Assessing the biogeochemical impact of AMOC collapse: New South Atlantic records spanning MIS 2-6

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Carbon isotope minima were a ubiquitous feature in the mid-depth (1.5-2.5 km) Atlantic during Heinrich Stadial 1 (HS1, 14.5-17.5 kyr BP), with the most likely driver being collapse of the Atlantic Meridional Overturning Circulation (AMOC) [1, 2]. Model simulations suggest a weaker AMOC increases the residence time of water at mid-depth and causes accumulation of respired carbon [3], consistent with [CO_3^{2-}] reconstructions from the western Atlantic [4, 5]. Subsequent weakening of the biological pump may cause light carbon to accumulate in the surface ocean and atmosphere, accounting for surface ocean $\delta^{13}C$ minima and the initial rise in atmospheric CO_2 [3, 6]. Here, we test the AMOC-biopump hypothesis using high resolution planktonic and benthic $\delta^{13}C$ records from the Brazil Margin (1.8 km and 2.1 km water depth). We show that *N. dutertrei* and *G. sacculifer* $\delta^{13}C$ lags benthic $\delta^{13}C$ during HS1 by ~500 years. Because the planktonic and benthic results are based on analyses of the same samples, the relative timing is constrained by the stratigraphic offset of the $\delta^{13}C$ time series. Our results are consistent with the model prediction of an initial AMOC collapse causing $\delta^{13}C$ minima at mid-depth followed by weakening of the biological pump and equilibration of the surface ocean with a ^{13}C-depleted atmosphere.

We will also present new results that extend the Brazil Margin records from MIS 2 to MIS 6. We find that benthic $\delta^{13}C$ minima occur during each glacial-interglacial transition of the last 140 kyr, including MIS 6-5e, 5d-5c, 5b-5a, and perhaps MIS 4-3. The $\delta^{13}C$ signal is larger at 1800 m water depth following MIS 6 and 2, while the deeper site (2300 m) displays larger anomalies following MIS 5d, 5b, and 4. The depth dependency of the $\delta^{13}C$ anomalies is likely due to shoaling of northern source water during full glacial conditions. We will also discuss whether planktonic $\delta^{13}C$ lags benthic $\delta^{13}C$ during each deglaciation of the past 140 kyr, a key prediction of the AMOC-biopump hypothesis.

[1] McManus et al. (2004) *Nature,* **428**, 834. [2] Oppo et al. (2015) *Paleoceanography,* **30**. [3] Schmittner and Lund (2015) *Clim. Past,* **11**, 135. [4] Lacerra et al. (2017) *Paleoceanography,* **32**. [5] Yu et al. (2010) *Science,* **330**, 1084. [6] Hertzberg et al. (2016) *GRL,* **43**.

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