Reassessing the nitrogen isotope composition of sediments from the proto-North Atlantic during Oceanic Anoxic Event 2

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Sediment records of the stable isotopic composition of N ($\delta^{15}N$) show light $\delta^{15}N$ values at several sites in the proto-North Atlantic during Oceanic Anoxic Event 2 (OAE2; ~94 Ma). The low $\delta^{15}N$ during the event is generally attributed to an increase in N_2-fixation and incomplete uptake of NH_4^+ for phytoplankton growth. Surprisingly, published $\delta^{15}N$ values for OAE2 vary widely, even for similar locations. Using analyses of $\delta^{15}N$ for sediments from three open-ocean and two coastal sites, we suggest that this reported variation is likely related to the treatment of sediment samples with acid prior to the $\delta^{15}N$ analysis. A compilation of available data for unacidified samples for the proto North-Atlantic during OAE2 demonstrates that the most pronounced negative shift in $\delta^{15}N$ from pre-OAE2 to OAE2 occurs in the open ocean with $\delta^{15}N$ never lower than -3 ‰. Using a box model of N cycling for the proto-North Atlantic during OAE2, we show that both N_2-fixation and incomplete uptake of NH_4^+ are major contributors to the $\delta^{15}N$ signal. Our study provides an overview of regional differences and highlights the role of upwelling and lateral exchange of water and nutrients, in addition to local biogeochemical processes, in determining $\delta^{15}N$ values of OAE2 sediments.