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[Millennial-scale deep ocean ventilation and sea-surface variability during the last four glacial cycles: a new assessment for the Northern Hemisphere ice-sheet growth](#)

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During Expedition 306 of the Integrated Ocean Drilling Program (IODP), site U1313 (41°N, 32.57°W, 3425 m wd) was drilled at the former DSDP site 607 to recover longer records of abrupt climate change. Here we report for the first time continuous millennial-scale, with a mean temporal resolution of ~200-500 yr, variability records of ice-rafted detritus (IRD), North Atlantic Deep Water (NADW) formation, and sea-surface properties during the last 460 ka from the subtropical North Atlantic Ocean. X-ray fluorescence (XRF) data show many-fold increase in Fe and Ti concentrations during the glacial compared to the warmer periods. We attribute such increases in Fe and Ti concentrations mainly to sediment remobilization from the continental shelves around the circum-Atlantic Ocean. IRD data demonstrate an increase in magnitude during the last glacial cycle and Marine Isotope Stage (MIS) 12 in comparison to the previous three glacial cycles. Most of the high IRD peaks are comprised of detrital carbonate grains, suggesting that they were mainly derived from the Laurentide ice-sheet. Enriched  $\delta^{13}\text{C}$  values in *U. peregina* were measured during MIS 3, 5.1, 7.1, and 11.3 whereas the lightest values were observed in MIS 4, 6.4, 8, 9.2, 10 and 12. Moreover, the  $\delta^{13}\text{C}_{\text{Cw}}$  data show progressive enrichment from MIS 12 to the Holocene suggesting waning influence of southern source waters relative to NADW at the site. The millennial-scale  $\delta^{13}\text{C}_{\text{Cw}}$  variability is not always tied to IRD-events. The abundance of *U. peregina* is higher in MISs 3, 4, 5d, 6, 8, 10 and 12 whereas the *U. peregina* is higher during the interglacial with some exceptions. Mg/Ca-derived sea-surface temperatures (SSTs) in *Globigerina bulloides* are not-in-phase with the June 21<sup>st</sup> insolation at 65°N. This relationship of Mg/Ca-SST with solar insolation is consistent with the foraminiferal transfer function-based SST.

1616 Climate variability (1635, 3305, 3309, 4215, 4513)

3344 Paleoclimatology (0473, 4900)

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4926 Glacial

4946 Milankovitch theory

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