

Interactive comment on “Low Florida coral calcification rates in the Plio-Pleistocene” by T. C. Brachert et al.

Anonymous Referee #3

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Overall This paper addresses growth dynamics (extension, density, calcification) in exceptionally well-preserved fossil corals from Florida. These data are then compared to a summary of rates from recent times. The authors find very low rates of growth for all three metrics and then hypothesize, in part utilizing previously published isotope data, the possible mechanisms that may be responsible. There is a lot of information distilled into one paper, which leads to certain aspects of this study not getting the discussion it deserves.

While I was fascinated by this work, there are several big concerns that will need to be addressed for the paper to be considered for publication. I fear the authors may have over-interpreted their data.

First, multiple species of coral are combined to generate 'big picture' means for modern
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growth rates. *Diploria* is used for these summary stats, but there are no fossil analogs studied. It is unclear and may be unwarranted to throw in these data from one genus out of the 60+ coral species in the Atlantic. It seems the rationale is that the data do not differ significantly from each other, but I don't think this warrants combination.

The biggest concern I have with the paper boils down to sample size. For the recent corals analyzed, it is reported that for the Western Atlantic there were 80 *Orbicella*, 8 *Diploria*, 15 *Porites*, and 1 *Solenastrea*. For the fossil corals, there were 16 *Solenastrea*, 2 *Orbicella*, and 1 *Porites*. This is a huge mismatch between fossil and recent in terms of sample size such that there is an inverse relationship between number of corals in one era versus the next. That is, you are comparing 1 recent *Solenastrea* with 16 fossil, 15 recent *Porites* with 1 fossil, and 80 recent *Orbicella* with 2 fossil. Given the inherent intraspecific variability in coral growth, I think the low sample sizes probably aren't providing useful information.

The authors state there are calcification records absent from the Florida Reef Tract for *Orbicella*. However, co-author Kevin Helmle published a paper on calcification rates in *Orbicella* from the Florida Reef Tract! (Helmle et al. 2011, *Nature Communications*). There are other calcification data for *Orbicella*, as well as *Porites astreoides* from the Florida Reef Tract that illustrate differences across inshore-offshore gradients (Manzello et al. 2015a, 2015b). This provides a nice snapshot of the type of variability that occurs on the Florida Reef Tract in recent times. Presumably you'd also want to include the Carricart-Ganivet et al. 2012 paper that specifically discusses thermal sensitivity in *Orbicella* and *Porites*. Similarly to your work, these authors look at data in the Atlantic and Pacific and this should provide a useful comparative study.

Some other things I couldn't help but wonder while I was reading this: why are these corals so well preserved? It would be nice to have more discussion on this, including some mention of the other examples. Secondly, one of the big limiting factors in coral growth and reef development in Florida is cold stress events (. While this is discussed briefly and discounted via the isotopic analysis, this warrants more discussion. Would

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short-term acute cold snaps show up in the annual integration of isotope data? At the very least, more information on what is limiting coral growth and reef development in present day south Florida and how that compares with geologic time addressed here would be very helpful.

Specific comments

- 1) Sections 1.1 and 1.2 would likely be better served if they were woven into the introduction. These sections between the introduction and methods do not flow well. By the time I got to the results, I was taken aback by discussion of modern corals because this was briefly discussed way back in the 2nd paragraph of the introduction and I had forgotten it was part of the study.
- 2) First line of methods. You say 18 fossil corals, but analyzed 19.
- 3) Bulk density is measured as a mean for the whole slab. Why not do what is commonly done and take measurements corresponding to each year of data? This allows you to get density for each year of growth and likewise calcification for each year of growth. This will give you an idea of year-to-year variability and a better understanding of the error associated with your calcification measurement rather than just a single point.
- 4) Line 5, 20525. They are not significantly different rather than identical. I doubt they are identical
- 5) P20526, line 6-8. These studies weren't experimental but were field investigations
- 6) Figure 4, fossil *Porites* is an outlier and shouldn't be included in regression as it is significantly impacting the analysis
- 7) Fig 5, lack of error bars on density and calcification provides no context for these values

References cited

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