IODP Expedition 339: Mediterranean Outflow

Week 3 Report (27 November to 4 December 2011)

Operations

The week began while piston coring Hole U1385C on 27 November. Because the core barrel of the first core was retrieved with a full barrel (9.87 m) a mud line depth could not be determined and another hole was required to obtain a good mudline core. Coring of Hole U1385D began with the APC system at 2595 mbsf (2584 mbsl) at 2045 hr. Piston coring advanced without incident to a final depth of 146.4 mbsf with a recovery of 105%. Cores were oriented starting with -4H. The APCT was deployed at 35.4 m (-4H), 60.9 m (-7H), 89.4 m (-10H), and 117.9 m (-13H). Cores -15H and -16H were partial strokes and advanced by recovery. All cores were obtained with non-magnetic core barrels. The bit cleared the seafloor at 1255 hr on 28 November and the vessel was offset 20 m west of Hole U1385D.

Piston coring in the last hole at Site U1385 began at 1520 hr on 28 November using non-magnetic core barrels. Seventeen cores were taken to the final depth of 148.7 mbsf by 0730 hr on 29 November. Cores were oriented starting with -5H. The last three cores (U1385E-15H to -17H) were partial strokes and advanced by recovery. Two cores were intentionally re-positioned (-8H and -10H) to maintain an offset relative to the previous holes on this site.

At Site U1385, a total of 67 cores from five holes recovered 621.8 m (103%). The drillstring was recovered with the bit clearing the seafloor at 0850 hr. Once the drilling equipment was secured and the beacon recovered, the vessel departed for the next site at 1515 hr on 29 November. The total time at Site U1385 was 4.5 days.

After a 150 nmi transit, the vessel was positioning at Site U1386 (proposed site GC-01A, water depth 560.4 m) at 0415 hr on 30 November. We deployed the camera system and conducted a ~2 hr survey of the sea bed on a 30-m grid pattern. There were no obstructions observed on the sea floor, but many shallow linear furrows that were assumed to be the result of fishing trawls. Once the camera system was recovered at 1255 hr on 30 November, we began piston coring in Hole U1386A. APC coring continued to refusal at 183.1 mbsf (U1386A-1H-21H). Recovery for this interval was 101%. Temperature measurements were obtained at 32.3 m (-4H), 60.8 m (-7H), 89.3 m (-10H), 117.8 m (-13H), 114.0 m (-16H), and 167.2 m (-19H) mbsf. Cores were oriented starting with -4H. The corer was advanced by recovery on Cores U1386A-16H to -19H and -21H. Non-magnetic hardware was used on all cores.

At 183.1 mbsf, the coring system was switched to the extended core barrel (XCB) and coring continued to a total depth of 349.3 mbsf (Cores U1386A-22X to -39X) by 0415 hr on 2 December. The 166.2 m interval was cored with a recovery of 97%. The total recovery for the hole was 346.16 m which represented 99% of the cored interval. The bit cleared the seafloor at 0620 hr on 2 December and the vessel offset 20 m east of Hole U1386A.

Piston coring of Hole U1386B began at 0825 hr on 2 December and advanced to an APC refusal depth of 162.3 mbsf (Cores U1386B-1H to 18H). Recovery for the piston cored interval was 100%. The calculated water depth from the recovery of the first core was 562 m. Temperature measurements using the APCT tool were taken at 16.8 m (U1386B-2H). 45.3 m (-5H), 73.8 m (-8H), 102.8 m (-11H), 130.8 m (-14H), and 157.6 m (-17H) mbsf. The cores were oriented starting with -3H. There were partial strokes with Cores U1386B-15H, -16H, and -18H. Non-magnetic hardware was used to obtain all cores. At 2200 hr on 2 December, the coring system was switched to the XCB and coring continued to 455.4 mbsf (U1386B-19X to -49X) when XCB refusal was reached. Recovery for the XCB cored interval was 293.5 m (100%). By the end of the week, we were pulling out of hole to deploy the rotary core barrel coring system and preparing to drill Hole U1386C.

Science Results

During the third week of Expedition 339 we completed the description and measurements of physical and paleomagnetic properties of all the remaining cores recovered at Site U1385 and the first two holes of Site U1386 (through Core U1386B-24X in Hole U1386B). Approximately 1390 m of core have been processed through the core laboratory so far. In addition, we continued with geochemical analyses of solid-phase and interstitial water samples retrieved from Holes U1385A, U1385B and U1386A, including shipboard oxygen isotopic analysis using a third party instrument.

Consistent with sediments from the upper part of Hole U1385A, the sediments described below Section U1385A-12H-2 also are dominated by nannofossils mixed with variable proportions of detrital material. The predominant lithologies are silty or clayey nannofossil ooze and nannofossil ooze with silt or with clay. As in the shallower part of Hole U1385A, silt- and clay-sized detrital carbonate is abundant. The sediment colors continue to be varying shades of gray, dark gray, and very dark gray, with greenish gray and dark greenish gray becoming more important in the lower third of the section. Bioturbation throughout these cores ranges from sparse to moderate, with scattered occurrences of recognizable ichnofauna. Lithologic distributions in Holes U1385B, U1385C, U1385D, and U1385E are consistent with those in U1385A.

