

## **IODP Expedition 396: Mid-Norwegian Continental Margin Magmatism**

### **Week 1 Report (6–14 August 2021)**

#### **Operations**

International Ocean Discovery Program (IODP) Expedition 396, Mid-Norwegian Continental Margin Magmatism, began with the first line ashore in Reykjavík, Iceland, at Berth 10 Scarfabakki at 0842 h (UTC + 0 h) on 6 August 2021. The ship cleared customs and immigration on arrival from Expedition 395C and began port call operations. The Expedition 396 Siem Offshore staff, JRSO staff, and scientific party boarded the *JOIDES Resolution* (JR) on the third day of port call, after completing a seven-day quarantine period in a local hotel following COVID-19 mitigation protocols established by the JR Science Operator for safe ship operations. These included two weeks of shelter-in-place period prior to travel, a pre-travel COVID-19 test, and a seven-day quarantine in a hotel in Reykjavík, with two additional COVID-19 tests, prior to boarding the vessel on 8 August. Expedition 396 is sailing with a reduced science party and JRSO staff and is the first IODP expedition to sail with a scientific team since the start of the COVID-19 pandemic.

During the hotel quarantine period, seven oncoming crew tested positive for COVID-19 and will remain quarantined until they recover. Additional personnel were sourced from the previous expedition to complete the ship's crew for Expedition 396.

Fresh food and catering consumables were loaded on board on 10 August. On 9 and 10 August, 1110 metric tons of marine gas oil, which was transported alongside the ship by two barges (one each day), were pumped on board. Fueling was completed at 1008 h on 10 August. The passage plan for the expedition was completed and arrangements were made with the agent, tugboats and harbor pilots for a departure at 1300 h on 11 August. After securing for sea, a pilot arrived on board at 1245 h and two port tugs, the *Haki* and the *Lemir*, arrived to assist with the departure. The mooring lines were released and pulled back on board with the last line being released at 1312 h. The vessel proceeded to the pilot station and the pilot departed the vessel at 1326 h after a 6 nmi transit. The vessel began its sea passage at 1400 h on 11 August 2021.

After the 803 nmi transit from Reykjavík, Iceland averaging 10.8 kt, the vessel arrived at the first expedition site, U1565 (proposed Site VMVM-20A), at 1530 h on 14 August. The thrusters were lowered and secured, and at 1600 h the drill floor was cleared for operations and we began Hole U1565A. On arrival at Site U1565, the rig crew made up the outer core barrel. The inner core barrels were spaced out in the outer core barrel and the bottom-hole assembly (BHA) was put together and lowered to 172.1 m below rigfloor (mbrf). At the end of the week the drill pipe was deployed to a depth of 1327 mbrf.

## **Science Objectives**

IODP Expedition 396 seeks to understand the nature, cause, and climate implications of excess magmatism during the northeast Atlantic continental breakup. Competing geodynamic end-member hypotheses exist for the formation of this excess magmatism, but their relative importance remains unresolved: (1) elevated mantle potential temperatures associated with mantle plume processes, (2) enhanced material flux through the melt window during rifting caused by small-scale convection at the base of the lithosphere, and (3) mantle source heterogeneity that may contribute to anomalously high melt production during continental breakup. Voluminous magmatism also coincides with the global greenhouse climate in the early Paleogene and has been proposed as a driver of both short-term (Paleocene-Eocene Thermal Maximum) and long-term (early Eocene Climate Optimum) global warming. However, the timing of the magmatism is not sufficiently constrained. Improved constraints on timing of magmatism, melting conditions, magmatic fluxes in time and space, eruption environment, sedimentary proxy data, and relative timing of climate events are required to resolve these linked controversies.

The expedition targets volcanic and sedimentary sequences at nine primary sites along and across the mid-Norwegian margin to address these five primary objectives: (a) determine the conditions of mantle melting; (b) determine spatial and temporal variations in along axis volcanic fluxes to test predictions made by fundamentally different geodynamic models for volcanic rifted margin formation including segmentation; (c) determine variations in the depositional environment (subaerial vs submarine) of inner and outer lava flows to test correlations between magma genesis and dynamic thermal support during late synrift, breakup, and early postrift oceanic spreading; (d) assess the temporal evolution of the styles of volcanic and magmatic activity in relation to paleoclimate proxies to test the relationship between large-scale volcanism and climate change events; and (e) investigate the relative importance of environmental consequences of two key processes during the initial opening of the North Atlantic: direct volcanic degassing and explosive thermogenic gas release through hydrothermal vent complexes that expel fluids derived from contact metamorphism. The expedition also aims to address two important secondary objectives: (i) early Eocene hothouse and freshwater incursions into the Atlantic, and (ii) carbon capture and storage in basalt provinces.

