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Surface Water Hydrography in the Mid-Latitude North Atlantic (IODP Site U1313) from 480-355 ka: Observations from Calcareous Nannoplankton

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Integrated Ocean Drilling Program Site U1313 cored thick sequences of Pleistocene sediments in the mid-latitude North Atlantic during Expedition 306. This site is located near the region of steepest sea-surface temperature gradients during the last glacial maximum, and is also on the southern margin of the ice-rafted debris (IRD) belt, making it an ideal location to study millennial-scale climate variability during the Pleistocene. Calcareous nannoplankton assemblages from 480-355 ka record changes in surface water conditions during this interval, which spans the end of Marine Isotope Stage (MIS) 13 to the beginning of MIS 10, thus including a complete glacial/interglacial cycle. The assemblage data are compared to the oxygen and carbon isotope records, lithics abundance, x-ray fluorescence measurements, and alkenone data to interpret changes in surface water hydrography. The nannoplankton assemblage is dominated by family Noelaerhabdaceae, and spans a single biostratigraphic event, the last occurrence of *Pseudoemiliania*, dated to 427 ka at this site. Most species indicate paleoecological preferences similar to those found in the literature, although *Gephyrocapsa oceanica* is more abundant during glacial MIS 12, even though it is thought to prefer warmer waters. Similarly, *Helicosphaera*, another warm-water taxon, is also more abundant during MIS 12. Both are generally considered eutrophic species, preferring higher nutrient conditions that occur during glacial stages at this site. The first factor of a CABFAC factor analysis explained nearly 92% of the variability in the assemblage. This factor is dominated by *G. oceanica*, and the varimax factor scores correlate well with the alkenone-based temperature record, suggesting that the distribution of *G. oceanica* at Site U1313 is mostly controlled by temperature. The *N* ratio, based on the ratio of lower photic zone dweller *Florisphaera profunda* to upwelling indicators, shows deep stratification during much of MIS 12, usually associated with an increase in IRD and freshwater proxies indicating the presence of icebergs. Finally, most productivity indicators suggest higher productivity during MIS 12, in contrast to the nannofossil accumulation rate (NAR), which was lower during that time. Other phytoplankton groups, such as diatoms, may have increased productivity during glacials, leading to an overall higher production rate even though calcareous nannoplankton productivity was reduced at that time.