

**IODP Wilkes Land Expedition 318
Week 3 Report; 17-23 January 2010**

OPERATIONS

On the approach to WLSHE-09B, the captain received an updated satellite image from the National Ice Center that indicated a large tongue of ice in the direct path to WLSHE-09B. This necessitated adding a dogleg in the track to WLSHE-09B so we could steer around the leading edge of the tongue. As the vessel altered course and speed in heavy mist and fog, large icebergs began to appear on the radar and a few growlers were spotted visually. When the fog suddenly cleared, large icebergs of various shapes and sizes were observed around the vessel. The vessel proceeded at slow speed attempting to approach WLSHE-09B amid the ice when the weather deteriorated during the afternoon of 18 January. With the winds gusting to 35 knots and accompanied by snow and reduced visibility, the effort to reach WLSHE-09B was suspended 19 nmi short of the objective until ice conditions were more favorable. The captain altered course to an approved primary alternate WLRIS-06A located ~167 nmi to the NNW. The most recent satellite pictures indicated that Site WLRIS-06A appeared to be free of floating ice.

The vessel exited the hostile ice conditions and proceeded at an average speed of 6.4 knots to WLRIS-06A arriving on site at 1045 hr on 19 January. The circuitous voyage from Wellington to the first site covered 2021 nmi at an average speed of 8.5 knots. During the voyage from the area of WLSHE-09B to WLRIS-06A, no icebergs were spotted on the radar or visually.

An APC/XCB bottom-hole assembly (BHA) was made up with an 11-7/16" bit and lowered to the seafloor. The initial mudline attempt was made at 0705 hr on 20 January with the bit at 3735 mbrf. When the corer was recovered, it was found that the core barrel had broken off at the connection joining the two 4.5 m non-magnetic sections making up the APC core barrel. To test the nature of the seafloor, the driller gently tagged seafloor with the bit at ~3740 mbrf. The bit was slowly rotated and a mild increase in torque was observed indicating that the seafloor was firm but apparently not unusually hard.

Another mudline core was attempted with the bit positioned at 3735 mbrf at 0940 hr using the more durable standard steel core barrels. The pressure bleed off indicated a full stroke but the core winch operator was unable to recover the APC core barrel with the coring line. For nearly 1.5 hours the core winch operator and driller tried various techniques to recover the corer with the coring line without success. The only recourse was to recover the drill string. The bit was back on the rig floor at 2225 hr on 20 January. This second APC core barrel was also broken off. Once the remains of the core barrel were cleared from the bit throat, it was decided to attempt a spud with the RCB coring system.

An RCB BHA with a new C4 9-7/8" bit and mechanical bit release were made up and deployed. The seafloor depth was again confirmed at 3740.0 mbrf (3729.0 m below

seafloor [mbsl]) by the driller gently tagging the bit on the seafloor. Coring at Hole U1355A was finally started at 0905 hr on 21 January. RCB Cores U1355A-1R to 4R penetrated from 0 to 31.7 m below seafloor (mbsf) and recovered 14.95 m (47%). The cores recovered unconsolidated coarse sands and gravel – so the recovery was quite remarkable. However, coring had to be terminated because of unstable hole conditions caused by these unconsolidated coarse-grained sediments.

We decided to abandon this site and find an area less hostile to coring. We considered making another attempt to return to the shelf sites, but based on remote sensing data and information from a research vessel in that region it was felt that ice conditions in the area had not substantially improved. Instead, we decided to move to an approved alternate site (WLRIS-07A) located 82 nmi WNW of Site U1355. After a total time of 2.8 days on site, we departed Site U1355 at 0600 hr, 22 January.

The short voyage to Site WLRIS-07A was without incident except for the spotting of a lone iceberg both on radar and visually. The vessel was positioning on Site U1356 (WLRIS-07A) at 1345 hr, 22 January. The 82 nmi journey was made at an average speed of 10.7 knots.