At Site U1386, the sedimentary sequence is composed of three distinct lithofacies, which are variably interbedded. The three lithofacies are: 1) nannofossil mud, 2) calcareous or nannofossil silty mud, and 3) silty sand or sandy silt, both with biogenic carbonate. Overall, the nannofossil mud is the most abundant lithofacies; in some cases, an entire core is composed solely of nannofossil mud. The calcareous or nannofossil silty mud is the second most abundant lithofacies; and in some cases, it forms more than half of a core, although it occurs more commonly in beds a few decimeters thick. The silty sand with biogenic carbonate or sandy silt with biogenic carbonate is the least abundant lithology, with maximum thicknesses less than ~150 cm.

All three lithofacies at Site U1386 are dominated by colors of gray to dark gray to very dark gray. Macrofossil debris is relatively common, mostly as shell fragments. However, identifiable corals, whole gastropods and bivalves, and echinoid spines have been found. Bioturbation intensity generally is sparse to slight, and recognizable ichnofauna are rare.

Core catcher samples from the Sites U1385 and U1386 were examined for nannofossil, planktonic and benthonic foraminifer, and ostracod composition. Pollen content was also examined in some samples. Additional samples for nannofossil examination were taken from selected core sections to develop a higher resolution biostratigraphic framework. Preliminary results based on nannofossil and planktonic foraminifer biostratigraphic events indicate that the sedimentary section in Hole U1386A spans from the Holocene to circa 1.2 Ma.

Whole-round core measurements of velocity, density, magnetic susceptibility, and natural gamma radiation of cores from Holes U1385C, D, and E and U1386A are finished. Whole round core scanning of core sections from Hole U1386B is currently underway. Velocity measurements gave good results for the upper ~21 m and can be extended by split-core measurements down to 76 mbsf, below which poor sediment-to-liner coupling deteriorated the acoustic signal. Additionally, thirty-nine thermal conductivity measurements have been performed on Site U1386A. Physical properties show a pronounced variability related to changes in the detrital content of the material.

The recovery of a complete continuous stratigraphic record at Site U1385 was confirmed and a composite depth scale was constructed based upon correlation of magnetic properties between the five holes cored at the site. For Site U1386, coring in Hole B was offset from that in Hole A to avoid coring gaps in the composite record. The absence of coring gaps can be confirmed down to about 140 mbsf through correlation of magnetic susceptibility between the two holes. Correlation below this depth will require additional observations from other physical, chemical, and magnetic data sets, which are currently being collected.

The remanent magnetization of archive-half sections of APC/XCB cores from all holes at Sites U1385 and U1386 was measured before and after 20 mT alternating field demagnetization, and measurements of cores from Hole U1386B continue. The Flexit core orientation tool was deployed in conjunction with all APC cores. At Site U1385 we identified the Brunhes/Matuyama boundary, and both the top and base boundaries of the Jaramillo Subchron despite significant loss of magnetic intensity below ~50 mbsf. The APC section at Hole U1386A provides stable magnetic record that is entirely in the Brunhes Chron. Paleomagnetic measurements of the XCB section reveal an expectedly very noisy signal that might be improved with discrete samples taken from the undisturbed XCB biscuits.

The geochemistry team finished high resolution squeezing of whole-round samples from Holes U1385B and U1386A; processing of samples from Hole U1386B is continuing. High resolution Rhizon sampling was also performed in Hole U1385B. Hydrocarbon concentration monitoring

continued in Hole U1386B as the depth of the hole extended beyond that of U1386A. Standard shipboard measurements of inorganic carbon and of interstitial water chloride, pH, alkalinity, major and minor elements, ions, and ammonia for Site U1385 are complete.

The $\delta^{18}O$ and δD of the Rhizon samples from U1385B are being measured to determine the level of drilling fluid contamination resulting from the sampling method. $\delta^{18}O$ and δD measurements have been completed on the standard shipboard set of interstitial water for Site U1385.

Education and Outreach

This week education and outreach events have continued through diverse activities. Blogs posted on the *JOIDES Resolution* site (http://joidesresolution.org/blog) include life at sea, day to day operations, and scientific research ongoing aboard the JR written in several languages (i.e., English, Portuguese, French, Spanish and Dutch) by our international bloggers. Some scientists also continue to run their own personal blogs at http://www.uu.nl/faculty/geosciences/NL/Actueel/dossiers/expeditiemediterraneanoutflow/Pages/default.aspx and http://mfiodpexp339.canalblog.com/.

Three live ship-to-shore interactive video conference programs were conducted with 8th graders from Kentwood Middle School (Michigan), children from Kindergarten Antonio Osuna (Madrid, Spain) and teachers attending the COSEE West Teacher Workshop at the Cabrillo Marine Aquarium in California. Two other videoconferences are scheduled for next week. In addition, the expedition's Education Officer continued to post daily updates on the JR Facebook page and Twitter account. Updates included links to the blog or other pages on the JR website and photos.

Technical Support and HSE Activities

The USIO marine technical staff supported the scientific contingent in the processing and analyses of core material recovered at Sites U1385 and U1386, and in data acquisition, storage and data output using the laboratories science systems. They also boxed and placed in cold storage all the core section halves once they were measured, described and sampled for shipboard analyses. A meeting was held to plan for upcoming use of seismic sources for VSPs at Site U1386 and thereafter.

A Fire and Boat Drill was held for all hands on 1 December.