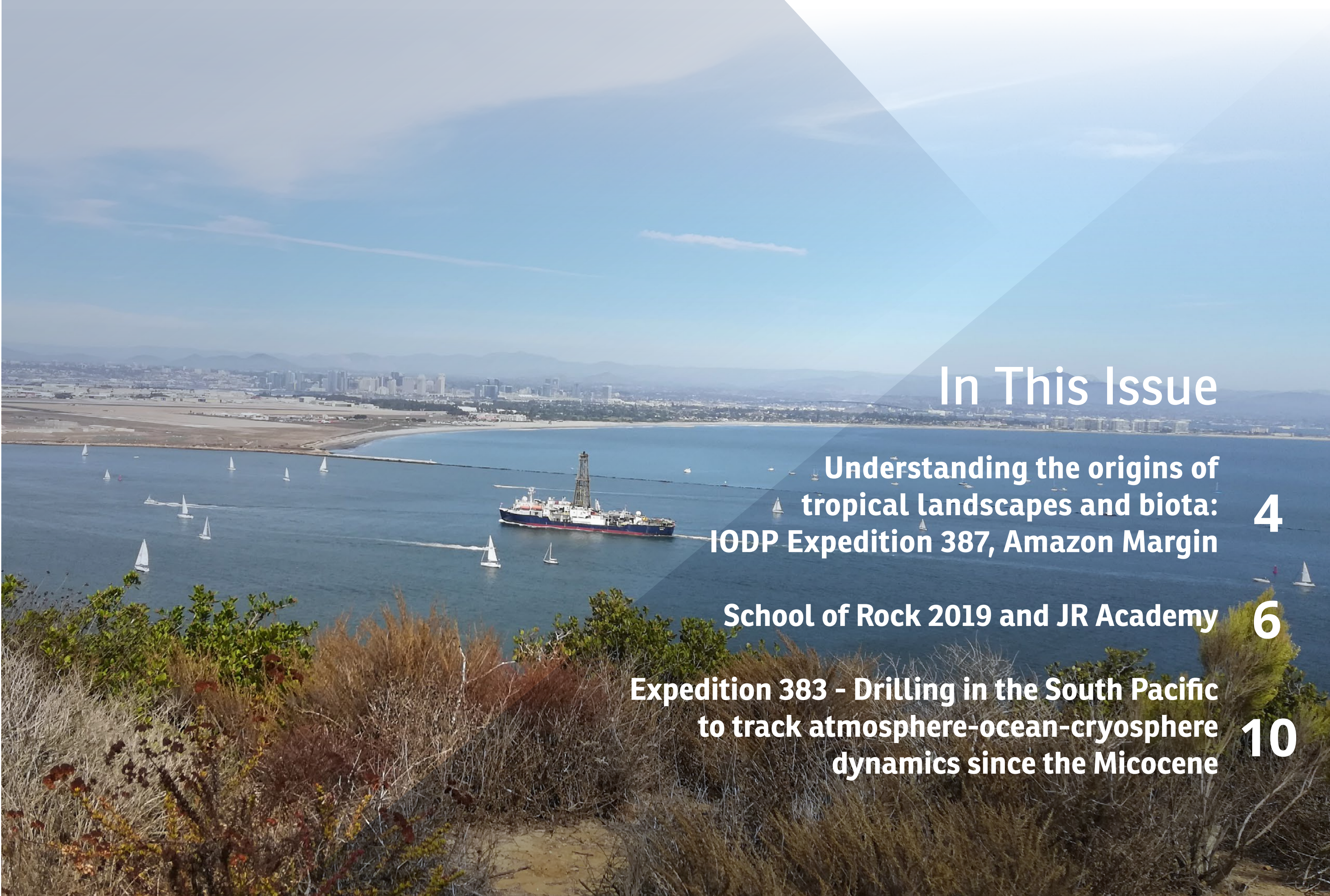
Fall 2019

Ocean Discovery

The U.S. Scientific Ocean Drilling Community Newsletter



In This Issue

The International Ocean Discovery Program (IODP) is an international research collaboration among roughly two dozen countries to advance scientific understanding of the Earth through drilling, coring, and monitoring the subseafloor. The U.S. Science Support Program (USSSP) supports the involvement of the U.S. scientific community in IODP and is funded by the U.S. National Science Foundation (NSF). IODP utilizes multiple drilling platforms to carry out its missions: the riserless *JOIDES Resolution*, managed by Texas A&M University; the riser-equipped *Chikyu*, operated by the Institute for Marine-Earth Exploration and Engineering (MarE^3), a subdivision of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC); and various mission-specific platforms operated by the British Geological Survey on behalf of the European Consortium for Ocean Research Drilling (ECORD). For more information, visit: www.iodp.org.

To contact the editor of *Ocean Discovery*, email: jspencer@LDEO.columbia.edu; or call 845-365-8785

For more information about USSSP, visit: usoceandiscovery.org/what-is-usssp

CALENDAR

December

9-13 — **American Geophysical Union Fall Meeting (IODP Town Hall, 11 December)**
San Francisco, CA

January

5-9 — **AGU Chapman Conference: Evolution of the Monsoon, Biosphere and Mountain Building in Cenozoic Asia**
Washington, DC

7-9 — **Science Evaluation Panel**
La Jolla, CA

28-30 — **U.S. Advisory Committee for Scientific Ocean Drilling**
Galveston, TX

February

17-20 — **Workshop: Demystifying the IODP Proposal Process for Early Career Scientists**
Palisades, NY

18-19 — **Environmental Protection and Safety Panel**
College Station, TX

March

24-25 — **ECORD Facility Board**
Aix-en-Provence, France

May

3-8 — **European Geosciences Union General Assembly**
Vienna, Austria

12-14 — ***JOIDES Resolution* Facility Board**
La Jolla, CA

June

16-28 — **Science Evaluation Panel**
Trieste, Italy

Letter from the IODP Forum Chair

The International Ocean Discovery Program (IODP) has successfully entered its second phase of drilling, with the current IODP Science Plan scheduled to conclude in 2023. Central to the IODP endeavors in this phase is the multi-drilling platform approach to be able to drill in a wide range of environments. Many geoscientists from IODP member nations will have the unique opportunity to experience the sense of scientific discovery through sailing on one of the drilling platforms.

