SCIENTIFIC OCEAN DRILLING

CREDIT: Tobias Höfig & IODP JRSO

Digital Newsletter

the Drilling Dispatch

March 2023

SCIENTIFIC OCEAN DRILLING

In This Issue

Happening now... Expedition 398P: JR Academy and School of Rock

JR Academy students learn about the stratigraphy preserved in cores through a fun and tasty activity (Credit: Carol Cotterill & USSSP).

written by Ed Robeck (AGI) and Maya Pincus (USSSP)

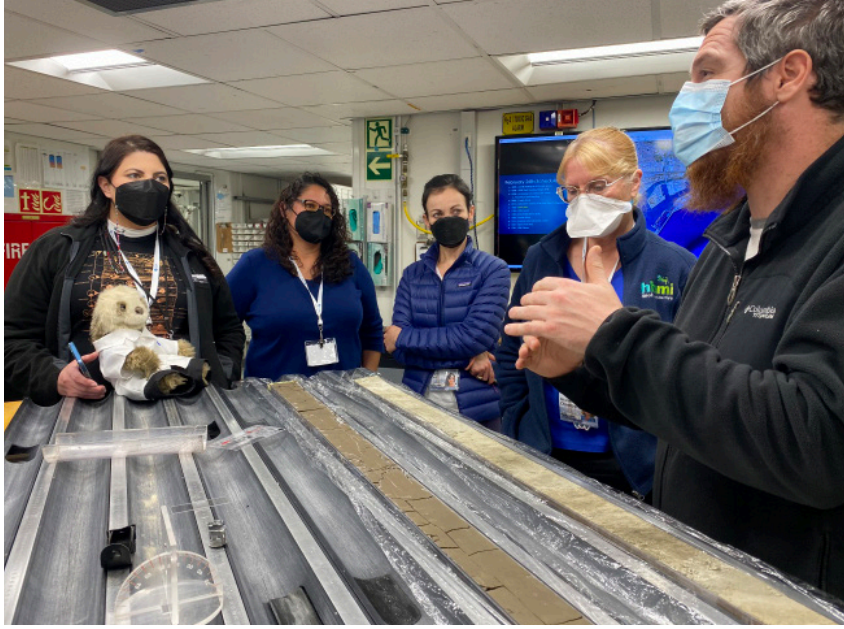
It's undeniable that the *JOIDES Resolution* is one of the most important tools we have for the advancement of scientific knowledge of the Earth. A lesser known, but equally significant achievement of the drilling vessel is its role in education, outreach, and science communication. Though IODP is currently between scientific expeditions, the JR has been busy during EXP398P, the transit from Heraklion, Greece, to Tarragona, Spain and subsequent tie-up in port. JR Academy brought fifteen undergraduate students from around the country together on the ship to learn about scientific ocean drilling. During School of Rock, a team of 12 science educators from six U.S. states gathered to revise, update, and curate lessons from the vast library of free educational materials available on the *JOIDES Resolution* website.

JR Academy

For the second time EVER, undergraduates took over for JR Academy. This exciting opportunity allowed students to experience what it is like to live and work on the ship, in order to develop their relationship with science and field work. They were joined by five mentors and instructors, including the EXP398P EPM Laurel Childress, USSSP outreach extraordinaires Carol Cotterill and Sharon Cooper, Director of E&O for the University of California Museum of Paleontology Lisa White, and filmmaker / media production specialist for NASA Astrobiology Mike Toillion.

Over the course of their time on the ship, students learned the ins and outs of scientific ocean drilling on the rig floor and in the labs. After tours around the ship with technicians, they collected their own samples to study under microscopes, and followed the core flow process to understand how scientists can use rocks from the ocean floor to interpret Earth's geology and history. In the words of Rylin Lofton, "It's amazing to learn something completely new, and after this experience I definitely want to take a geology class next semester!"

What stood out to all participants was the tight bond they so easily formed. About the experience, Eddie Franco said "JR Academy has provided an incredible opportunity for us to create new friendships with people from across the country and learn about their interests," and according to Rylin Duster, "I think I can say we are all beyond grateful for the memories and friendships made over these two weeks."



LEFT: School of Rock participants learn about different drilling techniques in the core tech shop (Credit: Maya Pincus & USSSP).
RIGHT: School of Rock participants practice core description with IODP technician Fabricio (Credit: Maya Pincus & USSSP).

