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Northern Sourced Water dominated the Atlantic Ocean during the Last Glacial Maximum

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Increased carbon sequestration in the ocean subsurface is commonly assumed to have been one of the main causes responsible for lower glacial atmospheric CO_2 concentrations. This carbon must have been stored away from the atmosphere for thousands of years, yet the water mass structure accommodating such increased carbon storage continues to be debated. Here we present new sediment derived bottom water neodymium isotope data that allow fingerprinting of water masses and their mixtures and provide a more complete picture of the Atlantic overturning circulation geometry during the Last Glacial Maximums. These results suggest that the vertical and meridional structure of the Atlantic deep water mass distribution only experienced minor changes since the last ice age. In particular, we find no compelling evidence supporting glacial southern sourced water substantially expanding to shallower depths and farther into the northern hemisphere than today, which has been inferred from stable carbon isotope reconstructions. We argue that depleted $\delta^{13}C$ values observed in the deep Northwest Atlantic do not necessarily indicate the presence of southern sourced water. Instead, these values may represent a northern sourced water mass with lower than modern preformed $\delta^{13}C$ values that were further modified downstream by increased sequestration of remineralized carbon, facilitated by a more sluggish glacial deep circulation. If proven to be correct, the glacial water mass structure inferred from Nd isotopes has profound implications on our understanding of the deep ocean carbon storage during the Last Glacial Maximum.