How about IODP beyond 2023? One of the IODP Forum consensus Items (September 2018; Chair Jamie Austin) was visionary: “Multiple planning efforts underway to continue scientific ocean drilling beyond 2023 will eventually require coordination, both to reconsider the extant decadal Science Plan and to evaluate the envisioned mix of drilling platform capabilities, that will be necessary to respond to the expected continued flow of high-quality proposals. The Forum, or its successor, should play an important role in this.”

The above Forum consensus has inspired the international scientific community to work on the first step of a post-2023 program: the whirlwind of writing a new Science Plan. Several international workshops were organized this year—in Yokohama, Vienna, Canberra, Denver, and Shanghai—to discuss scientific priorities and possibilities for post-2023. Early- and mid-career scientists played prominent roles during all of these workshops, with the Canberra workshop setting aside a special session for early career researchers alone. An international working group of IODP scientists, representing all IODP nations and consortia, then met in New York in July to summarize and integrate results of the workshops and to form the skeleton of a very ambitious Science Plan for post-2023, with a timeframe of having the final product available by June 2020.

In September 2019, the Forum delegates had the opportunity to discuss, scrutinize, and alter where necessary the proposed skeleton of the new Science Plan during a very well-attended meeting in Osaka, Japan. The Forum delegates were very impressed with the Plan’s progress and enthusiastically endorsed its development while suggesting it be renamed a “Science Framework,” which better expresses the IODP community’s long-range vision for taking scientific ocean drilling into the mid-21st century.

The Forum delegates thank the leaders and members of the New York working group for their hard work in developing this Science Framework for post-2023, and applaud the speedy formation of the writing and editing teams. We are looking forward to the final product in mid-2020, as it is necessary for long-range deliberation on the structure of a post-2023 scientific ocean drilling program. The Forum delegates also recognize that the concept and design of the current IODP structure has proved highly successful and provides a powerful possible model to take forward into the next phase of scientific ocean drilling post-2023. There will be challenges, but these can and will be overcome through international collaboration among all member countries.

Finally, on behalf of the Forum delegates, I would like to thank the organizers and participants in the many planning workshops that were held earlier this year. Their hard work has positioned scientific ocean drilling to flourish for many years to come.

Sincerely,

Dick Kroon
Chair, IODP Forum

Understanding the origins of tropical landscapes and biota: IODP Expedition 387, Amazon Margin

Paul A. Baker and Cleverson G. Silva

The neotropical forests of the Andes and Amazon are the most biodiverse on Earth. The biotic composition of these forests is vastly dominated by flowering plants (angiosperms) and most of their diversification has taken place in the past 66 million years—the Cenozoic Era, also known as the "Age of the Mammals." (Should it instead be called the "Age of the Flowering Plants"?) Today, these forests and their fauna are under grave threat from both climate change and, more directly, anthropogenic land and water use.

South America and Africa were once part of the super-continent Gondwanaland. About 120 million years ago, the two modern continents rifted apart, and South America began to drift westward. The paleo-equator of South America remained within a few degrees of latitude of the modern equator during the entire Cenozoic; thus the tropical biota remained ever-tropical, even as it evolved and completely transformed. As the Atlantic Ocean widened, increased atmospheric moisture was carried onshore (Liu et al., in press) and tropical South America likely became wetter, although decreasing atmospheric carbon dioxide levels were a countervailing influence on the moisture balance of the continent. The subduction of the Nazca Plate under western South America led to formation of the Andean volcanic arc, probably in the Cretaceous (Cobbold et al., 2007). At some later (Cenozoic) time, as the crust of the western margin of the continent thickened, the Andean cordillera rose higher. By blocking the advection of Atlantic-sourced atmospheric moisture, Andean uplift contributed to wetter climates in the tropical continental regions to the east and desert climates in the tropical forearc region to the west (but only south of the equator).

Beyond their climatic influence, the tropical Andes play a more direct role in the biotic evolution of tropical South America, providing a wide variety of different climatic and ecological niches. They constitute a barrier to dispersal and gene flow between biota living in the lowlands to the east and west (e.g., Dick et al., 2013). They provide a high-altitude, north-south biotic dispersal pathway (Luebert and Weigend, 2014). And their dissected topography, interacting with climate variability, successively joins and then isolates populations, thus constituting a "species pump" (e.g., Rangel et al., 2018). As a result of all of these factors, despite their relatively small area, the tropical Andes host a significant part of the total biodiversity of tropical South America. For example, it is estimated the Andes are home to roughly half of the ca. 100,000 flowering plant species of tropical South America (Antonelli and Sanmartín, 2011).

