

IODP Expedition 317: Canterbury Basin Sea Level

Week 4 Report (22-28 November 2009)

30 November 2009

Operations

The week began while coring on Core U1351B-70X at a depth of 611 m DSF. Because core recovery with the XCB system was poor, the coring system was again switched to the APC for Cores U1351B-78H and 85H, but recovery was <1 m in each case. Coring was terminated at 1030.6 m DSF after the Core U1351B-116X barrel became stuck. The hole was cleaned and then displaced with mud in preparation for logging. The drill string was tripped back to 80 m DSF and the triple combo was rigged up and run to bottom. Drilling conditions in the hole prior to logging were good. However, the first logging run revealed a hole that was oversized for logging over much of its length. The triple combo was rigged down and the FMS-sonic tool string was deployed but failed to pass 618 m WSF. Indications were that the hole collapsed and bridged at around 618 m WRF. The hole was logged from that point upwards and the logging equipment was rigged down. A cement plug was pumped at 283 m DSF and the drill string was tripped back to surface.

A new bottom hole assembly was made up with a 9-7/8 inch tri-cone bit fitted with a mechanical bit release. Drilling in the dedicated logging Hole U1351C began at 2335 h on 25 November and ended in the evening of 27 November at 1100 m DRF.

At 1915 h on 27 November, while sweeping the hole clean with mud in preparation for logging, a sudden wind change forced the vessel outside the maximum positioning offset (8% of water depth, or ~10 m). The vessel lost power to three of the six forward thrusters while trying to respond to the sudden shift. Position and power were re-established within 15 minutes. The maximum excursion from the hole was 38 m. With all drilling parameters still normal, Hole U1351C was displaced with logging mud in preparation for logging. The drill string was tripped to 80 m DSF and the section of drill pipe that was located at the seabed during the excursion was inspected after it was recovered at the surface. No damage to the drill string was visible.

The triple combo logging string was assembled and run into Hole U1351C. With the tool at ~912 m WSF, the winch lost weight, indicating that the tool got stuck. At that point the tool could not be moved either up or down. The decision was made to cut the logging line and trip in with drill pipe over the logging line in an attempt to recover the triple combo logging string. The week ended while still performing recovery operations to free the stuck logging tools.

Science Results

Coring at Hole U1351B proceeded using the XCB, although occasional attempts with APC coring were made. Core recovery was generally low and decreased with depth. Often only the core catcher was recovered and several cores were completely empty.

However, recovery was also highly variable: a number of longer cores (2-7 m) were obtained even near the bottom of the hole. Coring operations in Hole U1351B were completed at 1030 m (CSF) (U1351-B-116X) when the XCB drill bit finally yielded to the increasingly hard formation. Average recovery for the interval cored this week was 21%, average recovery for the entire hole was 31%.

Cores U1351-B-32X to -116X are composed mainly of sandy mud and very fine sand. Very fine sand dominates above ~300 m (CSF), while mud and sandy mud dominate below ~300 m.

The Pleistocene/Pliocene boundary is near 150 m and the Pliocene/Miocene boundary is at ~750 m, based on planktic foraminifers. Nannofossils lack definitive markers. Benthic foraminifers indicate that the paleoenvironment deepens downhole from outer shelf to upper slope. The last cores contained grayish green mud with an estimated age of 10.6 to 11.0 Ma based on planktic foraminifers. Therefore, ~150 m of Pleistocene, ~600 m of Pliocene and ~300 m of late Miocene strata were recovered. Recovery of thick Pleistocene and Pliocene intervals will provide high-resolution data on Pleistocene-Pliocene sea-level and environmental fluctuations.

Sequence boundaries U11-U7, interpreted using the EW00-01 seismic profiles, are represented as gaps in recovery because of the presence of coarse material at these boundaries. It is therefore difficult to determine the exact positions of the sequence boundaries. A sequence boundary might be at 1014-1024 m.

Continuous laboratory measurements of magnetic susceptibility, natural gamma radiation, bulk density and colorimetry were supplemented with discrete measurements of thermal conductivity, sediment strength, and density and porosity. Internal consistency among different measurement tools and methods was used to provide verification or error estimates. These measurements were used by stratigraphers to help them identify and characterize lithologic units.

Paleomagnetic measurements concentrated on performing full (0-80 mT) alternating field (AF) and thermal (only up to 140°C) demagnetization on a selection of discrete plastic cubic samples distributed throughout Hole U1351B. In addition, some rock magnetic experiments were also performed (isothermal and anhysteretic remanent magnetization acquisitions followed by AF demagnetization) in order to establish the magnetic carriers.

Forty-nine samples from Site U1351 were analyzed for interstitial water constituents. In addition to the well-defined sulfate-methane transition at 16 m, the upper ~200 m of sediment contain moderately high-salinity (10% greater than seawater) brine along with higher carbonate, organic carbon, and nitrogen contents. Dissolved calcium and magnesium show major changes over the depth interval 200 to 230 m, with calcium increasing (from 16 to 38 mM) while magnesium decreases (from 33 to 24 mM), possibly representing dissolution of biogenic calcite and re-precipitation of diagenetic carbonate. Potassium, silica, and sodium all decrease with depth, possibly associated with glauconite formation.

Caliper, gamma ray, density, porosity and resistivity logs (triple combo) were run throughout the entire depth of Hole U1351B. However the caliper indicated that the condition of the hole was poor after 5 days of coring with long intervals beyond the maximum caliper reading (>20 inches in diameter). Furthermore, a cave-in at ~490 m (WSF) prevented the FMS-sonic tool from being run below this depth. It was therefore decided to drill a dedicated logging hole at this site (Hole U1351C) with the goal of providing improved logs.

Technical Support and HSE Activities

Technical support staff processed cores and samples from Site U1351. The G-gun cluster was set up in preparation for vertical seismic profiling (VSP). Prior to the scheduled VSP operation a tool-box meeting was held with technical staff, the crane operator and roustabouts for the safe handling of the guns and to prepare for marine mammal watch.

A fire and boat drill was held on 22 November for the entire ship's complement. A safety meeting was held on 27 November with the Captain, Offshore Installations Manager, Doctor, Operations Superintendent, Expedition Project Manager, and Laboratory Officer to discuss protocols for the use of HF for microbiological sample preparation. On 28 November, a 1% HF working solution was prepared in the paleontology lab safely hood.