

Interactive comment on “North Pacific-wide spreading of isotopically heavy nitrogen from intensified denitrification during the Bølling/Allerød and post-younger dryas periods: evidence from the Western Pacific” by S. J. Kao et al.

Anonymous Referee #3

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This paper presents sedimentary nitrogen isotopic data from intermediate depths collected at the Okinawa Trough in the western North Pacific. The sedimentary record spans the last 30 kyr and shows interesting millennial-scale oscillations during the last deglaciation that the authors interpret as representing a widespread signal of denitrification occurring in the eastern Tropical North Pacific. In my opinion, the paper is still at a rather initial stage, more like a draft, but the data deserves publication. There are

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many pieces of information that need to be included and a substantial revision of the manuscript and its English is necessary.

At this stage I will not comment on all the specific aspects that should be addressed by the authors, rather I will give some general suggestions that, in my opinion, could help to improve each section:

Introduction:

I think that what the authors mean by "unsettled issues of denitrification in the past" is not the intensity of water column denitrification in the North Pacific during the LGM, which is known to be reduced, but the net effect of this reduction on the global ocean N inventory and the $\delta^{15}\text{N}$ signal in oceanic NO_3 . I would suggest revising the introduction and discussing in more detail why the selection of the Okinawa Trough coring site is pertinent to that particular "unsettled issue". Also, I would discuss here what would be the consequences of "settling" the issue.

Materials and Methods:

The age model construction for MD012404 is critical because they are comparing far distant records in a common time scale. I find the age model section too brief to say the least. Since the age model is based mostly on results obtained for this paper, the authors need to show all the information about the new radiocarbon ages, calibration method, other age constraints (presence of the volcanic eruption), etc.

Results and discussion:

Here the authors embark in a lengthy description/discussion on the study area and some potential influences on the sedimentary archive. I would suggest to write a separate "study area" section with a detailed oceanographic and biogeochemical description. In particular, given the inferred connection with the eastern North Pacific, I would like to see a review of the effect of NPIW on the local water column properties. Mapped sections could help here.

BGD

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Given the broad implications of a "North pacific-wide" denitrification signal, the interpretation of the sedimentary nitrogen isotopes as a "proxy of what" should be more carefully considered. How can we be certain that the millennial oscillations are not due to changes in local N fixation rates, as the authors recognize is a factor affecting their d15N data throughout the record (may be through climate-driven changes in Fe input)?...(this is just one example!)

As noted before, the discussion is embedded with the results and it is in general, very weak and vague. The authors seem to be content with just naming different scenarios for the observed variability but they failed to try to favor/discard one or another using their or other's data. Presenting more records to support their conclusions is one way to go.

In general terms, I miss a more detailed oceanographic discussion, i.e. implications of their data its interpretation for the ventilation history of the whole North pacific. What about connections with the Southern Hemisphere?, Indian Ocean? Monsoons?... etc. One example: The authors argue that the causes of an increased denitrification in the North Pacific during warm interstadials are still debatable (ventilation vs. export productivity). Surprisingly, they have overlooked the fact that by "seeing" the signal in their distant site might provide something important to say about that debate!

I am sure that the results of this study could add many interesting pieces to the ever growing N-cycle jigsaw puzzle.

Summary:

I think that this article could be considered for publication in Biogeosciences once a substantial revision is made. The data is certainly of interest but it is not ready for publication in its present form.

Interactive comment on Biogeosciences Discuss., 5, 1017, 2008.

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