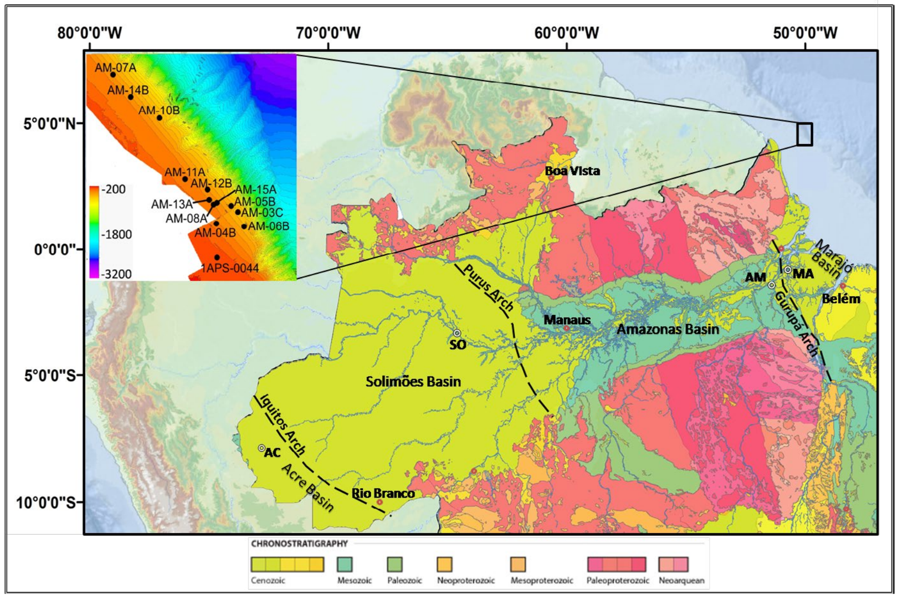


Figure 1. The modern Amazon drainage across Acre, Solimões, Amazonas and Marajó sedimentary basins, reaching the Atlantic Ocean. The Expedition 387 sites (inset detail) are the marine portion of the Trans-Amazon Drilling Project (TADP) that will drill four sites (AC, SO, AM, MA) to decipher the sedimentary record and elucidate the history of geology, climate and biodiversity during the Cenozoic.

South America is a continent dominated by fluvial landscapes. It hosts the single largest river on Earth, the Amazon, whose flow constitutes one-fifth of total global river discharge. In fact, the Amazon and its tributaries include 7 of the 20 largest rivers in the world (Latrubesse, 2015). And just beyond the modern limits of the Amazon, the Orinoco and Parana rank third and ninth largest. However, we know very little about the long-term hydrological evolution of this region. While it seems likely that western tropical South America drained westward (or northward or southward, but not eastward) during the late Mesozoic uplift and rifting of the super-continent that formed the Atlantic Ocean, nothing is known about the geomorphologic nature of the early Cenozoic drainage network or its subsequent "organization" into the present-day configuration that links several different ancient sedimentary basins into a modern hydrologic basin. As well, there is still much to learn about the timing of posited reversal of drainage from a westward-flowing river (cleverly named the "Sanozama," Almeida, 1974); to the modern eastward-flowing mainstream ("Amazonas"), the development of the linkage of the Andean catchments with the Atlantic Ocean, and the formation of the offshore Amazon delta and fan.

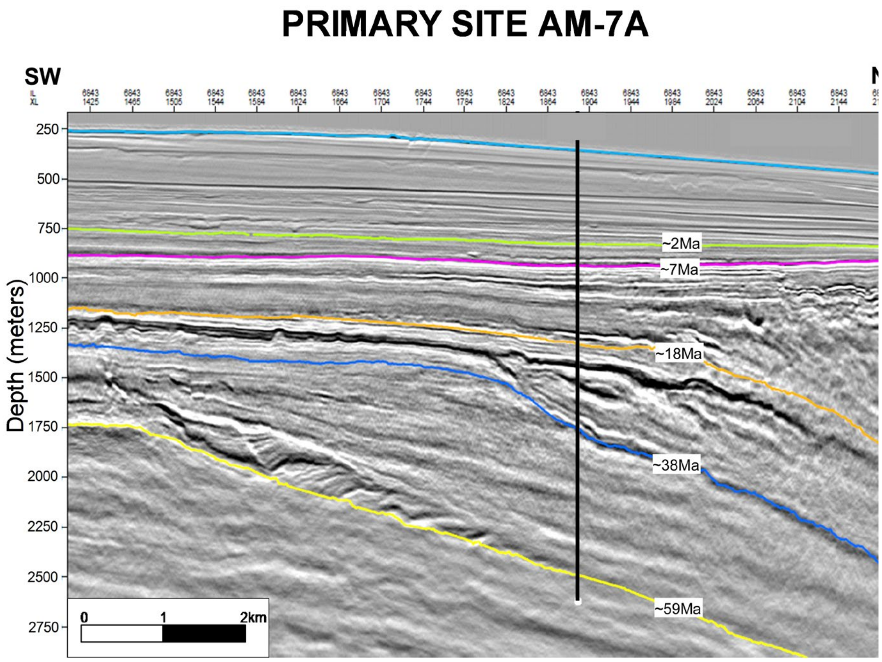


Figure 2. Most of the Cenozoic can be recovered at Primary Site AM-07A. The thick sedimentary sequence above 7Ma, especially above 2 Ma, likely marks the onset of trans-Amazon drainage and the establishment of a hydrologic connection between the Andes and the Atlantic. The thick and almost continuous Quaternary sequence will represent a wonderful opportunity to examine glacial-interglacial and higher-resolution climate/vegetation/oceanographic change of tropical South America in unprecedented detail.

Despite the manifestly interesting climatic, tectonic, biologic, and hydrologic histories of tropical South America, we have no continuous climate record for tropical South America, no continuous record of Andean uplift and exhumation, no continuous record of Amazon/Andean biodiversity, and no continuous record of Amazon fluvial development. In short, the Cenozoic geologic history of tropical South America remains largely unknown, especially prior to late Miocene time.

IODP Expedition 387 aims to recover nearly complete Cenozoic sedimentary records from two sites (AM-07A and AM-05B, Figure 1) on the Amazon continental margin located northwest of the mouth of the Amazon. These site locations are narrowly constrained to depths between the effective shallow water drilling limits of the *JOIDES Resolution* (> 300 m water depth) and the 500 m isobath below which the continental margin is disrupted by huge erosional scars that also represent the up-dip limit of extensional faulting (Reis et al., 2016). Previous exploratory drilling in adjacent regions and excellent industry 3-D seismic data across the whole study area inform site selection. Here, deep (>2 km) drilling is required to recover the thick sedimentary sequences that span most of the Cenozoic. An expected thick (ca. 800 m) Quaternary sequence will shed much light on the recent history of the rain forest, the river, and the equatorial Atlantic Ocean (Figure 2).

