Biogeosciences Discuss., 5, S636–S638, 2008
www.biogeosciences-discuss.net/5/S636/2008/

Biogeosciences Discussions

Interactive comment on "Does ocean acidification induce an upward flux of marineaggregates?" *by* X. Mari

Anonymous Referee #2

Received and published: 22 May 2008

This paper describes experimental work on the effect of pH on TEP formation, aggregation and carbon flux. It is found that more and larger TEP are formed abiotically as the pH is decreased by 0.2, 0.4 and 0.8 units below ambient (pH = 8.16). This increase is not linear, but large for the first decrease (by 0.2 units) and much smaller thereafter. The increase in total and average TEP volume is thought to be due to differences in the gel structure, rather than in the amount of TEP per se. Although, possibly a lower pH will change the equilibrium between TEP-precursor and TEP in the direction of TEP. This second option was not mentioned. Furthermore is was found that aggregation of TEP with beads decreases appreciably with decreasing pH. Again a large change is found for the initial reduction in pH of 0.2 units with smaller changes observed when the pH is lowered further. The data on settling is interpreted to indicate that the average

ascending velocity of TEP and beads increases linearly with decreasing pH.

Although this data is clearly not mimicking natural conditions, it very nicely shows potential effects of ocean acidification on the abiotic formation of TEP and its stickiness. These insights are used to discuss mechanisms and how ocean acidification can lead to a decrease in the biological pumping and thus to a positive feed back of ocean acidification. This is an important topic to discuss, especially as the opposite trends have just been postulated from a mesocosm experiment (Riebesell & al. 2007). The controversy between the two opposing hypothesis (positive or negative feed back of the biological pump) can not be resolved with the information available, as both studies are not directly comparable, and as both studies only take certain aspects into account. But this controversy highlights the need for further investigations and suggests potentially important mechanisms to investigate in more detail!

The pH changes investigated (pH 7.2 to 8.2) lie in the range which can be found in situ in today’s ocean. But as the authors point out, natural sinking aggregates are usually laden with heavier particles and investigations of the SML are rare. And TEP have been found to accumulate in the SML (Wurl & Holmes 2008) and may do so more than we are aware of. So our field knowledge does not contradict the findings of this investigation.

The interpretation of the settling experiment (Fig.3) is clearly difficult. Although the difference between control and pH reduced treatments is significant, the budgets within each treatment don’t close. That is unfortunate. The explanation that the SML layer was not sampled adequately is likely correct, but other explanations are possible. Bacterial degradation of TEP for example could have reduced the amount of TEP in both the top and bottom layer. Loss to the container walls, without prior transport to the SML is another potential reason for loss of TEP and maybe beads. Future experiments clearly need to sample the SML and the middle layer so as to close the budget. The difficulty in interpretation of this data contributes a certain uncertainty to the proposed ascending velocity as a function of TEP. However, the exercise demonstrates well the

BGD

5, S636–S638, 2008

potential impact of the proposed effects. Thus this paper should serve well to initiate a serious discussion on the topic of pH effects on the soft tissue carbon pump (the calcium carbonte carbon part of the biological pump is not discussed.

The MS is well written and figures are clear. The text in figure three is extremely small. Where TEP and beads always associated (including in figure 3), or did some beads remain unattached to TEP and sediment individually. The amount of unattached TEP and beads would impact the expected sedimentation. page 1637 line 18: take out "and"

Riebesell U, al. e (2007) Enhanced biological carbon consumption in a high CO2 ocean. Nature 450:545-548 Wurl O, Holmes M (2008) The gelatinous nature of the sea-surface microlayer. Marine Chemistry 110:89-97

Interactive comment on Biogeosciences Discuss., 5, 1631, 2008.