But perhaps even more memorable was the potential for this opportunity to shape the students' futures. To summarize his experience, Philip Siguenza said "I am so grateful for this opportunity and I will cherish this experience for a long time to come. I hope to come back to the JR and work here after completing my undergraduates degree, but for now keep on trippin pipes JR."

School of Rock

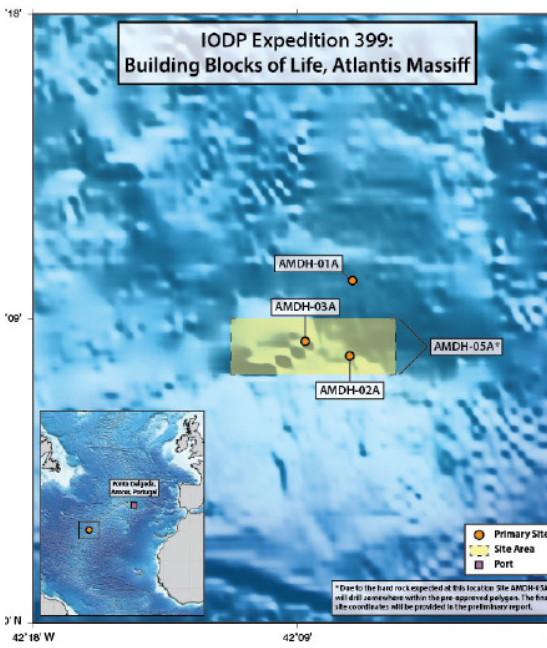
As with many areas of scientific research, ocean drilling presents opportunities in areas that extend its reach beyond the science that the cores and data make possible. This week one of those areas of opportunity—education and outreach—is being explored by a group of Earth science teachers as the latest section of "School of Rock" (SOR). For the first time since the onset of COVID-19, SOR is taking place aboard the research vessel, the *JOIDES Resolution*, as it had prior to the pandemic since 2008. While the JR is docked in Tarragona, Spain, a dozen middle and high school teachers engaged with the instructional resources that have been developed by SOR participants throughout the program's history.

This section of SOR, which goes by the expedition number 398P, is focused on building on the foundation of that earlier curriculum development. The teachers in 398P will revise the existing lessons to enhance connections to recent foundational curriculum documents such as the *2050 Science Framework for Ocean Drilling*, the *Framework for K-12 Science Education*, and the *Ocean Literacy Principles*. "The JR is both a unique and inspiring setting for the work being done, and also provides direct access to the scientific facilities and technical staff that make the science on the ship possible," said Ed Robeck, Director of Education and Outreach for the American Geosciences Institute (AGI). In partnership with IODP, AGI is guiding the process of curriculum revision that the 398P teachers are undertaking. The teachers are working on revising individual lessons, but are doing so in a collaborative environment that allows them to take advantage of the different areas of expertise that each of them bring. EXP360 onboard outreach officer Ale Martinez, one of the teacher participants, said "The opportunity to collaborate with teachers from different backgrounds around the United States has been invaluable. They inspire me to think outside the box and challenge my students."

In the planning... Expedition 399: Building Blocks of Life, Atlantis Massif

Andrew McCaig and Susan Q. Lang,
Expedition 399 Co-Chief Scientists

Written by Lesley Anderson, Sarah Treadwell, and Maya Pincus (IODP USSSP)

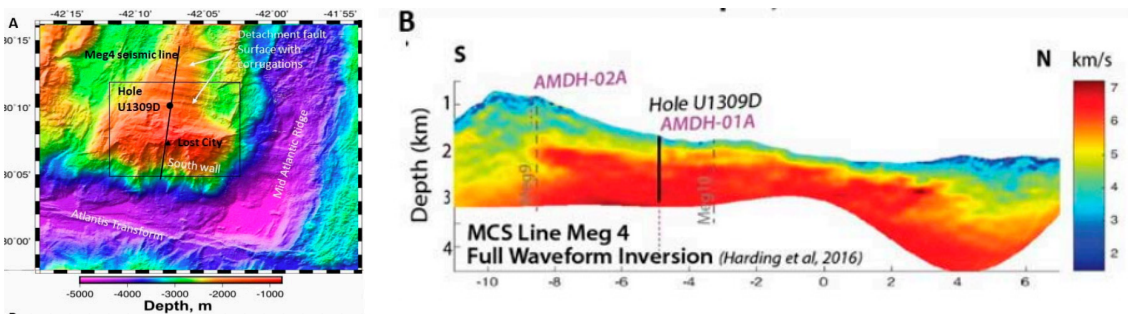


Location of Expedition 399 proposed primary Sites AMDH-01A and AMDH-02A, proposed alternate Sites AMDH03A and AMDH-05A, and Hole U1309D. Inset shows operational area and expedition start and end port. (Credit: McCaig et al., 2022)