IODP Expedition 387 constitutes the marine portion of the Trans-Amazon Drilling Project (TADP). Onshore, the TADP, sponsored by the International Continental Drilling Program, will drill up to 2 km deep at sites in four ancient sedimentary basins (Acre, Solimões, Amazonas, and Marajó). When completed the TADP will have transected almost 10% of Earth's equatorial circumference and helped to elucidate the geologic history of this incomparable biodiversity hotspot.

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School of Rock 2019—Show Me the Evidence

Vicki Randolph

The 2019 School of Rock (SOR) was held in San Diego, California on September 8-18, where the land-based workshop coincided with the *JOIDES Resolution's* first port call to the mainland United States in a decade. Formal and informal educators, and students from near and far, participated in the 10-day, geo-packed, hands-on experience at Scripps Institution of Oceanography and nearby field sites. The theme for this year's SOR was "Show Me the Evidence: Gulf of California Geology and the Scientific Ocean Drilling Program."

Once everyone got over the initial shock of how exciting it was just to be at Scripps, looking at the beautiful ocean views and botanically diverse campus, the students dove right into the science of ocean drilling with veteran JR co-chief scientist and Scripps professor, Dr. Richard Norris. SOR students visited the Scripps core locker, where everyone was wowed by the vast amounts of sediment samples in the collection and learned techniques for analyzing cores. Participants visited Scripps Beach where we were again wowed, this time by Eocene formations, a Miocene dike, and rhyolitic Poway Cobbles.

Back in the classroom, students were treated to presentations, lectures and labs throughout SOR by USSSP Education and Outreach Manager, Sharon Katz Cooper; Dr. Lisa White, Director of Education and Outreach at University of California Berkeley's Museum of Paleontology; and further instruction from Dr. Norris.

As the SOR days continued, Rockers went on some amazing field trips. We visited Torrey Pines State Natural Reserve, where we took in the beautiful geology of seaside cliffs, looked at an angular unconformity, saw concretions, and found fossilized shrimp burrows. We went into the desert at Mission Trails Regional Park where we also met Paleontologist Dr. Tom Demere and looked at Tierrasanta vertebrate paleontology of the middle Eocene (after making our way through the botanical "overburden"). Tourmaline Beach found us once again looking up at the storybook pages written on seaside cliffs into past environments (and also wondering at McMansions built on such fragile precipices). Rockers also had the rare experience of cheering the JR into San Diego's port from the bluffs at Cabrillo National Monument and then touring the ship in the harbor.

Participants took part in valuable indoor field trips as well—visiting Birch Aquarium at Scripps (including classroom time with the education staff), San Diego Museum of Natural History (including a behind-the-scenes tour of the paleontology collections and labs), and more touring around Scripps (including the coveted Benthic Invertebrate Collections). The SOR participants also took in the impressive "Expedition to Guaymas Basin Science Symposium" organized by Scripps IODP personnel.

Indoor lab time proved to be exciting, engaging and sometimes even mind blowing. Labs included Sedimentary Rocks & Structures; Microfossils—Effects of Mass Extinctions; Biostratigraphy using Calcareous Nannofossils—Diatoms, Radiolarians, Pteropods, Ostracodes and Ichthyoliths; and Climate Change and Historical Ecology—Climate in the California Current and Climate Shocks in the Mesoamerican Reef. Looking through microscopes and at SEM images, the Rockers were entertained by showy Cocolithosphores and Discoasters. We even created our own smear slides to bring the science home to our audiences.

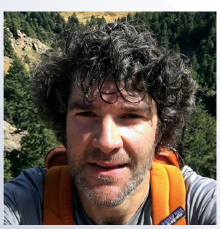
The lab that stunned us all and showed us the most visual line of evidence for a warming climate was the one where we plotted the rising population of our favorite foraminifera, *Orbulina universa*. This simple, easy and concrete observation activity is one which we all hope to bring back to our own students and communities to help them understand how quickly our ecosystems are being affected by climate change—no great prior background, instruments or interpretation required.

For our last big hurrah, participants put our new knowledge to the test. We used magnetostratigraphy and biostratigraphic data to build a geologic timescale, correlating both to help us learn how to choose the best drilling sites. We had to consider how we would find sites with the highest sedimentation rates, least amount of overlying younger materials, and in the least amount of water depth. All this information and lab work allowed us to really appreciate what goes into a drilling expedition on the JR.

Although SOR 2019 had to come to an end, it's really just the beginning of projects and work which will be rippling out into the world for months and years to come via students, teachers, educators, writers, and artists from California, Vermont, New Jersey, North Carolina, Texas, Pennsylvania, Guam and Trinidad. This year's SOR was co-sponsored by USSSP and a new NSF grant called Ambassadors for STEM Training to Enhance Participation (ASTEP) that aims to send SOR alumni into their minority-serving institutions and communities to share the exciting and cutting-edge geoscience they learn.

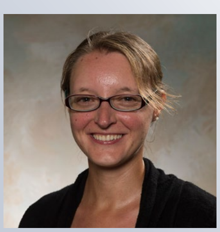
2020-21 Ocean Discovery Lecture Series

For over twenty years, the Ocean Discovery Lecture Series (formerly the Distinguished Lecture Series) has brought the exciting results and discoveries of scientific ocean drilling to academic research institutions and informal learning centers. The roster of 2020-21 Ocean Discovery Lecturers will focus on topics such as climate change, ice sheet history, microbial communities, rifting, and more.



