

November 9, 2004

IODP EXPEDITION 303: NORTH ATLANTIC CLIMATE I SITE 1306 SUMMARY

Hole 1306A Latitude: 58°14.228'N, Longitude: 45°38.588'W
Hole 1306B Latitude: 58°14.227'N, Longitude: 45°38.557'W
Hole 1306C Latitude: 58°14.228'N, Longitude: 45°38.527'W
Hole 1306D Latitude: 58°14.227'N, Longitude: 45°38.500'W
Water depth: 2272 mbsl

Site 1306 was placed at the crossing of two seismic lines (Lines 19 and 24) in the multichannel seismic network obtained over the Eirik Drift during Cruise KN-166 (R/V Knorr, PI: Greg Mountain) in summer 2002. At this location, mean upper Pliocene and Quaternary sedimentation rates were estimated to be about 18 cm/ky based on identification of seismic reflector R1 that can be correlated to the mid-upper Pliocene at ODP Site 646. The placement of the site was designed to yield a high resolution (high sedimentation rate) Quaternary environmental record from a water depth within the main axis of the Western Boundary Undercurrent (WBUC). Based on a nearby conventional piston core from a similar water depth (Core HU90-013-012), we expect glacial intervals to be expanded relative to interglacial intervals.

Four holes were cored with the APC system at Site 1306 reaching a maximum depth of 309.3 mbsf. Hole 1306D was cored to 180.0 mbsf to provide necessary stratigraphic overlap for the upper portion of the succession. Five intervals totaling 13 m were drilled without coring to adjust the stratigraphic offset between holes or get through difficult to core intervals. Five cores were obtained by drill-over. Average recovery was 102.5% for the cored interval.

The sediments at Site 1306 are designated as a single lithostratigraphic unit, composed of Holocene to uppermost Pliocene terrigenous and biogenic sediments, which are gradationally interbedded at scales of a few meters or less. Calcium carbonate content is low ranging from 0.3-12.3 wt% (mean = 3.2 wt%). The most common lithologies are silty clay, silty clay with diatoms, nannofossil silty clay, and silty clay nannofossil ooze. Dropstones are present throughout the cored interval and large dropstones (~4 cm) are common to abundant. Centimeter-to-decimeter scale beds of olive gray or greenish gray silty clay or clay with a high detrital carbonate content occur in all holes at Site 1306, but are thinner and less common than at Site 1305.

Rich assemblages of calcareous, siliceous, and organic-walled microfossils are present at Site 1306, although benthic foraminifers are barren in many samples below 175 mcd. Large variations in abundance of microfossils occur downcore. Although preservation is moderate to good in the upper part of the succession, preservation generally decreases below ~170 mcd for calcareous and siliceous microfossils. All samples contain moderately well to well preserved palynomorphs, but variable numbers of dinocysts, which are abundant only in a few samples. Some redeposition is indicated by the presence of reworked nannofossils and palynomorphs of Cretaceous to Miocene age through the cored interval. The dominant components of each microfossil group reflect cold sea-surface temperatures for most of the time represented by the sedimentary sequence.

The sediments at Site 1306 carry well-defined magnetization components and document an apparently continuous sequence including the Brunhes Chronozone and much of the

Matuyama Chronozone. The Jaramillo, Cobb Mountain, and Olduvai Subchronozones are clearly identified. Within the Brunhes Chronozone, the Iceland Basin Event (~190 ka) was observed in three of the holes.

A continuous stratigraphic composite section was constructed to ~337 mcd. Below 287 mcd, cores were recovered in two holes only but the section is complete with a single tenuous tie near the base of the record. The mean sedimentation rate calculated using biostratigraphic and magnetostatigraphic datums is 15.6 cm/ky for the entire section cored at Site 1306. Using only paleomagnetic datums, interval sedimentation rates vary between 12.4 and 19.3 cm/ky.

Pore water chemical profiles at Site 1306 document very similar reactions to nearby Site 1305. Complete sulfate reduction is achieved at shallow depths at Site 1306 (85 mbsf) despite the low organic carbon content (mean 0.3 wt%). Methane increases below 85 mbsf reaching a maximum of 46,000 ppmv. Alkalinity reaches a maximum of 18.7 mM at the sulfate-methane interface whereas calcium concentration attains a minimum value (3.7 mM) indicating carbonate mineral precipitation associated with methane oxidation. From 114-258 mbsf, sulfate increases slightly again (1.5 mM). This interval corresponds to pH and iron fluctuations, which are antithetic to each other, and may indicate zones of anaerobic pyrite oxidation. Dissolved strontium remains at or below seawater values suggesting little or no carbonate dissolution or recrystallization.

Physical property records at Site 1306 are highly variable recording lithologic and mineralogic changes. The higher carbonate content in the upper ~100 mcd results in average lower natural gamma ray and magnetic susceptibility values than in the sediments below. Site 1306 sediments are characterized by an overall downcore increase in density (1.5 to ~1.8 g/cm³) and decreasing porosity (~70 to 50%).

Based on current knowledge from nearby piston cores, Site 1306 has expanded glacial intervals. This sedimentary pattern is complementary to that at Site 1305, where interglacials are likely to be relatively expanded. The apparently complete Quaternary record recovered at Site 1306 provides a high resolution (high sedimentation rate) record of detrital events derived from instability of surrounding ice sheets, as well as providing a monitor of the activity of the WBUC that supplies a component of North Atlantic Deep Water to the Labrador Sea. The site appears to have the attributes required for the generation of a well-constrained age model based on oxygen isotopes, micropaleontology, and geomagnetic paleointensity.