IODP Expedition 391: Walvis Ridge Hotspot

Week 2 Report (12–18 December 2021)

The second week of the International Ocean Discovery Program (IODP) Expedition 391, Walvis Ridge Hotspot, included the passage to the first expedition site (proposed Site CT-04A), the initiation and suspension of operations at that site, and the beginning of the transit back to Cape Town, South Africa, due to an emerging health situation. All times in this report are in ship local time (UTC + 2 h).

Operations

This week began while in transit to proposed primary Site CT-04A, located in the Guyot Province of the Tristan-Gough-Walvis Ridge volcanic hotspot track. During the sea passage, we held the first weekly fire and lifeboat safety drill. After the 973 nmi voyage from Cape Town, South Africa, averaging 11.1 kt, the vessel arrived at proposed Site CT-04A at 0818 h on 15 December 2021. The thrusters were lowered and secured. The rig floor was cleared for operations to start assembling the rotary core barrel (RCB) bottom-hole assembly (BHA) when we switched to full dynamic positioning (DP) mode at 0845 h. The rig floor crew began making up the outer core barrel. Components on the inner core barrels were inspected and replaced and both core barrels were spaced out in the outer core barrel. At 1215 h, the captain informed the rig floor that operations were being suspended because of an emergent medical issue. During the last day of sea passage to proposed Site CT-04A, suspected cases of COVID-19 had been identified among the ship's crew. With several personnel isolated, which limited our ability to continue operations, the decision was made to return to Cape Town. We then rigged down, the core barrels were secured, and the components of the outer core barrel were laid out and secured. All staged drill collars were moved back to the drill collar racks. At 1300 h, the drill floor was secured for transit. In the meantime, the engine department had started the replacement of one of the propulsion motor cooling fans. This was completed at 1445 h. The thrusters were raised and secured, and the switch from DP to cruise mode was implemented. The vessel was underway to Cape Town at 1506 h on 15 December. At the end of this week, we completed 757 nmi of the 977 nmi return passage to Cape Town. The average speed of the transit was 9.4 kt through choppy seas. During the final day of this week, the ship reduced its speed to arrive at the port of Cape Town at 0700 h on 20 December 2021. Antigen testing for COVID-19 continued during the transit, and by 2400 h on 18 December, there were several additional cases recorded among the crew, requiring us to make shore-based quarantine arrangements to limit the spread of the virus on board. None of the scientists or JRSO personnel tested positive.

Science Results

Scientists spent the week continuing laboratory preparations and completing their methods chapters. They also received training on IODP core sampling procedures. Additionally, the whole-round sediment core sampling plan, which will be implemented on the core receiving platform, was discussed and drafted for proposed Site CT-04A. A towed magnetometer was deployed to measure seafloor magnetic data while passaging through international waters during the transits. Shipboard COVID-19 mitigation protocols continued to be followed.

Core Description

During the transit to the first site and the transit back to Cape Town, the core description team familiarized itself with Core Laboratory instruments and received training on those instruments and associated techniques. Training included sample techniques on two varieties of "practice" sediment core, an overview of Section Half Imaging Logger (SHIL) and Section Half Multisensor Logger (SHMSL) instruments, portable X-ray fluorescence spectrometer (pXRF) safety and operation training, and taking photomicrographs with various petrographic and stereoscopic microscopes. The handheld pXRF was calibrated using international standards and working curves were developed for the elements of interest. A first draft of the Methods chapter was completed and revised by the team. The team also established templates for lithologic classification that will be used for describing macroscopic and microscopic core information in the DESClogik core description software.

Biostratigraphy

The micropaleontologists continued to familiarize themselves with laboratory preparation as well as the transmitted-light and stereoscopic microscopes. The micropaleontology team received an introductory training from the technical staff on how to use the Spot RTS system with the IODP Image Capture and related Spot commercial software to image microfossils. The Methods chapter was revised and resubmitted for approval. Both shifts discussed and agreed on major planktonic foraminifera and calcareous nannofossil biostratigraphic events for implementation in the DESClogik software for this expedition.

Paleomagnetism

During this week, the paleomagnetism team received training on the laboratory instruments and their corresponding software tools that will be used during the expedition: the superconducting rock magnetometer (SRM), the JR6 spinner magnetometer, the DTech alternating field (AF) demagnetizer, and the demagnetizing oven. The team carried out a complete thermal demagnetization experiment on 18 minicores that they brought on board for training with the equipment (oven and JR6 magnetometer) during transit. Samples were stepwise demagnetized to 600°C. Moreover, the team received training on sediment sampling with paleomagnetic plastic cubes. These cubes (dummy samples) were also used to get more training with the DTech AF demagnetizer and the JR6 magnetometer. Concrete half-core sections were run through the SRM

to produce test data and practice operation. This SRM test data was used to further develop a Python-based graphical interface (originally developed by JRSO technical staff) to produce downhole plots of magnetic intensity and direction parameters from SRM auxiliary files and principal component analysis (PCA) results from the PmagPy software.

Geochemistry

The interstitial water (IW) and organic geochemists familiarized themselves with the laboratory instruments, sampling supplies, and protocols. They finalized a draft of the Methods chapter covering protocols to be used during the expedition. The geochemists were introduced to the Rhizon sampling method for IW extraction in the top part of sediments and were given further instructions on sediment sampling methods. With help from chemistry technicians, they finalized a protocol for sampling headspace gas, IW, and microbiological samples for postcruise personal research. Sampling strategies for personal IW samples were also discussed. The chemists also prepared sampling supplies for upcoming shipboard analyses and personal sampling.