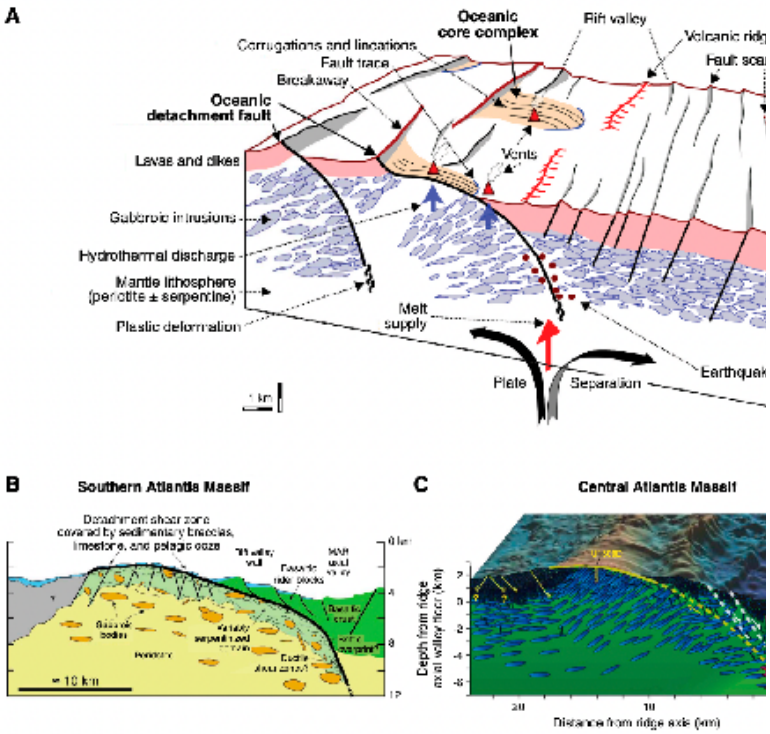
Since the implementation of scientific ocean drilling in the 1960s, humans have endeavored to reach Earth's mantle. Researchers hope that studying the rocks of this second deepest layer will provide important insights into processes that shape our planet's structure. and allow them to learn more about the alteration processes these rocks undergo with major consequences for the heat exchange between the ocean and crust, geochemical cycles, and microbial activity.

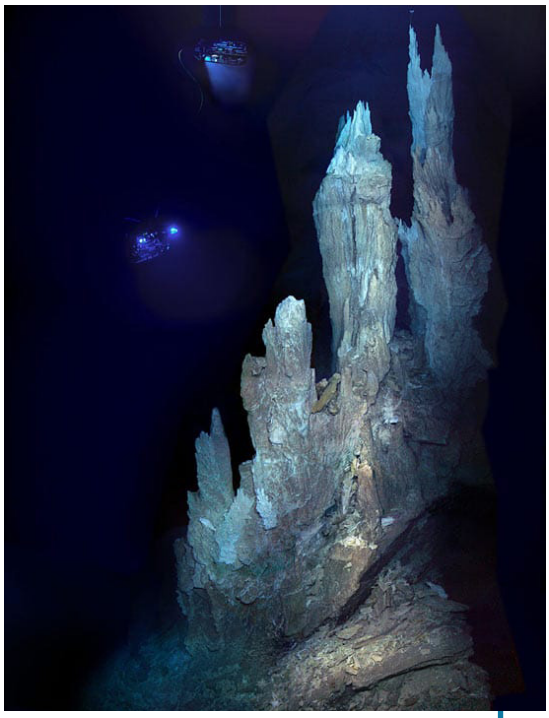
At the center of the northern Atlantic Ocean lies a dome-shaped area of elevated seafloor 14,000 feet high. This is the Atlantis Massif, and though its name implies mysticism and myth, it is a very real source of elusive geologic knowledge. Formed by intense tectonism, the massif is composed of mantle rocks that have been uplifted and exposed at the sea floor, allowing scientists to sample otherwise inaccessible rocks.

