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Biogeosciences Discussions

Interactive comment on "Effect of CO_2 on the properties and sinking velocity of aggregates of the coccolithophore *Emiliania huxleyi*" *by* A. Biermann and A. Engel

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Response to Anonymous Referee #1 (Referee comments in quotation marks)

We are grateful to referee 1 for providing important suggestions for improving our manuscript. Referee 1 requested us to better indicate the important finding that makes this paper unique/ different from already published work especially from Engel et al. (2009b). This study investigated the effect of CO2 on the ballasting of aggregates of calcifying E. huxleyi. An investigation of the effect of CO2 on formation and sinking of aggregates of E. huxleyi or other calcifying plankton cells has not been done before; so all data that we show are unique data. Engel et al. (2009b) compared the forma-

tion and sinking velocity of aggregates formed by a strain of calcifying cells with those formed by a strain of non-calcifying E. huxleyi cells. Both studies are related as they address the role of ballasting. Indeed, the findings of Engel et al. (2009b) directly led us to the hypothesis that changes in ballast due to CO2 will affect properties of aggregates. This study may thus be seen as a follow-up experiment. However, the fact that a hypothesis is conclusive does not abolish the need of actually testing the hypothesis, and for obtaining data. This study, for example, showed that even small changes in the PIC/POC ratio strongly affected sinking velocity, a finding that could not be inferred from the two extreme cases, i.e. naked and calcified cells. Moreover, several other observations were made, such as the larger aggregate formation at high CO2, which also could not be inferred from previous studies. We will clarify the differences between the two studies in the revised version.

Referee comment: "I would. . .suggest that the authors put the three CO2 treatments into perspective to predicted changes of atmospheric CO2". Response: For a better understanding we will add a sentence. The low CO2 treatment of 180 μatm CO2 represents the last glacial maximum, the medium CO2 treatment with 380 μatm refers to present day conditions and the high CO2 treatment mimicked the predicted level for the year 2100.

Referee comment: ". . .the sinking velocities measured in MCT and HCT aggregates were similar." Response: This is a misunderstanding. In the high CO2 treatment (HCT) sinking velocities of aggregates were in fact half as fast as in the medium CO2 treatment (MCT) (figure 1).

As for the technical corrections suggestions: 1. Abstract Referee comment: "High bacterial abundance does not suggest enhanced degradation per se." Response: We agree with this statement. Nevertheless, higher bacterial abundance indicates higher bacterial production, which has to be supported by higher organic matter consumption. We therefore think that it is justified to assume that higher bacterial abundance suggests potentially higher degradation. We will specify this in the revised version and

move this part to the discussion to clearly indicate that this is an interpretation of data.

Referee comment: “How do they (changes in PIC/POC) influence porosity and sinking velocity?” Response: The relation between PIC/POC and porosity is complex as porosity is also affected by aggregate size. For aggregates of comparable size higher PIC content decreases the porosity of aggregates. We will rework the abstract accordingly.

2. Methods We will correct this section according to the reviewers’ suggestions, except for the tables 2 and 4 that to our perception have to be separated because the data refer to aggregate per volume or suspension per volume. We will specify this in the manuscript. We will delete table 1 and add the full name of chemicals.

3. Results We will correct this section according to the reviewers’ suggestions, e.g. we moved the two paragraphs concerning the calculation for porosity and mass from the results to the methods section.

4. Discussion We will improve the text according to the reviewers’ suggestions, e. g. how our results of sinking velocity compare to other findings and rework the discussion to clarify what we think our results suggest for the marine carbon cycle (see also response to referee 3).

5. Conclusions We will improve our conclusions paragraph by reworking the idea what our findings may suggest for the future ocean carbon cycle.

Interactive comment on Biogeosciences Discuss., 6, 9817, 2009.