## **Science Activities**

To make most of the week-long quarantine in the hotel, the scientific party and JRSO staff conducted a significant portion of expedition preparations and orientations virtually from their rooms. These included Texas A&M University required laboratory safety training, shipboard laboratory and hydrofluoric acid (HF) use safety training, introduction to life at sea (including the JRSO Code of Conduct), shipboard curation and sample policy, coring and drilling operations, introduction to the core description application, and preparation of shipboard reports. Science laboratory teams began drafting their methods chapters and preliminary shipboard sampling plans for the expedition.

After moving aboard on 8 August, JRSO staff helped scientists familiarize themselves with the shipboard facilities, applications, and laboratory instruments, and set up their computers to access the ship's computer network and email system. The science party was divided into small groups to conduct the trainings and to watch the ship safety introduction video. They used training core material from past expeditions to learn the laboratory systems. The palynologists reviewed laboratory procedures, including HF treatment and safety, and conducted analysis on test samples in the Geochemistry Laboratory. The scientists finalized the drafts of their methods for the expedition and their measuring and sampling plans.

## **Education and Outreach**

Education and outreach for Expedition 396 is being led by shore-based Outreach Officer Mara Johnson-Groh. Social media duties are shared with shipboard Imaging Specialist Sandra Herrmann. Over the course of the cruise, there are plans for videos, shore-to-shore video conferences, and blog posts. The first blog post was written by Mara on [joidesresolution.org](http://joidesresolution.org).

## **Technical Support and HSE Activities**

The JRSO technical staff were engaged in port call logistics, cruise planning, and safety training.

### *Port Call and Laboratory Activities*

- The oncoming and offgoing freight was handled and distributed.
- Orientation and training presentations were held for the scientists and new JRSO technical staff over Zoom while in hotel quarantine. All remaining training was completed after boarding the ship on 8 August.
- Sample plans, laboratories, and instrumentation were prepared for coring operations.
- The scientists were given ship orientation tours in small groups.
- The Ship Safety Introduction video was presented to small groups on board the ship.
- Protected Species Observation training was conducted for the JRSO technical staff.
- The gantry laser AR1000 failed at program startup. After unplugging and plugging the instrument in again, it returned to working conditions. However, parameters had to be reestablished in the AR1000 utility.
- The Icefield 2052 failed rotation test and returned an erratic signal. It will be sent to the JRSO office at the end of the expedition for repair and recalibration.
- The communication between the source rock analyzer (SRA) and the peripheral computer failed. A burned capacitor was found on the main power board. Assistance from the Siemens Offshore electronics department was requested to make the needed repairs.

### *IT Support Activities*

- The Expedition 396 email distribution groups were set up.
- The oncoming staff and scientists were assisted in connecting devices to the ship's network.
- The Marine Computer Specialists lost the capability to reset passwords in the Exchange/Outlook email system. The TAMU Exchange Group resolved the matter after a couple of days.
- Adobe Acrobat was reinstalled on the Mac in the Microscopy Laboratory. The original installation of this program became corrupted.
- The server volumes had reduced disk space. After consulting with the Laboratory Officer, an email request was circulated to JRSO staff to review personal folders on the servers and the IODP Share volume for unnecessary files that can be removed.
- CrowdStrike was updated on all Mac workstations.

### *Developer Support Activities*

- A bug was fixed in Catwalk module's label printing (it was doubling the section number in some cases).
- Continuing work on the new SADR project.

### *Health and Safety Activities*

- Laboratory and ship safety orientations were held for new technical staff and scientists.
- The science party received the Texas A&M University required laboratory safety training and an introduction to the safe use of HF on the ship.
- The safety shower and eye wash stations were tested.
- An abandon ship and fire drill was held at 1030 h on 13 August.