

Interactive comment on “Organic matter exudation by *Emiliana huxleyi* under simulated future ocean conditions” by C. Borchard and A. Engel

Anonymous Referee #2

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Comments on “Organic matter exudation by *Emiliana huxleyi* under stimulated future ocean condition by C. Borchard and A. Engel

This paper reports results from continuous culture experiments where *Emiliana huxleyi* is grown in chemostats at elevated CO₂ and temperature conditions, at two different dilution rates (0.1 and 0.3d⁻¹). Primary production, both particulate and extracellular release, and production of TEP is measured. Amount and composition of and carbohydrates are analysed. In a chemostats, growth rate of the culture is determined by the by the dilution rate, or more precise the available nutrients as these are proposal with the dilution rate. The effect of different growth rate on organic production is a main focus in this paper, but as these are given by available nutrients it will be more exact to change the focus to “effects of different nutrient stress or limitation”. In these experiment the

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authors wants to mimic a situation of future ocean by testing the effect of phosphorus limitation, and a N:P ratio of 26 was used. They do not say why phosphorus and not nitrogen was chosen as the limiting nutrient. N:P = 26 is not a very high ratio, and *E. huxleyi* is known to grow perfectly well at much higher N:P ratios. One of the reasons is that *E. huxleyi* produce a lot of alkaline phosphatase when phosphate concentration is low and by that perfectly well can utilize organic phosphorus compounds. The enzyme activity that could have shown P-limitation was not measured here. The nutrient concentration in the chemostats which is not reported could also give an indication of nutrient limitation. A culture in a chemostat it will for sure respond to the dilution rate or a change in dilution rate, but will the dilution rate have any influence on the culture when it is incubated in a bottle outside the chemostat? I am sceptical to that. When a sample is taken out and incubated in a bottle for 4h for primary production measurements, the algal cells will only respond on the present nutrient concentration, which is higher in the 0.3d⁻¹ than in the 0.1d⁻¹. This problem can easily be solved by focusing more on different degree of nutrient limitation/stress as mentioned above. The results showing nutrient dependant altered primary production and extracellular release at future conditions are valuable data in view of microbial competition. Some methodical comments: P1205 L4. It is a bit confusing how many days the experiments ran. The cultures were grown as batch cultures for 3 days, then 12 days at dilution rate 0.3d⁻¹ and finally 12 days at dilution rate 0.1d⁻¹. This adds up to 27 days, while in the Methods sampling days 10, 14, 17 and 22, 25, 28 are given (?). These sampling days are later named “sampling 1, 2, 3 and 4, 5, 6”. Whys not use the sampling days instead of introduce a new sampling identification which is confusing? P1205 L. Methods for cell counting and nutrient analyses are described, but the results are not shown only referred in beginning of discussion (Borchard et al., 2011). It is better give this information in the Methods. P1208 L. Cell normalized values of PO₁₄C and DO₁₄C. Are there results reported? P1206 L 8.” Activity in the samples was determined by removing a 100 µl aliquot and transferred to 6 ml liquid scintillation vial.” I hope the authors also added a strong base to the sample otherwise the ¹⁴C activity will change.

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One interesting thing I believe could have been done based on these data is to calculate the amount of organic carbon (particulate and dissolved) produced versus to the amount nitrogen and phosphorus consumed in the different treatment. This may give a more quantitative estimate of carbon overconsumption and exudation at low nutrient concentration. The paper is in general well presented, and gives valuable input understanding of nutrient limitation of coccolithophorides in the future ocean. The authors should, however, be careful to say that this experiment mimics an oligotrophic situation (conclusion), as they use nutrient concentrations which is high above what you find in Atlantic water during a winter situation.

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