November 11, 2004

IODP EXPEDITION 303: NORTH ATLANTIC CLIMATE I
SITE 1307 SUMMARY

Hole 1307A Latitude: 58°30.347'N, Longitude: 46°24.033'W
Hole 1307B Latitude: 58°30.358'N, Longitude: 46°24.054'W
Water depth: 2575 mbsl

Site 1307 is positioned at common depth point (cdp) 14375 on seismic Line 25a in the multichannel seismic network obtained over the Eirik Drift during Cruise KN-166 (R/V Knorr, PI: Greg Mountain) in summer 2002. The location was chosen due to potential access to Pliocene sediments below the Quaternary sequence dilled at Site 1306. A thinner Quaternary sedimentary sequence at Site 1307 allows the Pliocene sequence to the sampled using the Advanced Piston Corer (APC).

Two holes were cored with the APC system at Site 1307 reaching a maximum depth of 162.6 mbsf. Two partial strokes of the APC required drilling two intervals in Hole 1307A that were difficult to APC core (50.5 to 52.5 mbsf, and 73.7 to 77.7 mbsf). Five cores were advanced by recovery. Only one core was a partial stroke in Hole 1307B and no intervals required drill-over. Average recovery was 102% for the cored intervals at Site 1307. Coring was terminated due to excessive heave when a passing storm system began to effect drilling operations.

The lower Pliocene to Pleistocene sedimentary succession at Site 1307, which is subdivided into three units, records variations in the input of terrigenous and biogenic components (mostly quartz, detrital carbonate, nannofossils, and foraminifers). Unit I (0-49.55 mcd) is composed of Holocene and Pleistocene mixtures of foraminifers, silty clay, and nannofossils (silty clay with foraminifers, foraminifer silty clay, and nannofossil silty clay). Minor lithologies included eight discrete foraminifer silty sand and sandy foraminifer ooze beds. Unit II (49.55 – 133.86 mcd) is composed mainly of Pleistocene to upper Pliocene silty clay with little biogenic component. Unit III (133.86-173.6 mcd) comprises upper to lower Pliocene silty clay, silty clay with nannofossils, and nannofossil silty clay. With the exception of the foraminifer sand beds, calcium carbonate content is low (mean = 3.8 wt%).

Calcareous, siliceous, and organic-walled microfossils at Site 1307 are common to rare with moderate to poor preservation. A possible hiatus (duration about 0.25 my), or a condensed interval (~ 1.21-1.45 Ma) is indicated between ~56-61 mcd. The dominant components of each microfossil group reflect subpolar to polar conditions during the Pleistocene. In the lower upper Pliocene (before 2.74 Ma), the nannofossil assemblage suggests warmer surface water conditions.

Paleomagnetic directional data yield an almost continuous sequence and permit unambiguous identification of the Brunhes, Matuyama, and Gauss Chronozones. Within the Matuyama Chronozone, the Jaramillo, Olduvai, and Reunion Subchronozones are clearly recognized. Within the Gauss, the Kaena and Mammoth Subchronozones are also recognized, with the base of the section corresponding to the top of the Gilbert Chronozone.

With only two holes drilled, it was impossible to construct a complete spliced record for Site 1307. However, several long intervals of overlap between holes allowed

segments to be correlated between holes (0-56.5 mcd, 76.4-104.7 mcd, and 104.7-146.2 mcd), which were then appended in the record. The mean linear sedimentation rate calculated using biostratigraphic and magnetostatigraphic datums is 4.9 cm/ky. Using only paleomagnetic datums, interval sedimentation rates vary between 2.7 and 7.6 cm/ky.

As for the other Eirik Drift sites, pore water geochemical profiles reflect the influence of organic matter remineralization reactions. Sulfate decreases linearly from the uppermost sample to 79 mbsf where it remains at or below ~1 mM. The methane profile is atypical, decreasing from 200 ppmv in the uppermost sample near the sediment-water interface to a low of ~30 ppmv at 54 mbsf, then increasing again below the sulfate reduction zone to a high of 26,000 ppmv. Calcium and strontium attain minimum values (5.5 mM and 76 mM, respectively) at the base of the sulfate reduction zone where alkalinity reaches a maximum (10 mM) suggesting carbonate mineral precipitation.

Physical property records at Site 1307 document high frequency changes in sediment composition. The variability in sediment composition recorded in magnetic susceptibility, natural gamma ray, and density likely reflect changes in paleoceanographic conditions in the overlying and surrounding water masses and ice sheets at a range of time scales. Site 1307 sediments are also characterized by an overall downcore increase in density (from 1.55 to ~1.76 g/cm^3), and variable but generally decreasing porosity (~70 to 40%).

Site 1307 demonstrates that the Pliocene sediments of the Eirik Drift can be drilled at penetration depths achievable with the APC. Apart from one possible hiatus (in the 1.2-1.4 Ma interval) the sedimentary record at Site 1307 is apparently continuous, with a fairly uniform interval sedimentation rate of about 5 cm/ky. The base of the recovered section correlates to the uppermost Gilbert Chronozone, indicating that the record extends back to ~3.6 Ma. The sediments from Site 1307 will provide information on the history of bottom and surface currents, the Laurentide and Greenland ice sheets, and age control for seismic reflectors that will provide constraints on the sedimentary architecture of the Eirik Drift. The Pliocene-Quaternary history at this site can be placed into a tight age model as the sediments have the attributes required for high-resolution chronostratigraphy based on paleontologic, isotopic, and magnetic methods.