Deep Ocean Circulation in the West and East North Atlantic during the Last Glacial Period and Holocene

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The transport of heat throughout the ocean using deep water circulation has a drastic impact on the Earth's climate. Determining the factors that drove deep ocean circulation and the composition of circulating water during past glacial periods is integral to understanding the ocean's role in future climate change. Tracking the composition of the deep water formed primarily in the high-latitude North Atlantic and the Southern Ocean over specific locations in the North Atlantic can show how inputs of water have changed since the last glacial period, and comparing two sites in the west and east Atlantic has the potential to reveal a bigger picture of the overall deep circulation in the North Atlantic. This study focuses on Integrated Ocean Drilling Program (IODP) Site U1313 on the western flank of the mid-Atlantic ridge (41°N, 32°W) at 3,426m depth, which is useful for evaluating deep water contributions from the North Atlantic and Southern Ocean through time. Bottom water was reconstructed using *Cibicidoides wuellerstorfi* d^{13}C (‰) and d ^{18}O (‰) isotope ratios. *C. wuellerstorfi* are an epifaunal species and are therefore a faithful recorder of the bottom water conditions at that location. With one sample per centimeter, this study has an approximate temporal resolution of 400 years and extended from 65ka through the Holocene. Our results reveal that despite the relatively modest shift in d ^{18}O (‰) between marine isotope stage 4 (MIS 4) to MIS 3, from about 4.6‰ to 3.8‰, there were substantial changes in d ^{13}C (‰), from approximately -0.5‰ to 1‰. The benthic d ^{13}C of around 1‰ in MIS 3 reflects similar values as in the modern Atlantic, where North Atlantic Deep Water has a larger influence than water sourced in the Southern Ocean. A comparison was also made to previously published data from IODP Site U1385 (37.57˚N, 10.13˚W) on the West Iberian margin at 2,578m depth [Hodell, et al., *Climate of the Past*, 2023]. The two sites had low, and similar, d ^{13}C during MIS 4, indicating the broad influence of southern-sourced water. While d ^{13}C reached 1‰ at U1313 repeatedly during MIS 3, U1385 values remained persistently lower than U1313 despite its shallower depth, hinting at a larger Southern Ocean influence at that eastern site and a stronger deep water contrast between east and west basins of the North Atlantic during that climatically variable interval.