Biogeosciences Discussions

Biogeosciences Discuss., referee comment RC2
https://doi.org/10.5194/bg-2021-230-RC2, 2021

Comment on bg-2021-230

Anonymous Referee #2

Referee comment on "Late Neogene evolution of modern deep-dwelling plankton" by Flavia Boscolo-Galazzo et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-230-RC2, 2021

The manuscript by Boscolo-Galazzo and coauthors is a fantastic contribution to the primary literature investigating the drivers of planktic foraminifera and calcareous nannoplankton through the Neogene. The use of multiple proxies integrated together (models, stable isotopes, biogeography) provides an in-depth look at evolutionary processes and patterns. The paper is very well-structured, well-written, and the figures are robust, informative, and well-designed. The supplementary materials are also very helpful and nicely constructed. I thoroughly enjoyed reading and reviewing this paper, and look forward to citing it in the future!

There are places in the manuscript that could use additional citations and/or references back to the figures that will strengthen the author's discussions and main points. I have also included some additional suggestions regarding including alternative hypotheses for evolutionary types.

Lines 18–20: The statement 'deep-living planktonic foraminiferal species were virtually absent globally during the peak of the middle Miocene warmth' is only true for your tropical sites, correct? The pie charts (Fig. 5) for Site 516 (mid 1) and Site 1138 (high latitude) do include a higher percentage of twilight planktic foram species compared to your tropical sites, especially Site 1138. This is really cool, and should be highlighted in the text.

Line 40: Suggest changing 'best studied' to something like 'most thoroughly studied'

Line 55: Change 'reconstruct phylogeny' to 'phylogenetic relationships'

Line 103: First time DSDP, ODP, IODP are mentioned, spell them out

I suggest making Figure 12 into Figure 1, and plotting the locations of your sites onto this map.

Section 2.1: Include a sentence here, similar to the sentence in Section 2.2 lines 142–145, where you state what taxonomic references you used. Some refs could include Kennett and Srinivasan, 1983 and the major update to mid-latitude Neogene species Lam and Leckie, 2020a (Micropaleontology), using phylogenetic genus names from Aze et al. (2011)

Line 157: Please also cite Matsui et al. (2016), who did an extensive study of changes in depth habit of *D. venezuelana* through time.

Matsui, H., Nishi, H., Takashima, R., Kuroyanagi, A., Ikehara, M., Takayanagi, H., & Iryu, Y. (2016). Changes in the depth habitat of the Oligocene planktic foraminifera (*Dentoglobigerina venezuelana*) induced by thermocline deepening in the eastern equatorial Pacific. *Paleoceanography*, *31*(6), 715-731.

Line 246: Remove 's' from end of 'Figs'

Lines 312–314: To make this finding more apparent and best connect with biogeography, you could include the date at which the species first appeared before the site, such as (XX Ma, Site 872). In this way, readers can also see the timing of first occurrences across your sites.

Line 312: In addition to citing Lazarus et al. (1995), the findings of Lam and Leckie (2020b, PLoS ONE) and Jenkins and Srinivasan (1986) also highlight the first appearance of *T. truncatulinoides* first in the SW Pacific and later in the N Pacific.

Lines 346–347: It may be worthwhile to include a sentence at the beginning of this section that globoconellids are mid-latitude temperate water dwellers, which will set the stage for this sentence. Could also include citations for such occurrences (e.g., Brombacher et al., 2021)

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

Section 4.1: Somewhere in here, should cite Fenton et al. (2016), in which they model environmental controls on diversity through the Cenozoic.

Fenton, I. S., Pearson, P. N., Dunkley Jones, T., Farnsworth, A., Lunt, D. J., Markwick, P., & Purvis, A. (2016). The impact of Cenozoic cooling on assemblage diversity in planktonic foraminifera. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *371*(1691), 20150224.

Line 358: Lam and Leckie (2020a, Micropaleo) synonymized *G. conoidea* with *Globoconella miotumida*. Throughout the text and on figures, simply change conoidea to miotumida.

Lines 407–410: Could you make the connection between O2 minimum zones and tight clustering of d18O values more clear here? Or is this sentence about d18O values making another point?

Lines 451–461: Is this discussion, in part, based on findings of Boscolo-Galazzo, Crichton et al. (2021), or other literature? This part of the discussion would benefit from references to other primary literature and figures in the paper.

Line 469–470: In addition to Aze et al. (2011), also include Scott et al. (1990) and Kennett and Srinivasan (1983)

Scott, G. H., Bishop, S., and Burt, B. J., 1990. Guide to some Neogene Globorotalids (Foraminiferida) from New Zealand. New Zealand Geological Survey Paleontological Bulletin 61, Lower Hutt, New Zealand, 176 p.

Kennett, J. P., and Srinivasan, M. S., 1983. Neogene Planktonic Foraminifera: A Phylogenetic Atlas. Hutchinson Ross Publishing Company, Stroudsburg, Pennsylvania, 265 pp.

Lines 554–556: There is literature that points to sustained genetic connectivity among foraminiferal populations in the high latitudes of each hemisphere (bipolarity; e.g., Darling et al., 2000; Norris and de Vargas, 2000), indicating water masses may not be an effective barrier to dispersal. Although allopatric speciation is not impossible in the planktic foraminifera, their high dispersal potential likely creates a scenario where other modes of speciation are more likely (e.g., Norris, 2000). Thus, it may be best to present other alternative modes of speciation that caused the evolution of *T. crassaformis* from *H. cibaoensis*, and/or acknowledge the body of literature that supports other modes of

speciation in the pelagic realm.

Lines 603–604: In addition to Norris et al. (1994) and Aze et al. (2011), please also include the citation Scott et al. (1990).

Lines 613–635: Also check out evolutionary studies of globoconellids by Norris et al. (1994), Wei and Kennett (1988), and Schneider and Kennett (1996). These papers may be beneficial to this part of your discussion and to integrate with your data.

Norris, R. D., Corfield, R. M., & Cartlidge, J. E. (1994). Evolutionary ecology of Globorotalia (Globoconella)(planktic foraminifera). *Marine Micropaleontology*, *23*(2), 121-145.

Schneider, C. E., & Kennett, J. P. (1996). Isotopic evidence for interspecies habitat differences during evolution of the Neogene planktonic foraminiferal clade Globoconella. *Paleobiology*, *22*(2), 282-303.

Line 622: *Globoconella sphericomiozea* was synonymized with *G. puncticulata* by Lam and Leckie (2020a, Micropaleo), as these species' morphology is not distinguishable.

Lines 640–644, 654, 21: Acknowledge here other potential forms of evolution besides allopatry.

Figures 7–11: These figures are great, but the map is a bit hard to see. Is it possible to make the maps larger? Likewise, the species names are also small. If the colors on all the pie charts correspond to the same species, could there be just one key per figure showing which pie slice color corresponds to which species?

Another figure that would aid greatly in visualization, especially for the discussions surrounding biogeography, is one (or a few) showing the ranges of your key species at each site you analyzed. Or, you could have a figure for each species showing its range at each site (arranged from highest to lowest latitude), so readers can compare and contrast first and last occurrence dates at each site and across latitude. Such a figure could go into the Supplemental materials.