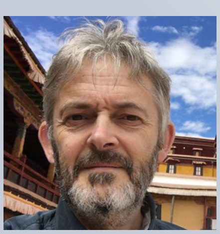
Valier Galy
Woods Hole Oceanographic Institution
The chilling effect of mountain growth: Cenozoic insights from Asian submarine fans

Lisa Tauxe
Scripps Oceanographic Institution
Hunting the magnetic field



Jessica Labonté
Texas A&M University
Some like it hot!: microbial communities inhabiting hydrothermal systems

Julia Wellner
University of Houston
Waxing and Waning of an Ice Sheet: Records from the Amundsen Sea, Antarctica



David Peate
University of Iowa
Magmatism at rifted margins: the story from drilling in the South China Sea

Jim Wright
Rutgers University
Development of modern ocean circulation during the Cenozoic

JR Academy

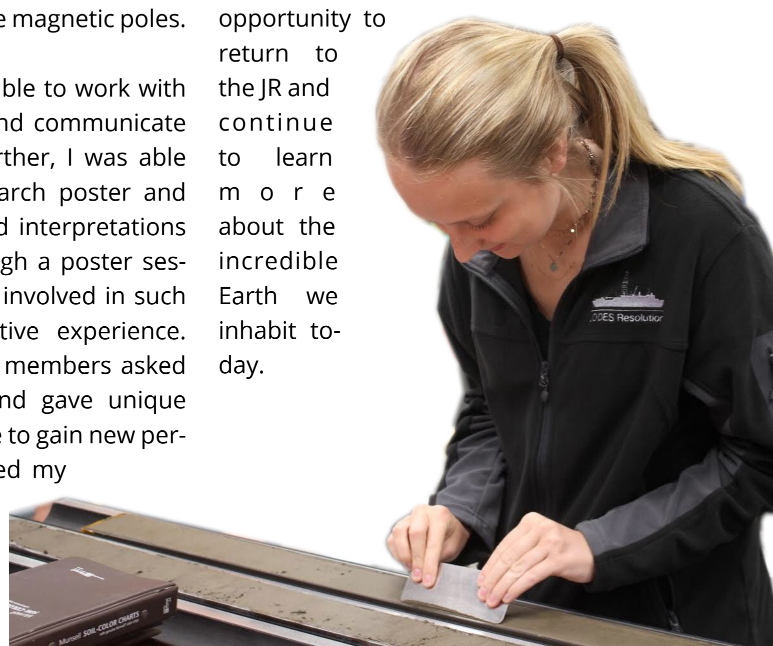
During IODP Expedition 385T (Panama Basin Crustal Architecture and Deep Biosphere: Revisiting Holes 504B and 896A), U.S. Science Support Program partnered with Whatcom Community College to offer the JR Academy—an IODP first! One dozen undergraduate students from around the country lived and work on board, taking two courses from experienced faculty members. Students enrolled in these courses through Whatcom Community College (Bellingham, WA) to receive credit. While on board, they also learned about IODP, the technology and engineering of the *JOIDES Resolution*, operations, and science communication techniques and strategies, and took part in life at sea. Bailey Flugel and Amanda Florea share their experiences in the following profiles.

Bailey Fluegel

On the *JOIDES Resolution*, I was part of the JR Academy. The JR Academy consisted of a group of undergrads led by two instructors. Throughout our time on the JR, we participated in two classes, one on geology and another geared more towards oceanography. We also worked in groups to complete a science communication project. However, I think the most impactful part of the trip was our ability to perform a research project of our choosing. Each student was given the freedom to pick a topic that interested them and come up with a research question to explore. I chose paleomagnetism, the study of the magnetic alignment of ocean sediments. Since I was new to this area of study, I simply wanted to learn the methodology behind paleomagnetism as well as what it can tell us about the Earth as a whole. In my opinion, the most rewarding part of this project was how hands-on we could be. I was allowed to work with a play core and run it through a special machine, the Superconducting Rock Magnetometer (SRM). This instrument uses advanced technology to perform alternating field demagnetization on the core. Essentially, the machine partially demagnetizes the sediments to remove any magnetic overprint caused by the drilling process or outside forces. This process exposes the magnetic alignment of the sediment at the time it was deposited, which scientists can use to correlate to the alignment of the magnetic field of the Earth. This can help us to learn more about fluctuations in the magnetic field, as well as reversals of the magnetic poles.

With this project I was able to work with scientists on the ship and communicate with those on land. Further, I was able to create my first research poster and present my findings and interpretations to those onboard through a poster session. I have never been involved in such a rewarding, collaborative experience. The scientists and crew members asked thoughtful questions and gave unique advice which allowed me to gain new perspectives and heightened my interest in my topic. Creating a research project on a boat in such a short amount of time proved to be challenging, but also extremely exciting.

This adventure provided me an area of research that I hope to continue to pursue. More importantly, though, it gave me a solid foundation of support from those onboard who know the struggles, and merits of being in the field of science. Failure is a natural part of any science-related field. However, it is how we learn and respond to those failures that makes us successful as scientists. The lessons I learned and the advice I received on this expedition helped me to grow not only as a scientist, but as a person. This opportunity was invaluable and absolutely intensified my passion for this field. I know I will forever cherish the friends and mentors that I had onboard the *JOIDES Resolution*. I hope that someday I will be lucky enough to have the opportunity to return to the JR and continue to learn more about the incredible Earth we inhabit today.



Expedition 385T began in Antofagasta, Chile. Before we disembarked in San Diego, California we learned about oceanography, geology, and the process of scientific coring. We earned 10 college credits through Whatcom Community College, but the experience was worth so much more than that.

