

IODP Expedition 317: Canterbury Basin Sea Level

Week 3 Report (15-21 November 2009)

23 November 2009

Operations

The ship arrived in Wellington, NZ at 1130 h on 16 November 2009. After receiving 1969 metric tons of fuel, the vessel departed Wellington at 0948 h on 17 November, transiting 257 nm to the first location, Site U1351 (proposed site CB-03B) at an average speed of 11.4 knots. Operations at Hole U1351A began at 0931 h on 18 November when the vessel shifted to dynamic positioning mode. Water depth was established at 122 m below sea level. Six APC cores were taken in Hole U1351A to provide sufficient whole-round samples for microbiology, chemistry, and geotechnical studies. Hole U1351A ended at 28 m (DSF), with 27.3 m of core recovered for an average recovery of 98%. Operations at Hole U1351B began at 0045 h on 19 November after moving the vessel 20 m south of Hole U1351A. Hole U1351B was piston-cored to a depth of 94.7 m (Core U1351B-13H) with a total recovery of 81.1 m, resulting in an average recovery rate of 86%. Forty-three cores (U1351B-14X through 56X) were subsequently taken with the XCB system with a recovery rate averaging 30%. In an attempt to obtain better recovery, the APC system was redeployed for three cores (U1351B-57H through 59H), recovering 4.46 m for a 7 m advance (64% recovery). Although recovery increased, it was based on very short APC penetrations with an overall progress that was not sustainable over an extended period of time. The XCB system was redeployed for Cores U1351B-60X through 64X. Poor recovery (9%) resulted in another switch to the APC system for Core U1351B-65H, again resulting in a very short (~1 m) partial stroke. XCB coring resumed with Core U1351B-66X and continued through the end of the week to Core U1351B-69X at a depth of 602 m (DSF). Microspheres and PFT's were deployed on all cores where microbiological sampling was anticipated. Temperature measurements were attempted several times but significant motion at the bit prevented acquisition of useful measurements.

Science Results

The science party concluded its science seminar series on 16 November before arrival in Wellington for fueling that morning. After a short shore leave, the focus of training switched from familiarization with equipment and databases to sampling procedures, with training sessions at the sample table arranged to fit the shift schedules of separate groups of scientists. The science party held a site preview meeting for the first site, U1351, at 0000 h on 18 November. The sampling plan for this site was also finalized at this meeting.

Site U1351 is the outermost shelf site of the Canterbury Basin transect. Hole U1351A was drilled to meet substantial requests for whole-round samples in the shallow subsurface for several projects and investigators, including microbiology, chemistry, and physical properties. Six cores (U1351A-1H through 6H) were recovered to a total depth of 28 m (DSF). Cores contain sandy mud and fine sand with shelly sand layers. The age at

the bottom of the hole is late Pleistocene (~0.3 Ma).

Hole U1351B is the principal hole for coring at Site U1351. APC coring (Cores U1351B-1H through 13H) penetrated to 94.7 m (DSF). Coring proceeded using the XCB. Recovery decreased below Core U1351B-40X and dropped markedly to zero in Cores U1351B-50X to -52X. Occasional attempts at APC coring below this interval resulted in slightly improved recovery at the cost of reduced penetration rate.

Sediments in cores opened for description to date (to Core U1351B-31X) are mainly sandy mud and fine sand with shelly sand layers. The sediments form a succession of fining upward cycles, grading from shelly sand to silty clay, though calcareous mud also occurs in the upper 100 m. Cycle characteristics vary, with Pliocene cycles finer grained and with less lithological contrast than Pleistocene cycles, possibly reflecting the lower amplitude eustatic oscillations indicated by oxygen isotopic records from the Pliocene relative to those from the Pleistocene. Bases of the cycles are frequently burrowed. Sequence boundaries U19-U12 interpreted using the EW00-01 seismic profiles can be provisionally linked to lithological boundaries observed in cores described so far. Sequence boundaries are represented by sandy or shelly sediments, sometimes with cemented nodules, overlying muddier sediment.

Nannofossil and diatom biostratigraphy yielded an age of 0.6 – 1.2 Ma at ~100 m (DSF; U1351B-13H). The Brunhes/Matuyama boundary (0.78 Ma) is possibly located between 65 and 70 m based on paleomagnetic data. Relatively continuous physical properties data in the upper ~75 m show cyclic variations, particularly in magnetic susceptibility and natural gamma radiation, that can tentatively be correlated to Marine Isotope Stages. Below ~100 m, biostratigraphic data are sparser, partly because of lower recovery by XCB coring, but also because the coarser-grained sediment of this interval may not have been suitable for deposition and preservation of microfossils. The age of Core U1351B-55X-CC is late Miocene based on nannofossil assemblages; possibly reworked planktonic foraminifers continue to indicate an early Pliocene age.

Alkalinity increases from the seafloor to 17 m, and then slowly decreases with depth to 100 m, before stabilizing. Over the same 0-17 m interval, sulfate decreases from seawater values to near zero, whereas methane is absent above 17 m and then increases to 100 m, with a steady increase in the methane/ethane ratio.

Technical Support and HSE Activities

During the transit to the first site, technicians were setting up the core receiving area and the core lab areas. Senior laboratory staff provided training in core handling and sampling procedures to all technicians, particularly new staff. The G-gun cluster was set up and tested for Vertical Seismic Profiling later in the cruise. Vidmar cabinets were installed in the logistics shop. After arrival of the first core on deck at 1735 h on 18 November, the shipboard labs were busy processing cores and samples. A fire and boat drill was held on September 22 for the entire ship's complement.