

The **authors' responses** are recorded below. November 10 2022

Associate Editor Comments

As you see, both reviewers like your manuscript and support its publication after minor revisions. Thank you for addressing both reviewers' comments. I agree with your proposal on how to improve the manuscript by incorporating both reviews. Please prepare a revised manuscript accordingly.

We would like to extend our thanks to the associate editor for their efforts handling to manuscript.

Reviewer 1

The manuscript by Woodhouse et al. presents planktic foraminiferal count data, species stable isotopic data, and morphometric analyses from the Pliocene of IODP Hole U1338A to assess changes in water structure across the closure of the Central American Seaway. The study is sound, and includes new data that can be incorporated into future paleoceanographic and geochemical studies related to CAS closure and plankton evolutionary responses. The Discussion section may need a bit of re-organization for clarity and flow, but other than that, the paper is well-organized in a logical way. All supplemental figures and files are great. All in-manuscript figures are excellent. I commend the authors on the nice presentation of data and excellent SEM images!

We thank the reviewer for their kind words and excitement for the manuscript.

Boscolo-Galazzo et al. 2021 is a two first-author paper; if the editors/journal allow, I suggest changing the reference to Boscolo-Galazzo & Crichton et al. (2021) throughout the manuscript.

This reference has now been changed to Boscolo-Galazzo & Crichton et al. 2021 throughout the text, thank you for pointing that out, I will ensure that I do this in the future, and when reviewing papers in the future that reference this work, that they do the same.

Methods section: Include in Section 2.1 or elsewhere in the methods the time interval for which you are conducting the analyses.

This data has now been added to the Methods section, see lines 156/157

Figure 2 – If you can add the species names next to the color key on the figure, instead of in the caption, this would be most helpful to readers. The figure caption reads 'dashed line represents permanent switch to higher proportion of cold-water taxa'; but there are two dashed lines in the figure and neither are labeled a cold-water switch; changing the *Dentoglobigerina* extinction horizon to be a solid line would be helpful and most clear.

The in-figure key has now been changed to the species names, and the ecologies are now included within the figure caption. The *Dentoglobigerina* extinction horizon has also now been changed to a solid line to avoid confusion

Line 183: Not clear what 'relatively even abundances' indicates, rephrase. Unchanging species abundances?

We have now changed this to “generally consistent species abundances” – see line 196

Line 198: Spell out ‘Dentoglobigerina’ as it starts a sentence.

Dentoglobigerina has now been spelt out. See line 212

Lines 289-290: First mention of the menardellid acme event. Suggest defining what this event is in more detail in the above paragraph (depth and age from which it occurs, if the acme event is defined based on the occurrences of *M. cf. exilis* and *M. cf. pertenuis* only, or all species of menardellids shown in Figure 6). Suggest taking the information in lines 254-255 and including it with more specific information about the acme event, so the information is less disparate.

This event has now been better defined on lines 267-269 to clearly layout what the event is showing and where it occurs.

Lines 266-290, Table 1, Figure 6: The discussion section text surrounding the menardellids should go under its own heading, as a separate sub-section within the Discussion.

This has now been added under a new heading

Lines 252-265: This text could go under section 4.1, where the discussion focuses on the dentoglobigerininiids.

Discussion: If you take the above advice and move the discussions surrounding dentoglobigerininiids and menardellids to their respective sub-sections, the Discussion could open with a shorter introduction paragraph that gives an overview of the coming sections. This is up to the authors.

We have added this text to the appropriate section, and also reordered the discussion to move from the topic of Dentos, then to Menardellids, as laid out in the Discussion intro. We thank the author for pointing this out, it now is more concise

Line 472: ‘capability’ is misspelled

This has now been spelt correctly

Reviewer 2

In this paper Woodhouse et al., use stable isotopes, faunal analyses and morphometrics to investigate changes in ocean structure from the Pliocene to present. In general, the paper is well-executed, and the figures are well constructed.

We thank the reviewer for their positive comments and feedback on the manuscript.

Main Point. The main themes of the paper, the stable isotopes and morphometrics of the ~3.5 to 3 Ma period and the long-term faunal analyses over the last five million years feel a little disjointed. Some of the emphasis on framing the Northern Hemisphere Glaciation doesn’t seem to fit with the stable isotope/morphometric data. I understand you’re trying to put this high-resolution dataset into some global context but, with respect to with ice sheet stability, the

dataset doesn't extend over our canonical understanding of Northern Hemisphere Glaciation at around 2.7 Ma. Although certainly many have argued that Northern Hemisphere Glaciation started before the mid-Pliocene Warm Period (e.g. Mudelsee and Raymo, 2005). I think the paper could be framed with more emphasis on understanding the mid-Pliocene warm period and how that's different from today. The mid-Pliocene is an IPCC modelling target because CO₂ levels are similar to today and global temperature were warmer than today (2-3C). Given those conditions, the upper ocean structure during your high-resolution analyses is really different from today with the cold water/thermocline species and what is the potential change would be in the future.

We thank the reviewer for their detailed feedback, and we agree that we should add in sections to highlight the importance of the mid-Pliocene Warm Period in this study, we have changed the title, the abstract, the introduction and the conclusions to highlight the importance of the mPWP as a baseline for the current warming scenario.

Minor Points. Figures 2 and 5: Could you confirm theses are colour-blind friendly? If not, could you use different line dashes or hatch marks to differentiate (would be good for black and white printing as well).

We thank the reviewer for making this point, Figure 5 was color-blind friendly, but Figure 2 was not, this has now been changed to improve accessibility.

Correct the xlsx tabs on the supplemental All Species datasheet (currently says benthic).

This has now been corrected.