

Microbial ecology of intracellular calcium carbonate biomineralization by bloom-forming cyanobacteria

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Biomineralization of intracellular amorphous calcium carbonate (iACC) has been recently discovered in widespread and phylogenetically diverse cyanobacteria [1]. This type of biomineralization occurs intracellularly and under out-of-equilibrium thermodynamic conditions [2].

Microcystis is a cyanobacterial genus usually found in freshwater environments and often involved in toxic blooms. *Microcystis* has been extensively studied especially for mechanisms of toxin production, genetic diversity of its populations, and dynamics of its blooms and their determinants [3]. Here we combined scanning and transmission electron microscopies (SEM and TEM) as well as Fourier transform infrared spectroscopy (FTIR) to study several *Microcystis* strains and determine whether they form iACC. We linked this phenotypical diversity to the time evolution of the chemical composition of their growth solutions and tested the dependence of their growth on different initial calcium concentrations. Moreover, we conducted a bioinformatics survey using available genomes in order to infer the potential involvement of some genes in iACC-biomineralization. Overall, we detected a phenotypic and genotypic diversity among the tested strains that correlates with their capability to form iACC. Since *Microcystis* cells can be periodically dominant in some water pools and some of them form iACC, this provides an original case where a mineralogical process may influence the dynamics and genotypic structure of microbial populations. In turn these population dynamics may impact the geochemical cycle of calcium. We will discuss how we aim at estimating the importance of these processes.

[1] Benzerara K. et al (2014) Intracellular Ca-carbonate biomineralization is widespread in cyanobacteria. Proc. Natl. Acad. Sci. USA 111, 10933-10938.

[2] Cam N, Benzerara K, Georgelin T, Jaber M, Lambert JF, Poinot M, et al. Cyanobacterial formation of intracellular Ca-carbonates in undersaturated solutions. Geobiology. 2017 ; 16(1) : 49-61.

[3] Harke MJ, Steffen MM, Gobler CJ, Otten TG, Wilhelm SW, Wood SA, et al. A review of the global ecology, genomics, and biogeography of the toxic cyanobacterium, *Microcystis* spp. Harmful Algae. 2016 ; 54 : 4-20