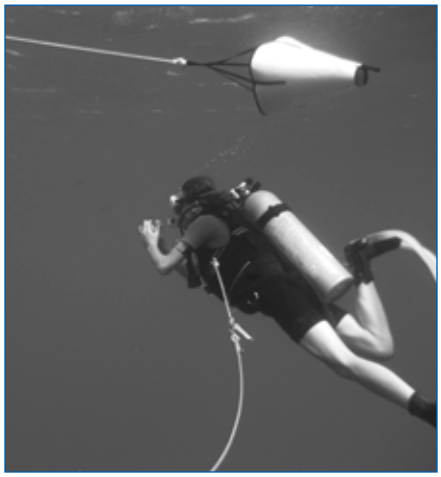
Echoes of Ewing's seismic experiments reverberate today in the investigations by Lamont scientists into the Cascadia subduction zone, which runs along the Pacific Northwest coast. This area is an active thrust boundary of the Juan de Fuca plate, a relatively young plate of 8 to 10 million years that originates from a mid-oceanic ridge and descends into the mantle along the western edge of North America. Researchers are interested in this subduction zone because it could produce a "megathrust" earthquake similar to the 2011 magnitude 9.0 earthquake off the coast of Japan. Although a big earthquake hasn't occurred along the Cascadia margin since 1700, seismologists estimate that another is due to take place sometime in the next several hundred years.

During June and July, Suzanne Carbotte of Lamont's Division of Marine Geology and Geophysics conducted imaging of the Juan de Fuca plate aboard the Lamont-Doherty operated research vessel *Marcus G. Langseth*. The R/V *Langseth* is the only research ship equipped to tow multiple streamer cables, which carry hydrophone listening devices for deep seismic imaging. A sound source towed behind the ship sends low frequency energy downward into the subsurface;

Bärbel Hönisch

Graduate student Katherine Allen (left) of the Department of Earth and Environmental Sciences and Kelly Strzepek (ANU Canberra) recover a plankton net off the coast of Santa Catalina Island, California.

Steve Doo



Lamont Assistant Professor Bärbel Hönisch collects living plankton off the coast of Puerto Rico. The plankton will be used in laboratory culture experiments to learn how plankton respond to changing ocean conditions.

these sound waves produce X-ray-like images of the oceanic crust. Ocean Bottom Seismometers (OBS) spaced roughly 15 kilometers apart along the seafloor were deployed by Helene Carton of the Division of Marine Geology and Geophysics to also record the ship's signals as they penetrated the crust and upper mantle, providing a picture of the deeper structure. Using the streamer and OBS data, Carbotte and Carton will generate complete transects of the Juan de Fuca plate, a first for any oceanic plate.

At the same time, along coastal Washington, Geoff Abers of the Division of Seismology, Geology, and Tectonophysics set up and ran seismometers on land to record the signals emanating from the *Langseth.* Some of these signals were clearly recorded up to 150 kilometers away. Using data from the land stations and OBSs, Abers and Carton will examine the deep structure of the subduction fault interface as the Juan de Fuca plate descends beneath North America.

"Earthquakes may only rupture the offshore part of this fault, or may slip up 100 kilometers inland, almost to Olympia," Abers says. "This project is a way to illuminate the fault so we can test different models of how it works. Is this a single strand? Is it happening in hard rock or is it happening in wet sediment? These sorts of things let us understand how big an area might actually rupture. More fundamentally, we'll understand the physics that underlie how these really big faults operate."

CHEMICAL AND BIOLOGICAL WARNING SIGNALS

In other parts of the world, Lamont researchers investigate chemical and biological clues to learn more about ocean processes and diagnose potential environmental changes. Bärbel Hönisch of the Geochemistry Division studies planktic foraminifers, a form of plankton that has existed for more than 100 million years. Because they do not reproduce in captivity, Hönisch collects juvenile foraminifers in the ocean, most recently near California's Catalina Island and off Puerto Rico, and grows them in a laboratory under controlled environmental conditions. The laboratory experiments enable her to test the degree to which foraminifers modify the chemistry of their shells in response to environmental changes. Results of the experiments are used to interpret past environmental conditions through comparison with the chemical composition of fossil shells found in marine sediments. Hönisch's most recent projects focus on calibrating the ratio of boron to calcium in foraminifer shells as a stand-in for seawater acidity.