It has been known for a long time that this region holds the key to understanding the properties of the oceanic lithosphere, an area on Earth where the crust and the upper portion of the mantle meet. There, heat exchanges between the ocean and crust, producing geochemical cycles, and fostering microbial activity. Cores were recovered during four previous expeditions (Integrated Ocean Drilling Program Expeditions 304, 305, and 340T and International Ocean Discovery Program Expedition 357) and additional data were obtained through dredging and submersible



A. Atlantis Massif showing main structural features, location of LCHF, and Hole U1309D. Bathymetry was collected during Expedition 357 (Früh-Green et al., 2018; Escartín et al., 2022). Box = area of Figure F3. B. Full waveform inversion of Seismic Line Meg 4 and locations of proposed primary Sites AMDH-01A (Site U1309) and AMDH-02A. After Harding et al. (2016).





LEFT: Conceptual sketches of tectonomagmatic evolution of heterogeneous lithosphere and denudation of mantle rocks as detachment faulting progressesc (Credit: A. Escartín and Canales, 2011; B. Boschi et al., 2006; C. Grimes et al., 2008). RIGHT: Carbonate chimneys of Lost City imaged during a 2005 expedition to the hydrothermal vent system. (Credit: D. Kelley and M. Elend/UW/URI-IAO/NOAA/The Lost City Science Team).

investigations. Now, the *JOIDES Resolution* will return to the area during Expedition 399 (12 April - 12 June 2023) to collect new data on ancient processes in this fascinating region.

When mantle rocks interact with seawater, they undergo a process known as serpentinization in which a reaction between the rocks and water alters the mineral composition and releases heat. This process is particularly intense at the Lost City Hydrothermal Field, which is located on the southern flank of the Atlantis Massif. Characterized by carbonate chimneys the height of a house, this area is the site of hydrothermal vents that produce warm alkaline fluids rich in hydrogen, methane, and abiotic organic molecules.

Many scientists believe that undersea vents such as these may be the first locations on Earth where organic molecules formed to become the building blocks of life. By deepening a previously drilled hole and collecting cores at additional shallow holes, the scientists of Expedition 399 hope to recover samples that will contribute to the story of the evolution of the first life on Earth. They also are working to develop a more detailed history of magmatism, deformation, and high temperature seawater-rock interaction. Astrobiologists believe that similar systems may be present on “ocean worlds” in our Solar System, such as moons around Jupiter and Saturn. This expedition presents a unique opportunity to better understand the possibility of life on other planets.

To learn more about Expedition 399: Building Blocks of Life, Atlantis Massif, visit the Expedition webpage, and read the Scientific Prospectus (McCaig et al., 2022). To request a postcard from the *JOIDES Resolution* during the expedition, fill out this Google Form.

Note: An earlier version of this article falsely attributed the diagram at the top left of this page to the EXP399 Scientific Prospectus (McCaig et al., 2022). The correct citation is as follows: A. Escartín and Canales, 2011; B. Boschi et al., 2006; C. Grimes et al., 2008.

FEATURED VIDEO

ShipSquad - JR Academy

The point of JR Academy is not just to learn about scientific ocean drilling—participants learn about science communication too! In this video, made during the first ever JR Academy in 2019, students teach viewers about science at sea.

For your calendar

- **Gulf of Papua workshop**
  (15-17 March 2023; Biosphere 2, Arizona, USA)
- **EXP401 Special Call: Sedimentology with ichnofacies expertise**
  (Deadline: 24 March 2023; learn more here)
- **Submit an IODP Drilling proposal**
  (Deadline: 3 April 2023; learn more here)
- **Call for nominations: Asahiko Taira SciOD Research Prize**
  (Deadline: 12 April 2023; learn more here)
- **International Ocean Discovery Program Forum**
  (22-23 April 2023; Vienna, Austria)
- **European Geophysical Union General Assembly**
  (23-28 April 2023; Vienna, Austria)

SCI COMM RESOURCE OF THE MONTH

Why just learn the science, when you can learn the process of science at the same time? In this activity, students investigate the question “What makes up the seafloor?” using equipment to analyze sediments and test hypotheses. They use the Science Flow Chart to reflect on their process.

