

IODP Expedition 401: Mediterranean–Atlantic Gateway Exchange

Week 1 Report (10–16 December 2023)

Operations

International Ocean Discovery Program (IODP) Expedition 401, Mediterranean–Atlantic Gateway Exchange, began at 0800 h on 10 December 2023 with the vessel docked at Berth 1, Damen Shipyard in Amsterdam, Netherlands. The vessel had been at Damen Shipyard since 24 October 2023 for maintenance, including in dry dock from 3 to 27 November, following a transit from Reykjavík, Iceland (this period collectively named Expedition 400T). Given that no science expedition immediately preceded Expedition 401, there was no freight to be offloaded during the Expedition 401 port call, and the port call duration was shortened from the usual five days to three days.

On 11 December, the IODP science party, JRSO staff, and Siem Offshore crew boarded. Remaining Expedition 400T crew/staff departed on 11 December or earlier, apart from two JRSO staff who would sail on Expedition 400. Gray water was offloaded and potable water taken on, and fresh food was loaded.

On 12 December, the final inbound IODP air freight shipment arrived in the afternoon and was loaded on board. The shipment included sheaves for the Schlumberger heave compensator (which are essential for downhole wireline logging) and JRSO staff personal boxes. An incoming shipment of Schlumberger porosity (Accelerator Porosity Sonde [APS]) tools had been anticipated to arrive in time for the expedition, but it was held up in United States customs. It was decided not to wait for this shipment, which would have delayed the vessel's departure from Amsterdam.

On 13 December, the vessel departed Amsterdam. The pilot came aboard at 0640 h and the last line was clear at 0718 h, marking the start of the transit to proposed Site ALM-03B (Site U1609). After passing through the Netherlands countryside on the North Sea Canal, the vessel entered the IJmuiden sea lock at 0936 h and exited at 1002 h, to enter the North Sea. The pilot left at 1054 h and we started the sea passage.

During the transit, the vessel's master clock was set back 1 h at 0200 h on 15 December to UTC + 0 h. This placed the vessel 6 h ahead of the IODP JRSO office in College Station, Texas. The week ended at midnight on 16 December with the vessel in transit to proposed Site ALM-03B (Site U1609), with 204 nmi of the 1202 nmi voyage remaining.

COVID mitigation

The current JRSO COVID mitigation protocol includes antigen testing for all personnel on the first full day aboard (12 December) and four days after leaving port (scheduled for 17 December). One of the JRSO staff tested positive before leaving the hotel and boarded on 11 December. The 12 December round of COVID testing resulted in positive tests for two more JRSO staff and three of the crew. All of them isolated in cabins aboard, following the COVID protocol.

Science Objectives

Marine gateways play a critical role in the exchange of water, heat, salt, and nutrients between basins. Changes in gateway geometry significantly alter both the pattern of global ocean circulation and climate. Over Miocene to recent times, the Mediterranean–Atlantic gateway has evolved from a wide-open seaway to two narrow corridors, and finally into the Gibraltar Strait, where today the overflow of dense water is among the largest in the global ocean. This restriction and closure of connections resulted in extreme salinity fluctuations in the Mediterranean, leading to the formation of the Messinian Salinity Crisis salt giant (MSC). IODP Expedition 401 will core and log two or three sites on the Atlantic side and one site on the Mediterranean side of the Gibraltar Strait. Expedition 401 forms part of the wider Land-2-Sea drilling project, IMAGE (Investigating Miocene Mediterranean–Atlantic Gateway Exchange), which also includes planned onshore ICDP (International Continental Drilling Project) sites in Morocco and Spain. The aim is to recover and log sediments that document when distinctive Mediterranean overflow began; reconstruct exchange before, during, and after the MSC; and test our quantitative understanding of the behavior of ocean plumes during the most extreme exchange in Earth’s history.

Science Results

The Expedition 401 science party includes scientists from ten IODP member countries, two scientists who also have observer roles for Portugal and Morocco, and two Outreach Officers from the U.S. The Captain, Ship’s Doctor, and Assistant Laboratory Officers gave ship orientation, ship safety, and life-at-sea presentations to the science party. The Co-Chief Scientists presented the background and aims of the expedition and the scientists each presented their research plans for the expedition. JRSO staff introduced the science party to IODP procedures in operations, curation, and publications, and they guided individual laboratory groups through safety and procedures in the laboratories. All groups worked on their methods sections for the

expedition *Proceedings* volume that will be published at the end of the sample and data moratorium in summer 2025.

Lithostratigraphy

The Lithostratigraphy team received training from technical staff on the GEODESC core description software. Because Expedition 401 sites are close in location and have objectives in common with Expeditions 339 (Mediterranean Outflow Water) and 397 (Iberian Margin Paleoclimate), the initial GEODESC templates were based on templates and descriptions from those expeditions. Description of contourites and turbidites is key to understanding bottom water flows (including Mediterranean outflow), so the lithostratigraphers will make detailed sedimentological logs including these features for each hole. The lithostratigraphers also received training on the X-ray image logger, the Section Half Imaging Logger (SHIL), and the Section Half Multisensor Logger (SHMSL).

Biostratigraphy

The scientists completed orientation and training in core flow, description software (GEODESC), microscopes, and imaging.

