Nd Isotopes in the North Atlantic endmember of the AMOC over the last 1.3 Ma

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Keywords: Atlantic meridional ocean circulation, neodymium isotopes, ice ages

The Atlantic Meridional Overturning Circulation is an important means for distributing heat between the tropics and the high latitudes, and its temporal variability has major impacts on ice age cycles. As part of a project to generate profiles of the AMOC from the North Atlantic to the Southern Ocean at time slices over the past ~2 Ma, we have analyzed Nd isotopes in Fe-Mn-oxide encrusted foraminifera and fish debris in DSDP Site 607 *(41°00'N, 32°58'W, 3,427 m)* on the western flanks of the Mid-Atlantic Ridge and ODP Site 1063 *(33°41´N, 57°37´W, 4,584m)* in the abyssal plain near the Bermuda Rise. Thus both Sites are in the deep western North Atlantic basin, and were targeted to constrain the variability of εNd in the North Atlantic end-member.

Our data show that εNd-values of Site 607 during interglacials are consistently close to the modern day NADW value of εNd ~ -13.5, as well as literature values for Fe-Mn crusts. During glacials, Site 607 shows more positive εNd values than interglacials, averaging ~ -12 prior to the Mid-Pleistocene Transition and ~-11 since the MPT. Moreover, the glacial-interglacial εNd variability covaries with benthic $\partial^{13}C$, and both are consistent with a small component of Southern-sourced water reaching the site during glacial. During the MPT "AMOC crisis" of Pena and Goldstein (Science 2014), Site 607 shows more positive εNd-values between MIS 25 and 21 indicating a strong and lasting incursion of southern waters into the deep North Atlantic. In contrast to the Site 607data, the values in Site 1063 fluctuate wildly, showing extreme εNd during some interglacials, reaching values of εNd ~ -20 several times. Its most extreme εNd value is ~ -27 during MIS 28, while during MIS 28 the values in Site 607 are between -13 and -14, like modern day NADW.

We conclude that the Site 607 εNd interglacial data represents the North Atlantic endmember of the AMOC, which has remained similar to the value of NADW today, and the higher values during glacials reflect incursion of southern waters into the deep north Atlantic. At the same time, the Site 1063 data do not appear to represent the North Atlantic AMOC endmember, but appear to show local or regional effects, whose mechanism is not yet explained. We are currently working to identify their cause.