Investigating Seafloor Sediments

Spotlight on... Dr. Maureen Raymo

Director, Lamont-Doherty Earth Observatory

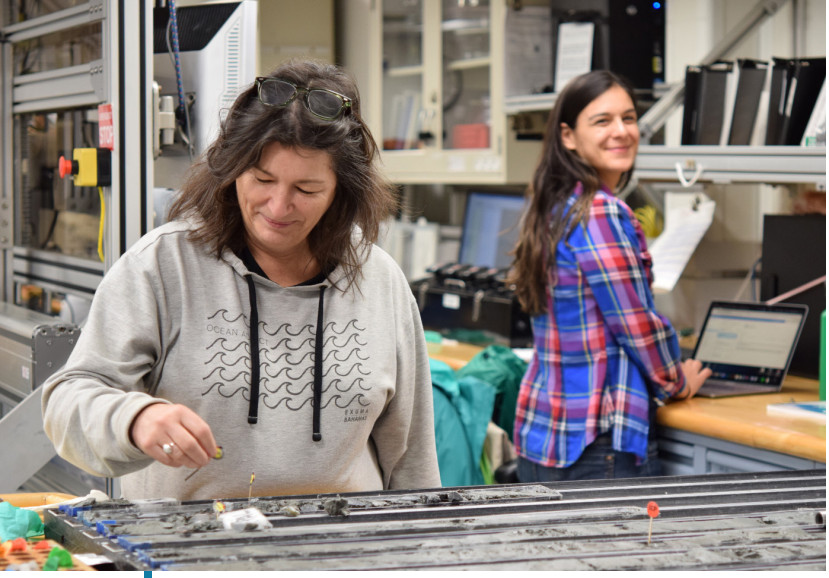
written by Maya Pincus (USSSP)

Credit: Gary Tutte & SOI Foundatiion.

"Cores are the gift that keep on giving," Dr. Maureen Raymo told me when I sat down to talk to her about her history with scientific ocean drilling. And she would know: Before she became Director of the Lamont-Doherty Earth Observatory at Columbia University, she was Director of the Core Repository on campus. And before that, she built her career on several ocean expeditions and the cores that were recovered from them.

Any article you read about Dr. Raymo will enumerate the ways in which her career path has been groundbreaking. It's the same for her involvement with scientific ocean drilling. Her first expedition was Leg 94 of the Deep Sea Drilling Project, where she supported as a shore-based scientist. The objective of this mission was to drill into sediment drifts in the northern Atlantic Ocean to investigate glacial-interglacial periodicities and ocean-ice sheet-atmosphere interactions during the late Quaternary. Through use of the then brand new Advanced Piston Core technology, this expedition marked the first time scientists were able to recover continuous spliced records of Earth's changing climate.

Dr. Raymo films an interview for CBS This Morning's Earth Day program from the bridge of the *JOIDES Resolution* during Expedition 382. In the background, the captain checks the iceberg radar (Credit: Trevor Williams, IODP JRSO).



LEFT: Dr. Raymo selects core for sampling (Credit: Frida Hoem, IODP). RIGHT: Dr. Raymo stands with Expedition 382 Project Manager Trevor Williams and Co-Chief Scientist Mike Weber in front of the derrick of the *JOIDES Resolution* (Credit: Lee Stevens, IODP).

She first went to sea as a graduate student, on Ocean Drilling Program (ODP) Leg 108. This expedition continued to investigate the extent to which paleoclimatic records could be preserved in ocean sediments, in this case through the integration of records of surface and deep-water paleoceanography with those of the zonal and meridional paleo-wind circulation. Soon afterwards, she wrote a proposal with her colleague Delia Oppo that "zipped to the top of the queue," and returned to the *JOIDES Resolution* as co-chief scientist for ODP Leg 162, continuing her research in the North Atlantic by recovering the first long millennial-scale records from sediment drifts. Most recently, Dr. Raymo sailed again on the JR as co-chief scientist for IODP Expedition 382. This expedition sought to investigate the long-term climate history of Antarctica, in order to understand how polar ice sheets responded to changes in atmospheric CO_2 in the past and how ice sheet evolution influenced global sea level.