Due to the problems with APC coring at the previous site, we decided to start coring with the RCB coring system. The drill string lowered to the seafloor and the seafloor tagged with the RCB bit at 4003 mbrf. This was 21.5 m deeper than the corrected PDR depth of 3981.5 mbrf.

RCB coring in Hole U1356A was started at 0025 hr on 23 January. RCB Cores U1356A-1R to 16R penetrated from 0 to 153 mbsf and recovered 40.8 m (27%). The presence of glacial erratics below the first two cores adversely affected recovery.

SCIENCE

Site U1355 (Proposed Site WLRIS-7A) is located at the transition between the continental rise and the abyssal plain in a water depth of 3729 mbsl. The primary scientific objective at Site U1355 was to core across the WL-U3 unconformity (~782 mbsf) to obtain the timing and distal nature of the first arrival of the ice sheet to the Wilkes Land continental margin which is currently inferred to have occurred during the earliest Oligocene (~33 Ma). The site is located where the uppermost sedimentary section is relatively thin so that WL-U3 could be reached at a shallower depth. This site also aims to obtain a record of glacial/interglacial and ice sheet variability from the Oligocene to Pliocene (?) as well as to document the timing of the major shift in continental rise sedimentation across unconformity WL-U5.

Four cores from one hole were obtained at Site U1356. Cores U1356A-1R to 4R penetrated from 0 to 31.7 mbsf and recovered 14.95 m (47%). The stratigraphic integrity of most of the core was highly compromised by drilling disturbance. The sediments are mainly composed of unconsolidated, sand to pebble sized, angular igneous and

metamorphic fragments. These are moderately-to-well sorted, and fine upwards into well-sorted, stratified coarse sands, pointing to their likely turbiditic nature. A 3-cm thick interbed of dark greenish grey, diatom-bearing, silty clay was preserved between two upward fining units.

Samples from Hole U1355A were analyzed for siliceous microfossils, foraminifers and palynomorphs. Core catcher samples U1355A-1R to 4R and additional samples from clay-rich clasts within the cores were analyzed for diatoms. The core material yielded an abundant Antarctic flora dominated by *Fragilariopsis kerguelensis* and *Thalassiosira lentiginosa*. The association of these typical Pleistocene-Holocene Antarctic diatoms along with common *Actinocyclus ingens* and *A. ingens* var. *ovalis* indicates an age no older than late Pleistocene. Reworking from Miocene and Eocene material was recorded as well. A sample from the top of the hole yielded a rich and diverse modern (Holocene) Antarctic diatom assemblage. Radiolarians typical of late Pleistocene-Holocene Antarctic waters were also found in the core-catchers and seafloor samples with an overall low abundance. The seafloor sample yielded a low diversity planktonic foraminifer assemblage dominated by *Pachyderma neogloboquadrina* indicating an age <9.2 Ma. Palynomorphs were recorded in the seafloor sample and Samples U1355A-1R-CC and -4R-CC. Notable finds included Holocene dinoflagellate cysts (dinocysts) including cysts of *Protoperidinium* spp. and *Impagidinium pallidum*, reworked latest Eocene dinocysts, reworked Cretaceous spores and pollen and plant remains, and a few foraminifer linings and copepod eggs.

Whole-round and section-half core logging measurements are significantly affected by poor core quality and the data are therefore compromised. Magnetic susceptibility values are relatively high reflecting the lithologic composition of the individual clasts in the gravels and sands. The silty, diatom-bearing clay clasts are characterized by pronounced lower magnetic susceptibility, bulk density and sonic velocity values, but higher natural gamma-ray counts. The P-wave velocities increase from 1800 m/s at the seafloor to more than 1920 m/s at the base of Core U1355A-2R.

TECHNICAL SUPPORT AND HSE ACTIVITIES

The final preparations were made for processing cores through the labs. Initial processing encountered typical start-up challenges. A fire and boat drill was held on January 19 for the entire ship's complement.