SC ENTIFIC OCEAN DRILLING

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Happening now... Expedition 398: Hellenic Arc Volcanic Field

Timothy H. Druitt and Steffen Kutterolf, Expedition 398 Co-Chief Scientists

written by Maya Pincus (USSSP)

As recently as 3,650 years ago, the island of Santorini exploded in an eruption so huge that an entire town on the island was buried, and populations on other islands were affected as far as 80 miles away. This catastrophic event was just one of over a hundred eruptions that have taken place in the past 360,000 years. When will the next eruption in the area occur? Will it lead to the decimation of an existing island, or be a catalyst to the formation of a new one? How and why do volcanoes in the Aegean sea erupt at all?

Scientists of Expedition 398 set sail from Tarragona, Spain on 16 December 2022 to answer these questions. The *JOIDES Resolution* will drill at six sites around the Hellenic arc volcanic field to collect core samples of volcanic material from beneath the seafloor. By analyzing these samples, scientists will develop a better understanding of island arc volcanism as well as how volcanoes interact with the surrounding environment. Specifically, Expedition 398 participants will study the marine volcanoes of Santorini, Christiana, and Kolumbo to establish the link between faulting and volcanic activity, determine if and how sea level fluctuations affect volcanic eruptions, predict risk of future eruptions, and investigate how microbiological communities react to eruptive phases and acidification of seawater.



LEFT: Hehe Chen (Structural Geologist, China University of Geosciences, China) works on structural geology observations of the cores (Credit: Thomas Ronge, IODP JRSO). RIGHT: K. Batuk Joshi (Inorganic/Igneous Geochemist, National Centre for Earth Science Studies, India) and Christopher Jones (Inorganic Geochemist, University of California, USA) filter a mudline sample (Credit: Johanna Suhonen, IODP JRSO).



The Greek Island of Amorgos with a cloud formation on top. (Credit: Nick Logan, IODP JRSO).

To date, over 1,000 meters of core from three sites have been recovered. Cores consist of volcanic materials such as tuffaceous muds, lapilli, and breccia; terrigenous and marine sediments; and clasts of metamorphic basement. Expedition 398 scientists have been working around the clock to collect whole-round, section-half, and discrete sample data to better understand the lithology, biostratigraphy, paleomagnetism, geochemistry, and physical properties of the Hellenic arc. As the expedition continues into its second month, cores from new locations will provide additional information to help us interpret the history of the Aegean basin and reveal the future behaviors of its marine volcanoes.

BELOW: Acacia Clark (Sedimentologist/Volcanologist, University of Tasmania, Australia) says hi while describing cores (Credit: Nick Logan, IODP JRSO). RIGHT: William Rhinehart (Operations Superintendent, IODP JRSO) examines the new drill bit before coring (Credit: Steffen Kutterolf, IODP JRSO).





From the field... A perspective from ACG student Kaleigh Young

written by Kaleigh Young (IODP / ACG)



Kaleigh teaches visitors about the local geology (Credit: Carol Cotterill, USSSP).

My name is Kaleigh Young and I'm a student at the American College of Greece in Athens (ACG). Interning with IODP was a truly unforgettable learning experience.

I applied for the IODP Santorini Internship Program because throughout my travels around the world and especially to Iceland, I have developed a deep interest in the ocean and its history, as well as volcanoes and volcanic activity. I knew the internship would give me the opportunity to learn from the scientists and expand my knowledge of the earth.

Throughout the week-long program my fellow students and I assisted in teaching the school children and older residents of Santorini about the upcoming *JOIDES Resolution* Expedition. Hundreds of children came in each day, and we answered all their questions about ocean drilling, volcanoes, and their home island of Santorini. The kids were enthusiastic to say the least about the exhibition, and many stayed behind afterwards to learn more. Anna (another ACG student) and I had a blast running a game where kids had to guess which part of the boat goes where on the large inflatable JOIDES Resolution. The floor map with all the drilling points was a huge hit. People young and old were captivated by the number of scientific findings they had never heard about. Running the exhibition was a lot of work, but incredibly rewarding.

We also had the pleasure of learning from Susan and Carol (outreach officers for the US Science Support Program) about their work, and Tim Druitt (Co-Chief Scientist on IODP Expedition 398) took us on a



Before the opening of the exhibition, interns set out neat piles of pamphlets to teach visitors about the science of Expedition 398: Hellenic Arc Volcanic Field (Credit: Kaleigh Young, IODP ACG).



