Biogeosciences Discussions

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Comment on bg-2022-81

Anonymous Referee #1

Referee comment on "Nature and origin of variations in pelagic carbonate production in the tropical ocean since the mid-Miocene (ODP Site 927)" by Pauline Cornuault et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-81-RC1, 2022

General Comments

It was a pleasure to read and review the Cornuault et al. manuscript (https://doi.org/10.5194/bg-2022-81). In this study the authors aim to better understand the dynamics of pelagic plankton calcification under warm climate conditions, by compiling published carbonate accumulation data from ODP Leg 154 sites drilled at the Ceara Rise. They also generated new high-resolution carbonate content, carbonate accumulation rates, benthic foraminifera stable isotope and sedimentation rate records in sediments from Site 927, across four time-intervals since the MCO. Their results show that the sedimentation rates increased in time, whereas the carbonate accumulation rates remained fairly stable across this time interval. These results are mainly interpreted as reflecting orbital-scale changes in both carbonate production and/or dissolution.

The manuscript is in general well written and the data produced are appropriate for the study aims. Because of this I reckon the manuscript potentially to represent a valuable contribution to the current paleoceanographic debate. However, there are some parts that in my opinion need to be further developed prior to publication. The main issues I found in the manuscript mostly concern the Discussion chapter, which needs to be expanded and rethought in some of its parts. Given this, my overall evaluation is that this manuscript has the potential to be published in *Biogeosciences* but it needs substantial revision before publication.

Specific comments

Line 85: add age range for each of the four intervals examined.

Figures: I suggest to give ages in Ma rather than in ka, so one can get rid of all the zeros.

Line 234: How about productivity changes? Sites 928 & 929 are farer to the coastline compared to other sites. Can the higher distance to the Amazon fan result in lower nutrient deliver and thus lower biological production at those sites?

Line 239: "The $CaCO_3$ AR, on the contrary, does not show any obvious temporal trend" I do not agree. In my opinion the $CaCO_3$ AR generally increases until ~4 Ma, and then it slightly decreases.

Lines 272-273: what do the authors mean with "fastest sea-level changes"? Do they mean that they interpret the Site 927 $d^{18}O$ record as reflecting sea-level changes? If so this needs to be stated and the motivation for such an interpretation needs to be explained.

Line 342: I think it is necessary to add a figure, perhaps in the supplemental information, to show the results of the spectral analysis.

Lines 349-352: this is confusing and difficult to follow as written. Can you add to Figure 7

the correlation lines between $d^{18}O$ and E+T-P?

Line 374: "the CaCO3 AR is driven by both the carbonate content and the SR" I disagree with this statement. The correlation between CaCO3 AR and SR during KM5 has a R2=0.089. This means that there is no correlation between the two parameters.

Figure 9, panel a: apart from the MCO, the panel shows that:

- i) there is no correlation between CaCO3 AR and SR;
- ii) at one single SR value corresponds different CaCO3 AR values. Can this result from the method used to build the age model? Or is there an oceanographic reason instead? I think the authors need to discuss this in the text. It seems to me that the fact that SR are linear plays a significant role in the relationship between CaCO3 AR and SR.

Figure 9, caption: regression lines of MIS 5 and MIS9 are difficult to distinguish. I suggest to add regression formula to the figure legend, to better represent the slope of regression lines.

Discussion: I found the discussion a bit difficult to read and not well organized (see comments below). In addition, I couldn't find any discussion and interpretation of the new stable isotope records, which is a bit of shame considering that they can provide important information for the interpretation of the other records presented. In my opinion, a discussion on the stable isotope records and on how they correlate with sedimentation and accumulation rate records needs to be added.

Paragraph 4.1: The discussion in this section is difficult to follow and needs rewriting.

Lines 402-403: How can you reconcile your observation of dissolution in Pleistocene sediments with the fact that Site 927 has been located above the lysocline?

Lines 411-414: deleted this sentence.

Lines 424-425: I do not agree. Pelagic carbonate AR can indicate both carbonate production and carbonate dissolution. So how can carbonate production be assessed by carbonate SR without considering carbonate dissolution?

Figure 12: It is not clear what the dashed curves are. I suggest to change the names of curves in the legend.

Line 503: Please describe briefly the main observations made by the cited studies.

Line 506: in my opinion it cannot be said that the new record has a similar long-term trend as Lyle et al. (2019).

Conclusions: I suggest to shorten the conclusions which are extensively long.

Technical Corrections

Lines 43-44: quantify short-term and long-term.

Line 124: add color scale for the bathymetry next to the map of Figure 1.

Line 131: add "modern" before "regional". Add lysocline depth.

Line 161: What does "loess" mean in the plot vertical axis? If a detrending function was applied to the record, state it in the figure caption.

Line 164: substitute "Stable oxygen isotopes" with "Oxygen stable isotopes".

Line 168: delete "Next,".s

Line 193: substitute "S3" with "S1".

Line 200: substitute "For the high resolution 4 intervals" to "For the four high resolution intervals".

Line 223: state that the graphs in panel a are box plots.

Line 253: the Leg number can be removed.

Lines 255-256: it is difficult to understand which color is which. I suggest to add a legend next to the panel.

Line 258: substitute "blue" with "light blue". Apply the same to figures 6 and 7.

Figure 6, panel f: I suggest to use another color instead of the light purple for the MS

record of the middle core because it is difficult to distinguish from the MS record in dark purple.

Line 280: add corresponding color for the MS record and the MS smoothed record.

Line 298: add a brief explanation of why this insolation curve has been used.

Line 213: which curve is obliquity and which is E+T-P?

Line 230: define “LAD”.

Line 358: substitute “local” with “Site 927”.

Line 368: substitute “periods” with “intervals”.

Line 381: “carbonate AR appears to decrease with time”. Do the authors mean with increasing age?

Line 443: delete “On the other hand,”