

**IODP Wilkes Land Expedition (318)  
Week 4 Report; 24-30 January 2010**

**OPERATIONS**

We departed Site U1355 at 0600 hr, 22 January. The short voyage to Site U1356 (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 at 1345 hr, 22 January. The 82 nmi journey was made at an average speed of 10.7 nmi/hr.

Due to the problems starting a hole with APC coring at the previous site, we decided to start coring with the RCB coring system. The drill string was lowered to the seafloor and the RCB bit tagged it at 4003 m below rig floor (mbrf). This was 21.5 m deeper than the corrected Precision Depth Recorder (PDR) depth of 3981.5 mbrf.

RCB coring in Hole U1356A started at 0025 hr on 23 January. RCB Cores U1356A-1R to -96R penetrated from 0 to 876.6 mbsf and recovered 293.3 m (33%). The presence of glacial erratics below the first two cores adversely affected recovery. Recovery varied considerably from 0% to 99%. However, it did improve with depth – Cores U1356A-66R to -92R penetrated 254.3 m of formation (622.3 to 876.6 mbsf) and recovered 140.58 m (55%).

Frequent 20-barrel mud flushes were circulated beginning at 296.7 mbsf and then every other core starting with Core U1356A-69R (660.6 mbsf). A single 40-barrel sweep was circulated at 631.9 mbsf. No significant hole problems were encountered through Core U1356A-92R. The only issue of note was one hour of rig downtime on 27 January when the WKM ball valve and remote actuator required servicing. We decided to extend coring beyond the original depth objective of 850 mbsf to ensure the full characterization of the transition across the inferred Eocene/Oligocene boundary reflectors. We are continuing to deepen Hole U1356A.

The only ice seen during operations at Site U1356 occurred on 29 January when a pinnacle-shaped iceberg was detected 12 nmi to the SE. It was estimated to be 40 m high, 110 m long, and moving haphazardly at approximately 0.5 knots. Two growlers were also observed visually in the general area of the iceberg. The iceberg came no closer than 10 nmi, did not impact operations, and drifted off radar 0430 hr 30 January.

**SCIENCE**

The primary objective at Site U1356 was to recover a distal record of the first arrival of glaciers to the eastern Wilkes Land margin. This it thought to represent the Earth's transition from a "Greenhouse" to "Icehouse" climate and is inferred to have occurred during the earliest Oligocene at this margin. Site U1356 also set out to document the Oligocene to recent history of the East Antarctic Ice Sheet. Site U1356 sampled

sediments across a regional unconformity in the seismic data, WL-U3, which is interpreted to separate pre-glacial strata below from glacial strata above.

Seven Lithostratigraphic Units are identified in Cores U1356A-1R to -87R. Units I and II (0-278.4 mbsf) are composed of diatom oozes and diatom-rich silty clays with dispersed gravel indicating hemipelagic sedimentation with ice rafting. The primary lithofacies association in Units III-VII (278.4 to > 823 mbsf) is characterized as interbedded light greenish gray bioturbated claystones and brown laminated claystones, indicating cyclical changes in bottom oxygenation and contour current strength. These are interbedded with diamictites and other coarse clastic facies in Units IV and VI.

Samples from Cores U1356A -1R through -94R were analyzed for siliceous microfossils, foraminifers and palynomorphs. Diverse, well-preserved and abundant diatoms and radiolarians within Cores U1356A-1R through -38R and in -41R are typical Southern Ocean assemblages. Palynomorphs are present in samples from Cores U1356A-1R to -91R. The dinoflagellate cyst (dinocyst) assemblages are characterized by three main components - in situ protoperidinioid dinocysts, reworked Late Eocene dinocysts, and in situ Miocene -Oligocene warm-water species that occasionally occur at the expense of the protoperidinioid assemblage. Reworked terrestrial palynomorphs were recorded and are sourced from the Paleogene, Mesozoic and Paleozoic. Benthic foraminifers were found sporadically from Core U1356A-34R downward. However, they are poorly preserved and occur in low abundances and diversity with only a few age diagnostic species present. Calcareous nannofossils are intermittently preserved within Cores 39R through -92R reaching high abundances in some intervals.

Sections U1356A-1R-1 to -2 are estimated to be about 5 Ma, indicating that much of the Pliocene and Pleistocene is not preserved at this site. Ages for the Miocene section are based primarily on diatoms and radiolarians. Below this depth, diatoms occur in only trace abundances or opal-A is not preserved; however, opal-A is sometimes replaced by pyrite and some diagnostic features of both diatoms and radiolarians are still discernible.

Ages for the Oligocene section (Cores U1356A-42R to ?89R) are constrained by calcareous nannofossils within limited intervals. Palynomorphs, benthic foraminifers and pyritized siliceous microfossils tentatively constrain Cores U1356A-65R to -89R to the Oligocene. Eocene ages are constrained by dinocysts. A distinct change is recorded in the lowermost sample processed thus far (Core U1356A-91R) containing mid- to late Eocene dinocyst assemblages.

We continued measuring archive halves in the rock magnetometer, demagnetizing them in four steps up to 20 mT. We also measured remanence and anisotropy of magnetic susceptibility (AMS) of the discrete samples with progressive demagnetization to either 20 mT or 25 mT. The archive and discrete data sets are in excellent agreement. Based on the step-wise demagnetization data, we believe we can remove the downward directed drilling remanence by demagnetization to 15-20 mT and are reasonably confident that the inclinations derived from the archive measurements reflect geomagnetic polarities. The magnetostratigraphic interpretation from about 125 to 475 mbsf, constrained in part by

the diatom stratigraphy, provides a convincing match to Chrons C5ABn to C5En. Between 475 and ~650 mbsf, paleomagnetic interpretation is problematic. Improved core recovery from 640 to 690 mbsf allows an excellent match to the time scale extending from the base of Chron 7n to near the bottom of Chron C8n. This is consistent with currently available biostratigraphic data.

Magnetic susceptibility data are exhibiting rhythmic changes especially visible in the cores with improved recovery starting at Core U1356A-47R (Middle Miocene), but even better in Core 1356A-68R (Oligocene) and below. These characteristic changes in the magnetic susceptibility pattern have been used for prediction of the sediment composition (bioturbated, carbonate-bearing units versus finely laminated carbonate-free intervals) on a cm- to dm-scale before the cores have been cut, greatly support the sedimentologists in quantifying their core descriptions.

In accordance with the lithologic descriptions, carbonate content down to 400 mbsf is below the detection limit. From 400 to 700 mbsf, some layers with carbonate contents between 2 and 50% have been recorded. Seventy samples have been prepared for main and trace element geochemistry and the first six samples have been processed for biomarker analysis.

## **TECHNICAL SUPPORT AND HSE ACTIVITIES**

This week, the technical staff supported the processing and data collection for 92 RCB cores. A fire and boat drill was held on January 25 for the entire ship's complement.