When looking at past ocean changes in the fossil record, Hönisch is particularly interested in a climate event about 56 million years ago, known as the Paleocene-Eocene Thermal Maximum (PETM). At that time global temperatures suddenly increased by 5 to 9 degrees Celsius due to a dramatic rise in the amount of carbon dioxide (CO_2) in the atmosphere, causing high rates of extinction among bottom-dwelling foraminifera. As the ocean absorbs CO_2 from the atmosphere, seawater turns more acidic. In the long-term, the dissolution of fossil carbonate shells at the seafloor will help to neutralize this acidity, but a high rate of acidification can negatively impact living carbonate organisms such as foraminifera and corals. Hönisch studies the PETM to predict potential consequences of modern ocean acidification for marine life, and her studies suggest that today's rate of atmospheric CO_2 build up due to human activity is perhaps 10 times more rapid than during the PETM.

"By understanding how climate behaved in the past in response to high or low CO_2 levels, we can make predictions of how climate will change in the future, when anthropogenic CO_2 levels will rise higher and higher," Hönisch says. "Quantifying past changes in ocean chemistry and identifying species that were affected by those chemical changes or even went extinct will prepare us to make better predictions of how the oceans and ocean life will change in the future."

Marine biologist Joaquim Goes of the Division of Biology and Paleo Environment also looks at how marine life interacts with the ocean carbon cycle. In July, Goes participated in a research cruise as part of the Amazon Continuum project, an international multi-institute study of diatom-diazotroph assemblages (DDAs) in the plume that extends thousands of miles into the Atlantic Ocean from the mouth of the Amazon River. DDAs are symbiotic microorganisms (diazotrophs) that form associations with diatoms, a type of phytoplankton. These large DDA communities are important because they draw down significant amounts of CO_2 from the atmosphere into the Amazon River plume.

Using data and imagery from ocean-observing satellites, Goes tracks the unique blue-green color created by the presence of DDAs in the water. Once detected, DDA blooms are closely monitored using autonomous floats equipped with a variety of sensors that transmit information to scientists aboard the ship about how the blooms behave. Goes and his team recently discovered that due to the existence of DDAs in the water, the Amazon plume absorbs 7 to 10 times more

Suzanne Carbotte

A group of Cascadia cruise participants aboard the R/V *Langseth* discuss seismic images of horizons and faults in the sediments and crust beneath the seafloor.

CO_2 than regions of the ocean without large DDA populations.

Goes will use the Amazon data to establish a baseline model against which he can assess the ongoing impact of environmental stresses on the Amazon plume, such as the construction of hydroelectric dams, and how these may affect DDA blooms. "Once we know how the river discharge affects the community of phytoplankton, we can address questions that are particularly important for the Amazon," Goes says. "Brazil is already in the process of constructing dams across some major tributaries. It's a big deal that will affect the river discharge, the quality of the water, and the nutrients that come out. Even if there's a slight change in the river discharge, we'll be able to tell how it affects the phytoplankton community."

CLIMATE AND THE HYDROLOGICAL CYCLE

Other Lamont scientists, including Arnold Gordon of the Division of Ocean and Climate Physics, inspect the unique characteristics of geographic regions and the general behavior of global ocean processes. Gordon has built his long career on understanding ocean circulation, from the icy Southern Ocean to the warm, humid tropics. In the seas of Southeast Asia, Gordon is pioneering significant studies of the interactions between the Pacific and Indian Oceans. The complex topography of the archipelago of Indonesia and the Philippines results in complicated ocean processes in the area. "Because of the islands, there's a lot of mixing going on and that's what makes it difficult to observe and to model," Gordon says. A central research quest in this region is to resolve and understand the Indonesian Throughflow, where tropical Pacific water flows through seas and straits into the Indian Ocean and influences extreme climate conditions such as El Niño/La Niña and the Asian monsoon.