Before this experience, I thought I wanted to be a marine biologist. I knew I was interested in the ocean and all the unknowns that lie within, but I didn't have a specific interest beyond that. That changed almost immediately after I boarded the JR. Having a chance to work hand in hand not only with amazing professors but scientists who are specialists in their field was incredible.

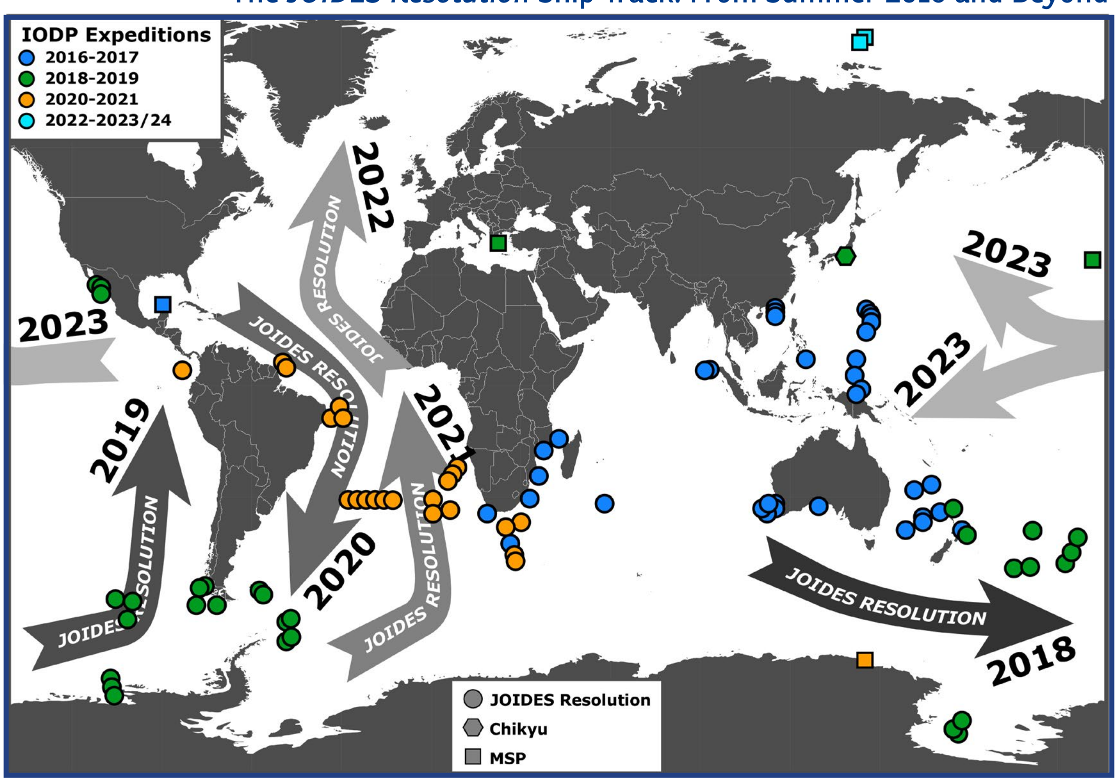
After we boarded the JR and familiarized ourselves with the ship, we dove into classwork. Some of this was lecture-focused, and some was geared towards learning from the specialists on board. Each scientist on our crew was kind enough to take time out of their day to visit our class and discuss their career path as well as what their job entails. I knew my life was about to change when Dr. Sarah Kachovich spoke to our class.

As soon as Sarah showed us the first photo of a radiolarian, I wanted to know more. I had no experience with paleontology, but I was incredibly intrigued. Sarah was kind enough to teach me the basics of micropaleontology and set me up with a microscope in the lab. I spent most of my time outside of class in the lab searching for different species of microfossils.

Part of our grade for our JR Academy classes came from two main projects. One of these was focused on science communication and the other was focused on hands-on research. I was lucky enough to be able to tie both of these into my new found love of micropaleo. My SciComm project was focused on educating elementary school kids about plankton. With help from my amazing SciComm mentor, Nicole Kurtz, I created a poster that could hang in a classroom. It discussed a few of the differences between diatoms and radiolarians. My research focused on recalibrating the biostratigraphy of Hole 504. With help from Sarah, I was able to come up with a rough timeline for this hole. I was incredibly excited when I was able to identify a specific species that was over 5 million years old.

My research project onboard steered me directly into my new career goal—I am now working towards a degree in micropaleontology. I came off the JR with an incredible drive to learn more and dive deeper into the scientific world. With help from my professors onboard, I was able to bring my research project home and continue working on it. From my findings, I hope to be able to publish a paper soon. The support I received from all of the scientists on board was and continues to be incredible.

The *JOIDES Resolution* Ship Track: From Summer 2016 and Beyond



Map modified with permission from the IODP-JRFB

Expedition 383 – Drilling in the South Pacific to track atmosphere-ocean-cryosphere dynamics since the Miocene

Gisela Winckler, Frank Lamy, Carlos Alvarez-Zarikian and the Expedition 383 Scientists

The Southern Ocean plays a powerful role in Earth's climate. It stores more anthropogenic heat and carbon dioxide than any other latitude band on Earth. The Southern Ocean is changing rapidly as the world's climate warms, yet we lack a basic understanding of the processes controlling this important piece of the global climate puzzle.

Sediments recovered during IODP Expedition 383 will provide for the first time a perspective of climate variability and its underlying mechanisms from the Pacific sector of the Southern Ocean. A major feature of the Southern Ocean is the Antarctic Circumpolar Current (ACC), arguably the most important ocean current on the planet. The ACC is the world's strongest current by far, carrying more than 150 times the volume of the world's rivers combined. As it encircles the Antarctic continent, it connects all three major global ocean basins (the Atlantic, the Pacific, and the Indian Oceans) and therefore integrates and responds to global climate variability.