LEFT: ACG students out in the field with Co-Chief Scientist Tim Druitt (Credit: Susan Schnur, IODP USSSP). RIGHT: ACG students posing at the end of a long week! From left to right: Anna-Nicole Fudge, Kaleigh Young, Sofia Gee, Ioanne Pezar, Rhylin Lofton and Taylor Lindeman (Credit: Carol Cotterill, IODP USSSP).

geological walk around the edge of the Caldera. These talks had us better equipped for questions the locals asked. It was fascinating to learn about the different career paths that may be available to us in the future, and the variety of skills and professions required to run an expedition.

I was so lucky to be able to document the exhibition through film and pictures, all the while learning about the importance of professional communication and organization when it comes to running an exhibition. Most importantly, it was the time spent with my fellow staff members and interns that taught me the most. I learned the importance of collaboration in any workplace, and that enthusiasm for your work is vital to the success of it.

Getting the chance to educate thousands about the program and ocean drilling while expanding my own knowledge was such an amazing experience. I hope to work again soon with IODP and their fantastic staff.

ABOVE: Visiting students circle up to learn about IODP and scientific ocean drilling (Credit: Susan Schnur, IODP USSSP). RIGHT: Students enjoying different aspects of the exhibition (Credit: Kaleigh Young, IODP ACG).

In the repository... Expedition 397: Iberian Margin Paleoclimate

David Hodell and Fatima Abrantes, Expedition 397 Co-Chief Scientists

written by Amy Mayer (IODP / USSSP) and Maya Pincus (USSSP)

Coring for Climate Clues Sixty-one days. Four sites. Seventeen holes. Over 6,100 meters of sediment collected from below the ocean floor.

Expedition 397 scientists set sail from Lisbon in early October to collect sediments from four locations off the coast of Portugal. The Iberian Margin is unique in its accumulation of sediments at 10-20 cm per thousand years, ten times faster than other locations in the ocean. As demonstrated by earlier expeditions to the area, cores recovered from this region assist scientists in reconstructing a high-resolution record of Earth's climate in the past, which can be correlated to ice cores collected from Greenland and Antarctica to develop a global paleoclimate model. To date, our detailed climate record exists for the past 1.45 million years; new samples

A sudden burst of activity breaks out when colorful cores appear in the core lab after being split (Credit: Carlos Alvarez Zarikian, IODP JRSO).

collected during Expedition 397 extend this sediment archive through the Pliocene and into the Miocene (up to 5 million years before present).

Drilling was carried out through use of an advanced piston coring (APC) drill bit in soft sediments, and an extended core barrel (XCB) drill bit in more lithified sediments. Multiple holes were drilled at each site in an attempt to recover an uninterrupted stratigraphic record from the seafloor to the bottom of the deepest hole. The co-chief scientists requested, and were granted, permission to extend drilling by 50m to 550m at the second site when they realized that likely would get them beyond the Messinian Salinity Crisis. They were successful and now will have the opportunity to explore conditions before, during and after that event.

At all locations, sedimentary layers are diverse in terms of lithology and color. Nannofossil ooze and clay layers exhibit distinct color banding, with oozes ranging from pale beige to light brown and siliciclastic clays varying between dark brown, green, blue/gray, and red. Clays show moderate to heavy evidence of bioturbation. In some cas-es, interspersed sand beds are marked by sharp erosional bases. Biostratigraphy, paleomagnetism,

LEFT: Sedimentologist Emilia Salgueiro (IPMA, Portugal) uses the new GEODESC program to describe cores (Credit: Sandra Herrmann, IODP JRSO). RIGHT: More happy faces as the final core gets carried on the catwalk (Credit: Sandra Herrmann, IODP JRSO).

geochemistry, gamma ray attenuation, bulk density, and magnetic susceptibility analyses support the interpretation of lithology and chronology of the cores.

Expedition 397 also utilized the new core describing software GEODESC, which this expedition's sedimentologists took out for its maiden voyage. Among its benefits is that members of the team were able to meet virtually ahead of the cruise to draft custom templates, which they then tweaked during the first hole of the first site to best meet their needs. The scientists also had access to most of the program, which meant they could adjust it without needing to request that an IODP technician make the changes for them.

WOW There are many things that make ocean drilling science an awesome (in the literal sense) endeavor. A ship that is not even 200 meters long can send a tube over four kilometers long to the bottom of the ocean, drill into whatever material is found down there, and then retrieve 10-meter-long tubes of sediment and rock for scientists to analyze in a floating laboratory. Less than a century ago, this feat was unimaginable.