Like Joaquim Goes, Gordon also uses remote sensing to study the relationship of ocean currents to climate. Ocean surface salinity data provided by NASA's Aquarius satellite guide

"By understanding how climate behaved in the past in response to high or low CO_2 levels, we can make predictions of how climate will change in the future, when anthropogenic CO_2 levels will rise higher and higher."

Ocean Classroom

In 1961, Arnold Gordon arrived at Lamont as the institution's first graduate student in oceanography under visiting professor Georg Wüst. He remembers his first cruise aboard the *Atlantis II* in 1963 as, "the perfect thing to do. … [I] learned the value of making accurate observations. How difficult it is to observe the ocean. And the effort, the extraordinary effort that must be made to collect quality data."

Student participation in fieldwork is an important part of Lamont's education mission. One project, Team Diebold, sends select Columbia University undergraduates to sea each summer as part of an immersive experience in ocean fieldwork. Led by Associate Professor Maya Tolstoy, the project is named for the late Lamont marine geophysicist John B. Diebold. Team Diebold students first prepare on land with classes on planning a research cruise and the fundamentals of ship operations. In 2012, the group spent two weeks at sea recovering and deploying Ocean Bottom Seismometers in connection with the Cascadia Initiative. During the cruise, students gain valuable insight into gathering data at sea. "Whenever the ocean is involved, collecting data can become very complicated," Team Diebold student Caitlin Dieck says. "It was very interesting to watch the daily challenges that we encountered due to sea conditions."

Participating in a cruise also inspires a sense of adventure in students. "Fieldwork is the most fun aspect of science. You really have to work together as a team to overcome all the hurdles and meet the goals in an intense and challenging environment," Tolstoy says. "I particularly enjoy seeing the students become confident in that environment and get a taste for the excitement and fun of marine science and exploration. I think John Diebold would have been very proud of these students."

Gordon's research in the North Atlantic Ocean as part of the Salinity Processes in the Upper Ocean Regional Study (SPURS). Here, Gordon looks at the saltiest surface water of the open Atlantic to understand how small, mesoscale (100-kilometer) features such as eddies bring fresh water in to mix with saltier waters, balancing net evaporation in the area. The SPURS program includes ship-based research expeditions from 2012 to 2014 that will use a range of ship- and mooring-based technology to measure ocean conditions in the SPURS region. Gordon will join colleagues from a number of international institutions in the March 2013 expedition when the mesoscale activity is expected to be strong. Gordon's research, carried out on opposite sides of the planet, enhances our understanding of the global hydrological cycle, how it regulates ocean temperature and salinity, and its influence on global climate conditions.

ON THE LEADING EDGE OF OCEAN EXPLORATION

The spirit of discovery that first led Maurice Ewing to investigate the ocean continues to drive Lamont-Doherty scientists in their pursuit of new information about our planet. Their unique, multidisciplinary studies expand our knowledge of oceanic processes and systems—past, present and future—while new technologies bring greater depth to their explorations. And like Ewing, present-day Lamont scientists share an active dedication to fieldwork as the key to exploring the unknown. "It's no accident Lamont has *Observatory* in its title," Gordon says. "Lamont has a strong tradition of making very fundamental observations of the various features within the solid earth, ocean, atmosphere, and ice. Though we also do numerical modeling and theory work, Lamont's focus has always been the observations that tell us something new about what's really happening out in the world."

Arnold L. Gordon

Researchers on the R/V *Revelle*, including Lamont's Phil Mele (right) deploy a Trawl Resistant Bottom Mount mooring (TRBM) in Lamon Bay, off the east coast of the Philippines. Part of a program supervised by Professor Arnold L. Gordon to investigate ocean circulation along the western boundary of the Pacific Ocean, the TRBM sits on the seafloor and measures acoustically the currents of the water column.