Expedition 383 drilled six sites within the ACC system in the central (U1539, U1540, U1541) and eastern South Pacific (U1543), as well as along the southern Chile margin (U1542, U1544) close to the Drake Passage (Figure 1; Table 1). The central South Pacific sites record the paleoenvironmental history of the ACC from the Late Miocene through the Holocene, while the eastern South Pacific and Chilean Margin sites provide a valuable depth transect spanning all major Southern Ocean water masses, ranging from 3900 to 1000 m water depth. The sediment composition at each site allows for the application of a wide range of siliciclastic-, carbonate-, and opal-based proxies for reconstructing surface to deep-ocean conditions with unprecedented stratigraphic detail. The high resolution sedimentary records recovered during Expedition 383 will improve our knowledge of atmosphere-ocean-cryosphere dynamics of the Pacific from the Late Miocene through the Holocene and their implications for regional and global climate and atmospheric CO_2. Specifically, Expedition 383 sediments will be used to examine the following two fundamental hypotheses:

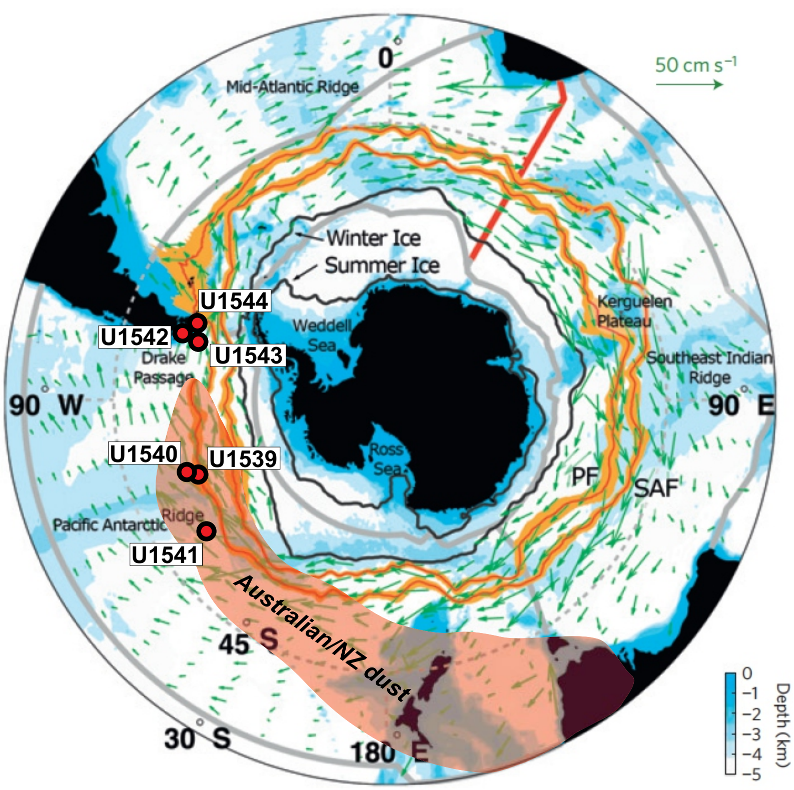


Figure 1. Map showing the sites drilled during Expedition 383. The orange lines indicate the Subantarctic Front and the polar Front, respectively, with the line thickness representing variability in their latitudinal position. The green arrows illustrate the speed and direction of the Antarctic Circumpolar Current, after Marshall and Speer, 2012.

Investigating ACC dynamics and Drake Passage throughflow and their effects on the global meridional overturning circulation and high-low latitude climate linkages. The Drake Passage is the major geographic constriction for the ACC and forms an important pathway for the return of surface and intermediate waters to the Atlantic through the cold-water route of the meridional overturning circulation, complementing the inflow of Indian Ocean water masses to the Atlantic through the Agulhas Current (warm-water route). Resolving changes in the flow of circumpolar water masses through the Drake Passage is crucial for advancing our understanding of the Southern Ocean's role in driving variations in ocean circulation and climate change on a global scale. Before Expedition 383, reconstructions of the throughflow along the Chile margin were limited to the past 60 kyr. Expedition 383 sediments now allow for reconstructions of throughflow variability at very high resolution back to the middle Pleistocene at the Chilean Margin (U1542) and into the Late Miocene at the eastern Pacific site (U1543). Combined, these two sites will be utilized to address the long-term, orbital-scale, and millennial-scale evolution and variability in ACC strength and Drake Passage throughflow, particularly in warmer-than-present interglacials (e.g., Marine Isotope Stage 5e, 11, and 31) and across the Pliocene warm period. The Chilean Margin sites will also be instrumental in reconstructing the evolution of the Patagonian Ice Sheet over time and its potential links to dust generation.

Evaluating the physical and biological characteristics of the oceanic carbon pump in the Pacific ACC and its effects on atmospheric CO_2. Atmosphere-ocean-cryosphere interactions and teleconnections between high and low latitudes play an important role in understanding processes and feedbacks of past and future climate change, and the Subantarctic Southern Ocean provides the major link between Antarctica and the low latitudes. In the Southern Ocean, these interactions are believed to control sea ice cover, Antarctic Ice Sheet dynamics, upper ocean stratification, biological nutrient utilization, and deep ocean ventilation. The physical and biological dynamics of the oceanic carbon pump in the Southern Ocean have been considered to play a key role in explaining past variability in global concentrations of atmospheric CO_2.

Expedition 383 drill cores from the central South Pacific (U1539-1541; Figure 2) allow us to test this hypothesis via exploration of both glacial–interglacial changes and the long-term evolution of dust input, biological productivity, SST, and surface and deep ocean conditions. Specifically, investigations of these new cores will provide robust data to test the extent to which physical and biologic processes that are active in the Atlantic sector of the Southern Ocean can be translated to the Pacific sector. Ultimately, this work allows for the construction of a more global picture of the Southern Ocean's role in nutrient distribution and biogenic export production and their impact on CO_2 variations. These reconstructions will provide important constraints for the climate-sensitive Southern Ocean that are essential to realistically model the impact of different climate conditions on the ocean carbon cycle.