Going beyond the science, Dr. Raymo recognizes the drilling program as a great equalizer. She told me, "One of the things I admire most about the drilling program is that anybody can bring a great idea to the table, and that idea will rise to the top." Ocean expeditions form a community "ranging from superstars to graduate students, and every career stage in between." No matter where you're at in your career as a scientist, you have the opportunity to work with a dream team of other people just as excited as you.

Despite such a successful career, Dr. Ramyo admits that "Being a scientist is hard work. You need to want to do it." But if you're ever feeling stuck? "Just follow your passion. If this is what gets you excited in the morning, then you should be doing it. There's opportunity everywhere."

Members of the Expedition 382 science party join the March for Science from the bridge of the *JOIDES Resolution* (Credit: Sarah Kachovich, IODP)

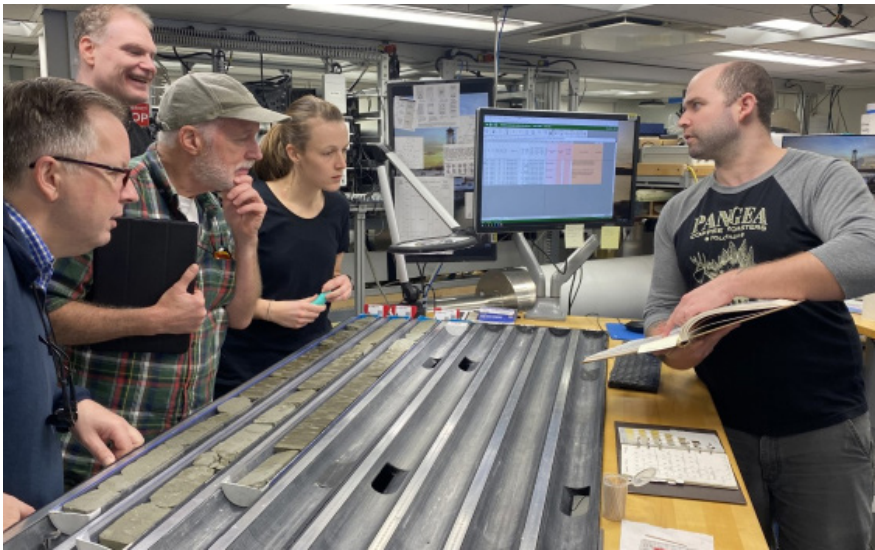
Spotlight on...
Dr. Adam Woodhouse

Distinguished Postdoctoral Fellow, University of Texas Institute for Geophysics

In the vastness of the world's oceans the tiniest organisms speak the loudest, and Dr. Adam Woodhouse is the interpreter who translates their stories into science. As a Distinguished Postdoctoral Fellow at the University of Texas Institute for Geophysics, his primary research focuses on Cenozoic planktonic foraminifera, using their incomparable fossil record to improve our understanding of micro- and macroevolution and paleoclimate. His microevolutionary work incorporates high resolution sediments recovered by the IODP to changes on individual populations of planktonic foraminifera, whereas his macroevolutionary work involves the collation of legacy scientific ocean drilling data.

Beyond his own research, Adam has made significant contributions to the accessibility of ocean science to a broader field of scientists. He is a co-creator of the Triton dataset, which is the largest single fossil group dataset ever conceived. This great compilation of information serves as an excellent resource to investigate how species responded to changing climate in the past. Specifically, Adam uses it to prospect global biogeographical changes within the planktonic foraminifera across the Cenozoic.

Adam first sailed on the *JOIDES Resolution* as a shipboard micropaleontologist during Expedition 375: Hikurangi Subduction Margin, and most recently participated in Expedition 398: Hellenic Arc Volcanic Field. To stay up-to-date on his adventures in science, follow him on Twitter @foradamifera.



TOP: Adam studies planktonic foraminfera from the Hellenic arc volcanic field while aboard the *JOIDES Resolution* for Expedition 398. (Credit: Erick Bravo, IODP JRSO).

RIGHT: Adam supports Expedition 398 sedimentologists during core description. (Credit: Susan DeBari, IODP JRSO).

How to...