Lamont Research Professor Profile
Suzana J. Camargo: On the Right Track

Suzana J. Camargo

Lamont Associate Research Professor Suzana J. Camargo

In 2011, tropical cyclones caused $26 billion dollars worth of damage worldwide. In Lamont-Doherty's Division of Ocean and Climate Physics, climate analyst and Lamont Associate Research Professor Suzana Camargo studies tropical cyclones, such as hurricanes and typhoons, and how they're influenced by changes in climate, both natural and man-made. The results of her work may reduce the damage and deaths caused by storms in the future by providing the public more information about when and where storms will make landfall.

Like the tracks of the storms she studies, Camargo's path to her research subject and Lamont-Doherty would have been hard to predict. Suzana grew up in Brazil and became fascinated by math at a young age. She planned to turn her love of math into a career until an engineering professor suggested physics might be of more interest to her. He was correct. Camargo earned a PhD in theoretical plasma physics and completed postdoctoral work in Germany before becoming an associate professor of physics at Brazil's São Paulo State University. In 1999 Camargo moved to the United States to work at Columbia University's International Research Institute for Climate and Society (IRI), also located on the Lamont campus. It was at IRI that she first began studying tropical cyclones, and they have been on her radar ever since.

Camargo joined Lamont in 2007 and in five years has built a very successful research program focused on analyzing data and observations to understand the relationship between climate and tropical storm activity. "I look at climate change across very different time scales to see what, for example, hurricane activity might look like at the end of the century," she says. Examining data related to both natural changes in weather and climate, like El Niño and La Niña events, as well as changes in climate caused by human activity, provides Camargo insight into why storms occurred in the past and how they may behave in the future.

Funded by the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA), Camargo's work contributes to our understanding of how climate variability affects tropical cyclones. "My research tries to understand the connection between hurricanes and climate, both what the connection looks like over long time scales, as well as for seasonal forecasting," Camargo explains.

Analyzing seasonal climate models enables Camargo and her colleagues to predict how storms will behave in the future. While Camargo is beginning to understand how hurricane activity is changing on a global scale, "The idea now is to try to understand storms in more detail to say something about what will happen regionally," Camargo says. "And can we learn more about the tracks of the storms too? Scientists can't answer these questions yet."

Camargo's analysis of climate data has revealed important information about future weather patterns. As climate models improve, Camargo can create better seasonal forecasts to predict hurricanes over shorter and shorter time scales. Scientists can now forecast hurricanes 30 to 60 days out and hope to refine this time scale even further. "If you know there will be a very intense, active hurricane season, or that the next few weeks will be very active, the public can get ready to deal with a storm in advance," Camargo says.

While continuing to explore questions about tropical cyclones, Camargo is expanding her research to include winter storms and tornadoes. With colleagues Michael Tippett of IRI and Columbia University Professor Adam Sobel, Camargo has already begun to explore methods that will aid in long-range prediction of tornado activity. Earlier this year Camargo, Tippett, and Sobel were awarded a highly competitive Research Initiatives for Science and Engineering (RISE) grant from Columbia University, which provided them seed money to pursue this new area of research. The results of this project may enable them to predict tornado behavior and activity as they do with hurricanes.

"My research tries to understand the connection between hurricanes and climate, both what the connection looks like over long time scales, as well as for seasonal forecasting," Camargo explains.

Camargo's interests also lie in working with policy makers to ensure that messaging about tropical cyclones is accurate and that the public knows how to prepare for tropical storms. "Knowing that there will probably be fewer hurricanes in the future doesn't mean we don't have to be prepared—quite the opposite, especially if the storms are going to be more intense. We have to be sure that message is being shared, especially with more people living in areas that can be badly affected by hurricanes."

Camargo is recognized as a top scientist in her field, a significant achievement for someone who not only changed her research focus mid-career, but switched to a fairly new area of research. Camargo's colleague Adam Sobel explained, "This is a field that has grown a lot and is one that Lamont had no track record in before Suzana arrived. Suzana has emerged as a leader in the field and put Lamont on the map for these types of studies. Thanks to Suzana, Lamont is now one of the main places that people think of when it comes to forecasting tropical storms."

Letter from Steven Cande Alumni Board President

Dear Alumni and Friends of Lamont,

This is my last letter to you as Alumni Board president. After six years, I'll retire as board president in December, though I'm pleased to announce that I'll remain on the Alumni Association Board of Directors.