The JOIDES Resolution runs like a well-oiled machine (because it is), but that does not mean that things always go according to plan. Several hours of Expedition 397 operational time were lost to waiting on weather ("WOW-ing"), as vertical ocean movement exceeded the ship's ability to compensate for heave. In these periods of suspended drilling, scientists continued shipboard analyses in their lab teams.

An additional challenge was the inconsistent internet connection. While drilling operations are largely unaffected by scientists' ability to communicate with the outside world, collaboration with parties onshore and outreach activities were twice disrupted for more than 12 hours.

Credit: Sandra Herrmann, IODP JRSO

LEFT: Jiawang Wu and Xiaolei Pang connect with China during a ship-to-shore event that reached over 3.5 million people (Credit: Amy Mayer, IODP JRSO). RIGHT: High school students in Portugal work together to determine the ages of sedimentary layers in a core by identifying micro- and nannofossils (Credit: Maya Pincus, IODP JRSO).

Outreach Through a creative multimodal campaign, the dynamic onshore/offshore outreach duo of Expedition 397 brought ocean drilling science into the lives of an expansive audience. Following an initial port call in Lisbon, the onshore outreach officer engaged students in the science of Expedition 397 through a series of in-person visits to schools and virtual webinars for educators. Over ten days, more than one thousand students, ranging in age from six to seventeen years old, participated in activities that introduced them to the process of ocean drilling and engaged them in hands-on scientific investigations. Direct conversations and follow-up surveys indicate that these events inspired a new interest in science for many students. Several teachers reflected on the power of an in-person experience, allowing their students to make personal connections with previously abstract scientific concepts.

The offshore outreach officer worked around the clock to reach an ever-widening virtual audience. Sixtyeight ship-to-shore broadcasts reached over 3.5 million people in 13 countries. Posts were regularly published to Twitter, Instagram, Facebook, and the JOIDES Resolution website, showcasing expedition science and life at sea through photography, short- and long-form writing, and memes. Twice a week, new audiogram posts highlighted the role of storytelling in scientific discovery; in each two-minute audio track a different Expedition 397 scientist speaks to listeners about their research and personal path to a career in science. Audiograms were also posted in Chinese, German, Japanese, Portuguese, and Spanish.

ABOVE: Bryce Mitsunaga (Organic Geochemist, Brown University, USA) explains what fossils are while Amy Mayer (Outreach Officer, USA) streams the video back to shore. (Credit: Sandra Herrmann, IODP JRSO).

RIGHT: Primary school students in Portugal work together to identify rock layers in a core to tell a story about Earth's past (Credit: Maya Pincus, IODP JRSO).

Santorini Exhibition Video

FEATURED VIDEO

Six students from the American College of Greece, including Kayleigh Young from this issue's *From the Field* article, helped us talk to visitors at the Santorini Exhibition. See the video that Kaleigh made about her experience here!

- U.S. Advisory Committee for Scientific Ocean Drilling February 7-9, 2023; Monterey, CA, USA
- Gulf of Papua Workshop March 15-17, 2023 Biosphere 2 Oracle, AZ, USA
- European Geophysical Union 2023 General Assembly
 23-28 April 2023
 Vienna, Austria

SCI COMM RESOURCE OF THE MONTH This two-part activity is designed to introduce young students to the basic principles that scientists aboard the JOIDES Resolution apply to interpret the cores they collect from the ocean floor. In Station 1, students learn how paleontologists identify fossils to determine the ages of different layers of sediments and rock in a core. In Station 2, students learn how different ocean environments lead to the appearance of different types of sediments and rock within a core.

Cores for Kids

<mark>Spotlight on...</mark> Dr. Huai-Hsuan May Huang

written by Maya Pincus (USSSP)

The 2050 Science Framework for Exploring Earth by Scientific Ocean Drilling emphasizes the interconnectedness of Earth systems and processes, and no one exemplifies that more in their research than IODP scientist Huai-Hsuan May Huang. May applies ostracod (a group of microscopic crustaceans) micropaleontology to analyze biodiversity, biogeography, and geochemistry. Her research supports our understanding of past environmental changes, processes of species distribution, and the vulnerability of marine organisms to extreme warmth and oceanic deoxygenation.

