

Interactive comment on “Primary production and respiration of hypersaline microbial mats as a response for high and low CO₂ availability” by L. Bento et al.

Anonymous Referee #1

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Review of “Primary production and respiration of hypersaline microbial mats as a response for high and low CO₂ availability” by Bento et al. submitted to Biogeosciences Discussions.

General comments

This paper addresses the relevant question of carbon limitation in microbial biofilms. Sedimentary microbial biofilm are known to be highly productive and, while usable forms of carbon may be present in non-limiting concentrations when measured in overlying or interstitial water, they may likely become locally depleted in the case of dense biofilms undergoing high rates of photosynthesis. Despite its importance, and as the

C5625

authors pointed out, this topic is poorly studied. This is a well written paper, which shows strong evidence for the occurrence of carbon limitation. However, there are a few issues that should be addressed before the paper is presented in a final version.

Light intensity. P12742L26. “Excess” is quite relative. What light level is actually excessive (even in the strict sense of ‘supersaturating’) depends on the photoacclimation state of the sample. Without knowing the photosynthetic light response it is not possible to determine if a certain light level is excessive. As this determines the interpretation of the results regarding the exposure to different light intensities, it would be important to know the light-response of MPB photosynthesis, when it saturates, when is supersaturating etc.

Replication. All figures show measurements of a single profile under each experimental condition. In fact, it seems that the whole paper is based on observations of a single sample per treatment. Is this true, or are the figures showing only representative cases?

Biofilm community composition. This is a main aspect, that could condition many topics of the discussion, and which is not adequately addressed. The authors simply state that the samples are dominated by diatoms and cyanobacteria, but will would be important to know, at least 1) which of these groups is in fact dominant (and what is their proportional abundance) 2) main genera present, if all motile.

Microalgae biomass. This is also a crucial piece of information needed to adequately characterize the studied biofilms. Carbon depletion will ultimately depend on absolute photosynthetic rates, which naturally depend on the amount of photosynthetic organisms present.

Some results seem counter-intuitive. What is the explanation for: - the photosynthetic activity of the bottom layer of the sediment being stimulated by lower atmospheric CO₂? (P12741 L11) - why a decrease in light intensity decreases respiration? (P12741 L23-25)

C5626

CO₂ concentrations. Were the tested CO₂ concentrations ecologically-relevant? Also, would be interesting if some information could be given regarding how long do changes in CO₂ in the atmosphere take to be translated into changes within the biofilm.

Specific comments

P12738 L18-20. A scheme would be very useful.

P12739 L14. Halogen lamps are known to deliver a lot of infrared radiation. Did the halogen lamp heat the sample surface significantly?

P12739 L27-. How accurate was this technique? Were the CO₂ concentrations measured independently?

P12742 L4. What does it mean exactly 'absolute carbon limitation'? This is presented as one of the key findings of this study, but the meaning of this expression is not clearly explained.

P12742 L22. It is hard to accept that CO₂ is the most important limiting factor for primary productivity – what about light? Also, wouldn't carbon limitation be dependent on microalgae biomass?

P12742 L23. Strickly speaking, a decrease in light intensity always causes an increase in photosynthetic efficiency. This is contradictory with the statement that elevated light intensities cause higher photosynthetic efficiencies (12743L11-12).

P12742 L24. Is photorespiration expected to occur in this particular communities? Another strong argument for knowing the composition of the biofilm.

P12743 L26-27 Meaning "can become carbon limited" (in the context of elevated CO₂)??

Technical corrections

P12739 L16,20: I think the IS units are umol m⁻² s⁻¹

C5627

P12742 L11 "Direct" instead of "Directly"?

P12740 L8 Why not 50 micrometers?

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C5628