Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-194-RC1, 2018

Biogeosciences Discussions
Open Access
EGU

Interactive comment on "Precipitation of Calcium Carbonate Mineral Induced by Viral Lysis of Cyanobacteria" *by* Hengchao Xu et al.

Anonymous Referee #1

Received and published: 15 May 2018

This study deals with an interesting topic, providing an experimental test of the hypothesis that lysis of cyanobacterial cells by virus may trigger Ca-carbonate precipitation by helping overcoming the energy barrier of nucleation. If true, this means that such biological events may change the apparent solubility of carbonates in eg seawater. While the study overall provides some results which are convincing to me, there are several flaws which need to be corrected first before acceptance for publication. The most important ones are: 1) there is a strong incoherence between XRD results showing crystalline aragonite and TEM data suggesting ACC. TEM data should be revised. 2) It is not convincingly explained what happens around day 8 and how DIC and total alkalinity follow such different paths. 3) The Mg story is really not convincing. How can you explain that the solution goes from supersaturated to undersaturated with brucite. I de-

Printer-friendly version

Discussion paper

tail thereafter these comments and add several other ones which should be addressed

Introduction: L29: sentence is awkwardly written. It should read "Dissolved inorganic carbon in the typical..." (dissolved CO2 is not HCO3-)

Page 2: formation and dissolution of carbonate is one of the most instead of the most. I guess photosynthesis is at least as important L4: Needs rewritting "seawater is considered supersaturated with several calcium carbonate phases such as xx (calcite?), with saturation index..." a solution is supersaturated with. A carbonate is not

L13 : you do not need to get into that debate about whether cyanobacteria formed the first stromatolites or not. Many studies now argue against this idea and I agree this is beyond the scope of your paper to debate about that. You should rephrase

L18: Instead of furthermore, I would write “In contrast”, since it has been suggested that intracellular precipitation might be controlled in opposition to non-control as mentioned on line 16. And I would remind that this is true for some species of cyanobacteria, not all. Last, it was recently showed that it can occurs in undersaturated solutions (Cam et al., 2018 Geobiology). I am wondering if the same could be imagined in some environments with viruses lysing cyanobacteria. Maybe as a perspective?

L30: you should specify that this increase would be very local

Page 3, L19: Synechococcus spp.This is such as broad name encompassing so different bacteria. Could you specify at this point the name of the strain? Or specify that the strain was isolated in the present study?

P4: Is the strain axenic?

L7: I guess the other not-mentioned treatment is a control where no virus has been added? Please specify this

Are culture bottles closed to air exchange or are they open? This is important to understand the evolution of DIC in your system I guess

L8-9: please rephrase. I guess you do not measure OD on a fixed and filtered suspension. And Why do you fix the cells before measuring the chemical composition of the solution. Could fixation modify the chemical composition of the solution?

L11: what is a TA sample?

2.3: Electron microscopy instead of electronic microscope

L19: what is the stable phase? Do you mean stationary phase (after exponential)? But what do you mean by the end of it?

L26 what is abs?

L27: Technically you do not sputter coat with carbon. This is achieved by evaporation. You can rewrite as: before being carbon coated

Page 5: L 3-4: the lag phase lasted 4-5 days

L5: you say slightly lower but I see on Fig 4a a DO of 3 vs 14. This sounds like a very big difference to me

Fig. 4a: you said you ran duplicates. Where are the error bars then in your curves?. Could you show the pH curve?

Why TA does not match with alkalinity? Which other species contribute to alkalinity here? Do you think that they als might vary differently? I think of N species? Or P species? TA sharply decreases at day 8 while alkalinity starts decreasing at day 6. How do you explain that?

Why is there such a sharp decrease of Ca in all conditions at day 8? Why does dissolved Mg increase again in viral treatment after 14 days? L21: you do not mention that Mg also redissolve in the viral treatment.

Fig 6, caption: by definition ACC is not crystalline so you should not write about crystallization of ACC but precipitation or formation

Printer-friendly version

Discussion paper

Fig 7: please show a spectrum. Maps are not enough. Why is these are phosphates? Only spectra could show that there is no P peak

Fig 9: what is the peak at 10°? If XRD sees aragonite (ie crystalline phase) how does it come that you see amorphous Ca-carbonates? Is aragonite amorphizing under the TEM beam?

Discussion: P25: the authors claim that this is no surprise that brucite forms but to my knowledge this has never been really shown by previous studies on cyanobacteria cultures; How do they explain that they produced brucite and not the other groups. Moreover, they detect brucite by XRD but they mention that the solution became undersaturated with brucite after 8 days. How is it possible. I would expect in the worst case a SI of 0. Not below. I see that Mg is released after 8 days even in the viral treatment. This could be consistent with the undersaturation of the solution with brucite. But how do we switch from supersaturated to undersaturated? Precipitation of brucite should take it to saturated. And since there is no Mg going to aragonite and there is no carbonate in brucite, this cannot be explained by aragonite precipitation and changes in DIC.

End of discussion is too long. The paragraph on page 9 from L 6 to 17 could be skipped or at least significantly reduced since this is quite faraway from the main scope of the paper

---

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-194, 2018.

Printer-friendly version

Discussion paper