My time as board president has been wonderful. I appreciate your participation in our alumni association and thank you for your support. I've enjoyed hearing from so many of you during my term as president and connecting with you in person at AGU. I've seen growth in our membership over the past few years and hope to see our numbers expand further in the near future.

It's my pleasure to share that Greg Mountain, PhD '81, will be assuming the role of Alumni Board president. Many of you know Greg, a marine geologist, who has long been active in the alumni association and who is both a professor at Rutgers University and an adjunct professor at Lamont. Greg is looking forward to assuming the helm of the board and plans to increase communication with alumni and work more closely with each of you, as well as with our board members. Our alumni span the globe, and we want to keep all of them involved with Lamont, wherever they may roam. You are always welcome to contact Greg or myself with your thoughts and suggestions on building a stronger alumni community.

I hope you'll join me, and many of our fellow alumni, at AGU this year. We will gather at the San Francisco Marriott on Tuesday, December 4, for one of the best parties held during AGU. This event is an opportunity for you to socialize with fellow alumni and will also be the first chance many of you will have to meet Lamont's new director, Sean Solomon. I encourage each of you to attend and look forward to seeing you there.

Thank you again for all that you do to stay involved and support Lamont-Doherty.

Best regards,

Steven C. Cande

Steve Cande

Alumni Association Board of Directors

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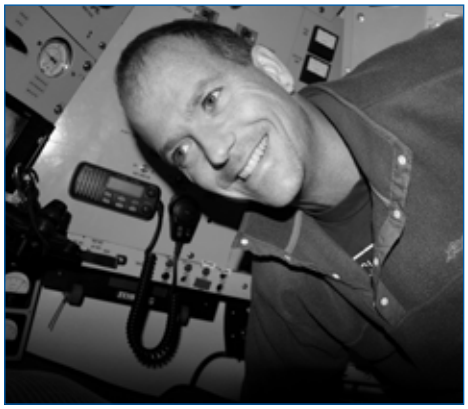
Alumni Profile: Tom Guilderson, PhD '97

Tom Guilderson



Tom Guilderson, about 1,000 meters below the Pacific Ocean, in the Hawaii Undersea Research Laboratory's *PISCES V* research submersible

Tom Guilderson is a geochemist at Lawrence Livermore National Laboratory and a lecturer in ocean sciences at UC Santa Cruz. In 2011, Guilderson was honored by the U.S. Department of Energy, receiving their E.O. Lawrence Award in Biological and Environmental Sciences for his contributions to our understanding of climate change and the global carbon cycle.

How would you describe your research and why it matters?

I am a historian and investigative journalist of sorts. Using sediments and fossils, I try to learn when, over the last ~50,000 years, certain events or climatic episodes happened and what occurred or transpired. My "modern" research uses isotopes of carbon to determine how much and where the carbon dioxide that is emitted during the combustion of fossil fuel goes and how long it might stay there. It is in these histories and modern processes that we find out how the coupled Earth system works, and knowing how things work gives us the ability to make informed choices for the future.

What does your research tell us about the future of our planet?

First and foremost: the background state of the climate system matters. It's like a table set for a dinner where one isn't sure how well the guests will play with each other or whether all of the courses fit nicely together. The background state sets the large-scale atmospheric and (surface) ocean circulation, but then interaction between regional forcing (cloud cover, sea surface temperature, sea ice, soil moisture, vegetation) occurs and you have variability that plays above the background state. Increasing greenhouse gas concentrations will, without a doubt, change the background state. In other words, we have knowledge of all the players, but still don't know how they'll interact with one another.

What are some of the most rewarding parts of your work?

Traveling and fieldwork are definite perks that bring me to interesting places around the world, and under the sea. It's rather startling to do the math on how few individuals have been to the bottom of the ocean in deep-sea research submersibles. I consider myself incredibly fortunate to have had the opportunity to dive with the Hawaii Undersea Research Laboratory and the Alvin groups. Over the last 12 years I've also been lucky to work with a wonderful group of postdocs, 11 at current count, and seeing them find their space is very rewarding.

