

Interactive comment on “Environmental controls on the *Emiliana huxleyi* calcite mass” by M. T. Horigome et al.

Anonymous Referee #1

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The ms by Horigome and colleagues is investigating the synergistic effect of multiple environmental parameters on calcite mass of the cosmopolitan coccolithophore species *E. huxleyi* in Holocene sediments. The major findings of the ms are: 1) The mass of *E. huxleyi* coccoliths follows a latitudinal distribution pattern mimicking the main oceanographic features. 2) Phosphorus and temperature are potentially important drivers for coccolith mass and *E. huxleyi* morphotype distribution and not the carbonate chemistry of the ocean. 3) Coccolith calcite mass should not be used in a straightforward manner to decipher the response of coccolithophore calcification to past atmospheric CO₂ fluctuations.

These results are potentially very important for our understanding of the impact of ocean acidification on coccolithophore calcification and the general ecology of coccol-

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ithophores, but there are some questions that need to be addressed.

1. page 9290 L. 24: Calcite mass calculation:

There are some issues with the method used for the mass calculation of coccoliths. Apparently the method used for the calculation of single coccolith mass is based on a flawed calibration method (see the recent paper by Bollmann *Biogeoscience Discussions* 10, 11155-11179). Therefore, all data presented in this study are potentially wrong and the difference between the presented results and the results of Beaufort et al. (2011) might be simply caused by different calibrations. This is a serious problem as potentially all data collected with the method first published by Beaufort (2005) are not comparable (see also the *Biogeoscience Discussions* paper by Bauke et al., bgd-10-9415-2013). This issue needs to be addressed including how the light intensity was controlled between samples.

2. page 9291 line 23: Taxonomy/automated recognition:

The authors used the SYRACO-program (Beaufort & Dollfus, 2004) to automatically identify coccoliths of *E. huxleyi* and *G. oceanica*. The system has been used successfully in a number of studies but apparently it can not distinguish between small placoliths ($<3 \mu\text{m}$ *E. huxleyi*, *gephyrocapsids/reticulofenestrads*). According to figure 2 all length measurements are smaller than $2.6 \mu\text{m}$ and therefore, might include placoliths of other species than *E. huxleyi*. This is supported by the fact that the size spectrum of EHUX seems to be biased towards smaller coccolith lengths (min. $2.1 \mu\text{m}$ max. $2.6 \mu\text{m}$) compared to the global average size spectrum (min $2.7 \mu\text{m}$ – max. $3.7 \mu\text{m}$, see Bollmann et al. 2009). The biased size spectrum points to a) a size calibration problem or b) a taxonomic/recognition problem. Placoliths smaller than $2.4 \mu\text{m}$ are mainly *G. ericsonii* or *G. protohuxleyi*. A taxonomic problem can be expected if the analysis were solely done on a light microscope. See also the *Biogeoscience Discussions* paper by Bauke et al., bgd-10-9415-2013.

3. page 9220 line 3: Sample selection/quality:

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The ms states that all samples were taken well above the lysocline insinuating that there is no preservational bias, e.g. calcite dissolution. As calcite dissolution already takes place well above the lysocline, I suggest to analyse the preservation of *E. huxleyi* coccoliths on SEM images and use a fragmentation index of *E. huxleyi* to quantify the preservation status. Furthermore, 14 out of the 70 samples are from depths greater than 4000m and I doubt that the preservation of *E. huxleyi* is sufficient to calculate the mass.

4. P. 9291 line 23: Sample preparation:

I am not aware of any standard sample preparation published by Henderiks and Torner (2006). Henderiks and Torner compared the quality of the generic smear slide method and the spraying method. I wonder which method was used to prepare the samples.

5. The significance of the *G. oceanica* analysis is not clear. Why was *G. oceanica* analysed and why are the data lumped together with EHUX data?

6. Figure 1 is misleading as it shows SEM images of coccospheres. I suggest showing light microscope images of the different EHUX morphotypes instead.

7. Figure 3b shows placolith weights up to 5pg. However, in figure 2b only values up to 3.5pg are shown. What is reason for that?

Interactive comment on Biogeosciences Discuss., 10, 9285, 2013.

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