Paleomagnetism

The scientists were introduced to the superconducting rock magnetometer (SRM) and its control software. The technician introduced the scientists to equipment and instruments for the measurement of discrete samples, including the spinner magnetometer, magnetic susceptibility (MS) (including anisotropy), and the alternating field (AF) demagnetizer.

Geochemistry

The geochemists trained in the use of laboratory equipment and software, including sample collection, preparation, and analytical methods, and they planned for shipboard sampling of interstitial water (IW), headspace gas, and sediments.

Physical Properties and Downhole Measurements

The physical properties and logging team received training on the Whole-Round Multisensor Logger (WRMSL), Natural Gamma Radiation Logger (NGRL), the X-ray image logger, thermal conductivity instrument, the *P*-wave velocity caliper, and moisture and density (MAD) procedures.

Outreach

Week 1 Outreach consisted of social media. Blogs on the *JOIDES Resolution* web page and ship-to-shore calls will start next week.

Posts on the *JOIDES Resolution* accounts included 11 posts on [X](#), seven reposts of scientists' posts on X, ten [Facebook](#) posts, nine [Instagram](#) posts, 79 Instagram and Facebook stories (these primarily disappear after 24 h, but are saved in a little highlight Reel on the *JOIDES Resolution* Instagram profile forever), six Threads posts, and two YouTube videos.

We also posted three original posts and eight reposts on the IMMAGE X account. One Outreach Officer posted some videos on her personal social media account and shared them on the *JOIDES Resolution* account.

Highlights from the posts this past week included:

- Video on swells and roll featuring the Expedition Project Manager
<https://www.instagram.com/p/C04lcL0pnsj/>
- Post on the whale sighting
<https://www.facebook.com/joidesresolution/posts/pfbid0Wg6a1KCJNk84XWm9BPmUVEhvqyNogJas59jKefF2Dcq3SF8219fvBKFUqXuExuspl>
- Instagram stories so far
<https://www.instagram.com/stories/highlights/17859346152035797/>

To summarize the reach and impact of these posts:

- We reached tens of thousands of different people with Expedition 401 kickoff content across platforms.
- Facebook is the platform on which the *JOIDES Resolution* has the largest following. There alone we reached more than 30,000 people.
- Across all platforms, our videos received more than 50,000 views in total.
- People are engaging and interacting with the content as well. Many people are liking and commenting and cheering on the expedition. Scientists who have sailed previously are sharing some of their memories in the comments.

Our piece of content with the biggest reach so far has been the [kickoff video](#) posted before the expedition on the Outreach Officer's personal account on Threads, directing people to follow the *JOIDES Resolution* accounts. It resulted in many people asking questions and learning about Expedition 401. More than 1,200 different people liked the post, meaning many more than that saw it. The *JOIDES Resolution* account gained

hundreds of followers from it. The hope is to continue to build momentum to draw more people in to follow the story of Expedition 401.

Technical Support and HSE Activities

JRSO technical staff prepared for Expedition 401 and worked on ongoing projects. They conducted training for life at sea, laboratory safety tour, ship safety, curation, IT, and other training.

Laboratory Activities

- The chill water for the Haskris Cryomech Compressor at the SRM station was filled with mud and/or rust. It clogged up the filter and heat exchanger in 2 h, resulting in a rapid temperature increase in the compressor. After discussion with Siem Offshore, an engineer installed a bag filter in the upper line. We removed the filter at the SRM side and used a canister as a sediment trap. We also installed a bypass line so we can clean out the canister more easily. The Haskris has now been able to hold a steady temperature around 69°F for over 72 h (and counting).
- Nitrogen pressure dropped to 40 psi in the Chemistry Laboratory, so we replaced the first three filters before the N₂ generator intake. Nitrogen pressure is now back to a steady 80 psi.
- We set up Niskin bottles for surface seawater collection for a scientist when we arrive at each site.
- We turned on the Echosounder, which had been refurbished in Amsterdam, after exiting the English Channel. The 3.5 kHz frequency now works well.
- Received freight.

IT Support Activities

- Conducted onboarding of scientists and staff; connected their laptop computers to the *JOIDES Resolution* intranet and the internet.
- Applied December updates for Windows and Linux systems.
- Assisted Texas A&M University IT to fix an issue with the email server leaving users unable to log in and the Marine Computer Specialists (MCS) unable to manage email accounts.
- Troubleshooting Video Display Units (VDU) streaming issues for the core and fo'c's'le units.
- Addressing other minor issues stemming from dry dock/tie-up activities.

Developer Activities

- Assisted with ongoing X-Ray Linescan Logger (XSCAN) work with shore personnel.
- Fixed an issue with XSCAN (and potentially other tracks), where after a Windows update, IMS was being launched in 32-bit LabVIEW rather than 64-bit. All shortcuts now explicitly launch the proper version of LabVIEW so this will not happen again.
- Helped Publications create a template in LIMS-2-Excel for downloading X-ray images.

HSE Activities

- The emergency shower and eye wash stations were tested.
- COVID tests were conducted on 12 December.
 - Three IODP, two Entier, and two Siem Offshore personnel tested positive on or before 12 December. All seven are to be free from isolation on 17 December.
- COPE COVID-19 mitigation protocol is being followed.