Who were your mentors at LDEO, and how did they influence your work?

My primary advisers were Wally Broecker and Rick Fairbanks. Other mentors include Bob Anderson, Doug Martinson, and Mark Cane. Bob was a good sounding board for out of the box geochemistry and how to do things in a lab. Doug instilled a sense of rigor and quantitative requirements with an interesting sense of humor. Science could use more Mark Canes. Mark takes a holistic approach that includes working hard but also having life balance—something that I am slowly applying. One of my favorite quotes of Mark's is something along the lines of, "If we were smarter, we would not need as much data."

At Lamont there is also another set of mentors that goes unrecognized: the cohort of postdoctoral researchers. I was fortunate to have the opportunity to learn from Edouard Bard, Bruno Hamblin, Gary Hemming, Sidney Hemming, Gideon Henderson, Will Howard, Leslie Sautter, and Niall Slowey.

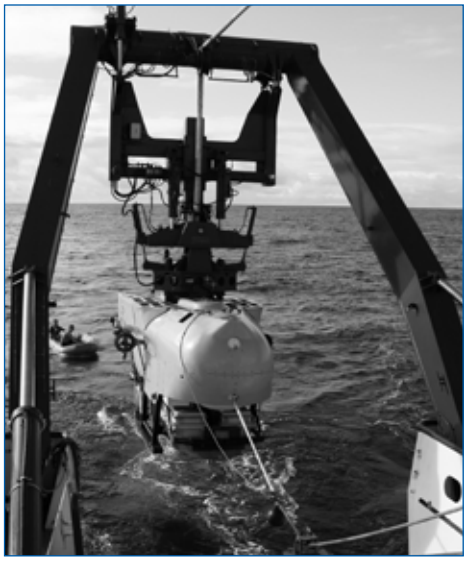
What are some fond memories of the time you spent at Lamont?

There are lots of memories associated with work and research; however, the ones that stand above the rest are about the people of Lamont. I have a lot of memories of the Core Repository's sediment lab, with or without Linda Baker's famous margaritas, and thoughtful discussions over cookies and coffee in the main office.

During a mini conference Wally Broecker held at Lamont in the early 1990s I was privileged enough to be the only student to have the time to go out to dinner with conference attendees. I had a wonderful and intellectually stimulating meal at the Hudson House with Dorothy Peteet, Richard Alley, and Chalmers Clapperton—heady times for a wet-behind-the-ears graduate student.

Another time my parents came to Lamont and brought a cooler filled with food so that we could have lunch together. While eating at one of the picnic tables in front of the old geochemistry building, Wally came out and joined us. My parents were tickled to have lunch and share a beer with Wally. They talked about that afternoon for years.

Tom Guilderson



The *PISCES V* research submersible being launched from the R/V *Ka'imikai-o-Kanaloa* during a research expedition Tom Guilderson participated in near Hawaii

Supporting Lamont-Doherty Earth Observatory

The important work of Lamont-Doherty scientists is funded through a mix of public and private support. Each year, many generous donors invest in Lamont-Doherty, advancing our understanding of Earth and continuing the Observatory's outstanding record of achievement. Every gift, large or small, helps generate another discovery. And in that way, every donor becomes a partner in our scientific and educational endeavors and plays a key role in advancing the fundamental knowledge needed to sustain our planet.

There are many ways alumni and friends of Lamont-Doherty can support the Observatory. Unrestricted annual gifts to Lamont-Doherty give the director unparalleled flexibility to direct support to research areas most in need or to fund special projects. Contributions to Lamont's Annual Fund sustain our critical research and education initiatives and enhance the facilities in which our scientists conduct their groundbreaking studies.

Please make your gift today using our secure online form (www.ldeo.columbia.edu /give-ldeo), or the enclosed envelope. Gifts are tax-deductible and can be made in someone's honor or memory, and as a one-time gift or recurring contribution.

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Your annual gift of $500 and above entitles you to become a Friend of Lamont-Doherty (FOLD). Leadership gifts from FOLD members enable the continued advancement of research by Lamont-Doherty scientists and students. In return, FOLD members receive special invitations to Observatory events.

