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Interactive comment on "Morphology of *Emiliania huxleyi* coccoliths on the North West European shelf – is there an influence of carbonate chemistry?" *by* J. R. Young et al.

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We are grateful to the reviewer for a careful analysis of the paper and for raising some interesting issues, his comments will enable us to improve the final ms as explained below.

MAJOR POINTS

1. Significance of results from bioassays E1 and E5 The referee suggests that there is a discrepancy between our light microscope observations which show a stable population of both cells and loose liths and our calcification measurements which indicate significant calcite production. However, the values the reviewer uses are the maximum

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values rather than the average values for these experiments. We will add an additional table to the ms giving the average values of cell numbers and inorganic carbon fixation for each experiment and the derived estimates of inorganic carbon fixation per cell per day and coccolith production per cell per day. The table is appended to this reply. It shows that estimated coccolith production rates for E1 and E5 are 4 and 5 liths per cell per day, rather than 20 liths per day as estimated by the reviewer. These lower rates are unexceptional and compatible with our light microscope observations.

2. Possibility of an acclimation effect in Bioassay E4. The referee suggests that the lower cell numbers in the high CO2 conditions in bioassay E4 may be due to an acclimation effect. This is a useful suggestion and we will emend the manuscript to follow it.

MINOR ASPECTS

1) Title: Why do you ask the question: “Is there an influence of carbonate chemistry?” when you can answer the question? Maybe it would be nicer to answer the question in the title already. E.g. “No detectable influence of ocean acidification on morphology of Emiliania huxleyi coccoliths on the North-West European shelf. I think it would be also better to call it “ocean acidification” because we have shown that there is an influence of carbonate chemistry on morphology, if conditions are manipulated extremely enough (Bach et al., 2012).

Reply: This is a fair suggestion but we prefer the existing title, since it succinctly describes the purpose of the study. We prefer to use carbonate chemistry rather than ocean acidification in the title since much of our data relates to natural variation in carbonate chemistry rather than ocean acidification

2) Page 4532 L. 7: It may be better not to call it “E4” because the reader does not know what that means.

Reply: Use of E4 in the abstract will indeed be of no value to readers who have not

BGD
11, C2725–C2730, 2014

read any other articles in this special issue however the sentence is structured so that use of the term should not hinder these readers. many readers of the ms will have read other papers in the volume and we have taken care through the volume to use consistent terminology.

3) Page 4532 L. 22 and elsewhere: “Calcification” is a vague term. Here you probably mean calcification rates. In other cases (e.g. Page 4533 L. 20) you may mean coccolith size. It would be easier to understand what you mean if you were precise on this.

Reply: Fair point, the usage here was ambiguous, we will reword.

4) Page 4532 L. 23-26: I do not understand this sentence. How could growth rates obscure these response? Calcification rates are the product of CaCO3 cell-1 and growth rates.

Reply: Indeed, calcification rates are the production of CaCO3 per cell and growth rates – hence a change in either one of these would result in a reduction in calcification rates. For example, a decrease in growth rates would result in a reduction in calcification rates but not necessarily cell CaCO3 content (depending on the time that observations are integrated across). We have modified the text in this section by changing “obscure” to “complicate”.

5) Page 4533 L. 28-29: What do you mean by “such issues”?

Reply: We will reword this: "a project aimed at investigating the likely effects of ocean acidification in the surface ocean via cruise-based research”

6) Page 4537 L. 18-20: Would you get more useful results if you had normalized number of rays on coccolith size?

Reply: The correlation of ray number with length is very high (r=0.92, 150 measurements) so the residual variation is low amplitude and not interesting

7) Page 4538 L. 24: Do you mean x-axis?

BGD
11, C2725–C2730, 2014

Reply: Yes - thank you!

8) Page 4542 L. 5-9: I do not really understand why you selected the upper 25%. It would be great if you could explain this in more detail.

Reply: The correlation coefficients indicated that the differences in morphology between the oceanic and neritic populations were more strongly developed in the larger specimens so plotting results from only the largest quartile was a simple way of testing this. Referee 1 also commented on this section, so we will expand the explanation to make the logic easier to follow.

9) Page 4542 L. 12: One “E” too much.

Reply: Yes - this needs correcting

10) Page 4543 L. 23-25: What do you mean by “muted”? By what could it be muted?

Reply: We will change that to low

11) Page 4545 L. 1-2: What is the difference between the “net effect of ocean acidification” and the “actual effect”?

Reply: We will reword this “whilst the net effect of ocean acidification on Emiliania huxleyi is likely to be detrimental the magnitude of this effect is likely to be low,”

12) Figure 3: Legend and X-axis label are missing.

Reply: Yes - this needs correcting

13) Figure 8: “Samples” is written twice.

Reply: Yes - this needs correcting

14) Figure 9: I know it could be quite some work but it would look great if you could show individual symbol sizes which are related to the given numbers. That way you would immediately see where you can find large coccoliths.

BGD

11, C2725–C2730, 2014

Reply: Good suggestion, and it will be quite easy to do this.

Interactive comment on Biogeosciences Discuss., 11, 4531, 2014.

Bioassay	E1	E4	E5
Cells ($x10^3$ l^{-1})			
Minimum	68	14	61
Maximum	306	150	272
Average	205	85	195
Inorganic carbon fixation (µg C l^{-1} d^{-1})			
Minimum	0.03	0.09	0.05
Maximum	1.2	0.63	0.74
Average	0.2	0.18	0.23
Inorganic carbon fixation per cell (pg C $cell^{-1}$ d^{-1})			
Average	1.0	2.1	1.2
Coccolith production (liths $cell^{-1}$ d^{-1})	4	9	5

Table 3 Calculation of average coccolith production rates per cell during the course of the experiments for the Bioassays with significant *E. huxleyi* populations. Inorganic carbon fixation was measured radiometrically as described in Poulton et al. (2014), conversion to coccoliths assumes a coccolith weight of 2pg and hence an inorganic carbon quota of 0.24pg.

Fig. 1. Table 3 - to be added to the final ms.

BGD
11, C2725–C2730, 2014