Piecing Together Ocean Circulation Changes: How the North Atlantic Circulation Changed from MIS 6 to MIS 5e

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The Atlantic Meridional Overturning Circulation (AMOC) is an essential factor when analyzing climate systems given its major transportation of heat, water masses, and chemical species in the Atlantic Ocean. In this study, we focused on better understanding the links between the AMOC and the Penultimate Deglaciation: the major and abrupt transition from Marine Isotope Stage 6 (MIS 6), a peak glacial period circa 135 kyr, to MIS 5e, a peak interglacial period, circa 125 kyr. To study the past changes in the AMOC, we have analyzed the calcium carbonate ($CaCO_3$) content within two high-sedimentation rate cores KNR191-19CDH (33.69°N, 57.58°W, 4550 m) and MD95-2037 (37.09°N, 32.04°W, 2159m) and calculated CaCO3 fluxes by normalizing to 230Th mass fluxes, to help unveil changes in deep water masses chemistry.
Our results show that $CaCO_3$ content is controlled by dilution by the lithogenic fraction. However, our $CaCO_3$ flux calculations, which are virtually insensitive to dilution effects, indicate for both cores similar flux and water chemistry during MIS 6. We observe an abrupt differentiation in $CaCO_3$ flux between the two cores around 130 kyr, when the $CaCO_3$flux in the shallower core spikes and the flux in the deeper core stays consistently low. Though it is possible that this change was caused by a fluctuation in biological production between the two sites, it is very unlikely because the two sites are under the influence of oligotrophic surface waters from the subtropical gyre. Thus, we attribute the cause of this divergence in flux to a change in water chemistry that may have enhanced carbonate dissolution at great depths.
By comparing our $CaCO_3$ records with other proxies sensitive to bottom water chemistry (Cd/Ca and the degree of fragmentation of foraminifera shells), we evidence the presence of corrosive Southern Source Waters during this abrupt event. The intrusion of Southern Source Waters in the deep Subtropical North Atlantic appears to be coeval with a major Ice Rafted Debris peak, a proxy that indicates a surge of continental icebergs in the North Atlantic, recorded in a sediment core from high Northern latitudes. Through massive release of freshwater at the ocean's surface, this iceberg surge has affected deep water formation in the Northern latitude which has resulted in a major change of the deep water circulation and favored the northward expansion of Southern Sourced Waters. Further studies, for instance by reconstructing sea surface temperature changes during this period, will help us unveil the climatic consequences of such a change in ocean circulation.