Director's Circle

Lamont-Doherty recognizes friends and alumni who make an annual gift of $2,000 or more by inviting them to join the Director's Circle. This is an excellent opportunity for those who care about the future of our planet to stay closely informed about recent scientific discoveries.

Members of the Director's Circle gain exclusive access to Lamont-Doherty Earth Observatory and the latest advances in Earth and environmental science made by our researchers. Throughout the year, Director's Circle members attend invitation-only events in New York, including an annual afternoon of science master classes at the Observatory, where members and their guests enjoy the unique opportunity to tour laboratories and engage with our world-renowned scientists.

Torrey Cliff Society

A planned gift to Lamont-Doherty is an excellent way to ensure an enduring commitment to outstanding Earth and environmental research. By including the Observatory in your estate plans through a bequest, charitable gift annuity, or other planned giving vehicle, you become a member of the Torrey Cliff Society. Reflecting the original name of the property on which the Observatory is located, the Torrey Cliff Society pays homage to the extraordinary generosity of Thomas and Florence Lamont, who donated their weekend estate to Columbia University in 1948, and to those who support the Observatory's decades of scientific achievement with a gift that leaves a lasting legacy.

If you are interested in planned giving options, would like to learn more about how to make a gift of properties or securities, or make a donation to name a fellowship, research fund, or endowed chair, please contact Barbara Charbonnet, Director for Development, at 845-365-8585.

Lamont-Doherty Earth Observatory is part of Columbia University and is a 501 (c)(3) nonprofit organization. Gifts to the Observatory are tax-deductible in accordance with law.

Not Exactly Lost, but Found: The Diaries of Marcus Langseth

Lillian and Marcus G. Langseth

A pioneer in marine geothermal research, Marcus Gerhardt Langseth spent most of his career at Lamont-Doherty, beginning his relationship with the Observatory in the mid-1950s as a research assistant and graduate student before advancing through the ranks to an endowed position as Palisades Geophysical Institute Senior Scientist in 1993. An expert on global heat flow, Langseth developed one of the first instruments able to measure the flow of heat through Earth's upper layers, a technique he later adapted and used to make the first measurements of the moon's heat flow during the *Apollo 15* and *17* missions in 1971–1972.

Langseth passed away in 1997, but his legacy lives on in Lamont's oceanographic research vessel, which bears his name. In an equally fitting remembrance, Langseth's journals—the scientific ones—now reside in the research collection of Columbia University's Rare Book & Manuscript Library, thanks to Langseth's wife, Lillian Langseth, who was devoted to locating the diaries, and Lamont Senior Research Staff Assistant Rose Anne Weissel, who found them.

The boxes containing the plain composition notebooks collected dust in the basement of the oceanography building for more than 10 years until Weissel unearthed them in 2010. At the suggestion of Higgins Professor Emeritus Lynn Sykes, and with the assistance of Research Scientist Paul Richards and others, Lillian Langseth contributed the diaries to the research collection of Columbia's Rare Book & Manuscript Library. In June, Michael Ryan, director of the Rare Book & Manuscript Library, met with Lillian Langseth and a small group of her friends and colleagues to describe the archive and cataloging of the journals and to remember Mark Langseth.

Weissel says the diaries cover the period from 1955 to 1996 and offer remarkable insights into one of the great minds in geophysics, and what he was thinking about Earth. "The notebooks contain everything from Mark's ideas about heat flow in the mid-Atlantic ridge, to sketches for the Apollo missions, and the vacation plans he was making with Lillian."

Those who knew Mark Langseth, and anyone else interested in viewing or reading the diaries, can use them in the University's Rare Book & Manuscript Library reading room but must request the diaries 24 hours in advance. Information on how to do so is available online (http://library.columbia.edu/) or by calling 212-854-7309.

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FROM THE ARCHIVE

Cartographer Marie Tharp at work in Lamont Hall in the mid-1950s. A pioneer of modern oceanography, Tharp was the first person to map details of the ocean floor on a global scale.

INSIDE