

IODP Expedition 339: Mediterranean Outflow

Week 7 Report (26 December 2011 to 1 January 2012)

Operations

Week 7 of Expedition 339 started while APC coring at Hole U1389C. Piston coring advanced to 95 m. Cores were oriented starting with -3H. There were three deployments of the APCT3 temperature tool: at 19 m (Core U1389C-2H), at 47.5 m (Core U1389C-5H), and at 76 m (Core U1389C-8H). All cores were obtained with non-magnetic core barrels. Coring continued in Hole U1389C with the extended core barrel (XCB) system which reached the depth objective of 350 m at 0815 hr on 26 December. Recovery for the 255 m XCB cored portion of the hole was 90%. The total recovery for both coring systems for Hole U1389C was 94%. The bit was pulled free of the seafloor at 1000 hr on 26 December and the vessel offset 20 m south of the previous hole.

An additional hole was piston cored to obtain a complete section of the top ~100 m portion of the sedimentary record at Site U1389. Hole U1389D was spudded with the APC at 1120 hr and established the water depth at 655.5 mbrf (644 mbsl). Piston coring advanced without incident to the depth objective of 94 m by 1845 hr. Recovery was 104%. The cores were oriented starting with -3H. There were three APCT3 temperature measurements at 24.5 m (Core U1389D-3H), 53 m (Core U1389D-6H), and 75 m (Core U1389D-9H). All cores were obtained with the non-magnetic core barrels.

The drill string was recovered. The bit cleared the rotary table at 2220 hr on 26 December and the vessel offset 20 m west. A 4-stand rotary core barrel (RCB) bottom hole assembly was made up and deployed. After the driller tagged the seafloor at 655 mbrf (643.5 mbsl), Hole U1389E was spudded with the RCB at 0240 on 27 December. We drilled without coring down to 355 m where continuous rotary coring was initiated at 1830 hr on 27 December. Rotary coring continued until 0845 hr on 1 January 2012 when the hole was terminated at the depth objective of 989.9 m. A total of 654.9 m was cored with a recovery of 54%.

Week 7 of Expedition 339 ended while conditioning Hole U1389E in preparation for downhole logging.

Science Results

This week we completed measuring, splitting and describing all cores and samples taken at Holes U1389C, U1389D and U1389E. We reviewed the scientific reports for Site U1388 and the final versions are being archived by the Publications Specialist. We also started writing expedition reports for Site U1389, and some scientists gave science seminars during our daily crossover meetings.

We completed the lithologic description of cores from Holes U1389A through U1389E. The cored intervals at Holes U1389A, U1389B, U1389C and U1389D extend to 354.9 m, 9.5 m, 350 m and 94 m, respectively. At Hole U1389E, sediments were recovered from 335 to 990 m. The sediment sampled at this site is predominantly mud (calcareous mud, and mud with biogenic

carbonate), silty mud (calcareous silty mud, and silty mud with biogenic carbonate), sandy mud (calcareous sandy mud, and sandy mud with biogenic carbonate), and silty sand (silty sand with biogenic carbonate). Relative proportions of mud, silty mud, sandy mud and silty sand vary widely. The top ~100 m interval at this site is characterized by a relatively high proportion of siltier and sandier sediments. Overall, the number of sandy beds (sandy mud and silty sand) ranges from 0 to 11 per core, with higher numbers in the top 100 m interval. As is observed in the previous sites, both typical contourite bedding showing bigradational grading and normal grading beds with sharp bottom contacts are recognized. Core recovery decreases below 320 m, but it is particularly low between 760 and 800 m (25%), 818 and 857 m (12%), 876 and 915 (3%), and 943 and 990 m (11%). Preliminary XRD results indicate that the sediments contain a wide range of minerals.

Samples from core catchers of Holes U1389C and U1389E were prepared for nannofossil, planktonic and benthic foraminifer, and ostracod analyses. Pollen content was also examined in seventeen samples of the Hole U1389E. Preliminary results based on various nannofossil and planktonic foraminifer events indicate that the age at the bottom of the Hole U1389E (990 m) is ~3.75Ma.

All routine physical properties measurements have been completed on all cores from Holes U1389D and U1389E, including magnetic susceptibility, natural gamma radiation, bulk density, color reflectance spectrometry, thermal conductivity, sediment strength, moisture and density. Physical property records show cyclic patterns that reveal grain size and mineral composition changes.

We measured the remanent magnetization of archive-half sections of APC/XCB and RCB cores from all five holes at Site U1389 before and after 20 mT alternating field demagnetization. Inclination data from Holes U1389A, U1389B, U1389C, and U1389D indicate that only the Brunhes (C1n) normal polarity chron is recorded above ~320 m. We are currently testing on discrete samples if the Brunhes/Matuyama polarity transition was captured in the deepest part of Hole U1389A. RCB cores from Hole U1389E recovered a complete magnetostratigraphic sequence from Subchrons C1r.2r through C2An.3n, possibly terminating in Chron C2Ar. Detailed measurements of the demagnetization behavior of discrete samples to confirm magnetic results from the pass-through measurements and to identify poorly resolved polarity transitions are currently in progress.

The five holes cored at Site U1389 provide enough material to produce a composite stratigraphic section that is virtually complete in the upper 120 meters composite depth (mcd), contains only relatively short gaps from 120 to 372 mcd, has one large gap from 372-380 mcd, and is poorly constrained from 385 to 404 mcd. Below 404 mcd (~355 mbsf) the section is single cored, with short gaps invariably occurring between cores and larger gaps occurring whenever core recovery is low.

Standard gas analysis from headspace samples have been completed for Site U1389. Methane, ethane, and propane were the only hydrocarbons detected. Bulk sediment analysis of CaCO₃, total and organic carbon, and total nitrogen are ongoing.

Whole-rounds were taken and squeezed for interstitial water geochemistry at a resolution of 1 per core in the upper 200 m and every third core thereafter to 350 m in Hole U1389A. In Hole

U1389E, whole-round samples were squeezed from 352 to 940 mcd. Geochemical analyses are ongoing but chloride has a particularly interesting pattern with near seawater values in the upper 200 m, increasing below 200 m to peak values of 950 mM at 533 m, and decreasing again between 533 and 700 m. Below 700 m, chloride concentrations are stable and average 370 mM. The profile indicates the presence of a subsurface brine as well as a source of low-chloride water. Preliminary stable isotope analysis suggest the low-chloride water is enriched in $\delta^{18}\text{O}$ and depleted in δD , suggesting dehydration reactions involving clay minerals as the likely cause of the low chloride concentrations.

Education and Outreach

Expedition participants continue to share their experience aboard the *JOIDES Resolution* on the JR's website (<http://joidesresolution.org/blog>) and other blogging sites. One live ship-to-shore interactive video conference program was conducted with students from the Sasebo-Nishi High School (Japan) English and Science Club. Four other videoconferences are scheduled for next week.

The expedition's Education Officer continued to post daily updates on the JR Facebook page and Twitter account. Updates include links to the blog or other pages on the JR website (e.g. expedition page, glossary) and photos. In addition, our Education Officer has devoted significant time to his own students regarding the development of classroom activities using core photos to identify the morphology of trace fossils and relate it with their ecological significance.

Technical Support and HSE Activities

The USIO technical staff was engaged in core processing at Site U1389. Other activities included assistance with laboratory and instrument support, as well as minor software upgrades to various applications.

An Abandon Ship drill was held for all hands on 26 December.