Complementing the two primary hypotheses, the Expedition 383 sites will additionally be crucial to improving constraints on the dynamics of the Antarctic Ice Sheet over the past 8 million years and connections between ice sheet variability, climate, atmospheric CO2 levels, and ocean circulation. In this context, results of Expedition 383 will be closely linked to recently completed IODP expeditions to the Ross Sea (Expedition 374), Amundsen Sea (Expedition 379), and Scotia Sea (Expedition 382), targeting Antarctic near-shore records, and provide critical paleoceanographic baselines including rates of change for improving the understanding of reconstructed Antarctic ice sheet changes and testing ice sheet models.

Hole	Latitude	Longitude	Water Depth [m]	Cored [m]	Recovered [m]	Recovery [%]
U1539	56°09.06'S	115°08.04'W	4071	533.2	502.4	94
U1540	55°08.47'S	114°50.52'W	3580	525.1	532.6	101.4
U1541	54°12.76'S	125°25.54'W	3606	266.1	239.31	89.9
U1542	52°42.29'S	75°35.76'W	1100	598.6	625.1	104.4
U1543	54°35.06'S	76°40.59'W	3863	622.7	645.59	103.7
U1544	55°32.22'S	71°35.62'W	2090	103	91.3	88.7
Totals				**2648.7**	**2636.3**	**99.5**

Table 1. Summary of the sites cored during Expedition 383

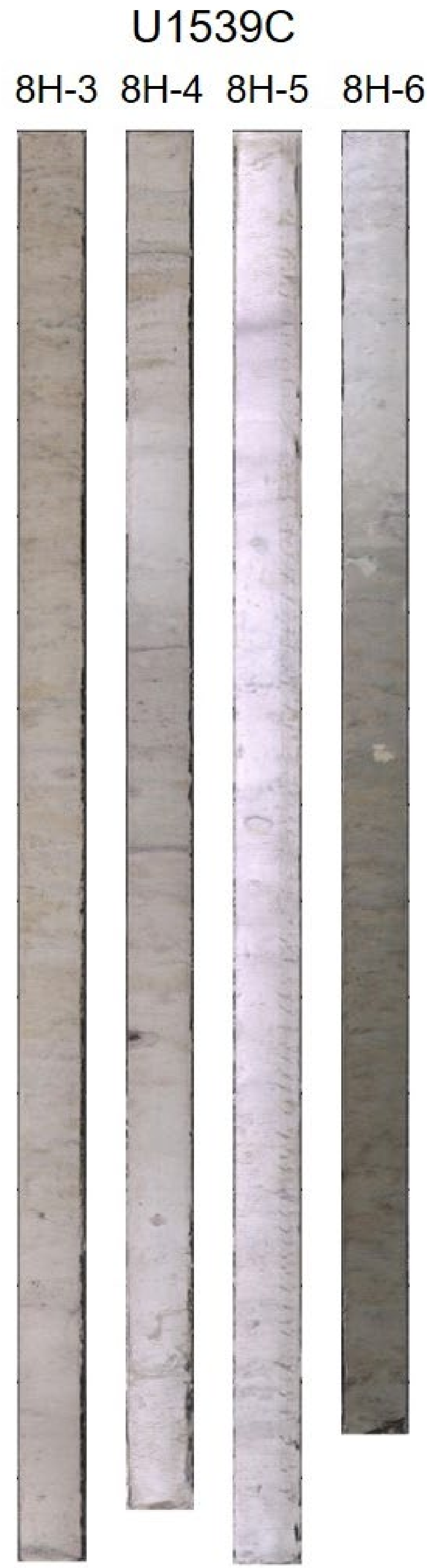


Figure 2. Core sections spanning Marine Isotope Stage 11 (MIS11) from U1539 in the Central South Pacific, where sediment composition is visibly sensitive to climate variability. Sediment composition varies from darker diatom oozes during cold intervals (8H-3, 8H-4, 8H-6) to a bright calcareous nannofossil ooze across the peak warmth of interval (8H-5).

2020 - 2021 IODP EXPEDITION SCHEDULE

Platform	#	Expedition	Dates	Ports
JOIDES Resolution	378	South Pacific Paleogene Climate	1/3/20 - 3/4/20	Fiji - Papeete, Tahiti
JOIDES Resolution	384	Engineering Testing	3/4/20 - 4/26/20	Papeete, Tahiti - Barbados
Mission Specific Platform	386	Japan Trench Paleoseismology	TBD	TBD
JOIDES Resolution	387	Amazon Margin	4/26/20 - 6/26/20	Barbados - Fortaleza, Brazil
JOIDES Resolution	388	Equatorial Atlantic Gateway	6/26/20 - 8/26/20	Fortaleza, Brazil - Fortaleza, Brazil
JOIDES Resolution	390	South Atlantic Transect 1	10/5/20 - 12/5/20	Rio de Janeiro, Brazil - Cape Town, South Africa
JOIDES Resolution	391	Walvis Ridge Hotspot	12/5/20 - 2/4/21	Cape Town, South Africa - Cape Town, South Africa
JOIDES Resolution	392	Agulhas Plateau Cretaceous Climate	2/4/21 - 4/6/21	Cape Town, South Africa - Cape Town, South Africa
JOIDES Resolution	393	South Atlantic Transect 2	4/6/21 - 6/6/21	Cape Town, South Africa - Rio de Janeiro, Brazil
JOIDES Resolution	394	Rio Grande Cone Methane and Carbon Cycling	10/2/21 - 12/2/21	TBD

JOIDES Resolution
Mission Specific Platform