

DIVERGENT ESTIMATES OF MIOCENE TO PLEISTOCENE UPPER OCEAN TEMPERATURES IN THE SOUTH ATLANTIC OCEAN FROM ALKENONE AND COCCOLITH CLUMPED ISOTOPE PROXIES- EGUSPHERE

0. Abstract

- a. The abstract does a good job at outlining the purpose and results of the paper

1. Introduction

- a. You start by talking about how latitudinal temp gradients are important for atmospheric circulation, rainfall, etc. I'd also come back to this at the end, either in the conclusion or in section 4.2, just to bring it full circle. I have notes on this below
- b. Line 54: I'm guessing you submitted this while Clark et al. 2025 was in review, but I think it's out now, so the citation should be updated

2. Settings, Sediments, and Analytical Methods

- a. Sample preparations and analysis
 - i. I'm not super familiar with clumped isotope preparation, when you say 'oxidized for 5 hour or 8-14 hour' (line 101), I'm assuming there was a reason some samples required the longer reaction time. Was this simply a matter of looking at the sample at hour 5 and noting there were still organics present, thus they were oxidized longer?
 - 1. Ok, after reading further in section 3 and the supplemental, it sounds like two samples from each depth underwent oxidation to compare the 5 hr oxidation time to the longer 8-14 hr time. Can you clarify this in the methods? Also, I noticed that you didn't do this for each sample, only a few, is this due to sediment availability or was there another reason you chose to do the 5 hr vs overnight oxidation comparison for these specific samples vs the others?

3. Results

- a. Line 150: "the three samples with minor detrital carbonate... temps are 1-4 degrees warmer than Uk37." This is hard to tell from figure 3d, can you add a running average for the ODP 1090 Uk37 like you did for the ODP 1088 temps? Or a table to directly show the clumped isotope temps vs uk37 temps?
- b. Unless I missed it in the text, I don't believe you discuss in depth the potential influence of detrital carbonate on your temperature calculations. Is there a connection between the detrital carbonate inclusion and warmer

temperature calculations for those three samples from ODP 1090? Are they less likely to be accurate because of the presence of carbonates?

- c. Line 209-213: I feel like there should be a citation or reference here
- d. Line 216: Not sure what the convention is in EGU sphere for referring to figures within citations, but I think this citation needs to be either ((Bolton and Stoll, 2013) Figs S6, S7) or (Bolton and Stoll, 2013; Figs S6, S7)
- e. Implications for estimation of latitudinal temperature gradients
 - i. That's a huge difference in the temperature gradient, something that would certainly have impacts on both atmospheric and oceanic circulations. Considering the role that a changing latitudinal temperature gradient is thought to play in the intensification of Northern Hemisphere Glaciation and, eventually, the Mid-Pleistocene Transition, I think it would be interesting to include a comparison of Uk37 and clumped isotope temperatures for the ~1Ma timeslice, however I know this is a new technique and the data might not be available yet. Maybe you could include a sentence or two in this section or the conclusions to say that it's not just the Miocene's latitudinal temp gradient that could be stronger, it could be other time periods as well. The implications of this are big for time periods in which a shifting latitudinal temp gradient are important (like the MPT). This might inspire further research.
 - ii. I'd also like to see more of a discussion of whether such a dramatic meridional temperature gradient would impact our current understanding of late Miocene climate, considering the new data suggests the gradient is almost double what the previous data suggested.
 - iii. How do your reconstructed temperatures compare to Mg/Ca ratios from the Southern Ocean or South Atlantic? Other proxies? Do these proxies more closely agree with clumped isotopes or alkenone proxies?

4. Conclusions

- a. Again, I'd circle back to your point at the beginning that latitudinal temp gradients are vital for atmospheric circulation, rainfall etc. Emphasize the importance of getting this gradient accurate for other fields

5. Figures:

- a. Fig 1: Are the contours temperature? If so, can you include that in the caption?

- b. Fig 3: As I mentioned above, would it be possible to add a running average for the ODP 1090 Uk37 like you did for the ODP 1088 temps?