The igneous geochemistry team checked the availability of igneous rock powder reference materials, decided which reference material should be used, and finalized the Methods chapter draft. They discussed the sampling strategy with the core description team and performed a preliminary experiment using reference materials (BCR-2 and BHVO-2) for an additional digestion method of chalcophile elements.

Physical Properties

While on transit, the Physical Properties team finalized instrument preparations and submitted the first Methods chapter draft. Each member of the team practiced running "play" core on each of the different instruments. For whole-round cores, this includes the Whole-Round Multisensor Logger (WRMSL), Natural Gamma Radiation Logger (NGRL), Thermal Conductivity Meter (TK04), and X-Ray Imager (XRI). For section-half cores, this includes the *P*-wave Gantry system (PWC Gantry), while moisture and density (MAD) tests were performed for discrete samples. The Physical Properties team worked closely with associated laboratory technicians to understand further the software capabilities for each method and acquired basic training on how to review and interpret the resulting datasets. The team also liaised with other shipboard scientific groups and determined a frequency of sampling plan, and a hierarchy of when different tests are to be performed on the sampled core material. Finally, the group held virtual meetings with corresponding shore-based science party members and discussed ways to achieve impactful workflow.

Outreach

This week, the Expedition 391 hosted six live broadcast events, reaching an audience of 667 people in three countries (USA, South Africa, and France). Ten posts were made on Twitter, leading to 17,435 impressions, 779 engagements, 224 likes, 39 retweets, and three replies.

Twitter engagement increased by 210% compared to the previous week. Seven posts were made on Facebook, reaching 12,954 people, and leading to 1,018 engagements, 384 reactions, 34 shares, and 10 comments. Facebook engagement increased by 191% compared to the preceding week. Four posts were made to Instagram after a technical issue with the social media managing platform Hootsuite was resolved. These Instagram posts reached 4,793 people, elicited 310 reactions, nine shares, and two comments. Instagram engagement increased by 142% compared to the first week of the expedition. One new blog post was written by a scientist for the *JOIDES Resolution* web page. Boosted by the onset of Expedition 391, website page views are up 12% compared to November.

Technical Support and HSE Activities

This week, JRSO technical staff focused on continued laboratory orientations for the science party and assistance with setting up the instruments. The technical staff also worked on several laboratory projects.

Laboratory Activities

- Deployed the towed magnetometer for transits.
- Prepared sample plans, laboratories, and instrumentation for coring operations.
- Conducted training sessions for scientists on instruments and sampling.
- Continued training sessions and practice for new JRSO staff in assigned laboratories.
- Performed physical counts of critical supplies and updated the inventory.
- Installed the new ZEISS Imager 2 microscope and are working on its configuration.
- A mechanism was designed, 3-D printed, and tested by the Siem Offshore Electrical Supervisor to trigger the release mechanism on the Niskin water sampling bottle mounted on the vibration isolated television (VIT) frame. The mechanism is attached to the beacon release module to be activated by the winch operator when directed.
- JRSO staff are working on projects including:
    - Designing and 3-D printing of components for projects;
    - Preparing the Radioisotope Laboratory Van for upcoming expeditions;
    - Updating user guides and other documentation;
    - Assisting with live ship-to-shore outreach broadcasts;
    - Evaluating 360-degree image uploader for possible changes;
    - Building a keyboard mount for the Malvern Panalytical AERIS X-ray diffractometer.

IT Support Activities

- The earlier part of the week was spent on initial Help Desk tasks, device setup, and training with new and regular expedition participants with their equipment.

- Installed DYMO® printer on personal computer in Core Tech Shop.
- Updated the SonicWall firewall software, the associated virtual private network (VPN) appliance, and an environment monitor software to their latest versions to mitigate a significant security vulnerability (allowing attackers to perform malicious coding remotely on a target computer) in a popular Java library service application (called "Log4j") that is used to log error messages in applications. We encountered configuration issues for the environment monitor software and work on a remedy is ongoing.
- IT personnel at the JRSO implemented Log4j prevention countermeasures by deploying the cloud-native, agent-based cybersecurity CrowdStrike sensor.
- Hewlett Packard M880 copier firmware was updated during Expedition 396T and changed screen functions. Therefore, we wrote up new instructions for users and demonstrated to various staff how to scan documents.
- OEMJR Oracle server was running out of disk space. The Marine Computer Specialists worked with personnel on shore to remediate the matter successfully.

Application Support Activities

- Cleaned up the database following beginning-of-expedition procedures.
- Implemented mitigation measures to prevent exploit of a security vulnerability in a widely used Java library service called "Log4j":
    - Scanned workstations, worked on the vulnerability security issue as suggested by IT personnel on shore, and removed the lower version of the Java log service library from those workstations running it.
    - Checked and found Java library files in the build box and cleaned these files.
    - Upgraded the Java log service library to version 2.16.0 in the DrillReport, followed by testing and deployment.

HSE Activities

- The safety shower and eye wash stations were tested.
- An abandon ship safety drill was held.