

## ***Interactive comment on “Can morphological features of coccolithophores serve as a reliable proxy to reconstruct environmental conditions of the past?” by Giulia Faucher et al.***

### **Anonymous Referee #1**

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Dear editor, I have reviewed the paper entitled with ‘Can morphological features of coccolithophores serve as a reliable proxy to reconstruct environmental conditions of the past?’ submitted by Faucher et al. to CP.

In this study, the authors designed different experiment to test the 4 species of coccolithophores’ response to the environment settings, such as seawater Mg/Ca, seawater carbonic chemistry, light and nutrient. They found that cell and coccolith sizes behave differently to environment setting among species, while the malformations of coccolith shared a common response to the seawater carbonic chemistry. They concluded that the size or other morphological parameters can not serve as paleoenvironment

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proxies, while the higher coccolith malformation rate can be an evidence for high CO<sub>2</sub> environment.

In general, the dataset is valuable for both modern and paleo coccolithophore research. I think what they have presented is clear enough except a few details should be added into the Methods part. The main problem is that they did not dig their data enough which leads their paper looks more like a data report rather than a mature article. I think the first author has a lot of experience on the nannofossil evolutions and the other two authors are experts in modern coccolithophore. They could offer a much better discussion for their valuable data. Here are some detailed comments:

1) I suggest that the authors should explain more about why they design these tests on coccolithophore in the Introduction or Methods part, such as the carbonic chemistry experiments are for ocean acidification and Mg/Ca experiments are for the long-time evolution of seawater. How about considering move the first paragraph in discussion into introduction? Because I feel that I am clearer for the study motivation after reading it.

2) I doubt about can the timing of measurement influence the coccolith length results. Because a previous work shows the growth phase can influence the coccolith and cell size (Sheward et al., 2017). That also means if the cells are harvested right after and before dividing, the results should be different. Since there were light-dark cycles in your experiment setting, the authors should mention when they harvest the cells for size measurement and are these timings same among different experiment.

3) I did not find how many coccoliths did they measured in the Methods part, which is important for statistical analyses.

4) In Figure 2, does the 'C' mean 'control experiments'. If so, why the results in different control experiment are quite different? Are the experiment settings in different control experiments different or the same? If the settings are same, why the results so different?

5) I did not find where they discuss the results of ellipticity, rays, bridge angles. That is why I say they should dig their data deeper.

6) They found that different coccolithophores have different response to the environment settings. From my point of view, that is not something surprises me: they should not behave in a similar way. What we really want to know is why is that, so the authors should try to offer an explanation rather than leaving the conclusion in this way. In this case, I do not quite agree with the opinion that coccolith morphological data can only serve as a paleo-proxy when different species have a same response to the environment variations. Well, that is only my idea, and the authors do not have to change their conclusion if they can offer a better discussion than this version.

7) These two papers may help for a rich discussion, Sheward et al. (2017) and Aloisi (2015), which are absent from their references list.

References:

Sheward R M, Poulton A J, Gibbs S J, et al. Physiology regulates the relationship between coccosphere geometry and growth phase in coccolithophores[J]. Biogeosciences, 2017, 14(6): 1493-1509.

Aloisi G. Covariation of metabolic rates and cell size in coccolithophores[J]. 2015.

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