Rapid climate changes recorded in sediments recovered by deep drilling in the North Atlantic Ocean

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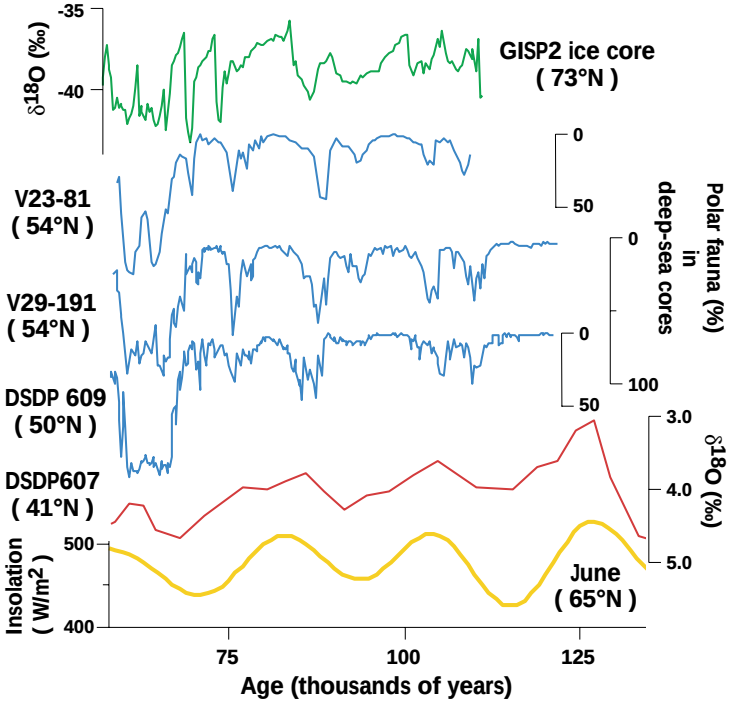
Studies of deep-sea sediments have been instrumental in demonstrating the influence of orbitally controlled insolation patterns on Earth's climate. Such climatic variations, including the repeated Pleistocene ice ages, have occurred on time scales of 10^4-10^5 years.

More recently, evidence has emerged from deep drilling on the Greenland ice sheet that dramatic climate oscillations occurred on much shorter, even human, time scales (10^2-10^4 years). The fact that essentially the same signal emerged from multiple cores through the last glacial episode indicates that the record is real, and not an artifact. Unfortunately, only two Greenland ice cores penetrate significantly into the preceding mild climatic interval, and none extends reliably through the last peak interglacial period, the nearest geologic analog to the Holocene interglacial, during which we live.

Exciting new evidence of abrupt and dramatic changes representing iceberg armadas (e.g., Broecker et al., [1992]) and temperature fluctuations (e.g., Bond et al., [1993]) has now emerged from high-resolution marine records of the last glacial in the North Atlantic Ocean. These studies by necessity focused on areas of rapid sediment accumulation, including deep drilling sites. Extending these records through the preceding warm period (see figure) demonstrates that deep-sea sediments have faithfully recorded the same signal preserved in the Greenland ice sheet, as far back in time as the best ice cores are in agreement with each other. Beyond that, only the deep-sea is likely to yield the requisite multiple undisturbed records to provide a reliable indication of past climate variability. High resolution analysis, so successful within the last glacial-interglacial cycle, may now be applied to the long spliced continuous sediment sections made possible by ODP's ability to recover multiple cores from each of several closely space drillholes at rapid-accumulation sites. Careful examination of these composite sections holds the exciting promise of a better understanding of natural climate variability on relatively short time scales.



Comparison of marine faunal data [*McManus et al.*, 1994] with isotopic records from Site 607 [*Ruddiman et al.*, 1989] and Greenland [*Grootes et al.*, 1993].

References:

Bond, G.C., W.S. Broecker, S. Johnsen, J.F. McManus, L. Labeyrie, J. Jouzel, and G. Bonani, Correlations between climate records from North Atlantic sediments and Greenland ice, *Nature*, *365*, 143-147, 1993.

Broecker, W.S., G.C. Bond, M. Klas, E. Clark, and J.F. McManus, Origin of the northern Atlantic's Heinrich events, *Climate Dynamics*, *6*, 265-273, 1992.

Grootes, P.M., M. Stuiver, J.W.C. White, S. Johnsen, and J. Jouzel, Comparison of oxygen isotope records from the GISP2 and GRIP Greenland ice cores, *Nature*, *366*, 552-554, 1993.

McManus, J.F., G.C. Bond, W.S. Broecker, S. Johnsen, L. Labeyrie, and S. Higgins, High-resolution climate records from the North Atlantic during the last interglacial, *Nature*, *371*, 326-329, 1994.

Ruddiman, W.F., M.E. Raymo, D.G. Martinson, B.M. Clement, and J. Backman, Pleistocene evolution: northern hemisphere ice sheets and North Atlantic Ocean, *Paleoceanography*, *4* (4), 353-412, 1989.