Access core data in the LIMS database

written by Maya Pincus (USSSP)

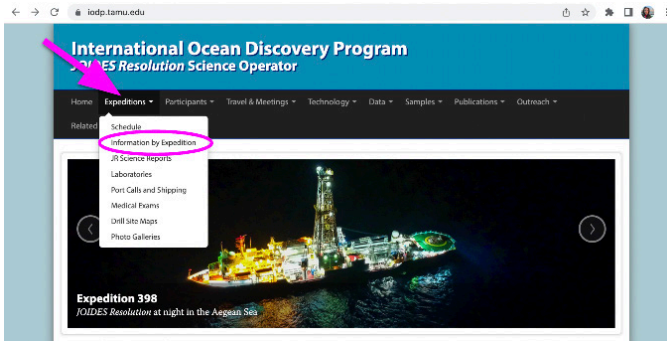
This is a general guide for users largely unfamiliar with the Laboratory Information Management System (LIMS), and is useful for those wanting to browse through the data. For more detailed information, especially pertaining to finding your own samples, watch these videos:

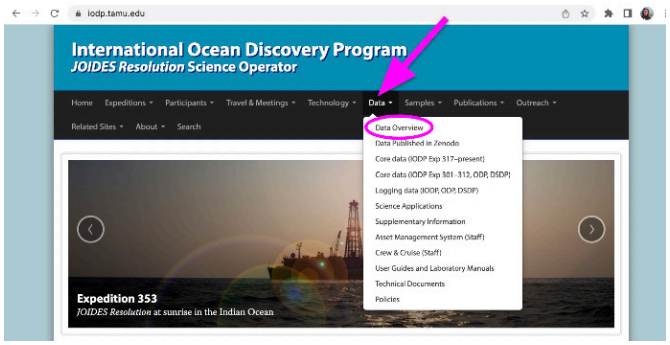
- IODP Tutorial: LIMS Overview
- IODP Tutorial: How to find your samples in LIMS
- IODP Tutorial: How to add CCSF depth scales to LIMS

To learn more about the types of data collected aboard the *JOIDES Resolution*, visit https://iodp.tamu.edu/database/datatypes.html.

1. Do you know which expedition you're looking for?
    a. If NO, go to (2).
    b. If YES, go to (3).

2. Go to https://iodp.tamu.edu/scienceops/expeditions.html to learn more about the different expeditions. Once you find an expedition that relates to your interests,
    a. Go to (3). NOTE: Expeditions that took place within the past year are under moratorium, so the data cannot be accessed until a full year has passed.

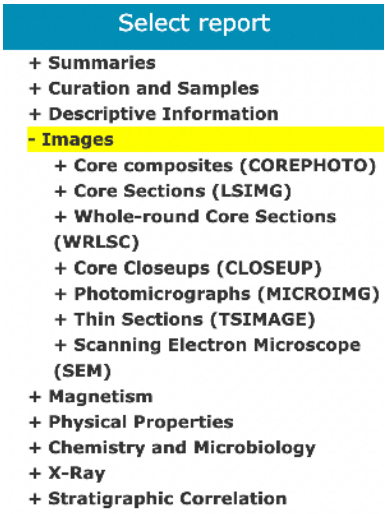




3. Once you know which expedition to search for, go to https://web.iodp.tamu.edu/OVERVIEW/. This is an overview of all the data available on the LIMS (Laboratory Information Management System) Database.
    a. Go to (4).

4. What type of information do you want to access?
    a. If you want images, go to (5).
    b. If you want data, go to (8).

5. What type of image do you want?
    a. If you want a core image, go to (6).
    b. If you want an image of a specific feature, go to (7).



6. How much of the core do you want to see?
    a. If you want to see all the section halves from one core, click **Core Composites (COREPHOTO)**. Go to (10).
    b. If you want to see a single core section half, click **Core Sections (LSIMG)**. Go to (10).
    c. If you want to see a close-up of a specific feature in a core section half, click **Core Closeups (CLOSEUP)**. Go to (10).
    d. If you want to see a 360° view of the exterior of a core section, click **Whole-round Core Sections (WRLSC)**. Go to (10).

7. How small is the feature you are looking for?
    a. If the feature is on the millimeter (mm) scale, click **Photomicrographs (MICROIMG)**. Go to (10).
    b. If the feature is on the micrometer (µm) scale, click **Scanning Electron Microscope (SEM)**. Go to (10).

