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Expedition 402: Tyrrhenian Continent-Ocean Transition

Nevio Zitellini and Alberto Malinverno

Expedition 402 Co-Chief Scientists

Emily Estes, Expedition Project Manager

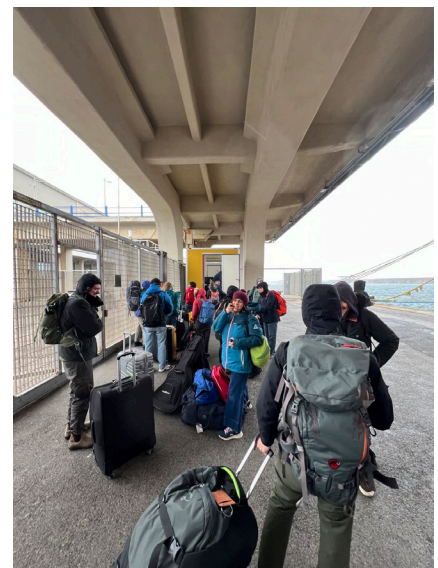
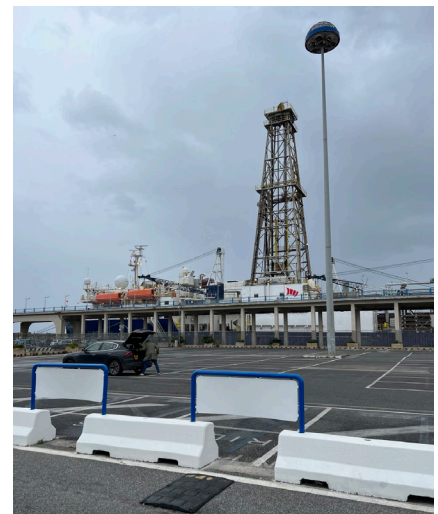
written by Tessa Peixoto and Larkin Bohn, Expedition 402 Onboard Outreach Officers

It was windy and a bit drizzly when the Expedition 402 science party stepped off a bus at the cruise port to start boarding the *JOIDES Resolution*. For veterans and rookies alike, it was an awesome sight to see the ship after months of Zoom meetings, and emails preparing us for the two-month-long expedition. We finally were seeing each other in person and on the ship!

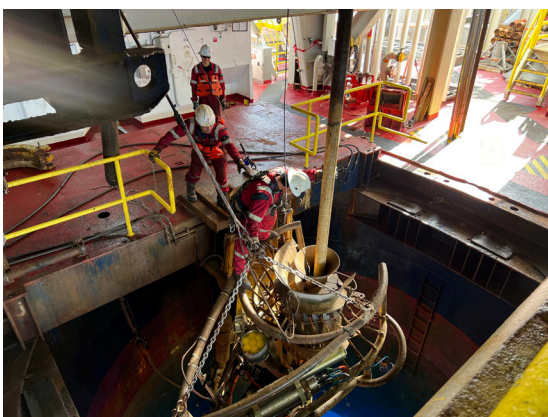
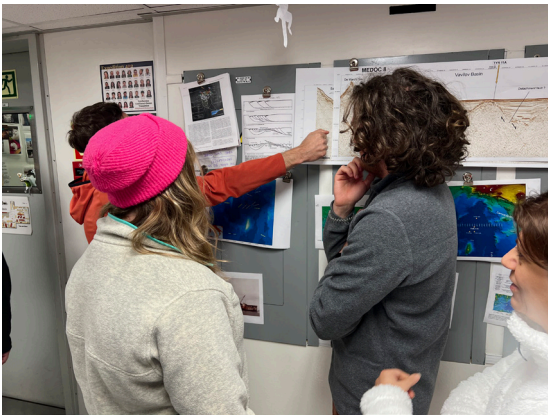
The 402 scientists unpacked and immediately went into onboarding meetings where we learned how to access our ship-board emails, connected to the ship's wifi, and were trained in laboratory instrumentation and safety. You could feel the energy coming off everyone as our excitement and anticipation to get started grew.

Expedition 402 set out to build a better understanding surrounding the exposed mantle that was recovered during [ODP Leg 107](#), and interpret what happened as the crust was stretched and the mantle below it was exposed to the seafloor during the opening of the Tyrrhenian Sea. There were three main locations that we wanted to drill: the Campania terrace, the Cornaglia terrace, and the Vavilov Basin. Before we could get any mantle rocks or sediment cores, we had to build the drill string by connecting sections of drill pipe, which, depending on the site, could be as short as 2700m or as long as 3800m (the water depth at these locations). The incredibly talented Siem Offshore crew seamlessly assembled and disassembled the drill string every time we moved onto another drilling site.

