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Interactive comment on "Cyanobacterial calcification in modern microbialites at the submicrometer-scale" *by* E. Couradeau et al.

Anonymous Referee #2

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The study presented by Couradeau and colleagues nicely demonstrates that the submicrometer-scale research on modern microbialite might provide tools to recognize ancient microfossiles. This study is well constructed and the authors use a set of microscopic technique that nicely complement each other. As a result the authors present convincing data and propose a model of biomineralization in Pleurocapsales (Fig. 5) that is supported by their observations. At this point, it must be noted that in contrary to the promising title, the conclusion of the authors only apply to the pleurocapsales.

Still, some comment and question remains about this study:

1) It seems from the authors discussion that precipitation of aragonite and hydromagnesite is directly linked to the oxygenic photosynthetic activity of pleurocapsales.

However, during night time, when photosynthesis is not possible, many microbial mat-forming cyanobacteria are know to be able to turn to respiration or even fermentation, thus releasing organic acid (Stal, 2012). If only Pleurocapsales are considered, then during night time dissolution of carbonate minerals is likely to occur as well (Dupraz et al., 2009).

2) It is clear that the focus of this paper is on Pleurocapsales. This group is indeed of interest. However, when looking at the microbial community present in such microbialite, it seems that pleurocapsales are rather not dominant at the depth indicated in this paper (i.e., 4m). At this depth, Oscilatoriales seem more numerous. The only sample where this group dominated the community was found at 14m depth (Couradeau et al., 2011). Microscopy does not allow to investigate large samples and the set of techniques deployed in this study cannot be applied on a very large number of samples. Although the model for the mineralization of the Pleurocapsales presented by the authors is well supported by their observations, it would be great to consider the contribution of other groups (Dupraz and Visscher, 2005) (cyanobacteria, but also other bacteria such as sulfate reducers) in the formation of the microbialite found in the lake Alchichica. As it has been nicely demonstarted for stromatolite, the formation of microbialite is usually the result of interaction between different key player in the microbial community(Reid et al., 2000).

3) Looking at the paper it seem that the claims of the authors would be even better supported if such process could be reproduced in the laboratory. Especially what would happen if a pure culture of those Pleurocapsales (or eventually strains from culture collection ATCC 29393 or ATCC 29394) would be inoculated to sterile filtered lake water. There is no doubt that the technique deployed by the authors would more than appropriate to study the mineral formation under such controlled conditions.

In addition some minor points would benefit from clarifications:

4) In the discussion (section 4.2) the authors claim that Pleurocapsales exhibit "cell

wall integrity". Usually cell wall integrity can be tested by ethidium bromide staining or propidium iodide staining (the latter being found in many live/dead staining kit) which are normally excluded of healthy cells. Autofluorescence can persist some time after the membrane has been compromised. Thus I would not rely on this only to assess cell wall integrity.

5) The authors should put the composition and condition used for modeling with Visual minteq available as supplementary material (the water composition is usually not equivalent to the matrix used in such software since pH is often "adjusted" with H+ or OH- and charge balance is often achieved with addition or subtraction of Cl-. This would make the comparison with other models or other site easier (Gallagher et al., 2013)

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