8. Navigate directly to the LIMS database: https://web.iodp.tamu.edu/LORE/.
    a. Go to (9).

9. What type of data are you looking for?
    a. If you want paleomagnetism data, click **Magnetism**. Through the dropdown menu, you can choose which instrument you want data from. Go to (10).
    b. If you want data about the physical characteristics of the core, click **Physical Properties**. Through the dropdown menu, you can choose which instrument you want data from. Go to (10).
    c. If you want geochemical or microbiological data, choose **Chemistry and Microbiology**. Through the dropdown menu, you can choose what type of data you want. Go to (10).
    d. If you want XRF or XRD data, click **X-Ray**. Through the dropdown menu, you can choose which instrument you want data from. Go to (10).
    e. If you want stratigraphy data, choose **Stratigraphic Correlation**. Through the dropdown menu, you can choose what type of data you want. Go to (10).

10. Once you have selected the type of data you want, pick the expedition you are interested in from the Hierarchy Search. If you know which Site, Hole, Core, or Section you are looking for, you can enter that information to refine your search.
    a. Go to (11).

11. Click **View data**.

Creative COREner

There are many ways to communicate information and data. As scientists, we frequently publish peer reviewed articles and white papers, present our findings in classrooms and at conferences, and even share what we do on social media.

Dr. Laura Guertin, Distinguished Professor of Earth Sciences at Penn State Brandywine, chooses to communicate in a different way: through quilts. Inspired by the stories of scientific ocean drilling, as well as the data that can be collected at sea, she creatively uses fabric to portray information through color and pattern.

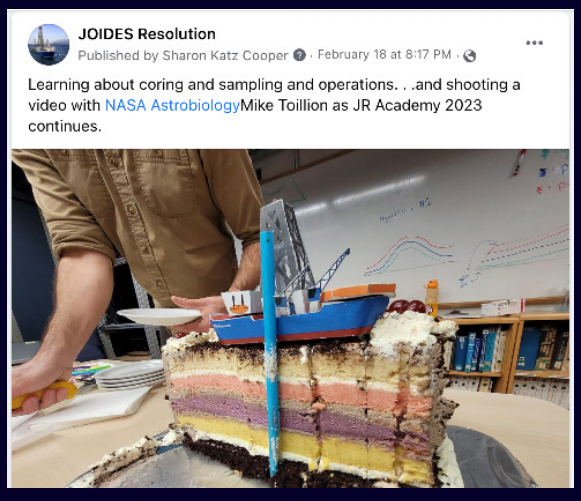
View her quilts at the links below!

SciQuilt - DSDP Leg 3

SciQuilt - What to know before we go

SciQuilt - Blue skies and cloud cover
(pictured right)

Find us on the web!



You don't need to wait for next month's newsletter to keep up-to-date with our adventures in science! We update our blog and social media regularly. Get involved, and stay in touch!

Twitter: **TheJR**

Facebook: **JOIDES Resolution**

Instagram: **joides_resolution**

Web: **https://joidesresolution.org**

Call for contributions

If there's one thing that can be said about the International Ocean Discovery Program (and the Integrated Ocean Drilling Program, and the Ocean Drilling Program, and the Deep Sea Drilling Program), it's that we are a tight-knit community. Just as much as this newsletter is for you, we want it to be from you, too! In future editions we will highlight our readers by featuring the following community contributions:

- **From the Field** - Have you had an experience with scientific ocean drilling that you want to share? Write a piece to tell us your perspective "from the field" for our next edition. Bonus points if you include some pictures!

- **Scientist Spotlight** - Do you know someone who's making waves in the ocean drilling scene, whether it's a grad student or accomplished scientist? Send us a nomination! Briefly tell us why this person deserves a shout-out, and ideally how to get in touch with them. Self-nominations are also accepted.

- **Photo Montage** - Thanks to everyone who submitted photos for this month's WOMEN IN SCIENTIFIC OCEAN DRILLING theme! April is Earth Month, so for next edition please send in your photos that illustrate the theme **Invest in our planet**.

- **Creative COREner** - Scientists are creators too! Send in your paintings, drawings, digital designs, poems, short stories, sculptures, or any other ocean science art you've made.

Send your contributions (and questions and concerns) to **mpincus@ldeo.columbia.edu** no later than March 20, 2023 to be featured in next month's newsletter.

See you next month!