May first sailed on the *JOIDES Resolution* as part of Expedition 371: Tasman Frontier Subduction Initiation and Paleogene Climate, and recently disembarked from Expedition 397: Iberian Margin Paleoclimate. Of her time at sea, she says "I work with the kindest scientists from all over the world in the fields of paleobiology, paleoceanography, and paleoclimatology on these projects. I see collaboration between excellent scientists in these fields resulting in the diversity of research questions and approaches." Through these international connections, she is making critical contributions to predicting climate scenarios and ecosystem responses based on fossil records, paleoenvironmental reconstructions, and climate modeling.

As an accomplished early career scientist, May does not limit herself to research; she sees the value of outreach as a tool to increase public access to science. She mentors high school and undergraduate students; organizes seminars, clubs, and other geology-related events; guest-lectures at universities around the world; and volunteers for research institutions and expeditions whenever she can.

May recently joined Princeton University as a postdoctoral research associate, where she will continue her investigations in climate science.

May stands next to a sediment core from the Iberian margin during Expedition 391. (Credit: Huai-Hsuan May Huang, IODP JRSO).

How to... Use the MerlinOne IODP Digital Photo Archive

written by Jennifer Hertzberg (IODP / JRSO) and Maya Pincus (USSSP)

Are you looking for high quality images of ocean sediment and rock cores, the JOIDES Resolution, scientists doing research at sea, drill ship operations, or some amazing sunsets? Or maybe you sailed on the JOIDES Resolution and are hoping to relive those memories through photos from your expedition? Look no further than IODP's new digital photo archive, MerlinOne!

With MerlinOne, you can browse and search through an extensive archive. Available content extends from the current expedition as far back as the Deep Sea Drilling Project, and ranges from photos and videos at sea to user guides and policies. Follow the simple steps below to find what you need from MerlinOne:

• Step 1: Navigate to the MerlinOne website (<u>https://iodp.merlinone.net/MX/Profiles/en/landing/</u>)

• Step 2: Click "Click here for guest access"

- Step 3: Look for images using the tools on the left side of the page
 - Use the drop-down menus to browse the curated collections
 - Use the search bar to find specific content based on keywords
 - Use the icons at the top to download or print images
- **Step 4:** When using content from MerlinOne, make sure to credit the original author and source. Read the JRSO licensing statement here: <u>http://iodp.tamu.edu/about/copyright.html</u>

For questions or more information, contact the IODP JRSO Digital Asset Management Administrator Dr. Jennifer Hertzberg (<u>DAM@iodp.tamu.edu</u>).

Photo montage... CELEBRATION!

Creative COREner

Editor's Note: Expedition 391 may go down in history as one of the most challenging expeditions. Originally scheduled for December 2020, it was postponed to December 2021 by the COVID-19 pandemic. After what seemed like a successful 7-day quarantine in Cape Town, we were forced to return to port soon after reaching our first site due an outbreak of the virus on board. Stuck at the dock for more than two weeks with no cores to study, we were left to seek out creative ways to pass the time.

The poem below was submitted by Expedition 391 volcanologist and sedimentologist Dr. Mike Widdowson (School of Environmental Sciences, University of Hull). About his piece, Mike says "the first verses are directly taken from John Masefield's classic poem 'Cargoes'. It's one that my dad used to quote, along with 'High Flight', and one or two others I can't quite now remember. Anyway, the last two verses were indeed mine - a la Masefield style... with obvious apologies to Masefield.."

Quinquireme of Nineveh from distant Ophir, Rowing home to haven in sunny Palestine, With a cargo of ivory, And apes and peacocks, Sandalwood, cedarwood, and sweet white wine.

Stately Spanish galleon coming from the Isthmus, Dipping through the Tropics by the palm-green shores, With a cargo of diamonds, Emeralds, amythysts, Topazes, and cinnamon, and gold moidores.

Dirty British coaster with a salt-caked smoke stack, Butting through the Channel in the mad March days, With a cargo of Tyne coal, Road-rails, pig-lead, Firewood, iron-ware, and cheap tin trays. Hulking rust-grey freighter fighting Atlantic waves Engines thundering madly into Nor'-westering foam With a cargo of kitchen-ware, consumables Four-wheel drives, and motorbikes, Bound for forecourts of USA and Europe, shopping malls and homes.

Drill-ship 'Resolution' oceans deep to yet explore, Steaming slowly back from Walvis, to a sunny foreign shore, With a cargo of drill pipe, drill bits, logging tools, technocrats and scientists, and cold rock core (we

hope!)

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 past themes! March is Women's History Month, so for the next issue please send in your photos that illustrate the theme **Women of Scientific Ocean Drilling**.
- **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 May 20, 2023 to be featured in next month's newsletter.

See you next month!