Our first drilling site provided a rough start, where the large amount of material from regional volcanic eruptions in sediment made operations more challenging and required some modifications to our original plan. One change was that we needed to install reentry cones and



TOP: The *JOIDES Resolution* docked in the port of Naples (Credit: Tessa Peixoto & IODP). BOTTOM: Expedition 402 scientists waiting to board the ship (Credit: Tessa Peixoto & IODP).



TOP: Scientists analyze seismic data for one of the drill sites (Credit: Tessa Peixoto & IODP). MIDDLE: Excitement fills the lab stack every time a new core is laid out on the catwalk (Credit: Tessa Peixoto & IODP). BOTTOM: Crew members prepare to release the Vibration Isolated Television frame down the drill string (Credit: Tessa Peixoto & IODP).

casing. These special devices, typically 2.3m tall and 4m in diameter and painted with a bull's eye, sit on the seafloor and help the crew re-enter the same hole multiple times. They also help stabilize the borehole so that it does not collapse in on itself over time like boreholes normally do. How does the crew find this cone with a drill string over two kilometers long? Outstanding question! With the help of a Vibration Isolated Television frame that holds an underwater camera that wraps around the drill string and is capable of transmitting the footage in real time from the deep all the way up to the skilled operators on the vessel. The Siem crew may be the ones in charge of the action, but the entire ship can enjoy the show from monitors located on every deck! That's right, while the drillers and captain are working together to carefully line up the end of the drill string with the cone, thanks to the dynamic positioning system, the entire ship is on the edge of their seats watching! The dynamic positioning system includes an impressive set of twelve propellers, all working together to hold the ship in place despite the winds and ocean currents that can move the vessel away from the target site.

One thing you can depend on is that fieldwork is full of surprises. Seismic surveys are incredibly useful to give us an estimate of how deep basement rock lies under the sediment, but it is only when you start to drill that the real depth is determined. Sometimes we found the basement to be more than 100m deeper than predicted. Due to the difference of basement depths and core recovery, Expedition 402 had its work cut out for the sedimentologists, while the petrologists waited patiently for their time to shine. The day we retrieved our first core of mantle rocks there were [applause and literal cheers of joy](#) on the core deck.

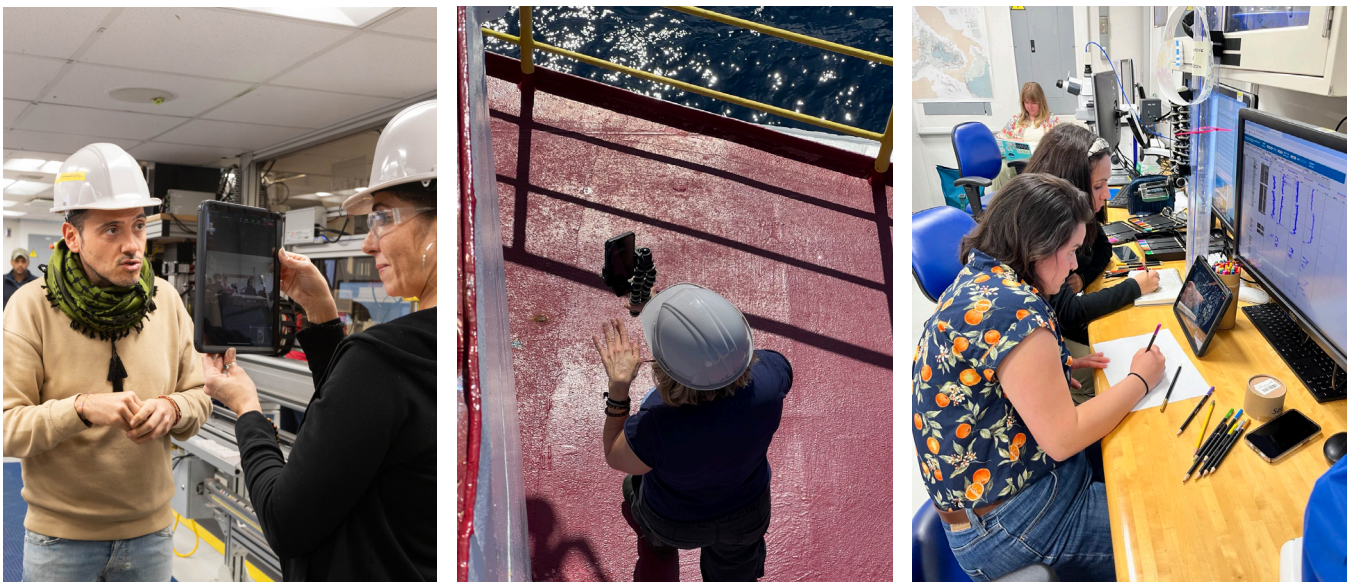
As the expedition carried on, cheers of joy turned to curiosity and hard work from the petrologists. Throughout the expedition, we successfully cored at all three locations, were even able to return to one of the sites to get more core. This gave us an opportunity to obtain more basement samples. There is not much downtime on the ship, especially when each site was within a few hours of each other. The longest break we ever had between cores was the twelve hours it took to build the drill string, or the 2-8 hours it took to move

