

Response to the comment of the anonymous referee 3

Suggestions for revision or reasons for rejection

“The author has addressed the primary concerns of the previous reviewers, however there are some minor corrections needed to ensure the language is clear, and also accessible to non-specialists. Other than the corrections and comments I have suggested, the quality and scientific rationale of the manuscript are very good, and I am more than happy it to be published if the comments are addressed.”

Response: I thank the anonymous referee for her/his helpful critic and her/his suggestions for an improvement of the manuscript.

Comment on Line 2: “planktonic foraminifer” instead of “planktonic Foraminifer”

Response: This suggestion is adopted.

Comment to Line 21: “likely suggests that” instead of “suggests that probably”

Response: This suggestion is adopted.

Comment on Line 26: “This is the first mention of the acronym "AMOC" so must be defined here, not later on line 28/29”

Response: This suggestion is adopted.

Comment on Line 29: “this” instead of “that”

Response: This suggestion is adopted.

Comment on Line 29f: “As you mention the AMOC/thermocline hypothesis, maybe mention the thermocline here too”

Response: This suggestion is adopted.

Comment on Line 32: “‘test’ is quite a specialist word for the general reader, so best to define what is meant early on”

“While short-term changes in the size of planktonic foraminifera (PF) calcareous skeletons, or "tests"...

Response: This suggestion is adopted.

Comment on Line 33f: “Maybe mention other studies which document significant size increases in PF e.g.:

Wade, B.S., Poole, C.R. and Boyd, J., 2016. Giantism in Oligocene planktonic foraminifera *Paragloborotalia opima*: Morphometric constraints from the equatorial Pacific Ocean. *Newsletters on Stratigraphy*, 49(3), pp.421-444.

Woodhouse, A., Jackson, S.L., Jamieson, R.A. et al. Adaptive ecological niche migration does not negate extinction susceptibility. *Sci Rep* 11, 15411 (2021).
<https://doi.org/10.1038/s41598-021-94140-5>“

Response: This suggested literature will be cited.

Comment on Line 34: “primarily associated” instead of “associated”

Response: This suggestion is adopted.

Comment on Line 37: insert “lineage”

Response: This suggestion is adopted.

Comment on Line 40: delete comma

Response: This suggestion is adopted.

Comment on Line 44: “may” instead of “is supposed to”

Response: This suggestion is adopted.

Comment on Line 45: “Define the acronym NHG here, not on line 51”

Response: This suggestion is adopted.

Comment on Line 53f: “A more up to date reference should be used for the Isthmus of Panama, whenever the closure is mentioned also reference:

O’Dea, A., Lessios, H.A., Coates, A.G., Eytan, R.I., Restrepo-Moreno, S.A., Cione, A.L., Collins, L.S., De Queiroz, A., Farris, D.W., Norris, R.D. and Stallard, R.F., 2016. Formation of the Isthmus of Panama. *Science advances*, 2(8), p.e1600883.”

Response: The suggested literature will be cited throughout the text.

Comment on Line 64: “can unequivocally prove” instead of “allow to proof”

Response: I will rephrase this passage.

Comment on Line 79: ”which(?)”

Response: I will rephrase this sentence to prevent misunderstandings.

Comment on Line 81: add “by this system”

Response: This suggestion is adopted.

Comment on Line 84: “are” instead of “is”

Response: This suggestion is adopted.

Comment to Line 86: regarding carbonate compensation depth: “very briefly define this for the non-specialist”

Response: This suggestion is adopted.

Comment on Line 87: remove “the”

Response: This suggestion is adopted.

Comment on Line 92: insert “an”

Response: This suggestion is adopted.

Comment on Line 102: insert “,”

Response: This suggestion is adopted.

Comment 1 to the caption of Fig. 1: “What about Site 503?”

Response: I will correct this mistake. I somehow forgot to mention this site in the caption.

Comment 2 to the caption of Fig. 1: “This is labeled PNECC on the figure”

Response: This mistake will be corrected.

Comment 1 to Table 1: “Units should be in brackets, for Age too”

Response: These suggestions are adopted.

Comment 2 to Table 1: “Move this to the Table caption, it looks a little squashed here”

Response: These suggestions are adopted.

Comment on Line 112: “weighed” instead of “weighted”

Response: This mistake will be corrected.

