Differences in Ca homeostasis between cyanobacteria forming and not-forming intracellular Ca-carbonates

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Cyanobacteria have been important microorganisms in the formation of carbonate sedimentary deposits such as stromatolites for billions of years. Overall, bioprecipitation of $CaCO_3$ by cyanobacteria has been traditionally considered as a non-controlled and extracellular process. Yet, this dogma has been recently challenged by the discovery of several cyanobacterial species collected in diverse environments and forming amorphous calcium carbonates (ACC) intracellularly [1, 2, 3]. Considering the pH, the concentrations of HCO_3^- and Ca^{2+} usually suspected for the cytoplasm of cyanobacteria, ACC precipitation is not possible thermodynamically [4]. It has been tentatively suggested that Ca homeostasis may be different in cyanobacteria forming intracellular ACC compared with other cyanobacteria [4, 5], but this hypothesis remains unexplored experimentally.

Here, we compared the uptake of Ca by 56 strains, including 17 forming intracellular ACC and 39 not forming intracellular ACC. We measured the concentration of Ca remaining in extracellular solutions, the pH and the optical density after complete growth of the cultures. We showed the existence of a correlation between the formation of intracellular ACC and a strong uptake of dissolved Ca. Moreover, we observed that the growth of intracellular ACC forming cyanobacteria is limited by Ca surrounding availability. Overall, we will discuss one origin of intracellular ACC formation linked to a higher Ca uptake and the possible roles for these intracellular Ca-carbonates in Cyanobacteria.

[1] Couradeau *et al.* (2012) *Science* 336, 459-462. [2] Ragon *et al.* (2014) *Front. Microbiol.* 5, 331. [3] Benzerara *et al.* (2014) *Proc. Natl. Acad. Sci. USA* 111, 10933-10928. [4] Cam *et al.* (2015) *Geochim. Cosmochim. Acta* 161, 36-49. [5] Li *et al.* (2016) *Minerals* 6, 10.