between our sites. During that transit time, one of the physical properties scientists studied data generated by the sonar system, an instrument the ship utilizes while navigating to map out the seafloor. Scientists are always looking for an additional piece of data to solve the puzzle. By comparing the new data and samples collected during Expedition 402 with the seismic data collected a few years earlier, scientists can better understand similarities and differences among the drill sites and answer the main question, what happened when the Tyrrhenian sea opened.

Outreach Tessa Peixoto and Larkin Bohn sailed as Expedition 402 Onboard Outreach Officers. By the end of the expedition Larkin and Tessa had hosted 104 ship-to-shore broadcasts, providing up to four tours per day for international audiences, some featuring scientists speaking other languages. Forty-eight of the 104 tours were delivered in Italian, to the point that Tessa now falls asleep to the phrase *Ci senti?* which means “Do you hear us?” in Italian. The reason we were able to give tours so frequently during Expedition 402 is due to the enthusiasm of the science party. This dedicated group loved to share their experiences with the audience, and the Outreach Officers were thrilled to facilitate such conversations. Word of mouth is a powerful factor in the number of broadcasts delivered. In one case, a broadcast scheduled by an Italian teacher ended up having over 200 students join, because other teachers in the school wanted to participate as well!

This expedition, broadcasts were not just for virtual audiences abroad, but were held for some of the ship crew! These were a very different kind of tour, since the *JOIDES Resolution* staff know the ship better than the science party. The “tour” was more of a Q&A style chat where Entier staff shared real life experiences with earthquakes as we discussed plate tectonics, and SIEM staff connected the dots when it came to why one hole can be harder to drill than another after seeing the samples up close!

One of Larkin’s goals was to showcase the scientists’ passion and turn the notion that science is stuffy or



LEFT: Larkin teamed up with Italian observer Alessio Sanfilippo to give ship-to-shore tours to students in Italy (Credit: Tiffany Liao & IODP JRSO). MIDDLE: Larkin also hosted several popular LIVES on Instagram (Credit: Tessa Peixoto & IODP). RIGHT: Tessa and metamorphic petrologist Eirini Poulaki led sketching workshops to teach viewers about the interpretation of thin sections (Credit: Tessa Peixoto & IODP).



LEFT: Scientists hosted some crewmembers in the core lab to make connections between drilling and the samples recovered (Credit: Tessa Peixoto & IODP). RIGHT: The new year's ball was dropped for the last time (Credit: Tessa Peixoto & IODP).

sterile upside down, proving it is anything but that. One way she did that was to conduct six LIVES on Instagram to present an immediate look into daily life and provide a “behind the scenes” feel to the public. She also made a [moving, longform video for YouTube](#), featuring interviews with scientists as they reflected on their careers and the importance of the *JOIDES Resolution*.

At the same time Tessa’s goal was to combine science and art as a way to make science more approachable and accessible to the public. Tessa conducted two Science & Art broadcasts in which she and the metamorphic petrologist, Eirini Poulaki, guided viewers through drawing a thin section while discussing why those key features are important for scientific interpretation.

With all the joy and excitement of Expedition 402 came the understanding that it would be the penultimate expedition aboard the *JOIDES Resolution* within the International Ocean Discovery Program. Despite uncertainty surrounding the next phase of U.S.-based scientific ocean drilling, every single person involved in the expedition gave their all to ensure that the quality of work never wavered. As normal operations continued on, teams behind the scenes identified what on the ship could be removed before the last expedition, such as the New Year’s ball and the radioisotope van (affectionately known as the Rad Van).

But there is still one more expedition to look forward to! Be sure to follow the *JOIDES Resolution* on social media ([X](#), [Instagram](#), and [Facebook](#)) to stay involved and support the scientific community as we strive to continue ocean science research!



The Expedition 402 group photo (Credit: Tiffany Liao & IODP JRSO).