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North Atlantic ice-rafting throughout the last large climatic cycle (0-140 kyr)

J. McManus (1), D. Oppo (1), J. Cullen (2) and W. Thompson (1)

(1) Dept. of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, (jmcmanus@whoi.edu, +01 (508) 289-3328), (2) Dept. of Geological Sciences, Salem State College, Salem MA 01970

We present a new high-resolution record of ice-rafted debris (IRD) deposited in the subpolar North Atlantic Ocean during the last 140,000 years. Measurements of the abundance of detrital grains $>$ 150 um were made in over 700 samples from the uppermost 20 meter section of sediment recovered at ODP Site 980 (55˚29'N, 14˚42'W, 2179 m). The sample resolution corresponds to approximately 200 years, and IRD abundance varies over three orders of magnitude, from the detection limit of less than one gram per gram of sediment to over 2000/g. Comparison of the IRD record with benthic and planktonic foraminifera stable isotopes from the same core allows the direct placement of ice-rafting events within the marine isotope stratigraphy. Overall, the section represents an interval from the late Holocene to the penultimate glaciation marine isotope stage 6 (MIS 6). A series of small peaks in IRD occurs within MIS 5, associated with the previously identified millennial cold events (McManus et al., 1994). A similar magnitude peak occurs at the Younger Dryas within the last deglaciation, although no comparable event accompanies the previous deglaciation. Larger peaks in IRD occur at the end of MIS 6 and within the last glaciation MIS 2-4, with the largest constituting the Heinrich event catastrophic iceberg discharges (Heinrich, 1988; Bond et al., 1992). The IRD at Site 980 consistently occurs in rather narrow, well-defined peaks, interspersed with intervals containing little ice-rafted sediment, confirming the episodic nature of iceberg discharges in the North Atlantic. Many of the most prominent IRD peaks are associated with lower benthic δ18O and higher planktonic δ18O, suggesting cooling near the sea-surface, possible subduction of meltwater from elsewhere, or changes in sea level throughout the entire cycle. The Heinrich events in particular are also associated with lower benthic δ13C, indicating reduced influence

of northern source waters.