Comment on Line 121: “views” instead of “view”

Response: This suggestion is adopted.

Comments to Line 122f: “has proven” instead of “is proofed”

Response: This mistake will be corrected.

Comment on Line 127f: “any how many *G. tumida*, I know they are not used but it would be good to mention“

Response: In total, 125 specimens of *G. tumida*, 18 specimens of *G. plesiotumida* and of 20 specimens of *G. merotumida* were found. But as the referee says, the *G. tumida* lineage is not included in this study, so I do not want to mention this lineage in the text. Data collected for those species will be deposited at the PANGAEA repository.

Comment on Line 155: “I think the technical term is "aspect ratio", which is used in a number of other morphometric studies of PF”

Response: This suggestion is adopted.

Comment on Line 167: insert “,”

Response: This suggestion is adopted.

Comment on Line 177: “‘solidify’ would be more appropriate I feel”

Response: This suggestion is adopted.

Comment on Line 193: “Should the Greek letter ‘delta’ be capitalized here?”

Response: I have chosen to denominate grid cell size as “ Δ ” to distinguish it against “ δ ”, which is used for the spiral height and axial length. “ Δ ” has no further meaning, it is not meant to express the difference between two values as e.g. in isotopic measurements.

Comment on Line 239: insert “a”

Response: This suggestion is adopted.

Comment 1 to Line 253: “Go with Fig. 7, maintain the same formatting throughout”

Response: This suggestion is adopted.

Comment 2 to Line 253: insert “the”

Response: This suggestion is adopted.

Comments for Line 254: insert “,”

Response: This suggestion is adopted.

Comment 1 to (the caption of) Fig. 5: “It would be helpful/aesthetic to have the name and an image of each of the species within each of boxes.”

Response: I will add the species’ name to the corresponding graphs.

Comment 2 to the caption of Fig. 5: “The line is blue, but the triangles appear to be black”

Response: This mistake will be corrected.

Comment on (the caption of) Fig. 6: “Again, species labels and images will improve this Figure”

Response: I will add the species’ name to the corresponding graphs.

Comment on (the caption of) Fig. 7: “Same as previous 2 figures”

Response: I will add the species’ name to the corresponding graphs.

Comment on Line 285f: “This sentence seems a little unnecessary, I would remove this and rephrase the start of the next sentence as perhaps: “If the described bimodality patterns were to indicate speciation within *G. menardii*, modal centres...” or something along those lines”

Response: This suggestion is adopted.

Comment on Line 287: “can” instead of “need to”

Response: This suggestion is adopted.

Comment on Line 287: “through vertical stacking of CFDs” instead of “which is done in a vertical section of stacked CFDs”

Response: This suggestion is adopted.

Comment on Line 287f: delete “so-called”

Response: This suggestion is adopted.

Comment on Line 289-292: “This seems a little in depth to be part of the results section. This whole highlighted part appears to be interpretation/discussion.”

Response: I will remove this passage from the script.

Comment 1 to the caption of Fig. 9: “You use the whole phrase here, but CFD on the next line. Please make sure the acronyms are consistent”

Response: This suggestion is adopted.

Comment 1 to the caption of Fig. 9: “I can't actually see the CFD from 7.11 on plot B”

Response: This mistake will be corrected by deleting the mentioning of CFD from 7.11 Ma for B.

Comment on Line 319: “during which” instead of “and”

Response: This suggestion is adopted.

Comment on Line 325: “a potential” instead of “an influence”

Response: I am not entirely sure if I fully understand the intention of this comment. The phrase “indicates an influence of” will be changed to “indicates a potential influence of”.

Comment 1 to the caption of Fig. 10: “Start this sentence with (2), or it reads like a continuation of the previous description”

Response: This suggestion is adopted.

Comment 2 to the caption of Fig. 10: “Again, start the sentence with (5)”

Response: This suggestion is adopted.

Comment 3 on the caption of Fig. 10: “This makes it sound like no giant specimens were found after this box. Do you mean that this is the interval where the size increase took place?”

Response: Yes, this sentence should express that the size increase took place in these site-specific time intervals. I will clarify this by extending this sentence.

Comment on Lines 330-333: “‘phases’. Define the phases which you then refer to on lines 337-339”

Response: The term “period” will be replaced by “phase”. A short definition of what defines a phase, i.e. a time period in which in the predominant coiling direction of populations exhibit a similar pattern, will be given.

Comment on Line 354: “prove” instead of “proof”

Response: This mistake will be corrected.

Comment on Line 405: “This is your first time using this acronym, define it earlier in the text if you are going to use it.”

Response: This acronym will be removed.

Comment on Line 409: “potentially suggest” instead of “rather call for”

Response: This suggestion is adopted.

Comment on Line 415-419: “This suggests that *G. tumida* evolved separately twice within both the Indian and Pacific sectors? I thought the conclusions of Hull & Norris (2009) superseded those of the Malmgren study?”

Response: This sentence should express that Hull and Norris (2009) observed this speciation event in an even shorter time interval at Hole 806C than Malmgren et al. (1983) did at Site 214. The sentence will be rephrased.

Comment on Lines 427-431: “Other PF studies which invoke these mechanisms as drivers include:

Schmidt, D.N., Caromel, A.G.M., Seki, O., Rae, J.W.B. and Renaud, S., 2016. Morphological response of planktic foraminifers to habitat modifications associated with the emergence of the Isthmus of Panama. *Marine Micropaleontology*, 128, pp.28-38.

Todd, C.L., Schmidt, D.N., Robinson, M.M. and De Schepper, S., 2020. Planktic foraminiferal test size and weight response to the late Pliocene environment. *Paleoceanography and Paleoclimatology*, 35(1), p.e2019PA003738.

Woodhouse, A., Jackson, S.L., Jamieson, R.A. et al. Adaptive ecological niche migration does not negate extinction susceptibility. *Sci Rep* 11, 15411 (2021).
<https://doi.org/10.1038/s41598-021-94140-5>

Response: The mentioned literature will be included.

Comment on Lines 433-435: “I would also reference the work of Anieke Brombacher and others, detailing size and biogeography dynamics of extinction of the thermocline dweller *Globoconella puncticulata*, which shows interesting size changes around the same time the menardellids are showing variation:

Brombacher, A., Wilson, P.A., Bailey, I. and Ezard, T.H., 2017. The breakdown of static and evolutionary allometries during climatic upheaval. *The American Naturalist*, 190(3), pp.350-362.

Brombacher, A., Wilson, P.A., Bailey, I. and Ezard, T.H., 2021. The Dynamics of Diachronous Extinction Associated with Climatic Deterioration near the Neogene/Quaternary Boundary. *Paleoceanography and Paleoclimatology*, p.e2020PA004205.”

Response: The mentioned literature will be included.

Comment on Line 437: insert “,”

Response: This suggestion is adopted.

Comment on Lines 440-443: “Interesting and exciting theory, is there isotopic evidence available which may support such a hypothesis?”

Response: Unfortunately, there was not enough time during the project to make isotopic measurements. A comment will be added that this hypothesis requires further evidence by isotopic measurements to be proven.

Comment on Line 442: insert “the”

Response: This suggestion is adopted.

Comment on Line 448: “similar” instead of “parallel”

Response: This suggestion is adopted.

Comment 1 to Line 461: insert “patterns in”

Response: This suggestion is adopted.

Comment 2 to Line 461: “circulation” instead of “circulations”

Response: This suggestion is adopted.

Comment 1 to Line 465: “strength, where the” instead of “strength. The”

Response: This suggestion is adopted.

Comment 2 to Line 465: insert “,”

Response: This suggestion is adopted.

Comment 1 on Line 469: insert “may”

Response: This suggestion is adopted.

Comment 2 on Line 469: “exist” instead of “exists”

Response: This suggestion is adopted.

Comment on Line 493: “may be invoked” instead of “come into mind”

Response: This suggestion is adopted.

Comment on Line 497: delete “In this context,”

Response: This suggestion is adopted.

Comment on Lines 509f: “This is no longer explicitly correct, see:

Rillo, M.C., Miller, C.G., Kučera, M. and Ezard, T.H., 2018. Predictability of intraspecific size variation in extant planktonic foraminifera. bioRxiv, p.468165.”

Response: I will rephrase the text and mention this.

Comment on Line 512: “Great figure”

Response: Thank you, but I would like to forward your compliment to Brown (2007), from whom I modified this figure.

Comment on Line 551: “confirm” instead of “test”

Response: This suggestion is adopted.

Comment on Line 552: “provides” instead of “provide”

Response: This mistake will be corrected.